



Exploring and Advancing Community Pharmacy Services for Patients with Non-Communicable Diseases in Saudi Arabia: A Scoping Review of Current Practices and Multi-Stakeholder Consensus to Develop a Cardiovascular Disease Risk Screening Service

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PharmD, MPH

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Abbreviations

Abbreviations	Definition
KSA	Kingdom of Saudi Arabia
SA	Saudi Arabia
GCC	Gulf Cooperation Council
UAE	United Arab Emirates
USA	United States of America
UK	United Kingdom
NCDs	Non-communicable diseases
CVDs	Cardiovascular Diseases
DM	Diabetes Mellitus
T1DM	Type 1 Diabetes Mellitus
T2DM	Type 2 Diabetes Mellitus
BG	Blood Glucose
HbA1C	Haemoglobin A1C
HTN	Hypertension
BP	Blood Pressure
SBP	Systolic blood pressure
DBP	Diastolic blood pressure
TC	Total Cholesterol
LDL	Low-density lipoprotein
HDL	High-density lipoprotein
TG	Triglycerides
BMI	Body Mass Index
EPS	Extended Pharmacy Services
MTM	Medication Therapy Management
MUR	Medication Use Review
POC	Point of Care testing
ADRs	Adverse drug reactions
OTC	Over the counter
PHC	Primary Health Care
GP	General Practice
MOH	Ministry of Health
SFDA	Saudi Food and Drug Authority
SCFHS	Saudi Commission for Health Specialities
KSAWHS	Kingdom of Saudi Arabia World Health Survey
GASTAT	General Authority for Statistics
NHS	National Health Service
WHO	World Health Organisation
NICE	National Institute for Health and Care Excellence
FIP	International Pharmaceutical Federation
IDF	International Diabetic Federation
DALYs	Disability-adjusted life years
YLDs	Years of healthy life lost due to disability

GDP	Gross domestic product
SAR	Saudi Riyal
US\$	United State Dollar
RCT	Randomised Control Trial
PRISMA-ScR	Preferred Reporting Items for Systematic Reviews and Meta-analyses extension for scoping review
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-analyses
JBI	Joanna Briggs Institute
MRC	Medical Research Council
NGT/ m-NGT	Nominal Group Technique/ modified Nominal Group Technique
APEASE	Acceptability, Practicality, Effectiveness, Affordability, Side effects, and Equity
ERIC	Expert Recommendations for Implementing Change
TDF	Theoretical Domains Framework
RE-AIM	Reach, Effectiveness, Adoption, Implementation, and Maintenance
ACCORD	Accurate Consensus Reporting Document
DELPHISTAR	The Delphi Studies in Social and Health Sciences—Recommendations for an Interdisciplinary Standardised Reporting
SCORE	Systematic Coronary Risk Evaluation
ACC/AHA	American College of Cardiology/American Heart Association
ASCVD	Atherosclerotic cardiovascular diseases
NZ	New Zealand
AF	Atrial Fibrillation
ECG	Electrocardiography
MI	Myocardial Infarction
IQR	Interquartile range
NPHIES	National Platform for Health and Insurance Exchange Services
AK	Amanj Kurdi (First supervisor)
NW	Natalie Weir (Second supervisor)
HA	Hisham Alshammari (PhD student)
HAA	Hadi Almansour (external facilitator)

Thesis Abstract

Introduction: Non-communicable diseases (NCDs), particularly cardiovascular diseases (CVDs), remain a major challenge in the Kingdom of Saudi Arabia (KSA). As community pharmacy practice in KSA shifts towards extended care, opportunities arise to enhance community pharmacists' involvement in NCD care. This thesis aimed to develop a community pharmacy service for NCDs/CVD prevention in KSA, aligning with the national health strategy to tackle NCDs.

Methods: A scoping review examined current community pharmacy services across Gulf countries to identify areas for improvement. Accordingly, a community pharmacy-based CVD risk screening service was developed, following the UK Medical Research Council framework, combining a literature review with two multistakeholder consensus methods. These included a modified Nominal Group Technique (m-NGT) with national experts to co-design the initial service model, and a modified e-Delphi with a larger group of experts to achieve consensus on the final service model and specifications, and to evaluate perceptions. A 70% threshold defined consensus.

Results: The scoping review of 116 studies highlighted the potential of the community pharmacy-based CVD risk screening service, with positive perceptions in KSA and promising pilot outcomes in the United Arab Emirates, informing its development. Six experts in the m-NGT reached (100%) consensus on the initial service model and recommended facilitators for implementation. In the e-Delphi, 50 stakeholders completed three rounds and reached consensus ($\geq 70\%$) on all service components. The service model focuses on higher-risk populations (≥ 40 years with comorbidities or other risk factors) and includes comprehensive screening and interventions (all assessments required for risk scoring, followed by education, referrals, and therapy management with follow-ups, based on risk). This model was positively perceived. Consensus was also reached on three recruitment approaches, two screening tools, one referral mechanism, two funding methods, and nine implementation strategies.

Conclusion: This thesis introduces a context-specific CVD risk screening model that could reduce the national CVD burden.

Thesis Summary

Background: The role of community pharmacies in the Kingdom of Saudi Arabia (KSA) is undergoing a significant shift from a primarily product-oriented model to a more extended practice. In parallel, the rising prevalence of non-communicable diseases (NCDs) has led to growing recognition of community pharmacists worldwide as highly accessible frontline primary health care (PHC) providers with the potential to contribute to preventive care. NCDs, particularly cardiovascular diseases (CVDs), represent a major public health challenge in KSA. Accordingly, the KSA national strategy for preventing and controlling NCDs emphasises early detection and prevention, prioritises CVD as the top public health priority, and recommends establishing a CVD risk screening programme at the community and primary care levels. Together, these ongoing advancements in community pharmacy practice and the national strategy to tackle the NCD burden highlight the need to understand and strengthen current community pharmacy practice in KSA to support the evolving role of community pharmacists in NCD care. Therefore, the overall aim of this thesis was to explore and develop opportunities to improve community pharmacy practice in KSA, with a focus on NCD/CVD prevention, in line with the national health strategy to prevent NCDs.

Methods: This thesis adopted a sequential, multi-stage approach

First stage: Review of current community pharmacy practices/services

The PhD programme began with a scoping review. Multiple databases were searched from inception to December 2024 to explore existing community pharmacy services across the Gulf Cooperation Council (GCC) countries and to identify gaps, challenges, and opportunities to improve services, particularly in the prevention of NCDs/CVDs. The review emphasised the lack of evidence on community pharmacists' current role in NCD/CVD care in KSA, offered supportive recommendations, and highlighted positive perceptions of developing extended services targeting NCDs, such as CVD risk screening, along with their potential. Building on these findings, the decision was made to develop a community pharmacy-based CVD risk screening service in KSA.

Second stage: Community pharmacy-based CVD risk screening service development

The methodological framework followed the UK Medical Research Council (MRC) guidelines for developing and evaluating complex interventions. The process comprised three consecutive steps: (1) idea generation through a preparatory literature review, (2) potential service model development using a multi-stakeholder modified Nominal Group Technique (m-NGT) consensus method, and (3) achieving consensus on the final service model and specifications using a multi-stakeholder modified e-Delphi method.

Step 1: Idea generation through a preparatory literature review

A search of the Ovid MEDLINE database was conducted from inception to May 2024 to examine community pharmacy-based CVD risk screening programmes worldwide and identify the key components typically included in these services. This literature review differs from the preliminary scoping review by focusing solely on community pharmacy-based CVD risk screening services internationally to identify key service components. Comprehensive lists of potential ideas for each component were compiled and used as a basis for discussions with stakeholders during the consensus-based service development in Steps 2 and 3. These components encompassed the target populations, screening procedures, post-screening interventions, recruitment methods, screening tools, referral mechanisms, service funding, and other implementation strategies.

Step 2: Potential service model development using a multi-stakeholder modified Nominal Group Technique (m-NGT) consensus method

The initial consensus activity focused on co-designing a potential community pharmacy-based CVD risk screening service model, aiming to reach agreement on its key components, including the target populations, screening processes, and post-screening interventions. This study purposively recruited experts from KSA, representing key stakeholders: clinical pharmacists, community pharmacists, community pharmacy owners, physicians, Ministry of Health (MOH) representatives, and public health experts. The m-NGT incorporated a pre-meeting questionnaire to generate additional ideas and an in-person, structured focus group on 7th February 2025 for discussion, ranking, and consensus building. A consensus level of 70% was considered acceptable. An inductive thematic analysis of the discussion was performed to contextualise the group's priorities.

Step 3: Achieving consensus on the final service model and specifications using a multi-stakeholder modified e-Delphi consensus method

Following consensus on the service's key components from the m-NGT study, a wider group of national experts, representing key stakeholders similar to those involved in the m-NGT, was recruited to participate in three-round modified e-Delphi questionnaires. This e-Delphi study, conducted between March and September 2025, aimed to refine the proposed service model, reach consensus, assess perceptions of the service model, and prioritise other service specifications not covered in the m-NGT. These included recruitment methods, screening tools, referral mechanisms, service funding, and implementation strategies. Perceptions of the service were assessed using the acceptability, practicality, effectiveness, affordability, side effects, and equity (APEASE) criteria. A combination of rating and ranking methods was used to identify priorities. Consensus was defined as $\geq 70\%$ agreement or $\geq 70\%$ ranking an item as a higher priority.

Results: The scoping review included 116 studies across GCC countries, with approximately half from KSA ($n=61$, 52.6%). The review highlighted variability in current practice, with community pharmacists mostly engaged in traditional dispensing and counselling roles, and limited evidence of involvement in extended services, such as chronic disease monitoring and health promotion. However, pilot initiatives, including diabetes education, health screening, and medication therapy management, demonstrated promising effectiveness, alongside generally positive perceptions of expanded roles. Commonly recommended future services included health screening, management and monitoring of chronic diseases, point-of-care testing, medication review, and health promotion. Key barriers were a lack of privacy, time, and training.

Six experts participated in the m-NGT study and developed an initial service model outlining the target population, screening processes, and post-screening interventions, achieving consensus (100%). Thematic analysis of the m-NGT discussion identified two main themes: 1) drivers of strategic decision-making and 2) facilitators for sustainable implementation, with five and four subthemes, respectively. The former offered insight into the rationale for the group's prioritisation, which was based on risk evidence, practicality, challenges, consumer characteristics, and pharmacists' capabilities. The latter provided recommendations for future implementation, including ensuring service regulation, ensuring system and

infrastructure readiness, empowering pharmacists, and fostering stakeholder collaboration.

In the subsequent e-Delphi study, 61, 51, and 50 experts participated in rounds 1-3, respectively. A strong consensus (98%) was achieved on the final service model. Four priorities for target population groups: those ≥ 40 years with comorbidities, on medications that increase risk, with a family history, or other risk factors. Five screening process priorities: demographic and lifestyle assessments, point-of-care testing, anthropometrics, medication adherence evaluation, and risk scoring. Three post-screening intervention priorities based on level of risk: health education, physician referrals, and therapy management with follow-ups. Consensus (92–100%) was also reached on other service specifications. These include three recruitment strategies (i.e., during chronic prescription refills, opportunistic, and programmatic), two screening tools (i.e., a Saudi-specific tool and the American College of Cardiology/American Heart Association calculator as an alternative), one referral mechanism (i.e., direct referral through an integrated system), and two funding approaches (i.e., government- and insurance-funded). Furthermore, key implementation priorities were identified to support effective and sustainable implementation, with consensus on each strategy ranging from 80.4% to 94.1%. These strategies include stakeholder training, interactive support, clinician support, stakeholder collaboration, infrastructure change, contextual tailoring and adaptation, consumer engagement, financial strategies, and iterative evaluation. The service model was perceived as acceptable (94.1%), practical (92.2%), effective (96.1%), and affordable (86.3%), with potential to generate positive effects (76.4%) and equity (88.2%).

Conclusion: This thesis offers valuable insights into community pharmacy practices in KSA and other GCC countries, highlighting limited evidence of current involvement in NCD/CVD care, positive perceptions of role expansion, key barriers and facilitators to extended services, and recommendations for future practice. It also supports expanding community pharmacy services in KSA by developing an evidence-based, context-specific community pharmacy-based CVD risk screening service model ready for implementation, subject to multifaceted strategies. The study demonstrated that such a service is perceived as feasible, acceptable, and aligned with national public health priorities. Implementing this service is expected to enhance early detection, improve public health outcomes, and help reduce the national CVD burden. Future

research should focus on piloting the model, evaluating clinical outcomes, assessing cost-effectiveness, and establishing policy to ensure successful nationwide implementation.

Thesis Structure

This thesis comprises six chapters, which are briefly described below:

Chapter 1 outlines the background and context of the study, providing an overview of the KSA context and community pharmacy practice. It discusses the burden of CVDs and other chronic NCDs both internationally and nationally in KSA. The chapter highlights the potential role of community pharmacies in delivering health services targeting patients with chronic NCDs. It also discusses the research problem and identifies key gaps in the existing literature, including limited evidence on the expanded role of community pharmacists in the prevention and management of chronic NCDs/CVDs, as well as the absence of a comprehensive review of current community pharmacy practice in KSA. Consequently, it presents the thesis aims and objectives.

Chapter 2 offers a comprehensive scoping review of the literature on community pharmacy services in KSA and other Gulf Cooperation Council (GCC) countries. It aims to summarise existing evidence on the type, nature, extent, and/or effectiveness of current community pharmacy practices; identify gaps; and suggest areas for improvement, including any required expansion, enhancement, or assessment of any community pharmacy service. The chapter details the search strategies, data extraction, and synthesis of results, highlighting gaps and future research opportunities, and serving as a foundation for the next stage of the thesis.

Chapter 3 explains the rationale for developing a community pharmacy-based CVD risk screening service and sets the stage for guidance and preparation for service development. It describes the frameworks that guided service development, including the UK Medical Research Council (MRC) framework and implementation science guidance. It also provides an overview of the literature on community pharmacy-based CVD risk screening services to inform idea generation and the development of service materials, thereby laying the groundwork for service development in the following chapters.

Chapter 4 presents the first consensus-based service development. It describes the study design, setting, participant recruitment, data collection methods, analytical techniques, and the findings, including both quantitative and qualitative results. This study employed a consensus method, the modified Nominal Group Technique (m-

NGT), involving a small group of national experts in a structured focus group discussion aimed at co-designing a consensually agreed-upon potential service model that specifies the target population, screening processes, and post-screening interventions, emphasising the quantitative data from the ranking and consensus exercises. It also offers qualitative insights into the rationales for the proposed service model and recommendations to support future implementation, thereby providing a foundation for the next step of service development in the following chapter.

Chapter 5 discusses the second consensus-based service development. It outlines the study design, setting, participant recruitment, data collection methods, analytical techniques, and the findings. This study employed another consensus method, involving three rounds of modified e-Delphi questionnaires and engaging a larger group of multi-stakeholders from KSA. The aim was to refine the initially proposed service model, reach wider consensus, evaluate perceptions, and prioritise implementation strategies, along with other service components such as the screening tool, recruitment methods, referral mechanisms, and funding approaches.

Chapter 6 summarises and discusses the key findings from this thesis in comparison with wider literature. It also presents and discusses the final service model and its expected outcomes through the service logic model. Additionally, it discusses the project's relevance to policy and practice, offers recommendations for piloting, implementing, and evaluating the developed community pharmacy-based CVD screening services, and proposes directions for future research. The strengths and limitations of the thesis are also outlined.

1 Chapter 1: Research background

1.1 Introduction

1.1.1 Kingdom of Saudi Arabia context

This thesis focuses on community pharmacy practice in the Kingdom of Saudi Arabia (KSA). To frame the research, this section provides key background information on the country's profile, the structure of its healthcare system, and current pharmacy practices and regulations within the Kingdom. Together, these elements establish the essential context for understanding the environment in which community pharmacies operate and the importance of the study's focus.

1.1.1.1 Country profile

KSA, commonly referred to as Saudi Arabia (SA), is one of the largest countries on the Arabian Peninsula, covering approximately 2,149,690 square kilometres. The country is administratively divided into 13 provinces, including Riyadh (the capital), Makkah, Eastern Province, Madinah, Qassim, Asir, Tabuk, Hail, Northern Borders, Jizan, Najran, Al-Bahah, and Al-Jouf. Riyadh province is both the political capital and one of the largest provinces by population (1).

By mid-2024, KSA's total population was estimated at around 35.3 million, according to the General Authority for Statistics (GASTAT), with an annual growth rate of 4.7% from 2023 to 2024. Of these, approximately 55.6% are Saudi nationals and 44.4% are non-Saudi residents; the majority, 62.1%, are male. The population is relatively young: about 74.7 % of the total population falls within the working-age group of 15–64 years, and life expectancy is estimated to be around 78 years (2).

Economically, KSA has traditionally been classified as a high-income country, heavily dependent on oil production. Oil revenues continue to play a significant role in the country's finances: as of 2024, oil accounted for the majority of government revenue. To reduce this dependence and foster more sustainable growth, the Saudi government launched Vision 2030, a long-term national transformation strategy aimed at diversifying the economy and increasing non-oil revenue. Key priorities of Vision 2030 include reducing reliance on oil, boosting private-sector participation, and investing in the young Saudi workforce to replace a portion of the expatriate labour force gradually (3). These national transformation plans cover various sectors, including healthcare reforms.

1.1.1.2 Saudi Healthcare System

1.1.1.2.1 Structure and regulation

The levels of care in KSA are organised into three tiers: primary, secondary, and tertiary. Primary care emphasises preventive and basic curative services provided through Primary Health Care (PHC) centres. Patients needing more advanced medical attention are referred to hospitals for secondary care, while highly complex or specialised cases are directed to tertiary hospitals (4).

The healthcare system in KSA comprises both the Government/public and private sectors. In the government sector, the Ministry of Health (MOH) is the leading provider, delivering about 59% of health services through its network of PHC centres and public hospitals. Non-MOH government agencies and the private sector also play important roles in service delivery, accounting for around 18% and 23% of healthcare services, respectively, thus supporting the MOH's efforts across all levels of care (4, 5).

Besides providing healthcare services, the MOH plays a key role in shaping and overseeing the entire national health system. Its responsibilities include planning, developing, and managing health policies; supervising health programmes; and monitoring health services not only in government institutions but also in the private sector, which guides the strategic direction of healthcare delivery across the country (4).

1.1.1.2.2 Funding of health services

Government-provided healthcare services are available free of charge to all Saudi citizens and to expatriates employed in the public sector (including their relatives). These include access to primary care, hospital services, preventive programmes, and medications. In contrast, healthcare in the private sector is mainly funded through employer-based health insurance and out-of-pocket payments. The government-funded model remains predominant: according to the Saudi Health Council's National Health Accounts for 2022–2023, general government health expenditure accounted for approximately 68.9% of total health spending in 2023. Total health expenditure in KSA in 2023 was 227,684 million Saudi Riyal (SAR), with government health spending amounting to 156,919 million SAR, which represents 3.92% of the country's Gross Domestic Product (GDP) (4, 6).

Figure 1.1 illustrates the organisation of the Saudi healthcare system, from primary care to specialised tertiary care, and outlines the structure, key providers and their sources of funding in KSA.

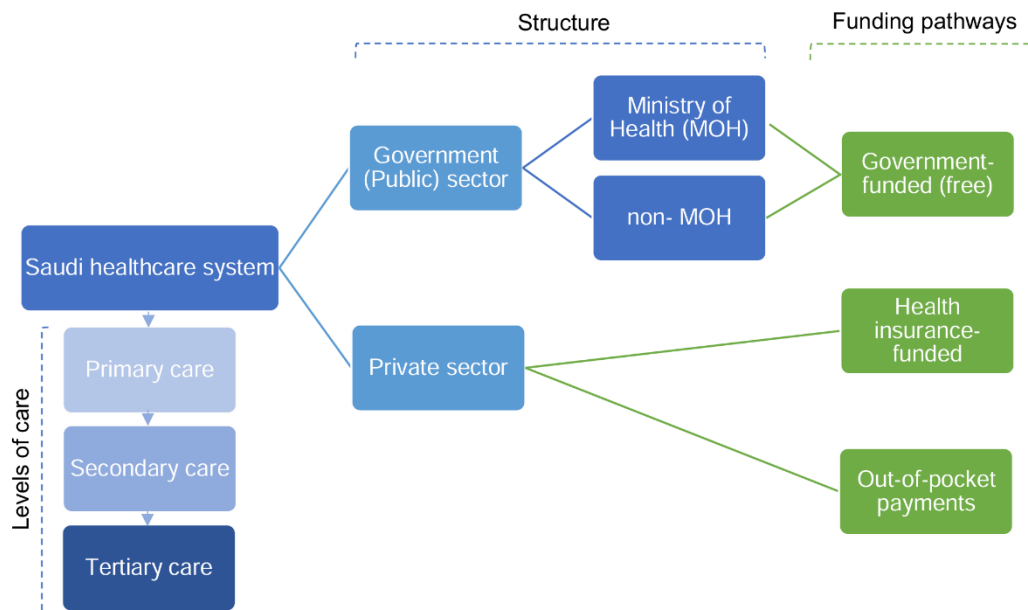


Figure 1.1. Healthcare system structure, levels of care and funding pathways in KSA.

1.1.1.2.3 Access and utilisation

The first point of access to the public healthcare services in KSA is typically the PHC centre, where individuals seek routine care, initial assessments, and referrals to specialised services. PHC centres generally operate during standard working hours, from 8:00 a.m. to 4:00 p.m.; however, some centres are designated as on-duty facilities and extend their services until 11:00 p.m. for urgent cases (7). Outside these hours, patients may access care through the emergency departments of public hospitals. PHC centres provide a comprehensive range of preventive and curative services. These include immunisation against communicable diseases, maternal and child health care, chronic disease management, dental services, health education, and the dispensing of essential medications, thereby ensuring accessible care for both acute and long-term health needs (8). Medications prescribed within PHC centres are supplied free of charge, either through onsite pharmacies or through participating private community pharmacies under the Wasfaty (“my prescription”) programme (9).

Unfortunately, there is considerable variation in the distribution, infrastructure, services, and staffing of PHC centres across the country, which affects their

accessibility and utilisation (10, 11). A study in Riyadh highlighted differences in accessibility to PHC between urban and rural populations: rural residents were affected by distance, cleanliness, understanding of treatment, and access to preventive services, while urban patients expressed the need for extended opening hours (12). Several patient satisfaction surveys consistently show low satisfaction with PHC centres, citing long travel distances, waiting times, limited working hours, inadequate facilities, lack of specialised clinics, and communication barriers (13). Nevertheless, many individuals continue to rely on PHC centres due to limited access to alternative primary care options (10). This evidence highlights the accessibility challenge of PHC in KSA and the need for more accessible PHC services.

1.1.1.2.4 Challenge of the health system

The healthcare system in KSA faces multiple challenges related to disease patterns, workforce capacity, health information systems, infrastructure, financial resources, and accessibility. A major contributor to these challenges is the rapid population growth, which is projected to increase from 33.4 million in 2018 to 39.4 million by 2030, thereby driving higher demand for health services (14, 15). Another significant factor is the high burden of non-communicable diseases (NCDs), which account for approximately 68% of all deaths in the country (16). On average, around 90,000 individuals die prematurely each year due to chronic diseases, negatively affecting life expectancy and overall population health (15). These factors place substantial pressure on the healthcare system, both in service provision and government expenditure, especially since public healthcare services are free and funded primarily from the government budget, underscoring the need for sustainable strategic planning and resource allocation (14, 15).

1.1.1.2.5 Health development strategies (Vision 2030)

In response to rising challenges in the healthcare system, the Saudi government launched a health sector transformation plan as part of Saudi Vision 2030, with goals to improve citizens' health, increase life expectancy, and enhance healthcare and the value of care. The main strategic objectives for these transformations are as follows (14, 15):

1) Ensure universal access to care

Expand the capacity of clinics, hospitals, and healthcare providers, and strengthen

e-health systems and unified electronic health records to improve access, coordination, and efficiency.

2) Ensure high-quality, value-based services

Deliver safe, effective, patient-centred, timely, and equitable care that improves outcomes and uses resources efficiently, while promoting public–private partnerships and an integrated healthcare system to reduce duplication and support sustainability.

3) Emphasise chronic disease prevention and public health

Shift toward preventive care, early detection of chronic diseases, and proactive health promotion through comprehensive health-education initiatives and integrated programmes prioritising NCDs.

1.1.1.3 Pharmacy in KSA

1.1.1.3.1 Areas of practice

Pharmacists in KSA work across various healthcare settings, each with its own specific roles. Pharmacists in primary care settings, such as PHC centre pharmacies and private community pharmacies, mainly handle traditional duties, like dispensing and counselling, with limited clinical involvement. Hospital pharmacists, including outpatient and inpatient pharmacists, have a broader range of responsibilities. Outpatient pharmacists conduct medication verification, ensure proper dispensing and counselling, support patient adherence, manage refill and follow-up services, and identify and report adverse drug events. Inpatient pharmacists review and verify medication orders for safety and accuracy, monitor therapy for hospitalised patients, and, like outpatient pharmacists, identify and report adverse drug events. Some inpatient pharmacists are involved in specialised tasks, like sterile medication preparation, chemotherapy, and parenteral nutrition (17). Within hospitals, clinical pharmacists, who typically hold postgraduate degrees in clinical pharmacy or complete specialised residency training, usually work at large tertiary hospitals. They play vital roles within hospital teams, collaborating with physicians and other healthcare providers. These clinical pharmacists may also manage specialised clinics and participate in clinical rounds across various fields, including ambulatory care, internal medicine, infectious diseases, cardiology, organ transplants, paediatrics, oncology, nephrology, critical care, and emergency medicine (17, 18).

Clearly, the pharmacy profession is a vital part of the healthcare system, yet it is undervalued in the PHC settings in KSA. Despite Saudi pharmacists' clinical competence and training, pharmacy practice in KSA, especially in PHC, remains more product-focused, with limited involvement in clinical services, public health, or patient-centred care.

Besides their practice in pharmacy settings, pharmacists are also involved in many other areas, such as regulatory roles within the Saudi Food and Drug Authority (SFDA), roles in the pharmaceutical industry, and teaching and research (17).

1.1.1.3.2 Pharmacy workforce

In 2021, KSA had 30,840 pharmacists, representing 9.04 per 10,000 people. Community pharmacies employed the majority (20,900; 67.8%), with men accounting for 89.2% (18,649), the majority of whom were non-Saudi (16,447; 78.7%) (19, 20). The dominance of males in community pharmacies might be due to the fact that females were not licensed to work in this sector until 2016 (21). Hospital pharmacies constituted the second-largest sector, employing 9,121 pharmacists (29.6%). PHC centres employed 415 pharmacists (1.3%), while the remaining pharmacists worked in academia and other sectors. Overall, the workforce was predominantly male (24,042; 78%) compared to 6,798 females (22%), and non-Saudi (18,781; 61%) compared with 12,058 Saudis (39.1%) (19, 20).

1.1.1.3.3 Community pharmacy accessibility, operation, and regulation

In KSA, community pharmacies are privately owned healthcare facilities that serve as the main point of access to medications and other health products for the public. As of 2022, there were approximately 10,347 community pharmacies operating across the 13 provinces in KSA, representing 3.22 pharmacies per 10,000 people (5, 21). Community pharmacies in KSA are commonly located on main streets, in residential neighbourhoods, adjacent to private hospitals or medical polyclinics and within commercial or shopping centres. They often have extended opening hours, up to 12 hours, with some operating 24 hours a day, 7 days a week (22). These pharmacies operate either as independent pharmacies (individual or small groups) or as part of larger chain pharmacy groups, with chain pharmacies often offering more products and services, as well as more standardised practice (23).

The pharmacy profession in general, including community pharmacies in KSA, is jointly regulated by the MOH, the SFDA, and the Saudi Commission for Health Specialities (SCFHS). The Pharmaceutical Care Department of the MOH serves as the primary authority overseeing pharmacy practice, including licensing community pharmacy premises, issuing and updating the national drug formulary, and developing relevant policies and regulations. The SFDA regulates the safety, registration, and pricing of medicines, medical devices, and health products. The SCFHS oversees the registration and professional classification of healthcare providers, including pharmacists. Together, these bodies ensure proper licensing of pharmacies, safe and compliant medication supply, and qualified pharmacy professionals (17, 24).

1.1.1.3.4 Community pharmacy development strategies

In 2019, the Saudi MOH published updated executive regulations that allow community pharmacists to provide expanded, more advanced patient care services, such as vaccination, patient assessment, point-of-care (POC) testing, medication therapy management (MTM), health education, chronic disease counselling and monitoring, minor illnesses care, pharmaceutical consultations, and other preventive and public health services (24). The provision of these services must comply with specific prerequisites, including being delivered by a licensed pharmacist, delivered within a designated private area within the pharmacy premises, obtaining patients' consent before service delivery, ensuring the pharmacists strictly adhere to safety protocols during service delivery, and recording patient information and each delivered service in the system (24).

Following this regulatory reform, community pharmacy practice in KSA is transitioning from a product-focused approach to a more extended advanced practice (25). Therefore, this thesis aims to explore current community pharmacy practice in KSA and compare it with that of other countries to identify opportunities for further improvement to meet these new regulations and to tackle the burden of NCDs, which place pressure on the healthcare system.

1.1.2 Community pharmacy

1.1.2.1 Background and definitions

Community pharmacy, or what is sometimes called retail pharmacy or pharmacy shop, is an important part of the healthcare system, characterised by its high

accessibility, long opening hours, and non-appointment-based services (26). Thus, community pharmacies often serve as the initial destination for healthcare needs (26). Although the World Health Organisation's (WHO) definition of the community pharmacy varies across countries based on the range of services offered, by combining the common activities stated in various country-specific definitions, community pharmacy can be defined as "private healthcare establishments that serve the public interest by guaranteeing continued and uninterrupted care for the population, ensuring the adequate supply of medicines and other products, and offering a series of pharmaceutical services including the retail sale, distribution, and preparation of pharmaceutical products, as well as counselling and other services related to pharmaceutical products" (27). Moullin et al. (28) have defined the professional pharmacy services provided by community pharmacy as "an action or set of actions undertaken in or organised by a pharmacy, delivered by a pharmacist or other health practitioner, who applies their specialised health knowledge personally or via an intermediary, with a patient/client, population or other health professionals, to optimise the process of care, with the aim to improve health outcomes and the value of healthcare"; this definition aligns with the concept of pharmaceutical care provision established decades ago by Hepler and Strand in 1990 (29) "the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve a patient's quality of life". It is important to understand the role of community pharmacists and their significance in the healthcare system. These definitions clarify their responsibilities and contributions to patients' care.

1.1.2.2 Community pharmacy practice in developed countries

The role of community pharmacists has evolved over the years, shifting from a product-oriented service to a more clinical, advanced role (30). The role of community pharmacists in the developed countries goes beyond dispensing and counselling. For instance, community pharmacists in the United Kingdom (UK), United States of America (USA), Australia, and Canada help manage chronic diseases and minor ailments by providing patient education, medication review, physical assessments, and monitoring adherence and progress (30-33). Additionally, community pharmacists in the USA play an essential role in improving immunisation rates by being immunisers, vaccine educators, and facilitators (34). In fact, according to the International Pharmaceutical Federation (FIP) (35) pharmacist-led vaccination services are now available in more than 26 countries and territories worldwide.

Furthermore, minor ailments services (which allow pharmacists to manage and treat patients with minor, self-limiting conditions) were introduced in community pharmacies in the UK over 20 years ago (36). In 2020, the UK's National Health Service (NHS) began implementing the Pharmacy First scheme to alleviate pressure on general practice (GP) services. This service allows community pharmacists to provide professional health care advice, treatments, and medication recommendations for several common illnesses, including skin conditions, urinary tract infections, gastrointestinal conditions, ear, nose, and throat conditions, pain, and fever; they prescribe certain treatments, such as antibiotics. Pharmacy First service encourages patients to seek community pharmacist help at any time without the need for an appointment, and without the need to visit a GP, though, in some cases, where serious symptoms that require urgent medical attention are identified, pharmacists would refer patients to see their GP (37-40). Undoubtedly, community pharmacists are qualified healthcare providers who could play a key role in providing extended and advanced services, and the above-mentioned practices are clear evidence of their capabilities and essential roles within the healthcare system.

1.1.2.3 Current community pharmacy practice in KSA

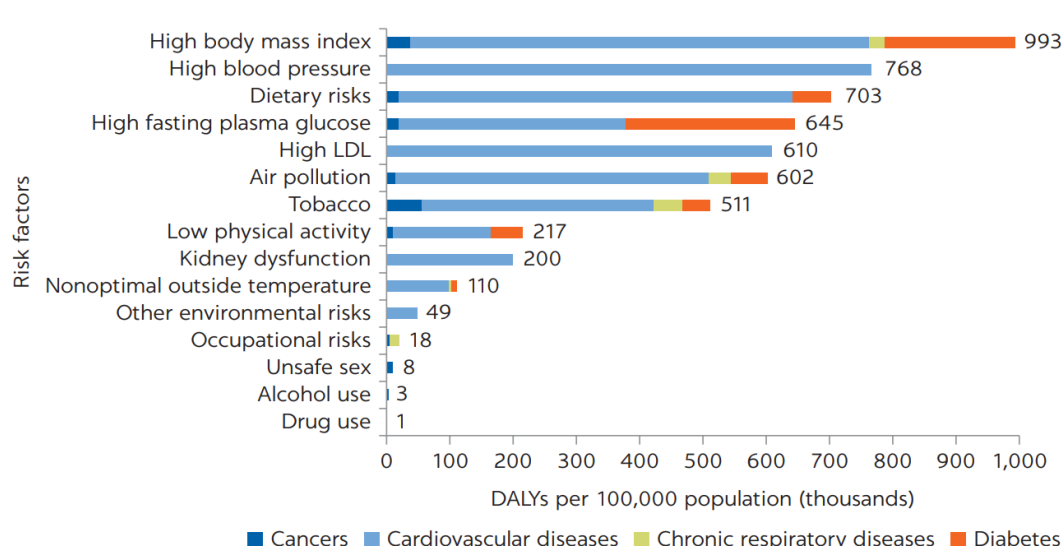
Despite the high number of licensed community pharmacists, the high accessibility of community pharmacies in KSA, and the evolving clinical role of community pharmacists, the provision of pharmaceutical care in these pharmacies in KSA remains largely limited to traditional dispensing and counselling. Enhanced or extended pharmacy services (EPS) are not yet well established in KSA and are still in the initial stages of planning and implementation (25). EPS refers to healthcare-related services provided in community pharmacies beyond the routine provision of over-the-counter (OTC) and prescribed therapeutic agents, including drug information, clinical interventions, medication management, preventive care, and therapeutic decision-making (41, 42). Since the announcement of the new regulations for community pharmacies in 2019, community pharmacy practice in KSA has been gradually shifting towards extended care through the adoption of new services. Few community pharmacies have started to provide more extended services such as the weight management programme “Wazen” aimed at controlling body weight and promoting a healthy lifestyle (43), vaccination service; video consultations; blood pressure (BP) measurements; and POC testing including blood glucose (BG), Haemoglobin A1C (HbA1C), lipid profile and C-Reactive Protein (CRP) test (44).

Additionally, some community pharmacies are enhanced digitally by participating in the national prescribing programme called “Wasfaty”, which translates to “my prescription”. This electronic prescribing and dispensing system allows patients to collect their prescriptions from the nearest community pharmacies, improving patient adherence and safety by ensuring medication availability and reducing medication errors (9). However, it is worth noting that all these services are in their initial stages of implementation, limited to a few community pharmacies, and their scope and impacts need to be evaluated to identify areas for improvement and inform further expansion. From these services, it is evident that they are mostly related to chronic NCDs, such as hypertension (HTN), dyslipidaemia, and diabetes. It is therefore important to understand the role of community pharmacies in the prevention and management of NCDs.

1.1.3 Chronic NCDs and community pharmacy services

1.1.3.1 Epidemiology and prevalence

Chronic NCDs are among the main challenges facing the global healthcare system. In 2021, NCDs accounted for over 40 million deaths globally, with diabetes, respiratory diseases, cardiovascular diseases (CVDs), and cancer accounting for 75% of non-pandemic-related deaths worldwide (16, 45). In KSA, there has been an alarming increase in the prevalence of NCDs, mostly attributed to the lifestyle in KSA and behavioural risk factors, such as unhealthy eating habits, tobacco consumption, and limited physical activity. These behaviours also contribute to key biological risk factors, including obesity, elevated BP, high BG, and abnormal lipid levels, which further increase the risk of NCDs, as illustrated in Figure 1.2 (46, 47). Between 2009 and 2019, diabetes showed the most significant increase in prevalence among NCDs at 99%, rising from 1.4 million to 2.7 million cases, followed by CVDs, which increased by 58%, all types of cancer increased by 52%, and chronic respiratory disease showed a 51 % increase in prevalence during this period (47). In 2018, NCDs accounted for 73% of all deaths in KSA, with CVDs contributing to the highest proportion of NCD-related mortality (37%), followed by cancer at 10%, chronic respiratory disease at 3%, diabetes at 3%, and other NCDs at 20% (46). According to the WHO Noncommunicable Disease Progress Monitor 2025, based on 2021 data, NCDs accounted for approximately 68% of all deaths in KSA, with over 57,800 total deaths from NCDs and a 14% risk of premature death (16).



Source: IHME 2020.

Note: DALYs = disability-adjusted life years. LDL = low-density lipoprotein.

NCDs = noncommunicable diseases.

Figure 1.2. Risk factors for developing selected NCDs among the population of KSA, 2019.

Source:(47), License: CC BY 3.0 IGO.

1.1.3.2 Impact of chronic NCDs on the health system and other consequences in KSA

The high incidence of NCDs in KSA has increased demand for PHC and treatment costs (14, 15). NCDs impose an annual financial burden of 91.3 billion SAR (US \$24.4 billion) in KSA, accounting for 3.08% of the country's GDP in 2019 (48). The direct (Figure 1.3) and indirect (Figure 1.4) costs of NCDs account for 73.2% and 26.8% of the total costs of NCDs, respectively. In 2019, NCDs accounted for 34.9% of total government health expenditure. As a result, recent healthcare system reforms aim for significant improvements, as discussed earlier. These include, but are not limited to, improving access to healthcare by increasing the healthcare facilities and providers; promoting public-private partnerships; advancing health education initiatives; developing a preventive programmes focused on NCDs; establishing a monitoring and surveillance system; expanding home-based and community health care; and delivering value-based healthcare through an integrated system and promoting E-health (15, 49, 50). Furthermore, as previously discussed, new regulations now enable community pharmacies to provide chronic disease monitoring, health education, medication reviews and management, and POC testing. As healthcare shifts towards prevention, early detection, and community-based management, community pharmacies are increasingly positioned as accessible points of care. These initiatives have created new opportunities for community pharmacists to play a

vital role in healthcare delivery and help reduce the burden of NCDs.

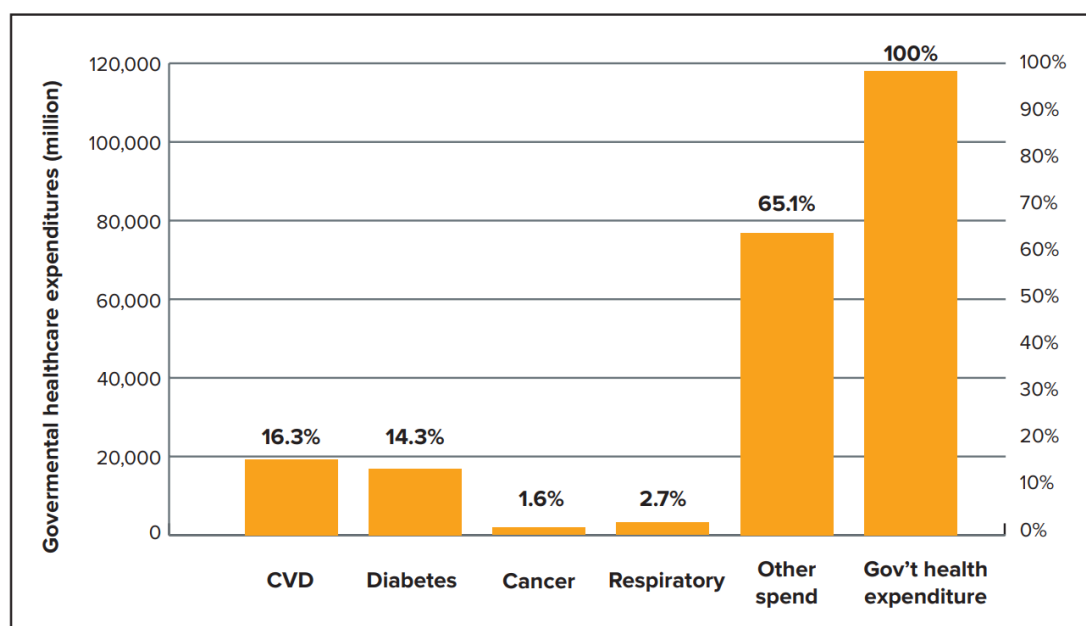


Figure 1.3. KSA Government Health Expenditure in 2019 on the four major NCD groups.

Source:(48), License: CC BY 3.0 IGO

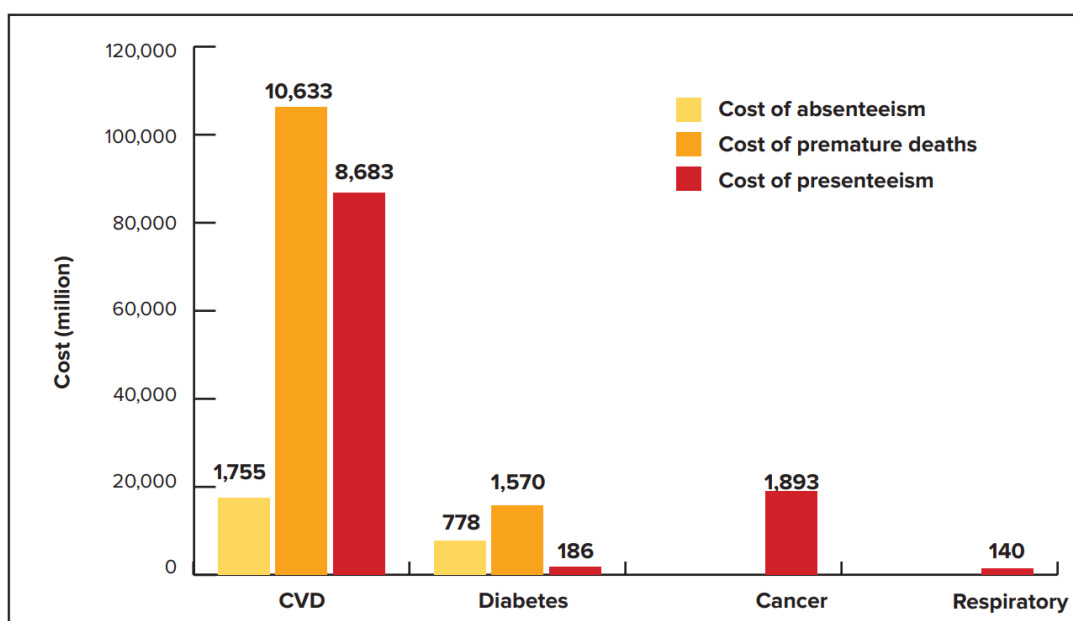


Figure 1.4. Cost of absenteeism, presenteeism, and premature death due to NCDs in KSA, 2019.

Source:(48), License: CC BY 3.0 IGO

1.1.3.3 International evidence of community pharmacist-led chronic disease management services

Community pharmacists worldwide have been involved in chronic disease management by delivering a wide range of interventions. A systematic review in 2010

found that community pharmacists in several countries, including the UK, Canada, Germany, Australia, Portugal, Brazil, and Finland, were involved in the management of various chronic diseases, including CVD, diabetes, asthma, arthritis, osteoporosis, and depression, either alone or in collaboration with other healthcare providers (30). The study highlighted evidence supporting the effectiveness of community pharmacist-led interventions such as BP monitoring, CVD risk counselling, and education on disease and lifestyle, for managing hyperlipidaemia, diabetes, and HTN. Additionally, preventive services such as weight management and screening were found to be effective services in community pharmacies in some countries (30). An umbrella review in 2020 was conducted to explore the impact of community pharmacist-led chronic disease management interventions on clinical, utilisation, and economic outcomes. The review found that community pharmacist-led interventions resulted in significant reductions in total cholesterol (TC), low-density lipoprotein (LDL), and HbA1c levels in patients with diabetes. Furthermore, favourable reductions in BP and readmission rates among patients with heart failure, improved lung function in patients with respiratory conditions, and improved medication adherence were reported in some of the included reviews as positive impacts of community pharmacist-led chronic disease management services (33). Although only a limited number of studies within that umbrella review have investigated the economic impact of community pharmacy services, these studies have reported that medical and healthcare costs for patients with diabetes decreased with their use. This international evidence shows that community pharmacists can not only promote public health but also help reduce healthcare costs. This supports expanding community pharmacy services in KSA to achieve the same benefits and values observed in other countries.

1.1.3.4 National KSA evidence of community pharmacist-led chronic disease management services

The extended services targeting chronic NCDs in community pharmacies are not fully implemented across all community pharmacies in KSA. Some of the recently implemented services to prevent and manage chronic conditions in a few branches of large pharmacy chains in KSA include patient education, lifestyle modification, POC testing, and BP monitoring (43, 44). Nevertheless, there is a lack of evidence on the detailed nature, description, extent, and impact of these newly implemented services, apart from a few studies that evaluated the counselling service provided for asthmatic and diabetic patients (51-53). Two studies conducted in previous years that assessed community pharmacists' ability to counsel asthmatic patients on the appropriate use

of inhalers found that counselling practices were suboptimal in both, highlighting the need for improvement (51, 52). On the other hand, previous evidence suggests the feasibility and effectiveness of in-store one-to-one counselling sessions for diabetic patients provided by trained community pharmacists (53). This study evaluated the impact of the diabetic education programme on the patients' behaviours, treatment adherence, and diabetes biomarkers, and found promising results, including significant improvement in HbA1C level after the counselling sessions in comparison to the baseline level, and significant improvement in patients' behaviours and self-care, where the patients reported less skipping of their medication, more monitoring of their BG and more engaging with physical activity and healthy diet (53). Another study aimed to evaluate the medical devices-related counselling practice among community pharmacists in KSA reported that community pharmacists had good counselling practice for medical devices such as BG monitors and BP monitors; however, this study only reflected the self-reported practice and did not assess the impact of this service on patients' health outcomes (54). Due to the paucity of studies evaluating the effectiveness of newly implemented services, the roles and impacts of community pharmacists in chronic disease prevention and management in KSA remain unknown. Therefore, more rigorous studies are needed to explore the extent and effectiveness of community pharmacists' involvement in chronic disease management.

1.1.4 CVDs as a public health priority in KSA

1.1.4.1 Background and epidemiology

CVDs are the leading cause of death and a major public health concern globally, with an estimated 523 million prevalent cases of CVDs reported in 2019 (55), and approximately 19.8 million deaths worldwide in 2022 (56). According to the WHO, CVDs are defined as "a group of disorders affecting the heart or blood vessels", including coronary heart disease, cerebrovascular disease, peripheral arterial disease, rheumatic heart disease, congenital heart disease, deep vein thrombosis, and pulmonary embolism (56). In KSA, CVDs account for approximately 45 -46% of all deaths (57), with 294 per 100,000 population dying each year from CVDs, and 3,702 per 100,000 population non-fatal CVD cases (58). A 2024 study found that the overall prevalence of CVDs among people aged 15 and older was 1.6%, with a significantly higher rate in males (1.9%) than in females (1.4%) (59). In 2016, the estimated economic impact of CVDs in KSA amounted to 13.125 billion SAR (US \$3.5

billion) (57, 60). By 2035, the prevalence of CVDs in KSA is projected to rise by approximately 480,000 individuals, leading to a threefold surge in the economic burden (60). As of the latest available data from 2019, the economic burden of CVDs in KSA is estimated at 52 billion SAR, equivalent to 57% of the total economic burden of NCDs in KSA (48). The disability burden of CVDs in KSA, as reported in 2017, was 10,921 years of healthy life lost due to disability (YLDs) per 100,000 individuals (61). Moreover, the onset of CVDs is affecting the younger population in KSA, causing premature death, which in turn has resulted in early retirement, reduced workforce, and long-term healthcare costs (58, 62). Clearly, CVDs significantly affect the healthcare system, mortality rates, quality of life, and the economic burden, making them a top public health priority in KSA over other NCDs (58, 63). Therefore, there is an urgent need for public health strategies that target and prioritise CVDs to minimise their health and economic burden and increase the life expectancy of Saudi citizens (15, 58). For instance, the involvement of community pharmacists in more extended services targeting the prevention and control of CVDs.

1.1.4.2 CVD risk factors

CVD risk factors are classified as modifiable and non-modifiable. The modifiable risk factors are commonly lifestyle or behavioural factors, such as smoking, lack of exercise, and an unhealthy diet high in salt and fat. All of these could be targeting areas for community pharmacy extended services as seen in other developed countries. These behavioural factors could lead to high BP, high cholesterol levels, obesity, and diabetes, which are considered intermediate risk factors for CVD (described below: Intermediate risk factors for CVDs) (56, 64). The sedentary lifestyle of Saudi citizens, the high consumption of tobacco, and high fatty foods have resulted in the high prevalence of CVDs in KSA (57, 58). A previous epidemiological study in 2020 assessed the prevalence of CVD risk factors among Saudi adults, including 2047 participants from rural and urban areas in KSA. Physical activity was observed in 69.4%, obesity in 49.6%, unhealthy diet in 34.4%, dyslipidaemia in 32.1%, hypertension in 30.3%, diabetes in 25.1%, and 12.2% were current smokers, with all having more than one risk factor, highlighting the high prevalence of major CVD risk factors in the country (65).

On the other hand, the non-modifiable factors that cannot be controlled include gender, age, race, and family history of NCDs. In KSA, a study conducted in 2019 found that patients aged 61-75 years were at the highest risk of CVDs compared to

the youngest age groups, with a prevalence of 49.6%. Although the risk of CVDs increases with age in both males and females, the study showed that it was twice as high in males (33.1%) compared to females (17.1%). The risk in males begins early, around age 30, whereas in females it rises after age 50 (66). It is also important to note that younger adults (18-40 years) face an increasing risk of CVDs due to the prevalence of metabolic syndromes, including elevated lipid levels, BG, BP, and obesity, as well as behavioural factors in the younger population (58, 62, 66). Family history is another important, well-recognised non-modifiable risk factor that was frequently reported in previous Saudi studies (66-68). Even though these non-modifiable risk factors are inevitable, the consequences could be mitigated by controlling the behavioural factors from an early age (58, 66). This is an example in which community pharmacists could play a crucial role by providing preventive services for chronic diseases, such as weight management, smoking cessation, and other health promotion activities.

1.1.4.2.1 Intermediate risk factors for CVDs

Several intermediate risk factors, including HTN, dyslipidaemia, diabetes, and obesity, drive CVDs. These risk factors are closely interconnected, with each condition increasing the likelihood of developing another, ultimately compounding an individual's overall CVD risk. These factors are described as follows:

1. Dyslipidaemia refers to an imbalance or elevation in lipids such as total cholesterol (TC), low-density lipoprotein (LDL), triglycerides (TG), and high-density lipoprotein (HDL). It is usually associated with genetic or behavioural factors and with other medical conditions, such as obesity, diabetes, and other metabolic syndromes. There are two main types: primary dyslipidaemia, which is inherited and caused by genetic mutations disrupting normal lipid metabolism; and secondary dyslipidaemia, which results from lifestyle factors or underlying medical conditions. Dyslipidaemia is a well-known and significant risk factor for CVDs (69). The estimated prevalence of dyslipidaemia in KSA, according to the 2021 Kingdom of Saudi Arabia World Health Survey (KSAWHS), was 43% (70).
2. Hypertension (HTN), or what is called the "silent killer", is usually an asymptomatic condition that occurs when the BP in the blood vessels increases to an abnormal level ($\geq 140/90$ mmHg). An unhealthy diet, limited physical activity, stress, smoking, obesity, as well as other conditions like

diabetes and high cholesterol, are the major risk factors of HTN. Elevated BP affects the ability of the heart to pump blood, which could lead to stroke, heart failure, kidney injury, and other CVD events and complications. HTN is the leading cause of death globally, affecting 1.28 billion people worldwide (71, 72). In KSA, according to the most recent descriptive national analysis in 2023, the prevalence of HTN among Saudi Adults was 9.2% (73).

3. Diabetes Mellitus (DM): is a non-communicable metabolic disease characterised by an elevation in BG due to a defect either in the production of insulin in the pancreas (type 1 DM) or in the use of insulin by the body (type 2 DM). Lifestyle, overweight, obesity, and family history are the common risk factors of type 2 DM. Diabetes is the major cause of many serious conditions, such as blindness, kidney disease, stroke, heart attack, and other CVD events. The latest edition of the International Diabetes Federation Diabetes Atlas 2025 estimates the prevalence of diabetes among adults aged 20-79 in KSA at 23.1%, which is approximately double the global prevalence of 11.1% (74).
4. Overweight and obesity: defined as an excessive fat accumulation where the body mass index (BMI) is over 25 Kg/m² (Overweight: 25-29 Kg/m², Obesity: ≥30 kg/m²). They are considered major risk factors for most chronic diseases and are significantly associated with CVDs. The prevalence of overweight and obesity is dramatically increasing, particularly in children and adolescents (75). According to the KSAWHS-2021 report, the estimated prevalence of overweight and obesity in the Saudi population was 38% and 20%, respectively (70).

1.1.4.3 Prevention

Primary, secondary, or tertiary prevention strategies could be used to address CVDs. Primary prevention of CVDs involves intervening before CVD events occur, which can be achieved by addressing and controlling modifiable risk factors, such as lifestyle modifications, including healthy eating, increased physical activity, and avoidance of smoking and stress. Furthermore, ensuring the regular use of prescribed medications to lower and control blood cholesterol, BP, and BG is also considered primary prevention in patients with dyslipidaemia, HTN, and DM (76). On the contrary, secondary prevention is achieved by screening at-risk individuals to identify CVD at the earliest stage, reduce its impact, and prevent subsequent events and complications (76). Tertiary prevention targets individuals living with CVD and aims to

improve their quality of life and increase their life expectancy. Tertiary prevention is usually achieved through significant interventions, such as invasive medical procedures, to prevent symptom recurrence, further disease progression, and subsequent complications (76). Indeed, primary and secondary prevention are more cost-effective compared to tertiary prevention (76). Thus, preventive services such as lifestyle modification education, early screening, and monitoring medication adherence must be encouraged in community settings to control and address the burden of CVDs.

1.1.4.3.1 The role of community pharmacists in the prevention and control of CVDs globally

The role of community pharmacists in CVD prevention has been reported in several previous reviews, including a wide range of primary and secondary preventive services for CVDs and their major risk factors, as illustrated in Table 1.1 (77-82).

Table 1.1. Community pharmacists' roles in the prevention and control of CVDs (77-82)

Community pharmacist-led interventions	Type of prevention
Lifestyle counselling	Primary
BP and BG self-care management/ device counselling	Primary
Smoking cessation	Primary
Medication adherence support	Primary and secondary
Health education (DM education, HTN education, CVD education)	Primary and secondary
Regular patients follow up	Primary and secondary
Medicine use review/MTM/Drug-related problem identification	Primary and secondary
Referral	Primary and secondary
Prescription initiation/ treatment recommendation (in case of detected dyslipidaemia, DM, HTN)	Primary and secondary
CVD risk screening	Primary and secondary
Weight management	Primary
Physical examination	Primary and secondary
Home visits	Primary and secondary

BP: Blood Pressure, **BG:** Blood Glucose, **DM:** Diabetes Mellitus, **HTN:** Hypertension, **CVD:** Cardiovascular Diseases, **MTM:** Medication Therapy Management

A recent systematic review by Motlohi et al. (2023) found that the most frequently reported roles of community pharmacists in controlling and preventing CVD were

consultation and therapeutic monitoring, medicine and lifestyle counselling, and health education. Moreover, Motlohi et al. (82) assessed patients' perceptions of those services, reported in 11 (24%) of the 45 included studies in the review, showing high patient satisfaction with community pharmacist roles, particularly for medicine and lifestyle counselling, MTM, screening, disease education, and treatment prescribing. Additionally, patients showed a willingness to engage with those services in the future (82). In addition to humanistic outcomes (patients' willingness and satisfaction), previous studies have also assessed the clinical outcomes of community pharmacist-led interventions to prevent and control CVDs. For instance, a systematic review and meta-analysis of randomised controlled trials (RCTs) found that community pharmacist-led interventions, such as patient education, medication review, and lifestyle counselling, can significantly reduce both systolic and diastolic blood pressure (SBP/DBP) in patients with HTN (79). Similarly, another systematic review reported improvements in SBP and HbA1C following community pharmacist-led interventions for HTN and diabetes management. Furthermore, a significant reduction in CVD risk reflected by an improvement in cholesterol level, SBP, HbA1C, and smoking cessation were reported in a previous RCT in Canada as a result of community pharmacist interventions, including patient assessment and screening for CVD risk factors, patient education, treatment recommendation and patient follow-up (83). All these findings shed light on the significance of community pharmacists' roles in preventing and controlling CVDs and encourage the implementation of such interventions in community pharmacies in KSA.

1.1.4.4 Public health recommendations to tackle CVDs in KSA

The Saudi government has prioritised CVDs and recommends several public health strategies to reduce CVD mortality and morbidity. The recommendations, as presented by the National Heart Centre (58), are presented in Figure 1.5. Based on a discrete-event simulation model, it is expected that within the first five years of implementing those strategies, there will be a substantial reduction in total CVD deaths and non-fatal CVD events (58). To achieve this promising result, the government has invested 11,269 SAR (US \$3,005) per patient to cover the costs of screening tests, healthcare professional visits, and lipid-lowering therapies over five years. This investment is expected to result in an annual productivity increase of 1,905 million SAR (US \$ 508 million), calculated based on the number of prevented deaths and the GDP per capita in 2018 (58). Keeping that in mind, community pharmacies

offer an opportunity to establish screening and educational programmes at the community level with multiple access points to prevent and control CVDs.

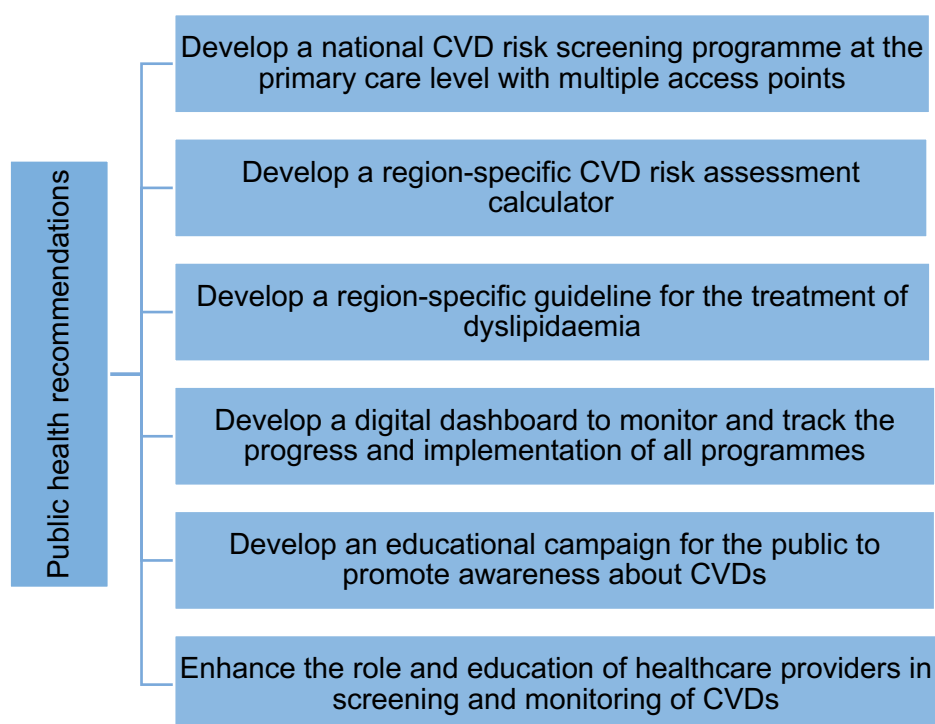


Figure 1.5. Public health recommendations to tackle CVDs in KSA (58)

1.2 Thesis rationale

Based on the evidence discussed previously, community pharmacists can contribute to the prevention and management of chronic NCDs by providing a range of services. Internationally, the documented humanistic, clinical, and economic outcomes of pharmacy-led interventions in the literature provide strong evidence of the vital role community pharmacists play in delivering expanded non-dispensing services. As noted earlier, extended and advanced community pharmacy care is a relatively new concept in KSA, and its implementation is only partial. National evidence on the nature, scope, and effectiveness of these services in KSA remains limited, underscoring the need for further research to examine them in detail and assess their impact on patients' health outcomes. Furthermore, there is no comprehensive review of current community pharmacy practices within the country. Most existing evidence in KSA comprises individual studies that either evaluate a single service or examine stakeholder perspectives on current practices or future service development. While useful, these isolated studies do not offer a complete picture of the current practice landscape or the potential benefits of introducing new services. Consequently, additional research is necessary to develop a thorough understanding of current

practices, identify gaps and opportunities for improvement, and provide insights to guide the evaluation or expansion of services and the development of new extended initiatives, especially those targeting NCDs and CVDs.

1.3 Aim and objectives

This thesis aims to examine current community pharmacy practices in KSA and develop opportunities to enhance community pharmacy services for patients with chronic NCDs/CVDs. To achieve this goal, it adopts a sequential, multi-stage approach in which each stage informs the next. It comprises two main stages, with the second further divided into three consecutive steps, as presented in Figure 1.6.

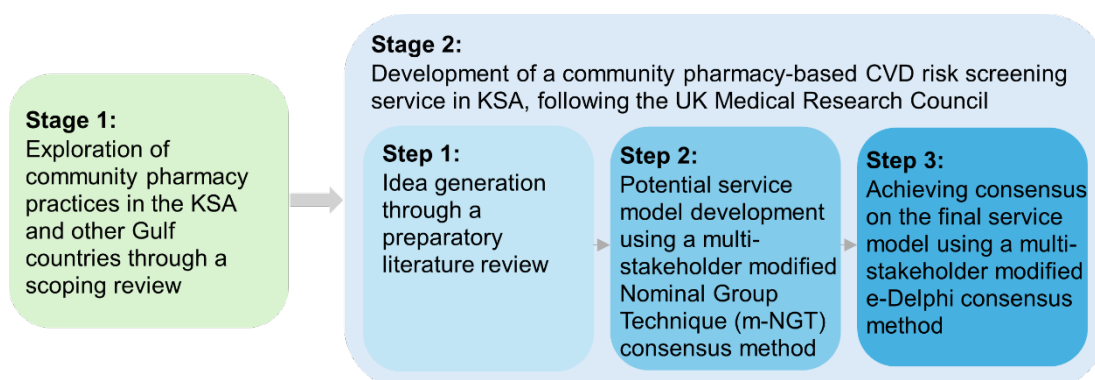


Figure 1.6. Overview of the thesis's stages.

Stage 1: Exploration of community pharmacy practices in KSA and other Gulf countries (Chapter 2)

The rationale for examining community pharmacy practices across all Gulf Cooperation Council (GCC) countries (Kingdom of Saudi Arabia (KSA), the United Arab Emirates (UAE), Kuwait, Qatar, Oman, and Bahrain), rather than just in KSA, is that the Gulf region is working together towards a shared goal. In other words, all GCC countries are experiencing increased pressure on the healthcare system due to the rising prevalence of NCDs, population growth, and higher life expectancy, which has led to major changes in healthcare infrastructure by GCC governments, with a focus on strengthening primary care and prioritising strategies to prevent NCDs (84, 85). As a result of these transformations, community pharmacy practice in some GCC countries is shifting towards extended care (86-91). Furthermore, the similarities in culture and healthcare systems among GCC countries make it practical to use other GCC nations as benchmarks for learning from their experiences and identifying research and practice gaps in KSA (84). Therefore, understanding the services available in other Gulf countries would help identify which services require further

evaluation and which might be feasible to develop and implement in KSA, drawing on the experience of other GCC countries.

Aim: to explore the evidence of existing established services, piloted services, and services tested for future implementation in KSA and other Gulf countries to help identify the gaps and inform improvement opportunities (Chapter 2).

Objectives:

- Describe the type, nature, extent, and/or effectiveness of community pharmacy services in the Gulf region
- Summarise the barriers and enablers for delivering community pharmacy services in the Gulf region

Stage 2: Development of community pharmacy-based CVD risk screening service in KSA

This stage was informed by the results of the first stage. As discussed in this chapter, CVDs remain the leading cause of death in KSA, accounting for the highest proportion of NCD-related mortality in the country. Developing a CVD risk screening service has been recommended as a top public health strategy. The findings of the scoping review (Stage 1: Chapter 2) further supported the development of a community pharmacy-based CVD risk screening service. Therefore, the overall aim of this stage is to develop an evidence-based, consensus-driven community pharmacy-based CVD risk screening service in KSA.

This stage, guided by the UK Medical Research Council framework for developing and evaluating complex interventions, comprised three consecutive steps: (1) idea generation, (2) potential service model development, and (3) achieving consensus on the final service model and specifications, as outlined below:

Step 1: Idea generation through a preparatory literature review (Chapter 3)

Aim: to explore community pharmacy-based CVD risk screening programmes worldwide and identify the key components typically included in these services, in order to inform the development of materials for the subsequent service-development process and to support the creation of an evidence-based service.

Objectives:

- Summarise existing evidence on community pharmacy-based CVD risk screening services regarding their structure, components, requirements, and/or effectiveness
- Create detailed lists of ideas for essential service components
- Map previously identified barriers and facilitators from the literature onto a determinants framework
- Create a list of implementation strategies based on the identified barriers and facilitators

Step 2: Potential service model development using a multi-stakeholder modified Nominal Group Technique (m-NGT) consensus method (Chapter 4)

Aim: to collaboratively design an evidence-based and consensually agreed-upon potential model for a community pharmacy-based CVD risk screening service in KSA.

Objectives:

- Engage multiple national stakeholders in co-designing a potential service model
- Discuss ideas from the literature with stakeholders to identify the needs and priorities for the service to be implemented in KSA
- Gain stakeholders' agreement on the proposed service model, including its structure and key components

Step 3: Achieving consensus on the final service model using a multi-stakeholder modified e-Delphi consensus method (Chapter 5)

Aim: to refine the model, attain a wider consensus on the final service model and priorities, and assess perceptions of the service.

Objectives:

- Engage a broader group of national experts to refine and/or reach consensus on the proposed service model
- Assess the proposed service model in terms of perceived acceptability, practicality, effectiveness, affordability, side effects, and equity using the APEASE criteria (92)

- Prioritise other service specifications and implementation strategies to ensure effective service implementation
- Develop the final service logic model (Chapter 6)

2 Chapter 2: Exploring community pharmacy services in Gulf Cooperation Council (GCC) countries: a scoping review

2.1 Introduction

Community pharmacy plays a vital role in the healthcare system due to its high accessibility, extended opening hours, and appointment-free services. This places community pharmacists as the primary point of contact for many healthcare needs, offering essential services such as retail sales, medication distribution, counselling, and other pharmaceutical services (26, 93). The professional pharmaceutical care services offered by community pharmacists aim to optimise patient care, improve health outcomes, and enhance the value of healthcare (28, 29). Thus, community pharmacists can make significant contributions to patient care.

As discussed in Chapter 1, community pharmacy practice has been evolving, with community pharmacies worldwide, particularly in developed countries, now contributing to public health by providing extended services. For instance, in countries like the UK, USA, Australia, and Canada, community pharmacists collaborate with other healthcare providers in chronic disease and minor ailment management through education, medication review, assessment, and adherence monitoring (30, 31). Additionally, community pharmacists in several countries play an essential role in enhancing immunisation rates through education and vaccination services (32-35). Furthermore, the introduction of minor ailment services in the UK over 20 years ago, alongside recent implementations of more clinical services such as the Pharmacy First scheme (36-40), demonstrates the expanding role of community pharmacies in alleviating pressure on general practice (GPs) while providing accessible healthcare services. Significant outcomes have been identified as a result of community pharmacists-led interventions, such as improved medication adherence, better disease control, and improved quality of life (94-96). This international evidence clearly demonstrates the capabilities and important roles of community pharmacists within the healthcare system.

However, despite this expanding and evolving clinical role of community pharmacists in health promotion and disease management globally, the provision of pharmaceutical care in community pharmacies in the Gulf Cooperation Council (GCC) countries (Kingdom of Saudi Arabia (KSA), United Arab Emirates (UAE), Kuwait, Qatar, Oman, Bahrain) are not universally established and are still in initial stages of planning and implementation (25, 88, 97).

In the GCC countries, community pharmacy practice primarily revolves around the traditional role of dispensing and counselling, with limited involvement in enhanced or extended pharmacy services (EPS) beyond the routine provision of over-the-counter (OTC) (25, 44, 86). Several GCC countries plan to expand community pharmacists' roles and enhance their scope and responsibilities. In KSA, for instance, recent Ministry of Health (MOH) regulations in 2019 allow community pharmacists to offer vaccinations, vital signs assessment, health education, medication therapy management (MTM), minor illness care, consultations, and compounding (87). Similarly, the Health Authority Abu Dhabi (HAAD) has extended the range of services provided by community pharmacists to include screening, point of care (POC) testing, vaccination, medicine use management, patient counselling, health promotion and preventive care (88). Qatar National Health Strategy (QNHS) 2018–2022 has prioritised the integrated model of care, supporting the role of community pharmacists as a key healthcare professional whose contribution is crucial to expanding access to primary care services and providing more services, including management of minor ailments and health promotion (90, 91). On the other hand, Kuwait and Oman focus more broadly on enhancing pharmaceutical care services without specific measures tailored to community pharmacies (89, 98). Unfortunately, Bahrain lacks a published regulatory framework for pharmaceutical care in this context.

In line with these regulations and development plans, some GCC countries have recently established new community pharmacy services, including e-prescription, telepharmacy, weight management, vaccination, and POC testing (9, 25, 44, 88, 99, 100). However, little is known about the range, scope, and impact of services currently implemented and practised in community pharmacies across the GCC countries, compared with what has been stated and defined in their regulations. Previous studies have primarily assessed individual services within single countries (25, 88, 100). Moreover, prior reviews have focused on opportunities and challenges for extended community pharmacy services rather than on the services actually delivered (97, 100). Importantly, no comprehensive review has yet been conducted to collate the available evidence on the current state of community pharmacy practice across all GCC countries. This is particularly important because results from different countries can serve as benchmarks to assess performance, identify gaps and areas for improvement, and provide lessons to inform further expansion and implementation of services. Therefore, this study addresses this gap by undertaking a scoping review of the evidence on existing services, piloted services, and services tested for future

implementation in the region, and by describing the type, nature, extent, quality and impact of these services, as well as the barriers and facilitators to their delivery.

2.2 Review question

The current review aims to address the following question: What published evidence exists on the services provided or tested in the community pharmacy setting in the GCC countries, including their type, nature, extent, and/or effectiveness?

2.3 Methods

Given the broad, exploratory, and descriptive nature of this review, a scoping review was employed as a more appropriate method than a systematic review and meta-analysis. It aimed to describe community pharmacists' practice in the Gulf region, summarise the available evidence and identify gaps in the literature, without informing clinical decision-making (101). The scoping review was conducted in accordance with the Joanna Briggs Institute (JBI) methodology for scoping review (102) ([JBI scoping review](#)) and followed the Preferred Reporting Items for Systematic reviews and Meta-Analysis extension for scoping review checklist (103) (Appendix A5: Reporting checklist). The study protocol was submitted to Pure (104) ([Review protocol](#)).

2.3.1 Changes to the protocol

Minor modifications to the eligibility criteria were made after the protocol was submitted. Studies that assessed knowledge, attitudes, or perceptions regarding community pharmacy services or community pharmacists' roles were included, as they would help understand community pharmacists' readiness to provide future extended services.

2.3.2 Eligibility criteria

The **P**articipants, **C**oncept, and **C**ontext (**PCC**) framework was used to determine the eligibility and exclusion criteria for this review, and to help develop an effective search strategy (102). The PCC framework is recommended to be used in the scoping review to help construct a clear title and inform less restrictive inclusion criteria (102). The detailed inclusion and exclusion criteria are presented in Table 2.1.

2.3.2.1 Participants

This review considered pharmacists working in community pharmacy, community pharmacy consumers, and other stakeholders, such as clinical practitioners. On the other hand, pharmacists working in settings other than community pharmacy, such as hospitals, clinical, and ambulatory care, were excluded. Additionally, studies that included pharmacists from different settings without distinguishing the role of community pharmacists were excluded.

2.3.2.2 Concept

The concept of interest is any community pharmacy service, including both traditional (dispensing and counselling) and extended non-dispensing services such as medication prescribing, medication review and management, adverse drug reaction reporting, performing diagnostic testing and administering vaccination, vital signs assessment, health, and medical device education, pharmaceutical consultations, and lifestyle modification. However, studies were excluded if the services were provided in settings other than community pharmacies, such as hospital or ambulatory care pharmacies. Exploring all types of community pharmacy services would help assess readiness to change practice by understanding the extent of each service and the existing evidence for both traditional and extended services.

2.3.2.3 Context

This scoping review included all studies from the Gulf countries on community pharmacy practice and the role of community pharmacists in promoting public health. Studies on community pharmacy practice in countries other than the Gulf region, or in the Gulf region but in a setting other than community pharmacy, were excluded.

Table 2.1. Inclusion and exclusion criteria

	Inclusion	Exclusion
Participants (P)	community pharmacists, community pharmacy consumers, and other stakeholders such as clinical practitioners.	Pharmacists work in settings other than community pharmacies, such as hospitals, clinical, or ambulatory care. Studies that include pharmacists from different settings without distinguishing the role of community pharmacists.

	Inclusion	Exclusion
Concept (C)	All services provided within the community pharmacy setting (traditional or extended), including but not limited to dispensing, medication prescribing, E-prescribing, medication refill, medication review and management, counselling, adverse drug reaction reporting, point of care testing, vaccination, vital signs assessment, health, and medical device education, pharmaceutical consultations, lifestyle modification.	Any service provided in a setting other than the community pharmacy setting, such as hospitals, ambulatory care, or primary care settings.
Context (C)	Community pharmacies in the GCC countries (KSA, UAE, Kuwait, Qatar, Oman, and Bahrain).	Outpatient pharmacies in hospitals, primary care centres or community pharmacies in countries other than GCC countries.
Type of Study	-Studies that assess the existing services, piloted services, or studies that assess the readiness and willingness for future services implementation. -Studies that assess knowledge, attitude, or perception (barriers and facilitators) about community pharmacy services or the community pharmacists' role.	-Studies that assess knowledge, attitude, and perception, that are not related to the services or community pharmacists' role. -Studies that explore barriers and facilitators without describing a specific service.
Type of publication/ Methodology	Primary research methodologies: qualitative, quantitative, and mixed methods.	Reviews, case studies, reports, posters, conference abstracts, abstracts without full-text, and study protocols.
Language	Only Arabic and English languages.	Any other languages.

2.3.3 Types of sources

This review considered all original primary research methodologies: qualitative, quantitative, and mixed methods. Qualitative studies, such as in-depth one-to-one interviews with stakeholders, and other types of interviews, as well as quantitative study designs, including analytical and descriptive cross-sectional self-reported questionnaire-based studies, feasibility studies, simulated patient studies, and other analytical observational studies, such as pre- and post- and case-control studies,

were included. The rationale for incorporating various designs is to comprehensively explore and synthesise all accessible evidence concerning this topic.

2.3.4 Search strategy

A specific search strategy was developed by initially searching the Ovid EMBASE database to identify articles on the topic. The text words contained in the titles and abstracts of the relevant retrieved articles and the index terms in each article were used to inform a full search strategy for this review. A combination of medical subject headings (MeSH) and free-text terms and Keywords related to the three domains in the research question: community pharmacist, community pharmacy services, and GCC countries were adopted and combined using the Boolean operator OR for each domain and operator AND to combine all search domains (**Appendix A1: Search strategy**). Following the initial search of one database, the final search strategy was developed after constructive discussion with supervisors (AK, NW) and the faculty librarian (Elaine Blair). Published studies on this topic were identified using the agreed search strategy on multiple databases: Ovid MEDLINE, EMBASE (Excerpta Medica database), CINAHL (Cumulative Index to Nursing and Allied Health Literature), and Scopus, as these databases are more relevant to the pharmacy practice and useful for studying pharmacy, health policy, public health, and the healthcare system. Databases were initially searched from inception on 25th July 2023 and re-searched for an update on 6th December 2024, to capture all studies relevant to community pharmacy practice in the Gulf region. Studies published in English or the Arabic language were included.

2.3.5 Source of evidence selection

Following the search, identified studies were imported first into EndNote 20 reference manager software with each database in a separate file, for reference storing, then uploaded into Covidence software (105) where duplicate studies in each database were removed first automatically. After deduplication, titles, and abstracts screening of the remaining studies was carried out by two independent reviewers, the primary reviewer (SN) and another independent reviewer (HA) to assess the studies against the eligibility criteria. This validation process was conducted only for the initial search, whereas the subsequent updated search was screened solely by the primary reviewer and was not independently validated by a second reviewer. Any additional duplicates identified throughout the screening process were manually removed. Potentially

relevant sources were retrieved in full. The full text of selected citations was assessed in detail against the inclusion criteria by two independent reviewers (SN, HA). Inaccessible full-text studies were requested through the university library or by emailing the author. Studies that could not be accessed or did not satisfy the inclusion criteria were excluded. Reasons for exclusion of sources of evidence in the full text were recorded.

Any disagreements between the reviewers at each stage of the selection process were resolved through discussion between the two reviewers. As the second reviewer completed the screening process for all studies (100%), the objective was to achieve a minimum agreement of 80%. Ultimately, achieving at least 80% agreement between reviewers is recommended to enhance the robustness, reliability, and validity of the review process (106, 107). The higher the agreement, the more accurate and dependable the research outcomes are (107). The PRISMA-ScR flow diagram was used to represent the studies' screening and selection process (Figure 2.1. PRISMA-ScR flow diagram.).

2.3.6 Data charting

The data extraction form was first developed by the primary reviewer in Microsoft Excel 2021©, then piloted for each study design and service type, and modified to include the required information. Thus, the data extraction form that was previously designed in the study protocol was modified later to collect comprehensive details about the study characteristics, including authors, year of publication, the aim of the study, methodology, setting, participants, baseline characteristics, and the study findings, conclusion, and recommendations relevant to the review. Additionally, the extraction form included comprehensive information about the service and the service characteristics, including the type of service, service-targeted population, service-targeted health issue, service fees, and stage of implementation, following the guidance of the Template for Intervention Description and Replication (TIDieR) checklist (108). An example of the data extraction form used is provided in (Error! Reference source not found.). The data extraction process was carried out for all included studies by the primary independent reviewer using the data extraction form developed (SN). Another independent reviewer (HA) performed data extraction for 10% of the included studies to validate the primary reviewer's work, aiming for at least 80% agreement to provide confidence for the primary reviewer to proceed with data extraction for all included studies independently.

2.3.7 Data analysis and presentation

Data were extracted for both narrative synthesis and descriptive purposes. Thus, the extracted data were presented in a tabular form accompanied by a narrative descriptive summary of the evidence that aligns with the review question and objectives. For the synthesis of the results, each service was first grouped according to the extent of practice/ stage of implementation into four categories:

- 1) Nationally implemented: the fully developed, traditional or regulated services that are practised in all or a wide range of pharmacies, irrespective of the quality of practice;
- 2) Locally practised: service that is not considered a core service but is practised by some pharmacists to varying degrees and quality, irrespective of the regulation status;
- 3) Piloted: service in the developmental stage wherein the service is implemented within a limited number of pharmacies to evaluate its feasibility; and
- 4) Explored for future implementation services that are not implemented or practised yet but are explored for future implementation by exploring perceptions, knowledge, attitudes, readiness, willingness, barriers and/or facilitators.

Services were then sub-grouped according to the nature of service into two main categories: 1) Traditional services, and 2) Extended services. Those under “Extended services” were further classified by service type, including minor ailment management, Health promotion, mental health care, services targeting chronic conditions, immunisation, medication review, technology-assisted services, independent prescribing, pregnancy and lactation, and adverse drug reactions reporting. Each service in each group was described in terms of the country of practice, nature of practice, and/or effectiveness. The identified areas for improvement and recommendations for future services were described in a separate section. Additionally, various tables were created to systematically present the data, including tables for study characteristics and study results.

2.3.8 Critical appraisal of sources of evidence

This step is ideally not required for scoping reviews (102). Since the research question for this review is broad and aims only to describe services in which no clinical decision would be made, the decision was made not to conduct a critical appraisal.

2.4 Results

2.4.1 Source of evidence selection

The search strategy identified a total of 2,385 (576 from MEDLINE, 867 from Embase, 343 from CINAHL, and 599 from Scopus), which were imported into Covidence (105). A total of 958 duplicate studies were removed: 895 were automatically detected, and 63 were manually detected. After deduplication, 1,427 studies underwent title and abstract screening. Subsequently, 175 potentially relevant sources were selected for full-text screening; however, 10 studies were initially inaccessible and had to be requested. Of them, 6 studies were successfully accessed upon request, resulting in a total of 171 studies retrieved in full. One additional study was identified from the reference lists of the included studies. A total of 56 studies did not satisfy the inclusion criteria and were excluded. The reasons for excluding each source of evidence in the full text were documented, including wrong setting, wrong participants, conference abstracts, focusing on knowledge, and not describing the service. These reasons aligned with the eligibility criteria and the review's objective. The agreement rate at both title and abstract and full-text screening was 92%. The results of the database search and the study inclusion process, as well as the reasons for exclusion, are presented in Figure 2.1. PRISMA-ScR flow diagram.

2.4.2 Data charting

Data were extracted from 116 included studies. To ensure validation, an independent reviewer (HA) extracted data from 9 studies (10% of the 95 included studies from the initial search). The two reviewers demonstrated 96.7% agreement during data extraction.

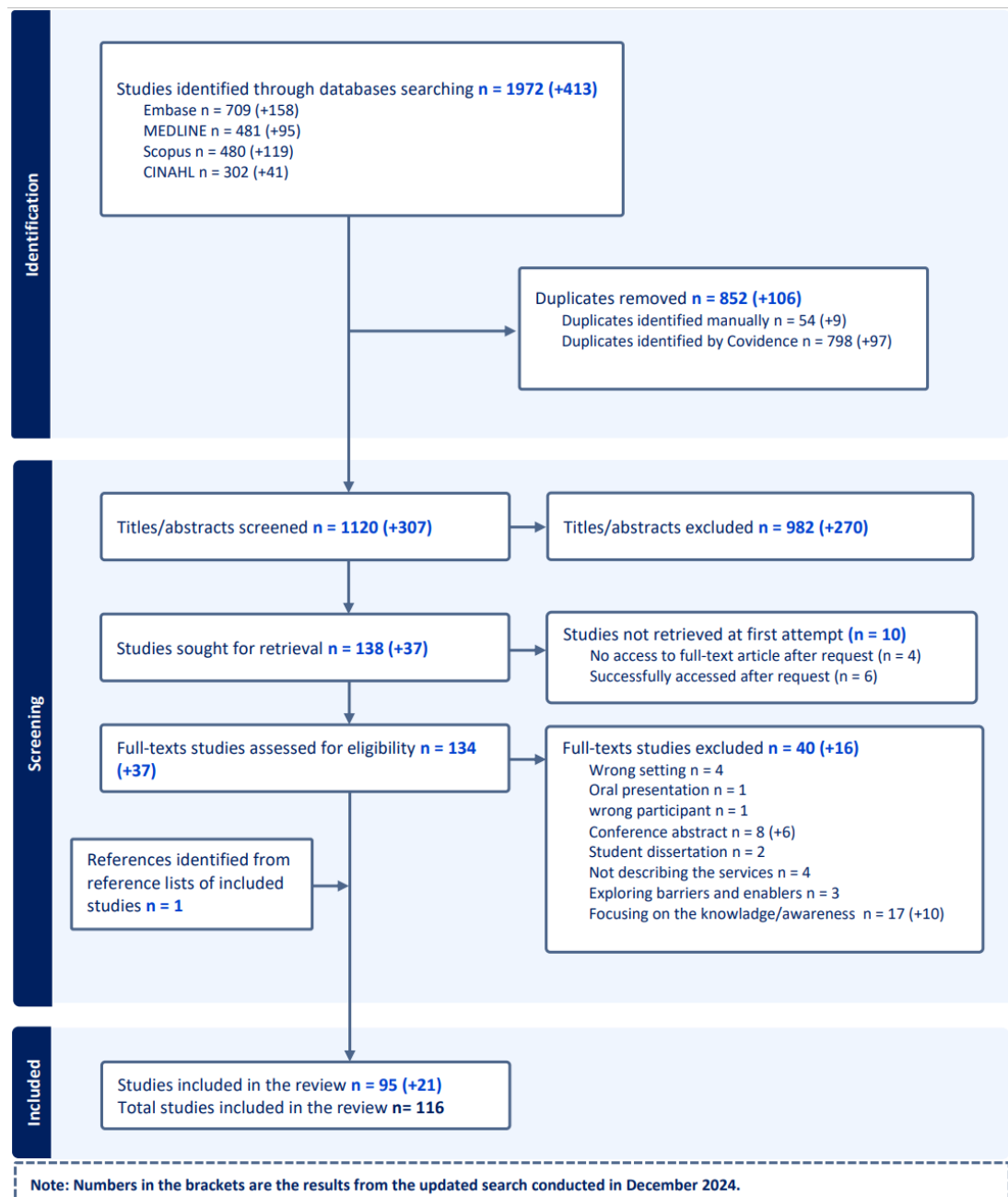


Figure 2.1. PRISMA-ScR flow diagram.

2.4.3 Characteristics of sources of evidence

Table 2.2 provides an overview of the studies characteristics. Slightly more than half of the included studies were conducted in KSA (n=61, 52.6%) (21, 22, 25, 51-54, 109-162), and nearly one-third of the studies were conducted in UAE (n=38, 32.8%) (86, 163-199), (n=12, 10.3%) studies in Qatar (200-209), (n=5, 4.3%) studies in Kuwait (210-214), with no studies found in Bahrain and Oman. Of the 116 included studies, 34 (29.3%) studies explored the traditional services (22, 54, 109-123, 151, 154, 157, 158, 163-169, 193, 194, 200, 202, 214, 215), 97 (83.6%) explored the extended

services (21, 22, 25, 51-53, 86, 109, 115, 120, 122-150, 152-157, 159-164, 167-192, 195-213, 216), and of them, 15 (12.9%) explored both traditional and extended services (22, 25, 53, 115, 120, 122, 123, 129, 163, 164, 168, 200, 202). The majority of studies used quantitative methodology (n=105, 90.5%) (21, 22, 51-54, 86, 109-124, 126-137, 139-144, 163-171, 173-179, 181-187, 189-194, 200-203, 205-216), (n=8, 6.9%) studies used qualitative methodology (25, 125, 138, 145, 146, 156, 172, 188), and (n=3, 2.6%) studies used mixed methods design (153, 180, 204). Of the 105 studies that used quantitative methodology, (n=74/105, 70.5%) were questionnaire-based (21, 22, 54, 86, 109-111, 113, 114, 118, 120-124, 126-128, 130-137, 139, 141-144, 147-149, 152, 154, 155, 157-163, 166, 169, 175-178, 184-187, 189-192, 194-196, 199, 201-203, 205, 206, 208-214, 216), (n=15, 14.3%) were observational simulated patients-based study (51, 52, 115-117, 119, 157, 158, 164, 165, 167, 168, 174, 179, 193, 200, 201), and (n=7, 6.7%) used both self-reported questionnaire and simulated patient visits (112, 116, 129, 154, 215). Additionally, (n=2, 1.9%) were before and after comparative studies (53, 170), (n=2, 1.9 %) were prospective observational comparative studies (181, 198), (n=3, 2.9%) feasibility studies (173) (53, 153), (n=1, 0.95%) randomised control trial (RCT) (183), and (n=1, 0.95%) cost-analysis economic study (140). Most studies either described the practice and/or explored perceptions (n=106, 91.4%) (21, 22, 25, 51, 52, 54, 86, 109-138, 141-147, 149, 152-159, 161-169, 171, 172, 174-180, 184-216), while a minority of studies evaluated effectiveness in terms of humanistic (n=16, 13.8%) (22, 53, 114, 118, 122, 139, 148, 152, 153, 160, 161, 170, 171, 173, 183, 197), clinical (n=10, 8.6%) (53, 153, 170, 171, 173, 181-183, 197, 198), and economic (n=1, 0.9%) effectiveness (140). A large number of studies evaluated the community pharmacists' practice or explored the service from the perspective of community pharmacists (n=80, 68.4%) (21, 51, 52, 54, 110, 112, 115-117, 119-121, 124, 126-133, 138, 141-144, 147-149, 154-159, 161-165, 167-169, 172, 174, 176-182, 184-187, 190, 193-196, 199-207, 209-216) with (n=7, 6.03%) studies included pharmacists from different sectors like community, hospital and ambulatory pharmacies (125, 135, 136, 166, 175, 191, 208). Some studies evaluated the impact of service on patients' health outcomes or explored the service from patients'/consumers' perspectives (n=24, 20.7%) (22, 53, 109, 111, 113, 114, 118, 122, 123, 134, 137, 139, 146, 170, 171, 173, 183, 189), while the perspective of physicians, and other stakeholders or policymakers were assessed in (n=2, 1.7%) studies for each (25, 145, 188, 192). The majority of studies (n=80, 68.9%) were published in the latest years (between 2019 and 2024) (21, 22, 25, 53,

54, 86, 117-123, 125, 127-132, 134-141, 143-162, 164-168, 171-175, 177, 179-186, 191, 192, 195-199, 201, 202, 204, 206, 207, 216), with (n=23, 19.8%) studies published between 2013 and 2018 (51, 52, 112-116, 124, 126, 142, 169, 178, 187-190, 200, 205, 208, 209, 212, 213, 215), and (n=13, 11.2%) studies published before that (109-111, 133, 163, 170, 176, 193, 194, 203, 210, 211, 214) (see Appendix A3: Detailed study characteristics). Specific findings for each service are described in the following section.

Table 2.2. Summary of studies characteristics (n=116 studies)

Characteristics	Studies n (%)
Location	
KSA	61 (52.6%)
UAE	38 (32.8%)
Qatar	12 (10.3%)
Kuwait	5 (4.3%)
Bahrain	0 (0.0%)
Oman	0 (0.0%)
Nature and type of service *	
Traditional	34 (29.3%) *
Extended	97 (83.6%) *
• Minor Ailment	12/97 (12.37%)
• Health promotion:	11/97 (11.3%)
- Smoking cessation	3/11 (27.3%)
- Weight management	2/11 (18.2%)
- Breast cancer health promotion	2/11 (18.2%)
- Reproductive health services	2/11 (18.2%)
- Multiple health promotion activities	2/11 (18.2%)
• Mental health care	3/97 (3.1%)
• Services targeting chronic conditions:	21/97 (21.6%)
- Asthma education and management	4/21 (19%)
- Diabetes education	2/21 (9.5%)
- Point of care testing, chronic condition monitoring and management	8/21 (38.1%)
- Disease risk screening	7/21 (33.3%)
• Immunisation	4/97 (4.1%)
• Medication review	6/97 (6.2%)
• Tele-pharmacy/ E-prescription	11/97(11.3%)
• Service for pregnant and lactating women	3/97 (3.1%)
• Independent prescribing	4/97 (4.1%)
• Adverse drug reactions (ADR) reporting	5/97 (5.2%)
• Multiple extended services	17/97 (17.5%)
Both Traditional and Extended	15/116 (12.9%)
Methodology	
Qualitative	8/116 (6.89%)
- Semi-structured in-depth one-to-one interviews	6/8 (75%)
- Semi-structured in-depth one-to-one interviews + focus group discussion	2/8 (25%)
Quantitative	105/116 (90.5%)
- Questionnaire-based study	74/105 (70.5%)
- Observational simulated patients-based study	15/105 (14.3%)
- Both observational simulated patients and questionnaire-based study	7/105 (6.7%)

Characteristics	Studies n (%)
- Before and after comparative study	2/105 (1.9%)
- Prospective observational comparative study	2/105 (1.9%)
- Interventional feasibility study	3/105 (2.9%)
- Randomised control trial (RCT)	1/105 (0.95%)
- Cost-analysis economic study	1/105 (0.95%)
<u>Mixed methods</u>	3/116 (2.6%)
- Exploratory sequential design; semi-structured interviews + a quantitative cross-sectional survey.	1/3 (33.3%)
- Explanatory sequential design; a quantitative cross-sectional survey + semi-structured individual and focus group interviews.	1/3 (33.3%)
- A randomised controlled study embedded with qualitative interviews	1/3 (33.3%)
<u>Outcomes*</u>	
Describing practice and/or exploring perceptions	106/116 (91.4%)
Humanistic (e.g., satisfaction and behavioural change)	16/116 (13.8%)
Clinical	10/116 (8.6%)
Economic	1/116 (0.9%)
<u>Type of participants</u>	
Community pharmacists	80/116 (68.9%)
Community pharmacists, hospital pharmacists, or ambulatory pharmacists	7/116 (6.03%)
Patients/consumers	24/116 (20.7%)
Both community pharmacists and patients	1/116 (0.9%)
Physicians	2/116 (1.7%)
Multiple stakeholders and policymakers	2/116 (1.7%)
<u>Publication</u>	
2004-2012	13/116 (11.2%)
2013-2018	23/116 (19.8%)
2019-2024	80/116 (68.9%)

KSA: Kingdom of Saudi Arabia, **UAE:** United Arab Emirates.

*Given that several studies assessed multiple services and outcomes, the final percentages will add up to more than 100%.

2.4.4 Narrative synthesis

In this section, all the explored community pharmacy services and the involvement of community pharmacists in those services are described in detail. See (Table 2.3) for a summary of results or (Appendix A4: Detailed results) for more detailed results.

Nationally implemented/practised services

Traditional service

Dispensing and counselling:

In the included studies, dispensing and counselling services were mostly combined and treated as a single service, despite being two distinct tasks. This is likely because they are interconnected, with counselling usually occurring at the end of the dispensing process. Overall, dispensing and counselling services appear to be nationally implemented, with those services

fully developed, regulated, and practised by all pharmacists in the included Gulf countries; however, the quality of practice varies. Of the 34 studies that explored the traditional services, 12 studies used simulated patients and observational methods to evaluate and describe the dispensing and counselling practice for various medicine and conditions including OTC, prescription-only medicine (112, 116, 119, 158), sedating antihistamines (117), hormonal contraceptives (164), isotretinoin (165), antidiabetic, antiasthma treatment (193), cardiac conditions treatments (115), gastrointestinal conditions treatments (168, 215), and different minor ailments treatments (201). Collectively, these studies found that the dispensing and counselling practice was suboptimal, where most of the given information was about dose and duration, while information about expected side effects, potential drug-drug interactions, or food-drug interactions was less frequently provided. Additionally, information on medical or medication history, pregnancy status, and drug allergies was often not requested (112, 115-117, 119, 158, 164, 165, 167, 168, 193, 200, 215). Moreover, some studies have revealed that community pharmacists spend insufficient time on counselling (116, 119, 215). For prescription-only medications, two studies found that some community pharmacists in KSA dispensed medications without requesting a prescription or verifying patients' eligibility to use the requested medication (112, 115). A more recent study has shown an improvement in practice, with community pharmacists requesting prescriptions for antibiotics and advising patients to consult a physician before using them (158). A study in the UAE assessed the dispensing practices of community pharmacists for antidiabetic and antiasthma prescriptions with missing data and medication errors, and found that most observed community pharmacists prepared and dispensed the prescription without addressing the missing information or investigating the wrong medication (193).

The traditional services were also described from the perspective of community pharmacists and patients using self-reported questionnaires. Community pharmacists in KSA and UAE described their current role as the following: dispensing of prescription-only and OTC medicines, compounding, identifying medication errors, solving drug-related problems, counselling, and advising patients on the use of medications or other nonpharmacological

treatments and answering other medical inquiries (110, 120, 163, 169, 194). Furthermore, community pharmacists in KSA and Kuwait reported good awareness and medical device-related counselling practice (54, 214). Blood glucose (BG) monitors, blood pressure (BP) monitors, thermometers, weighing scales, nebulisers, metered-dose inhalers, and insulin pens were the top-rated devices that the community pharmacists were aware of and confident in counselling about (54). Community pharmacists in KSA and Qatar reported that they always provide patients with information on the frequency, dose, route of administration, and duration of use, whereas information on contraindications, side effects, and potential drug or food interactions is provided less frequently (112, 121, 201). Comparably, patients have reported that community pharmacists were willing to answer their queries (118, 122, 123) provide clear and full instructions (111, 122, 123, 194) solve medication-related problems (122), counsel about the disease, side effects and drug interactions, maintain their privacy (123) and spend enough time with them (118, 122, 123). Overall, patients were satisfied with dispensing and counselling services and had positive perceptions (22, 111, 114, 118, 122, 123, 194). However, there was evidence that medicines were sometimes dispensed without prescriptions, with insufficient information, and with errors (113, 114).

Extended service

Technology-assisted services (tele-pharmacy/ e-prescription):

Of all the extended services explored in this review, only telepharmacy/e-prescription services were identified as nationally implemented in the UAE (181-184, 191) and KSA (138-140, 148, 152, 160). In the UAE, community pharmacists became more involved in tele-pharmacy services after the pandemic (COVID-19) (184). Telepharmacy services in the UAE include remote video consultations, medication reviews, prescription refills, and home delivery (181, 182, 184). Telepharmacies (virtual pharmacies) offer several advantages over traditional pharmacies. Virtual pharmacies, as a convenient environment, offer more time for community pharmacists to check and prepare, thereby effectively empowering them to identify and intervene in the abuse and misuse of OTC (180), prevent drug-related problems (182), and reduce dispensing errors (182). Additionally, interventions provided in virtual

pharmacies were significantly higher than those in traditional pharmacies (181). Interventions provided to patients with hypertension (HTN) through virtual pharmacies have resulted in significant reductions in mean PB, increases in medication adherence, and improvements in patients' knowledge and lifestyle during follow-up periods (183).

In KSA, the e-prescription service (Wasfaty system) has enabled community pharmacists to provide pharmaceutical care services and played an essential role in reducing medication errors, offering more time for community pharmacists to provide medication instructions and education and facilitating the refill process (138). Patients and community pharmacists have reported varying levels of satisfaction. Patients expressed high satisfaction with the service in terms of community pharmacists' competency and expertise, the easy accessibility of pharmacies, medication availability, convenient prescription renewals and refills, short waiting times, ease of use, and clarity of instructions (139, 152, 160). However, compared with patient satisfaction with pharmacies in primary healthcare centres, some patients reported lower satisfaction with medication availability, waiting time, and prescription explanations (148). Similarly, community pharmacists were mostly dissatisfied with Wasfaty (138, 161). Although they acknowledged the benefits of the service in improving patients' safety and reducing medication errors, their dissatisfaction primarily resulted from medication unavailability, inaccurate or incomplete information entered into the system, lack of communication with prescribers, increased workload and other technical issues in the system (138, 161).

Besides the humanistic impact of Wasfaty, an economic study found that Wasfaty has led to a tremendous reduction in healthcare expenditure, in which the cost of medications per visit, the costs per patient, the cost of human resources and the cost of medication errors are all substantially dropped post-Wasfaty (140).

Locally practised services

Most of the explored extended services were found to be locally practised by some community pharmacists in some pharmacies rather than being standardised

nationally. These include minor ailments management, health promotion, mental health care, services targeting chronic conditions, immunisation, services for pregnant and lactating women, independent prescribing, and Adverse drug reactions (ADR) reporting.

Minor Ailments Management:

Twelve studies (10.3%) explored the management of minor ailments. A minor ailments service was found to be practised by some community pharmacists in Qatar (200-202, 215), UAE (168, 176, 177), and KSA (126-129, 154, 157). In Qatar, community pharmacists were involved in managing some minor ailments like the common cold, allergic rhinitis, constipation, cold and catarrh, sore throat, headache, skin conditions (200-202) and gastroenteritis (215). Community pharmacists claim that they assess patients' symptoms, medical and medication history, and possible allergies, recommend appropriate treatments, and provide clear instructions when managing minor ailments (202). Additionally, some community pharmacists claimed they follow up with patients, document their recommendations and refer patients to physicians if required (202). Nevertheless, community pharmacists in Qatar were unable to differentiate between minor ailments and other medical conditions that have similar signs and symptoms (200, 201). Moreover, antibiotics were inappropriately prescribed by community pharmacists for some minor ailments (200).

Community pharmacists in the UAE were involved in managing ailments such as Gastroesophageal Reflux Disease (GERD) (168), pain in children (177) and minor wounds (176). Community pharmacists had positive perceptions of wound management and expressed a strong willingness to be trained and to expand their role in it (176). Similarly, they had good knowledge about the management of pain in children, but indicated the need for more educational training to improve their skills and appropriately manage children with pain (177). However, in the case of GERD, community pharmacists failed to comprehensively assess patients' symptoms and medical or medication history, which resulted in recommending inappropriate treatment (168).

In KSA, community pharmacists were involved in managing acute childhood diarrhoea (129, 154, 157), oral health-related problems (126, 127), and anaemia (128). Community pharmacists held positive perceptions of anaemia

management and expressed high interest in managing and counselling patients with anaemia. They counsel patients on drugs that might interact with anaemia treatment and provide advice on diets for anaemia management (128). In the management of oral health-related problems, community pharmacists in KSA were mainly involved in providing advice on oral hygiene, counselling patients on dental products, and referring patients to dentists, though they were willing to play a more proactive role in oral health promotion (126, 127). Varied results were found in the management of acute childhood diarrhoea. The self-reported results showed good practice in collecting patient information, making medication recommendations, providing instructions on food and fluid intake, and providing instructions on the preparation and storage of the recommended treatment. On the other hand, the simulated patient visits revealed the poor practice of history-taking and instruction (129).

Health Promotion:

Eleven studies (9.5%) explored the health promotion practice. Some countries practice health promotion activities such as smoking cessation, weight management, breast cancer awareness, reproductive health promotion, oral health promotion, and stress reduction. Community pharmacists in the UAE (163, 179), KSA (131, 132, 149) and Qatar (203) were involved in providing smoking cessation services. In the UAE, a poor smoking cessation practice by community pharmacists was reported (163, 179). Community pharmacists' performance in patient assessment, therapeutic planning, intervention, follow-up, and communication was suboptimal (179). Some community pharmacists in Qatar and KSA offer smoking cessation services to some extent for interested patients, providing advice on quitting, developing a cessation plan, recommending OTC treatments, and providing educational materials (131, 132, 203). They showed a high interest in offering smoking cessation services (132, 203).

A weight management service was found to be practised in Qatar (204), Kuwait (210, 211), and KSA (122, 131). In Qatar, community pharmacists have a positive attitude towards their role in providing weight management services and are interested in receiving training in this area. Qatar community pharmacists offer basic weight management services, including educating patients on the risks associated with overweight and obesity, recommending

weight-loss treatments, counselling on their appropriate use, and advising on lifestyle modifications (204). Community pharmacists in Kuwait and KSA were primarily involved in promoting healthy eating and physical activity (131, 210, 211). Some patients reported that they had received health promotion services, such as smoking cessation and weight management services from community pharmacists in KSA (122).

Additional health promotion activities that were found to be practised by some community pharmacists to a lesser extent include breast cancer health promotion in the UAE (178) and Qatar (205), sexual and reproductive health promotion (130, 131, 149) and dental health promotion (131) in KSA, stress reduction-related promotion in Kuwait (210).

Mental Health Care:

Three studies (2.6%) explored the provision of mental health care by community pharmacists in KSA (133), UAE (180), and Qatar (206). Overall, the involvement of community pharmacists in mental health care was limited to counselling and dispensing the prescribed medications, explaining the purpose, and encouraging adherence (133, 180, 206). Community pharmacists in KSA and UAE reported that they felt uncomfortable counselling or solving drug-related problems for patients with mental illness (133), and they usually adopt precautionary practices when dispensing and counselling these patients (180).

Services targeting chronic conditions:

Twenty-one studies (18.1%) explored services targeting chronic conditions. Asthma management and education were found to be practised by some community pharmacists in KSA (51, 52, 124) and UAE (174). Simulated patient-observation studies in KSA (51, 52) and UAE (174) showed that community pharmacists' practice in educating patients on inhaler use was suboptimal. As was their ability to assess and manage patients with uncontrolled asthma. Most community pharmacists did not assess symptom severity or adherence to asthma inhalers or other medications, and did not ask about any side effects (174). In self-reported data, community pharmacists reported educating patients about their condition and the proper use of inhalers and other medications (124).

Various services to monitor diabetes and other metabolic syndromes were reported to be practised by some community pharmacists in Kuwait (212), KSA (25, 122, 123, 150), and the UAE (86, 163, 175, 196). Community pharmacists in Kuwait reported that they provide services such as measuring height and weight, measuring BP, counselling patients on a healthy diet and exercise, encouraging patients' adherence, and advising on self-monitoring (212). Community pharmacists in the UAE were mainly involved in dispensing and counselling about the prescribed medication, while extended activities like educating patients on the disease risk factors and complications, screening, BP management, point of care testing and monitoring, or making appropriate recommendations were only practised by a few community pharmacists (86, 163, 175, 196). In KSA, some community pharmacies have started to offer some extended services targeting chronic conditions, including diabetic clinics, and disease monitoring services (25, 122, 123), offering counselling on disease and risk factors, promoting lifestyle modification, educating on the importance of regular screenings, and guiding the use of screening devices (150).

Community pharmacists in Qatar (207, 208), UAE (197, 199) and KSA (125) were found to be involved in some cardiovascular disease (CVDs)-related health promotion activities such as counselling on the use of medication, educating patients on lifestyle modification and self-monitoring (125, 199, 207, 208), referring patients to physicians when needed (207, 208) and offering BP monitoring (125, 199). A study in the UAE evaluated the effectiveness of a HTN clinic within a community pharmacy, which provided monthly BP monitoring, physician referral, lifestyle modification counselling, and medication counselling (197). The study reported high patient satisfaction with the service and reductions in both systolic and diastolic blood pressure (SBP/DBP) attributed to the continued care provided by community pharmacists (197).

Immunisation:

Four studies (3.4%) explored the immunisation service (25, 134, 156, 216). Some community pharmacies in KSA have started to provide immunisation services (25, 156). Community pharmacists in KSA played a key role in

providing COVID-19 vaccines (156). The Saudi public was willing to take the vaccine by community pharmacists and supportive of the provision of vaccination by community pharmacists (134). In Qatar, community pharmacists had minimal involvement in vaccination services, with only a minority having previous experience in administering vaccines (216).

Service for pregnant and lactating women:

Three studies (2.5%) examined the services provided by community pharmacists to pregnant and lactating women. Services for pregnant and lactating women were found to be practised by some community pharmacists in Kuwait (213), and the UAE (167, 185). Community pharmacists in Kuwait and the UAE reported confidence in providing advice and treating minor ailments in pregnant and lactating women (185, 213). However, they prefer to refer patients to a physician in more complicated cases (185, 213). In an observational study (167), community pharmacists effectively manage migraine headaches in simulated pregnant women with appropriate treatment. The simulated patients expressed satisfaction with the service provided (167). Other services offered included recommending vitamins, food supplements and medications to boost breast milk production, advising on lifestyle modifications, discussing contraception and weight control options (213), pregnancy testing, and education on family planning and oral contraceptives (86).

Independent prescribing:

Four studies (3.4%) assessed the independent prescribing practice. Independent prescribing of oral contraceptives and other prescribed-only medicines was reported by some community pharmacists in KSA (115, 141) and the UAE (164, 186). Community pharmacists in KSA reported prescribing oral contraceptives independently (141). In the UAE, a simulated patient observation study found that community pharmacists failed to completely assess the simulated patient's medical and medication history for the safe use of contraceptives, which led to an inappropriate selection of contraceptives (164). Besides prescribing oral contraceptives, community pharmacists in the UAE perceived themselves as highly competent to prescribe appropriate treatment for minor ailments, independently, but not for chronic condition

management (186). In a simulated patient observation study, community pharmacists in KSA failed to assess and manage the simulated patients with heart failure and acute coronary syndrome, and they misdiagnosed the simulated patients and prescribed incorrect treatment (115).

Adverse drug reactions (ADRs) reporting:

Five studies (4.3%) assessed the ADR reporting practice. Reporting ADRs was found to be practised by some community pharmacists in KSA (142-144, 159) and UAE (163, 187). Some community pharmacists in KSA reported that they always report ADRs as part of their professional role (142-144, 159). In the UAE, the ADR reporting practice was poor (187), and only a few pharmacies provided this service (163).

Piloted service

Three different services were delivered on a pilot basis: chronic disease risk screening services in the UAE (171-173, 198), diabetic education services in the UAE (170) and KSA (53), and medication therapy management services in KSA (153).

Chronic diseases risk screening services:

Three studies in the UAE evaluated pilots of screening services for diabetes and CVD (171-173), and one evaluated a screening service for chronic kidney disease (CKD) (198). The feasibility study of a community pharmacist-delivered diabetes and CVD risk screening service (including POC testing, CVD risk calculation, diabetes risk assessment, and patient history assessment) found that the service was feasible and successful in identifying and referring patients at risk for diabetes and CVD (173). A high rate of referral uptake was observed during the follow-up period (173). Additionally, patients reported some lifestyle changes, such as adopting healthier diet habits and engaging in regular physical activity (173). Furthermore, patients expressed satisfaction with the screening service and indicated their willingness to pay for it if it were implemented (171). Similarly, community pharmacists had positive experiences providing screening services and expressed professional satisfaction (172). Similar to diabetes and CVD risk screening, the CKD risk screening (including POC testing, on-site blood analysis to estimate glomerular filtration rate, medication review, lifestyle modification counselling,

and referrals) demonstrated effectiveness in early identification of at-risk undiagnosed patients (198).

Diabetic education services:

Pilot studies evaluating the effectiveness of two different interventions for diabetes education were reported from KSA (53) and the UAE (170). In KSA, one-to-one diabetic education sessions provided by community pharmacists resulted in significant improvements in patients' attitudes and behaviours, as well as in disease biomarkers (e.g., HbA1C) during the follow-up period compared to the baseline (53). Similarly, the "Reminders packages" intervention piloted in the UAE resulted in significant improvements in patients' self-care activities, including medication adherence, diet habits, exercise, and self-testing (170). Moreover, a significant reduction in the average patient's body mass index (BMI) was observed 24 months following the intervention (170).

Medication Therapy Management (MTM):

MTM service was evaluated in a community pharmacy in KSA for patients with uncontrolled diabetes (153). The service included face-to-face visits where pharmacists conducted comprehensive reviews of patients' medication and home monitoring data (including BP and BG), ensured patients' understanding of their medication, identified and resolved any drug-related problems, provided patient education, referred patients when necessary, and followed up with patients. Compared with standard care (education on the prescribed medication, answering patients' questions, and advising on a healthy lifestyle), the MTM service led to significant clinical benefits. These include reductions in disease biomarkers such as HbA1C, and BP, fewer drug-related problems, decreased healthcare centre utilisation, improved medication adherence, and reduced diabetes-related distress. Besides the clinical benefits, patients were satisfied with the provided services (153).

Explored for future implementation

Three types of services had been explored for future implementation from stakeholders' perspectives.

Medication Use Review/ Medication Therapy Management (MUR/MTM):

Studies found that MUR/MTM is not yet implemented, but it has been explored for future implementation in the KSA (135-137) and Qatar (209). In KSA and Qatar, community pharmacists showed good knowledge, a positive attitude, and a high willingness to provide MUR services in the future (135, 136, 209). Additionally, patients perceived MTM service as important, community pharmacists as qualified providers, and showed a high willingness to register for this service if implemented (137).

CVD risk screening:

Three studies in KSA explored the perspectives of multiple stakeholders on developing a novel CVD risk screening programme in community pharmacy settings (125, 145, 146). Community pharmacists showed a strong willingness to provide CVD risk screening and prevention services and perceived community pharmacies as a suitable venue for these services (125). Health consumers were willing to use screening services if they were provided free of charge by qualified, trained pharmacists and monitored by health authorities (146). Similarly, policymakers supported CVD risk screening and prevention services, though they highlighted the need for a structured, evidence-based model to implement such services (145).

Immunisation:

An immunisation service was explored for future implementation in the UAE (195). Community pharmacists showed strong willingness and preparedness to provide the service, highlighting community pharmacies as safe places for vaccination (195).

Table 2.3. Summary of community pharmacy services and practices in the included GCC countries

Service	Extent of practice/implementation				Description of practice	Effectiveness
	KSA	UAE	Qatar	Kuwait		
Traditional services (22, 54, 109-123, 163-169, 193, 194, 200, 202, 214, 215)	****	****	****	****	-Dispensing of medicines and non-pharmacological products, compounding, counselling, identifying medication errors, and solving drug-related problems (110, 111, 118, 120, 122, 123, 163, 169, 194). -Device-related counselling (54, 214). -Counselling about dose and duration, but not about side effects and interactions. Dispensing without assessing medical or medication history, and drug allergies (112, 115-117, 119, 121, 164, 165, 167, 168, 193, 200, 201, 215). - Dispensing prescription-only medicines without prescription, and dispensing errors (113, 114, 193).	(+) Humanistic (n=6) (22, 114, 118, 122, 123, 194)
Tele-pharmacy/ E-prescription (138-140, 148, 152, 160, 161, 181-184, 191)	****	****			- Tele-pharmacy: remote video consultation, medication review, prescription refills, and home delivery (181-184, 191) - E-prescription: prescription refills, patient education and counselling (138-140).	(±) Humanistic (n=7) (138, 139, 148, 152, 160, 161, 183) (+) Clinical (n=3) (181-183) (+) Economic (n=1)(140)
Minor ailments management (126-129, 168, 176, 177, 200-202, 215)	***	***	***		- Managing common cold, allergic rhinitis, constipation, cold and catarrh, sore throat, headache, skin conditions, gastroenteritis, GERD, pain in children, minor wounds, acute childhood diarrhoea, oral health-related	Not evaluated

Service	Extent of practice/implementation				Description of practice	Effectiveness
	KSA	UAE	Qatar	Kuwait		
					problems, and anaemia (126-129, 154, 157, 168, 176, 177, 200, 201, 215). - Assessing patients' symptoms, medical and medication history, and allergies and recommending treatments (202) (129, 154, 157). -Counselling patients on drugs that might interact with anaemia treatment and advising on diets for anaemia management (128). -Providing advice about oral hygiene, counselling about dental products and referring patients to dentists (126, 127). - Unable to differentiate between minor ailments and other medical conditions with similar signs and symptoms (200, 201). - Inappropriately prescribing of antibiotics for some cases (157, 200, 215).	
Health promotion:						
-Weight management (122, 131, 204, 210, 211)	***		***	***	- Educating patients and advising on lifestyle modifications (122, 131, 204, 210, 211). - Recommending treatment for weight loss (204).	
-Smoking cessation (131, 132, 163, 179, 203)	***	***	***		-Poor assessment, therapeutic planning, follow-up, and communication (163, 179). - Providing advice on how to quit, developing a cessation plan, recommending OTC treatment, and providing educational materials (131, 132, 203).	Not evaluated
-Breast cancer health promotion (178, 205)		***	***		Poor involvement, counselling (178, 205).	

Service	Extent of practice/implementation				Description of practice	Effectiveness
	KSA	UAE	Qatar	Kuwait		
-Sexual and reproductive health promotion (130, 131, 149)	***				Counselling (130, 131), educating patients on the use of pregnancy and ovulation tests, and contraceptive methods (149).	
-Dental health promotion (131)	***				Counselling (131).	
-Stress reduction health promotion (210)				***	Counselling (210).	
Immunisation (25, 134, 156, 195, 216)	***	*	***		COVID-19 Vaccine and other types of vaccine (25, 134, 156, 195, 216).	Not evaluated
Service for pregnant and lactating women (167, 185, 213)		***		***	- Providing advice and treating minor ailments in pregnant and lactating women (167, 185, 213). - Treating headache, fever, cough and colds, constipation, nausea, vomiting and indigestion during pregnancy (185, 213). - Treating headache, fever, and sore nipples in lactating women (185, 213). - Referring patients to a physician in complicated cases such as haemorrhoids, varicose veins, swelling of feet and legs and vaginal itching (185, 213). - Recommending vitamins, food supplements, and medications to boost breast milk production, advising on lifestyle and physical activity, educating on contraception and weight control (213). - Educating on family planning and oral contraceptives, and offering pregnancy testing (86).	(+) Humanistic (n=1) (167)
ADRs reporting (142-144, 163, 187)	***	***			-Identify and report ADRs (142-144, 163, 187).	Not evaluated

Service	Extent of practice/implementation				Description of practice	Effectiveness
	KSA	UAE	Qatar	Kuwait		
Mental health care (133, 180, 206)	***	***	***		-Dispensing and counselling about the prescribed medications, explaining the purpose of medications and encouraging adherence (180, 206). - Precautionary practices (133, 180).	Not evaluated
Independent prescribing (115, 141, 164, 186)	***	***			-Prescribing of oral contraceptives (141, 164) and other prescribed-only medicines (115). - Prescribing treatment for minor ailments (186).	Not evaluated
Services targeting chronic conditions:						
-Asthma education (51, 52, 124, 174)	***	***			- Educating patients on the proper use of inhalers (incomplete counselling) (51, 52, 174). - Suboptimal practice of assessing uncontrolled asthma (174) - Educating patients about their condition and the proper use of medications (124).	Not evaluated
-Diabetic education (53, 170)	**	**			-One-to-one diabetic education sessions: about medications, lab tests, BG and doctor visits (53). - Reminders packages: standardised information about body weight, physical activity, healthy diet, self-testing, foot care, smoking habits, BP, and dyslipidaemia, sent periodically as a reminder for all patients with diabetes (170).	(+) Humanistic (n=2) (53, 170) (+) Clinical (n=2) (53, 170)
-POC testing, chronic disease monitoring and management (25, 86, 122, 123, 125, 163, 175, 197, 207, 208, 212)	***	***	***	***	-Measuring height and weight and performing diagnostic testing (197, 212). -Counselling on a healthy diet, exercise, and lifestyle modification (125, 197, 207, 208, 212). - Counselling and dispensing of prescribed medications (86, 125, 163, 175, 197, 207, 208, 212).	(+) Humanistic (n=1)(197) (+) Clinical (n=1) (197)

Service	Extent of practice/implementation				Description of practice	Effectiveness
	KSA	UAE	Qatar	Kuwait		
					-Encouraging patients' adherence and advising on self-monitoring (125, 207, 208, 212). -Educating patients on the disease risk factors and complications (86, 150, 163, 175). -Disease monitoring (25, 86, 122, 123, 125, 163, 175, 197, 212).	
-Risk screening (125, 145, 146, 171-173, 198)	*	**			-Diabetes and CVD risk screening services: POC testing, CVD risk calculation, diabetes risk assessment and patients' history assessment ** (171-173). CKD risk screening: POC testing, on-site blood analysis to estimate Glomerular filtration rate, medication review, lifestyle modification, and referrals**(198). -Identifying and referring at-risk individuals ** (171-173, 198). -Community pharmacists showed a high willingness to provide the service*(125). -Consumers showed a high willingness to use the service* (146). -Policymakers were supportive of CVD risk screening* (145).	(+) Humanistic** (n=2) (171, 173) (+) Clinical** (n=3) (171, 173, 198)
Medication review (135-137, 153, 209)	*/ **		*		-Community pharmacists had a high willingness to provide the service in the future * (136, 137). - Community pharmacists had good knowledge about medication review and identifying potentially inappropriate medications * (135). - Consumers showed a high willingness to register for the service in the future * (137).	(+) Humanistic** (n=1) (153) (+) Clinical ** (n=1) (153)

Service	Extent of practice/implementation				Description of practice	Effectiveness
	KSA	UAE	Qatar	Kuwait		
					-Face-to-face MTM visits, reviewing medication and home monitoring data (e.g. BP and BG), ensuring patients' understanding of their medication, identifying and resolving drug-related problems, patient education, referrals, and follow-ups ** (153).	

(*): Explored for future implementation (services that are not implemented or practised yet but are explored for future implementation by exploring perceptions, knowledge, attitudes, readiness, willingness barriers and/or facilitators)

(**): Piloted (service in the developmental stage wherein the service is implemented within a limited number of pharmacies to evaluate its feasibility)

(***): Locally practised (service that is not considered a core service but is practised by some pharmacists to varying degrees and quality, irrespective of the regulation status)

(****): Nationally implemented (the fully developed, traditional or regulated services that are practised in all or a wide range of pharmacies, irrespective of the quality of practice)

KSA: Kingdom of Saudi Arabia, **UAE:** United Arab Emirates, **OTC:** Over the counter., **GERD:** Gastroesophageal Reflux Disease., **CVD:** Cardiovascular Disease., **CKD:** Chronic Kidney Disease., **ADRs:** Adverse drug reactions., **BP:** blood pressure., **BG:** Blood Glucose, **MTM:** medication therapy management,

POC testing: Point of care testing.

(+): positive results, (±): varied results.

Barriers and facilitators for community pharmacy services

Barriers and facilitators were reported in 50/116 (43.1%) studies for both traditional (n=6/50) (22, 113, 120, 122, 151, 194) and extended (n=44/50) community pharmacy services (21, 22, 25, 86, 120, 125-128, 130, 132, 133, 138, 141, 143, 144, 146, 147, 150, 155, 156, 159, 162, 172, 175, 178, 180, 184, 186, 188, 190, 195, 196, 199, 203, 205-211, 216). Lack of privacy (n=3/6) (22, 120, 122) was the most frequently reported barrier to traditional services. The most frequently reported barriers for all extended services included lack of time/workload (n=28/44), lack of privacy (n=19/44), and lack of training (n=18/44). Additional specific barriers and facilitators were reported for some extended services (see Table 2.4).

Table 2.4. Barriers and facilitators for community pharmacy services

Services	Barriers and facilitators	Reference
Traditional services (dispensing and counselling)	Barriers:	
	- Lack of privacy (n=3).	-(22, 120, 122)
	- Lack of communication between the community pharmacists and other healthcare providers (n=1), educational and training programmes for community pharmacists (n=2), and staff (n=1).	-(120, 194)
	- The busyness of the pharmacists (n=1) and lack of trust (n=1).	-(22)
	- Lack of time (n=1).	-(151)
	Facilitators:	
	- Private room or designated counselling area (n=1).	-(113)
	- Training programmes and increasing the staff (n=1).	-(194)

Services	Barriers and facilitators	Reference
All extended services	Barriers:	
	- Lack of time/workload(n=28), privacy (n=19), knowledge, skills and training (n=18), patients' awareness/patients' perceptions of the pharmacist role/ patient trust (n=15), educational material, tools and other resources (n=13), staff (n=11), access to patient's medical records (n=8), pharmacists-other healthcare providers collaborations (n=9), patients' interest /demand (n=6), reimbursement/ financial support (n= 8), implementation support (organisation/governmental/ external) (n=6), physicians' resistance(n=4), lack of motivation (n=3), and documentation (n=1), consumer financial situation (n=1), and cultural barriers (n=1).	-(21, 22, 25, 86, 120, 125, 126, 128, 130, 132, 133, 138, 141, 144, 147, 150, 155, 156, 159, 162, 172, 175, 178, 180, 184, 186, 190, 196, 199, 203, 205-211, 216)
	Facilitators:	
	- Educational and training programmes for community pharmacists (n=14), private treatment area (n=7), pharmacist-physician collaboration and integration of pharmacy with other healthcare systems (n=7), increasing the number of staff (n=5), availability of educational materials and other resources(n=5), raising public awareness about pharmacists' role (n=5), governmental/health authority support (n=4) financial support and incentive (n=7).	-(25, 125, 127, 133, 143, 146, 147, 159, 180, 188, 190, 195, 209-211)
ADRs reporting service	Barriers:	
	- Unavailability of reporting forms (n=1), unknown reporting address (n=1), lack of clear processes and regulations for ADR reporting (n=2), lack of patients' awareness about their medication (n=1), and confidentiality-related reasons (n=1).	-(142, 144)
	Facilitators:	
	- Feedback on previously submitted report (n=1), and surveillance system (n=1).	-(159)
Screening service	Barriers:	
	- Unclear referral mechanisms (n=1), lack of professional frameworks and standards (n=1), safety issues (n=1), length of screening and assessment (n=1), and legislation restrictions (n=1).	-(125, 172)
	Facilitators:	
	- Following clear guidelines and an evidence-based and structured model for the development, implementation, and evaluation of the service (n=2), collaboration between community pharmacists and physicians in	-(125, 145, 172, 188, 190)

Services	Barriers and facilitators	Reference
	primary care to facilitate the screening, referral, and follow-up process (n=3), avoiding any marketing influence (n=1), providing the service in selected pharmacies for better control (n=1), free of charge (n=3).	
Mental health care service	Barriers: - Emotional discomfort and negative attitude of community pharmacists (n=2).	-(133, 180)
Independent prescribing	Barriers: -Patient safety (n=1).	-(141)

Attitudes and recommendations for future services

Community pharmacists had a positive attitude towards extending their professional role (86, 120, 125, 169, 190). Similarly, the public and patients showed positive perceptions and a high willingness to use several extended services if implemented (22, 109, 146, 189, 197). Various extended services have been recommended for future implementation. These include health screening, chronic disease management and monitoring, POC testing, medication review, dental health promotion, smoking cessation, weight management, lifestyle modification education, disease counselling, and preventive services (22, 25, 86, 109, 146, 188-190), device-related counselling, self-care education (189), vaccination (22), minor ailments care, and specialised education such as education about anticoagulant monitoring, antihypertensive, contraceptive, and medication during pregnancy (25).

2.5 Discussion

This study set out to explore and describe all available evidence on community pharmacy services in the GCC countries, including their types, the extent of their practice, and, where applicable, their effectiveness. The objectives of this study were 1) to describe and consolidate the existing evidence on community pharmacy services that have been implemented, practised, piloted, or explored for future implementation, 2) identify the gap in practice and any area for improvement, 3) inform future implementation or further expansion of services, and 4) inform future research projects. This study found a variation in the type, nature, and extent of community pharmacy services across GCC countries. Traditional dispensing and counselling services were nationally implemented but varied in quality. In contrast, the extended services were either nationally implemented and evaluated (n=1 types of service), locally practised and under-evaluated in most countries (n=8 types of service), piloted

(n=3 types of service) and showed promising effectiveness in some countries, or not implemented yet (n=3 types of service) but showed supportive results for future implementation. This review revealed that privacy, time, and lack of training were the most frequently reported barriers to community pharmacy services.

2.5.1 Summary of evidence

For the traditional services, although they were nationally implemented, it was surprising that their quality was found to be inadequate. Similar to the findings among GCC countries identified in this review, a previous review conducted in the UK and other comparable countries, van Eikenhorst and colleagues (217) found a variation and inconsistencies in the quality of counselling provided in community pharmacies. Another international review (218) revealed that community pharmacists are less likely to counsel on side effects, contraindications, precautions, interactions and storage. A possible explanation for the reported poor practice might be that counselling is a complex process influenced by several factors, including patient- and pharmacist-related factors (219), which were reported as barriers in this review. The identified key barrier in this review is consistent with that reported in a study in the Netherlands, which showed that a lack of privacy was the most frequently reported reason for patients having difficulty asking questions (220). A study by Khojah (221) found that community pharmacies in KSA lack the necessary measures to maintain patient privacy during consultations and highlighted the need to design new infrastructure to ensure patient privacy. These results highlight the need for practical and effective strategies to improve dispensing and counselling practices in community pharmacy settings across the GCC countries. Interestingly, despite reported barriers and inadequate practices, this review found that patients were generally satisfied with the dispensing and counselling services provided by community pharmacists.

Besides the traditional services, the national adoption of tele-pharmacy can be attributed to the technological advancements driven by the COVID-19 pandemic, which significantly accelerated its evolution (184, 222, 223). Consistent with our findings, previous literature reported that both tele-pharmacy and e-prescription showed potential in improving the quality of and access to pharmaceutical care (224-226).

On the other hand, services such as minor ailments management, health promotion (including; smoking cessation, weight management, breast cancer health promotion,

reproductive health promotion, oral health promotion and stress reduction-related health promotion) mental health care, services targeting chronic conditions (including; asthma management and education, POC testing and chronic disease monitoring), immunisation, services for pregnant and lactating women, independent prescribing, and ADR reporting were locally practised by some community pharmacists in some countries. The range, extent and variation in the practice of extended services reported in this review were expected as the role of community pharmacists in the GCC countries is still evolving and not until the announcement of new plans and regulations to extend the role of community pharmacists in KSA (2019), UAE (2011), and Qatar (2011), community pharmacists in those countries were not allowed to provide any service other than the traditional dispensing and counselling (87, 88, 90, 91). Another explanation for the variation and non-national implementation of extended services is the reported barriers, which might have influenced implementation. A systematic review conducted at an international level by Weir and Newham (227) found that the national implementation of innovations in community pharmacy could be influenced by several factors, including aspects related to pharmacy staff engagement, operationalisation of innovation, and external engagement (227), which were all reported in this review as barriers to extended services. Hence, developing effective implementation strategies is essential to facilitate the nationwide implementation of community pharmacy services.

This review found that none of the locally practised services has yet been evaluated for effectiveness in those countries. In contrast, the effectiveness of most of these services has been evaluated in many other countries globally for various outcomes and from different perspectives (77, 78, 82, 228-230). This finding highlights the need for future research to assess the services currently practised in GCC countries, revealing various research opportunities.

Another finding in this review is that the health screening service had not yet been implemented in any country in the Gulf region, and it had been piloted only in the UAE and explored for future implementation in KSA. Another example of an extended service piloted is the diabetic education service, which has been piloted in the KSA and the UAE. Both services have been evaluated for their humanistic and clinical effectiveness and resulted in favourable impacts on the patient's health outcomes, which inform the future implementation of those services. These findings align with results from studies conducted in Australia and Iran assessing the feasibility of

screening services. These studies demonstrate the effectiveness of community pharmacy-based CVD risk screening services in identifying and referring patients with elevated CVD risk factors (231, 232). A systematic review of the effectiveness of screening services in a community pharmacy setting concluded that community pharmacy-based screening interventions have effectively identified patients at high risk of CVD or type 2 diabetes (233). Furthermore, an RCT in the UK found that the community pharmacists-led diabetic education and monitoring programme have resulted in favourable improvements in the health outcomes of patients with type 2 diabetes. Based on these findings, other countries in the Gulf region could adopt the same piloting procedure to evaluate the feasibility of those services in their community pharmacy settings. Given that non-communicable diseases (NCDs) such as CVD and diabetes are prevalent in all GCC countries, effective strategies to tackle and prevent these conditions are needed (84). Thus, developing and implementing services such as community-based health screening in the Gulf region should be a top priority.

Similar to the health screening service, the MUR/MTM service has not yet been implemented in any country in the Gulf region. It has only been explored for future implementation in KSA and Qatar and piloted in KSA, specifically for diabetic patients. Interestingly, this review found that not only community pharmacists, but also patients, were willing to engage with this service if it were provided in the future. Additionally, the piloted study demonstrated promising effectiveness for this service. Similarly, the beneficial impact of MTM has been reported in several previous reviews across various countries (234-236). A retrospective study evaluated the effectiveness of the MTM service in the USA over 10 years and found that it not only improved clinical outcomes but also led to cost savings and high patient satisfaction (237). The findings of this review and previous literature encourage the implementation and evaluation of MUR/MTM services in community pharmacy settings in GCC countries, particularly since this service was among the most frequently recommended by stakeholders.

The other most frequently recommended services by community pharmacists, pharmacy consumers, physicians, other stakeholders and policymakers were health screening, chronic disease management and monitoring, POC testing, health promotion, disease counselling, and disease preventive services. These services have been implemented in many countries globally and have demonstrated clinical, economic, and humanistic effectiveness (228). This highlights the importance of

future projects to pilot and evaluate those services for potential implementation and expansion in the GCC countries.

Several barriers and facilitators for extended services were identified in the current review. The most frequently reported barriers and facilitators to the effective implementation of extended community pharmacy services included time/workload, privacy, pharmacists' training and education, public awareness of the role of community pharmacists, and the availability of tools and resources. There are similarities between the barriers and facilitators reported in this study and those described in the previous studies in other countries. For example, a review in Australia (238) found that one of the commonly identified factors was pharmacists' training and education. Moreover, factors related to privacy, and patients' beliefs and awareness of pharmacists' role were reported in a recent study in the Netherlands (239) as barriers and facilitators that influence the provision of self-care advice in community pharmacies. In the USA, pharmacists' time, staffing levels, staff support, and patients' willingness were identified as key barriers to community pharmacists' provision of MTM services (240).

Although the main aim of the current review was not to explore barriers and facilitators, understanding these factors could help improve the service and provide valuable insight for future projects. The literature recommends that, to implement or improve any health service, a comprehensive assessment of the service's context must be undertaken (241, 242). The evaluation of the context should consider the perspectives of all stakeholders who might influence or be affected by the service, as well as other factors that might influence its implementation, including social, physical, economic, political, and environmental factors (241, 242). Thus, the results of this review would help policymakers improve community pharmacy practices in the GCC countries by understanding these influential factors.

2.5.2 Strengths and limitations

To the best of our knowledge, this is the first review to comprehensively summarise evidence on the type, nature, extent and effectiveness of community pharmacy services in the GCC countries. This review included both quantitative and qualitative studies that considered not only community pharmacists but also patients, other stakeholders, and policymakers, offering a broad understanding of the practice from different perspectives. Furthermore, the pre-registration of the study protocol and the

adherence to PRISMA-ScR guidelines strengthen confidence in the integrity, credibility, transparency, and reproducibility of the study. Moreover, including papers without date restrictions provided a holistic understanding of the practice and its evolution.

While this study has notable strengths, its limitations must also be acknowledged. First, the exclusion of grey literature; however, the plentiful primary studies offer insight into real-world practices from different viewpoints, which regulatory statements, for instance, may not always reflect. Additionally, primary literature has many advantages over grey and secondary literature. Not only is primary research peer-reviewed, which ensures the quality and validity of results, but also because the primary literature allows direct access to the original study findings, which ensures the reliability and accuracy of the data and prevents misinterpretation. Second, as most of the included studies were self-reported questionnaires, the validity and reliability of the data might be influenced by social desirability and response bias. Nevertheless, when additional methods were used in addition to the self-reported questionnaires, the results from those methods validated the self-reported questionnaire results. Third, the results cannot be generalised to all GCC countries, as the majority of studies were conducted in KSA and the UAE, with only a few in Qatar and Kuwait, and no studies in Bahrain or Oman. This affects the external validity and generalisability of the results. Given the varying geographic sizes of GCC countries, the dominance of data from larger countries may not accurately reflect the practice in smaller countries. However, this limitation might be mitigated by the similarities observed across GCC countries in their healthcare systems and by shared strategic initiatives aimed at enhancing healthcare delivery (84). Fourth, although some prominent cities were included in the search strategy, not all cities in the GCC countries were, which may have introduced bias.

2.5.3 Reflection on the scope of the review

Given the broad scope of this review, a more focused research question could have reduced its breadth and enabled a more in-depth synthesis of the evidence. If repeated, the review could be narrowed by focusing on a specific community pharmacy service or clinical area, such as extended pharmacy services or services targeting chronic conditions, or by focusing solely on describing practice without examining barriers and facilitators. This would allow for greater depth and focused conclusions.

2.5.4 Implication of research

This review highlights gaps and opportunities for policymakers and researchers in the Gulf region to inform further projects. The high willingness of community pharmacists to extend their role, the recommended services, and the promising results from the evaluated services would encourage policymakers to support future implementation and evaluation of those services. The identified barriers and facilitators would help policymakers develop implementation strategies and interventions to address those specific barriers, ensure the successful implementation of services, and facilitate future changes. Results from different countries can serve as benchmarks to assess the performance of individual countries relative to others. Researchers might use the findings of this study to decide on the type of study to conduct in a specific country. For example, the researcher might wish to replicate studies conducted in other countries but not in their own country to evaluate or pilot particular services. Researchers from Oman and Bahrain might be encouraged to begin research in this area to assess community pharmacy practice in their countries, as no studies on this topic were found in either country. Policymakers could utilise the evidence presented in this review to inform the development of policies and strategies to enhance the role of community pharmacists and raise public awareness of their role. Additionally, the results of this review would help policymakers establish legislative frameworks to facilitate the implementation of new services and promote multidisciplinary collaboration.

2.5.5 Recommendation

- 1) Future research should focus on evaluating the effectiveness of community-pharmacist-led services, not only the humanistic but also the clinical and economic effectiveness
- 2) Evidence-based development, pre-evaluation and piloting of new services must be considered, such as CVD risk screening and the MUR/MTM service
- 3) Appropriate strategies to enhance the role of community pharmacists and facilitate the implementation of services must be developed, for instance, by improving the infrastructures of community pharmacies, offering specialised training programmes for community pharmacists, establishing integrated healthcare systems, and promoting public awareness about the role of community pharmacists.

2.6 Conclusions

This review provided valuable insights into the type, nature, extent, and impact of community pharmacy services across GCC countries, including key challenges and opportunities. This knowledge is essential for advancing the pharmacy profession, addressing the needs, and improving the practice in this rapidly evolving region. Although this review revealed that community pharmacists in some GCC countries offer a wide range of services beyond traditional dispensing and counselling and are willing to extend their role, several barriers have been identified. The results of this review should be utilised to develop appropriate, structured implementation and evaluation frameworks to overcome obstacles, facilitate national implementation, and ensure service quality. This framework should comprehensively evaluate the service from different perspectives, including humanistic, clinical, and economic effectiveness, to ensure consistent health delivery and optimal patient outcomes.

3 Chapter 3: Overview summary of guidelines, frameworks, and underpinning evidence used in the development process of the community pharmacy-based CVD risk screening service in KSA

3.1 Introduction to the chapter:

This chapter lays the foundation for the development of the proposed service and provides the conceptual and methodological basis for subsequent chapters. It begins by outlining the rationale for selecting this service for development, followed by a structured and systematic development process guided by the UK Medical Research Council (MRC) framework for complex interventions (243). The chapter then synthesises existing evidence relevant to the service to inform idea generation and service design and describes the theoretical and implementation frameworks underpinning the development process. Consequently, this chapter aims to provide a transparent, theory-informed, and evidence-based foundation to support the subsequent service development activities in the following chapters.

3.2 Rationale for community pharmacy-based CVD risk screening service development:

As discussed in Chapter 1 (CVDs as a public health priority in KSA), cardiovascular diseases (CVDs) remain the leading cause of death in the Kingdom of Saudi Arabia (KSA), and the development of a CVD risk screening service has been recommended as a top public health priority to reduce CVD mortality and morbidity in KSA (58). Furthermore, my previous scoping review (Chapter 2) confirmed that no such service has yet been developed or implemented in the country. Existing studies have only explored the perspectives of various stakeholders in KSA regarding this potential CVD risk screening service and have generally reported positive attitudes (125, 145, 146, 244). However, there is a noticeable gap in the Saudi literature: no study has described the structure or content of such a service, nor has any research employed a systematic, structured and evidence-based approach to service design and development in the Saudi Arabian context. The scoping review also highlighted that this type of service has been piloted in other Gulf Cooperation Council (GCC) countries, such as the United Arab Emirates (UAE), where it demonstrated positive outcomes (171, 173). Collectively, this evidence underscores the need for and supports the development of a CVD risk screening service in KSA. Therefore, the decision was made to develop a community pharmacy-based CVD risk screening service in KSA to address the gap and to support the government's recommendation to tackle the CVD burden.

3.3 Applying the UK MRC and O'Cathain A, et al's guidance for developing and evaluating complex interventions for the CVD risk screening service:

Developing a complex intervention, defined as an intervention with multiple interacting components that require coordination, specialised skills, and experience, is inherently challenging (243). The community pharmacy-based CVD risk screening service that this thesis aims to develop is considered a complex intervention because it integrates several interdependent elements. These include risk assessment, patient counselling, referral, and multidisciplinary collaboration, all of which demand considerable expertise and coordination for effective implementation. Based on the UK MRC guidance for developing and evaluating complex interventions (243), there are four phases of complex intervention research: 1) development or identification of an appropriate intervention, 2) feasibility/piloting, 3) evaluation, and 4) implementation (243). This project focuses primarily on the first development phase, which involves co-designing and planning the intervention; its components and other implementation strategies. It also provides insights into the other phases by exploring the perceived service feasibility, prioritising future implementation strategies, and planning for piloting, evaluation, and implementation, all of which will be explained later in this chapter.

Following O'Cathain A, et al (245), extension to the UK MRC guidance on the development of complex interventions, the key principles underpinning intervention development emphasise a dynamic and adaptable process that involves iterative cycles and creative ways of idea generation, testing, and refinement, with a continuous focus on facilitating future implementation (245). To align with these key principles of service development, a combined approach integrating co-design, evidence-based, and implementation-focused approaches was adopted. Co-design was defined as a collaborative approach involving diverse stakeholders in the design and development process to achieve desirable outcomes or address a pre-identified problem (246). An evidence-based approach means the intervention development process is grounded in published evidence. Lastly, the implementation-based approach involves developing the intervention with attention to ensuring it will be used in the real world, by considering all influential factors that might affect future implementation, and prioritising effective implementation strategies. All of which were considered key actions for service development in this project. Several key actions

have been recommended for consideration throughout the development process, given their relevance and importance to the developed intervention (245).

Figure 3.1 provides a comprehensive visual summary of the service development process undertaken in this project, highlighting the core elements, project focus, and critical considerations that shaped the development of this service.

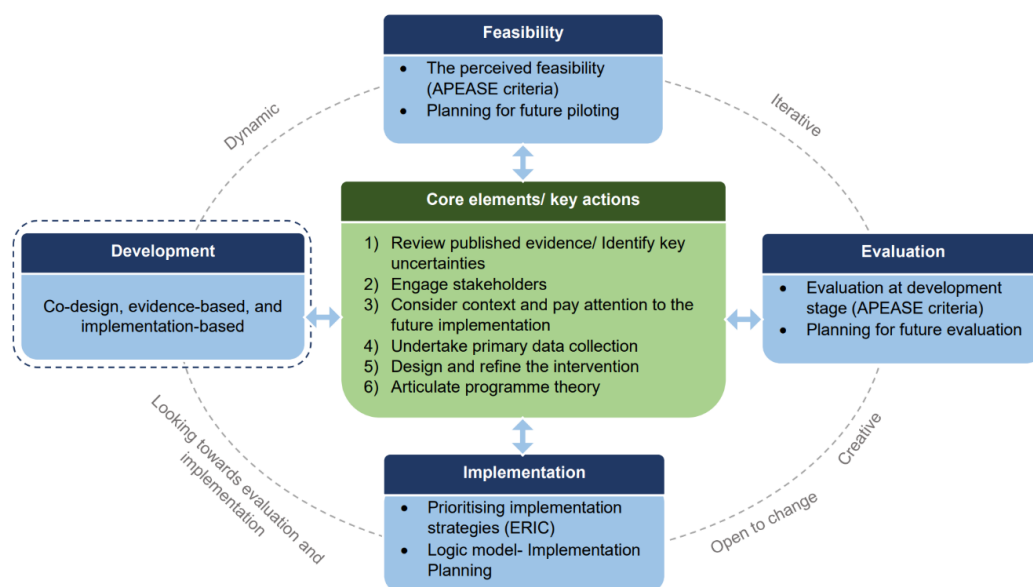


Figure 3.1. Adapted the UK MRC and O’Cathain et al. framework for intervention development, used to guide the development of the service in this thesis.

This figure highlights the core elements/key actions, development phases, and key considerations that were followed in each phase. The outer circle represents the key principles guiding intervention development. The dark circle surrounding a development phase highlights the phase on which this project specifically focused. (Adapted from Skivington et al., 2021 (243), licensed under CC BY 4.0)

***APEASE:** Acceptability, Practicality, Effectiveness, Affordability, Side-effects, Equity. **ERIC:** Expert Recommendations for Implementing Change.

The key actions that were considered in the development process of this service are as follows:

- 1) Review published evidence/ Identify key uncertainties

The development of the community pharmacy-based CVD risk screening service began with a review of the published literature to assess the global evidence on the service's content, structure, and implementation measures, and to identify gaps. As discussed in Chapter 2: Scoping review, previous national studies have examined the acceptability and feasibility of CVD risk screening services in community pharmacies in KSA by exploring the perspectives of multiple stakeholders and proposing various

service models (125, 145, 146, 244). Additionally, these studies have highlighted the barriers and facilitators for such a service, which would help identify and prioritise implementation strategies for the service (125, 145, 146, 244). This evidence provided confidence in the importance of developing such a service. Moreover, community pharmacy-based CVD risk screening services practised worldwide were also examined to identify common components. This international evidence not only illustrated how such a service could be structured, generating ideas for its components and informing the development of its key elements, but also demonstrated its effectiveness, highlighting the potential impact of implementing a similar service. Understanding this evidence and integrating those generated ideas into the development process would support the creation of an evidence-based service. Both national and international evidence will be described later in this chapter (see Preparatory literature review on community pharmacy-based CVD risk screening programmes (Idea generation):).

2) Engage stakeholders

One of the core elements and key actions in intervention development is engaging stakeholders throughout the process (243, 245). Early stakeholder involvement is recommended to assess the intervention's acceptability, feasibility, cost-effectiveness, scalability, and transferability across various contexts (243, 245). Furthermore, collaborating with stakeholders in designing the intervention helps generate ideas and guide decisions regarding its content, format, style, and delivery (245). The types of stakeholders involved vary depending on the intervention and its development phase; they may include patients or the public, intervention providers, and policymakers. Targeting the appropriate stakeholders at each stage is crucial to achieving desirable outcomes from engagement (243, 245, 247). For this stage of service development, national stakeholders with relevant clinical and practical expertise in shaping and implementing the service were targeted, including experts in CVD prevention or management, public health and pharmaceutical policy, service implementation, and service providers. The selection was guided by previous studies that developed similar services in different contexts (145, 171, 232, 248). Although patients and the public are considered key stakeholders in the development of interventions to understand their needs and create user-centred, experience-based interventions, they were not involved in this project (243, 245). A previous Saudi study included patients and members of the public and captured their perspectives on the

service, which were generally positive (146). However, because this phase focuses on generating ideas for the service model and components, which require clinical expertise, service users were excluded due to their limited clinical knowledge, which could lead to minimal contributions or misunderstandings. Nevertheless, their earlier views and recommendations were considered to inform discussions with other stakeholders and experts in this project. Additionally, their involvement will be considered during the planning of the feasibility and piloting phases, where their feedback on the service would be essential for refining it based on their experience with the pilot.

3) Consider context and pay attention to the future implementation of the intervention in the real world.

Intervention development is highly dependent on context; therefore, considering contextual factors is a core element in service development (243, 245). Understanding these factors is essential, as interventions that are effective in one setting may not yield the same outcomes in another due to variations in local needs, available resources, and system characteristics (249). Therefore, instead of adopting an intervention that has been successful in other contexts, this thesis aimed to collaborate closely with local experts to co-design an intervention that is contextually appropriate and responsive to local needs. This project was aimed not only to develop the service but also to ensure its relevance and applicability in real-world settings. It explicitly considered contextual factors, facilitators and barriers to implementation, and evaluated the perceived feasibility of the service, helping inform the selection of effective implementation strategies that support future scalability and sustainability. Multiple theoretical and implementation frameworks were applied throughout this project to bridge the gap between evidence-based service development and real-world implementation. These frameworks will be explained later in this chapter (see Implementation science guidance). Together, these considerations ensure that the service development process follows a context-specific and implementation-focused approach.

4) Undertake primary data collection.

Deciding on the appropriate data collection method to effectively answer the research question is a crucial step in the research process. At this stage of service development, the lack of a national protocol for community pharmacy-based CVD

risk screening services in KSA, alongside the variation observed in international CVD risk screening programmes and in previously proposed models within the Saudi context, highlighted the need for a structured consensus-based approach. Two consensus methods, the Nominal Group Technique (NGT) and the e-Delphi methods, were therefore adopted to ensure methodological rigour, contextual relevance, and stakeholder alignment in defining the service's key components.

Consensus methods are commonly used in health service and guideline development, as they help generate ideas, determine priorities, and inform service development decisions (250). The project starts with NGT, followed by the e-Delphi, conducted at a broader level. Starting with the NGT facilitates the early and fast generation and prioritisation of ideas from diverse perspectives through structured, thorough discussion, helping make subsequent e-Delphi rounds more focused and efficient. The ideas generated through the NGT also provide a solid foundation for developing the e-Delphi questionnaire. Both NGT and e-Delphi are structured, consensus-building techniques; however, the NGT facilitates in-depth idea generation and discussion in a shorter time, while the e-Delphi method enhances consensus reliability by involving a wider range of experts and iterative feedback cycles. Combining these two methods strengthens the overall process, leading to a more rigorous and comprehensive service development approach.

A similar approach has been adopted in previous health and pharmacy research (251, 252). For instance, a study by Newlands et al (251) aimed to prioritise a community pharmacy service for quality improvement. The study initially employed a modified NGT with a small group of stakeholders to generate potential ideas in a shorter time, followed by three rounds of e-Delphi questionnaires to achieve consensus among a broader range of stakeholders. This combined, sequential approach ensured comprehensive stakeholder engagement and an efficient prioritisation process (251).

5) Design and refine the intervention

The development of complex interventions inherently involves processes of systematic design and refinement. Adopting a creative and iterative approach to idea generation, refinement, and decision-making is recommended (243, 245). As discussed earlier, two distinct consensus-building methods were employed in this project: focus group discussions through NGT and multiple rounds of e-Delphi questionnaires, to facilitate the iterative and cyclical development and refinement of

the intervention. In each round, ideas were presented to stakeholders, who then evaluated and refined them. Ideas that did not initially achieve consensus were reconsidered in subsequent rounds, contributing to the development of a more optimised and contextually appropriate service.

6) Articulate programme theory – logic model

It has been recommended that programme theory be explicitly articulated by conceptualising the intervention's overall structure, including its components, underlying mechanisms, and anticipated outcomes. Such articulation enhances the clarity and coherence of the intervention design, facilitates effective communication with stakeholders and policymakers, and supports systematic testing and iterative refinement (243, 245). In this project, a comprehensive logic model of the developed service was constructed to represent its structure, processes, and anticipated outcomes, which will be presented and discussed in detail in Chapter 7 (Logic model).

3.4 Preparatory literature review on community pharmacy-based CVD risk screening programmes (Idea generation):

A literature review of community pharmacy-based CVD risk screening programmes internationally was conducted to provide an overview of existing evidence, identify key service components, and explore needs, barriers, and enablers. The main purpose of the review was to inform early-stage service design and development rather than to evaluate effectiveness or quantify impact. Therefore, given the exploratory nature of this review, a narrative approach was considered appropriate for synthesising diverse evidence sources and supporting the preliminary identification of potential service components. This helped generate ideas to inform the development of materials for the next stage, the consensus studies (the NGT and e-Delphi).

A targeted search of one database (Ovid MEDLINE) was conducted, from inception, in May 2024 to explore community pharmacy-based CVD risk screening programmes worldwide. This database was selected because it provides comprehensive coverage of healthcare literature and, as shown in my previous scoping review, it identified the most relevant articles on community pharmacy services. Given that this was a supplementary review aimed at exploring and generating ideas to inform service development, a single database was considered sufficient to identify key service models and components, thereby enabling timely synthesis for subsequent stages of

service development. The limitation of searching a single database, including the risk of missing relevant studies, is acknowledged; therefore, the reference lists of included studies were also screened to identify additional relevant literature.

Studies were eligible for inclusion if they involved adult populations, including patients or service users, pharmacists, other healthcare providers, or policy makers. The concept of interest was a CVD risk screening service delivered in community pharmacies. Studies conducted in community pharmacies in any country worldwide were considered. Eligible studies included international research that described CVD risk screening service models, structures, components, or implementation strategies, and/or assessed service feasibility or effectiveness. Additionally, national studies exploring stakeholder perspectives on the service, including perceived barriers and facilitators, were included. Any primary study design (quantitative, qualitative, or mixed methods), as well as intervention reports or guidance documents, were eligible. Only studies published in English were included. Studies were excluded if they involved populations other than adults or focused on services other than CVD risk screening. Studies conducted in settings other than community pharmacies, such as primary care clinics, hospital pharmacies (inpatient or outpatient), or non-healthcare settings, were excluded. Reviews and conference abstracts with insufficient data were also excluded. Moreover, international studies that did not describe the service, assessed feasibility or effectiveness only, or explored perspectives without providing a service description were excluded.

The search terms used were related to cardiovascular diseases, screening, community pharmacy services and service development and implementation (Appendix B1: Search strategy). The database search yielded 114 studies. Of these, 29 were reviewed in full text, and an additional 7 were identified through reference list screening. In total, 36 studies and reports were reviewed in full and included. Four of which were national studies (the three Saudi studies previously identified in the scoping review, along with one newly identified study). For the international evidence, comprehensive data were extracted, including the screening programme name, country of practice, target population/eligibility criteria, assessment and screening procedures, post-screening interventions, recruitment methods, implementation requirements, and reported service outcomes. On the other hand, data extracted from the Saudi studies primarily focused on identified barriers and facilitators, as well as the proposed service model.

3.4.1 International evidence on community pharmacy-based CVD risk screening

A total of 32 international studies have been identified, describing 28 distinct community pharmacy-based CVD risk screening programmes developed, piloted, implemented, and evaluated in 16 countries worldwide. Of the 28 programmes, 4 (14.3%) were identified in Australia (232, 253-256) and the UK (257-261) each, 3 (10.7%) in Canada (83, 262-264) and the USA (265-267) each, 2 (7.1%) in Poland (268, 269) and Italy (270, 271) each, and 1 (3.6%) in each of the UAE (171, 173), Belgium (272), Germany (273), Iran (231), Nigeria (274), Norway (275), Thailand (276), Portugal (277), Ghana (278), and Spain (279). Each programme followed a specific protocol and had a unique model in terms of its core service components (see Table 3.1). These included:

Targeted population: The majority (n=15/28, 53.6%) targeted individuals without a previous diagnosis of any CVD risk (171, 231, 232, 253, 254, 257, 258, 260, 261, 266, 270-272, 274-276, 280), while a minority (n= 5/28, 17.9%) targeted patients with pre-identified risk factors and comorbid conditions (83, 255, 256, 263, 264, 268, 278), with the remaining programmes (n=8/28, 28.6%) targeted at everyone without pre-specified criteria. Most screening programmes (n=11/28, 39.3%) targeted age groups based on the adopted screening tool, typically ≥ 40 years (171, 232, 255-258, 261-264, 272, 278, 280), while some included a broader range, such as ≥ 18 years (n=6/28, 21.4%) (83, 254, 268, 269, 271, 275) and ≥ 30 years (n=5/28, 17.9%). The targeted age group were not specified or reported in six (21.4%) programmes.

Recruitment methods: Participants were recruited into the screening programmes through several methods, including opportunistic recruitment, where pharmacists invite and interview consumers during their pharmacy visits (n=12/28, 42.9%) (232, 253, 261-264, 269, 272, 274, 276-278), or recruitment based on medical and medication records (n=6/28, 21.4%) (83, 257, 263, 264, 268, 279), advertising (n=14/28, 50%) (171, 231, 254, 257, 266, 267, 275), or programmatic invitation of eligible individuals from the local authority (n=1/28, 3.6%) (258, 280). Some programmes (n=9/28, 32.1%) adopted a combined approach using various recruitment methods. Recruitment methods were not specified or reported in four (14.3%) programmes.

Assessment and screening processes: The majority (n=19/28, 67.9%) screened all CVD risk factors and comorbidities (83, 171, 231, 232, 253-258, 260, 261, 268, 270,

272, 274, 277, 280), while a minority (n=9/28, 32.1%) focused on screening specific CVD risk factors, such as hypertension (HTN) (262, 265, 271, 276), dyslipidaemia (263, 264, 267, 275), or atrial fibrillation (AF) (262, 279). Additionally, only few programmes (n=6/28, 21.4%) relied solely on self-reported screening questionnaires or non-invasive procedures such as anthropometric and blood pressure (BP) measurements (254, 265, 271, 273, 278, 279) while the majority (n=22/28, 78.6%) used additional screening procedures, including invasive point of care (POC) testing, such as lipid and glucose levels (171, 173, 231, 232, 253, 255-261, 263, 264, 267, 268, 270, 274-277) to assess the risk and calculate the individual risk scores (83, 171, 231, 232, 253, 255-262, 266, 270, 272, 274).

CVD risk screening tools: the CVD risk score calculator was used in 14/28 (50%) programmes to assess the risk scores. The most commonly used validated CVD risk score calculator, reported in half of these programmes, is the Framingham risk score tool (n=7/14, 50%) (83, 231, 257, 260, 266, 270). Various other screening tools, such as the modified New Zealand risk calculator (n=2/14, 14.3%) (253, 256), American College of Cardiology/American Heart Association Atherosclerotic cardiovascular diseases (ACC/AHA ASCVD) risk calculator (n=1/14, 7.1%) (171), QRISK (n=1/14, 7.1%) (258, 280), or Systematic Coronary Risk Evaluation (SCORE) (n=2/14, 14.3%) (272, 277), were used by some screening programmes. In the CVD Absolute Risk Screening (CARS) programme in Australia (232), a validated tool for the Australian population was used to calculate the 5-year absolute risk.

Post-screening interventions: The majority (n=23/28, 82.1%) focused on primary prevention interventions, by assessing the risk, educating the patients, and referring the high-risk individuals to physicians (171, 231, 232, 253, 254, 257, 258, 261, 265-274, 276-280), whereas only a minority (n=5/28, 17.9%) incorporated secondary prevention interventions, including prescribing medication (260, 263, 264) or conducting medication reviews for patients on chronic treatment (83, 255, 256, 262).

Referral mechanisms: Referral to GP was provided in 25/28 (89.8%) programmes. Two referral approaches were commonly used to refer high-risk individuals from the pharmacy to their general practitioner (GP) following the screening service: either through passive referral by providing a written report for the patient, advising them to visit their GP (n=11/25, 44%) (171, 231, 232, 253, 263, 264, 268, 274, 275, 277), or active referral directly communicating the results to the GP through an integrated

health system (n=18/25, 72%) (83, 232, 253-259, 261-264, 269-273, 279, 280), with some programmes combined both (n= 4/25,16%) (232, 253, 263, 264).

Implementation strategies: The implementation requirements were highlighted in 25/28 (89.3%) screening programmes. The most frequently reported implementation requirements across these screening initiatives were provision of the service at no cost to patients or through appropriate remuneration mechanisms within health plans (n=19/25, 76%) (83, 171, 173, 231, 232, 253, 254, 261, 262, 265-269, 272, 274-279), pharmacist training (n=16/25, 64%) (83, 171, 173, 232, 253-256, 258, 259, 263, 264, 268, 271, 272, 278, 279), availability of a private screening area and necessary resources (n=16/25, 64%) (171, 173, 231, 232, 253-259, 265, 269, 272, 274, 275, 277-279) and effective collaboration with GP (n=8/25, 32%). This evidence emphasising the importance of considering both individual-level factors and system-level requirements when designing implementation strategies to support feasibility, consistency, and long-term sustainability.

All these screening programmes, except one, reported multiple outcomes, collectively demonstrating their feasibility and effectiveness. These include early identification and referral of people with risk factors or at high risk of CVDs (n=27/27, 100%) (83, 171, 173, 231, 232, 253-257, 260-279), early diagnosis and treatment initiation (n=6/27, 22.2%) (253, 262, 265, 268, 269, 278), improved patients' behaviours and lifestyles (n=7/27, 25.9%) (171, 231, 253, 255, 256, 266, 267, 278), increased patient satisfaction (n=2/27, 7.4%) (171, 274), improved disease outcomes (n=3/27, 11.1%) (83, 255, 256, 263, 264) and widened access for people in deprived areas or with low access to primary care (n=4/27, 14.8%) (257, 260, 261, 275), and the potential cost savings (n=1/27, 3.7%) (270).

This evidence regarding the service components, other specifications, implementation strategies, and effectiveness is crucial for service development and implementation, as they can influence the programme's effectiveness and ensure an evidence-based service (281).

Table 3.1. Summary of international literature on community pharmacy-based CVD risk screening programmes

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
CVD risk screening (253)	Australia	- Age ≥30 years. - No diagnosed CVD, HTN, or hyperlipidaemia. - Opportunistic + Advertisement-based recruitment.	- Private area. - Training. - Promotional materials. - GP collaboration. - 45-minute appointment. - Free service.	- Assess family and medical history, medications, physical activity, and smoking status. - - Anthropometrics: height, weight and BMI. - POCT: TC, HDL-C, BP and random BGL. - Calculate 10-year absolute CVD risk (the modified NZ).	- Provide a copy of the risk results + explanation. - Provide written and verbal education on CVD risk factors and lifestyle modification. - Advise at-risk individuals to visit their GP. - Send results to the GP with notes/suggestions. - Follow up at 3 months.	- Identified and referred undiagnosed high-risk individuals (467/640; 73%). - Improved knowledge of CVD risk factors. - Improved lifestyle behaviours (191/346; 55%). - Referral uptake (43/52; 83%) and treatment initiation post-GP visit (24/52; 46%). - Well accepted: worthwhile (245/346; 71%), appropriate place (97%), supported as routine service (90%).
CVD Absolute Risk	Australia	- Age ≥45 years. - No diagnosed CVD.	- IT/software for screening & GP-integrated referral.	- Australian CVD guideline-based assessment.	- Document results via tailored screening software, auto-	- Feasible: 388 screened

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
Screening (CARS) (232)		- Not on HTN/cholesterol medications. - Exclude mental illness & pregnancy. - Opportunistic screening.	- Private area. - Screening tools/equipment. - GP integration & referral system. - Promotion. - Training & implementation support. - Sufficient staff. - Free service.	- Anthropometrics: height, weight, BMI. - Assess smoking, DM status, age, sex. - POCT: BP, random/fasting TC, HDL, BG. - AUSDRISK diabetes risk assessment. - AF screening ≥65y; optional <65y. - 5-year absolute CVD risk. - Evaluate need for renal referral.	- generated patient reports; add pharmacist recommendations. - Explain/interpret the risk results to patients - Provide report with results & GP follow-up timeline. - Send results to GP for all patients. - Phone follow-up 6–10 weeks post-screening.	- Identified at-risk (22/117; 19%). - Referred (134/388; 34%). - Referral uptake: seen (75/246; 31%), scheduled/intended (54/246; 22%).
Health promotion and screening service for CVD risk factors (254)	Australia	- Age ≥18 years. - Not on HTN/cholesterol medications. - Exclude pregnant & immunocompromised.	- Training. - Equipment, tools & resources. - Promotion. - GP referral system/engagement. - Standardised protocol. - Free service.	- Risk factor questionnaire (evidence-based). - Assess CVD/DM risk: BMI, BP, TC, fasting TG, family history, lifestyle.	- Health promotion: exercise, diet, smoking cessation. - GP referral or 6-week follow-up. - Re-assess at 3 months.	- Identified at-risk (216/243; 89%). - Referred at-risk (61/204; 30%).

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
		- Opportunistic + Advertisement-based recruitment.				
Pharmacist Assessment of Adherence, Risk and Treatment in CVD (PAART CVD)- Holistic model (255, 256)	Australia	- Age 50–74 years. - On ≥1 cholesterol/HTN medications. - No established CVD, DM, or CV event. - Recruited based on dispensing records & patient interviews.	- Training. - Materials, guidelines & referral options. - GP involvement. - Private area. - Time: 60–90 minutes.	- Questionnaire: demographics, social info, family and medical history, current meds, recent CVD tests, medication adherence, smoking, physical activity, weight management, alcohol consumption, depression. -Anthropometrics & POCT: waist, BMI, BP, lipids, random BG, depression score. -Calculate 5-year CVD risk (NZ modified Framingham).	-Advise urgent care if SBP ≥180 mmHg or DBP ≥110 mmHg -Refer & send assessment summary to GP. -Structured medication review: treatment goals, changes, behavioural change advice. -Monthly counselling sessions: CVD education, adherence, lifestyle. -Post-GP visit counselling: review treatment, adherence, lifestyle, progress.	-Identified high-risk (7/67; 10%), moderate-risk (22/67 ;33%). -Identified risk factors: uncontrolled BP (34/67; 50.7%), BMI ≥30: (23/67; 34%). -Significant reduction in risk factors and the CVD risk after 6 months: ↓CVD risk score to 5.1% (ARR 1.7%), ↓SBP -11 mmHg, ↓DBP -5 mmHg, ↓waist -1.3 cm; non-significant lipid/BMI changes. - Significant improvement in

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
						Medication adherence & lifestyle: nonadherence ↓16%, missed medications ↓13%, diet score ↑9.6, weight-loss diet ↑22.4%, exercise days/week ↑.
RxEACH (Alberta Vascular Risk Reduction Community Pharmacy Project): MTM and CVD risk assessment and education (83)	Canada	- Age ≥18years. - High CV risk: DM, CKD, ASCVD, prior stroke/TIA, MI, ACS, stable angina, revascularisation, PAD. - On metformin, clopidogrel/acetylsalicylic acid, antihypertensives, statins. - Smokers. - Exclude pregnant.	- Training. - Remuneration health plan/insurance. - Contact with GP.	MTM consultation: -Patient assessment: BP, HTN education, waist, weight, height -Lab assessment: HbA1c, fasting lipids, eGFR. -Individualised CVD risk (Framingham).	- Educate on CVD risk, risk factors, &lifestyle modification. - Provide treatment recommendations or adjustments. - Regular communication with physicians. - Follow-up every 3–4 weeks for 3 months.	-Identified and referred individuals with CVD risk factors and at high risk: HTN (316/370, 85.4%), dyslipidaemia (308/370, 83.2%), smoking (97/370, 26.2%), sedentary lifestyle (237/370, 64%), >20% CVD risk (53/370, 14.3%) -Significant reduction in CVD risk after 3

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
		- Recruited based on medication records + advertisement.				months: CVD risk ↓ 21% RRR (ARR 5.37%, 95% CI 4.17–6.56, p<0.001). - Significant reduction in risk factors, achieving the target: LDL-C -0.2, SBP -9.37 / DBP -2.92, HbA1c -0.92, smoking -20.2%, (p<0.001).
Programme for Identification of “Actionable” Atrial Fibrillation (PIAAF): pharmacy screening for AF, HTN, and T2DM (262)	Canada	- Age >65 years. - Opportunistic screening.	- Remuneration health plan.	- AF screening: single-lead handheld ECG. - Diabetes risk assessment. - BP measurement.	- Send results to GP. - Medication reviews. - Flu vaccination. - Prescription assessment/renewals. - Smoking cessation counselling.	- Identified AF and at risk of stroke. - Helped initiate appropriate treatments. - Identified patients at high risk for diabetes and HTN. - Enabled further pharmacist interventions.

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
CVD Risk Intervention by Pharmacists (SCRIP/ SCRIP plus): lipid risk management for patients at high risk of CVD events (263, 264)	Canada	- High CV risk: ASCVD, prior MI, angina, revascularisation, cerebro/peripheral vascular disease - DM + ≥1 risk factor: smoking, HTN, family history, premature CVD, obesity, sedentary lifestyle, hypercholesterolemia, age >45 male/>55 female. - Medication: nitroglycerin, insulin/oral hypoglycemics. - Recruited during the dispensing of a new/refill	- Training. - Pharmacist helpline + cardiologist consultation.	- POCT: Lipid profile.	- Patient education: CVD risk, kit & brochures - Encourage GP visit - Send results to GP with recommendations (lipid-lowering therapy). - Follow-up: 1 week & 1-month calls; 3- & 6-month clinic visits (re-assess BP & cholesterol).	- Identified and referred individuals at high risk with lipid abnormality (n=251) - Reduction in the LDL level: (62/162; 38%) achieved the target after 6 months follow-up.

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
		prescription for chronic medication + based on medical/medication records, + advertisement.				
Heart MOT service: CVD risk assessment (257)	UK	- Age 40–70 years, no known CVD. - Exclude: on CVD medications or recently screened by GP. - Advertisement-based recruitment.	- Experience in CVD risk assessment. - Adequate staff. - Quality assurance. - Suitable premises & location (private area, near deprived area), - Marketing strategies.	- POCT: BP, non-fasting TC/HDL-C. - Assess other CVD risk factors: smoking, diabetes. - Calculate 10-year CVD risk (Framingham).	- Provide verbal & written education. - Refer to GP. - Medium/low-risk: signpost to lifestyle services (exercise, diet, smoking cessation).	- Feasible to implement - Identify & refer at-risk (792; 70%). - Increased access in deprived areas: Black 7.4%, Asian 24.8%.
NHS Health check service: CVD risk screening (258, 259)	UK	- Age 40–74 years - Exclude: existing CHD, CKD stage 3–5, DM, HTN, AF, TIA, hypercholesterol	- Local authorities' invitation: 5-yearly health checks. - Monitor & improve service uptake. - Record keeping & data protection.	- Assess: age, gender, smoking, family history, ethnicity, BMI, BP, cholesterol, physical activity, alcohol, CVD risk.	- Communicate the results to the patient & GP. - Behaviour change interventions: smoking cessation, weight management, alcohol, and physical activity.	NR

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
		emia, HF, PAD, stroke, on statins, or prior NHS Health Check. - Advertisement-based + local authorities' invitation.	- Safe handling of bodily fluids/POC hazards. - Standardised guidelines, tools & educational material. - Training, free e-learning. - Quality control & programme governance. - Private, prepared area.	- Calculate 10-year CVD risk (QRISK®) - Offer HbA1c & diabetes assessment if high diabetes risk or elevated BP.	- Refer high-risk patients to GP for further tests, follow-up & treatment.	
Free Healthy Heart Assessment (HHA) service (260)	UK	-Age ≥30 years.	NR	- Calculate 10-yr CHD risk (Framingham). - Assess: age, gender, ethnicity, lifestyle, and medication history. - Anthropometrics: height, weight - POCT: BP, TC, HDL-C levels.	- Provide lifestyle modification advice for at-risk patients. - Supply OTC simvastatin to eligible patients.	- Accessed hard-to-reach groups (men, deprived areas). - Identified at-risk individuals. - Community pharmacies suitable for service delivery.

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
The vascular risk assessment 'Healthy LifeCheck (261)	UK	- Age 40–70 years. - No diagnosed CVD. - No BP/cholesterol test in the past 12 months. - Opportunistic +advertisement-based recruitment.	- Free service. - 30 minutes.	- Calculate CVD risk tool (Framingham) - Assessment: BMI, waist, BP, smoking, age, sex, ethnicity, postcode. - POCT: TC, HDL-C, BG.	- Refer high-risk patients to a GP. - Provide verbal & written lifestyle modification advice. - Send results to GP.	- Identify & refer high-risk patients (462; 18%). - Feasible to implement. - Increased access for. hard-to-reach: (1696; 67%) South Asians, (199; 7.9%) unregistered with GP.
Diabetes and CVD risk screening model (171, 173)	UAE	- Age 40–74 years. - No prior DM/CVD. - Not on HTN, DM, dyslipidemia, or CVD medications. - Exclude pregnant & mental illness. - Advertisement-based recruitment.	- Training. - Pharmacist incentive. - Necessary infrastructure.	- Assessment: sociodemographics, medical/family history, smoking, physical activity, diet. - Anthropometrics: weight, height, waist, BMI. - POCT: TC, HDL-C, LDL-C, HbA1c, BP. - CVD risk: 10-year ASCVD risk	- Provide lifestyle modification education. - Provide a referral letter summarising results; advise GP visit within 4 weeks. - Phone follow-up at 2 & 6 weeks. - Urgent care if SBP ≥180 mmHg or DBP ≥110 mmHg.	- Feasible: 12 pharmacies; screened 115 (period 1) & 568 (period 2). - Identified & referred at-risk patients: 66/115 (57.4%) & 332/568 (58%). - Referral uptake: 9/37 (24.3%) & 68/206 (33%). - Lifestyle improvement: diet 12/37 (63.1%),

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
				(ACC/AHA equations). - Diabetes risk: HbA1c + ADA T2DM risk questionnaire.		weight loss 11/37 (57.8%), exercise 7/37 (36.8%). - Patient satisfaction: 69/73 (94.5%) satisfied/very satisfied. - Willingness to pay: 60/73 (80%).
Opportunistic screening for diabetes and CVD risk factors (272)	Belgium	- Age 40–65years (or ≥25y if North African, Turkish, South-Asian). - Irregular GP visits. - No CVD, DM, or CKD medications. - Opportunistic screening.	- Free service. - 20–30 minutes. - Training. - GP collaboration. - Financial compensation. - Awareness campaign & promotional materials. - Private, dedicated area. - Adequate staff.	- Collect patient information: age, BP, smoking, diabetes, personal/family CVD history. - Diabetes risk: FINDRISC + HbA1c (POCT). - CVD risk: Boland algorithm (ABCDEF) + SCORE.	- Provide counselling & personalised advice for low/moderate risk. - Refer high-risk patients to a GP.	- Feasible: 502 screened in 32 pharmacies. - Identify and refer high-risk patients: 74 (19.7%).
We love your heart project (community-based CVD risk)	Italy	- Healthy people who do not have access to other primary care.	NR	- Assessment: validated questionnaire + BP & cholesterol measurements.	- Health promotion activities. - Refer high-risk patients to a physician.	- Identify high-risk: 46,097 screened; 3.8% high CVD risk,

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
screening programme) (270)				- CVD risk assessment: Italian Framingham + FINDRISC.		14.5% high T2DM risk - Cost-saving: up to €1,046,117 potentially avoidable public expenditure.
Pharmacy-based screening program for CVD risk and the BP status (271)	Italy	- Age ≥ 18 years.	- Training.	- Collect demographics & CV risk factors: DM, HTN, CKD, dyslipidemia, cardiac/cerebrovascular events. - Assess HTN knowledge via validated questionnaire (Italian Hypertension Society). - Measure BP & HR.	- Educate patients on HTN & CVD risk. - Refer uncontrolled/suspected HTN cases to GP.	- Feasible: 2731 screened in 94 pharmacies. - Identify & refer uncontrolled HTN patients.
BP screening and referral guideline (273)	Germany	NR	NR	- Measure BP per the European Society of Cardiology and the European Society of	- Based on the risk category: refer to GP or advise for monitoring and follow-up.	- Feasible: 187 pts screened in 17 pharmacies. - Identified & referred: uncontrolled BP

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
				Hypertension (ESH) HTN guidelines. - Determine risk category.		47/86 (55%), undiagnosed HTN 16/101 (16%).
Comorbidities screening - refer the patients service (268)	Poland	-Age ≥18 years. - with ≥1 condition: DM, CVD (HTN, arrhythmia), endometriosis, Crohn's, rheumatoid arthritis (hip/knee). - Recruited based on medications during refill.	- Pharmacist reimbursement. - Pharmacy near the diagnostic centre. - Training.	- Refer at-risk patients to diagnostic centre for tests: CBC, BG, lipid profile, creatinine, albumin, HbA1c, ALAT, ASPAT.	- Educate patients on a healthy lifestyle. - Advise patients to share results with GP. - Follow-up to check referral uptake.	- Early disease detection & treatment initiation.
Screening services for early detection of HTN (269)	Poland	- Age ≥ 18 years. - No diagnosed HTN. -Opportunistic screening.	-Training. - Dedicated area. - Free service.	- Collect patient information & risk factors: age, height, weight, BMI, diabetes, cholesterol. - BP measurement.	- Provide verbal and written education on lifestyle modification & HTN prevention. - Physician referral & follow-up within 2 months if BP ≥140/90 mmHg.	- Identify and refer individuals with elevated BP: 20/118(16.9%). - Early diagnosis of HTN: 4/20 (20%).

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
CVD risk screening service (231)	Iran	- Age 30–75 years. - No diagnosed CVD/DM. - No glucose/lipid test in the past 3 months. - Advertisement-based recruitment.	- Private area. - Free service.	- Collect patient info & CVD risk factors: age, sex, education, region, medications, medical/family history, smoking, physical activity, supplement use. - Anthropometrics: height, weight, waist, BMI. - POCT: BP, random BGL, TC, HDL-C. - Calculate CVD risk score (Framingham).	- Counselling session post-physician visit and confirmation of diagnosis.	
					- Provide referral letter with clinical summary to high-risk patients; encourage GP visit and follow-up. - Provide verbal and written counselling on diet, weight, physical activity, and smoking. - Follow-up call within 1 month to check referral uptake & lifestyle changes.	- High-risk identification: 26/287 (9%) $\geq 20\%$ CVD risk; $\uparrow$SBP 32/287 (11.1%); $\uparrow$DBP 22/287 (7.6%); $\uparrow$TC 50/287 (17.4%); low HDL-C 108/287 (36.7%); abnormal glucose 22/287 (7.6%). - Referrals: 146/287 (50.8%) referred to a physician. - Referral uptake: 71/132 (54%) attended follow-up. - Lifestyle improvement: regular exercise 50/132 (37.8%);

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
						weight-loss 44/132 (33.3%); dietary changes 79/132 (59.8%).
Opportunistic screening of CVD risk factors (274)	Nigeria	- No specific criteria. - Opportunistic + advertisement-based recruitment.	- Resources and tools. - Training. - Free service.	-Anthropometrics: weight, height, BMI, and waist circumference. - POCT: BP, fasting BG, and TC.	- Refer patients with elevated readings of BP, BG, or TC to a physician. - Provide signed referral note with screening summary + pharmacy contact information.	- Identified previously undiagnosed risk factors in 569/889 (64.1%): overweight 59.7%, obese 71.5%, HTN 28.2%, DM 3%, hypercholesterolemia 45.3%. - Referred at-risk individuals to physicians. - High patient satisfaction: 98.9% rated screening effective, satisfactory & beneficial.
Cholesterol and CVD risk screening (Vascular)	Norway	- Age ≥18 years. - Not on lipid-lowering medications.	-Training. - Screening tools. - A consultation room.	- POCT: TC level. - Screening questionnaire: age, sex,	- Give TC result + diet/lifestyle CVD-prevention brochure.	- Reached individuals with no prior TC/BG/BP

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
lifestyle-Intervention and Screening in pharmacies - VISA project) (275)		- Not pregnant/lactating. - Advertisement-based recruitment.		education, weight, height, BMI, physical activity level, smoking, prior TC, BG, BP tests, prior TC knowledge.	- If TC ≥ 7.76 mmol/L → advise GP follow-up.	checks: 6.6% (1401/20,743). - Identified individuals with previously undetected elevated TC: 11% (2337/20,743).
Pre-HTN and elevated CVD risk factors screening (276)	Thailand	- Age ≥ 35 years. - No diagnosed HTN or other CVD. - Opportunistic screening.	- Free service. - 15-20 minutes.	- Collect demographics and CVD risk factors. - BP measurement. - If pre-HTN/HTN (per JNC7), test random BG + TC.	- Provide verbal and written lifestyle modification advice and counselling for all. - If high BG/TC: recommend further testing: fasting BG or full lipid panel. - HTN stage 1 or 2: advise GP visit.	- Identified pre-HTN 36% & HTN 29.3%. - Detected elevated TC 46.9%.
HTN and stroke prevention screening (265)	USA	- No specific criteria; all adults entering the pharmacy were offered BP screening. - Opportunistic + advertisement-	- Dedicated area. - Community pharmacy resident. - Free service.	- Collect patient information: demographics, medications, diagnosis, GP, baseline BP, lifestyle factors. - Measure BP. - Stroke risk screening: AHA	- High readings: direct referral to physician + send follow-up form - Counsel patient regarding treatment, risk reduction, and stroke warning signs. - Give a written summary for the physician	- Identified individuals with elevated BP: 216/351 (62%); and stroke risk: mild 2/50 (26%), moderate 13/50 (32%), high 19/50 (38%).

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
		based recruitment.		protocol (normal, mild, moderate, and high) + pulse check; ECG if irregular pulse. - Assess antihypertensive medication adherence (if any).	- Advise follow-up with the pharmacy after the physician visit. - at follow-up: adherence counselling + lifestyle education.	- Referred to GP: 121/351 (34%); 43/121 (36%) had regimen changes. -Early diagnosis in 6/103 (6%) as a result of referral.
Screening for metabolic syndrome (266)	USA	- Age ≥35 years. - No diagnosed CHD. - Advertisement-based recruitment.	- Free service. - 20-minute appointment.	- Patient assessment: metabolic syndrome & medication use. -10-year CHD risk assessment (Framingham)	- Provide education on lifestyle modification. - Follow-up: 3-6 months.	- Identify patients with metabolic disease (36%), moderate CHD risk (26.4%), and high CHD risk (8.3%). - Lifestyle improvement at follow-up: 87%.
Cholesterol screening (267)	USA	- No specific criteria. - Advertisement-based recruitment.	- Free service. - Appointment.	- Cholesterol screening. - Assess CHD risk factors.	- Provide education on lifestyle modification. - Follow-up.	- Identify high cholesterol: 280/539 (78%). - Lifestyle improvement: 83%.
CVD risk screening (277)	Portugal	- Invite all pharmacy	- Private counselling room.	- Collect sociodemographic & health data	- Explain the risk results for the patient.	- Identified CVD risk factors: 94.9% (242/255)

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
		customers to participate. - Exclude: <18 years, pregnant, or mentally disabled. - Opportunistic screening.	- Remuneration needed for future implementation.	via self-report questionnaire. - POC testing: BG, TC, HDL, LDL, TG, BP, HR. - Anthropometrics: weight, height, BMI, waist circumference - CVD risk score: SCORE & SCORE-OP (>65 yrs).	- Provide Counselling on CVD risk factors & risk reduction. - Advise patient to discuss results with GP.	had >1 modifiable risk factor. - Identified individuals at CVD risk: 80% (96/120); moderate (n= 77), high (n=12), very high (n=7).
HTN preventative and detection service (278)	Ghana	- Age ≥45 years. - With risk factors: obesity, diabetes, smoking, pregnancy Exclude: with diagnosed HTN or no risk factors. - Opportunistic screening + during medication refill	- Private counselling room. - Training. - Experienced pharmacists. - Medicine Counter Assistants (MCA) support for patient recruitment. - Collaboration with local hypertensive clinic physicians. - Pharmacist reimbursement.	- Collects demographics: age, sex, education, phone. - Measures BP & calculates BMI.	- Provide verbal and written lifestyle modification advice (smoking cessation, weight loss, healthy diet, exercise). - GP referral: if BP >140/90 on 3 readings, complete referral form. - Schedule follow-up visit at 6-month + sent reminder.	- Identify risk factors: inactivity 107/170 (63%), obesity 36/170 (12%). - Pre-HTN detection & follow-up: 43/170 (25.3%). - Referral for patients with High BP: 34/170 (20%). - Early diagnosis & treatment

Screening Programme (ref)	Country	Targeted population and recruitment methods	Requirements /implementation strategies	Screening processes	Post-screening interventions	Outcomes
		for diabetic patients.				initiation:10/34 (29%). - Lifestyle changes at 6 months: weight loss, reduced alcohol. - Feasible & acceptable per pharmacists.
Early Detection of AF (279)	Spain	- Age ≥50 years. - Recruitment based on medical records (those who visit to check and/or monitor any CVD risk factor).	- Training. - Private area. - Necessary materials and protocol. - 20 minutes. - Free service.	- BP measurement. - AF detection: irregular pulse in ≥2 readings. If AF detected: calculate stroke risk (CHA ₂ DS ₂ -VASc score).	- Explain results & provide patient report. - Refer AF-positive patients to a physician with a report + ECG recommendation.	- Early AF detection: 41/452 (9.1%). - High stroke risk identification: 35/41 (85%) scored ≥2.

CVD: Cardiovascular Disease., **CHD:** Chronic Heart Disease., **BP:** Blood Pressure., **BG:** Blood Glucose., **TC:** Total Cholesterol, **HDL-C:** High-Density Lipoprotein Cholesterol., **HDL-C:** Low-Density Lipoprotein Cholesterol., **HTN:** Hypertension., **DM:** Diabetes Mellitus., **T2DM:** type 2 Diabetes Mellitus., **ACC/AHA:** the American College of Cardiology/American Heart Association., **ASCVD:** Atherosclerotic Cardiovascular Diseases., **AF:** Atrial Fibrillation., **TIA:** Transient Ischemic Attack., **HF:** Heart Failure., **MI:** Myocardial Infarction., **ACS:** Acute Coronary Syndrome., **PAD:** Peripheral Artery Disease., **eGFR:** estimated Glomerular Filtration Rate., **ECG:** Electrocardiography., **BMI:** Body Mass Index., **POCT:** Point-of-care testing., **HbA1C:** Haemoglobin A1C/ glycated haemoglobin., **ALAT:** Alanine Aminotransferase., **ASPAT:** Aspartate Aminotransferase., **CBC:** Complete Blood Count., **GP:** General Practitioner.

3.4.2 National KSA evidence on community pharmacy-based CVD risk screening

A total of four studies in KSA explored the perspectives of multiple stakeholders toward the pharmacy-based CVD risk screening service, including health consumers (146), physicians (244), pharmacists (125), and policymakers (145). These studies were exploratory and lacked structured development, piloting, or implementation; however, they provide an important foundation for future service development by offering insights into the potential acceptability, feasibility, and implementability of such a service (125, 145, 146, 244). The reported barriers and facilitators, as well as recommendations in these studies, helped to understand the needs and the influential factors to be considered in the future development and implementation of the service (125, 145, 146, 244) (see Table 3.2). Stakeholders in previous studies have also proposed various models for the service that vary in the extent of pharmacist involvement, including minimal, medium and comprehensive involvement models (145, 244):

The minimal involvement model includes providing written health promotion information on CVD risks (e.g., brochures, leaflets, or app-based CVD risk information), referring to a GP, and supporting medication adherence.

The medium involvement model involves conducting POC testing (e.g., BP, BG, lipids), calculating a risk score (e.g., questionnaire-based assessment, technology-assisted app), and offering oral and/or written advice on lifestyle modifications based on the risk score (such as smoking cessation, weight management, chronic disease prevention, and CVD risks), referring to a GP, other healthcare providers, or specialists, and supporting medication adherence.

The comprehensive model involves conducting POC testing, calculating risk scores, and performing individualised risk assessments and management, providing oral and/or written advice on lifestyle modifications based on the risk score, referring to a GP or other healthcare providers, or specialists with a written report, and offering medication counselling, medication review, and treatment monitoring after diagnosis is confirmed and treatment is being prescribed by a physician.

However, these proposed service models rely on stakeholders' professional experience and perspectives; they were not supported by a structured, evidence-based design and development process. Furthermore, agreement on the most

suitable model and service components has not yet been reached. Key service elements identified in global screening programmes, such as target populations, screening tools, recruitment methods, referral mechanisms, service costs, and other implementation strategies, have not been examined in the Saudi context. Therefore, this project aims to address these gaps by applying a structured service development process and utilising existing literature to inform the evidence-based identification of service components. This will serve as a foundation for future service design, fostering a more robust and transferable service model.

Table 3.2. Key barriers and facilitators for community pharmacy-based CVD risk screening and preventive services as reported in Saudi literature (125, 145, 146, 244)

Study	Stakeholders (n)	Data collection method	Barriers	Facilitators and recommendations
(244)	Physicians (n=26) (7 Cardiology, 9 internal medicine, 4 emergency medicine, 6 general practitioners)	Semi-structured interviews	- Ethical concerns related to the commercial nature of community pharmacies. - Limited pharmacist–physician communication. - Gender, religious, and social constraints. - Public resistance. - Weak primary healthcare system, with many individuals lacking a family physician. - Community pharmacies operate separately from the public primary healthcare system.	Current facilitators: - Long opening hours, high accessibility, and frequent consumer interactions. - A wide patient catchment, increasing early identification of individuals at CVD risk. Recommendations: - Implement physician–pharmacist collaborative models. - Provide training for pharmacists. - Ensure ministerial oversight to maintain service quality and sustainability. - Reform the healthcare system to integrate community pharmacies with primary care. - Offer financial incentives for service providers. - Promote the service to enhance patient acceptance and clarify provider roles. - Establish clear roles, protocols, guidelines, and simple screening tools. - Prepare private counselling areas. - Pilot the service before wider implementation. - Document screening activities for quality assurance. - Legalise the service through the MOH and relevant regulatory bodies. - Improve public awareness of the role of primary healthcare, including family physicians and pharmacists.

Study	Stakeholders (n)	Data collection method	Barriers	Facilitators and recommendations
(125)	Pharmacists (n=50) (26 hospital pharmacists and 24 community pharmacists)	Semi-structured interviews + focus group discussions	- Low pharmacist awareness of their role in CVD risk prevention. - Absence of risk assessment tools and guidelines. - Limited access to patient medical records. - Business-oriented practice in community pharmacies. - Lack of motivation, training, and professional development. - Public mistrust of pharmacists' clinical abilities. - Poor interprofessional collaboration with physicians. - Negative physician attitudes toward pharmacists' roles. - No integrated system or clear referral mechanisms. - Legislative restrictions on clinical services. - Staff shortages and high workload. - Sociocultural barriers (gender, religion, language, diversity of pharmacists). - Lack of private consultation areas. - Weak professional frameworks and safety standards (hygiene, ethics, clinical competence).	- Develop a public–private integrated model linking primary care with community pharmacies. Current facilitators: - High accessibility of community pharmacies. - Willingness of pharmacists to expand their roles. Recommendations: - Government and professional bodies support (e.g., MOH, Saudi Pharmaceutical Society, SFDA). - Provide free services to ensure uptake. - Promote pharmacists' roles through public campaigns. - Develop roles, career advancement, and reward systems. - Implement incentives to motivate pharmacists. - Provide resources: clinical guidelines, protocols, patient education materials. - Offer ongoing clinical and communication training. - Provide clinical mentors for less experienced pharmacists.

Study	Stakeholders (n)	Data collection method	Barriers	Facilitators and recommendations
(146)	Health consumer (n=25)	Semi-structured interviews	- Public distrust of community pharmacists. - Perception of pharmacies as business-oriented. - Limited pharmacist–patient communication and engagement. - Gender gaps in the pharmacy workforce (need for female pharmacists for female patients). - Patients’ fear of chronic disease diagnosis and low health literacy.	Current facilitators: - High accessibility, long opening hours, and short waiting times. Recommendations: - Provide the service free or at low cost. - Offer specialised clinical and communication training for pharmacists. - Ensure MOH oversight for quality assurance. - Promote pharmacist–physician collaboration. - Provide incentives and rewards for pharmacists.
(145)	Key policymakers, industry leaders, and academics (n=23)	Semi-structured interviews	- Low engagement of local graduates in the community pharmacy sector. - Pharmacy curricula lack clinical and public health content, including patient psychology, communication, and management skills. - Absence of quality accreditation systems for community pharmacies. - Public distrust and hesitancy to use pharmacy services. - No integrated system linking community pharmacies with primary healthcare centres.	Current facilitators: - Pharmacists are perceived as capable HC providers. Recommendations: - Implement collaborative physician–pharmacist models. - Use appropriate screening and risk assessment protocols and tools. - Design private, comfortable areas with access to electronic medical records. - Utilise systems like Wasfaty* to identify at-risk individuals. - Ensure evidence-based service with quality control. - Ensure service evaluation, quality monitoring, and accreditation. - Integrate digital health innovations and screening software.

Study	Stakeholders (n)	Data collection method	Barriers	Facilitators and recommendations
				- Collaborate with professional bodies, educators, business owners, medical experts, and consumers. - Provide clinical and communication skills training. - Pilot in large chain pharmacies before scale-up. - Promote services via social media, referrals, word of mouth, TV/radio, public health activists, influencers, and community leaders. - Establish government- or insurance-supported reimbursement systems (pay-for-performance) to keep services affordable and incentivise pharmacists. - Enhance pharmacy curricula to support preventive services. - Expand community pharmacy placements and professional roles to attract graduates. - Promote Saudisation in the pharmacy workforce.

CVD: Cardiovascular Disease., **MOH:** Ministry of Health., **SFDA:** Saudi Food and Drug Authority., **HC:** Healthcare.

Wasfaty*: an electronic prescribing and dispensing system.

3.5 Implementation science guidance

Designing an evidence-based intervention does not necessarily guarantee its successful implementation. Numerous health innovations remain at the design stage or experience significant delays in progressing to implementation, often due to an inadequate understanding of the factors influencing implementation (282, 283). Implementation science, defined as “the scientific study of methods to promote the systematic uptake of research findings and evidence-based practices into routine practice, and, hence, to improve the quality and effectiveness of health services and care”(284). It provides frameworks for addressing the implementation challenges. Therefore, it is essential to consider influential factors and implementation strategies from the earliest stages of intervention development, guided by implementation science principles, to achieve implementation objectives and enhance the future adoption, effectiveness, and sustainability of the intervention (285). In implementation science, numerous frameworks have been developed to guide the systematic translation of evidence-based interventions into practice. These frameworks serve different purposes and are generally classified into three main categories: 1) Determinant frameworks, which aim at understanding and identifying factors influencing implementation outcomes; 2) Process frameworks, which aim at outlining the effective stages or strategies for carrying out implementation; and 3) Evaluation frameworks, which aim at providing criteria for assessing the success, feasibility, and sustainability of implementation efforts. Each category includes multiple frameworks that can be selected based on the specific aims, context, and stage of the intervention (285).

In this project, three frameworks were integrated to provide a comprehensive approach to implementation planning. The Theoretical Domains Framework (TDF) was employed as a determinant framework to understand barriers and facilitators influencing implementation (286-288). The Expert Recommendations for Implementing Change (ERIC) strategies served as a process framework to guide the selection and prioritisation of effective and context-appropriate implementation strategies (289, 290). Finally, the Acceptability, Practicality, Effectiveness, Affordability, Side-effects, and Equity (APEASE) criteria were adopted as an evaluation framework to assess the potential appropriateness and feasibility of the proposed service (92). Each framework, along with its specific applications in this thesis, is described in detail in the subsequent subsections.

3.5.1 Determinants framework: Theoretical Domain Framework (TDF)

The Theoretical Domains Framework (TDF) is a determinants framework, designed to understand and address the determinants of behaviour change in healthcare and implementation contexts. It synthesises constructs from multiple behavioural theories into a set of domains. It was first developed in 2005 by a multidisciplinary group of experts through consensus-building exercises, aiming to simplify and integrate the many overlapping behavioural theories into a single, practical framework. The original TDF consolidated 33 behaviour change theories into 12 theoretical domains (286). This was refined in 2012 to 14 domains to improve clarity, reduce overlap between domains, and enhance its applicability in identifying barriers and facilitators in implementation research and health innovation development (287). The refined domains and their constructs are presented in Table 3.3.

Table 3.3. The Theoretical Domains Framework (TDF): an overview of its domains, definitions, and key constructs (286, 287)

TDF framework domains (definition)	Constructs
1. Knowledge (An awareness of the existence of something)	Knowledge (including knowledge of condition/scientific rationale), procedural knowledge, and knowledge of the task environment.
2. Skills (An ability or proficiency acquired through practice)	Skills, skills development, competence, ability, interpersonal skills, practice, skill assessment.
3. Social/professional role and identity (A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting)	Professional identity, professional role, social identity, identity, professional boundaries, professional confidence, group identity, leadership, organisational commitment.
4. Beliefs about capabilities (Acceptance of the truth, reality or validity about an ability, talent or facility that a person can put to constructive use)	Self-confidence, perceived competence, self-efficacy, perceived behavioural control, beliefs, self-esteem, empowerment, professional confidence.
5. Optimism (The confidence that things will happen for the best or that desired goals will be attained)	Optimism, pessimism, unrealistic optimism, and identity.
6. Beliefs about Consequences (Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation)	Beliefs, outcome expectancies, characteristics of outcome expectancies, anticipated regret, and consequences.
7. Reinforcement (Increasing the probability of a response by arranging a dependent relationship, or contingency,	Rewards (proximal/distal, valued/not valued, probable/improbable), incentives, punishment, consequents, reinforcement, contingencies, and sanctions.

TDF framework domains (definition)	Constructs
between the response and a given stimulus)	
8. Intentions (A conscious decision to perform a behaviour or a resolve to act in a certain way)	Stability of intentions, stages of change model, transtheoretical model and stages of change.
9. Goals (Mental representations of outcomes or end states that an individual wants to achieve)	Goals (distal/proximal), goal priority, goal/target setting. Goals (autonomous/controlled), action planning, and implementation intention.
10. Memory, attention and decision processes (The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives)	Memory, attention, attention control, decision making, cognitive overload/tiredness.
11. Environmental context and resources (Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour)	Environmental stressors, resources/material resources, organisational culture/climate, salient events/critical incidents, person × environment interaction, barriers and facilitators.
12. Social influences (Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours)	Social pressure, social norms, group conformity, social comparisons, group norms, social support, power, intergroup conflict, alienation, group identity, modelling.
13. Emotion (A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event)	Fear, anxiety, affect, stress, depression, positive/negative affect, burnout.
14. Behavioural regulation (Anything aimed at managing or changing objectively observed or measured actions)	Self-monitoring, breaking habits, and action planning.

The TDF was selected for this project to map previously identified determinants from the literature, as it provides a comprehensive, theory-informed framework for understanding the behavioural and contextual factors influencing implementation. Unlike other determinants frameworks, the TDF integrates constructs from multiple behaviour change theories, enabling a systematic understanding of barriers and facilitators and linking them directly to potential mechanisms of change (286-288). This makes it particularly suitable for developing implementation strategies in complex healthcare interventions, such as community pharmacy-based CVD risk screening. In

this thesis, barriers and facilitators identified in previous research from KSA (125, 145, 146, 244) were mapped into the TDF, as shown in Table 3.4 alongside the ERIC mapping, to enable theory-based interpretation of influential factors and the identification of appropriate implementation strategies. The mapping was performed by the researcher (SN) and independently reviewed and validated by an experienced researcher (HA) from KSA, with expertise in determinant mapping and qualitative research, to minimise self-bias and ensure an accurate representation of barriers and facilitators within the selected frameworks. This mapping showed that most determinants clustered around environmental context and resources, social/professional roles and identity, and beliefs about capabilities and knowledge, suggesting that implementation strategies should address both system-level and individual-level factors.

3.5.2 Process framework: Expert Recommendation for Implementing Change (ERIC)

The Expert Recommendations for Implementing Change (ERIC) framework is a process framework developed to provide a standardised compilation of implementation strategies to improve the uptake of evidence-based interventions in healthcare settings. Initially, a multidisciplinary panel of experts in implementation science and clinical practice identified and consolidated 73 discrete implementation strategies and definitions through a comprehensive consensus-building process using the Delphi technique (290). These strategies offered a shared language for researchers and practitioners to plan, report, and evaluate implementation efforts. Subsequently, given the wide variation and terminological inconsistency in the implementation strategies reported in the initial phase, efforts were made to refine and prioritise them to enhance their practical applicability. Through concept mapping and expert consensus, the extensive list was synthesised into nine distinct strategy clusters that represent broader domains of implementation activity to guide stakeholders in planning implementation (289, 290).

The nine refined ERIC strategies are: 1) use evaluative and iterative strategies; 2) provide interactive assistance; 3) adapt and tailor to context; 4) develop stakeholder relationships; 5) train and educate stakeholders; 6) support clinicians; 7) engage consumers; 8) utilise financial strategies; and 9) change infrastructure. Appendix B2: The nine Expert Recommendations for Implementing Change (ERIC) implementation strategies provides an overview of these strategies, including definitions and

illustrative examples for each. This consolidation improved the usability and coherence of the ERIC framework, enabling stakeholders to select strategies more systematically and align them with identified barriers and facilitators. Therefore, this framework was selected for this project due to its structured taxonomy of clearly defined, easily adaptable strategies that can be aligned with specific contextual barriers and facilitators. This provides a distinct advantage over other process frameworks by supporting strategic, theory-informed implementation planning while enhancing transparency, rigour, and reproducibility in implementation research.

In this project, following the initial mapping of the pre-identified barriers and facilitators to relevant TDF domains, these were subsequently linked to corresponding ERIC implementation strategies, as discussed above (Table 3.4). This mapping approach is widely adopted in implementation science research (291), with multiple previous studies employing similar methods to guide strategy selection and strengthen the theoretical grounding of implementation strategies (292-294). The mapping process in this project indicates that all nine implementation strategies are important for addressing the identified determinants across all domains. This process informed a comprehensive list of potential strategies, which will be discussed with stakeholders during the co-design and development process to facilitate prioritisation and ensure thorough coverage of implementation approaches.

Table 3.4. An overview of determinants from previous Saudi studies on community pharmacy-based CVD risk screening, mapped to the Theoretical Domains Framework (TDF) and matched with the Expert Recommendations for Implementing Change (ERIC) strategies

Determinants from prior Saudi studies (125, 145, 146, 244)		TDF domains(287)	Matched ERIC strategies (289, 290)
Barriers	Facilitators/recommendations		
-Public health beliefs and low health literacy (146)	- Raise public awareness (244)	-Knowledge -Beliefs about Consequences	-Engage consumers
-Undergraduate curriculum lacks preparation for CVD screening services (145)	- Inclusion of CVD screening training in undergraduate pharmacy curriculum (145)	-Knowledge -Skills -Environmental context and resources	-Train and educate stakeholders -Change Infrastructure
-Insufficient training (125)	- Offer continuous professional education and ongoing specialised clinical training for pharmacists (125, 145, 146)	- Skills - Knowledge	-Train and educate stakeholders
-Lack of communication skills (145, 146)	- Offer communication and motivational skills training for pharmacists (125, 145, 146)	-Skills	-Train and educate stakeholders
- Public distrust in pharmacists' ability (125, 146)	- Raise public awareness about the roles of pharmacists (244) - Ensure service promotion with the MOH or government and professional bodies' support (125, 146) - Promote via social media, word of mouth, and professional referrals and recommendations (145, 146)	-Social influences - Beliefs about capabilities	-Engage consumers
- Physician attitudes and views toward pharmacists' role and potentials (125, 145)	- Define the roles of pharmacists and physicians (244) - Foster pharmacist-physician collaboration (145, 146, 244)	-Social/professional role and identity - Beliefs about capabilities	-Develop stakeholders' interrelationships

Determinants from prior Saudi studies (125, 145, 146, 244)		TDF domains(287)	Matched ERIC strategies (289, 290)
Barriers	Facilitators/recommendations		
-Limited pharmacist-physician collaboration (125)	- Foster pharmacist-physician collaboration (145, 146, 244) - Promote an integrated healthcare system and public-private collaboration (244)	-Social/professional role and identity	-Develop stakeholders' interrelationships
-Low pharmacist awareness about their potential roles in CVD prevention services (125)	- Define the roles of pharmacists and physicians (244) - Offer continuous professional education and specialised clinical skills training for pharmacists (125, 145, 146) - Inclusion of CVD screening training in undergraduate pharmacy curriculum (145)	-Beliefs about capabilities -Knowledge	-Train and educate stakeholders
- Safety concerns and legislative restrictions on clinical services (125, 145)	- Ensure government supervision and quality control (145) - Establish clear guidelines, protocols, and frameworks for service delivery (125, 244) -Conduct pre-piloting and service evaluation (244)	-Beliefs about Consequences -Environmental context and resources	-Use evaluative and iterative strategies
- Healthcare system issues: lack of an integrated healthcare system where community pharmacies operated separately from the public primary healthcare system, limiting access to patient medical records and referral (125, 145, 244)	- Promote an integrated healthcare system and public-private collaboration (125, 145, 244) - Develop an integrated system for referrals and medical records access (125, 145). - Foster pharmacist-physician collaboration (145, 146, 244).	-Environmental context and resources -Social/professional role and identity	-Develop stakeholders' interrelationships -Provide interactive assistance -Change Infrastructure
- Lack of CVD risk assessment tools, and standardised service delivery frameworks and guidelines (125)	- Establish clear guidelines, protocols, and frameworks for service delivery (125, 244) - Develop culturally appropriate protocols and tools (145) -Use simple screening tools (145)	-Environmental context and resources	-Use evaluative and iterative strategies -Adapt and tailor to context

Determinants from prior Saudi studies (125, 145, 146, 244)		TDF domains(287)	Matched ERIC strategies (289, 290)
Barriers	Facilitators/recommendations		
			-Provide interactive assistance
- Workload and staff shortages (125)	- Enhance the appeal and incentives of community pharmacy careers to attract more pharmacists to the sector (145) - Provide incentives and rewards for pharmacists (125, 145, 146, 244).	-Environmental context and resources -Reinforcement	-Support clinicians
- Lack of private areas (125)	-Well-prepared physical environment (private, comfortable areas) (145, 244).	-Environmental context and resources	-Change Infrastructure
- Sociocultural factors (gender, religion, language, ethnicity) (125, 244)	- Promote Saudisation and gender equity in the workforce (145)	-Social influences -Environmental context and resources	-Support clinicians
Public acceptance and demand (244)	- Ensure service promotion with the MOH or government and professional bodies' support (125, 146) - Promote via social media, word of mouth, and professional referrals and recommendations (145, 146) -Financial support from the government or insurance for service costs (125, 145) - Provide the service free or at a low cost (146)	-Social influences -Goals -Reinforcement	-Engage consumers -Utilise financial strategies
- Fear of seeking help (146)	-Raise public awareness (244)	-Emotion	-Engage consumers
- Lack of professional motivation (125)	- Provide incentives and rewards for pharmacists (125, 145, 146, 244)	-Emotion	-Support clinicians -Utilise financial strategies

Determinants from prior Saudi studies (125, 145, 146, 244)		TDF domains(287)	Matched ERIC strategies (289, 290)
Barriers	Facilitators/recommendations		
- Ethical concerns due to the commercial nature of community pharmacies and the absence of accreditation standards (145, 244)	- Establish clear guidelines, protocols, and frameworks for service delivery (125, 244) - Government supervision and quality control (145) - Service development with stakeholders and professional bodies to set the standards (145) - Ensure documentation and record-keeping (145, 244)	-Environmental context and resources -Social/professional role and identity - Beliefs about capabilities	-Use evaluative and iterative strategies -Develop stakeholders' interrelationships -Adapt and tailor to context

CVD: Cardiovascular Disease., **MOH:** Ministry of Health.

3.5.3 Evaluation framework: APEASE Criteria

The APEASE criteria provide a structured framework for assessing interventions at any stage of development or following the implementation process, across six dimensions: Acceptability, Practicability, Effectiveness/cost-effectiveness, Affordability, Side-effects, and Equity (Table 3.5). This approach facilitates the assessment of an intervention's appropriateness, feasibility, and acceptability, and supports decisions regarding the need for further refinement (92).

Table 3.5. APEASE criteria for assessing interventions (92)

Criteria	Corresponding questions
Acceptability	How far is it acceptable to all key stakeholders?
Practicability	Can it be implemented as designed within the intended context, with the available material and human resources?
Effectiveness	How effective and cost-effective is it in achieving desired objectives in the target population?
Affordability	How far can it be afforded when delivered at the scale intended?
Side-effects	How far does it lead to unintended adverse or beneficial outcomes?
Equity	How far does it increase or decrease differences between advantaged and disadvantaged sectors of society?

Implementation success can be evaluated using multiple categories of measures, including implementation outcomes (e.g., acceptability, adoption, appropriateness, feasibility, fidelity, implementation cost, penetration, and sustainability), service outcomes (e.g., efficiency, safety, effectiveness, equity, patient-centeredness, timeliness), and client/service users outcomes (e.g., satisfaction, function, symptomatology) (295, 296). In implementation research, implementation outcomes are prioritised, as they are considered intermediate outcomes that directly influence both service and patient outcomes (295). The literature indicated that some terms related to the implementation outcomes are often used interchangeably, with some overlap in their definitions. Experts in the study by Klaic et al.(297), which sought to develop and refine a conceptual framework for the implement ability of healthcare interventions, emphasised the importance of assessing perceived acceptability, fidelity, and feasibility early in the development phase, considering these as important influential factors of an intervention's sustainability and scalability, which eventually affect its uptake and long-term implementation (297). Among existing evaluation frameworks (295, 296), the APEASE criteria offer a particular advantage by integrating the assessment of both implementation and service outcomes, providing a comprehensive and structured approach to evaluation. It provides a structured,

multidimensional approach that enables researchers to systematically consider practical, economic, and ethical aspects of an intervention before implementation, unlike other frameworks that typically focus primarily on a specific set of outcomes. Although a well-established and commonly used framework, RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance), integrates both effectiveness and implementation outcomes, it still has limitations, as it does not encompass other important service outcomes, such as safety and equity (298). Therefore, the APEASE criteria are particularly suitable for this early stage of the service development, as they support a comprehensive preliminary evaluation of the service, ensuring that the intervention is not only feasible and acceptable, but also potentially effective, safe, and equitable within the context of community pharmacy practice.

Multiple methodologies could be used to evaluate these criteria during piloting or after implementation. For example, randomised controlled trials (RCTs), experimental designs, or pre- and post-intervention studies could evaluate effectiveness, side effects, and equity; qualitative approaches or surveys could assess acceptability and practicality; and administrative data combined with cost-effectiveness analysis could examine affordability (92). However, at this early stage of service development, the most suitable approach was to capture stakeholders' perspectives on each criterion using numerical rating scales incorporated into the e-Delphi questionnaire to assess the proposed service model and determine whether any improvement is required, providing confidence for the future implementation plan.

3.6 Conclusion:

This chapter has established a strong foundation for the proposed service development by drawing on the UK MRC and O'Cathain et al. guidance for developing complex interventions. The synthesised evidence and selected frameworks have supported the generation of evidence-based, theory-informed service ideas, clarified key components, and highlighted factors likely to influence implementation. In line with UK MRC guidance, a consensus-based methodological approach was chosen as the most suitable strategy for co-designing the service. Consequently, this chapter provides a critical basis for the subsequent chapters that utilise the NGT and the e-Delphi consensus method. The service ideas, components, and implementation strategies identified in this chapter have informed the development of materials and

discussion points for stakeholder engagement in these two subsequent consensus studies. Overall, this structured process ensures that the proposed service is rooted in the best available evidence, informed by theory, and tailored to the relevant context. Progressing systematically from evidence synthesis to stakeholder consensus further enhances the overall rigour and credibility of the service development process.

4 Chapter 4: Co-design of a community pharmacy-based CVD risk screening service in KSA: a multi-stakeholder modified Nominal Group Technique (NGT) consensus study

4.1 Introduction

As discussed in the preparatory literature review in Chapter 3, various community pharmacy-based CVD risk screening programmes have been piloted, implemented, and evaluated in many countries worldwide, highlighting the potential of such a service. Although all those programmes are designed to detect and manage CVD early and to prevent further CVD events, they vary globally in structure and components, including targeted population, screening processes, and types of intervention provided. The variation in CVD risk screening programmes globally is likely influenced by several factors, including disease prevalence and the distribution of risk factors, healthcare infrastructure and resource allocation, cost-effectiveness, and cultural considerations (249). This highlights the need for context-specific programmes that address local needs and cultural contexts. Accordingly, lists of key service components were compiled from the literature and discussed with local experts in this study to help develop an evidence-based, context-specific service (see Figure 4.1).

Currently, there is no established CVD risk screening programme or other screening service within community pharmacy settings in KSA. A previous randomised controlled trial (RCT) piloted and evaluated the feasibility and effectiveness of a community pharmacy-based medication therapy management (MTM) and diabetes screening service for patients with uncontrolled diabetes (153). The study's findings highlighted the service's feasibility and its positive impact on disease outcomes, including significant improvements in HbA1c levels and blood pressure (BP), reduced hospitalisations and drug-related problems, and increased patient satisfaction (153). These promising findings support expanding community pharmacy-based screening services beyond diabetes to include CVDs and other chronic conditions.

As discussed in Chapter 3, previous studies on CVD risk screening in KSA were exploratory and did not involve research around the development, piloting, or implementation of the service. All interviewed stakeholders in those studies (consumers, physicians, pharmacists, and policymakers) viewed pharmacy-based CVD risk screening positively and supported its implementation (125, 145, 146, 244). Various service models, including minimal, medium, and comprehensive involvement

models, have been proposed (145, 244). However, no structured consensus exercise has been conducted with all stakeholders to agree on the most appropriate model and its core components, like the target population, screening processes, and post-screening interventions. To address this gap, this study aims to co-design an evidence-based and consensus-driven community pharmacy-based CVD risk screening service model in KSA, involving multiple stakeholders.

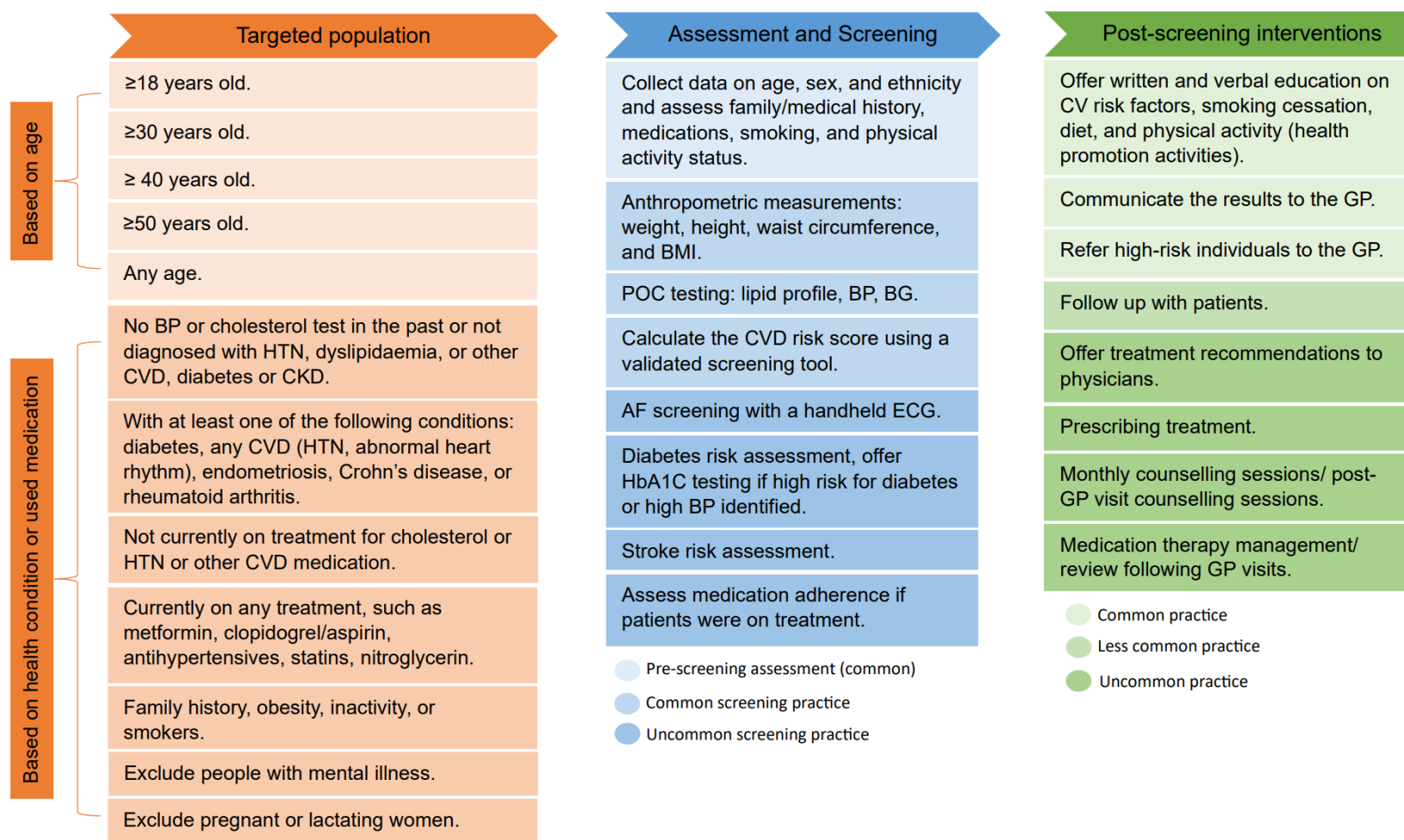


Figure 4.1. Summary of ideas on the key components of community pharmacy-based CVD risk screening service, including service-targeted populations, screening processes, and interventions, as presented in the literature (Chapter 3).

HTN: hypertension, CVD: cardiovascular disease, CKD: chronic kidney disease, BP: blood pressure, BMI: body mass index, POC: point of care testing, BG: blood glucose, AF: atrial fibrillation, ECG: electrocardiogram, Hb A1C: Haemoglobin A1c, GP: general practitioner.

4.2 Aims and objectives

This study aimed to collaboratively design and develop a potential, evidence-informed, consensus-driven model for a community pharmacy-based CVD risk screening service in KSA.

The key objectives include:

- 2) Engage multiple stakeholders to discuss ideas from the literature and generate additional ideas to help co-design a potential service model for community pharmacy-based CVD risk screening in KSA
- 3) Identify the needs and priorities for community pharmacy-based CVD risk screening services in KSA
- 4) Achieve stakeholders' consensus on the key components of the service, including the target population, screening processes, and post-screening interventions

4.3 Research questions

Q1: What are the essential components of an effective, feasible and sustainable CVD risk screening service in community pharmacies in KSA?

Q2: Which service model is appropriate for implementation in KSA?

4.4 Methods

This study was reported following the Accurate Consensus Reporting Document (ACCORD) checklist for reporting consensus methods (299) (see Appendix C5: Reporting checklist).

4.4.1 Registration and ethics:

The study protocol was not registered; however, ethical approval was obtained from the Strathclyde Institute of Pharmacy and the Biomedical Sciences Ethics Committee.

4.4.2 Study design:

Due to the absence of a national protocol for community pharmacy-based CVD risk screening services in KSA, the variation in the CVD risk screening programmes reported in the literature worldwide, as well as the variation of the proposed models for the service in previous studies in KSA, a consensus method - the nominal group technique (NGT) - was applied. This helps generate ideas, determine priorities, and

make decisions on service development in KSA, while seeking consensus among key stakeholders involved in CVD prevention and management. This method is considered an appropriate method for decision-making and was particularly suited to the study's aim of identifying and prioritising key aspects of the service (250, 300). Unlike other qualitative methods such as focus group discussions, NGT aims not only to explore participants' perspectives but also to generate, prioritise, and reach consensus on key ideas. Its structured round-robin format reduces the potential for dominant participants to influence the discussion and ensures that all participants have an opportunity to contribute. NGT also offers greater group interaction than individual interviews while retaining a structured approach to prioritising the ideas identified (250, 300).

Although there are various consensus methods, the decision was made to start with the NGT in the first phase of this project, to generate ideas, outline an initial service model, and identify key components. This approach supports the development of a structured and focused Delphi questionnaire for the next phase, which will explore the service in greater detail based on the potential service model. Additionally, NGT allows for immediate responses, which is especially suitable for the early stages of service development, where stakeholders' perspectives and consensus need to be gathered and synthesised quickly to inform further planning (250, 300).

The NGT is a highly structured face-to-face group discussion that involves several stages following the nominal questions, including multiple rounds of generating ideas, ranking, and re-ranking those ideas to achieve agreement and resolve disagreements among participants (250). This structured nature of the NGT method, which focuses on specific questions, ensures organised discussion and equal contribution, making it more effective than other qualitative interviews and focus groups in generating and prioritising ideas within a limited time, by keeping the discussion focused (300-302). Moreover, the NGT ensures each participant has an equal opportunity to generate and present their ideas independently, eliminating bias from the dominance of one participant or the influence of others (300-302).

The classic NGT comprises four key stages following the nominal questions: silent generation, round-robin sharing of ideas, clarification, and ranking/voting (250). In this study, since comprehensive lists of the key components of service have been collected from the literature (Figure 4.1), a modified NGT was employed (250), in

which the initial silent generation of ideas was conducted before the group discussion day. The modified NGT (m-NGT) is recommended if the ideas were pre-identified from the literature or a previous study (250, 300). In this study, the pre-identified lists of ideas were sent to the expert panel via a pre-NGT online questionnaire to review and suggest any additional ideas they considered essential for community pharmacy-based CVD risk screening programmes in KSA. Following the m-NGT approach (Figure 4.2) provides the participant more time to reflect on the pre-identified ideas, suggest new ideas, and eventually, helps achieve greater consultation during the meeting (250). The m-NGT meeting comprises three key stages following the presentation of the pre-NGT questionnaire results and the nominal questions (250); clarification (round robin and group discussion), ranking, and pre-consensus discussion and consensus voting (Figure 4.2). Similar modifications to the idea generation process have been adopted in a previous pharmacy practice study, in which ideas related to the topic were initially generated through a literature review and subsequently presented to experts prior to the meeting to allow reflection and the suggestion of additional ideas (303).

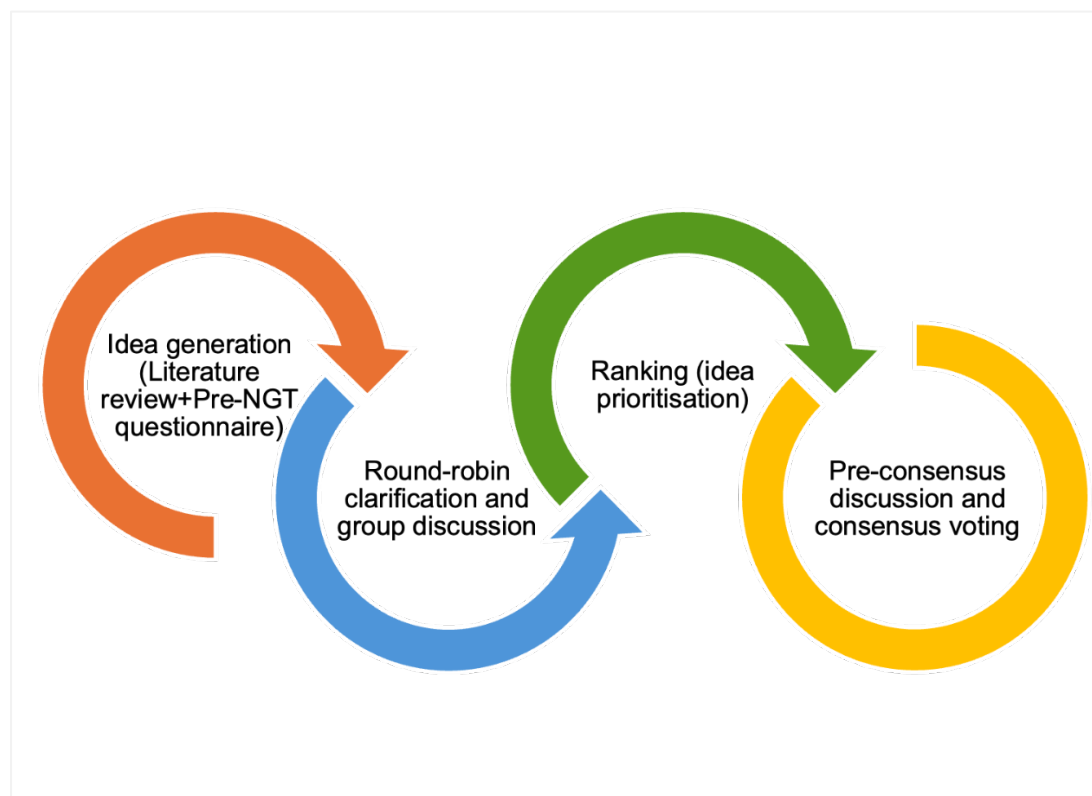


Figure 4.2. The modified Nominal Group Technique (NGT) stages

4.4.3 Nominal Questions:

Two main questions were discussed to help identify and design an appropriate model for the service, with two topics discussed under each nominal question:

Nominal question 1: Who should be targeted for CVD risk screening in community pharmacies?

Discussion topics: 1) targeted age group, and 2) other targeted population characteristics.

Nominal question 2: What should the community pharmacy-based CVD risk screening services involve?

Discussion topics: 1) assessment and screening processes, and 2) post-screening interventions.

4.4.4 Participants' inclusion criteria and recruitment:

The targeted experts for this study were stakeholders who could influence service implementation directly or indirectly, such as those with experience in CVD prevention or management, and in health and pharmaceutical policy or service implementation in KSA, as well as service providers (304). Those experts were determined based on the suggestions from previous literature, including cardiologists, senior clinical pharmacists (171), community pharmacists, general practitioners (GPs) (248), representatives from the Ministry of Health (MOH), community pharmacy managers/owners (145), and representatives from the public health authority (232). Service consumers were not included in this study because they lacked clinical expertise about what the service should look like, which might lead to lower contributions or misunderstandings (146). Additionally, service consumers may feel intimidated by the presence of experts and professionals, which might hinder them from expressing their ideas.

The group size in a typical NGT usually ranges from 9 to 12 participants (301). Although having a large group size enhances the reliability of group decisions, it might result in coordination issues, and the reliability may diminish in a group exceeding 12 participants (305). Thus, this study aimed to purposively recruit ten representative stakeholders: 1 cardiologist, 1 GP, 1 senior clinical pharmacist, 2 community pharmacists, 2 representatives from the MOH, 1 from a public health authority, and 2 community pharmacy managers/owners. A purposive sampling was recommended as an appropriate method in the NGT study to ensure representative sampling (301).

Unlike traditional focus group discussions, the NGT discussion does not rely on data saturation. This is because of the structured nature of the NGT, which is designed to prioritise and rank ideas through a systematic and consensus-driven process rather than through ongoing data collection until no new information emerges.

The targeted stakeholders were contacted through publicly available contact information, personal contacts (e.g., colleagues and stakeholders met at a previous conference), and snowball sampling (contacted stakeholders were asked to recommend other potential participants). Recruitment of participants began on 27th November 2024. An invitation letter, participant information sheet, consent form, and demographic information questionnaire were sent to each participant (Appendix C1: Participant information sheet, consent form and demographic information questionnaire). A reminder was sent to non-responders after 2 weeks.

4.4.5 Setting:

The NGT meeting was carried out on one day (7th February 2025) and over 3 hours in a hotel meeting room in Riyadh (the capital and largest city in KSA). The time and date were determined based on participants' preferences, which were collected as part of the demographic information questionnaire. The meeting room was equipped with essential tools to facilitate discussion (e.g., a whiteboard/flipchart, sticky notes, a projector, and a U-shaped table).

Although online NGT meetings offer geographic flexibility and potential for broader representation, an in-person format was chosen to ensure richer interaction, immediate clarification, deeper discussion, more effective facilitation, and stronger engagement, which might be affected by technical issues in virtual settings.

4.4.6 Materials and procedure:

All materials, including the pre-NGT questionnaire, ranking exercise, and consensus exercise, were online-based using the Qualtrics platform to ensure participants' confidentiality and anonymity and speed up data collection and analysis. This also safeguarded data storage and minimised the risk of missing data associated with paper-based materials, particularly during travel. In addition to the electronic materials, the workbook (**Error! Reference source not found.**) included a paper-based ranking exercise as a backup in case of any technical issues. The workbook included the meeting agenda, the nominal questions with space for note-taking, the

pre-identified ideas from both the literature and the pre-NGT questionnaire, and the ranking exercise. All paper-based materials and workbook notes were collected from the participants at the end of the meeting and properly discarded by hand shredding into small, unrecognisable pieces to ensure that no information could be identified and that the paper could not be reconstructed.

All materials were reviewed and piloted by the primary researcher, PhD students and other Saudi researchers and pharmacists (n=10). The piloting process focused on assessing the clarity of content, the appropriateness of question types used, the time required to complete, and the overall ease of use.

4.4.6.1 Preparatory literature review

As noted in the introduction and discussed in Chapter 3, the study materials were informed by a literature search on community pharmacy-based CVD risk screening programmes worldwide. MEDLINE was searched from inception in May 2024. A total of 36 studies were reviewed in full, of which 4 were national studies. Comprehensive data on the service structure, components, and/or effectiveness were extracted from each study. Consequently, lists of various screening practices, including targeted populations, screening processes, and post-screening interventions, were created (Figure 4.1) to develop the study materials.

4.4.6.2 Pre-NGT questionnaire

The pre-NGT questionnaire was focused on idea generation by asking participants to review the pre-identified ideas from the literature regarding the community pharmacy-based CVD risk screening services and offer any additional ideas (if any). The lists of ideas were presented graphically under 3 groups: service-targeted population, assessment and screening processes, and post-screening interventions. At the end of each group, the experts were asked to offer additional ideas they considered appropriate to the context of pharmacy practice in KSA. This questionnaire was developed using the Qualtrics online platform to facilitate data collection and analysis. The questionnaire was written in English, a common language for health professionals in KSA. The pre-NGT questionnaire was sent to those who consented to participate on 16th January 2025. Participants were asked to complete the pre-NGT questionnaire within one week to allow the researcher to analyse the results and prepare the meeting material. An example of the pre-NGT questionnaire is presented in (Appendix C2: Pre-NGT meeting questionnaire).

4.4.6.3 Pilot meeting

The meeting was piloted with 3 Saudi pharmacists and PhD students, facilitated by two researchers (SN: the primary researcher, a PhD student trained in conducting focus group discussions and consensus methods, and HAA: a Saudi researcher with experience in qualitative methods) and observed by the supervisor (NW: experienced in consensus methods). However, the results from this pilot meeting were not included in the final analysis, as this piloting was only to assess the meeting timing, processes and materials before conducting the actual meeting. Some modifications were made to the score calculation and presentation in response to the supervisor's and participants' recommendations. These included using Excel to both calculate and present the results, utilising the filter function to quickly present the ranking results from highest to lowest, rather than transferring the results to a separate slide and manually ordering the ideas. Additionally, a minor amendment to the ranking exercise was made to enable its distribution through various channels. This included adding a space for participants to write their names and optimising the questionnaire to be more mobile-friendly, enabling it to be shared via the most preferred and accessible methods for participants: email, QR code, or an anonymised link, to facilitate the process.

4.4.6.4 NGT meeting

The consented participants who completed the pre-NGT questionnaire were invited to the scheduled meeting (7th February 2025). Table 4.1 provides an overview of the NGT meeting stages. The first facilitator (SN) presented the topic, meeting agenda, nominal questions, and ground rules using a PowerPoint presentation, followed by an opportunity for participants to ask questions. Consent was obtained verbally from all participants and recorded before the discussion began, allowing them to clarify uncertainties and address doubts before proceeding. The pre-identified ideas, as well as the results from the pre-NGT questionnaire, were presented on a PowerPoint slide and within the participant workbook (Appendix C3: NGT meeting workbook). Participants were first asked to reflect on and share their proposed ideas in a round-robin format, followed by an open discussion that allowed them to modify, clarify or further explore the ideas and opinions presented. They were encouraged to take notes before sharing their thoughts and instructed not to speak over each other. The meeting was audio-recorded using both a digital Dictaphone and Microsoft Teams to ensure the clarity and reliability of the recorded data. The second facilitator (HAA)

was responsible for recording the discussion and sending the ranking exercises to participants after the discussion of each topic.

An online ranking questionnaire was used to ensure confidentiality and facilitate data collection and analysis. The two facilitators collated and calculated the rankings and presented them to the group. Participants were then asked to reflect on the ranking, discuss the results, and select the final priority lists. Following this, a consensus exercise was conducted via Qualtrics for anonymous online voting, in which participants were asked whether they agreed with the final proposed service model.

All attending experts were offered a 250 SAR gift voucher as a token of appreciation for their attendance and contributions; these vouchers were sent following the meeting.

Table 4.1. Stages of the modified Nominal Group Technique (m-NGT) with a detailed description of the meeting processes

m-NGT meeting stages and processes	Description
Ideas generation (Literature review + pre- meeting questionnaire)	• The pre-identified ideas from the literature were sent to the participants through a pre-meeting questionnaire, asking them to review these ideas and offer any additional ideas (if any). • The final lists of ideas were generated and discussed in the meeting.
Round-robin clarification and group discussion (20-30 minutes/topic)	• Each participant had the opportunity to clarify their ideas (if any) and share their opinions about each idea. • Followed by an open discussion to allow participants to modify, clarify or discuss the presented ideas and justify their opinions.
Ranking/Idea prioritisation (5 minutes/topic)	• Following the discussion of each topic, participants independently rank each idea according to their preference. • Depending on the number of ideas for each topic, the most favourable idea was given the highest number and the least favourable the lowest. • Participants were instructed to keep their ranking confidential. • Following the ranking of each topic, participants were asked to take a 10-minute break. The ranking results were collected and analysed during that time by the two facilitators. • The total ranking score in each ranking exercise was calculated based on the number of participants and the

	number of items within each category, with the highest score indicating the highest priority. • The maximum possible ranking score for each item was determined by multiplying the number of items by the number of participants.
Pre-consensus discussion and consensus voting (20 minutes)	• The highest-ranked items were highlighted and presented to participants, with a score difference of >10 points between the scores used as a cut-off for determining whether an idea should be included among the highest priorities (Table 4.4). • Participants had the opportunity to decide which items from the highest-ranked to include or exclude, with no fixed threshold number used to select items; except for the targeted age group, only one item was selected (Table 4.4). • Participants anonymously voted on whether they agreed or disagreed with the final proposed service model (Figure 4.3). • Consensus was achieved if $\geq 70\%$ of participants agreed with the final proposed service model.

4.4.7 Analysis:

4.4.7.1 Pre-NGT questionnaire

The qualitative data generated from the pre-NGT questionnaire were analysed through content analysis. Each suggested idea was considered, incorporated into the pre-identified ideas and grouped with a similar idea. The final lists of ideas for each group were generated and presented in the meeting.

4.4.7.2 NGT meeting

The recorded data obtained from the clarification and discussion on the day of the meeting were transcribed following the intelligence verbatim approach (306). This process involved removing pauses, repetitions, and stutters and correcting grammatical errors for clarity. After cleaning the transcript, an inductive thematic analysis was conducted to contextualise and justify group priorities (307). This involved a systematic review of the transcript without being guided by a pre-existing theoretical framework. The transcript was imported into NVivo software v14 for coding and analysis (308).

Following data familiarisation, listening to the recorder multiple times and reading the transcript thoroughly to gain a deep understanding of the data, the primary researcher (SN) independently generated initial descriptive codes through a careful and close review of the transcript to capture key concepts and ideas (307). These initial codes were revisited multiple times, refined and adjusted as necessary by the researcher to

ensure accuracy and consistency. Similar codes were then grouped into categories, helping to consolidate related ideas and generate themes and sub-themes. Finally, each code was mapped to its corresponding theme to ensure that all relevant data were appropriately linked to the most fitting theme. The codebook (Appendix C4: Thematic analysis codebook), which contained all the codes and themes along with their descriptive definitions, was then reviewed by the supervisors to ensure consistency and alignment with the research objectives. Additional independent coding for part of the transcripts was performed by an experienced qualitative researcher (HAA) for validation purposes. In a further validation step, the independent researcher (HAA) also reviewed the codebook developed by the primary researcher (SN) and matched the codes with the relevant quotes from the transcript. Following this two-step validation, the primary researcher compared the independently applied codes with their codes to ensure confirmability and consistency (309).

The identified themes and sub-themes underwent further interpretation and in-depth analysis. These were presented in detail in the analysis section and supported by illustrative quotes from participants. In some cases, quotations from a single participant were compiled from multiple points in the discussion to ensure a comprehensive reflection of participants' views on a specific theme. In addition to the emerging themes from the discussion, the participants suggested modifications and agreed on the number of items to prioritise from each list of ideas. All the suggested modifications to the list of ideas from participants during the discussion were incorporated into the service model and described in the ranking table.

4.4.7.3 Ranking exercise

Quantitative data were obtained from the ranking exercise. All pre-identified ideas from the literature and additional suggestions from the participants were ranked. This involved four ranking exercises: ranking of targeted age group (items=6), other population characteristics (items=12), screening processes (items=10), and post-screening interventions (items=8). For each ranking exercise, participants were asked to rank the items from most to least favourable, with the highest number assigned to the most favourable items and the lowest to the least favourable. The total ranking score in each ranking exercise was calculated based on the number of participants and the number of items within each category, with the highest score indicating the highest priority. The maximum possible ranking score for each item was determined by multiplying the number of items by the number of participants. For

example, in the targeted age group where six items were ranked by six participants, the maximum possible score was 36 (6 items x 6 participants), and the lowest possible score was 6 (1 point from each of the 6 participants). The top-ranked items were highlighted, with a score difference of more than 10 points used as the cut-off for inclusion in the top priorities. For the targeted age group, only the highest-ranked option was selected.

4.4.7.4 Consensus exercise

Since there is no universally accepted standard for the consensus level in NGT studies, it is recommended that researchers determine the consensus threshold before starting data collection (249, 318), with 70%-80% considered a reasonable consensus threshold in most previous research, particularly in healthcare research (310). Therefore, for this study, a consensus level of 70% was deemed acceptable, meaning that consensus was achieved if 70% or more of participants agreed with the final proposed service model. As the consensus exercise was conducted online, the total number of votes and corresponding percentages were automatically calculated and visualised on the Qualtrics platform.

4.5 Results

4.5.1 Participants' recruitment results and demographic characteristics

A total of 41 experts were contacted via various recruitment methods, including WhatsApp (n=24), email (n=16), LinkedIn (n=13), and other colleagues and personal contacts (n=3), with some individuals approached through multiple channels. Of those contacted, 22 (53.6%) responded, and among them, 13 (59.1%) consented to participate and were sent the pre-meeting questionnaire. For practical reasons, only the experts living in Riyadh (n=11) were invited to the meeting; of these, 10 completed the pre-meeting questionnaire. Six attended the NGT meeting; the majority were male (n=4, 66.7%) and Saudi (n=4, 66.7%). The attending experts represented different sectors, including a clinical pharmacist (n=1, 16.7%), a community pharmacist (n=1, 16.7%), a representative from MOH (n=1, 16.7%), a public health representative (n=1, 16.7%), and community pharmacy managers/owners (n=2, 33.3%). Although no invited physicians attended, one of the community pharmacy managers introduced himself as a physician. The median years of experience for the attending experts was 10.5 years. Three (50%) held a master's degree, 1 (16.7%) had residency training, and 2 (33.3%) held a PharmD as their highest qualification. One (16.7%) participant

had prior experience providing CVD risk screening in community pharmacies in another country (see Table 4.2 for participants' demographics).

Table 4.2. Participants' demographics

Demographics variables	Consented (n=13)	Invited to the NGT meeting (n=11)	Attended the NGT meeting (n=6)
Gender: n (%)			
- Male	7 (53.8%)	6 (54.5%)	4 (66.7%)
- Female	6 (46.2%)	5 (45.5%)	2 (33.3%)
Targeted experts: n (%)			
- Physicians (Cardiologist, GP)	2 (15.4%)	2 (18.2%)	1 (16.7%)^
- Clinical pharmacists	2 (15.4%)	2 (18.2%)	1 (16.7%)
- Community pharmacists	4 (30.7%)	2 (18.2%)	1 (16.7%)
- Representative from MOH	2 (15.4%)	2 (18.2%)	1 (16.7%)
- Representative from Public Health	1 (7.7%)	1 (9.1%)	1 (16.7%)
- Community pharmacy manager/owners	2 (15.4%)	2 (18.2%)	2 (33.3%)^
Nationality: n (%)			
- Saudi	10 (76.9%)	8 (72.7%)	4 (66.7%)
- Non-Saudi	2 (15.4%)	2 (18.2%)	1 (16.7%)
- Not reported	1 (7.7%)	1 (9.1%)	1 (16.7%)
Area of living: * n (%)			
- Riyadh province	11 (84.6%)	11 (100%)	6 (100%)
- Hail province	2 (15.4%)	0 (0.0%)	0 (0.0%)
Highest level of education: n (%)			
- PharmD	5 (38.5%)	3 (27.3%)	2 (33.3%)
- Residency training	1 (7.7%)	1 (9.1%)	1 (16.7%)
- Master's degree	5 (38.5%)	5 (45.5%)	3 (50%)
- Fellowship	2 (15.4%)	2 (18.2%)	0 (0.0%)
Years of experience: median (IQR: Q1-Q3), n (%)	8 (4-15)	14 (5.5-15)	10.5 (3.75-15)
<1 year – 4 years	4 (30.8%)	2 (18.2%)	2 (33.3%)
5 years – 8 years	3 (23.1%)	3 (27.3%)	1 (16.7%)
13 years – 16 years	4 (30.8%)	4 (36.4%)	2 (33.3%)
17 years – 20 years	1 (7.7%)	1 (9.1%)	0 (0.0%)
21 years – 24 years	1 (7.7%)	1 (9.1%)	1 (16.7%)
Had previous experience in conducting CVD risk screening in community pharmacies: n (%)	2 (15.4%)	2 (18.2%)	1 (16.7%)

*For practicality, we only invited participants living in Riyadh, where the NGT meeting took place.

[^] One participant introduced himself as both a family medicine physician by background and a community pharmacy owner. **GPs**: General Practitioners. **MOH**: Ministry of Health. **IQR**: Interquartile range. **CVD**: Cardiovascular Disease.

4.5.2 Pre-NGT questionnaire

The pre-meeting questionnaire was sent to 13 participants, and 10 (76.9%) completed the questionnaire. Among those who completed the pre-meeting questionnaire, 7 (70%) suggested additional ideas. A total of 24 ideas were proposed (see Table 4.3). Those additional ideas were analysed and grouped with the pre-identified ideas from the literature. The number of items in each list has changed after adding the participants' suggested ideas: 6 items for the targeted age group, 12 items for other population characteristics, 10 items for the assessment and screening processes, and 8 items for the post-screening interventions.

Table 4.3. Participants' suggested ideas from the pre-NGT questionnaire

Targeted population (n=10)	Assessment and screening processes (n=6)	Post-screening interventions (n=8)
- 18-40 years old. - Bodybuilders. - Gender. - Socioeconomic status /deprived population. - Unhealthy diet. - Confirmed diagnosis of dyslipidaemia. - People with disabilities. - Former smokers. - Pre-diabetic. - Medications that are known to have CV harm.	- Collect information on socioeconomic status and residence area. - Testing based on whatever is available: (venipuncture or POC testing). - May consider ECG if the patient has a history of HTN or diabetes. - Assessment of health literacy. - Heart rate variability (HRV). - Oral health assessment.	- Lifestyle and behaviour modification coaching. - Referral to dietitians and wellness clinics. - Counsel to stay away from stress factors/ stress reduction education^{^2}. - Weight reduction education. - Offer education for all regardless of risk. - Low CV risk: follow up within a specific time frame. - Moderate risk: referral to physician or referral to MTM programme + follow-up with patients. - High risk: refer to a physician + refer to MTM programme + follow up with patients.

^{^2}: Idea suggested by 2 participants.

HTN: hypertension, **CVD**: cardiovascular disease, **POC**: point of care testing, **ECG**: electrocardiogram, **MTM**: medication therapy management.

4.5.3 NGT ranking exercise and suggested modifications

All 6 attending experts completed the ranking exercises after discussing each list of ideas. In the first ranking exercise for the targeted age group, participants gave the

highest score to the age group ≥ 40 years old, with a score of 32 out of 36. The highest possible scores for the targeted population, screening processes and post-screening interventions were 72, 60, and 48, respectively. Based on pre-identified cut-off points, the top six ranked items for the first two and the top seven for the last were identified as the highest priorities (See Table 4.4 for detailed ranking results). However, throughout the discussion of each list, participants proposed various modifications, which included removing and adding specific words in certain items, rephrasing statements, combining similar items, and determining the number of top-priority items from the highest-ranked items in each list. These modifications are presented in Table 4.4, which offers a clearer understanding of the specific changes proposed for each item and clarifies the returned and excluded items. Therefore, after modifying and combining some items, the number of prioritised items has changed to the top five for both the targeted population and screening processes, and to the top three for post-screening interventions (Figure 4.3). The potential service model after modifying those lists is presented in Figure 4.4.

Table 4.4. The ranking results, ordered from the highest to the lowest priority according to the total ranked score.

Targeted population based on age			
#	Ideas	scores	Suggested modifications during the discussion
1	≥ 40 years old*	32/36	Nil
2	≥ 30 years old	28/36	Nil, excluded
3	≥ 50 years old	27/36	Nil, excluded
4	≥ 18 years old	20/36	Nil, excluded
5	<u>18 - 40 years old</u>	12/36	Nil, excluded
6	Any age	7/36	Nil, excluded
Targeted population based on other characteristics			
#	Ideas	Scores	Suggested modifications during the discussion
1	With at least one of the following conditions: <u>pre-diabetes</u> /diabetes, <u>HTN</u> , <u>dyslipidaemia</u> , or any CVD, endometriosis, Crohn's disease, or rheumatoid arthritis*	65/72	-It was suggested that "or any CVDs" be removed, as participants believed that this screening service should not be provided to patients with existing CVDs. -It was suggested that individuals be targeted based on their refill records for anti-hypertensive, anti-diabetes, or anti-dyslipidaemia medications.

			Thus, combining item 6 with this item. -It was suggested that even individuals with elevated BP (pre-HTN) should be targeted.
2	Family history, obesity, inactivity, <u>unhealthy diet</u> , smokers or <u>former smokers</u> *	60/72	-Overweight and bodybuilders were suggested as risk factors to be added to this item.
3	<u>Currently on medications that cause CV harm</u> *	59/72	Nil
4	No BP or cholesterol test in the past year, or not diagnosed with HTN, dyslipidaemia or other CVD, diabetes or chronic kidney disease*	48/72	Nil
5	Not currently on treatment for cholesterol, HTN, or other CVD medication*	47/72	Nil
6	Currently on any treatment: metformin, clopidogrel/aspirin, antihypertensives, statins, nitroglycerin*	42/72	-It was suggested that this be combined with item 1, with individuals currently on treatment for pre-existing conditions such as HTN, diabetes, or dyslipidaemia being targeted. -It was suggested that individuals currently on treatment for CVDs be excluded.
7	<u>Gender</u>	28/72	Nil, excluded
8	Exclude pregnant or lactating women.	27/72	Nil, excluded
9	<u>Socioeconomic status (deprived population)</u>	27/72	Nil, excluded
10	<u>Bodybuilders</u>	26/72	-It was suggested that this be combined with item 2 as one of the lifestyle-related risk factors.
11	Exclude people with mental illness	25/72	Nil, excluded
12	<u>People with disabilities</u>	14/72	Nil, excluded
Assessment and screening processes			
#	Ideas	Scores	Suggested modifications during the discussion
1	Calculate the CVD risk score using a validated screening tool*	51/60	-It was suggested that the screening tool be valid and approved for the Saudi population. -Participants believed that to calculate this, all the parameters in the items

			below are required, and feed into each other.
2	Collect data on age, gender, ethnicity, <u>socioeconomic status</u> , <u>residence area</u> , family/medical history, medications, smoking, diet, physical activity status and health literacy*	48/60	-It was suggested that a unified medical record be used to check the available data for the patient instead of collecting all data from the patient.
3	POC or <u>venipuncture</u> testing: lipid profile, BP, BG*	48/60	-It was clarified that venipuncture testing could be ordered if needed or reviewed if the patient already had previous lab results.
4	Anthropometric measurements: weight, height, waist circumference, and BMI*	38/60	Nil
5	Diabetes risk assessment using a validated tool*	36/60	-Participants believed that this is a repeated point, similar to item 3, as the risk of diabetes could be assessed through POC testing.
6	Assess medication adherence if patients were on treatment*	35/60	-As item 5 will be removed, this item will be the 5th.
7	<u>Heart Rate Variability (HRV) assessment</u>	24/60	Nil, excluded
8	Stroke risk assessment	19/60	Nil, excluded
9	AF screening with a <u>handheld ECG</u> , if the patient has a history of diabetes or hypertension	18/60	Nil, excluded
10	<u>Oral health assessment</u>	13/60	Nil, excluded
Post-screening intervention			
#	Ideas	scores	Suggested modifications during the discussion
1	Offer written and verbal education on CV risk factors, smoking cessation, <u>stress reduction</u> , <u>weight reduction</u> , diet, and physical activity/ <u>lifestyle and behaviour modification coaching (for all regardless of risk)*</u>	42/48	-It was suggested that the results be communicated to the patient and that the results be explained as part of the education.
2	Refer individuals to the physician, <u>dietitian</u> , or <u>wellness clinic</u> , and <u>follow up with the patient to assess referral uptake (depending on the risk)*</u>	37/48	-It was suggested that referrals be done electronically and that referral notes be included to communicate results to physicians and propose treatment plans or recommendations.

3	MTM and <u>follow up with the patient on the provided intervention (depending on the risk)*</u>	31/48	-It was suggested that this intervention be provided for high-risk individuals with chronic diseases, polypharmacy, or non-adherence issues.
4	Communicate the results to the physician*	29/48	It was suggested that this be combined with the referral, item 2.
5	Offer treatment recommendations to physicians*	25/48	It was suggested that this be combined with the referral, item 2.
6	<u>Follow up with patients</u> within a specific timeframe (depending on the risk)*	24/48	-It was suggested that patients be followed up after each intervention, with the follow-up timeframe structured based on patient risk. -It was suggested that this be combined with items 2 and 3.
7	Monthly counselling sessions/post-physician-visit counselling sessions*	22/48	-It was suggested that this be combined with item 3: medication therapy management. -It was suggested that the frequency of those sessions be structured based on patient risk and needs.
8	Prescribe treatment	6/48	Nil, excluded

(*): represent the highest-ranked items and indicate the highest priority before modifications.

Underline: represents the additional ideas suggested through the pre-NGT questionnaire.

HTN: hypertension, **CVD**: cardiovascular disease, **CKD**: chronic kidney disease, **BP**: blood pressure, **BMI**: body mass index, **POC**: point of care testing, **BG**: blood glucose, **AF**: atrial fibrillation, **ECG**: electrocardiogram, **Hb A1C**: Haemoglobin A1c, **GP**: general practitioner, **MTM**: medication therapy management.

4.5.4 Consensus voting

The final priority lists were presented to all experts to discuss before voting. They suggested some modifications to these lists and decided on the number of the top priorities from each list. The final consensus vote was completed by all six attending experts, resulting in 100% agreement on the final priority lists, exceeding the pre-determined consensus threshold of 70%.



Figure 4.3. The highest priorities for the targeted population, assessment and screening processes and post-screening interventions summarised in Bar charts: A) top five targeted population characteristics (maximum score = 72), with the highest scoring 65 and the lowest of the five scoring 47; B) top five screening processes (maximum score = 60), with scores ranging from 51 (highest) to 35 (lowest); and C) top three assessment and screening processes (maximum score = 48), where the highest scored 42 and the lowest scored 31.

4.5.5 Qualitative analysis of discussions that occurred during the m-NGT meeting

Upon analysis, two main themes were identified from the rich discussion data. These were Theme 1: Drivers of strategic decision-making, with five subthemes that relate to the reasoning behind the prioritisations, and Theme 2: Facilitators for sustainable implementation, with four subthemes, offering insight into the proposed recommendations. These themes and their corresponding subthemes are described in detail in the following subsections.

4.5.5.1 Theme 1: Drivers of Strategic Decision-Making

1.1 Evidence of CVD risk

Participants justified their prioritisation of the targeted population and screening processes based on the presence of high-risk CVD indicators. There was consistent agreement that the programme should prioritise individuals based on their level of CVD risk, with a strong emphasis on those at higher risk. Age was seen as the most important risk factor, with participants consistently emphasising that the risk of CVDs rises with increasing age. Individuals aged 40 and above were therefore prioritised, as this stage of life was considered critical, given that many risk factors emerge at this age. Conversely, younger populations were viewed as having a comparatively lower risk.

“Because once they get older, they have a higher risk of developing such diseases”. P4, Public Health rep (<1-4 years of experience)

“The 18-year-old or younger population in general has a lower risk”. P3, Clinical Pharmacist (13-16 years of experience)

Besides age, comorbidities were recognised as a key risk factor because of their significant role in increasing CVD risk. Some participants also suggested including healthy individuals without known comorbidities, emphasising that family history and lifestyle behaviours also serve as evidence of risk.

“I would go with the comorbidities, which are Diabetes, Hypertension and Dyslipidaemia, because this means that the body is already in a kind of malfunction, and some organs, which will make the heart easily affected”. P4, Public Health rep (<1-4 years of experience)

“For comorbidities, let’s focus also on those risk factors that will make them at higher risk and do not exclude those who are not diabetic, but have prediabetes. This is a high-risk patient still... So, why would I wait for those individuals to become diabetic or to become hypertensive? And that would increase the risk of cardiovascular disease... If they’re healthy, but they have high risk factors, meaning they’re obese, overweight, smokers, maybe they have a family history of cardiovascular disease, a premature family history of cardiovascular disease. So, if they are healthy with any of these risk factors,

definitely they should be targeted for the cardiovascular screening programme... and a patient with more than one risk factor is going to be at higher risk than a patient with one risk factor". P3, Clinical Pharmacist (13-16 years of experience)

While acknowledging that males generally have a higher risk than females, some participants emphasised the importance of targeting both genders, recognising that multiple risk factors can affect individuals regardless of sex.

"Gender, I would target both of them, male and female, definitely both have risk. We know that males have a higher risk of cardiovascular disease, but still, I will target both of them". P3, Clinical Pharmacist (13-16 years of experience)

Additionally, some participants emphasised the importance of assessing medication adherence to determine whether a patient's comorbid conditions are well controlled, noting that poor adherence may signal an elevated risk.

"A patient with diabetes is at high risk for cardiovascular disease, patients who have hypertension are at high risk of cardiovascular disease, if we do not address their compliance, definitely, they will end up with some cardiovascular diseases. So, adherence definitely is one of the important risk factors". P3, Clinical Pharmacist (13-16 years of experience)

Furthermore, point-of-care testing for conditions such as diabetes and HTN was highlighted by some participants as essential, as these conditions serve as strong evidence of high CVD risk.

"I will go with the blood pressure measurements since it's one of the highest risk factors of CVD". P4, PH rep (<1-4 years of experience)

"Because diabetes may help, and the majority of them are misdiagnosed". P1, Community Pharmacy manager (13-16 years of experience)

A minority of participants also viewed socioeconomic status as an indicator of risk, noting that risk levels could vary by residential area and socioeconomic status. They noted that individuals living in rural areas may face higher risks, potentially due to limited access to healthcare services.

“The socioeconomic, I believe, there's a [variation] in between, and we'll find out between different areas, specifically, talk about Riyadh city”. P6, Community Pharmacy owner (21-24 years of experience)

“Outside of the main cities, it's a highly at-risk population”. P1, Community Pharmacy manager (13-16 years of experience)

1.2 Practicality and impact consideration

Practical considerations of the service, such as affordability, applicability, feasibility, ease of implementation, time required, comprehensiveness, and the importance of each item in achieving the intended outcomes of the service, were key factors in prioritising the targeted population, screening processes, and post-screening interventions. Participants emphasised the practicality of focusing on older individuals or those with pre-existing comorbid conditions, noting that most clients receiving treatment for chronic conditions and visiting the pharmacy for refills are aged 40 and above. Conversely, targeting younger individuals without existing conditions was considered less practical in the community setting due to limited current resources. Therefore, targeting the older population through their refill records could be more practical, allowing community pharmacists to easily identify at-risk individuals and streamline the process. Participants also emphasised that adopting this strategy would facilitate the identification of more targeted participants, ultimately leading to greater impact in addressing CVD risks within the community.

“I think 40 or 30 and above that would be something of most importance, especially that with all of the resources that are going to happen, I don't think it's feasible to look at a younger age”. P3, Clinical Pharmacist (13-16 years of experience)

“I will go with clients who come either for a refill, a prescription or patients known to have hypertension, pre-diabetic and diabetic... The most important one is the name of the medication because it is the only thing that you can target the right clients quickly... If we target above 40 or above 30, but only in this small number of pharmacies [who provide refills], we will catch the highest number of risky populations”. P1, Community Pharmacy manager (13-16 years of experience)

Practicality and importance played a central role in guiding decisions of prioritising certain screening processes. Most participants supported the use of both the CVD risk calculator and POC testing, describing them as quick, easy to use, efficient, and cost-effective methods suited to the community pharmacy setting. Some participants highlighted the value of using a CVD risk calculator as a comprehensive tool that captures and identifies a wide range of risk factors. However, some participants stressed the need for additional tools to assess risk factors not captured by the CVD risk calculator, such as medication adherence. They noted that poor adherence may be a marker of increased CVD risk that cannot be identified with other tools. Additionally, collecting patient data, including anthropometric measurements, laboratory results, demographics, medical and medication history, and lifestyle information, was considered essential not only for identifying targeted individuals but also for calculating CVD risk scores.

“Point of care testing is very fast, very efficient to give the lipid profile, blood pressure, and blood glucose.” P2, MOH rep (5-6 years of experience)

“This calculator is usually very quick because it’s an electronic calculator; you just log in the patient information very quickly, click the button, and in less than 30 seconds, you would have the risk factor percentage for that individual, so it’s not a difficult process... You will not be able to calculate until you get all the other parameters, so they feed into each other... The cardiovascular risk assessment actually calculates the risk score for both stroke, myocardial infarction and the others... For lipid profile, I’m not sure we have that. I don’t think it’s something costly”. P3, Clinical Pharmacist (13-16 years of experience)

“Assess medication adherence in patients with treatments, I think this is a smart entry to catch the right risky population... a cohesive, good tool to recruit them”. P1, Community Pharmacy manager (13-16 years of experience)

Furthermore, participants emphasised the importance of patient education, referrals, and MTM sessions as post-screening interventions to improve health outcomes. These interventions were considered essential for achieving a significant impact on screening outcomes. Additionally, participants stressed the need to follow up on each

intervention to maintain patient engagement and support adherence to pharmacists' recommendations, ensuring continuity of care and lasting impact.

"Offering the written and verbal communications and education to the patient, because the patient is the number one individual who has this interest or should be aware of risk factors that they have, to reduce these risk factors".

P3, Clinical Pharmacist (13-16 years of experience)

"Very important for me is to direct him to the right channel of our healthcare system... because it's a serious thing, it's the most common cause of death in Saudi Arabia. So, I'll refer him to the multidisciplinary team, to assess him, to start him on the right multidisciplinary approach... and follow up with the patient within a specific timeframe just to make sure that he is engaged". P1, Community Pharmacy manager (13-16 years of experience)

"Medication therapy management is the most important thing, and I believe that this has to go immediately, giving appointments for the patients to be there." P2, MOH rep (5-6 years of experience)

1.3 Challenges and limitations

Several challenges and limitations were identified as reasons that significantly influenced the group's priorities. These challenges were mostly related to the pharmacy setting, privacy concerns, limited data access, complexity, time constraints, affordability issues, accuracy, perceived relevance, and legal boundaries.

Privacy/Setting-related challenge

Some screening processes, such as ECG, stroke assessments, and venipuncture testing, were given lower priority or excluded due to their requirement for clinical environments or privacy, which participants felt could not be adequately provided in community pharmacy settings.

"Stroke risk assessments at all is not the right place. Heart rate variability, no way, because we cannot offer an ECG or any device that helps to assess or even perform at the community-based... Point of Care at all, no, no way, because it needs privacy, and the community pharmacies are not the right place... Because I know it's really difficult to make the non-clinical setting a

clinical setting". P1, Community Pharmacy manager (13-16 years of experience)

Although medication adherence was recognised by some participants as an important screening component, one participant viewed it as impractical due to privacy concerns, highlighting the need for simple, practical processes in the community pharmacy setting.

"However, you are talking about counselling the patient inside a private area and a clinic. This will never happen...due to the flow in the pharmacy, it cannot go practically [cannot be practical].....I want to simplify that process to just make it can be done by any pharmacy, not only the pharmacy that has a clinic right now" P2, MOH rep (5-6 years of experience)

Setting-related challenges were also cited as a reason for excluding certain populations. For instance, pregnant or lactating individuals and those with mental illness were excluded by some participants, who believed these groups required to be screened in a hospital setting or private settings.

"In patients with mental illnesses, pregnant women and lactating women, those could be excluded at this stage. I wouldn't definitely include them as individuals to be screened in the community setting. Maybe in a private setting, maybe a hospital setting, but not in the community setting" P3, Clinical Pharmacist (13-16 years of experience)

Limited data access

Data accessibility was another key concern, as community pharmacists often lack access to patients' full medical records, making it difficult to identify and target appropriate individuals for the service.

"If you're going to check the patients' data information, it's not easy to attain or find out". P6, Community Pharmacy owner (21-24 years of experience)

"But from where? What are the data? If he is doing this in the hospitals or the hospital pharmacists, they are going to the medication profile, for example". P2, MOH rep (5-6 years of experience)

Complexity and time constraints

Screening processes such as ECG, stroke assessments and medication adherence assessment were seen as time-consuming and complex.

“Atrial fibrillation, I don't think it's the right tool that could be adhered. The stroke assessment, I think, also in addition to that, will be harsh, and it will take time”. P6, Community Pharmacy owner (21-24 years of experience)

“Going into big details like this [assessing medication adherence] requires the patient to stay in the pharmacy for a long period of time” P2, MOH rep (5-6 years of experience)

Affordability issues

One participant perceived venipuncture testing as an unaffordable screening option for implementation in community pharmacies.

“The venipuncture testing, some of the pharmacies, they don't have the facilities, they can't afford them for their patients”. P6, Community Pharmacy owner (21-24 years of experience)

Accuracy and reliability

Concerns were also raised regarding the accuracy and reliability of some tools, including POC testing and CVD risk calculators, with one participant suggesting the need for further validation and additional tools.

“Remember that whatever risk assessment tool we will use, it has its own limitations in terms of either the age or even the risk factors included within that calculator...The point of care testing, because of the limitation of the accuracy, it's very important to take it as just a first, as a number and definitely, any validation for that number to be above the target or something that needs to be addressed has to be followed by a blood venipuncture, or we have to go back to their physician.” P3, Clinical Pharmacist (13-16 years of experience)

Relevance

The irrelevance of the ECG, stroke assessments, heart rate variability monitoring, and oral health screenings to the service was another reason to exclude these screening processes.

“ECG, I don't think it's relevant or something that should be considered, at least at this stage. Heart rate variability assessment, also, I don't think it's something relevant or even should be done... Oral health, I'm not sure how much is relevant to cardiovascular diseases”. P3, Clinical Pharmacist (13-16 years of experience)

Legal boundaries

Legal restrictions also posed a challenge, particularly the restriction on pharmacists' ability to prescribe medications. All participants acknowledged that pharmacists are not allowed to prescribe treatment, agreeing that treatment prescription must be excluded from the interventions they provide.

“Currently, it is illegal to prescribe any kind of medications”. P2, MOH rep (5-6 years of experience)

“We don't expect pharmacists to prescribe medication”. P1, Community Pharmacy manager (13-16 years of experience)

“If there's no collaborative agreement, there's no room for pharmacists in the current situation to actually offer treatment, unless it's something over the counter that the patient should take, that's fine, maybe. But prescribing medication with no collaborative agreement, I don't think it should be done”. P3, Clinical Pharmacist (13-16 years of experience)

“I don't think that pharmacists are allowed to prescribe treatment, unless it is over the counter”. P4, Public Health rep (<1-4 years of experience)

1.4 Consumer characteristics and public awareness

Participants emphasised the importance of considering the characteristics of typical pharmacy visitors when targeting specific populations for screening services. For instance, bodybuilders who come to purchase steroids, adults with chronic conditions who regularly visit for refills or to buy medications, were viewed as common characteristics of regular pharmacy consumers, making them easily identifiable individuals. Additionally, public awareness was considered a critical factor, noting that younger individuals tend to be more informed and proactive about their health, while older adults often lack awareness, making them an important group to target.

"The vast majority of Pharmacy visitors or clients, I would say from 18 to 40... I will go with clients who come either for a refill, a prescription or patients known to have hypertension, pre-diabetic and diabetic". P1, Community Pharmacy manager (13-16 years of experience)

"I think about the bodybuilders, as most patients coming to the pharmacy, because if they use the steroids and they have physical stress and another reason for these symptoms". P5, Community Pharmacist (<1-4 years of experience)

"18 years old now, with the language of sport, the language of awareness, the language of the 2030 vision, I believe they have a lot of precautionary and public health awareness. But I'm thinking about the 40s, who missed that part and who have been in a model of life and style that is different from the younger." P6, Community Pharmacy owner (21-24 years of experience)

1.5 Pharmacists' capability and responsibility

The inclusion or exclusion of specific screening processes and interventions was guided by pharmacists' perceived competencies. Some participants regarded pharmacists as knowledgeable and skilled healthcare providers capable of educating patients, referring them to physicians, proposing treatment plans, and offering recommendations to physicians. Furthermore, assessing medication adherence was seen as a key responsibility of pharmacists, given their expertise in medication management. However, certain screening and intervention components, such as oral health assessment and independent prescribing, were considered beyond the current scope of pharmacists' practice and capabilities and were therefore excluded.

"For education, this is the basic essence of the work of pharmacists, whether that for cardiovascular, for smoking cessation, or even for diet, physical activity, we are still capable with the training and education to offer all of these things... It's part of the pharmacist's skill and knowledge to educate the patient about smoking cessation, weight reduction, physical activities, all of that". P3, Clinical Pharmacist (13-16 years of experience)

"Pharmacists are trained to ask patients questions in order to assess their compliance". P6, Community Pharmacy owner (21-24 years of experience)

“My referral should also include a plan, because I am a healthcare provider and I should, based on my skills, knowledge and experience.” P3, Clinical Pharmacist (13-16 years of experience)

“We are not even training our students on oral health assessment”. P3, Clinical Pharmacist (13-16 years of experience)

“Community pharmacies are capable of referring patients who are already on the refill programme, but not to prescribe a treatment for early, newly diagnosed patients.” P1, Community Pharmacy manager (13-16 years of experience)

4.5.5.2 Theme 2: Facilitators for Sustainable Implementation

Some participants shared insights on various aspects of the service that should be integrated into future regulations to facilitate its effective implementation. In addition to the recommendations, some participants highlighted initiatives that could improve the service. All the discussed recommendations were identified as important strategies for ensuring the service's effectiveness and sustainability within the healthcare system in the future.

2.1 Service protocol and regulations

A clear protocol and a structured framework for the service were recommended to guide pharmacists in delivering it consistently. The protocol should specify the targeted population, detail appropriate actions for various scenarios, define the follow-up timeframe, and specify necessary interventions based on patient needs and risk. The entire programme should be regulated and controlled by the authorities.

“Regulatory, in order to set the guidelines, who are the groups that would be targeted? Somebody mentioned how often they're going to have this screening. Especially if they are younger individuals, 16 or 18, how often are they going to have that in place... The pharmacists, when they see the patient and identify that the patient is at high risk of cardiovascular disease, have to follow whatever guidance that will be set up by the authority based on the agreement between the pharmacists and the authority... Following up with the patients would be helpful; again, it depends on how the setup of that risk assessment is, what the protocol is that this risk assessment programme will

come with. So, for sure, it will come with a certain structure... There has to be structure for these visits and follow-up visits". P3, Clinical Pharmacist (13-16 years of experience)

Additionally, programmatic screening was discussed as one of the initiatives and recommendations of the public health authority for a national screening programme.

"We made in the Public Health Authority a national guideline that states that above 18 years old, they should do an early screening for CVDs at least once every five years, based on their lifestyle and comorbidities as well, because as we know CVDs takes time to evolve, give or take 10 years, 8 years, 12 years, something like that based on lifestyle and comorbidities. So, once every five years is suggested or recommended by our side, and then above 40, they should screen at least once every two years". P4, Public Health rep (<1-4 years of experience)

2.2 Empowering pharmacists

Ensuring that providers are qualified to deliver the screening service was considered essential. Suggestions included structured training programmes and skill-building initiatives to equip pharmacists with the competencies required for effective service delivery. Apart from professional development, financial incentives were also proposed to motivate and support pharmacists in adopting and maintaining the service within their practices.

"You don't want anybody with a degree and a license to let's say engaged, they have to be trained, maybe they have certain courses... Hopefully, the pharmacists will be paid for these services at the end." P3, Clinical Pharmacist (13-16 years of experience)

"The pharmacist should be ready. I mean smart enough to bring him [patient] up to the awareness". P6, Community Pharmacy owner (21-24 years of experience)

2.3 Stakeholders' involvement and collaboration

A collaborative agreement between pharmacists and physicians in primary healthcare centres was also suggested, highlighting that it would enable pharmacists to

collaborate with other healthcare providers, contribute to treatment plans, propose modifications, and prescribe treatments to optimise patient care.

“We are supposed to set a plan with the physician and sign the collaborative agreement”. P6, Community Pharmacy owner (21-24 years of experience)

“This screening programme would be part of a national kind of programme that would, along with that programme, have something that's called a collaborative agreement. So, with a certain collaborative agreement, in a certain situation, the pharmacist in that clinic, after they do the screening and find out that this patient with diabetes is not on statin therapy, not because they are contraindicated, but just because the physician did not write the statin therapy. So, maybe that's something that's also within a collaborative agreement that's also approved within this programme structure”. P3, Clinical Pharmacist (13-16 years of experience)

Additionally, some participants emphasised the importance of involving stakeholders from different sectors and encouraging collaboration, such as engaging insurance companies and fostering partnerships between the private and public sectors to prepare pharmacies and facilitate the implementation of services.

“It requires a guideline and also a regulation to be enacted and enforced, specifically with the insurance companies”. P6, Community Pharmacy owner (21-24 years of experience)

“It [requires] an agreement between the private sector and the governmental sector”. P2, MOH rep (5-6 years of experience)

2.4 System and infrastructure preparedness

The importance of prepared infrastructure, including systems, settings, and tools, was also discussed. Some participants highlighted the need for a private area within community pharmacies to ensure patient confidentiality and maintain the quality of care during service delivery.

“We expect that this screening programme is not happening at the cashier point or in the front point of the pharmacy, definitely, as I am aware of the regulation from the Ministry of Health that any services that are provided by

pharmacies should be in a private area within the pharmacy". P3, Clinical Pharmacist (13-16 years of experience)

Furthermore, participants emphasised the need for simple, quick screening tools, as well as the development of an approved, specifically tailored screening tool for the Saudi population to ensure both cultural relevance and clinical appropriateness.

"We should have a specific question, a quick fix and also save time, doesn't bother the patients, doesn't take that long, and also, it's supposed to be clear". P6, Community Pharmacy owner (21-24 years of experience)

"Cardiovascular risk score assessment using a validated tool in the Saudi population, or something approved in Saudi Arabia". P3, Clinical Pharmacist (13-16 years of experience)

The need for an integrated healthcare system that promotes collaboration among healthcare providers and improves access to patient data was also emphasised. One participant noted promising national initiatives to enhance data accessibility, viewing them as positive steps toward successful service implementation.

"NPHIS, the unified medical record, you can share the information, and you will know how the patients can share the information with you as a healthcare practitioner. It's only a barcode scan; you will get all the information, have immediate access, and can check. You can open your Anat [application], and you can check the whole patient's previous history or the available information, plus the medication, plus the weight and height, all of these measurements can be checked right now from NPHIS... Referral has to be electronic because currently, the pharmacist is not there. So, we need to have something similar to our national programme: a physician for every family, a nurse for every family, I believe that we should have a pharmacist as well for every family, and between them, electronically we can refer cases to each other" P2, MOH rep (5-6 years of experience)

4.6 Discussion

4.6.1 Key findings

This study aimed to co-design a potential model of a community pharmacy-based CVD risk screening service, with a focus on achieving consensus on key service components, including the targeted population, screening processes, and post-screening interventions. Consensus was reached on the core components of the potential model, which targets individuals aged ≥ 40 years, prioritising high-risk individuals, followed by lower-risk individuals. The model also includes comprehensive screening processes and post-screening interventions (Figure 4.4). A thematic analysis of the experts' discussion offered further insights into the factors influencing prioritisation decisions such as evidence-based reasoning related to CVD risk, practicality and potential impact considerations, recognition of challenges and limitations, consumer characteristics and public awareness, as well as pharmacists' capabilities and responsibilities. It also provided key recommendations for sustainable implementation, including establishing clear service protocols and regulations, empowering pharmacists, engaging and collaborating with stakeholders, and preparing the necessary systems and infrastructure.

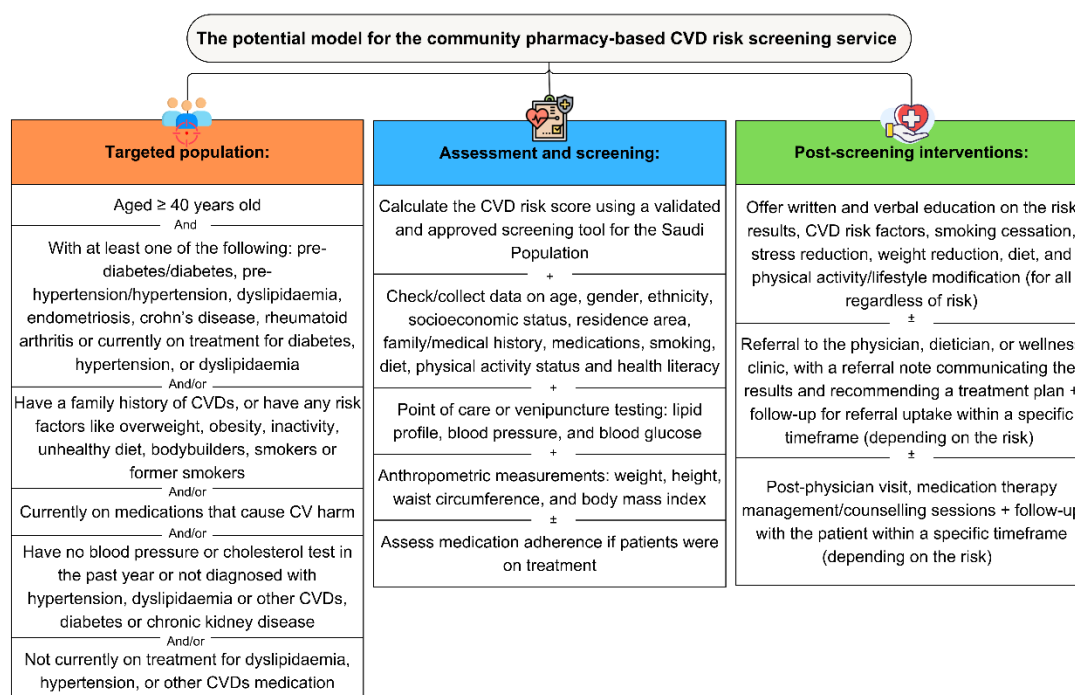


Figure 4.4. The potential service model based on stakeholders' prioritisation.

4.6.2 Comparison with the literature

Unlike most CVD risk screening programmes implemented internationally, which primarily focus on healthy individuals without known comorbidities or pre-identified risk factors (171, 231, 232, 253, 254, 257, 260, 261, 266, 270-272, 274-276, 280, 311), the proposed model in this study prioritises individuals at higher risk. Interestingly, while the healthy population was also included in the priority list, with acknowledgement of the potential presence of unidentified modifiable risk factors or relevant family history, they were ranked lowest among the high-ranked priorities, with a substantial gap in scores compared to the top three groups. This discrepancy reflects the strategic focus on addressing the high prevalence of comorbidities and modifiable risk factors in KSA, which are largely driven by sedentary lifestyles. Prioritising high-risk populations with the greatest needs who are most likely to benefit from the service can enhance its efficiency and cost-effectiveness (57). A recent WHO report in 2024 found that population-wide screening for CVD risk factors does not significantly reduce morbidity and mortality (312) which supports the development of a targeted screening model that allocates resources to high-risk individuals most likely to benefit.

The rationale reported in this study for targeting these specific populations was primarily based on risk indicators, consumer characteristics, practical considerations, and anticipated impact, which align with recommendations from previous evidence (57, 312, 313).

Assessment of patient demographics, medical and medication history, anthropometric measurements, POC testing, and CVD risk calculation were core components commonly included in CVD risk screening programmes worldwide (83, 171, 231, 232, 253, 256, 257, 260-264, 266, 267, 270, 272, 274, 276). However, medication adherence assessment was uncommon and was explicitly included only in the PAART CVD Holistic model in Australia (256). Although the model proposed in this study includes medication adherence as a screening component, acknowledging that poor adherence is a recognised risk factor for complications and the development of other conditions, it was ranked as the lowest priority. This low prioritisation, along with its limited presence in established international models, may reflect the inherent complexity and practical challenges of assessing medication adherence in community settings (314). One participant in this study also cited the practical challenges of

assessing medication adherence in the community pharmacy as a key reason for its low prioritisation.

The post-screening interventions, including patient education, referral, and follow-up, were widely adopted across most programmes (171, 231, 253, 257, 261, 270, 272, 274, 276, 280, 311) while interventions such as MTM and treatment recommendations directed to physicians were only reported in the PAART CVD Holistic model (256) and the Rx EACH (83) and SCRIP projects in Canada (263, 264). Although these interventions have the potential to enhance medication adherence and improve the overall effectiveness of the service (315), they could be challenging due to the workflow limitations, resource constraints, and the lack of an integrated healthcare system (316). Participants in this study have recognised those challenges and recommended strategies for sustainable implementation. Therefore, these challenges must be considered when planning the service and mitigated through effective implementation strategies.

When compared to the three previously proposed models in an earlier Saudi Arabian study (145), including minimal, moderate, and comprehensive pharmacist involvement models, the model proposed in this study most closely aligns with the comprehensive involvement model. This model includes conducting POC testing, calculating risk scores, performing individualised risk assessment and management, providing both oral and written lifestyle modification advice, referring patients to physicians, offering medication counselling, conducting medication reviews, and monitoring treatment after physician prescriptions (145). This can be attributed to the growing recognition of pharmacists' potential, the high accessibility of community pharmacies, and global evidence demonstrating that comprehensive pharmacist involvement in patient care improves health outcomes and public health (317).

The rationale behind the prioritisation and the recommendations discussed by participants in this study are consistent with findings from previous research conducted in KSA by Almansour et al (125, 145, 146, 244). Those studies identified key barriers to service implementation, including lack of access to patient medical records, inadequate private areas, healthcare system issues, safety concerns, legislative restrictions on clinical services, insufficient training, limited interprofessional collaboration, and the absence of CVD risk assessment tools (125, 145, 244). These barriers largely explain the group's prioritisation and align with some

of the reported rationale, including considerations of practicality, pharmacists' capabilities, and existing challenges. Moreover, stakeholders in earlier studies proposed facilitators that closely mirror the recommendations of this study, such as developing clear service protocol and framework, providing ongoing specialised training, enhancing collaboration between pharmacists and physicians, creating integrated referral and record systems, fostering public-private partnerships, implementing culturally appropriate tools, ensuring MOH oversight and support, offering pharmacist incentives, using simplified screening tools, and preparing suitable physical environments (125, 145, 146, 244). In fact, these recommendations are not only similar to those from previous studies in KSA but have also been widely identified as essential requirements for the success of screening programmes in several other countries, including Australia (232, 253, 254, 256), Canada (83), the UK (257, 280, 311), the UAE (171), Belgium(272), and Norway (275).

Interestingly, certain recommendations, such as offering the service free of charge, promoting the service, ensuring record-keeping and documentation, and implementing ongoing programme review and evaluation, were identified as essential in previous studies conducted on CVD risk screening in KSA (125, 145, 146, 244) and other countries like Australia (232, 253, 254) UK (257, 280, 311), and Belgium (272), but were not discussed in our study. A possible explanation is that our study focused on service design rather than on exploring barriers and facilitators. Nevertheless, these remain critical considerations in service development. Therefore, the next phase of this project should incorporate both the recommendations identified in this study and those reported in the previous literature, as discussed in Chapter 3, to guide prioritisation using another consensus method (e-Delphi).

A notable outcome of this study was achieving 100% consensus among the expert panel on the prioritised components of the proposed service model. While several studies successfully used consensus methods to inform the development or improvement of community pharmacy services (251, 318, 319), achieving 100% consensus is exceptional. This high level of agreement reflects strong alignment among stakeholders from diverse professional backgrounds, suggesting that the model is clear, feasible, and relevant within the Saudi healthcare context. However, it is important to acknowledge that the relatively small sample size of the expert panel may have also contributed to this unanimous consensus. With fewer participants, discussions are often more focused, and the likelihood of reaching an agreement

increases (300). Therefore, future validation with a wider stakeholder group using another consensus method (e-Delphi) was planned to ensure diverse perspectives and confirm the generalisability of the results.

4.6.3 Strengths and limitations

To our knowledge, this is the first study to co-design a community pharmacy-based CVD risk screening service model tailored specifically to the Saudi Arabian context. The model was designed to align with local needs, cultural norms, and system capabilities, improving its feasibility, acceptability, and potential for sustainability. The employed modified NGT method in this study facilitated a structured process of service development and consensus-building among experts. This approach has been recommended and utilised in other contexts to develop healthcare services (250, 301). Additionally, a pre-NGT questionnaire allowed participants to reflect on ideas and issues in advance, promoting deeper engagement and better consultation during the session and generating additional insights that might not have emerged during group discussions alone. Moreover, the model development covered core components, including the target population, screening processes, and post-screening interventions, offering a comprehensive approach to service design.

An additional strength of this study is its adherence to recommendations from previous research in KSA advocating for the involvement of diverse stakeholders (145). This was demonstrated by the inclusion of an expert panel comprising professionals with relevant expertise in pharmacy practice, public health, health policy, and cardiovascular care, ensuring informed, context-specific, and experience-based contributions. Additionally, the service model development process was informed by both pre-identified evidence from the literature and participant-generated ideas, ensuring an evidence-based approach, as also recommended in the previous study (145).

Moreover, the discussion was facilitated by two trained facilitators and remotely observed by an expert researcher in the NGT process, ensuring a well-managed discussion and providing confidence that the process was conducted appropriately. Furthermore, the achieved consensus on the proposed model supports the validity and potential practical applicability of the findings. Additionally, qualitative analysis of the recorded discussion provided valuable insights that informed modifications to the service model, justified group priorities, and offered recommendations to support

future implementation, contributing to the development of informed and practical implementation strategies. The trustworthiness of the qualitative findings was maintained through several validation strategies, including peer debriefing, investigator triangulation, and detailed documentation. Together, these measures contributed to the credibility, dependability, confirmability, consistency, and overall trustworthiness of the study's outcomes (309).

Despite the outlined strengths, this study also had limitations that must be acknowledged when interpreting the findings. Firstly, the study involved a relatively small sample size of six experts, whereas a sample size of 8-12 participants is generally recommended for NGT discussions. Despite the small number of participants, the discussion was rich and thorough, as participants had sufficient time to discuss ideas in depth, yielding rich data that might not have occurred with a larger sample. In addition to the sample size, the absence of cardiologists and primary care physicians may have limited the range of clinical perspectives, particularly regarding clinical appropriateness, referral pathways, and integration with wider cardiovascular care. This may have influenced the ideas identified and the content of the initial model developed for the subsequent Delphi study. Although the panel included one expert from each target population and notably, one of the attending experts had a background in medicine, broader multidisciplinary representation could have strengthened the model's clinical relevance and generalisability. Therefore, the initial model should be interpreted as reflecting the perspectives of the participating expert groups rather than representing a fully multidisciplinary clinical consensus. Nevertheless, the subsequent Delphi process provided an opportunity to refine and validate the proposed model through iterative expert review and consensus involving a broader range of experts, helping to address some of the gaps in the initial panel composition.

Second, for practical reasons, all participants were chosen from Riyadh province, and no experts from the other 12 provinces of the Kingdom were included. As Riyadh is the capital and administrative centre of KSA, it was expected that most key stakeholders would be based there. To overcome these limitations, the second phase of this project will involve a larger, more diverse group of experts from across the kingdom, with a particular focus on including more physicians to achieve broader consensus and enhance the generalisability of the results.

Third, this study focused solely on designing a potential service model, without considering evaluation measures such as acceptability, feasibility, or effectiveness. Nevertheless, qualitative analysis of the recorded discussion offered insight into the participants' reasoning behind their priorities, which included considerations of practicality, acceptability, and other relevant factors. A more comprehensive evaluation of the proposed model is still needed and is planned for the next step in this project, following the achievement of consensus on the final service model.

Fourth, service users/patients were not included as key stakeholders in this study, as the initial stage of development required input from those with clinical expertise. However, their exclusion poses a limitation. Including patients could have provided valuable insights into their needs, preferences, expectations, and experiences of community pharmacy services, as well as potential barriers to engagement and uptake. Their involvement may also have helped identify aspects of the proposed service that are clinically appropriate but less acceptable or accessible from a patient perspective. Furthermore, patient input could have strengthened the relevance, acceptability, and patient-centredness of the proposed model and potentially informed its implementation. To address this, service users/patients should be actively involved in the pilot testing phase, where their feedback can help refine the model before scale-up to ensure it is acceptable, aligned with their needs, and practically feasible (243).

4.6.4 Implications of research

This study represents a foundational step toward developing a community pharmacy-based CVD risk screening service in KSA, aligning with national public health priorities and Saudi Vision 2030's focus on preventing NCDs (58, 320). Developing and implementing such a service is expected to improve public health outcomes and address the CVD burden in KSA. Utilising community pharmacies for CVD risk screening can significantly enhance access to healthcare services, especially in areas with limited primary care availability, thereby enabling earlier identification of at-risk individuals and the prevention of CVD. This would also contribute to achieving the goal of Vision 2030, the health sector transformation programme, focused on improving access to health services and promoting the prevention of health risk (320, 321). The proposed service model supports the expanded role of community pharmacists and promotes multidisciplinary collaboration in healthcare. Additionally, the findings of this study offer valuable guidance for policymakers, healthcare

planners, and researchers to support future implementation efforts and research opportunities. This study provides a foundation for future research and evaluation. Moreover, the rationale for prioritising service components, along with the recommendations discussed during the session, can help inform the development of effective implementation strategies, which will be beneficial for policymakers and the researcher in preparation for the second phase of this project.

4.7 Conclusion

This study successfully achieved consensus on a potential, context-specific community pharmacy service model for CVD risk screening in KSA, informed by existing evidence and experts' input. However, further study is needed to achieve wider consensus, prioritise additional service specifications and implementation strategies, and evaluate the proposed model. The reported rationale behind the prioritisation, as well as the suggested recommendations, could support future implementation efforts.

5 Chapter 5: Co-design of a community pharmacy-based CVD risk screening service in KSA: a multi-stakeholder modified e-Delphi consensus study

5.1 Introduction

In my previous study (Chapter 4), using a modified Nominal Group technique (m-NGT) consensus method, a potential model for a community pharmacy-based CVD risk screening service was co-designed with a group of six experts, informed by both evidence and local expertise, and achieved consensus. The expert panel discussion focused on prioritising the key components: service-targeted population, screening processes, and post-screening interventions. Furthermore, the expert panel in the previous m-NGT study suggested several facilitators for future implementation, which are useful for implementation planning in conjunction with recommendations from earlier national studies (125, 145, 146, 244).

Building on the findings of the previous m-NGT study, additional service components and specifications, which were highlighted in the preparatory literature review (Chapter 3), including recruitment methods, screening tools, referral mechanisms, funding methods and implementation strategies, need to be considered. Accordingly, lists of ideas for these components were generated to be discussed with the experts in this study for further development (Figure 5.1). It is essential to consider all these components and specifications during service development, as they could influence the service's effectiveness and sustainability after implementation. A systematic review in 2014 (233) included 16 studies (comprising 108,414 screened participants) and aimed to assess community pharmacy-based screening for diabetes and CVD risk. It found that community pharmacy-based screening services helped identify and refer a significant number of cases with or at high risk of CVD or diabetes. However, the referral uptake to their GPs for follow-up, further assessment and early treatment was low, likely attributable to limitations in the referral methods used or other implementation measures (233). Therefore, a comprehensive service design that considers all components and implementation strategies is essential for the successful delivery and long-term sustainability of future screening services.

Additionally, as discussed in Chapter 3, assessing the appropriateness and potential feasibility of the service by examining stakeholder perceptions is particularly important at this stage to determine whether the proposed model is appropriate or requires improvement and to build confidence in implementation (92, 295, 322, 323).

Therefore, further development, including broader stakeholder engagement, is necessary to achieve wider consensus on the proposed service model, to evaluate perceptions of the service, and to prioritise other supportive components and strategies essential to successful implementation. This will strengthen the outcomes of the previous m-NGT consensus study and ensure a comprehensive service design.

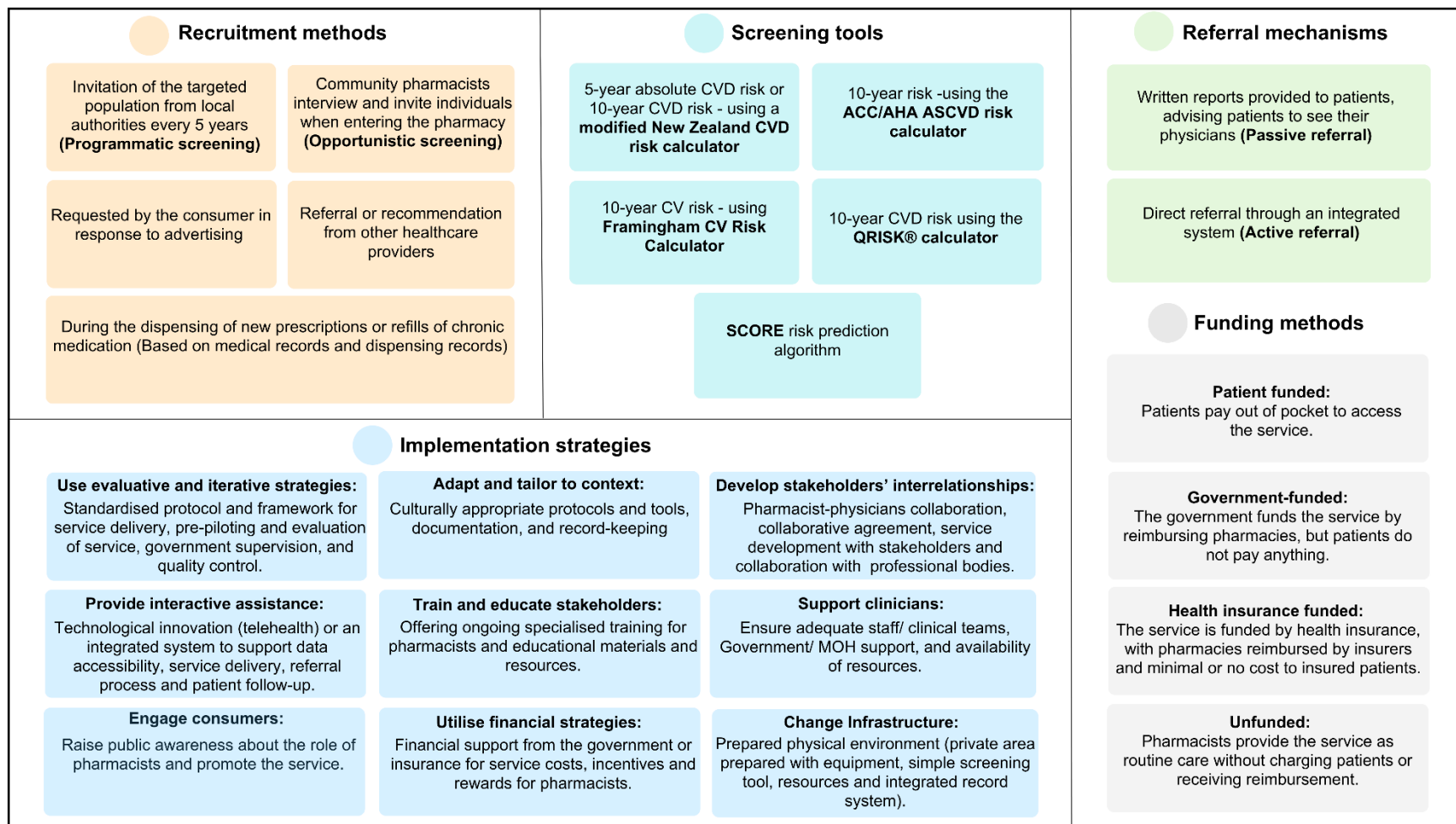


Figure 5.1. List of ideas on recruitment methods, screening tools, referral mechanisms, funding methods, and implementation strategies, collected from the literature (reviewed in Chapter 3).

***CVD**: Cardiovascular Disease; **ACC/AHA ASCVD**: American College of Cardiology/American Heart Association Atherosclerotic Cardiovascular Disease; **SCORE**: Systematic Coronary Risk Evaluation; **MOH**: Ministry of Health.

5.2 Aims and objectives

This study aimed to develop a consensus-driven, practical model for community pharmacy-based CVD risk screening services, along with effective implementation strategies in KSA.

The key objectives include:

- 1) Involving a larger group of experts to validate the previously made decision (from the m-NGT study) about the proposed service model.
- 2) Evaluate the proposed service model in terms of perceived Acceptability, Practicality, Effectiveness, Affordability, Side effects, and Equity following the APEASE criteria (92)
- 3) Prioritise other service specifications, including screening tools, recruitment methods, referral mechanisms, service funding methods, as well as Implementation strategies for the effective implementation of the proposed service.

5.3 Research questions

Q1: What is the most feasible and consensually agreed-upon service model and components for a community pharmacy-based CVD risk screening service to be implemented in KSA?

Q2: What are the stakeholders' perspectives on the acceptability, practicality, effectiveness, affordability, side effects, and equity of the proposed community pharmacy-based CVD risk screening services in KSA?

Q3: What strategies are considered most important for the successful implementation of community pharmacy-based CVD risk screening services in KSA?

5.4 Methods

This study is reported using the Delphi Studies in Social and Health Sciences—Recommendations for an Interdisciplinary Standardised Reporting (DELPHISTAR) checklist to ensure comprehensive, transparent, and standardised reporting of the Delphi study (Appendix D5: Reporting checklist).

5.4.1 Registration and ethics:

The study protocol was not registered; however, the study was designed a priori. Ethical approval was obtained from the Strathclyde Institute of Pharmacy and the Biomedical Sciences Ethics Committee.

5.4.2 Study design:

A 3-round modified e-Delphi technique was adopted as a consensus method for this phase of service development (250, 324, 325). An e-Delphi approach was selected to systematically refine the proposed model and establish consensus among experts from diverse professional and geographical backgrounds. Unlike qualitative methods, which are primarily designed to explore individual experiences and perspectives, the Delphi method enables iterative assessment of expert judgements with controlled feedback, while anonymity reduces the potential influence of dominant individuals or professional hierarchies. The online format also facilitated participation across different locations and provided a consistent and structured approach to achieving consensus (250, 324, 325).

While a different consensus method, the NGT, was used in the initial phase of service development, the Delphi technique is particularly suited to this stage due to its key advantages that align with the study's needs. Unlike the NGT method, the Delphi method can involve a larger group of experts, allowing for broader input. Additionally, it is a highly structured method involving anonymous group interactions and multiple rounds of questionnaires, incorporating participants' feedback, and providing both quantitative and qualitative data while eliminating peer pressure and enabling participants to share their ideas and opinions anonymously, which enhances the reliability and validity of the consensus (250, 324, 325).

Unlike the traditional Delphi, which starts with open-ended questions to generate ideas for later rounds, the modified Delphi used in this study informed its questionnaire content based on the previous NGT consensus study and a literature review (see Figure 5.2).

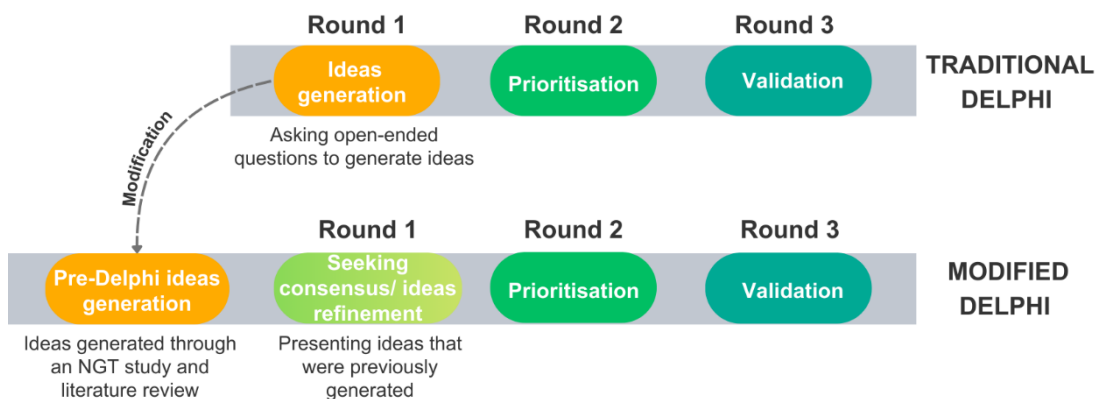


Figure 5.2. Traditional versus modified Delphi stages.

*NGT: Nominal Group Technique

This method provided a solid base of existing evidence and expert input, allowing the questionnaires to concentrate on specific, relevant items while maintaining the iterative, anonymous, and structured nature of the Delphi process. Moreover, the modified e-Delphi made the questionnaire more focused and enabled its online distribution, thereby enhancing both response time and response rates (250, 324, 325).

5.4.3 Participants' inclusion criteria and recruitment:

The experts were of the same type as those engaged in the first consensus study (the NGT study). This includes people with direct or indirect influence in the service development process, including individuals involved in CVD prevention or management, health and pharmaceutical policy, service implementation in KSA, and service provision, without requiring a specific threshold for years of experience (304). As in the NGT study, service consumers were not included in this stage, since it required input from people with more in-depth clinical expertise, which consumers do not possess.

A larger number of participants were included in this stage. The number of experts included in a Delphi study can greatly vary, ranging from 15 to hundreds (250, 324, 325). Although the large panel size allows more variety of expertise, improves the reliability of findings and reduces errors, it has been recommended not to include more than 25-30 participants, as a larger panel size will eventually result in diminishing returns, in which no additional ideas or improvement in the results will be observed (250, 325, 326). Given the risk of attrition across Delphi rounds, a dropout rate of 20-30% was considered when calculating the sample size, aiming for a minimum of 25-30 participants by the third round (325). Thus, a sample size of 62 was targeted for the first round, and approximately 30 participants were expected to complete all three rounds. The experts were purposively invited to this study to recruit approximately 9 participants from each profession (332): 9 cardiologists, 9 senior clinical pharmacists, 9 community pharmacists, 9 GPs, 9 representatives from the Ministry of Health (MOH), 9 community pharmacy managers/owners, and 9 public health experts. Those experts had to be residents of KSA and able to communicate in English, as the questionnaires were prepared in English, a common language for health professionals in KSA.

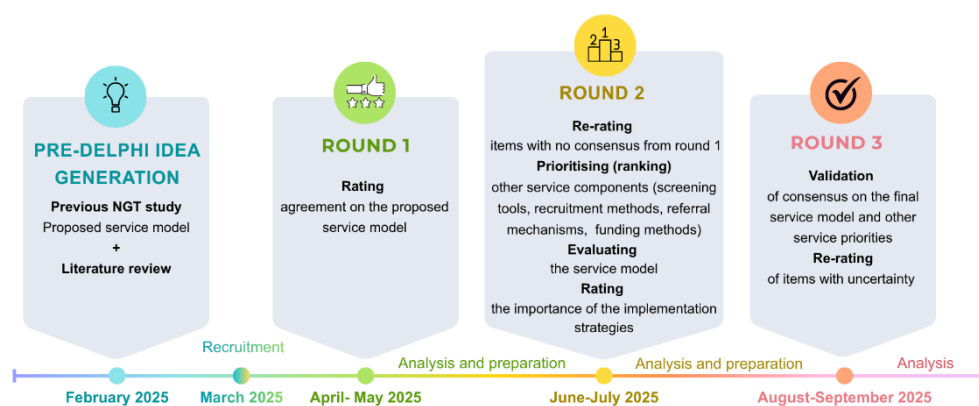
Several recruitment strategies were employed to reach a broad range of stakeholders: advertisements (Appendix D1: Advertisement poster) on LinkedIn and X, and in WhatsApp groups (e.g., for clinical pharmacists, healthcare volunteers, and pharmacy academics), as well as snowball sampling. Participants in the NGT study were asked to either nominate potential participants for the e-Delphi study or share the advertisements with their colleagues. With their permission, nominators shared the contact details of interested individuals, who were then contacted directly through email or their preferred method of communication.

The recruitment began in March 2025 and continued until mid-April 2025. The participation link, created in the Qualtrics platform, included the participant information sheet, consent form, and demographic questionnaire (Appendix D2: Participant information sheet, consent form, and demographic questionnaire). Once recruitment was completed, participants' eligibility was confirmed by checking their demographic details to ensure they met the criteria. The first-round e-Delphi questionnaire was then sent to those deemed eligible. All experts who completed the first round were invited to the next round, and only those who completed the second were invited to the third. For each round, participants were given a one-month deadline to complete the questionnaire. Weekly reminders were sent to non-respondents, along with a final reminder 24 hours before the end of each round.

5.4.4 Materials and procedure:

5.4.4.1 Delphi instruments development

Three rounds of questionnaires were conducted to ensure confidence in the consensus results, meeting the minimum standard for Delphi studies (325). A summary of the Delphi rounds is depicted in a flowchart, illustrating the process, timeline and aims of each round (Figure 5.3). An example of e-Delphi questionnaires is presented in Appendix D3: e-Delphi questionnaires.



Delphi process and timeline

Figure 5.3. Delphi process and timeline

*NGT: Nominal Group Technique

5.4.4.1.1 First Round

The first round commenced on 15th April 2025. The results from the m-NGT study informed the content of the initial e-Delphi questionnaire. Since the previous m-NGT study developed the initial service model with a limited number of stakeholders, the first round of this e-Delphi study aimed to establish wider consensus on the proposed model before evaluating the service model and prioritising other service components and implementation measures. Therefore, in the first round, the proposed service model was presented, covering the targeted population (6 items), screening processes (5 items), and post-screening interventions (3 items) priorities. Participants were then asked to indicate their level of agreement with these priorities by rating each item on a 5-point Likert scale, with 1 indicating the greatest disagreement and 5 indicating the greatest agreement. An optional free-text box was provided to allow participants to justify their responses. See Appendix D3.1. Round 1 e-Delphi questionnaire.

5.4.4.1.2 Second Round

The second round commenced on 15th June 2025. The content of the second round was informed by the first-round results, which required consensus on the proposed model before proceeding. Results from the first round enabled finalisation of the service model, which was then further evaluated in the second round. Additional service specifications, informed by a prior literature review of community pharmacy-

based CVD risk screening services worldwide (discussed in Chapter 3) and by recommendations from the m-NGT study and from previous studies in KSA (125, 145, 146, 244), were also prioritised in the second round based on the final service model. Lists of common CVD risk screening tools, recruitment methods, referral mechanisms, service funding methods, and implementation strategies were compiled from the literature (see Figure 5.1) to inform the questionnaire content. Thus, based on the consensus results from the first round on the service model, the second round asked participants to evaluate the proposed service model and prioritise the other service specifications mentioned above. See Appendix D3.2. Round 2 e-Delphi questionnaire. As discussed in Chapter 3, the implementation strategies from the literature were mapped to nine strategies according to the Expert Recommendations for Implementing Change (ERIC) (289) to ensure that all key implementation strategies were covered and presented to participants. A combination of rating and ranking methods was used in this round, based on the nature of the questions. Rating was used to assess the level of agreement or perceived importance of individual items independently, allowing participants to express nuanced views and confirm consensus on previously identified priorities. As rating is less cognitively demanding, particularly when many items are included, it was used to assess agreement or importance rather than to establish priorities. However, because participants may rate multiple items as equally important, its ability to support prioritisation order is limited. In contrast, ranking was used when prioritisation was required, as it required participants to directly compare items and indicate their relative importance, particularly for items that had not yet been prioritised. While ranking produces a clear list of priorities by forcing participants to highlight the top and the bottom items, it is more cognitively demanding, especially with longer item lists. Accordingly, each question was carefully matched to the most appropriate method to minimise participant burden and avoid unnecessary complexity (327, 328). Using both approaches provided complementary insights.

A 5-point Likert scale was used for the first question, asking participants to re-rate their agreement with the two statements about the targeted population in the service model that did not achieve consensus in the first round. This question included the aggregate results of all participants (including frequencies and median scores) and a summary of qualitative feedback. Participants had the opportunity to revise their initial votes and cast new ones based on the provided results, suggestions, and explanations from other participants (250, 325). A 5-point Likert scale was also used

in the second question about the evaluation of the service model to measure the extent of the perceived acceptability, practicality, effectiveness, affordability, side effects, and equity (APEASE) of the service model (92), with 1 representing the lowest extent and 5 the greatest. Similarly, for the question on the importance of implementation strategies, a 5-point Likert scale was used to rate each of the nine implementation strategies, with 1 indicating not at all important and 5 indicating extremely important. For the remaining questions on prioritising CVD risk screening tools (6 items), recruitment methods (5 items), referral mechanisms (2 items), and funding methods (4 items), items were ranked from the highest to least priority (based on the number of items in each question) to determine priorities, with the highest score provided to the highest priority and the lowest score provided to the lowest priority. A space for free-text comments was provided with each question to allow participants to explain their opinions and/or suggest another idea (250, 325). See Appendix D3.2. Round 2 e-Delphi questionnaire.

5.4.4.1.3 Third Round

This final round started on 22nd August 2025 and aimed to validate the results from the previous round and achieve consensus on the items that did not reach full consensus in the second round, with only items with uncertainty included for re-rating (see Consensus definition). The service model and consensus-based priorities for CVD risk screening tools, recruitment methods, referral mechanisms, and service funding methods from the second round were visually presented. These were accompanied by the collective ranking results, ordered from highest to lowest priority based on all participants' rankings, along with a summary of qualitative feedback and a list of items that achieved consensus, those without consensus, and those with uncertainty and requiring re-rating (all defined below, see Consensus definition). Participants were then asked to indicate their agreement with these priorities to validate the consensus results, with only two response options provided at this stage (agree or disagree). In case of disagreement, participants were asked to specify the item or component they disagreed with and were provided a free-text field to justify their disagreement or suggest modifications. In case of uncertainty, participants were asked to re-rate their agreement with these items on a 5-point Likert scale, to determine whether they should be included among the top priorities alongside the already prioritised items. Providing comments was optional for agreement but

mandatory for disagreement, requiring participants to explain their disagreement or suggest modifications. See Appendix D3.3. Round 3 e-Delphi questionnaire.

5.4.4.2 Delphi instruments validation

To ensure the validity of the questionnaires, pilot testing was conducted prior to dissemination. Face validity and usability testing were performed to gain insight into participants' interpretations and responses to the questions. The grammar, structure, organisation and appropriateness of each question were reviewed to ensure the questionnaire's clarity and logical flow (329). The piloting process was performed by the primary researcher (SN) and her supervisors (AK and NW), along with other PhD students, Saudi pharmacists and researchers (Hisham A, Eman O, Khalid A, Fahad A, Hadi A, Faisal M).

After piloting, no modifications were needed for the round one questionnaire, while some adjustments were suggested for rounds two and three to improve clarity, wording, format, and flow. For round two, changes included adding an introduction to explain the aim and process of the round and each section, providing a participant information sheet, clarifying figures of round one results, changing the implementation strategies question type from ranking to rating, rewording unclear questions, and emphasising ranking instructions in red and bold. Round three modifications included changing the validation question to a binary agree/disagree format with mandatory comments for disagreement, simplifying the graphical presentation of round two results by removing the statistical results, and adjusting the questionnaire's logic flow.

Usability testing indicated that the questions were difficult to complete on a mobile screen. Consequently, participants were encouraged to use a larger screen, with this recommendation highlighted in bold in both the participant information sheet and the invitation email. Piloting showed that the questionnaires took approximately 5–15 minutes to complete on average.

5.4.4.3 Delphi instruments dissemination

Delphi questionnaires were electronic-based questionnaires (e-Delphi). The online Delphi facilitated the distribution of the questionnaire and the data collection process (325). Given that this study targets experts from KSA, while the primary researcher is based in Glasgow, an online Delphi facilitated broader access to global experts. The Qualtrics online platform was used to develop and disseminate the questionnaires

and collect responses. In the first round, anonymised links were sent to all eligible participants, who were asked to confirm once they had completed the questionnaire, so that we could identify who to include in the subsequent round. However, for the following two rounds, personalised links were sent to each participant via email. This facilitated tracking of questionnaire completion and allowed responses to be linked to their demographic data, which would have been useful for exploring variation in responses across different professions if consensus had not been reached.

5.4.5 Data collection and analysis:

Both quantitative and qualitative data were collected from e-Delphi questionnaires. Quantitative data were collected from the numerical scales used for the rating and ranking exercises, while qualitative data were collected from the provided free-text fields. The quantitative data were analysed using Microsoft Excel©. The descriptive statistics (i.e., mean, median) and the measure of dispersion (i.e., interquartile range (IQR)) were reported to represent the panel's opinions. The overall median score, IQR, and total scores for each participant were calculated (326). The number and percentage (%) of participants voted/ranked for each item were calculated.

The qualitative data were analysed through summative content analysis to summarise the explanations for the responses and participants' suggestions, using NVivo software © for qualitative data management. This approach enabled the systematic organisation and interpretation of participants' feedback, allowing the identification of recurring ideas or concerns, patterns of disagreement or uncertainty, and the refinement of priorities. The frequency with which ideas were suggested informed whether they should be added to the priority list in subsequent rounds. By combining frequency counts with contextual interpretation, summative content analysis provided a structured, efficient method for extracting insights to inform subsequent rounds of the Delphi study (330, 331).

Both quantitative results and qualitative summary were then presented back to the expert panel in the subsequent e-Delphi round. Findings were reported using a narrative-weaving integration approach (332); in which the quantitative consensus statistics were presented together with the participants' qualitative comments to explain the reasoning behind scores and highlight participants' suggestions. A summary of the quantitative consensus statistics from each round was also presented in tables.

5.4.5.1 Consensus definition

A consensus was considered reached when $\geq 70\%$ of participants either agreed or disagreed with an item, as measured by the Likert scale. For instance, if $\geq 70\%$ of participants rate an item as 4 (agree) or 5 (strongly agree) on a 5-point Likert scale, consensus agreement is achieved for that item. Specifically, a median score greater than 3 indicates consensus agreement, while a median score less than 3 indicates consensus disagreement. Minimal dispersion in ratings (IQR difference ≤ 1) further supports consensus, whereas an IQR difference >1 suggests a lack of consensus or mixed opinions. If the IQR narrows in subsequent rounds, it indicates stability between rounds and suggests that consensus has been achieved (333).

For the ranking question, which depended on the number of items in each question, consensus was based on the total ranking score, mean ranking score and the % of participants who ranked an item in the top half (334). Consensus was considered reached when $\geq 70\%$ of participants ranked a specific item within the top half. For example, if $\geq 70\%$ of participants ranked an item among the top 3 of 6 items, consensus agreement to be in the top priority was considered achieved for that item. For an item to be classified as a top priority, both the mean total score and the percentage of responses in the top half must fall within the pre-defined consensus threshold. If either criterion is not met, this indicates uncertainty, and the item must be re-rated. For example, in a question with six items, an item may be ranked as a top priority with a high total score and a mean score ≥ 4 ; however, if fewer than 70% of participants rated it in the top half, this indicates that consensus was not fully achieved (uncertain), and the item would require re-rating.

5.4.5.2 Non-response bias

Given the attritional nature of the Delphi method and the associated risk of participant dropout, it is recommended to assess non-response bias (331). Accordingly, non-response bias was assessed across rounds when the dropout rate exceeded 10% (331). Non-response bias was evaluated by comparing the demographic characteristics of respondents and non-respondents using the Chi-squared or Fisher's test for categorical variables and the independent t-test for continuous variables. A p-value of less than 0.05 will be considered statistically significant (335).

5.5 Results

5.5.1 Delphi process and response rate per round

The Delphi process commenced in March 2025 and concluded in September 2025 (Figure 5.3). A total of 62 participants were invited to the study, of whom 61 (98.4%) completed the first round. All participants who completed the first round were invited to the second round; of these, 51 (83.6%, $n = 51/61$) responded. These participants were then sent the third-round questionnaire, and 50 (98.0%, $n = 50/51$) completed it. Overall, 50 participants completed all three e-Delphi questionnaires, reflecting a response rate of 80.7%. The dropout rate was 16.4% between the first and second rounds and 2.0% between the second and third rounds, resulting in a cumulative attrition rate of 18.0% from the first to the final round ($n = 11/61$).

5.5.2 Non-response bias

Given the 16.4% dropout rate between rounds 1 and 2, non-response bias was assessed to determine whether attrition influenced the study results. No significant differences were observed between respondents ($n=51$) and non-respondents ($n=10$) in any of the demographic characteristics, including sex ($p = 0.20$), profession ($p = 0.30$), province ($p = 0.11$), nationality ($p = 0.80$), education level ($p = 0.40$), and years of experience ($p = 0.07$). These small and non-significant differences suggest minimal non-response bias.

5.5.3 Participants' demographic characteristics

An overview of participants' demographics for all three rounds is presented in Table 5.1. Participant demographics remained relatively similar across the three rounds; the majority of participants were male (82.0%-78.0%), and Saudi (88.5%-88.0%). Although experts were recruited from various provinces across the kingdom, a large proportion were based in Riyadh (41.0%-46.0%) and Makkah (21.3%-20.0%). The sample comprised participants from a range of targeted experts, predominantly clinical pharmacists (21.3%-34.0%), community pharmacists (21.3-18.0%), and public health experts (18.0%-20.0%), with a median year of experience and IQR of 7 (5-13.5), 9 (5-15), 9.5 (5-15) across the three rounds, respectively. A master's degree was the most reported highest level of education among participants (31.1%-34.0%). A minority of participants reported prior experience conducting CVD risk screening in community pharmacies (18.3%-16.0%), which was practised in the USA, UK, Australia, Egypt, and KSA.

Table 5.1. Participants' demographic data across the three rounds

Demographics variables	First round (n=61)	Second round (n=51)	Third round (n=50)	Dropped out in the second round (n=10)	P-value*
Gender: n (%)					
- Male	50 (82.0%)	40 (78.4%)	39 (78.0%)	10 (100%)	0.20
- Female	11 (18.0%)	11 (21.6%)	11 (22.0%)	0 (0.0%)	
Targeted experts: n (%)					
- Physicians (Cardiologists, GPs)	9 (14.8%)	6 (11.8%)	5 (10.0%)	3 (30.0%)	0.30
- Clinical pharmacists	18 (29.5%)	17 (33.3%)	17 (34.0%)	1 (10.0%)	
- Community pharmacists	13 (21.3%)	9 (17.6%)	9 (18.0%)	4 (40.0%)	
- Representative from MOH	6 (9.8%)	5 (9.8%)	5 (10.0%)	1 (10.0%)	
- Public health experts	11 (18.0%)	10 (19.6%)	10 (20.0%)	1 (10.0%)	
- Community pharmacy managers/owners	4 (6.6%)	4 (7.8%)	4 (8.0%)	0 (0.0%)	
Nationality: n (%)					
- Saudi	54 (88.5%)	45 (88.2%)	44 (88.0%)	9 (90.0%)	0.80
- Non-Saudi	4 (6.5%)	3 (5.9%)	3 (6.0%)	1 (10.0%)	
- Not reported	3 (5.0%)	3 (5.9%)	3 (6.0%)	0 (0.0%)	
Area of living: * n (%)					
- Riyadh province	25 (41.0%)	23 (45.1%)	23 (46.0%)	2 (20.0%)	0.11
- Hail province	1 (1.6%)	1 (1.9%)	1 (2.0%)	0 (0.0%)	
- Eastern Province	7 (11.5%)	6 (11.8%)	6 (12.0%)	1 (10.0%)	
- Najran province	8 (13.1%)	6 (11.8%)	6 (12.0%)	2 (20.0%)	
- Jazan province	1 (1.6%)	1 (1.9%)	1 (2.0%)	0 (0.0%)	
- Al-Jawf province	2 (3.3%)	1 (1.9%)	1 (2.0%)	1 (10.0%)	
- Makkah province	13 (21.3%)	11 (21.6%)	10 (20.0%)	2 (20.0%)	
- Asir province	2 (3.3%)	0 (0.0%)	0 (0.0%)	2 (20.0%)	
- Northern Borders province	1 (1.6%)	1 (1.9%)	1 (2.0%)	0 (0.0%)	
- Tabuk province	1 (1.6%)	1 (1.9%)	1 (2.0%)	0 (0.0%)	

Demographics variables	First round (n=61)	Second round (n=51)	Third round (n=50)	Dropped out in the second round (n=10)	P-value*
Highest level of education: n (%)					
- Bachelor's degree	3 (5.0%)	2 (3.9%)	2 (4.0%)	1 (10.0%)	0.40
- BPharm	8 (13.1%)	6 (11.8%)	6 (12.0%)	2 (20.0%)	
- PharmD	9 (14.7%)	7 (13.7%)	7 (14.0%)	2 (20.0%)	
- Residency training	10 (16.4%)	10 (19.6%)	9 (18.0%)	0 (0.0%)	
- Master's degree	19 (31.1%)	17 (33.3%)	17 (34.0%)	2 (20.0%)	
- PhD degree	9 (14.7%)	6 (11.8%)	6 (12.0%)	3 (30.0%)	
- Fellowship	3 (5.0%)	3 (5.9%)	3 (6.0%)	0 (0.0%)	
Years of experience: median (IQR: Q1-Q3), n (%)	7 (5-13.5)	9 (5-15)	9.5 (5-15)	4.5 (2.0- 10.0)	0.075
- <1 year – 4 years	14 (22.9%)	9 (17.6%)	9 (18.0%)	5 (50.0%)	
- 5 years – 8 years	18 (29.5%)	16 (31.4%)	15 (30.0%)	2 (20.0%)	
- 9 years – 12 years	11 (18.0%)	10 (19.6%)	10 (20.0%)	1 (10.0%)	
- 13 years – 16 years	11 (18.0%)	9 (17.6%)	9 (18.0%)	2 (20.0%)	
- 17 years – 20 years	5 (8.2%)	5 (9.8%)	5 (10.0%)	0 (0.0%)	
- 21 years – 28 years	2 (3.3%)	2 (3.9%)	2 (4.0%)	0 (0.0%)	
Had previous experience in conducting CVD risk screening in community pharmacies: n (%)	11 (18.3%)	8 (15.7%)	8 (16%)	3 (30.0%)	0.71
Country of practice: n (%)					
- USA	3 (27.3%)	3 (37.5%)	3 (37.5%)	0 (0.0%)	
- UK	2 (18.2%)	1 (12.5%)	1 (12.5%)	1 (10.0%)	
- Australia	1 (9.1%)	1 (12.5%)	1 (12.5%)	0 (0.0%)	
- Egypt	1 (9.1%)	0 (0.0%)	0 (0.0%)	1 (10.0%)	
- KSA	1 (9.1%)	1 (12.5%)	1 (12.5%)	0 (0.0%)	
- Not specified	3 (27.3%)	2 (25.0%)	2 (25.0%)	1 (10.0%)	

*P-value associated with non-response bias analysis; Chi-squared was used for categorical variables, and the independent t-test for continuous variables. GPs: general practitioners. MOH: Ministry of Health. IQR: interquartile range. CVD: Cardiovascular disease. USA: United States of America. UK: United Kingdom, KSA: Kingdom of Saudi Arabia.

5.5.4 Consensus results

The consensus results from the three e-Delphi rounds are presented in the following subsections, covering the proposed service model, model evaluation, other service priorities, and implementation strategies. The results are presented alongside participants' feedback to provide contextual insight into the consensus process. A summary of these results is provided in the tables (Table 5.2, Table 5.3, Table 5.4, Table 5.5). Detailed ranking and rating results for each participant across all rounds are presented in Appendix D4: Detailed rating and ranking results for each participant across the three rounds.

5.5.4.1 Service model results

In the first round, participants reached consensus, with a median score of 5 (strongly agree) and minimal variability in ratings (IQR difference ≤ 1) for all items in the screening processes:

- *Calculate the CVD risk score;*
- *Check/collect patient data;*
- *POC or venipuncture testing;*
- *Anthropometric measurements;*
- *Assess medication adherence if patients were on treatment.*

The same consensus results were also achieved for the post-screening interventions:

- *Offer written and verbal education;*
- *Refer individuals to the physician with a referral note, recommendation for treatment plan + follow-up -depending on the risk-;*
- *Post-physician visit counselling / MTM sessions + follow-up -depending on the risk.*

Among the targeted population, consensus was achieved with a median score of 5 (strongly agree) and minimal variability in ratings (IQR difference ≤ 1) on four of six items:

- *Aged ≥ 40 years old;*
- *With at least one of the following: pre-diabetes/diabetes, pre-HTN/HTN, dyslipidaemia, endometriosis, Crohn's disease, rheumatoid arthritis or currently on treatment for diabetes, HTN, or dyslipidaemia;*
- *Have a family history of CVDs, or have any risk factors like being overweight, obesity, inactivity, unhealthy diet, bodybuilders, smokers or former smokers;*

- *Currently on medications that cause CV harm.*

The remaining two items received a median score of 3 (neither agree nor disagree), with greater variability in ratings (IQR difference = 2), and therefore did not meet the consensus threshold. These items represent the healthier population:

- *Have no BP or cholesterol test in the past year or not diagnosed with HTN, dyslipidaemia or other CVDs, diabetes or CKD;*
- *Not currently on treatment for dyslipidaemia, HTN, or other CVDs medications.*

These two items were subsequently included in the second round for re-rating. In the second round, consensus was not reached on these two items, following re-rating, with median scores remaining at 3 (neither agree nor disagree) and an IQR difference of 1. The reduction in IQR suggested that participants' views had stabilised between rounds; however, the persistence of neutrality indicated a lack of collective agreement. Consequently, these items were excluded from the final service model to ensure that its components reflected areas of clear expert agreement. In the third validation round, a strong consensus was maintained, with 98% agreement on the final service model. The remaining 2% disagreement related specifically to the screening processes and post-screening interventions, indicating that 100% consensus was achieved on the targeted population. See Table 5.2 for a summary of results from all e-Delphi rounds.

The lack of consensus on the two statements regarding the targeted population was justified by feedback from the first round (n=6/61, 9.8%), which emphasised the need to refine the inclusion criteria and priorities. Suggestions included focusing on adults aged ≥ 40 , despite other risks (n=1), adopting risk-based screening (e.g., obesity, lifestyle, and other factors) to detect at-risk individuals (n=3), and prioritising higher-risk groups to ensure cost-effectiveness (n=1). One participant questioned the link between endometriosis and CVD risk, highlighting the need for clearer evidence. In the second round, the provided feedback (n=9/51, 17.6%) supported the lack of consensus on the two statements regarding healthy populations and justified their exclusion. Although four suggested that, as a public health strategy, screening should include all individuals, even those without prior tests, diagnoses, treatment or risk factors; highlighting the potential for early detection and prevention, they all acknowledged that healthy populations should not be a top priority, as this may be less cost-effective, lead to inefficient use of resources, and risk over-screening.

Instead, they emphasised that screening should be guided by risk factors such as age, gender, family history, and other relevant factors (n=5).

The provided comments on the screening process (n=4/61, 6.5%) and post-screening interventions (n=6/61, 9.8%) in the first round further supported the consensus achieved. One participant supported medication adherence assessment and its impact on CVD risk, while three highlighted barriers and recommendations, including limited access to lab results (n=1), the use of the ASCVD risk calculator (n=1), and piloting the service model to generate evidence (n=1). Participants supported follow-up as a post-screening intervention to improve patient engagement (n=1) and recommended strategies for successful delivery, including pharmacist training (n=2), adequate staffing (n=1), interdisciplinary collaboration (n=1), pharmacist incentives (n=1), and telehealth use (n=1). All suggestions were incorporated into the idea and implementation strategy lists for the second round.

Table 5.2. Rating results for the proposed service model components from round 1 (n=61), round 2 (n=51), and the final validation round (n=50)

Service model components	Round 1 and Round 2 *			Round 3
	Median (IQR: Q1-Q3)	% Agreement (rated ≥ 4)	Consensus decision	Validation
Targeted population Items				
-Aged ≥ 40 years old.	5 (4-5)	90.2%	✓	100% consensus achieved: included in the proposed service model
-With at least one of the following: pre-diabetes/diabetes, pre-HTN/HTN, dyslipidaemia, endometriosis, Crohn’s disease, rheumatoid arthritis or currently on treatment for diabetes, HTN, or dyslipidaemia	5 (5-5)	93.4%		
-Have a family history of CVDs, or have any risk factors like being overweight, obesity, inactivity, unhealthy diet, bodybuilders, smokers or former smokers	5 (5-5)	91.8%		
-Currently on medications that cause CV harm	5 (4-5)	85.2%		
-Have no BP or cholesterol test in the past year or not diagnosed with HTN, dyslipidaemia or other CVDs, diabetes or CKD	3 (3-5)	47.5%	?	Not included in the proposed service model
	3 (3-4)*	49.01%*	✗	
-Not currently on treatment for dyslipidaemia, HTN, or other CVD medications	3 (2-4)	34.4%	?	
	3 (3-4)*	41.18% *	✗	
Screening process items				
-Calculate the CVD risk score using a validated and approved screening tool for the Saudi population	5 (5-5)	93.4%	✓	98% consensus achieved: included in the proposed service model
-Check/collect data on age, gender, ethnicity, socioeconomic status, residence area, family/medical history, medications, smoking, diet, physical activity status and health literacy	5 (4-5)	91.8%		
-POC or venipuncture testing: lipid profile, BP, and BG (diabetes assessment)	5 (4-5)	93.4%		
-Anthropometric measurements: weight, height, waist circumference, and BMI	5 (4-5)	93.4%		
-Assess medication adherence if patients were on treatment	5 (4-5)	86.8%		

Service model components	Round 1 and Round 2 *			Round 3
	Median (IQR: Q1-Q3)	% Agreement (rated ≥ 4)	Consensus decision	Validation
Post-screening intervention items				
-Offer written and verbal education on the risk results, CVD risk factors, smoking cessation, stress reduction, weight reduction, diet, and physical activity/lifestyle and behaviour modification coaching (for all regardless of risk)	5 (5-5)	91.8%	✓	98% consensus achieved: included in the proposed service model
-Refer individuals to the physician, dietician, or wellness clinic, with a referral note communicating the results to the physician and recommending a treatment plan + follow-up with the patient for referral uptake within a specific timeframe (depending on the risk)	5 (5-5)	96.7%		
-Post-physician visit counselling / MTM sessions + follow-up with the patient for the provided intervention within a specific timeframe (depending on the risk)	5 (5-5)	91.8%		

Note: 5-likert scale: 1= Strongly Disagree, 2= Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree.

Consensus threshold: median ≥ 4 (agreement) or ≤ 2 (disagreement), IQR difference ≤ 1, % agreement/disagreement ≥70%.

*Round 2 results; for the items required re-rating.

Blue (✓): Consensus achieved; items retained in model,

Yellow (?): Consensus not achieved; re-rating is required,

Red (X): Consensus not achieved after two rounds; removed.

HTN: hypertension., **CVD:** Cardiovascular disease, **CKD:** chronic kidney disease., **POC:** point of care testing., **BG:** blood glucose., **BP:** blood pressure., **MTM:** medication therapy management., **IQR:** Interquartile range.

5.5.4.2 Service model evaluation results

Most participants in the second round perceived the proposed service model as acceptable (n=48/51, 94.1%), practical (n=47/51, 92.2%), effective (n=49/51, 96.1%), and affordable (n= 44/51, 86.3%), with the potential to generate positive side effects (n= 39/51, 76.4%) and enhance equity (n= 45/51, 88.2%). The Acceptability, Practicality, Effectiveness, Affordability, (+) Side effect, and (+) Equity (APEASE) statements achieved strong agreement, with median scores ranging from 4 (agree) to 5 (strongly agree), reflecting minimal variability in rating. In contrast, participants disagreed with the negatively framed statements about potential negative side effects (n=33/51, 64.7%) and negative equity impacts (n=31/51, 60.8%). Both statements received a median score of 2 (disagree), with greater variability in rating (IQRs: 1-3 and 1-3.5, respectively) (see Table 5.3). As this question was exploratory, aiming to capture participants' perspectives rather than establish priorities, achieving consensus was not essential. Accordingly, these statements were not re-rated in subsequent rounds.

These results were justified by the provided feedback (n= 4/51, 7.8%). Equity was noted as being influenced by multiple factors (n=4), including affordability, service awareness, accessibility for underserved populations, and the comprehensiveness and structure of the service model. One participant specifically highlighted that affordability is also dependent on other contextual factors. Acceptability and practicality were supported by two participants, who emphasised that preventive services are more important than treatment and that, given physicians' busy schedules, delivery through other healthcare centres, particularly pharmacies, would be more practical and improve accessibility. Effectiveness and positive impacts were supported by two participants, who viewed the model as beneficial for both patients and the healthcare system, with benefits outweighing potential negative effects (e.g., over-referral). Finally, one participant recommended further research to evaluate the service's potential positive and negative impacts.

Table 5.3. Results of participants' evaluation of the potential service model in terms of its Acceptability, Practicality, Effectiveness, Affordability, Side effects, and Equity in round 2 (n=51)

Service evaluation (APEASE)	Median (IQR: Q1-Q3)	% Agreement/ disagreement
Acceptability This service model is acceptable to all key stakeholders.	5 (4-5)	94.1% rated ≥ 4
Practicality This service model can be practically implemented as designed, using the available resources within the community pharmacy settings.	4 (4-5)	92.2% rated ≥ 4
Effectiveness This service model will be effective and cost-effective in achieving its intended objectives in the targeted population.	5 (4-5)	96.1% rated ≥ 4
Affordability This service model will be affordable to implement at the intended scale.	4 (4-5)	86.3% rated ≥ 4
Positive side effects This service model will lead to unintended beneficial outcomes.	5 (4-5)	76.4% rated ≥ 4
Negative side effects* This service model will lead to unintended adverse outcomes.	2 (1-3)	64.7% rated $\leq 2^{\wedge}$
Positive equity This service model will help decrease health differences between advantaged and disadvantaged groups in society.	4 (4-5)	88.2% rated ≥ 4
Negative equity* This service model will increase health differences between advantaged and disadvantaged groups in society.	2 (1-3.5)	60.8% rated $\leq 2^{\wedge}$

Note: 5-likert scale: 1= Strongly disagree, 2= Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree.

Consensus definition: median ≥ 4 (agreement) or ≤ 2 (disagreement), IQR difference ≤ 1 , % agreement/disagreement $\geq 70\%$.

*For negative statements, consensus disagreement is expected.

$\wedge$ As this question was exploratory and intended to capture perspectives rather than establish priorities, achieving consensus was less critical. Therefore, these statements did not require re-rating.

IQR: Interquartile range.

5.5.4.3 Recruitment methods prioritisation results

Two of the five assessed recruitment methods achieved full consensus, with total and mean scores of 187/255 (3.7) and 164/255 (3.2), and agreement percentages for inclusion among the top three priorities of 72.5% and 76.5%, respectively:

- *Community pharmacists interview and invite individuals when entering the pharmacy (Opportunistic screening), and*
- *During the dispensing of new prescriptions or refills of chronic medication*

One additional item received a relatively high total and mean ranking score of 170/255 (3.3); however, the percentage agreement for ranking it within the top three priorities was 64.7%, falling below the predefined consensus threshold:

- *Invitation of the targeted population from local authorities every 5 years (Programmatic screening)*

Consequently, this item was carried forward to the subsequent round for re-rating. In the third round, consensus was maintained for the items that had achieved consensus in the previous round, with 96% and 100% agreement on prioritising those two recruitment methods, respectively. Additionally, consensus was reached on the item with uncertainty from the previous round after being re-rated, with 92% supporting the addition of “*programmatic screening*” to the top recruitment method priorities. The remaining two items, which received lower ranking scores and did not reach consensus, were excluded (see Table 5.4).

The feedback provided in the second round (n = 10/51, 19.6%) supported these priorities and the observed uncertainty regarding programmatic screening. Four participants supported the programmatic invitations from local authorities, considering this approach more practical, acceptable, cost-effective, and able to ensure broader reach and follow-up with healthcare. Two participants noted that programmatic screening might require more effort; therefore, they perceived opportunistic screening as more practical. Two participants viewed advertisement-based recruitment as unsustainable and the least reliable approach. Seven participants suggested alternative recruitment methods, including programmatic screening mandated by health insurance (n=2); integration with national digital health platforms such as Sehaty, Tawakkalna, and Naphis, where eligible individuals would receive direct invitations (n=3); combining opportunistic screening with chronic medication refills (n=1); mandating screening with prescription refills (n=1); and home visits (n=1). In the third round, 9/50 (18%) commented on programmatic screening as a recruitment

method. Overall, programmatic screening received strong support, with participants emphasising its wide coverage (n=3), strong follow-up potential (n=1), and remarkable outcomes (n=2), while some recommended combining it with other methods (n=2) and tailoring invitation intervals to individual risk levels, rather than using a fixed invitation interval for everyone (“every 5 years”) (n=5).

5.5.4.4 Screening tools prioritisation results

One of six suggested CVD risk screening tools achieved full consensus, with a total and mean score of 253/306 (4.9) and 78.4% agreement for inclusion among the top three priorities:

- *a specific, validated, and approved tool for the Saudi Population*

Consensus was uncertain for another tool, which received a relatively high total and mean ranking score of 205/306 (4.02), but its percentage agreement for ranking within the top three priorities was 60.8%, falling below the predefined consensus threshold:

- *ACC/AHA ASCVD risk calculator*

Accordingly, this item was carried forward to the subsequent round for re-rating. In the third round, after re-rating, 96% agreed to prioritise “*ACC/AHA ASCVD risk calculator*” until a Saudi-specific tool becomes available, while consensus agreement on prioritising “*a specific, validated, and approved tool for the Saudi Population*” rose to 98%. The remaining four tools, which had lower ranking scores and did not achieve consensus, were excluded (see Table 5.4).

Participants who provided feedback in the second round on the screening tools (n=8/51, 15.6%) emphasised the importance of prioritising a Saudi-specific tool, highlighting its alignment with Saudi Vision 2030 and its potential to ensure acceptability, accuracy, practicality, and contextual relevance. Some participants recommended using the ACC/AHA ASCVD risk calculator (n=3) or QRISK (n=5) as interim alternatives until Saudi-specific tools become available, noting that these options are more practical, digitally supported, accurate, comprehensive, and more relevant to the Saudi population. In contrast, two participants felt that the remaining tools were less applicable to the Saudi context and risked producing misleading results. Additionally, two participants suggested alternative options, including the PREVENT calculator (n=1) and the WHO HEARTS tool (n=1). Similarly, in the third round, participants (n=10/51, 20%) provided feedback to support the use of the ACC/AHA ASCVD risk calculator as an alternative screening tool. The ACC/AHA ASCVD risk calculator was perceived as helpful, suitable, accessible, and time-

efficient; however, participants (n=2) recommended supplementing it with local data to avoid misclassification. Additional alternatives suggested included Globorisk and the WHO chart for the Eastern Mediterranean Region (EMR) (n=1).

5.5.4.5 Referral mechanism prioritisation results

One of the two referral mechanisms assessed achieved full consensus with a total and mean score of 87/102 (1.7) and 70.6% agreement in ranking it as the top priority:

- *Direct referral through an integrated system (Active referral)*

In the subsequent validation round, this consensus rose to 98% in favour of prioritising this referral mechanism (see Table 5.4).

Varied feedback was provided on the referral mechanism (n=4/51, 7.8%). One participant stressed the importance of active referral through an integrated system, highlighting its role in ensuring continuity of care, timely intervention, follow-up, and quality improvement. They argued that passive referral could lead to poor follow-up and missed opportunities for early prevention. In contrast, another participant argued that active referral may not adequately convey the significance of referral to patients, whereas passive referral could enhance patient awareness of its importance. Two participants recommended a dual approach combining active and passive referral pathways.

5.5.4.6 Funding methods prioritisation results

Two of the four ranked funding methods achieved full consensus, with total and mean scores of 169/204 (3.3) and 151/204 (3), and agreement percentages for inclusion among the top two priorities of 80.4% and 82.4%, respectively:

- *Health insurance funded, and*
- *Government-funded*

In the subsequent validation round, 98% and 100% consensus were achieved for the two priorities, respectively. The remaining two items, which received lower ranking scores and did not achieve consensus, were excluded (see Table 5.4).

The feedback provided in the second round (n=4/51, 7.8%) supported these consensus results. The patient-funded model was perceived as impractical, unsustainable, and inequitable (n=3). Government (n=2) and insurance-funded (n=2) options were considered more effective at promoting equity and sustainability. One participant emphasised government funding for uninsured or low-income groups,

while two suggested offering the service free of charge initially to demonstrate its value to healthcare providers and insurers.

Table 5.4. Ranking results for service specifications from round 2 (n=51) and round 3 (n=50)

Service specifications	Round 2				Round 3
	Total ranking scores	Mean ranking score*	% ranked in the top half	Consensus decision	Validation
Recruitment methods (5 items)					
Invitation of the targeted population from local authorities every 5 years (Programmatic screening)	170/255	3.3	64.7%	?	92% consensus; included
Community pharmacists interview and invite individuals when entering the pharmacy (Opportunistic screening)	187/255	3.7	72.5%	✓	96% consensus achieved
Requested by the consumer in response to advertising	106/255	2.1	35.3%	✗	Excluded
During the dispensing of new prescriptions or refills of chronic medication	164/255	3.2	76.5%	✓	100% consensus achieved
Referral or recommendation from other healthcare providers	138/255	2.7	51%	✗	Excluded
CVD risk screening tools (6 items)					
Specific validated and approved tool for the Saudi Population (doesn't exist yet, to be developed)	253/306	4.9	78.4%	✓	98% consensus achieved
QRISK® Calculator (10-year risk, in the UK)	151/306	2.9	45.1%	✗	Excluded
Modified New Zealand Absolute CVD Risk Calculator (5-year or 10-year risk, in New Zealand, but modified for other settings internationally)	148/306	2.9	33.3	✗	Excluded
ASCVD Risk Calculator (10-year or lifetime risk, in the USA)	205/306	4.02	60.8%	?	96% consensus; included

Service specifications	Round 2				Round 3
	Total ranking scores	Mean ranking score*	% ranked in the top half	Consensus decision	Validation
Framingham Risk Calculator (10-year risk, in the USA and internationally)	156/306	3.1	29.4%	✗	Excluded
SCORE2 (10-year risk, in Europe)	158/306	3.03	53%	✗	Excluded
Referral mechanisms (2 items)					
Written reports provided to patients, advising patients to see their physicians (Passive referral)	66/102	1.3	29.4%	✗	Excluded
Direct referral through an integrated system (Active referral)	87/102	1.7	70.6%	✓	98% consensus achieved
Funding methods (4 items)					
Unfunded: Pharmacists provide the service as routine care without charging patients or receiving reimbursement	106/204	2.1	23.5%	✗	Excluded
Patient funded: Patients pay out of pocket to access the service	84/204	1.6	13.7%	✗	Excluded
Government-funded: The government funds the service by reimbursing pharmacies, but patients do not pay anything	151/204	3	82.4%	✓	100% consensus achieved
Health insurance funded: The service is funded by health insurance, with pharmacies reimbursed by insurers and minimal or no cost to insured patients	169/204	3.3	80.4%	✓	98% consensus achieved

Note: The ranking score is based on the number of items in each list. The number of items in each list represents the highest-ranking score each participant could give.

Consensus definition: high total ranking score, high mean ranking score, and ≥70% of participants ranked an item within the top half.

Blue (✓): Consensus achieved; items prioritised,

Yellow (?): Consensus uncertain; re-rating is required,

Red (✗): Consensus not achieved; removed.

5.5.4.7 Implementation strategies rating results

Most participants rated the nine proposed implementation strategies as highly important, with a median score of 5 (extremely important) and IQR: 4-5 for all items (see Table 5.5). The strategies were ordered from highest to lowest importance based on their rating scores and the percentage of participants rating them as highly important (extremely important or very important), as follows:

- 1) *Train and educate stakeholders* (n= 48/51, 94.1%),
- 2) *Provide interactive assistance* (n=47/51, 92.2%),
- 3) *Support clinicians* (n=46/51, 90.2%),
- 4) *Develop stakeholders' interrelationships* (n=46/51, 90.2%)
- 5) *Change Infrastructure* (n= 45/51, 88.2%),
- 6) *Adapt and tailor to context* (n= 45/51, 88.2%),
- 7) *Engage consumers* (43/51, 84.3%),
- 8) *Utilise financial strategies* (n=43/51, 84.3%), and
- 9) *Use evaluative and iterative strategies* (41/51, 80.39%).

Three participants provided feedback on implementation strategies (n=3/51, 5.9%). One emphasised a comprehensive approach, highlighting the need for an evaluation framework and telehealth support to ensure quality and continuity of care, and suggested that public engagement and infrastructure upgrades could follow initial piloting. Another recommended a centralised national digital dashboard linking all community pharmacies for real-time reporting, monitoring, and quality control. A third proposed using social media to raise awareness about the service and stressed that incentives should be structured to minimise bias.

Table 5.5. Rating results for the importance of the nine implementation strategies (n=51)

Implementation strategies	Median (IQR: Q1-Q3)	% Importance (rated ≥ 4)
Use evaluative and iterative strategies: Standardised protocol and clear framework for service delivery, pre-piloting and evaluation of service, government supervision, and quality control.	5 (4-5)	80.39%
Provide interactive assistance: Technological innovation (telehealth) or an integrated system to support data accessibility, service delivery, referral process and patient follow-up.	5 (4-5)	92.2%
Adapt and tailor to context: Culturally appropriate protocols and tools, documentation, and record-keeping.	5 (4-5)	88.2%
Develop stakeholders' interrelationships: Pharmacist-physicians collaboration, collaborative agreement, service development with stakeholders and collaboration with different professional bodies.	5 (4-5)	90.1%
Train and educate stakeholders: Offering ongoing specialised training for pharmacists and educational materials and resources.	5 (4-5)	94.1%
Support clinicians: Ensure adequate staff/ clinical teams, Government/ MOH support, and availability of resources.	5 (4-5)	90.2%
Engage consumers: Raise public awareness about the role of pharmacists and promote the service.	5 (4-5)	84.3%
Utilise financial strategies: Financial support from the government or insurance for service costs, incentives and rewards for pharmacists.	5 (4-5)	84.3%
Change Infrastructure: Prepared physical environment (private area prepared with equipment, simple screening tool, resources and integrated record system).	5 (4-5)	88.2%

Note: 5-likert scale: 1= Not at all important, 2= Slightly important, 3=Moderately important, 4=Very important, 5=Extremely important.

Consensus definition: median ≥ 4 (high important) or ≤ 2 (low important), IQR difference ≤ 1 , % importance $\geq 70\%$.

IQR: Interquartile range.

5.6 Discussion

5.6.1 Summary of findings:

This study employed a three-round modified e-Delphi consensus approach with multidisciplinary experts in KSA to refine and achieve consensus on a community pharmacy-based CVD risk screening service model, to prioritise essential service components and implementation strategies, and to evaluate perceptions of the proposed model. Participants reached a strong consensus (98%) on the final service model, which outlined a clearly defined targeted population and comprehensive screening processes and post-screening interventions (see Figure 5.4). The service model was subsequently perceived positively by the expert panel, supporting its feasibility and relevance in the Saudi healthcare context. Additionally, a strong consensus was reached on the key priorities for other essential service components, including three recruitment strategies, two screening tools, one referral mechanism, and two funding approaches. Consensus was also reached on the perceived importance of implementation strategies, enabling the identification and prioritisation of practical approaches for successful, sustainable implementation.

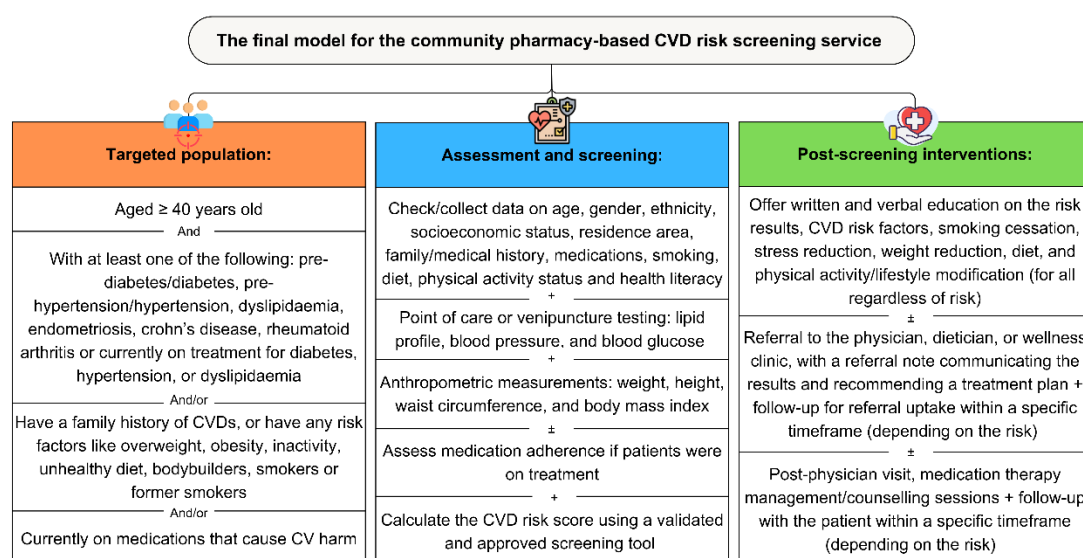


Figure 5.4. Final service model outlining targeted population, screening processes and post-screening interventions.

5.6.2 Discussion of the findings:

5.6.2.1 Service model and its evaluation

The final developed model focused on screening individuals more likely to be at higher risk of CVDs while excluding healthier populations with no existing comorbidities or treatments. This exclusion aligns with and helps explain the discrepancy in ranking scores observed in the previous m-NGT study, which ranked the healthier individuals as the lowest priority. Compared with international CVD risk screening programmes (discussed in Chapter 3), most of these programmes differ from the developed model in that they tend to target a healthier population without pre-existing risk factors or treatments. The targeted approach prioritised in the model developed in this study aligns closely with that of the Rx EACH (83) and SCRIP projects in Canada (263, 264), the PAART CVD Holistic model in Australia (256), and the comorbidities screening service in Poland (268), all of which also focused on high-risk individuals. This targeted approach is supported by the recent WHO report in 2024 (312) as more effective at identifying individuals who would benefit most from intervention and as more resource-efficient than population-wide screening. A WHO Health Evidence Network (HEN) review (312) found that population-level screening programmes failed to reduce CVD mortality and morbidity, while some evidence raised concerns about potential adverse effects and the widening of health inequalities if high-risk groups were not specifically prioritised for screening (312, 313). Consequently, the WHO recommends strengthening case-finding strategies within primary care to identify and manage individuals with established risk factors (312, 313). Therefore, this targeted approach could enhance cost-effectiveness, promote health equity, and align preventive care with evidence-based benefit thresholds.

In addition to the targeted population, the developed model encompasses comprehensive screening processes and post-screening interventions, aligning with the comprehensive screening model proposed in the previous Saudi study by Almansour (145). This targeted and comprehensive screening service model is consistent with a few CVD risk screening programmes in other countries, such as the Holistic screening model in Australia (256) and the Rx EACH screening model in Canada (83).

Clearly, the developed model in this study differs from the widely adopted models in other countries. Although some similarities exist with a few programmes in specific

components, the overall model remains distinct. This difference may reflect the variation in contextual factors. For instance, the prevalence of risk factors, healthcare resources, workforce capacity, and practical challenges may vary across populations, potentially justifying differences in screening programmes' targets, structures, and components across countries. All these factors were highlighted by participants in this project as reasons for prioritisation.

Overall, participants perceived the proposed service as acceptable, practical, effective, and affordable, anticipating positive outcomes and improved access and equity while rejecting concerns about potential harms or increased disparities. These perceptions are consistent with previous evidence demonstrating high acceptability, feasibility and patient satisfaction with community pharmacy-led screening programmes for diabetes and CVD risk in other settings with similar cultural, social, and healthcare characteristics, such as the UAE (171, 173). Additionally, as discussed in Chapter 3, several studies worldwide have demonstrated the feasibility and effectiveness of the CVD risk screening programmes, as well as their ability to reach individuals who may not routinely access primary care, particularly in underserved communities, supporting these positive perceptions (257, 260).

However, the Royal Pharmaceutical Society has noted that equity can be influenced by multiple structural factors, including service accessibility, public engagement, and funding models. Therefore, supportive policies and resources are required, as these structural barriers may limit equitable service delivery (336). For example, the service should be inclusive of populations across all socioeconomic levels, and supported by a funding model that ensures affordability regardless of individuals' economic circumstances (336). This evidence aligns with some participants' views in this study, who argued that equity is affected by factors such as affordability and accessibility. Moreover, while community pharmacy screening effectively identifies high-risk individuals, studies report inconsistent follow-up and integration with general practice, which may reduce the long-term impact (233). This suggests that effective implementation strategies and ongoing evaluation of service outcomes are crucial for achieving sustained effectiveness. This was also highlighted by one participant in this study, who recommended post-implementation evaluation of the service to assess the positive and negative impacts. Overall, these findings reflect both the promise and the challenges of implementing such a service, highlighting that successful implementation requires structural and contextual support to ensure that the reported

early positive perceptions translate into sustained effectiveness and equitable health outcomes.

5.6.2.2 Recruitment methods

Participants in this study prioritised three recruitment approaches to effectively reach the targeted population for screening, each with demonstrated advantages in previous research. Programmatic screening offers a targeted strategy by inviting eligible individuals and improving consistency in follow-up (258, 337). Opportunistic screening provides a broader reach and is particularly effective in underserved areas (257, 338). Recruitment during chronic prescription refills targets higher-risk individuals already engaged in regular medical follow-up, thereby enhancing uptake (268, 278, 279).

Nevertheless, it is important to consider the potential limitations of these recruitment strategies. Opportunistic screening may contribute to missed opportunities and inequitable reach, as recruitment is limited to individuals who visit community pharmacies, thereby excluding those who do not. Additionally, this approach is highly dependent on pharmacists' time, workload, and motivation, which may introduce variability in implementation. Programmatic screening also does not guarantee high service uptake despite targeted invitations and may be associated with low response rates. It also requires substantial organisational infrastructure, administrative coordination, and follow-up mechanisms to support participation, which participants in this study highlighted as challenges for programmatic screening. Recruitment during medication dispensing may disrupt workflow in busy pharmacy settings, potentially affecting dispensing and leading to inconsistent implementation due to time constraints.

Clearly, no single method is optimal; the positive and negative implications of each strategy should be carefully considered during implementation, and a combination of methods might be required. Some participants recommended combining multiple strategies to maximise reach and follow-up. One participant also suggested home visits. Although this strategy is recommended by only one participant, it warrants consideration, particularly for housebound patients. Offering home visits could improve accessibility and thereby enhance equity. Accordingly, further consideration is needed to adapt recruitment strategies to the local context and patient needs.

5.6.2.3 Screening tools

A Saudi-specific CVD risk assessment tool was identified as the highest priority. However, as such a tool was not available at the time of this study, participants prioritised the ACC/AHA ASCVD risk calculator as an alternative until a locally validated tool becomes available. Given the unique epidemiological, genetic, and lifestyle characteristics of the Saudi population, such as high prevalence of diabetes, obesity, sedentary lifestyles, and distinct dietary patterns, internationally derived CVD risk calculators may not be well calibrated to local risk profiles (339). A scoping review in 2025 examining existing CVD risk assessment tools in the Middle East included 17 studies, four of which were conducted in KSA (339). These studies assessed commonly utilised tools, including the Framingham Risk Score (340), SCORE (341), the ACC/AHA Pooled Cohort Equations (PCE) /ASCVD calculator (342), the WHO/ISH charts for the Eastern Mediterranean Region (EMR) (343), and the QRISK algorithm (344). The findings of the review indicated that these tools often over- or underestimate risk in the Middle East populations, leading to misclassification and limited external validity, emphasising the need to develop a validated, country-specific CVD risk calculator. Nonetheless, the Saudi studies included in that review reported that the ACC/AHA ASCVD calculator has relatively good predictive accuracy in the Saudi population compared with other tools (339). These findings support prioritising the development of a Saudi-specific tool in this study and justify expert recommendations to use the ACC/AHA ASCVD risk calculator as an interim alternative.

Using a locally validated screening tool will better align with national public health recommendations and support policy implementation under Saudi Vision 2030, which promotes evidence-based, locally tailored interventions (58). Simultaneously reducing misclassification, overtreatment, and missed preventive opportunities. In 2023, efforts began to develop a locally derived ASCVD risk model using Saudi cohort data and culturally relevant predictors, with potential for national adoption after validation (345). By late 2025, the Saudi Health Council (SHC) introduced a national, locally calibrated digital calculator to estimate 10-year ASCVD risk (346). The introduction of this tool would facilitate the implementation of the developed service, as it aligns with the study's recommendation for a Saudi-specific risk assessment tool.

5.6.2.4 Referral mechanisms

Direct physician referral (active referral) through an integrated system was prioritised in this study to enhance referral uptake and follow-up. Evidence supports this approach, with multiple prior international systematic reviews of CVD, diabetes, and other major disease screening programmes reporting low referral uptake with passive referral methods (233, 347). A recent study in the USA assessed the implementation of CVD and diabetes screening and referral programmes in 15 community pharmacies (348). The study found that only 65% of identified high-risk individuals had their results communicated to physicians, with successful referrals occurring primarily when pharmacies were linked to clinics or had existing connections with healthcare providers (348). These findings highlight the critical role of system integration and collaboration with primary care physicians, both identified in this study as essential implementation strategies.

5.6.2.5 Funding methods

Participants in this study prioritised government- and insurance-based funding as the most effective strategies to ensure equity and the service's long-term sustainability. Each of these funding model have their advantages and disadvantages. One participant argued that government-funded services would be more equitable, as they would cover people with low incomes or without health insurance. This is consistent with the recommendations of the former Director-General of the WHO (349), who advocated for public investment in preventive services and primary healthcare to ensure more efficient and equitable universal health coverage. In contrast, the health insurance system focuses more on curative than preventive care and may introduce health disparities by excluding the unemployed population (350).

Worldwide, various funding models have been used for pharmacy services, each with distinct advantages and disadvantages (351). Some countries use a blended model that combines government and private insurance funding to address the disadvantages of a single-funding model and balance affordable, equitable service delivery with sustainability (351). Despite these variations, the evidence supports the importance of having a clear funding and reimbursement model to ensure the quality and sustainability of pharmacy services (351). Therefore, it is important to carefully consider the most appropriate funding model(s) to support equity, quality, and service sustainability.

5.6.2.6 Implementation strategies

Participants rated the nine proposed implementation strategies as highly important. This consistent agreement likely reflects the fact that these strategies were informed by recommendations from previous research conducted in KSA (125, 145, 146, 244) and systematically mapped to the ERIC (12) framework, ensuring both contextual relevance and theoretical grounding (289). This also indicates that a comprehensive approach that considers multiple implementation strategies is required, rather than focusing on a single or limited strategy. This is consistent with international evidence, emphasising the need for multiple implementation strategies to effectively deliver community pharmacy services, including training, collaboration, stakeholder engagement, adequate resources, prepared infrastructure, organisational and government supports, and evaluation (227, 352). In the current study, when implementation strategies were ranked by importance based on their rating scores, training and educating stakeholders, providing interactive assistance, supporting clinicians, developing stakeholder interrelationships, and changing infrastructure were identified as the top five priorities. This aligns with previous evidence from local and international studies, which consistently highlight targeted training, workforce capacity-building, ongoing support, collaborative stakeholder engagement, and infrastructure preparedness as central to the successful implementation of community pharmacy services (25, 353, 354).

Nevertheless, this may also reflect a deeper structural issue in KSA, such as insufficient institutional readiness or workforce capacity, that needs multifaceted strategies to sustain change (355). The prioritisation of “interactive assistance” and “infrastructure change” suggests that participants view implementation as a resource- and system-dependent process that requires more than individual-level efforts. The remaining prioritised strategies were also aligned with international literature, which often emphasises contextual adaptation, consumer engagement, and continuous evaluation as critical for sustaining implementation (356, 357). The findings of this study, along with its alignment with previous evidence, support the need for a multifaceted approach to ensure effective implementation and sustainable service delivery.

5.6.3 Strengths and limitations:

The relatively large and multidisciplinary Delphi panel strengthened the credibility and comprehensiveness of the consensus process. Compared with the initial NGT study, which was limited mainly to participants from Riyadh and did not include cardiologists or other physicians, the Delphi panel included a broader range of stakeholders, including physicians and cardiologists, as well as participants from other provinces. This wider professional and geographical representation provided additional clinical and contextual perspectives, strengthening the refinement and validation of the model and its potential applicability.

Furthermore, by integrating international evidence and local expertise, the process produced an evidence-based, culturally appropriate, and feasible service model for implementation in the Saudi healthcare system. The use of implementation science frameworks, such as the ERIC, to map prior evidence further supported the generation of evidence-based, theory-informed ideas and highlighted factors likely to influence implementation.

Using three e-Delphi rounds enabled participants to iteratively refine their perspectives by considering aggregate group responses, thereby reducing individual biases and achieving a more reliable consensus. Anonymity of responses and feedback further mitigated the influence of dominance and group conformity. Notably, this study achieved a high response rate and low dropout rate across all rounds, compared with previous Delphi studies in health services research, which often report declining participation over successive rounds (358). Consistent participation in this study strengthened the reliability and credibility of the consensus achieved and minimised non-response bias.

Moreover, participants were not required to prioritise a single option, acknowledging that multiple strategies may be equally important in real-world implementation. This flexible approach enabled a more comprehensive understanding of collective priorities, preventing the loss of valuable insights that might have occurred if participants were constrained to a single response, and it supported inclusive consensus-building. Including participants' qualitative feedback alongside their prioritisation responses was an additional strength of this study. Although only a minority of participants provided comments in each round, their insights offered valuable context to justify prioritisation choices and highlight practical

recommendations. Integrating this feedback not only enriched the interpretation of quantitative findings but also enhanced the transparency by making the reasoning behind participants' decisions explicit. This may help policymakers and decision-makers better understand stakeholder perspectives and refine and implement CVD risk screening more effectively.

Nonetheless, certain limitations should be acknowledged. Despite broad inclusion criteria, the panel was unevenly distributed, with clinical and community pharmacists predominantly represented relative to physicians and policymakers. As a pharmacist, my professional network is limited to pharmacists, which may have influenced recruitment and contributed to the imbalance in representation between pharmacists and other stakeholders. However, because pharmacists are the primary providers of such interventions, their perspectives are particularly relevant and central to the study's aim. Additionally, the absence of patients and service end users from the study means that insights into their preferences, expectations, and perceived acceptability of the proposed service cannot be drawn. Although the initial development stage focused on obtaining expert consensus regarding the clinical and operational components of the model, patient involvement could have provided an important complementary perspective, particularly regarding accessibility, acceptability, and practical barriers to uptake. Given that the purpose of this stage was to establish the core components of the service, involving patients during subsequent piloting and evaluation may be more appropriate and practical, allowing the model to be assessed and refined based on real-world user experiences and preferences.

Furthermore, although this study included participants from multiple provinces across the kingdom, the majority were from Riyadh and Makkah, with minimal participation from other regions. Given that some regional and institutional variation in practice may exist due to differences in local implementation and resource availability, the sample may not fully represent practice in other regions. However, the MOH regulates the entire healthcare system in KSA; therefore, healthcare regulations are mostly standardised across the Kingdom, which may reduce regional differences in policies and practices (4, 5). Additionally, both Riyadh and Makkah are the two most populous provinces in KSA, characterised by high population density, diverse demographics, and a wide range of healthcare facilities and professionals (1, 5). Therefore, the views and experiences captured from these regions are likely to reflect the broader national context reasonably well.

5.6.4 Implications and future directions:

This study offers an evidence-based, contextually relevant framework for integrating community pharmacies into KSA's national CVD prevention strategies, aligning with public health priorities and Saudi Vision 2030's focus on preventive and community-based care (58, 320). The developed service can enhance access to early detection of CVD risk, particularly in areas with limited primary care coverage, thereby helping to reduce health disparities. Policymakers and healthcare planners can use these findings to guide future implementation efforts, including the development of standardised protocols, referral pathways, and reimbursement models, and to ensure effective and sustainable implementation. The prioritised implementation strategies underscore the need for competency-based training in risk assessment, highlighting the opportunity to include these skills in undergraduate curricula and continuing professional development (CPD) modules, for instance, to strengthen pharmacists' capacity to deliver high-quality screening. The results also indicated that digital health integration and structured interprofessional collaboration are essential for efficient data sharing and continuity of care; therefore, fostering collaboration among healthcare providers and advancing a more integrated healthcare system are strongly encouraged to enhance service coordination and patient outcomes. Collectively, these implications underscore that community pharmacy-based CVD screening is not merely a service innovation but a potential structural reform in preventive healthcare delivery.

The findings of this study also provide a basis for considering the next steps in the development and evaluation of the intervention. In line with the UK MRC framework, future work should build on the findings of the present study by further developing and refining the intervention, followed by more systematic evaluation of its feasibility, acceptability and potential effectiveness. This provides an opportunity to address the limitations identified in the current study while progressing towards subsequent stages of intervention development and evaluation.

In particular, future research should pilot the developed service in real-world community pharmacy settings to assess feasibility, acceptability, and effectiveness, focusing on service uptake, patient satisfaction, referral compliance, pharmacist workload, and clinical and economic impacts. Understanding both pharmacists' and community attitudes will help refine the service and enhance service uptake. A

rigorous evaluation of clinical outcomes and early risk detection rates will help demonstrate the service's effectiveness and inform continuous improvement. Economic evaluations are essential for providing policymakers and healthcare insurers with evidence on the value of community pharmacy-based screening in reducing the national CVD burden and for guiding decisions on the most suitable financing model for preventive programmes. Importantly, future research should closely monitor and evaluate the newly introduced ASCVD risk screening tool in Saudi Arabia to ensure its validity and reliability, thereby supporting the implementation of the developed service, as recommended in this study, using a Saudi-specific, validated screening tool. These areas align with the UK MRC framework by addressing intervention development/refinement, feasibility testing, evaluation, and implementation. These next steps would support the continued refinement of the intervention and provide a clearer pathway towards its future evaluation and implementation.

5.7 Conclusion

This study collaboratively developed an evidence-based, context-specific community pharmacy-based CVD risk screening service model that details the target population, screening processes, and post-screening interventions, and prioritises recruitment strategies, referral mechanisms, screening tools, funding approaches, and other implementation considerations. The findings demonstrate that such a service is perceived as feasible, acceptable, and aligned with national public health priorities. The model provides a practical framework for integrating preventive CVD risk screening into community pharmacy practice in KSA. Its implementation is expected to enhance early detection, improve public health outcomes, and help reduce the national burden of CVD. Future research should focus on piloting the model, evaluating clinical outcomes, assessing cost-effectiveness, and establishing supportive policies to facilitate successful nationwide adoption.

6 Chapter 6: Final discussion and conclusion

6.1 Introduction to the chapter

This chapter summarises and discusses the thesis's key findings. The discussion of the findings is followed by an explanation of the logic model developed for the community pharmacy-based CVD risk screening service, outlining its structure and intended outcomes. This is followed by the thesis's implications and recommendations for future research, strengths and limitations, reflexivity, and finally, the conclusion.

6.2 Summary of the key findings in comparison with the literature

This thesis identified several key findings that address the study objectives and contribute to the existing body of evidence. These findings are:

- 1) Limited evidence on the current involvement of community pharmacists within KSA and other Gulf countries in NCDs/CVDs prevention and management;
- 2) Positive perceptions of future expansion of community pharmacy services, including the CVD risk screening service, within KSA and other Gulf countries;
- 3) Strong consensus on a comprehensive context-specific community pharmacy-based CVD risk screening service model targeting individuals at higher risk in KSA;
- 4) Limited outcomes evaluation of the community pharmacy services in KSA and other Gulf countries; and
- 5) Strong consensus on specific, multifaceted strategies to overcome barriers for community pharmacy-based CVD risk screening services and promote expansion in KSA.

The following sub-sections present and discuss each of these findings in the context of the wider literature.

6.2.1 Limited evidence on the current involvement of community pharmacists within KSA and other Gulf countries in NCDs/CVDs prevention and management:

It is evident from the scoping review findings (Chapter 2) that community pharmacists in the Gulf Cooperation Council (GCC) countries still have limited involvement in non-communicable diseases (NCDs), with only 18.1% (n=21/116) of studies exploring

community pharmacy services targeting chronic NCDs. These services included disease education and management (6/116, 5.2%), point-of-care (POC) testing (e.g., BP measurement) (8/116, 7%), and disease screening (7/116, 6%); however, some of these services have only been proposed for future implementation rather than actively practised. Compared with other Gulf countries, KSA is practising most of these services; however, they still have not been implemented nationwide. Additionally, more advanced clinical services, such as health screening and medication therapy management (MTM), have not yet been implemented in any GCC country; CVD risk screening has been piloted only in the UAE, and MTM has been piloted only in KSA, both of which showed positive outcomes.

These findings highlight the opportunity to further expand community pharmacy services in KSA and other GCC countries to include additional extended clinical roles, such as screening, patient identification, and treatment management. To support this expansion, there is a need to develop practical strategies for national and broader implementation of these services to ensure adequate involvement of community pharmacists in the prevention and management of chronic NCDs. Such expansion efforts would build on the existing international evidence base and align with established practices in developed countries, where community pharmacists have been actively involved in chronic disease prevention and management for more than a decade (30). For example, a 2010 systematic review of 45 studies conducted across several countries, including the UK, Canada, Germany, Australia, Portugal, Brazil, and Finland, demonstrated that community pharmacists in those countries are actively engaged in managing chronic diseases, either independently or as part of multidisciplinary healthcare teams (30). This evidence highlights the extensive range of services provided by community pharmacists in many countries, including medication review and management, POC testing for BP, BG, and lipid levels, early disease detection, and preventive measures such as weight management and health promotion. This evidence underscores the evolving role of community pharmacists in supporting chronic disease management for decades.

However, it is important to acknowledge that community pharmacy practice in KSA and other GCC countries remains in its early stages of development. Regulatory frameworks supporting a shift from traditional dispensing roles to more extended clinical pharmacy services have only been introduced in the past decade (between 2011 and 2019) (86-91). This may have contributed to the slow evolution of

community pharmacy practice there and to the current limited evidence on community pharmacists' involvement in preventive care in KSA and other GCC countries.

6.2.2 Positive perceptions of future expansion of community pharmacy services, including the CVD risk screening service, within KSA and other Gulf countries:

As previously discussed in the scoping review (Chapter 2), stakeholders in GCC countries, including pharmacists and community pharmacy consumers, consistently support expanding community pharmacists' roles. Pharmacists demonstrated a strong willingness to offer more extensive services, and consumers were receptive to engaging with future extended services and suggested a range of potential services. These include medication review and management, health screening, POC testing, chronic disease monitoring, health promotion, and preventive services. Similarly, throughout the development of the CVD risk screening service in this project, stakeholders in KSA, including pharmacists, physicians, public health experts, and other policymakers, supported the service. They perceived it as acceptable, practical, effective, affordable, and potentially capable of generating positive impacts. These encouraging findings further support the future expansion of community pharmacy practice.

This is consistent with international evidence supporting extended community pharmacy services (359). A comprehensive review of 55 studies across multiple countries demonstrates generally positive attitudes and perceptions towards extended community pharmacy services among both pharmacists and the general public. The review found that services such as professional pharmaceutical care and public health promotion activities were broadly considered valuable additions to traditional pharmacy roles. Both stakeholder groups supported expanding community pharmacy services, recognising their potential to improve accessibility and patient care (359).

6.2.3 Strong consensus on a comprehensive context-specific community pharmacy-based CVD risk screening service model targeting individuals at higher risk in KSA:

Figure 6.1 provides an overview of the final model and specifications for the community pharmacy-based CVD risk screening service, developed using two consensus methods: the modified Nominal Group Technique (m-NGT) and modified e-Delphi.

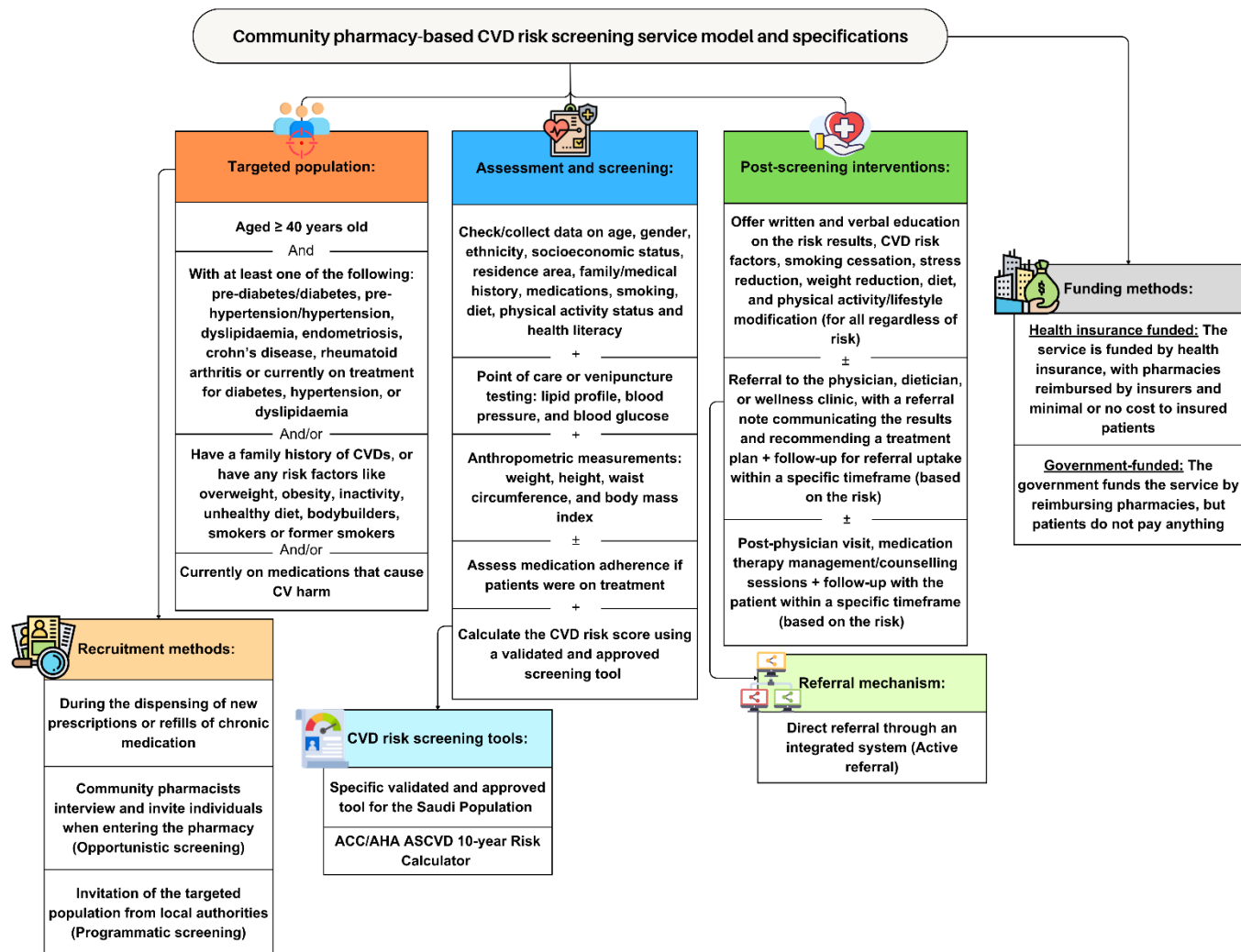


Figure 6.1. The final community pharmacy-based CVD risk screening service model and specifications

The final service model developed in this project targets individuals at higher risk and, in terms of the level of pharmacist involvement, aligns with the comprehensive model proposed in a previous national study (145). Although the previous national study proposed several service models with varying levels of pharmacist involvement (minimal, medium, and comprehensive), as discussed in Chapter 3, these models were based solely on participants' experiences and views. They did not specify the target population or other key service components and were not developed through an evidence-based or consensus-driven process to identify the most suitable model for adoption. The model developed in this thesis is evidence-based and consensus-driven, involving comprehensive screening procedures and interventions, including assessment of patient demographics and medical and medication histories; anthropometric measurements; POC testing; calculation of CVD risk; and assessment of medication adherence. Additionally, providing both oral and written lifestyle modification advice, referring patients to physicians, offering medication counselling, and MTM sessions after physician prescriptions, and following up with patients. Each of these service components represents a distinct service that has been frequently recommended by stakeholders in previous studies, as demonstrated by the scoping review (Chapter 2), thereby justifying the prioritisation of the comprehensive service model.

Compared with service models adopted in other countries worldwide, there are both similarities and differences, but no single model is entirely comparable to the developed model across all components. For example, regarding the targeted population, this model closely aligns with screening models in Canada (83, 264, 265), the Holistic screening model in Australia (257), and the comorbidities screening model in Poland (268). All of which focused on high-risk individuals with prior diagnoses or on treatment for any chronic condition, or with other risk factors. However, these models differ in the target age group. While the model developed in this thesis targets individuals aged 40 and above, some models target individuals aged ≥ 18 (83, 269), and in others, the targeted age varies by gender (45 for males, 55 for females) (263, 264). Interestingly, all models targeting a similar age group ≥ 40 , such as the screening model in the UAE (171, 173) and the heart MOT (257), NHS health check (258, 259), and healthy life check (261) in the UK, target healthy individuals, with age being the only apparent risk factor. In fact, previous evidence and recommendations from the NICE guideline on cardiovascular disease risk assessment and reduction

(2023)(360), and the WHO report on cardiovascular disease prevention (2024)(312, 313), support the targeted CVD risk screening approach prioritised in this project. These resources demonstrated that targeting higher-risk individuals is more effective for identifying those most likely to benefit from intervention and is more resource-efficient than population-wide screening (313, 360).

In terms of a comprehensive approach of screening processes and interventions, the developed model aligns closely with the PAART CVD Holistic model in Australia (256), and the Rx EACH screening model in Canada (83). Despite these similarities, there are still some variations, such as the targeted age group discussed earlier and the screening tools they used. In Australia's model, the NZ-modified Framingham screening tool was used to estimate 5-year CVD risk, and in Canada's model, the Framingham risk calculator was used; both were ranked as the lowest priorities in the current project. These screening tools were excluded because they were considered less relevant to the Saudi population and might yield misleading results. Interestingly, the recommended alternative screening tool, ACC/AHA ASCVD, aligns with previous evidence that showed that this specific tool has relatively good predictive accuracy in the Saudi population compared with other tools (339). Additionally, this tool was also used in the UAE screening service (171). This similarity reflects comparable demographic and population characteristics across GCC countries and supports prioritising ACC/AHA ASCVD as an alternative screening option. However, the UAE model differs in its target population and other elements of the screening processes, as it was adapted from an Australian model.

Besides these variations, other service specifications, such as recruitment methods, referral mechanisms, and funding approaches, varied across these international programmes. Participants in the current project achieved a strong consensus on these service specifications (see Figure 6.1). For example, a strong consensus was achieved in prioritising three recruitment methods, suggesting that different recruitment strategies could be adopted. Although some international programmes have also adopted various recruitment methods, most of which use advertisement-based recruitment (171, 231, 254, 257, 266, 267, 275), whereas participants in the current project excluded this method, as they perceived it as less practical.

These variations reflect differences in contextual factors and local needs across countries, highlighting the importance of co-designing and developing a context-

specific service rather than simply adopting a model that has been successful in other contexts. Although these variations appear minimal, it was worthwhile to undertake these development processes to build a more tailored, context-specific model that understands local needs, as these minor differences may have significant impacts. For example, adopting a population-wide screening programme focused on the healthy population, like in most existing international programmes, might be less cost-effective and lead to over-referral and other undesirable effects (313). Therefore, considering local stakeholder engagement in the development process or adopting a model from a country with similar population demographics and contextual factors could improve feasibility and potential impact.

6.2.4 Limited outcomes evaluation of the community pharmacy services in KSA and other Gulf countries:

As discussed in the scoping review (Chapter 2), humanistic and perceived outcomes of community pharmacy services were the most frequently evaluated in prior national literature, whereas clinical and economic outcomes were less frequently evaluated. Additionally, although an evaluation framework was used in the current project to assess the acceptability, practicality, and effectiveness of the developed service, as well as affordability, side effects, and equity, the evaluation solely relied on perceived and anticipated outcomes. Despite the positive perceptions observed during this evaluation (Chapter 5), some participants emphasised the need for a post-implementation evaluation to assess the service's clinical and economic effectiveness, negative side effects, and impact on equity. Therefore, based on these findings, future efforts should prioritise comprehensive service evaluation using rigorous methods and structured evaluation frameworks to assess implementation, service, and users' outcomes (295), considering not only humanistic measures but also clinical and economic impacts. Detailed recommendations for the future evaluation of the developed community pharmacy-based CVD risk screening service will be discussed later in this chapter (see Research implications and recommendations for future research:).

An adequate assessment of any health service is essential to ensure its effectiveness, feasibility, and sustainability. A systematic review of 57 studies involving over 16,000 participants across diverse international settings that assessed health promotion and public health interventions for chronic conditions delivered in community pharmacies reported a range of outcomes. Health-related behavioural outcomes were assessed

in 10 studies, intermediate clinical outcomes (including cholesterol and glycated haemoglobin levels) in 20 studies, and quality-of-life related outcomes in 10 studies. Economic outcomes were examined less frequently, with cost-effectiveness evaluated in seven studies. The review authors also highlighted the inconsistency in outcome measures and the lack of assessments of adverse events and event-based clinical outcomes, such as stroke and myocardial infarction, across the included studies (229). This international evidence further underscores the critical need for a standardised, comprehensive evaluation of community pharmacy services to better understand their impact and to support expansion and sustainable implementation.

6.2.5 Strong consensus on specific, multifaceted strategies to overcome barriers for community pharmacy-based CVD risk screening services and promote expansion in KSA:

Throughout the conducted scoping review and the CVD risk screening service development process in this project, several barriers to expanding community pharmacists' roles have been identified. These barriers were largely linked to time constraints and workload, privacy concerns, insufficient training, low public awareness of pharmacists' roles, lack of collaboration and system integration and limited resources. These were not only seen as influential factors for CVD risk screening service but also as obstacles to other extended community pharmacy services, highlighting the need for effective strategies to address them and support the national implementation of these services, including CVD risk screening. Given the comprehensiveness of the developed service model and the practical challenges it may pose, particularly in light of the reported barriers, including the lack of system integration and collaboration with other primary care providers (125, 145, 146, 244), it is important to consider effective strategies to support practical, sustainable service delivery. During the development of the CVD risk screening service, stakeholders considered all implementation strategies highly important and consistently recommended a multifaceted approach to facilitate service implementation. Although they perceived the service as practical, their emphasis on and strong consensus for comprehensive implementation strategies suggest awareness of the challenges associated with such a model and the need for multifaceted approaches to ensure its practicality.

These recommended strategies aim to empower pharmacists, promote interprofessional collaboration, ensure infrastructure and system preparedness,

secure regulatory support, establish clear protocols, and provide sufficient resources. This finding aligns with the previous Saudi study by Almansour and colleagues (125), which noted that barriers to pharmacy-based CVD risk prevention and management services need to be addressed at multiple levels: macro (policy, government, and organisational support), meso (structural preparedness and resources availability), and micro (individual factors, including pharmacists' capacity, consumer engagement, and collaboration with other healthcare providers) (125). This is also consistent with broader international evidence, indicating that effectively implementing extended community pharmacy services requires a combination of professional education and training, interprofessional collaboration, organisational support, policy alignment, and structural adjustments (227, 352).

Furthermore, the similarity of barriers across all extended community pharmacy services, as evident in the scoping review (Chapter 2), indicates that implementation strategies should not be service-specific; instead, a system-wide approach should be adopted. Given that the developed screening service encompasses multiple components, including health promotion, POC testing, medication review, and referral, each of which is considered a distinct service, the recommended strategies may also be applicable to other extended services, subject to further evaluation. Interestingly, all the implementation strategies identified in this study are consistent with those highlighted in a 2026 report by the International Pharmaceutical Federation (FIP) on enabling the implementation of community pharmacy-led toolkits for NCD management (361). The report emphasises that structured training for pharmacists is a fundamental first step in implementing community pharmacy-led NCD initiatives. It also underscores the importance of a clear regulatory framework, effective bidirectional collaboration between pharmacists and physicians, early engagement of multidisciplinary stakeholders and patients, reliable digital infrastructure and system integration, robust quality assurance and evaluation mechanisms, and appropriate remuneration and funding models (361).

Collectively, the findings from this thesis, along with the previous evidence, support the adoption of comprehensive implementation strategies to strengthen community pharmacists' role in NCD management and to facilitate sustainable national implementation and impact. Addressing all structural, professional, and regulatory challenges holistically will make the national implementation of community pharmacy extended services, including CVD risk screening, more feasible. These findings

underscore that the successful expansion of community pharmacy-based services depends on multiple factors and requires multiple strategies, rather than relying on a single or limited strategy.

6.3 Logic model

A programme logic model is a systematic, visual representation that links the programme's resources and activities with anticipated outcomes (362). It provides a structured framework for describing how an intervention is expected to work and the mechanisms through which it achieves its intended impact. Typically, a simple logic model is organised into key components, including inputs, activities, outputs, outcomes (both short-and long-term), and impact, enabling a clear articulation of programme structure and theory of change. Inputs represent the resources required to implement the activities, while activities describe the processes and actions undertaken to achieve the intended results. The distinction among outputs, outcomes, and impacts primarily concerns the timeframe over which results are achieved. Outputs are the direct and immediate results of inputs and activities; short-term outcomes occur within 1–3 years, and long-term outcomes within 4–6 years. Finally, impacts refer to the fundamental changes resulting from the programme over a longer period, typically within 7–10 years (362, 363). The primary aim of using a programme logic model is to support intervention conceptualisation, planning, communication with others, implementation, and evaluation by clarifying objectives, aligning activities with expected outcomes, and identifying measurable indicators of success (362-364). Logic models are widely used in public health and health services research to guide the development of complex interventions, facilitate stakeholder engagement, and enhance transparency and reproducibility in programme evaluation (363). Therefore, a logic model was created in this thesis for the developed community pharmacy-based CVD risk screening service to serve as a roadmap for stakeholders to support future implementation and evaluation.

The logic model presented in Figure 6.2 was developed by integrating findings from the current thesis with evidence from the existing literature (Chapter 3). Specifically, the inputs and activities reflect the results of the CVD risk screening service development process described in this thesis, capturing the resources required (i.e., implementation strategies) and the final service model developed (Chapter 5). In contrast, the anticipated outputs, outcomes, and impacts were informed by prior literature and evidence from the implementation of similar CVD risk screening

services in other countries (Chapter 3). The results regarding the inputs and activities were also integrated and discussed in relation to Saudi Vision 2030 and health-sector transformation plans. This integration ensured that the logic model was both grounded in the empirical findings of the present project and aligned with established evidence on the expected effects of such services, avoiding self-assumptions and potential bias. The outcomes in the logic model were mapped by type into humanistic, clinical, and economic outcomes, as well as service, service user, and implementation outcomes (295, 296).

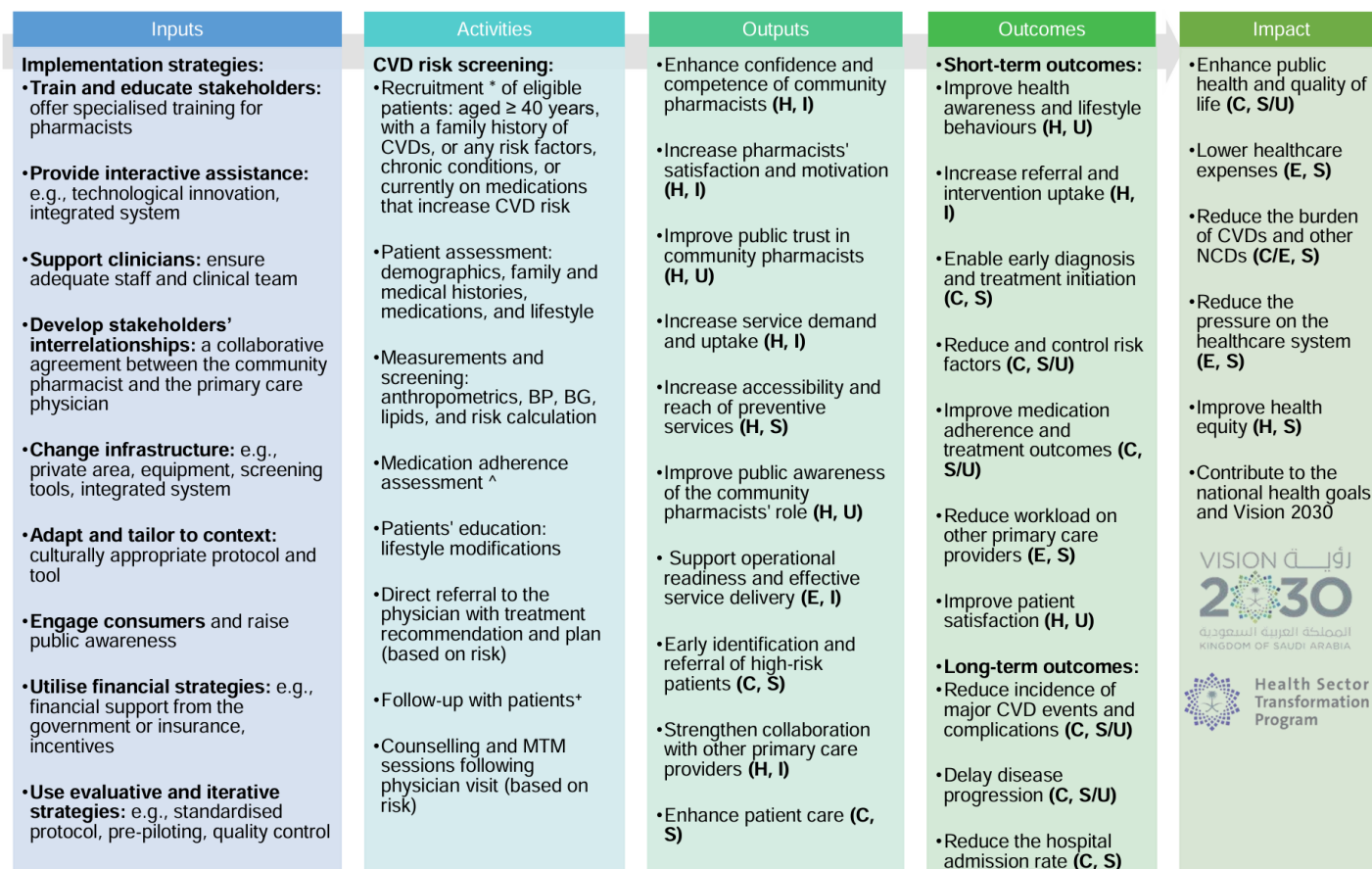


Figure 6.2. Logic model of the developed community pharmacy–based CVD risk screening service.

*: Recruitment methods: during the dispensing or refills of chronic medication, opportunistic screening by inviting individuals when entering the pharmacy, or programmatic screening: targeted invitations from the authorities.

^: Medication adherence assessment only for those who are already on treatment for any chronic conditions.

*: Follow-up for the uptake of all interventions: referral uptake, lifestyle changes, treatment adherence and progress.

H: Humanistic outcomes; **C:** Clinical outcomes; **E:** Economic outcomes; **I:** Implementation outcomes; **S:** Service outcomes; **U:** Service Users' outcomes.

CVDs: Cardiovascular diseases; **BP:** Blood Pressure; **BG:** Blood glucose; **MTM:** Medication therapy management; **NCDs:** Non-communicable diseases

This developed logic model is explained and discussed further in the following subsections:

6.3.1 Inputs (implementation strategies) and their intended outputs/outcomes:

6.3.1.1 *Train and educate stakeholders: enhancing community pharmacists' confidence and competence, increasing professional satisfaction and motivation, and improving public trust*

Offering specialised, ongoing training for community pharmacists in clinical skills and service provision was identified as the highest-priority implementation strategy in this project. This strategy is expected to enhance pharmacists' confidence and competence in delivering extended services, increase their motivation to engage in clinical services and patient-centred roles, and, consequently, potentially increase their job satisfaction, as shown by prior international literature. For instance, pharmacists in the CVD absolute risk screening (CARS) programme in Australia considered such training essential to the service's success and sustainability. They reported that training increased their confidence and professional satisfaction (232).

From another perspective, as the role of the community pharmacist advances, this could attract more pharmacists to work in community pharmacy settings, thereby ensuring adequate staffing. A recent systematic review has identified professional development opportunities as a factor contributing to pharmacist job satisfaction and retention (365). Together, this may help achieve the Saudi vision by investing in Saudi graduates to increase the Saudization of the private sector (3). Additionally, given that previous national studies reported the lack of training and clinical skills as reasons for the public's perceived distrust in pharmacists (146, 244), investing in improving pharmacists' knowledge and skills, as well as in the services they provide, would enhance public trust in community pharmacists.

As previously discussed in Chapter 3, pharmacist training was among the most frequently reported requirements and strategies for implementing screening services in many countries. The literature recommended that the training be comprehensive, including practical in-person workshops where pharmacists engage in hands-on practice before becoming certified screening service providers (171, 232, 255, 272). This could be combined with self-directed, life-long online courses that pharmacists can access anytime (254, 258, 275). The training was advised to cover CVD risk factors, measurement of individual risk factors, POC testing, calculation of overall risk, and the safe use of screening equipment and tools. Additionally, training in medication adherence assessment, treatment, health promotion, lifestyle modification, and therapy management was recommended. In addition to these clinical skills, it was recommended that patient engagement and communication skills be included to ensure effective risk communication with patients and with physicians (171, 232, 255, 258, 272). Previous Saudi studies recommended that developing a training programme in

collaboration with professional and academic bodies, such as the Saudi Commission for Health Specialities (SCFHS), would ensure high-quality training and proper certification (145, 146, 244).

6.3.1.2 Support clinicians: enhancing operational readiness and service delivery.

Another strategy considered highly important in the current project is the availability of an adequate staff and clinical team capable of providing these services. This aligns with previous international studies that reported the availability of adequate staff as an important strategy to offer the service (232, 257, 272). In the CARS screening programme in Australia, pharmacists reported that having more than one pharmacist on duty facilitated the successful implementation of the screening service (232). Supporting clinicians in ensuring adequate staffing and clinical teams also involves the availability of pharmacists' assistance, including technicians, clinical pharmacists or residents. For example, in Ghana, the presence of pharmacists' assistance facilitated recruitment and screening, as the work was divided among them according to their skills and competence (278). In the USA, screening was provided by a community pharmacist and a clinical pharmacy resident. The community pharmacist was responsible for initial recruitment and assessment, while the clinical pharmacy resident was responsible for additional clinical measurements, referral decisions, and interventions (265). These examples highlight the importance of supporting providers by ensuring a sufficient clinical team.

Currently, most clinical pharmacists in KSA work in hospital settings (17, 18); however, if community pharmacies offered job opportunities for clinical pharmacists, this would help ensure an adequate number of qualified staff to provide screening services. Moreover, these clinical pharmacists could train and supervise other community pharmacists, thereby increasing their confidence to take on a more clinical role and facilitating the expansion of patient-centred care in community pharmacies over time (366). In fact, this strategy aligns with the new pharmacy model under Vision 2030, which emphasises shifting pharmaceutical care from hospitals to community pharmacies, and recommends increasing the number of ambulatory care clinical pharmacists working in community settings to support privatisation (367). These clinical pharmacists, who are skilled in areas such as chronic disease management, therapy management, immunisation, preventive care, and collaborative practice with other healthcare professionals, are qualified to deliver such a service and would help reduce the workload on community pharmacists.

6.3.1.3 *Provide interactive assistance: fostering service delivery and strengthening collaboration with other healthcare providers*

Providing digital and interactive support, such as a digital screening tool and an integrated healthcare system, was considered a highly important implementation strategy for the developed screening service in the current project. An integrated healthcare system that links all levels of care and all healthcare providers would facilitate service delivery, enabling providers to access patient data at any point of care. This would enable pharmacists to easily check patient information, identify eligible patients, and recruit them. Moreover, such an integrated system would facilitate communication among pharmacists, primary care physicians, and other healthcare providers, fostering direct referrals and follow-up to ensure optimal patient care. Using a digital, interactive screening tool would streamline the screening process and, if integrated into the system, would further enable pharmacists to directly communicate results to primary care physicians, along with their recommendations and treatment suggestions, as in Australis's CARS screening programme (232). In that screening programme, pharmacists used screening software integrated with GPs, which enables the documentation of patient data and the direct referral of patients to a physician with the pharmacist's recommendation. This integration allowed physicians to easily access patients' data and pharmacists' recommendations. Pharmacists in that programme perceived electronic and technological supports as enablers of successful service implementation (232).

Currently in KSA, several digital transformation initiatives have been launched to better connect and integrate the healthcare system and facilitate access to patient medical records (368, 369). One key example, also suggested by a stakeholder in this project, is NPHIES (the National Platform for Health and Insurance Exchange Services). NPHIES aims to create a unified electronic health record infrastructure across the country, enabling clinicians and insurers alike to access and exchange patient data (370, 371). Having a properly integrated health information system would enable accurate documentation of identified cases, support authorities in monitoring and tracking the progress of the screening programme, and facilitate the development of an epidemiological database. This aligns with the public health recommendation of developing a monitoring and tracking dashboard (58). Such a transformation would also strengthen collaboration between community pharmacies and primary care physicians and foster a collaborative care model.

6.3.1.4 *Develop stakeholders' interrelationships: strengthening collaboration, enhancing patient care, and reducing pressure on other healthcare providers*

In addition to an integrated system to facilitate access to patient data and referrals to other healthcare practitioners, ensuring a collaborative healthcare approach was another key

strategy recommended in this project. Establishing a collaborative agreement between pharmacists and other healthcare providers, with clearly defined roles, would enhance patient care while reducing the workload of other primary healthcare providers. This strategy aligns with prior international studies that identified collaboration with GPs as an important implementation requirement for the CVD risk screening service, as discussed in Chapter 3. Additionally, a recent study in KSA (153), examined the implementation of MTM services in a community pharmacy, in which physicians working in primary care centres near that pharmacy signed a collaborative agreement with community pharmacists, outlining shared responsibilities for patient medication management. This collaborative practice enabled pharmacists to actively participate in monitoring therapy, identifying medication-related problems, and supporting physicians in optimising treatment plans. As a result, the establishment of this agreement led to measurable improvements in patient care outcomes, demonstrating the value of structured pharmacist–physician collaboration in the community setting (153). This evidence underscores the importance of supporting stakeholders' interrelationships and collaboration.

6.3.1.5 *Change Infrastructure: supporting service delivery, and increasing patient demand*

Preparing community pharmacies with essential infrastructure is one of the important implementation strategies identified in this project and supported by previous evidence. For example, having a dedicated, private area or an isolated screening clinic or room to ensure patient confidentiality and safety was frequently reported as an important requirement for implementing CVD risk screening in existing evidence, as discussed in Chapter 3. Given that a lack of privacy was among the most reported barriers to community pharmacy services in KSA and other GCC countries (discussed in Chapter 2: Scoping Review), it is crucial to consider this important strategy to ensure successful implementation of the service. In fact, the MOH in KSA has made the implementation of extended services in community pharmacies conditional on the availability of a private area (24). The screening room should implement safety measures and be equipped with essential tools and resources, including POC testing devices, the CVD risk calculator, and, as previously discussed, an integrated system to streamline screening, referral, and documentation. Having a dedicated, private room would not only ensure patient safety and confidentiality but also increase patients' demand for community pharmacy services, as they would feel more confident to discuss their health issues in a private space. A recent study in KSA found that privacy concerns are a significant factor discouraging consumers from discussing their health problems with community pharmacists, underscoring the need to implement effective privacy measures (372).

In Canada, community pharmacy-based clinics have enabled community pharmacists to provide more clinical and extended services. These include minor illness management, acute infections, chronic disease management, mental health, and other outpatient illnesses; they have also raised public awareness of pharmacists' scope of practice and increased patient demand and access to primary care services (373, 374). Therefore, having a dedicated private clinic or room would support the delivery of screening and other extended services, allowing pharmacists to play a greater role in patient care.

6.3.1.6 *Adapt and tailor to context: supporting effective and efficient service delivery*

Developing a Saudi-specific screening tool was prioritised in this project; therefore, it is vital to invest in a simple, culturally appropriate, and effective screening tool and protocol. This supports the Saudi public health recommendation to develop a validated screening tool (58). Although the ACC/AHA ASCVD risk calculator was recommended as an interim alternative screening tool, having a country-specific, validated tool would prevent over- or underestimation of individual risk that might occur with international tools that are not well calibrated to the Saudi population, ensuring accurate results for optimal patient care (339). Encouragingly, the Saudi Health Council (SHC) has recently introduced a national ASCVD risk digital calculator that aligns with the recommendations in this project and would support the implementation of the developed service and ensure effective service delivery (346).

Additionally, a standardised, tailored, and clear protocol that guides pharmacists in interpreting screening results, detailing when to refer the patient and the necessary actions, would help achieve early identification and referral goals while avoiding over-referral, which one participant mentioned as a potential drawback of the screening service in community pharmacies. In the CARS screening model in Australia, pharmacists reported that the availability of a clear implementation guide and a detailed workbook was a key factor underpinning successful service delivery (232). Therefore, investing in tailored tools and clearly defined protocols is essential to facilitate effective service delivery, ensure long-term success, consistency, and sustainability, and minimise the risk of potential harm.

6.3.1.7 *Engage consumers: increasing service uptake and demand, and raising public awareness*

Engaging service users and raising public awareness about the role of pharmacists was also recommended in the current project. Given that the service end users were not involved in the current project, it is essential to engage them before the implementation or during the piloting phase. This helps assess their acceptance of the final service model, identify potential implementation barriers, and refine the model based on their feedback. Such iterative

engagement is essential to ensure the service responds to consumer needs and has a realistic potential for high uptake and long-term sustainability (243, 245).

In addition to engaging consumers in refining the service, raising public awareness of the service's availability and the role of pharmacists is crucial. Investment in targeted marketing and promotional activities is therefore essential to support service uptake (125, 145, 146, 244). A recent national study assessing public awareness and utilisation of community pharmacy services found limited awareness of the full range of extended community pharmacy services currently provided, which corresponded with low utilisation and demand for these services (375). This evidence highlights the importance of investing in the promotion and marketing of community pharmacy services to raise awareness, increase utilisation and demand, support role expansion, and enhance community pharmacies' contribution to public health. Previous national literature has recommended promoting the service through various channels, including social media, recommendations from other healthcare professionals, word of mouth, television and radio, public health activities and campaigns, social media influencers, and religious leaders (125, 145, 146, 244). Promotion and marketing of the service were also suggested to be sponsored or supported by the MOH or other relevant professional bodies to enhance trust in pharmacists (125, 145, 146, 244).

6.3.1.8 *Utilise financial strategies: increasing service uptake, promoting health equity, and motivating pharmacists*

Using an effective financial model that covers the cost of the service, ensuring that patients do not pay out of pocket, and incentivising pharmacists have been identified as important implementation strategies in the current project and in prior literature. This would help increase uptake, promote equity, motivate pharmacists and ensure sustainability. Stakeholders in this project have prioritised two funding approaches: government and insurance, with some participants arguing that government funding may have a greater impact on achieving health equity. As national health strategies aim at privatisation and universal insurance for all citizens and non-citizens (367), if this occurs and the entire population is insured, an insurance-funded model would be the most effective, reducing government costs while guaranteeing equity. Involving insurance company stakeholders in the implementation stage is important to demonstrate the service's expected impact and to negotiate with them to secure the most suitable funding model. Such a funding model should also include incentives and remuneration for participating pharmacies to motivate them to provide the service and ensure its long-term sustainability. Previous evidence indicates that, despite international variations in remuneration models, the presence of an effective reimbursement system is crucial for service sustainability and the expansion of pharmacists' roles (351). In the current project, one participant suggested pay-for-performance as a

potentially effective financial strategy to ensure the quality and cost-effectiveness of the service. Accordingly, policymakers should critically evaluate all available financing options to identify the most appropriate and sustainable financial and remuneration model.

6.3.1.9 *Use evaluative and iterative strategies: ensuring effective and efficient service delivery*

The use of a standardised service delivery protocol, supported by pre-piloting and continuous evaluation, was identified in the current project as an essential strategy to ensure the feasibility and consistency of service implementation. Ongoing quality assurance, such as continuous monitoring, supervision, and audit, enables the systematic evaluation of service performance and adherence to best practice. Importantly, iterative evaluation allows early identification and correction of service limitations, facilitating continuous improvement and responsiveness to patient needs. Previous Saudi studies have recommended introducing the service in stages, refining processes based on early evidence, and scaling gradually (145, 244). Collect feedback from pharmacists, service end users, and other stakeholders to identify challenges and areas for improvement, continuously enhancing service effectiveness and efficiency (243, 245). Therefore, embedding evaluation and audit within service delivery is critical to maintaining high standards of care, supporting value-based practice, aligning with Saudi Vision 2030 and national health system development strategies (14, 15). Evaluation and clinical audit are widely recognised as core components of effective health service governance and quality improvement (376). Clinical audit provides a structured mechanism for comparing practice against agreed standards, identifying performance gaps, and implementing targeted improvements. Together, contentious evaluation and audit promote accountability, reduce variation in care, and support the delivery of standardised, high-quality, patient-centred, and value-based health services (376).

Collectively, these resources and implementation strategies are interrelated and complementary, each contributing to broader impact in achieving the national health transformation plans and Vision 2030.

6.3.2 Activities (CVD risk screening) and intended outcomes:

6.3.2.1 *Community pharmacy-based CVD risk screening: enhancing access to preventive services, enabling early identification of high-risk patients, and improving patient satisfaction*

The primary aim and intended output of the screening service is to identify high-risk individuals early. Previous international literature on CVD risk screening programmes (Chapter 3) supports this outcome. All these existing programmes have successfully helped identify individuals at high risk and those with undiagnosed risk factors and conditions.

Providing the service in community pharmacy settings offers additional value by improving access to preventive and screening services and thereby reaching and identifying more people. For example, previous studies in the UK showed that community pharmacy-based CVD risk screening services have helped increase access and reach hard-to-reach populations, such as those living in deprived areas or unregistered with GPs (257, 260, 261). Additionally, this accessible and comprehensive screening service model would result in patient satisfaction. This is supported by findings from the UAE screening service, which showed that patients were highly satisfied with the screening service and the quality of education provided by community pharmacists (171, 173).

Having the screening service provided in community pharmacies aligns with Saudi public health recommendations to develop screening services in community settings with easy access (58). In fact, Saudi Vision 2030 and the health sector transformation plans aim to offer accessible and equitable healthcare (14, 15). This accessible preventive service would ensure early identification and management of CVDs, thereby achieving the broader goal of reducing the CVD burden in the country and, consequently, healthcare costs (58).

6.3.2.2 *Education and health promotion: enhancing public awareness, improving clinical outcomes, and reducing risk factors*

Providing health promotion and lifestyle modification counselling would yield positive outcomes in both the short and long term. Several previous international studies (Chapter 3) have found that health promotion activities have improved patients' awareness of CVD risk factors, enhanced patients' behaviours, and led to lifestyle changes. For instance, in Ghana (278), the USA (266, 267), Iran (231), Canada (83), the UAE (171), and Australia (253), providing verbal and written lifestyle modification education and follow-up with patients as part of the screening service resulted in lifestyle modifications at the time of follow-up. These included dietary changes, regular exercise, weight loss, and reduced smoking and alcohol consumption. In Canada, such education has also resulted in a significant reduction in risk factors (83). This evidence underscores the importance and benefits of providing patient education as part of the screening service for all individuals, regardless of risk status.

6.3.2.3 *Direct referral with recommendations and treatment plan plus follow-up: increasing referral and intervention uptake, enabling early diagnosis and treatment initiation*

Referring high-risk individuals to physicians would further improve service outcomes by facilitating early diagnosis and prompt treatment initiation, as demonstrated in the international literature (Chapter 3). However, referral alone does not necessarily guarantee uptake. A previous systematic review of community pharmacy-based Diabetes and CVD risk screening services reported low referral uptake despite referrals being made, highlighting the

need to prioritise effective referral methods and strategies to enhance referral uptake (233). Therefore, prioritising direct referrals through an integrated system, with screening results and pharmacists' recommendations communicated directly to physicians, would enhance referral uptake and, eventually, enhance service outcomes. Additionally, following up with patients and maintaining communication with physicians would also help enhance uptake and service outcomes (83, 171, 173, 231, 232, 265, 268).

6.3.2.4 *Counselling and medication therapy management sessions, with follow-up: controlling risk factors, and enhancing treatment adherence and outcomes.*

Early counselling and MTM sessions with pharmacists at treatment initiation are associated with improved treatment adherence, disease control, and clinical outcomes, as evidenced by prior studies (Chapter 3). For example, in Australia's holistic screening model, providing post-GP visit, monthly counselling and medication review sessions was associated with notable improvements in medication adherence and lifestyle, as well as a significant reduction in risk factors and the CVD risk score after six months. (255). Similarly, in Canada, providing MTM consultation sessions and monthly follow-up with patients resulted in a significant reduction in CVD risk after 3 months, as well as a notable decrease in risk factors, achieving targets for BP measurements (SBP, DBP), lipid levels (LDL), and glycated haemoglobin (HbA1C) (83). This evidence highlights the importance of counselling and therapy management sessions as part of post-screening interventions, following physician confirmation of the diagnosis and prescription of treatment, to enhance adherence and disease outcomes control.

Collectively, providing this preventive CVD risk screening service is expected to have promising long-term impacts. These include reducing CVD complications, delaying disease progression, reducing hospital admissions and CVD-related mortality and, consequently, reducing pressure and costs on the healthcare system, thereby achieving the Vision 2030 to reduce the burden of CVDs in KSA (58). Although the existing literature lacks evidence on the cost-effectiveness and long-term impact of this service, the reported short-term outcomes suggest potential cost savings and other promising long-term outcomes (58, 270).

6.4 Implications and recommendations

6.4.1 Policy and practice implications:

Given that the GCC countries are working together to reduce the NCD burden and improve healthcare systems (84, 85), this project would likely benefit not only KSA's healthcare system and policy but also those of other GCC countries, offering transferable lessons.

First, the thesis provides region-specific evidence to support the expansion of community pharmacies' roles as accessible primary healthcare providers, aligning with Saudi Vision 2030 and regional priorities for preventive care, early disease detection, and healthcare system efficiency. Specifically, as the community-based, highly accessible CVD risk screening programme has been identified by the Saudi Public Health authorities as a national priority to tackle the CVD burden, this thesis has promising implications for achieving public health goals (58). Second, the evidence generated can inform national strategies for CVD prevention by demonstrating the feasibility of the community pharmacy-based CVD risk screening model developed. Third, the project can also guide regulatory reform to authorise pharmacists to deliver structured screening services by providing evidence on the potential role of pharmacists in early disease detection and health promotion. Therefore, positioning pharmacists as key contributors to public health. Fourth, the findings highlight structural and workforce policy implications. These include opportunities to reform undergraduate curricula to prepare pharmacists for preventive care (145); establish pharmacist training and reimbursement models; and increase the number of clinical pharmacist positions in community pharmacies (367). Fifth, by emphasising the accessibility of community pharmacies, the project supports policies to improve access to preventive services, thereby promoting equity and aligning with Saudi Vision 2030's goal of ensuring accessible and equitable healthcare (14, 15). Sixth, the findings would also support policies to develop an integrated system that connects all sectors of the healthcare system and fosters interprofessional collaboration, enhancing continuity and quality of care.

Collectively, the lessons learned from this thesis are likely to inform and guide the development of policy frameworks for similar services and interventions at both the national and regional levels.

6.4.2 Research implications and recommendations for future research:

This thesis provides region-specific evidence on community pharmacy practice, identifies research gaps across all GCC countries, and establishes a foundation for a contextually relevant research agenda. Researchers from each country can use the scoping review findings to pinpoint and prioritise locally relevant research questions and ideas. Additionally, this thesis can guide future implementation studies aimed at developing specific interventions, offering a clear framework for the development process and lessons that can be applied to similar projects at both national and regional levels. The developed service provides a foundation for future implementation and evaluation efforts in KSA.

Building on the findings of this thesis, several directions and opportunities for future research have been identified. Given that this thesis did not include piloting or real-world evaluation,

and that the current work assesses perceived outcomes only, future research should prioritise piloting and rigorous evaluation of the service before scale-up. Moreover, since patients/service end users were not involved in the current project, the piloting phase is recommended to include their input to assess their experience and satisfaction, thereby informing necessary modifications before scale-up. For example, their experiences may reveal determinants of implementation to consider in future efforts, such as screening duration and intervention quality.

It is recommended to use a comprehensive evaluation framework to assess all types of outcomes, and from multiple perspectives, including implementation, service, and service users' outcomes (discussed in Chapter 3) (295, 296), as well as humanistic, clinical, and economic outcomes (377). The recommended evaluation frameworks and methodologies for each evaluation phase are discussed in the following subsections:

6.4.2.1 *Piloting phase recommendations*

The findings of this project and prior national literature recommended that the service initially be piloted in selected areas before large-scale implementation. Previous national studies recommended initially piloting the service in large chain pharmacies, given their established infrastructure and organisational supports, which enhance operational readiness and facilitate service implementation (145, 244). However, it is also important to consider piloting the service in other independent pharmacies and diverse socioeconomic areas (378). Piloting the service in various settings will enable greater variation in workflows, staffing, infrastructures, and patient volumes, while also capturing a more diverse patient population in terms of demographics and socioeconomic status (379). Therefore, ensure equity and generalisability of findings (378).

The pilot phase should aim to assess feasibility, acceptability, and operational practicality in real-world settings before large-scale implementation. Although this project has successfully identified implementation strategies, these strategies should be further refined and informed through the pilot, ensuring that any barriers related to workflow integration, staff training, resource allocation, and stakeholder engagement are carefully addressed prior to large-scale implementation.

An evaluation framework, such as RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance), is recommended to ensure a comprehensive assessment (Table 6.1). The RE-AIM framework is a commonly used evaluation framework that focuses on outcomes at all levels, including service users, providers, and settings (295, 298). This multi-level evaluation strengthens external validity by examining who is reached, how the intervention

performs in routine practice, and whether it can be adopted and sustained within existing healthcare structures, thereby supporting scalability. In addition to the evaluation framework, a rigorous methodological approach is required to support internal validity. A mixed-methods design combining quantitative indicators (e.g., recruitment rates, number of high-risk patients identified, consultation duration, intervention uptake) with qualitative feedback (e.g., patients' and pharmacists' satisfaction and experience) is recommended (243, 298). More detailed explanations of the recommended framework and methodologies are presented in Table 6.2.

Table 6.1. RE-AIM outcomes and examples indicators for each outcome (296, 299)

RE-AIM Outcomes (type)	Examples Indicators
Reach (implementation outcome)	The number and proportion of the target population who receive the screening service (recruitment rates).
Effectiveness (service and service users' outcomes)	Clinical effectiveness: number of high-risk patients identified, number of referred patients, referral uptake, improvement in clinical measures for modifiable risk factors (e.g., BP, BG, and lipid levels), improvement in lifestyle behaviour, improvement in medication adherence, reduction in complications and disease progression. Humanistic (service users reported) effectiveness: satisfaction, improvement in public awareness and health knowledge. Economic effectiveness: lower healthcare costs
Adoption (implementation outcome)	The number and proportion of pharmacies that adopt the screening service, the number and proportion of pharmacists trained and actively delivering the service, and the characteristics of adopting settings.
Implementation (implementation outcome)	Fidelity and adherence to the screening protocol (e.g., % of steps completed correctly and as intended), duration of screening, used resources, any required modifications and adaptations, pharmacists' acceptability, experience and perceived operational barriers and facilitators.
Maintenance (implementation outcome)	Number of patients engaging with long-term follow-up; number of pharmacies integrating the service into routine practice.

6.4.2.2 Implementation and evaluation phase recommendations

In addition to small-scale piloting of the service, findings from current projects and prior national literature also suggest the need for ongoing evaluation to build evidence of its benefits (145, 244). It was recommended that the service be comprehensively assessed for

both short-term (e.g., reductions in risk factors and patient-reported benefits and satisfaction) and long-term outcomes (e.g., reductions in national CVD-related mortality and hospital admission rates, and cost savings) (145). Therefore, this implementation and evaluation phase should aim to scale and optimise service delivery, and to assess service effectiveness, scalability, and sustainability. As in the pilot phase, the RE-AIM framework and mixed-methods approach are recommended for comprehensive service evaluation, combining quantitative and qualitative indicators to assess outcomes across multiple levels (243, 298). Various study designs are available to assess the service, including, but not limited to, pre-post studies, randomised controlled trials (RCTs), and longitudinal evaluations for long-term evaluation (243).

A hybrid implementation-effectiveness model is recommended to evaluate both the implementation process and the service's effectiveness simultaneously, thereby accelerating the translation of research findings into practice (380, 381). There are three types of this hybrid model: type 1) testing the clinical effectiveness on relevant outcomes while observing and collecting information on implementation; type 2) testing of both clinical and implementation interventions/strategies; and type 3) testing of an implementation strategy while observing and collecting information on the effectiveness of the clinical interventions on relevant outcomes (380). It is recommended that the Type 2 hybrid implementation-effectiveness model be used in future research to evaluate the developed service.

Table 6.2 provides a detailed description of future research recommendations for piloting, implementation and evaluation. These recommendations are informed by prior international piloting and evaluation studies of the community pharmacy-based CVD risk screening service (Chapter 3), current project findings, and recommendations from the UK MRC for intervention evaluation (243).

Such piloting and evaluation should be considered for any community pharmacy services, not only for the developed CVD risk screening service, as lessons learned from the pilot, implementation and evaluation phases will be critical for optimising the service, informing wider implementation, and supporting policy-level decisions to integrate the service into the broader health system.

Table 6.2. Recommendations for future piloting, implementation, and evaluation research

	Piloting	Implementation-effectiveness evaluation
Aim	Test feasibility, acceptability, potential effectiveness, and implementability	Assess implementation process, effectiveness, impact, scalability, and sustainability

Design and methods	Mixed methods: Quantitative (e.g., pilot RCTs or single-arm pre-post, survey) + Qualitative (e.g., semi-structured interviews or focus groups).	Mixed methods: Quantitative (e.g., RCTs, pre-post, longitudinal, survey) + Qualitative (e.g., semi-structured interviews or focus groups).
Setting	Small scale: selected community pharmacies, in various socioeconomic levels (rural and urban).	Larger scale: expanded set of community pharmacies in various socioeconomic levels (rural and urban).
Participants	Key stakeholders: patients/service users, providers (pharmacists, physicians, technicians/assistants), administrators and funder representatives.	
Evaluation Framework	RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance). Refer to Table 6.1 for examples of outcome measures and indicators for each outcome.	

6.5 Strengths and limitations

6.5.1 Strengths

A key strength of this thesis is its evidence-based and experience-based foundation, drawing on both national/region-specific evidence and international literature, as well as local stakeholders' experience. This co-design approach ensured that the study design and proposed service model were informed by best practices while remaining reflective of the local healthcare context, cultural considerations, and system-level realities within KSA. Incorporating regional evidence enhances the relevance, transferability, and potential scalability of the findings across similar healthcare settings.

Another notable strength of this thesis is the use of a two-consensus, iterative methodological approach, which enabled systematic design and refinement of the service through structured expert engagement (250, 301). This iterative process facilitated convergence of expert opinion, minimised individual bias, and enhanced the credibility and robustness of the final decision (243, 245). Repeated rounds of feedback ensured that areas of disagreement were carefully explored and that consensus was achieved through informed deliberation rather than single-point agreement.

Additionally, the methodological approach is further strengthened by its grounding in implementation science frameworks, which guided the service development process throughout the project. By applying implementation science principles, the thesis considers contextual factors and determinants for service adoption, increasing the likelihood that the proposed intervention can be successfully integrated into routine community pharmacy practice.

Furthermore, the sufficient response rate and the diversity of stakeholders involved across project phases strengthen the validity and reliability of the findings. A high level of engagement indicates strong stakeholder interest in the project and decreases the risk of non-response bias, increasing confidence that the results accurately represent the target experts.

Moreover, this project offers a comprehensive service design that extends beyond the core components to systematically address operational and system-level priorities. These include recruitment strategies, funding mechanisms, screening tools, referral pathways, implementation strategies, and evaluation considerations. By addressing multiple levels of service delivery, this thesis presents a well-developed, implementation-ready service model that enhances its feasibility, scalability, and integration with the existing health system. This comprehensive approach strengthens the translational value of the research.

6.5.2 Limitations

Despite these strengths, several limitations should be acknowledged. Although multidisciplinary experts and key stakeholders were included throughout the project, physician participation was relatively low compared with that of other professionals, with the highest dropout rate observed among physicians. This may be explained by their demanding workloads as frontline practitioners, long working hours, time constraints, and competing professional responsibilities, which may have limited their ability to complete all stages of the study. This limited physicians' participation may have reduced the breadth of clinical perspectives, particularly regarding interprofessional collaboration and referral pathways. Nevertheless, the relatively high participation of clinical pharmacists helped ensure that strong clinical perspectives were represented throughout the project. To further address this limitation, future research should implement targeted physician engagement strategies, including early involvement in the study design phase, clarification of roles, and establishment of clear interprofessional collaboration.

Furthermore, other healthcare providers who could influence or support service delivery, such as pharmacy technicians, were not included, nor were health insurance or payer representatives, whose input could have strengthened considerations regarding reimbursement, sustainability, and system-level integration. To mitigate this limitation, future research should broaden stakeholder involvement to include pharmacy technicians and representatives of the service funder.

Another limitation concerns stakeholder selection, as participants were not recruited based on years of professional experience. Differences in experience levels may influence

perspectives on service. However, including stakeholders with varied experience also represents a strength, as it reflects the diversity of real-world practice. Importantly, the high level of consensus achieved despite this variation suggests that the proposed service model and priorities are acceptable across different professional backgrounds and experience levels.

6.6 Reflexivity

Reflexivity is defined as “a set of continuous, collaborative, and multifaceted practices through which researchers self-consciously critique, appraise, and evaluate how their subjectivity and context influence the research processes”(382). The benefit of this process is that it makes these influences transparent by acknowledging them, thereby strengthening methodological rigour and interpretive credibility. Guided by Walsh’s framework (383), reflexivity in this thesis is considered across four interrelated dimensions: personal, interpersonal, methodological, and contextual, which are discussed in the subsections below.

6.6.1 Personal reflexivity:

My professional background as a pharmacist and my academic degree in public health have shaped my understanding of pharmacists’ potential roles in public health services and research, helping me to choose this topic and recognise the importance of this project. However, my limited real-world practice experience and lack of prior exposure to community pharmacy practice reduced the influence of personal experience-based assumptions and professional preconceptions. As a result, I relied solely on evidence and participants’ perspectives, allowing the findings and service design to be driven primarily by data rather than by personal views or self-practice bias. Additionally, undertaking this project independently as a PhD student influenced the quality of the work by fostering a high level of personal responsibility, motivation, and engagement with each stage of the research process. Being an independent researcher required me to thoroughly learn, apply, and document all methodological decisions, supporting transparency, methodological rigour, and the overall quality of the study.

6.6.2 Interpersonal reflexivity:

My limited prior experience working within the local healthcare system and my relatively limited professional relationships with community pharmacists, physicians, and other key stakeholders initially posed challenges for participant access and recruitment. The absence of direct professional contact with these groups made outreach and engagement more time-consuming and required additional effort. At the same time, my limited professional connections may have helped minimise selection bias by reducing reliance on pre-existing

relationships in participant recruitment. This supports the inclusion of participants who were more likely to express their views openly and independently, without feeling pressure to align their responses with my perceived expectations.

On the other hand, my position within academia and my involvement in clinical pharmacy networks and voluntary professional groups facilitated access to clinical pharmacists who had established relationships with physicians, which later supported the dissemination of the study and helped identify other relevant stakeholders. Furthermore, my active participation in national conferences in KSA and discussions with local experts contributed later to the development of professional relationships with key stakeholders. Overall, this highlights how my positionality both positively and negatively influenced the recruitment, reinforcing the need to allocate additional time to relationship-building in similar future research. Over the course of the project, sustained engagement with stakeholders strengthened my professional networks, which is expected to facilitate more efficient and broader participant recruitment in future research and during the service's piloting and evaluation phases.

6.6.3 Methodological reflexivity:

Following the UK MRC guidelines and an implementation science framework, the study design was well-guided, ensuring the selection of appropriate methods and the development of high-quality services. Validation and piloting of the study materials and processes with other researchers from KSA minimised the risk of subjectivity, self-bias and errors. Piloting the NGT meeting and the e-Delphi questionnaires contributed to their success by identifying and addressing potential errors in advance and reducing the risk of participant misunderstanding. My training in moderating focus group discussions, combined with the involvement of qualitative experts as facilitators, further enhanced the quality of the discussions during the NGT meeting. Additionally, validating qualitative data with other researchers strengthened the credibility and trustworthiness of the findings and reduced subjectivity in their interpretation.

Although I had prior knowledge and experience in both qualitative and quantitative research, I had no previous experience with consensus methods. Learning and applying these techniques required considerable time and effort to read, understand, and identify the most suitable approach for this project. This experience reinforced the importance of being aware of a broad range of research methodologies and critically selecting the most appropriate methods, as well as emphasising the significance of collaboration in research to learn from each other's experiences, ensuring methodological rigour and alignment with the research objectives.

6.6.4 Contextual reflexivity

Being from KSA and aware of the country's vision and public health priorities shaped the choice of research topic, enhanced my motivation to complete the project, and informed the development of a service model that is contextually relevant. My understanding of cultural norms and other local contextual factors also facilitated participant recruitment and study implementation. For example, knowing the most appropriate ways and channels to contact participants, accounting for holidays and religious observances, and anticipating periods that could impact response rates. Integrating this contextual knowledge into the planning of data collection, questionnaire dissemination, and analysis schedules helped ensure the study progressed efficiently and was completed on time.

While my local knowledge facilitated recruitment and planning, it also required me to remain cautious against assuming that all participants would respond or behave as I expected, ensuring that data collection and interpretation were guided by participants' actual responses rather than my cultural assumptions.

6.7 Conclusion

Further efforts are needed to expand community pharmacists' role in the prevention and management of chronic NCDs. This project successfully developed an evidence-based, consensus-driven, and context-specific CVD risk-screening service, aligned with national public health priorities. The study demonstrated that such a service is perceived as feasible, acceptable, and has the potential to generate positive outcomes. The model offers a practical framework for integrating preventive CVD risk screening into community pharmacy practice in KSA. Although the service was well received by all stakeholders, future initiatives should focus on engaging service users and comprehensively evaluating community pharmacy services before and after wider implementation, considering outcomes from multiple perspectives. Additionally, investing in effective multifaceted implementation strategies at an early stage should be considered for the national rollout of CVD risk screening and other extended services.

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Appendices

Appendix A: Chapter 2 appendices

Appendix A1: Search strategy

A1.1. Embase database

#	Search terms	Results (25 July 2023)	Results (06 December 2024)
1	exp "pharmacy (shop)"/	(29393)	(33948)
2	community pharmacy.mp.	(9438)	(10348)
3	community pharmacist.mp.	(4490)	(5327)
4	community pharmacist/	(2724)	(3516)
5	retail pharmacy.mp.	(628)	(686)
6	private pharmacy.mp.	(159)	(180)
7	pharmaceutical care services.mp.	(411)	(459)
8	exp pharmaceutical care/	(23364)	(25297)
9	community pharmacy-led intervention.mp.	(3)	(4)
10	Extended community pharmacy services.mp.	(10)	(14)
11	Extended community pharmacy.mp.	(11)	(19)
12	community pharmacist-led intervention.mp.	(10)	(14)
13	patient-centered care.mp.	(9996)	(11960)
14	patient-oriented care.mp.	(173)	(187)
15	dispensing services.mp.	(97)	(110)
16	non-dispensing.mp.	(115)	(122)
17	community pharmacist-led.mp.	(134)	(153)
18	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17	(70249)	(79136)
19	GCC.mp.	(4160)	(4660)
20	Gulf Cooperation Council Countries.mp.	(181)	(231)
21	UAE.mp.	(8356)	(9475)
22	KSA.mp.	(2618)	(2965)
23	KSA.mp.	(36226)	(41266)
24	United Arab Emirates.mp.	(6199)	(7079)
25	united arab emirates/ or exp abu dhabi/ or exp ajman/ or exp dubai/ or exp sharjah/	(5476)	(6306)
26	Qatar.mp.	(5526)	(6431)
27	Bahrain.mp.	(2471)	(2768)
28	Kuwait.mp.	(7440)	(8004)
29	Oman.mp.	(5119)	(5799)
30	Gulf region.mp.	(743)	(834)
31	Gulf countries.mp.	(495)	(572)
32	19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31	(69469)	(78372)
33	18 and 32	(709)	(867)

A1.2. Ovid MEDLINE database

#	Search terms	Results (25 July 2023)	Results (06 December 2024)
1	community pharmacy.mp.	(8304)	(9119)
2	"pharmacy (shop)".mp.	(12)	(12)
3	community pharmacist.mp.	(1174)	(1326)
4	retail pharmacy.mp.	(307)	(346)
5	exp Community Pharmacy Services/	(5758)	(6169)
6	private pharmacy.mp.	(85)	(97)
7	pharmaceutical care services.mp.	(221)	(244)
8	exp Community Pharmacy Services/	(5758)	(6169)
9	community pharmacy-led intervention.mp.	(2)	(3)
10	Extended community pharmacy services.mp.	(4)	(8)
11	community pharmacist-led intervention.mp.	(7)	(10)
12	patient-centered care.mp.	(27867)	(30671)
13	patient-oriented care.mp.	(124)	(134)
14	dispensing services.mp.	(67)	(75)
15	non-dispensing.mp.	(79)	(82)
16	community pharmacist-led.mp.	(76)	(92)
17	GCC.mp.	(3077)	(3435)
18	Gulf Cooperation Council Countries.mp.	(173)	(220)
19	UAE.mp.	(5710)	(6618)
20	KSA.mp.	(1975)	(2312)
21	KSA.mp.	(31079)	(36664)
22	United Arab Emirates.mp.	(4528)	(5232)
23	Qatar.mp.	(3547)	(4193)
24	Kuwait.mp.	(5252)	(5592)
25	Bahrain.mp.	(1446)	(1670)
26	Oman.mp.	(4335)	(4866)
27	Gulf region.mp.	(542)	(601)
28	Gulf countries.mp.	(359)	(405)
29	exp Pharmaceutical Services/	(81011)	(84505)
30	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 29	(111412)	(118164)
31	17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28	(54845)	(63393)
32	30 and 31	(481)	(576)

A1.3. Scopus database

Search terms	Results (25 July 2023)	Results (06 December 2024)
(TITLE-ABS-KEY ("community pharmacy" OR "community pharmacist" OR "pharmaceutical care services" OR "community pharmacist-led" OR "Extended community pharmacy services" OR "patient-centered care" OR "patient-oriented care" OR "dispensing services" OR "non-dispensing" OR "community pharmacist-led intervention" OR "community pharmacist-led services") AND TITLE-ABS-KEY ("GCC " OR "Gulf Cooperation Council Countries" OR "UAE" OR "KSA" OR "KSA" OR "United Arab Emirates" OR "Qatar" OR "Bahrain" OR "Kuwait" OR "Oman" OR "Gulf region" OR "Gulf countries")) AND (LIMIT-TO (LANGUAGE , "English"))	480	599

A1.4. EBSCOhost (CINHAL)

#	Search terms	Search type	Results (25 July 2023)	Results (06 December 2024)
S1	community pharmacy	Advanced search, Expanders	9714	9902
S2	community pharmacists	Advanced search, Expanders	5994	6196
S3	community pharmacist intervention	Advanced search, Expanders	1450	1502
S4	community pharmacist-led	Advanced search, Expanders	284	305
S5	community pharmacist-led intervention	Advanced search, Expanders	170	177
S6	retail pharmacy	Advanced search, Expanders	7826	8087
S7	private pharmacy	Advanced search, Expanders	877	863
S8	pharmaceutical care services	Advanced search, Expanders	3882	3944
S9	Extended community pharmacy services	Advanced search, Expanders	81	89
S10	patient centered care	Advanced search, Expanders	46523	50273
S11	patient oriented care	Advanced search, Expanders	5046	5232
S12	dispensing services	Advanced search, Expanders	1543	1590
S13	non-dispensing	Advanced search, Expanders	36	39
S14	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13	Advanced search, Expanders	68683	72976
S15	GCC	Advanced search, Expanders	366	393

S16	Gulf Cooperation Council Countries	Advanced search, Expanders	133	152
S17	uae or united arab emirates or dubai or abu dhabi	Advanced search, Expanders	2826	2956
S18	ksa or kingdom of KSA	Advanced search, Expanders	927	993
S19	KSA	Advanced search, Expanders	8201	9297
S20	Qatar	Advanced search, Expanders	1406	1560
S21	Bagrain	Advanced search, Expanders	538	564
S22	Kuwait	Advanced search, Expanders	1538	1600
S23	Oman	Advanced search, Expanders	1582	1477
S24	Gulf region	Advanced search, Expanders	351	370
S25	Gulf countries	Advanced search, Expanders	384	415
S26	S15 OR S16 OR S17 OR S18 OR S19 S20 OR S21 OR S22 OR S23 OR S24 OR S25	Advanced search, Expanders	16008	17307
S27	S14 AND S26	Advanced search, Expanders	302	343

Appendix A2: Data charting instrument

Study Characteristics								
Author (year of publication)	Country	Aim	Study design (start and end date)	Study setting	Participants/ method of recruitment	Additional methodological details	Inclusion and exclusion criteria	Demographics

Service Characteristics					
Type of service/ intervention	Service fee	Stage of implementation	Service targeted population	Service targeted health issue/ condition	Service required time/ duration

Study Findings								
Response rate	Outcome measures					Significant findings	Summary of findings	Conclusion and recommendations
	Knowledge	Attitude (satisfaction, willingness)	Practice	Clinical outcomes	Economic outcomes			

Appendix A3: Detailed study characteristics

Author (year) (ref)	Country (study period)	Study aim	Study design	Setting/ geographical area	Number and type of participants
Alaqueel and Abanmy (2015) (111)	KSA (April -May 2012)	Investigate the counselling practices of community pharmacists in Riyadh when dispensing OTC and prescription-only medicines without a prescription.	A simulated patient visits and a cross-sectional self-reported questionnaire-based study.	community pharmacies in Riyadh city: north, south, west, east, and central.	• 161 simulated patient visits • 350 community pharmacists
Alfadi et al. (2018) (115)	KSA (April -May 2017)	Evaluate the counselling practices of the community pharmacists in Qassim region.	An observational study (observing and evaluating the counselling service)	Community pharmacies in Qassim region.	11 community pharmacies; 235 evaluation forms were completed.
Al Qarni et al. (2020) (118)	KSA (August - October 2017)	Evaluate real counselling practices of community pharmacies in Bisha.	A cross-sectional study of simulated patient visits.	Community pharmacies in Bisha.	73 pharmacies were visited.
Fathelrahman (2021) (54)	KSA (August - November 2020)	Assess medical device-related counselling practices among community pharmacists using a large nationwide sample.	A cross-sectional self-reported questionnaire-based study.	Different regions of KSA.	1006 community pharmacists.
Khojah (2019) (116)	KSA (July 2018)	Investigate the level of counselling regarding the effects of sedating antihistamines on driving skills provided by private community pharmacies.	An observational study used Mystery shoppers' visits.	Community pharmacies in Madinah.	88 community pharmacies.

Mobark et al. (2019) (163)	UAE (March -May 2018)	Evaluate community pharmacists' current practice of dispensing and counselling on hormonal contraceptives.	A simulated patient method.	Independent and franchised chain community pharmacies in seven emirates: Abu Dhabi, Dubai, Sharjah, Ajman, Umm Al Quwain, Ras Al Khaimah, and Fujairah	201 community pharmacies.
Boura et al. (2023) (167)	UAE (November 2020; 3 weeks)	Evaluate community pharmacists' counselling and dispensing practices regarding complaints of Gastroesophageal Reflux Disease, including recommending an appropriate treatment to prevent possible drug-drug interaction.	A simulated patient method (an observer evaluated the practice without engagement).	Community pharmacies in Ajman and Sharjah.	150 community pharmacies.
Rashid et al. (2020) (164)	UAE (June - September 2019)	Evaluate the community pharmacist's assessment of patient eligibility for safe use of isotretinoin and the quality of counselling.	An observational cross-sectional study using simulated patient method.	Community pharmacies across the UAE.	400 community pharmacies.
Makhlouf et al. (2021) (201)	Qatar (June - August 2019)	Assess the determinants of community pharmacists' information gathering and counselling practices during the management of minor ailments.	A cross-sectional self-reported questionnaire-based study.	Chain and independent pharmacies in Qatar.	282 community pharmacists.

Ibrahim et al. (2016) (214)	Qatar (NR)	Evaluate community pharmacists' prescribing, labelling, dispensing, and counselling practices for acute community-acquired gastroenteritis.	A non-traditional questionnaire, and simulated patient method: Face-to-Face (n=15) vs. Telephone-call (n=15)	Community pharmacies in Doha, the capital city.	30 community pharmacies.
Kashour et al. (2016) (114)	KSA (NR)	Determine the prevalence of prescription medication sales and explore how community pharmacists assess and counsel patients with acute cardiac conditions.	A cross-sectional observational design using the simulated patients method.	Community pharmacies in the two largest cities in KSA: Riyadh and Jeddah.	600 community pharmacies.
Alkherat and Alkhalidi (2022) (165)	UAE (July - September 2021)	Evaluate and compare the knowledge and counselling practices of community and hospital pharmacists regarding warfarin.	A cross-sectional self-reported questionnaire-based study.	Hospital and community pharmacies.	400 pharmacists (193 community pharmacists).
Alotaibi and Abdelkarim (2015) (112)	KSA (October - November 2013)	Explore consumers' perceptions of community pharmacists' roles in the dispensing process.	A face-to-face interview questionnaire-based study.	Community pharmacies in Dawadmi, Riyadh province.	100 consumers.
Alomar et al. (2011) (192)	UAE (January - April 2010)	Assess community pharmacists' behaviour towards antidiabetic and antiasthma prescriptions.	A simulated patient method.	Abu Dhabi, Dubai, Sharjah, and Fujairah.	194 community pharmacies.
AlShayban et al. (2020) (117)	KSA (March - April 2019)	Evaluate patients' satisfaction and willingness to pay for pharmacist counselling in Saudi healthcare settings.	A cross-sectional questionnaire-based study.	Hospital and community pharmacies in three cities: Khobar, Dammam, and	531 patients.

Qatif, in the Eastern Province.					
Al-Tannir et al. (2016) (113)	KSA (March 2014)	Evaluate the satisfaction of Saudi adults with the healthcare services offered by community pharmacies.	A cross-sectional questionnaire-based study.	Community pharmacies in different areas of Riyadh.	500 consumers.
Matowe et al. (2008) (213)	Kuwait (January - June 2005)	Evaluate the types of BP devices available to consumers in Kuwait and assess the practice and advice of pharmacists regarding BP devices and self-monitoring.	A cross-sectional self-reported questionnaire-based study.	Community pharmacies in: Ahmadi, Farwaniya, Capital, Hawalli and Jahra.	174 community pharmacists.
Alzubaidi et al. (2019) (170)	UAE (December 2017 - May 2018)	Test the feasibility of pharmacist-delivered diabetes and CVD risk screening model in the UAE.	A feasibility study on three phases: development, implementation, and evaluation.	12 community pharmacies in Dubai, Sharjah, and Ajman.	120 consumers.
Almansour et al. (2020) (124)	KSA (August - November 2017)	Explore the perspectives of hospitals and community pharmacists on potential roles in CVD risk screening, and propose interventions to facilitate the development of pharmacist-delivered models for CVD risk prevention and management services in KSA.	A qualitative study using semi-structured in-depth interviews and focus group discussions.	Hospital and community pharmacies.	50 pharmacists (24 community pharmacists).

Alzubaidi et al. (2021) (172)	UAE (NR)	Evaluate the capacity of a locally tailored community pharmacist-delivered diabetes and CVD risk screening model in identifying and referring at-risk individuals to physicians for a follow-up appointment.	A cross-sectional observational study.	12 community pharmacies in Dubai, Sharjah, and Ajman.	568 pharmacy consumers.
Almansour et al. (2021) (144)	KSA (December 2018 - February 2019)	Explore policymaker and industry leader perspectives and recommendations around the development of high-quality CVD risk prevention (screening and management) services in community pharmacies.	Qualitative study using semi-structured interviews.	NA	23 policymakers (e.g., the Manager/CEO/President).
Alzubaidi et al. (2020) (171)	UAE (January 2019)	Explore the views and experiences of pharmacists participating in the UAE PHARMASCREEN trial.	Qualitative study using in-depth face-to-face individual interviews.	NA	12 community pharmacists participated in PHARMASCREEN trial.
Almansour et al. (2020) (145)	KSA (September - November 2017)	Explore health consumers' experiences with the current role of pharmacists in KSA and their perspectives on possible future pharmacy services, with particular focus on CVD and related risks.	A qualitative study using semi-structured interviews.	The capital city (Riyadh), and Najran, a less developed city in the South of KSA.	25 consumers.

Alsheikh and Alasmari (2022) (142)	KSA (November 2020 - January 2021)	Assess community pharmacists' knowledge, attitudes, and practices regarding pharmacovigilance and ADR reporting.	A cross-sectional self-reported questionnaire-based study.	Different regions.	1172 community pharmacists.
Abdulsalim et al. (2023) (143)	KSA (September 2020 - April 2021)	Explore community knowledge, attitudes, and practices regarding Pharmacovigilance, and assess the barriers to reporting ADRs.	A cross-sectional self-reported questionnaire-based study.	Qassim region.	209 community pharmacists.
Rabba and Ain (2015) (141)	KSA (September 2013 - January 2014)	Evaluate knowledge, attitude, behaviour and perception of ADRs reporting among community pharmacists.	A cross-sectional self-reported questionnaire-based study.	community pharmacies in Al-Kharj city.	53 community pharmacists.
Qassim et al. (2014) (186)	UAE (In 2013)	Evaluate the knowledge, attitudes, and practices toward ADRs reporting among community pharmacists.	A cross-sectional self-reported questionnaire-based study.	Community pharmacies in Ajman and Sharjah.	223 community pharmacists.
Alshahrani et al. (2022) (133)	KSA (January - March 2021)	Determine the Saudi public's attitude and willingness to receive the COVID-19 vaccine through community pharmacists.	An analytical cross-sectional, self-reported questionnaire-based study.	NA	415 Public participants.

El Hajj et al. (2023) (215)	Qatar (April - December 2020)	Assess community pharmacists' practices in advocating for and promoting adult vaccination, and characterise and quantify potential determinants of their participation in adult vaccination as vaccine administrators, based on the theoretical domains framework (TDF).	A cross-sectional, self-reported questionnaire-based study	Community pharmacies in Qatar.	271 community pharmacists.
AlMukdad et al. (2021) (203)	Qatar (April 2018 - June 2019)	Explore community pharmacists' attitudes, practices, perceived competence, and role in weight management services.	A mixed-method explanatory sequential design: (1) quantitative data (cross-sectional questionnaire); (2) qualitative data (individual and focus group interviews).	Community pharmacies in Qatar.	• Questionnaire: 270 pharmacists. • Interview: 15 pharmacists.
Awad and Waheedi (2012) (210)	Kuwait (NR)	Describe the self-reported practices of community pharmacists regarding counselling patients with obesity, identify the barriers to obesity counselling, and explore strategies to overcome these barriers.	A descriptive cross-sectional, self-reported questionnaire-based study.	Five governorates: Capital, Al-Ahmadi, Al-Farwaniyah, Hawalli and Al-Jahra.	206 community pharmacies.
Abduelkarem et al. (2012) (175)	UAE (January - June 2006)	Explore the new role of community pharmacists in wound healing in the UAE, and investigate the current	A cross-sectional, self-reported questionnaire-based study.	Community pharmacies in Dubai.	60 community pharmacists.

level of pharmacists' wound management experience and their views on this role.					
Makhlouf et al. (2021) (200)	Qatar (September - December 2019)	Assess community pharmacists' self-perceived competency to manage fourteen common minor ailments and identify their significant predictors.	A cross-sectional, self-reported questionnaire-based study.	Chain and independent pharmacies in Qatar.	282 community pharmacists.
Mohamed Ibrahim et al. (2018) (199)	Qatar (February - May 2013)	Assess: (i) the extent to which community pharmacists fulfil their roles in managing respiratory conditions; (ii) pharmacists' ability to differentiate between common cold and allergic rhinitis; (iii) their therapeutic recommendations and dispensing practices; (iv) their labelling and counselling practices; and (v) medicines prescribed and costs charged to the patient.	An observational study using simulated clients methodology.	Community pharmacies in Doha, Qatar.	25 community pharmacies.
Almaghaslah et al. (2022) (126)	KSA (June - September 2019)	Assess the role of community pharmacists in providing oral healthcare advice in Asir region.	A prospective cross-sectional, self-reported questionnaire-based study.	Community pharmacies across the Asir region.	202 community pharmacists.

Madkhali and Alzahrani (2022) (127)	KSA (October - December 2020)	Assess community pharmacists' perceptions of anaemia management practices and barriers.	A descriptive cross-sectional, self-reported questionnaire-based study.	Jazan region.	324 community pharmacists.
Al-Saleh et al. (2017) (125)	KSA (NR)	Assess how often patients seek advice on oral health issues at community pharmacies and examine the prevalence of the most common oral health-related complaints encountered by community pharmacists, along with the recommendations for dental pain and frequently requested dental products.	A cross-sectional, self-reported questionnaire-based study.	The Eastern Province.	279 community pharmacists.
Merghani Ali et al. (2022) (128)	KSA (August - December 2021)	Assess community pharmacists' involvement in the management of acute childhood diarrhoea in Jazan Province by examining their knowledge, attitudes, and practices.	A cross-sectional, self-reported questionnaire-based study and simulated patient visits.	Community pharmacies in Jazan.	• 303 community pharmacists • 100 simulated patient visits
Akkad et al. (2022) (184)	UAE (February - November 2020)	Assess the practice of community pharmacists regarding counselling and OTC medication dispensing to pregnant and lactating women.	A cross-sectional descriptive self-reported questionnaire-based study.	Chain pharmacies in Sharjah.	256 community pharmacists.

Kubaisi et al. (2022) (166)	UAE (June - September 2019)	Assess the effectiveness of the pseudo customer model on community pharmacists' care services (counselling, advice, and management) for migraine during pregnancy.	A cross-sectional observational study (pseudo customer visits).	Community pharmacies in Dubai, Sharjah, and Ajman.	200 community pharmacists.
Albassam and Awad (2018) (212)	Kuwait (March - December 2015)	Identify the services offered by community pharmacists concerning self-care during pregnancy and lactation, evaluate the pharmacists' advice for treating pregnancy-related and lactation-related conditions, and explore their views about self-care during pregnancy and lactation.	A cross-sectional, self- reported questionnaire- based study.	Community pharmacies in six governorates in Kuwait.	192 community pharmacists.
Al Mazrouei et al. (2021) (180)	UAE (August - October 2020)	Examine how often, the nature, and the clinical importance of pharmacist interventions on OTC medicines with abuse potential across community pharmacies, both with and without virtual care, and assess whether information technology can assist pharmacists in detecting potential abuse or misuse of OTC medications and if	A prospective observational comparative study.	community pharmacies in the UAE: capital, central region, and northern region.	12 community pharmacies (6 operating virtual pharmacy care, and 6 community pharmacies operating traditional pharmacy services)

		the introduction of virtual services can enhance the clinical outcomes of pharmacist interventions on OTC abuse and misuse.			
Almaghaslah et al. (2022) (138)	KSA (January - March 2022)	Assess patient satisfaction with the e-prescription service.	A cross-sectional, self-reported questionnaire-based study.	NA	400 patients.
Alshammari et al. (2023) (139)	KSA (2017 and 2021)	Evaluate the economic impact of implementing the new digital health transformation initiative (Wasfaty service) on the health care budget using diabetes mellitus as an example.	A cost analysis compared the pre-Wasfaty and Wasfaty periods in terms of direct medical costs.	NA	NA (Data sources were the Ministry of Health)
Mohamed Ibrahim et al. (2021) (181)	UAE (March - July 2020)	Evaluate the predictors for effective tele-pharmacy services by exploring factors associated with pharmacist interventions and dispensing errors in community pharmacies.	A prospective observational study (direct observation).	community pharmacies across Abu Dhabi, the northern region, and the central region.	52 community pharmacies with and without tele-pharmacy services (26 for each group)
Khardali et al. (2022) (137)	KSA (January - March 2022)	Explored the community pharmacists' perception of the use of Wasfaty services, benefits, and barriers.	A qualitative method using semi-structured interviews.	Community pharmacies that adopted and used the Wasfaty services in Jazan.	9 community pharmacists who had worked in pharmacies that adopted and used the Wasfaty services in their everyday work

Ibrahim et al. (2022) (182)	UAE (June 2021 - August 2022)	Assess the effectiveness of remote pharmaceutical care in managing hypertension through a 12-month follow-up in the intervention group (tele-pharmacy services) and the control group (traditional pharmacy).	2-arm follow-up of randomised clinical trial.	Community pharmacies in the UAE	• 16 community pharmacies • 239 patients with uncontrolled HTN • Intervention arm (8 tele-pharmacy): 119 patients • Control arm (8 standard pharmacy): 120 patients
Jirjees et al. (2022) (183)	UAE (December 2019 -August 2020)	Explore changes in procedures within community pharmacies in response to the COVID-19 pandemic, while assessing the quality, frequency, and barriers to delivering telepharmacy services in the UAE.	A cross-sectional, self-reported questionnaire-based study, divided into three periods: “before the lockdown”, “during the lockdown”, and “after the lockdown”.	Community pharmacies in the UAE.	391 community pharmacists.
Almalag et al. (2022) (140)	KSA (May - November 2021)	Evaluate the community pharmacists' knowledge, willingness, and readiness to prescribe oral contraceptives.	A cross-sectional, questionnaire-based study.	Community pharmacies across Riyadh: the Northern, Southern, Western, Eastern, and Central suburbs.	347 community pharmacists.
Sadeq et al. (2022) (185)	UAE (September - December 2019)	Evaluate community pharmacists' perceptions and attitudes toward independent prescribing, and their perceived ability	A cross-sectional, self-reported questionnaire-based study.	Community pharmacies in Al-Ain City, one of the largest cities in the UAE	200 community pharmacists.

		to diagnose and manage common health problems.			
Alzahrani et al. (2023) (131)	KSA (March - September 2022)	Explore the confidence and the current involvement of community pharmacists in providing smoking cessation services and their perceived barriers to successful smoking cessation.	A cross-sectional, self-reported questionnaire-based study.	All regions.	370 licensed community pharmacists.
Alzubaidi et al. (2022) (178)	UAE (NR)	Evaluate the quality of community pharmacists' smoking cessation counselling in the UAE.	A cross-sectional, simulated patient study.	urban community pharmacies in Sharjah city.	101 community pharmacists.
El Hajj et al. (2012) (202)	Qatar (June - October 2010)	Determine the current smoking cessation practices of community pharmacists in Qatar, examine their attitudes toward tobacco use and smoking cessation, evaluate their perceptions of performing professional roles with respect to smoking cessation, and assess their perceived barriers to smoking cessation counselling.	A descriptive cross-sectional, self-reported questionnaire-based study.	community pharmacies in Qatar.	127 community pharmacists.

Babiker et al. (2014) (208)	Qatar (December 2012 - January 2013)	(1) assess the availability of facilities to support MUR implementation in community pharmacies in Qatar; (2) evaluate pharmacists' knowledge and self-perceived competence in providing the MUR service; (3) explore their attitudes and perceptions towards the implementation of MUR; and (4) assess their practices related to MUR.	A cross-sectional, self-reported questionnaire-based study.	Chains and independent private community pharmacies in Qatar.	220 community pharmacists.
Alfahmi et al. (2023) (134)	KSA (March - August 2021)	Explore the pharmacists' knowledge, attitude and practice regarding the existing explicit and implicit tools available to detect and prevent potential inappropriate medication (PIMs) use in older adults and the potential impact of PIM use on older adults' health.	A cross-sectional self-administered survey questionnaire.	Major public hospitals and community pharmacies in Jeddah.	157 hospital and community pharmacists.
Alshehri et al. (2022) (135)	KSA (September - March 2021)	Identify pharmacists' attitudes, subjective norms, perceived behavioural control, knowledge of MTM, and other factors influencing	A cross-sectional, self-reported questionnaire-based study.	Hospital and community pharmacies in KSA.	149 Pharmacists (64 community pharmacists).

		their intention to provide MTM services.			
Alhaddad (2019) (136)	KSA (NR)	Assess patients' experiences with services provided by community pharmacists and their perceptions of community pharmacists offering MTM services in the Western region of KSA, and their willingness to pay for the MTM programme led by community pharmacists.	A cross-sectional, questionnaire-based study.	Taif, Makkah, and Jeddah.	953 pharmacy consumers.
Khan et al. (2020) (53)	KSA (NR)	Demonstrate that retail community pharmacists could successfully recruit, engage, and counsel people with diabetes by serving as a trusted source of diabetes information, and evaluate the outcomes of "let's talk about diabetes" (LTAD) clinical programme.	Pre and post evaluation, questionnaire-based study (2–4-month follow-up).	11 Nahdi retail pharmacies in seven cities: Jeddah, Riyadh, Dammam, Hafof, Maddinah, Taouk and Abha.	2639 individuals enrolled in the LTAD programme, 1582 participated in at least one session, and of these, 1137 (71.9% of 1582) completed the follow-up questionnaire.
Abduelkarem and Sackville (2009) (169)	UAE (NR)	Examine changes in health indicators among people with type 2 diabetes mellitus: self-care activities, health-related quality of life, and patients' opinions of services provided.	Pre- and post-evaluation study (24-month follow-up).	Community pharmacies in Sharjah.	59 patients.

Katoue et al. (2013) (211)	Kuwait (July 2010 - January 2011)	Determine the community pharmacists' awareness and opinions about the metabolic syndrome, explore the services they provide for identifying and monitoring patients, and describe the current self-reported practice in the prevention and management of the metabolic syndrome.	A descriptive cross-sectional, self-reported questionnaire-based study.	Community pharmacies in Kuwait.	220 community pharmacists.
Eshbair et al. (2022) (174)	UAE (July - September 2018)	Evaluate the counselling provided by pharmacists related to diabetes self-care and lifestyle choices, and identify barriers to providing pharmaceutical care to patients.	A cross-sectional, self-reported questionnaire-based study.	Community/government, non-government, hospital pharmacies, in Abu Dhabi and Al Ain city.	300 pharmacists (112 community pharmacists).
Ibrahim and Ibrahim (2013) (177)	UAE (Over a 24-week period in 2013)	Evaluate community pharmacists' involvement in breast cancer health promotion in the UAE, assessing their attitudes toward participation, receiving continuous education, and identifying barriers to integrating such activities into daily practice.	A cross-sectional, self-reported questionnaire-based study.	Community pharmacies in Sharjah, Abu Dhabi, and Ajman.	275 community pharmacists.

El Hajj and Hamid (2013) (204)	Qatar (March - May 2009)	Assess community pharmacists' involvement in breast cancer health promotion in Qatar, examine their attitudes and knowledge, evaluate their interest in ongoing education, and identify barriers to integrating breast cancer promotion into daily practice.	A cross-sectional, self-reported questionnaire-based study.	Community pharmacies in Qatar.	195 community pharmacists.
Alshahrani and Alsheikh (2021) (129)	KSA (September 2019 - March 2020)	Measure the perception of community pharmacists in KSA towards the provision of counselling on sex education and reproductive health, including barriers to and proficiency in the delivery of services.	A cross-sectional, self-reported questionnaire-based study.	All regions.	1097 community pharmacists.
Awad and Abahussain (2010) (209)	Kuwait (December 2006 - November 2007)	Explore community pharmacists' self-reported practice in health promotion, their involvement and preparedness, their perceived barriers limiting their engagement, and their willingness to participate in continuing education programmes in health promotion.	A descriptive, cross-sectional, self-reported questionnaire-based study.	Community pharmacies within five governorates: Capital, Al-Ahmadi, Al-Farwaniyah, Hawalli and Al-Jahra.	205 community pharmacists.

Almanasef et al. (2021) (130)	KSA (September 2019 - February 2020)	Investigate the level of community pharmacists' involvement in public health activities in Asir region and examine the barriers that prevent them from practising their public health roles.	A cross-sectional, self-reported questionnaire-based study.	Asir region.	193 community pharmacists.
Al-Arifi (2008) (132)	KSA (May - September 2006)	Investigate community pharmacists' practices, counselling involvement, perceived barriers, and willingness to engage in continuing education programmes for health promotion.	A cross-sectional, face-to-face questionnaire-based study.	Community pharmacies.	41 community pharmacists.
Samorinha et al. (2022) (179)	UAE (September - December 2021)	Examine how community pharmacists in the UAE provide mental health care to individuals with mental illness, focusing on their dispensing and counselling practices, confidence levels, attitudes, and beliefs.	A mixed-methods study with a sequential exploratory design, Semi-structured qualitative interviews + a quantitative cross-sectional questionnaire.	Community pharmacies in four cities: Ajman, Dubai, Fujairah and Sharjah.	• Qualitative study: 5 CPs. • Quantitative: 252 community pharmacists.
Shami et al. (2022) (205)	Qatar (September - December 2019)	Investigate the role of Qatar community pharmacists in the treatment of depression by assessing their attitudes, practices, and perceived barriers towards depression care.	A cross-sectional, self-reported questionnaire-based study.	Community pharmacies in Qatar.	205 community pharmacists.

Siddique et al. (2022) (119)	KSA (September 2019 - May 2020)	Evaluating the knowledge, attitude, practice, and perceived barriers of community pharmacists in Qassim, toward the provision of pharmaceutical care.	A cross-sectional, self-reported questionnaire-based study.	Community pharmacies in seven cities in Qassim region.	130 community pharmacists.
Hasan et al. (2015) (188)	UAE (NR)	Determine which primary care services patients would use if provided by community pharmacies in the UAE.	A questionnaire-based study.	Public places (such as shopping malls and markets) in various emirates across the UAE.	466 pharmacy consumers.
Al-Hassan (2009) (109)	KSA (May - August 2008)	Examine pharmacists' attitudes towards their profession and identify areas for improvement.	A cross-sectional, self-reported questionnaire-based study.	chain and independent community pharmacies in Riyadh city.	186 community pharmacies.
Almanasef (2023) (22)	KSA (February - April 2022)	Evaluate the attitudes of the general public toward community pharmacy services in KSA, given the recent expansion in the services provided.	A cross-sectional, self-reported questionnaire-based study.	Five regions: Eastern Province, Riyadh, Asir, Madinah, and Northern Borders.	449 pharmacy consumers.
Rasheed et al. (2023) (23)	KSA (NR)	Evaluate the knowledge, attitude, and practices of community pharmacists in delivering patient-centred care services.	A nationwide, cross-sectional, self-reported questionnaire-based study.	Chain and independent community pharmacies.	301 community pharmacists.
Hasan et al. (2012) (162)	UAE (May - June 2009)	Identify the types and frequencies of services provided by community pharmacies in the UAE.	A cross-sectional, self-reported questionnaire-based study.	Community pharmacies in the UAE.	344 community pharmacists.

Bawazir (2004) (108)	KSA (February - May 1999)	Determine consumer attitudes towards community pharmacies in Riyadh and their preferences for introducing new services.	A cross-sectional, self-reported questionnaire-based study.	Community pharmacies in Riyadh city.	911 consumers.
Alhazmi et al. (2022) (120)	KSA (February - April 2021)	Assess the current practices of community pharmacists from their perspectives to identify potential areas for improvement that can be used to develop recommendations for policymakers.	A cross-sectional, self-reported questionnaire-based study.	All regions.	164 community pharmacists.
Palaian et al. (2022) (86)	UAE (February - April 2020)	Assess the perceptions, practices, perceived barriers, and willingness of UAE community pharmacists to provide Extended Community Pharmacy Services.	A descriptive, cross-sectional, self-reported questionnaire-based study.	Northern emirates: Sharjah, Ajman, and Um al Quwain.	195 community pharmacists.
Al-Arifi (2012) (110)	KSA (July - December 2010)	Provide guiding information about the population perception, views, and satisfaction with pharmacists' performance as health care providers in the community pharmacy.	A cross-sectional, self-reported questionnaire-based study.	Community pharmacies in Riyadh city.	125 community pharmacies 1699 pharmacy consumers.

Rayes et al. (2015) (168)	UAE (December 2013 - February 2014)	Explore community pharmacists' perceptions of their current professional role in Dubai's healthcare system.	A cross-sectional, self-reported questionnaire-based study.	Dubai.	198 community pharmacists.
Hamoudi et al. (2011) (193)	UAE (NR)	Investigate the pharmacist's role in patient counselling, evaluate their opinions on counselling, and identify potential determinants of personal consultations in the UAE.	A cross-sectional, self-reported questionnaire-based study.	Community pharmacies in Ajman and Sharjah.	80 community pharmacies, 100 pharmacists.
Alahmad et al. (2023) (191)	UAE (September - December 2019)	Explore physicians' attitudes toward expanding the role of community pharmacists to include traditional and non-traditional/advanced pharmaceutical care activities.	A cross-sectional, self-reported questionnaire-based study.	Al Ain.	229 physicians.
Panda et al. (2022) (122)	KSA (For 2 months in 2021)	Explore the perceptions and attitudes of the public towards the extended services of community pharmacies with respect to their gender, age, and education during the COVID-19 pandemic.	Institutional based, cross-sectional, self-reported questionnaire-based study.	Jouf region.	945 pharmacy consumers.

El-Kholy et al. (2022) (121)	KSA (January - June 2019)	Evaluate public perception of community pharmacists' role in providing pharmacy services and determine opinions and satisfaction with current community pharmacy services in Al-Madinah Al-Monawara.	A cross-sectional, face-to-face interview-questionnaire-based study.	Community pharmacies in Al-Madinah Al-Monawara.	1000 pharmacy consumers.
Rasheed et al. (2020) (25)	KSA (NR)	Explore key stakeholders' perspectives on the expanded role of community pharmacy in primary healthcare in KSA, and identify drivers, motivators, and facilitators for transitioning community pharmacies toward providing patient-centred care.	Qualitative research.	NA	15 stakeholders: (independent community pharmacy owners or CEO of community pharmacies, academics and researchers in pharmacy practice, high-ranking MOH officials, and people from professional pharmacy organisations in the KSA).
Kharaba et al. (2022) (190)	UAE (December 2020, - March 2021)	Investigate the impact of COVID-19 on the role that hospitals and community pharmacists can play in the UAE, focusing on medication dispensing and review, patient education, and telepharmacy services.	A cross-sectional, face-to-face interview-questionnaire-based study.	Hospital and community pharmacies in the UAE.	428 pharmacists (339 community pharmacists).

Hasan et al. (2015) (187)	UAE (October 2011 - February 2012)	Elucidate physicians' attitudes towards pharmacists' roles in providing primary care services through community pharmacies in the UAE.	A qualitative study, using semi-structured interviews (one-to-one or in groups)	Private/government hospitals, clinics.	53 Physicians having direct contact with community pharmacists.
Alzubaidi et al. (2018) (189)	UAE (October - December 2016)	Explore community pharmacists' opinions and preparedness to expand professional services, including capacity, perceived barriers and facilitators, and measure their delivery of specific services such as screening, MUR, and chronic disease management.	A cross-sectional, self-reported questionnaire-based study.	Dubai and Sharjah.	200 licensed community pharmacists.
Zolezzi et al. (2019) (206)	Qatar (May - August 2016)	Explore the competencies and preparedness of community pharmacists for the provision of CVD risk assessment and management, and explore their views on the provision of these services in community pharmacies, including setting suitability and perceived barriers.	A cross-sectional questionnaire + observational study using simulated patients methodology.	Community pharmacies in Doha and Al Rayyan districts.	50 community pharmacists.

El Hajj et al. (2016) (207)	Qatar (January - October 2013)	Evaluate Qatar pharmacists' engagement in CVD health promotion, routine patient care for those with CVD risk factors, attitudes toward involvement in CVD health promotion and management, and perceived barriers.	A cross-sectional questionnaire.	Community pharmacies and ambulatory pharmacies in Qatar.	141 pharmacists (41 community pharmacists).
Hasan et al. (2021) (173)	UAE (March and July 2015)	Assess community pharmacists' skills in assessing, managing, and educating patients with asthma following the 3C's (control, compliance, complication).	A simulated patient methodology.	Independent or Chain-registered community pharmacies in Abu Dhabi, Dubai, Sharjah, and Ajman.	195 community pharmacies.
Alotaibi et al. (2016) (123)	KSA (September - November 2014)	Evaluate the contribution of community pharmacists in the improvement of life span and quality of life of asthma patients.	A cross-sectional, structured, face-to-face interview- questionnaire-based study.	Community pharmacies in Al- Dawadmi, Riyadh province.	Chief pharmacist in 20 community pharmacies.
Khan and Azhar (2013) (51)	KSA (March - April 2012)	Evaluate the community pharmacist's knowledge about the appropriate use of metered dose inhalers in the Eastern Region.	A cross-sectional study using a simulated patient methodology.	Community pharmacies in the Eastern region, Al-Ahsa.	71 community pharmacists.
Adnan et al. (2015) (52)	KSA (November 2013 - February 2014)	Assess the ability of community pharmacists in Al-Qassim region to demonstrate proper inhalation technique with a metered-dose inhaler and	A cross-sectional observational study using mock patient methodology.	Community pharmacies of five cities: Buraydah, Unayzah, Ar	96 community pharmacies.

		compare baseline outcomes with a similar study in the Al-Ahsa region.		Rass, Al Badai and Bukayriyah.	
Jairoun et al. (2022) (176)	UAE (May 2021 - January 2022)	Assess the Knowledge, Attitudes, and Practices of UAE community pharmacists regarding pain management in children.	A cross-sectional, structured, face-to-face interview-questionnaire-based study.	Community pharmacies in Abu Dhabi, Dubai, and the Northern Emirates.	867 community pharmacists.
Alzarea et al. (2023) (146)	KSA (January - April 2023)	Determine the role of community pharmacists, identify barriers to their involvement, assess their preparedness for future public health services, and develop effective strategies to enhance their current role.	A cross-sectional self-administered questionnaire.	Community pharmacies in three major cities of the Al-Jouf region: Sakaka, Dumat al-Jandal, and Qurayat.	119 community pharmacists.
Thomas et al. (2023) (194)	UAE (April - June 2022)	Assess community pharmacists' willingness and readiness to administer vaccines to the public in the UAE.	An observational cross-sectional self-administered questionnaire.	Community pharmacies.	374 community pharmacists.
Jairoun et al. (2024) (195)	UAE (November 2022 - March 2023)	Investigate community pharmacists' level of expertise and engagement in providing counselling and health promotion services for individuals with diabetes mellitus in the UAE.	A cross-sectional face-to-face interview-questionnaire-based study.	Community pharmacies.	516 community pharmacists.

Alzahrani et al. (2024) (147)	KSA (January - June 2022)	Assess and compare satisfaction levels with the pharmaceutical services among patients who received medications through pharmacies within PHCs with those who received medications through community pharmacists using Wasfaty.	A cross-sectional observational study, using existing patient experience surveys.	Community pharmacies vs MOH PHC pharmacies.	91,317 patients.
Mohammed et al. (2024) (196)	UAE (April 2022- over one year)	Assess the impact of pharmacist-led hypertensive clinics in a community pharmacy setting.	An interventional exploratory design, population-based study.	A community pharmacy in Dubai.	30 patients.
Almaghaslah (2024) (148)	KSA (January - May 2023)	Assess the role community pharmacists play in providing sexual and reproductive health, their practices, and their attitudes toward meeting this exciting demand.	A cross-sectional, self-administered questionnaire.	Community pharmacies across Asir region.	196 community pharmacists.
Salem et al. (2024) (149)	KSA (February - April 2022)	Assess community pharmacists' knowledge of diabetes and investigate their role in diabetes management by identifying the various diabetes care services they provide and evaluating potential barriers to delivering them.	A prospective cross-sectional self-administered questionnaire.	Community pharmacies in Asir region.	258 community pharmacists.

Kurdi et al. (2024) (150)	KSA (January - June 2023)	Evaluate the appropriateness of dispensing and counselling practices of community pharmacists towards topical corticosteroids.	A cross-sectional, self-administered questionnaire.	Community pharmacies from different regions.	418 community pharmacists.
Jairoun et al. (2024) (197)	UAE (January - November 2023)	Investigating the prevalence of chronic kidney disease in high-risk patients and evaluating the effectiveness of a point-of-care screening program administered by community pharmacists.	Prospective point-of-care interventional study.	Six carefully selected community pharmacies in the UAE.	400 patients.
Rasheed et al. (2024) (151)	KSA (May - July 2022)	Assess patients' perspectives on and experiences with the e-prescribing service.	A nationwide, cross-sectional descriptive study used a web-based questionnaire.	Different regions.	718 individuals from the public.
Albabtain et al. (2024) (152)	KSA (April 2021 - June 2022)	Evaluate the impact of a community pharmacy-based MTM programme on clinical and humanistic outcomes in patients with uncontrolled diabetes.	A mixed method: randomised, 6-month, 2-arm, open-label, parallel-group, investigation embedded with qualitative interviews.	A community pharmacy in Riyadh city.	160 patients.
Alfadly et al. (2024) (153)	KSA (January - March 2020)	Evaluate the knowledge and counselling skills of community pharmacists regarding managing acute diarrhoea in children in the Qassim region.	A cross-sectional study consisting of a questionnaire and a simulated client scenario.	Community pharmacies in Buraidah and Unaizah governorates, Qassim region.	60 community pharmacists.

Alotaibi et al. (2023) (154)	KSA (February - May 2023)	Assess community pharmacists' knowledge, attitude, and barriers to providing MTM services to the older adult population in KSA.	A cross-sectional online-based questionnaire.	Different regions.	319 community pharmacists.
Alotaibi et al. (2023) (155)	KSA (March - April 2022)	Explore community pharmacists' perceptions about providing COVID-19 vaccines in Saudi community settings.	A qualitative semi- structured face-to-face interview.	Al-Ahsa governate.	15 community pharmacists.
Alnezary et al. (2024) (156)	KSA (March 2023 for 3 weeks)	Assess the practice, proficiency, and willingness of community pharmacists in KSA in managing childhood diarrhoea.	A cross-sectional, observational design utilising a simulated patient methodology.	Community pharmacies in Madinah Province.	182 community pharmacists.
Alrasheed et al. (2024) (157)	KSA (January - March 2022)	Assess community pharmacists' practice regarding self-medication requests for acne treatment in pregnant women within KSA.	A cross-sectional study involving prospective interviews following the simulated client visit.	Community pharmacies in Riyadh.	100 community pharmacists.
Khardali (2024) (158)	KSA (NR)	Assess community pharmacists' knowledge and perceptions of ADRs and their reporting practices in KSA.	A cross-sectional study using a structured self- administered questionnaire.	Different regions.	163 community pharmacists.
Alzahrani et al. (2024) (159)	KSA	Assessed patient satisfaction with community pharmacists and the Wasfaty system.	A cross-sectional observational study used existing data from the Saudi MOH Patient	NA.	66,541 patients.

			Experience Programme.		
Alsahali et al. (2023) (160)	KSA (September - November 2022)	Explore the benefits observed from using the Wasfaty system and the most common challenges faced by community pharmacists in Qassim region.	A descriptive online self-administered questionnaire.	Qassim region.	124 community pharmacists.
Jairoun et al. (2023) (198)	UAE (January - March 2023)	Assess community pharmacists' perceptions and practices regarding pharmaceutical care for patients with CVD.	A cross-sectional face-to-face interview-questionnaire-based study.	Community pharmacies in Abu Dhabi, Dubai, and the Northern Emirates.	551 community pharmacists.
Alghamdi et al. (2023) (161)	KSA (October - December 2021)	Exploring community pharmacists' perspectives towards the capacity and readiness of community pharmacies to use automated pharmacy systems, provide extended community pharmacy services, and identify perceived barriers.	A multicentre, cross-sectional, online self-administered questionnaire.	Community pharmacies in 3 provinces: Al Baha, Jazan and Najran.	403 community pharmacists.

KSA: Kingdom of KSA, UAE: United Arab Emirates, OTC: over the counter, CVD: Cardiovascular diseases, BP: blood pressure., ADRs: Adverse drug reactions., MOH: Ministry of Health., PHC: primary health care., MUR: medication use review., MTM: medication therapy management., NR: not reported., NA: not applicable.

Appendix A4: Detailed results

Author (year) (ref)	Type of service: targeted health condition/scenario	Description	Effectiveness (Humanistic, Clinical, Economic)	Perceptions (attitude, barriers, facilitators, recommendations)
Alaqeel and Abanmy (2015) (111)	Dispensing and Counselling: 1. Patient with anaemia, asking for iron (FerozeR) 2. Patient with a sore throat, asking for amoxicillin 3. Patient with renal failure, asking for an antacid (an aluminium- containing antacid) 4. Patient requests simvastatin (ZocorR).	Observed practice: - Antibiotics dispensed without prescription - Patients were not asked about prior medication use, concomitant medications, or drug allergies. - Dosing information is often given, yet information on precautions is less frequently provided. - Counselling is mostly provided only upon request. Self-reported practice: - Community pharmacists reported they often counsel patients on dose, duration, and time of administration - Community pharmacists reported they provide information on side effects, drug interactions, and food interactions less often.		
Alfadl et al. (2018) (115)	Counselling: Not specified	Observed practice: - Counselling practice was inadequate (e.g., basic instructions without thorough education or checking identification, prescriptions, or patient expectations). - No details were given on drug		

		usage, interactions, side effects, or storage.
Al Qarni et al. (2020) (118)	Counselling: 1. Prescription -only medicines (amoxicillin + clavulanic acid) 2. OTC medicines (ibuprofen).	Observed practice: - Most community pharmacists did not ask about previous use of the medications, drug allergies, current medication, or patient concerns. - Most provided information on dose and duration. - No pharmacists explained the possible side effects or provided written information. - A minority detected potential drug allergy and side effects in the antibiotic scenario, whereas no pharmacist detected the problem in the Ibuprofen scenario.
Fathelrahman (2021) (54)	Medical device counselling: (Various conditions)	Self-reported practice: - Community pharmacists demonstrated good to very good counselling practices regarding medical devices. -The top-rated devices for counselling were blood glucose monitors, blood pressure monitors, thermometers, weighing scales, nebulisers, metered dose inhalers, and insulin pens.
Khojah (2019) (116)	Dispensing and Counselling: Patient with transient allergy of the skin and nose, ask for	Observed practice: -Spontaneous counselling was offered by only 23 community pharmacists (26.1%), 22 of them mentioned sedation as a side-

(sedating antihistamine)	effect, while one stated that the medication is safe without any side-effects. -Upon request, 43 mentioned sedation as a side-effect. - Two of the community pharmacists who mentioned sedation as a side-effect recommended using a non-sedating alternative, one warned against driving, three warned against using dangerous machinery or tools, and two advised the clients to take it at bedtime. - None asked if the customer was taking another medication.
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Mobark et al. (2019) (163)	Independent prescribing, dispensing and counselling: A 30-year-old woman had a history of migraine with aura and asked for a contraceptive pill.	Observed practice: - Most community pharmacists did not inquire about the condition. - A few asked about pregnancy, menstruation, chronic illnesses, or current medications. - A few made the correct treatment decision and dispensed the progesterone-only pill. - Approximately half of the community pharmacists offered spontaneous counselling on oral contraceptives; however, most were incomplete. - None spontaneously counselled about adherence, missed doses, or medication side effects. - When prompted, only a few provided complete counselling on the proper use of the pills, adherence, or side effects.
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Boura et al. (2023) (167)	Minor ailment management, dispensing and counselling: The patient asking for something to help with stomach acidity (GERD), the patient is taking Cefuroxime axetil (for tonsillitis).	Observed practice: - A poor counselling practice was observed. - The most frequently asked questions were about the symptoms and the pregnancy/breastfeeding status. - A few community pharmacists asked about the medical condition, current medications, and other treatments tried for GERD. - Two participants were asked about their lifestyle and diet habits, and one about their history of allergies. -A poor dispensing practice was observed. - The most given information, spontaneously, was dose information. - None provided information about the drug-drug interactions with cefuroxime axetil. - One participant suggested referral with treatment supply, while the rest suggested treatment without referral to a physician. - Most community pharmacists recommended proton pump inhibitors (PPI). - One recommended H2RA, and five advised about lifestyle modification.
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- Only a few community pharmacists suggested having a time gap between the antacid and cefuroxime axetil.
 - Some community pharmacists think cefuroxime axetil is the reason for the GERD symptoms.
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Rashid et al. (2020) (164)	Dispensing and Counselling: A 25-year-old married woman presented with a prescription for oral isotretinoin for acne.	Observed practice: - A few community pharmacists provided a complete assessment of patient eligibility for using isotretinoin with comprehensive counselling. - Less than half of the community pharmacists asked about patients' age, required laboratory tests, medical history, current medicines or supplements, and family history. - The overall pharmacists' counselling was "incomplete". - On prompting, a few provided complete counselling about the expected side effects and adverse drug reactions. - More than half of the community pharmacists provided unprompted educational counselling about proper use. - A few advised the patient to have laboratory tests for monitoring and counselled about the need to use contraceptives while taking isotretinoin. - Most of the community pharmacists counselled about the importance of treatment compliance.
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Makhlouf et al. (2021) (201)	Minor ailment management, dispensing and counselling: Minor ailments	Self-reported: - Community pharmacists reported that they always or often follow up with patients when recommending a treatment for minor ailments, and document related activities. - Approximately 67% make referrals to physicians as needed. - The most frequently gathered information includes patient identity, age, symptoms, duration, medical history, and medications. - The most frequently provided information includes dosage, frequency, administration route, and duration, with fewer pharmacists counselling on contraindications and potential drug interactions.
Ibrahim et al. (2016) (214)	Minor ailments management, dispensing and counselling: The patient with diarrhoea, vomiting, cramping, and slight fever (acute community-acquired gastroenteritis), is asking for treatment.	Observed practice: - The most frequently stated information on the label: frequency, dose, and duration. - None of the community pharmacists assessed the past medical history. - The commonly dispensed drug category was 'antibacterials, followed by antidiarrheals, which indicates overuse of antidiarrheals and antimicrobials. - The commonly prescribed drug was loperamide (an antimotility

		drug), followed by nitrofurazide. - None have discussed benefits, adverse drug reactions, precautions, or contraindications, or asked about other allergies and treatments. - A few from the face-to-face visit explained the duration of the medication regimen, while no one did from the phone call group. - The most provided information in both face-to-face visits and phone calls was about name, indication, dosage, and route of administration.
Kashour et al. (2016) (114)	Assessment, independent prescribing and counselling: 1. Patient with acute coronary syndrome (ACS) 2. Patient with acute heart failure (AHF).	Observed practice: - The quality of assessment and counselling provided was inadequate. - A few questions were asked to assess patients before making treatment decisions. - The most frequently asked questions were about comorbidities and other symptoms. - A few asked about allergies. - Most community pharmacists dispensed medication without a prescription. - The treatment decision was mostly inappropriate. - Community pharmacists misdiagnosed heart failure as

		chronic obstructive pulmonary disease or asthma and prescribed bronchodilators. - Some community pharmacists advised the simulated patients to go to the hospital. - The provided information was mostly about medication dose, frequency, and duration.	
Alkherat and Alkhalidi (2022) (165)	Counselling: Patients on warfarin	Self-reported knowledge and practice: - Pharmacists showed inadequate knowledge and counselling practice towards Warfarin. - Hospital pharmacists reported better knowledge and counselling practice than community pharmacists. - Pharmacists indicated having difficulty in identifying warfarin drug or food interactions. - Pharmacists reported that they rarely inquire about patients' concurrent use of herbal products.	
Alotaibi and Abdelkarim (2015) (112)	Dispensing and counselling: Any patient requesting medication.	Reported practice by consumers: - Most consumers reported that the community pharmacists dispensed their medication with a prescription. - Some consumers reported that they got their medications without a prescription.	Facilitators: Consumers supported private consultation areas.

		- Most consumers believed that community pharmacists did not give enough counselling about their medications. - The majority think that community pharmacists only give instructions upon request. - A few consumers think they give instructions and encourage questions. - Some consumers think the community pharmacists did not pay attention to them when dispensing their medication. - Some consumers believed that they encountered a dispensing error earlier, while the majority did not face any problem regarding their medication dispensing.
Alomar et al. (2011) (192)	Dispensing and Counselling: Patients with asthma and diabetes mellitus are prescribed: glibenclamide 5 mg, metformine 500 mg, salbutamol inhaler, and Prednisolone 5mg.	Observed practice: -Patient assessment and medication counselling were suboptimal. -None of the community pharmacists screened the prescription for any missing data (age, duration, instruction of use) or medication errors (prednisolone as contraindicated medication) before preparing the prescription. -After preparing the prescription, half of the community pharmacists asked the patients about the

		duration of treatment, as it was missing information. A few advised the patient to check the treatment duration with the physician, while the remaining dispensed the medication regardless of the duration. - A few asked the patients about their health status, concurrent use of other medications, and pregnancy status. -Half of the community pharmacists counselled the patients on the use of inhalers, but none of them demonstrated show-and-tell techniques for inhaler counselling. -A few asked the patients about the onset of asthma and what might worsen asthma. -Information regarding the dose and frequency was the common information provided by some community pharmacists. -Counselling on lifestyle modification was ignored by most community pharmacists.		
AlShayban et al. (2020) (117)	Counselling: Not specified	Reported practice by consumers: -Most patients reported that they received counselling from pharmacists without difficulty. -Almost half of the patients indicated that pharmacists help	Humanistic: Almost half of the patients were satisfied with pharmacist counselling, with an average satisfaction	Attitude: - Patients consider counselling an essential service that pharmacists must provide and recommend others to seek counselling from pharmacists.

		resolve their queries and provide the necessary information to some extent. -More than half of patients claimed that pharmacists spent an appropriate time in counselling.	rating of 7.87 ± 1.99 out of 10.	- A few patients indicated their willingness to pay for a counselling service, should it be charged, with an average of SAR 25 (USD 6.67).
Al-Tannir et al. (2016) (113)	Dispensing and Counselling: Not specified	Reported practice by consumers: -Some participants reported that community pharmacists ask about their concomitant medication and comorbidity, while the majority reported that community pharmacists do not ask about that. -Most participants agreed that community pharmacists always explain the dosage regimen, but do not explain the side effects of medications. -Most participants agreed that they could discuss all medication-related problems with the community pharmacists and receive appropriate counselling time.	Humanistic: Most of the participants were satisfied with the community pharmacy services.	Attitude: Patients perceived counselling provided by CPs as an important and useful service.
Matowe et al. (2008) (213)	Counselling and dispensing of Blood Pressure devices for self-monitoring: Patient with hypertension	Self-reported practice: - Community pharmacists claimed that they always provide advice about the device during the purchase. - More than half of the community pharmacists reported either explaining or demonstrating the		

		use of the device for the patients, even if they did not ask.		
Alzubaidi et al. (2019) (170)	Diabetes and CVD risk screening: Diabetes and CVD risk	The service included an education session, during which community pharmacists explained the lifestyle factors contributing to increased CVD and diabetes risk and provided advice to participants. The screening process includes anthropometric measurements, POC testing (of TC, LDL, HDL, HbA1c, SBP, DBP), CVD risk assessment by calculating the projected 10-year atherosclerotic CVD (ASCVD) risk, diabetes risk assessment through HbA1c level and the American Diabetes Association (ADA) T2DM risk questionnaire, and patient history assessment. * The mean duration of the complete screening process was 27 minutes.	Humanistic: -Almost all participants were satisfied with the screening service and the quality of advice. Clinical: - 57.4% were identified as high risk for diabetes and/or CVD - 61.7% of at-risk individuals were referred to physicians - 24.3% of the referred participants had visited their physician for follow-up	Attitude: -Participants perceived the screening service as an important service that should be routinely provided in the community pharmacy and thought that the community pharmacy presents a good venue for the screening service. - Most participants expressed willingness to pay for the screening service, should it be provided.
Almansour et al. (2020) (124)	CVD risk screening: CVD risk	Self-reported practice: -Individual efforts were reported by a few community pharmacists, such as providing lifestyle modification advice for some patients with chronic conditions. -A few community pharmacists reported that their pharmacies offered BP monitoring.		Attitude: - Most community pharmacists perceived CVD screening services as feasible to be conducted in community pharmacy settings, and they were willing to expand their role and offer CVD risk screening and prevention services. Barriers:

			- Lack of patients' awareness about the role of pharmacists - Lack of communication between pharmacists and physicians - Lack of organisational support - Lack of training, - Lack of an integrated system to access patient medical records, - Lack of privacy - Lack of professional frameworks and standards - Lack of motivation - Unclear referral mechanism - Workload -Language barriers -Safety issues Facilitators: - Government support to develop and regulate the service - Financial support for the patients - - Promotion for pharmacists' role - Professional support and training - Resources and educational materials -Reward system for pharmacists
Alzubaidi et al. (2021) (172)	Diabetes and CVD risk screening: Diabetes and CVD risk	* The screening process includes Anthropometric measurements, POC testing (of TC, LDL, HDL, HbA1c, SBP, DBP), CVD risk assessment by calculating the projected 10-year atherosclerotic CVD (ASCVD) risk, Diabetes risk assessment through HbA1c level	Humanistic: - Participants reported some lifestyle changes after receiving the service, including increased regular exercise and attempts to lose weight.

		and the American Diabetes Association (ADA) T2DM risk questionnaire, and Patient history assessment.	Clinical: - 58% were identified as at-risk for diabetes or CVD and referred to physicians -At the 6-week follow-up calls, 31% of the referred participants reported visiting a physician - Some participants reported that their physicians prescribed medications, including medications for dyslipidaemia, diabetes, and HTN.
Almansour et al. (2021) (144)	CVD risk prevention-health screening, primary and secondary prevention services: CVD risk		Policymakers' recommendations: - Primary and secondary preventive services, including health screening and referral, point of care testing, health education, education on medication adherence, and medication therapy management/ medication use review. Facilitators: -Access to patient's medical records, availability of private areas, pharmacists-physicians collaboration and other stakeholders' support. - An evidence-based framework for

		developing, implementing, and evaluating services
Alzubaidi et al. (2020) (171)	CVD risk screening: Diabetes and CVD risk	Attitude: - Screening service provided personal and professional satisfaction to Community pharmacists. - Community pharmacists perceived the screening service as a great opportunity for them to gain patients' trust, build good relationships with patients, and be directly involved in patient-centred care. Barriers: - length of screening and assessment time - Workload, shortage of staff -Legislation restrictions -Physicians' unacceptance - Lack of a private area - Lack of an integrated system to communicate the results to physicians - Lack of implementation support Facilitators: -Adequate staffing and implementation support -Governmental or insurance coverage for service cost, or offer it free of cost, -Use of testing devices

Almansour et al. (2020) (145)	CVD screening service, and other preventive services: CVD risk		Attitude: - Most participants had positive attitudes and were willing to use new services if these were offered free of charge, pharmacists were trained and the service was overseen by health authorities. - For CVD screening and management, participants suggested pharmacists-physicians collaboration. Other suggested services for future implementation: - Pharmacists' clinics, vaccinations, monitoring and point of care tests, health promotion and medication review or medication therapy management.
Alsheikh and Alasmari (2022) (142)	ADRs reporting: ADRs	Self-reported practice: - Reporting ADRs is a professional obligation; however, reporting practices were unsatisfactory: -33.9% of participants had never reported an ADR to the SFDA - Only 25.9% had reported an ADR more than three times.	Attitude: - Most community pharmacists had positive attitudes and were aware of the ADRs reporting process. -More than half of the participants found the ADR reporting system too complex and time-consuming to complete. Facilitators: - Training - Incentives
Abdulsalim et al. (2023) (143)	ADRs reporting: ADRs	Self-reported practice: -Most community pharmacists were willing to report ADRs in their practice.	Barriers: - Lack of a formal reporting process

		-68% conducted medication reviews with patients, 55% of pharmacists had identified an ADR. However, only 22% of pharmacists reported ADRs to the SFDA.	- Lack of training on how to report and on how to conduct a medication review -Lack of patients' awareness about their medication, - Lack of time - Lack of staff - Communication difficulties
Rabba and Ain (2015) (141)	ADRs reporting: ADRs	Self-reported practice: - 49% of pharmacists had noticed an ADR in a patient in daily practice, while 83% had ever reported an ADR to either the drug control authorities or SFDA. - 79% believed that they always report ADRs because it is part of pharmaceutical care.	Barriers: - Unavailability of reporting forms. - Unknown reporting address. - Confidentiality-related reasons.
Qassim et al. (2014) (186)	ADR reporting: ADR	Self-reported practice: - 88.8% of participants had low practice scores, in which only 3.6% of the participants had submitted ADR reports to the MOH or manufacturing companies.	Knowledge and attitude: - Community pharmacists had poor knowledge towards ADRs reporting and Pharmacovigilance activity. - Approximately half of the surveyed Community pharmacists were unaware of the Health Authority in Abu Dhabi (HAAD) Pharmacovigilance programme. - They were keen and willing to attend training and education programmes to improve their practice.
Alshahrani et al. (2022)	Vaccination: Covid-19		Attitude: - Most of the respondents are

(133)			willing to be vaccinated by Community pharmacists if the pharmacists are trained and certified as vaccination providers. - Most of the participants trust Community pharmacists when it comes to COVID-19 vaccination. - They believe that community pharmacies should expand their healthcare services on vaccination and other services.
El Hajj et al. (2023) (215)	Vaccination: Not specified	Self-reported practice: - Most pharmacists lacked experience in vaccine administration and had not participated in any vaccine-related advocacy activities. - For those with experience, the most commonly administered vaccines were for influenza, tetanus, and hepatitis B.	Attitude: - Pharmacists' perceived knowledge, skills, confidence, and behavioural control were low. - Pharmacists had positive emotions regarding the administration of vaccines and the high perceived consequences and usefulness of vaccinations. Barriers: - Lack of training -Insufficient supports
AlMukdad et al. (2021) (203)	Weight management - health promotion: Overweight and obese patients	The surveyed pharmacists: - Indicated that they often or always explain the risks associated with overweight and obesity, recommend weight loss medications, herbs, or dietary supplements, counsel about their proper use and/or side effects, and offer weight management consultations.	Attitude: -The majority of pharmacists had positive attitudes towards the provision of weight-management services - They expressed their interest in receiving weight-management-related training. - Pharmacists felt they were not fully competent or confident in

		The interviewed pharmacists: - Claimed that they play an important role in weight management through building rapport with the patient, gathering the patient's information, recommending a weight loss product, and counselling on a healthy lifestyle and the appropriate use of the weight loss product. - Some participants indicated that they frequently measure patients' BG, BP, and BMI. - They considered patient monitoring, assessing outcomes, offering follow-up, and referring to other healthcare providers when necessary.	providing a comprehensive weight management programme as they had not received any related training.
Awad and Waheedi (2012) (210)	Obesity counselling -health promotion: Overweight and obese patients	Self-reported practice: - Counselling about exercise and diet.	Barriers: - Lack of patient awareness about pharmacists' expertise, and lack of time. - Pharmacists' opinions that obese patients lack willpower and are non-adherent to weight reduction interventions, Facilitators: - Increased awareness among the public about pharmacists' role. - Improvement of pharmacists' knowledge about obesity and communication skills.

Abduelkarem et al. (2012) (175)	Wound management-Minor ailments management: Patients with minor, major or severe wound	Self-reported practice: - Over half of the respondents reported involvement in treating minor wounds at their pharmacy.	Attitude: - Community pharmacists perceived wound management as an opportunity for them to be involved in patients' healthcare. -They expressed their willingness to be trained in wound management to improve their role. -They suggested the availability of separate treatment areas.
Makhlouf et al. (2021) (200)	Minor ailments management: Several minor ailments: Constipation, Cold and catarrh, Headache, Head lice, Sore throat, Skin rash, Sunburn, Teething discomfort, Musculoskeletal pain, Burns/scalds, Hay fever, Athlete's foot, Ringworm, Travel sickness.	Self-reported practice: -The minor ailments with the highest community pharmacists' self-perceived competency to manage were constipation, cold and catarrh, headache, and skin conditions. -The highest perceived ability to recommend appropriate OTC medicines and provide instructions to guide their use. -The diagnostic ability to differentiate minor ailments from other medical conditions with similar features had the lowest median competency.	
Mohamed Ibrahim et al. (2018) (199)	Minor ailments management, labelling, dispensing, and counselling: 1. Common cold (sore throat, slight	Observed practice: - Community pharmacists were unable to differentiate between the common cold and allergic rhinitis. -There was no difference in the types of medications dispensed by pharmacists for the management	

	cough, tiredness, and body aches) 2. Allergic rhinitis (running nose or congestion, sneezing, slight sore throat with phlegm and slight cough when in bed).	of the common cold and allergic rhinitis. - Antibiotics were inappropriately prescribed and given without prescriptions in some cases. - The labels only included information about the dose and frequency of the medication. They did not provide details on the medication's strength, duration, administration time, or quantity.	
Almaghasla h et al. (2022) (126)	Oral health management - Minor ailments management: Tooth and gum diseases	Self-reported practice: -About half of the community pharmacists claimed that they often or always counsel their clients about oral conditions such as oral pain, gum bleeding and tooth erosion. -More than half of the community pharmacists claimed they often or always provide referral services to patients with oral diseases.	Knowledge and attitude: - Community pharmacists have good knowledge and attitudes towards oral health care. - Most Community pharmacists agreed on the importance of oral health promotion, suggesting that dentists-pharmacists collaboration could enhance their role. - Most Community pharmacists expressed willingness to pursue a more proactive role in oral health promotion. -They indicated the need for dentistry-oriented education.

Madkhali and Alzahrani (2022) (127)	Anaemia management - Minor ailments management: Patient with Anaemia	Self-reported practice: - Most community pharmacists counselled patients on drug-drug interactions. - Some community pharmacists advised on diets in connection with anaemia management.	Attitude: -Community pharmacists had a positive perspective toward their role in anaemia management. Barriers: -Lack of awareness of anaemia by patients, -Health beliefs of patients, -Patients' confidence in the care being provided by their doctors, -Patient's perception of the pharmacist's role -Time constraints -Language barriers
Al-Saleh et al. (2017) (125)	Oral health management - Minor ailments management: Tooth and gum diseases	Self-reported practice: -Oral ulcers, dental pain and bleeding gums were the three most common oral conditions encountered by community pharmacists. -Most community pharmacists referred clients to dentists, and some of them prescribed analgesics and gave oral hygiene advice.	Attitude: - Community pharmacists thought that they had an important role in oral health education and were willing to provide oral health information. Barriers: - Lack of collaboration with dentists - Lack of knowledge and training
Merghani Ali et al. (2022) (128)	Diarrhoea management - Minor ailments management: Acute childhood diarrhoea	Self-reported practice: - Most community pharmacists claimed that they inquired about the symptoms of dehydration, the age of the child, the duration of diarrheal episodes, frequency of diarrheal episodes, and the presence of fever as part of history	

		taking. Observed practice: - The duration of diarrheal episodes, frequency of diarrheal episodes and the presence of fever were less frequently inquired. Treatment recommendation: - Most of the participants in the self-report survey and the simulated patient visits recommended the use of oral rehydration salt (ORS) to their patients; half of them recommended zinc supplements along with ORS. Counselling: - Community pharmacists in a self-reported survey claimed they advised patients to continue normal feeding and increase the fluid intake during diarrhoea and that they instruct the child's parents on how to prepare ORS, while in actual practice poor practice of counselling was observed.
Akkad et al. (2022) (184)	Service provision for pregnant and lactating women: Minor ailments in pregnant and lactating women	Self-reported practice: - Most community pharmacists had experience in offering counselling to pregnant and breastfeeding women - They were confident to counsel and advise pregnant and breastfeeding women. - Nausea, vomiting, headache,

back pain, and fever are the symptoms that pregnant women most frequently consult the pharmacist for.

- Cough, runny nose, and sore throat are the symptoms that breastfeeding women most frequently consult the pharmacist for.

- Community pharmacists indicated that they referred pregnant and breastfeeding women to physicians for the following cases: varicose veins, swelling of the feet and legs, and vaginal itching.

- They recommend and dispense medication to treat common symptoms such as headache, fever, and gastroesophageal reflux disorder/indigestion during pregnancy.

- The most common symptoms they dispense OTC medications for during breastfeeding are headache, fever, and sore or cracked nipples.

Kubaisi et al. (2022) (166)	Service provision for pregnant women: Migraine in pregnant women	Observed practice: - Most of the community pharmacists asked about symptoms and duration of symptoms, and other conditions that might co-exist, such as sinusitis, cold, hay fever, nausea, vomiting, and photophobia. - Only when prompted, community pharmacists enquired about the potential factors that could trigger the attack of migraines, such as type of food, alcohol, stress, hormonal change or eye problems, and recent falls or fainting. - Almost half of the community pharmacists asked if the patient had taken any treatment to resolve the pain. - More than half of the community pharmacists prescribed medication to the patient without a probe. - Information about the dose and the frequency of the treatment was the only information offered to the patient without any probe. - None has informed the patient about the possible drug-drug and drug-food interactions. - Less than half of community pharmacists have advised the patient for non-pharmacological treatment.
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		- Some community pharmacists did not offer treatment and refer the patient to the physician. -The most commonly prescribed medication for migraine headaches was paracetamol. A minority were prescribed Ibuprofen and mefenamic acid. Vitamin C and magnesium effervescent tablets were prescribed with paracetamol. - Some community pharmacists recommended non-pharmacological treatment.
Albassam and Awad (2018) (212)	Service provision for pregnant and lactating women: Pregnant and lactating women	Self-reported practice: - Most community pharmacists had experience in providing services for pregnant and breastfeeding women. - The provided services for pregnant women were recommending vitamins and food supplements, referring them to a doctor, and offering advice about lifestyle and exercise. - The most frequently provided services for breastfeeding women were contraception advice, recommending vitamins and food supplements and weight control advice. - Other services offered, but to a lesser extent, included symptom diagnosis, dispensing herbal

		products and medicines, and doctor referrals. - Community pharmacists mostly recommend medications for the treatment of headache, constipation, cough, sore throat, runny nose, nausea, vomiting and indigestion. - In case of diarrhoea and haemorrhoids, swelling of the feet and legs, varicose veins, insomnia, vaginal itching, back pain, and fever and aches, they recommended referral to a doctor or providing only advice. - For breastfeeding: they mainly recommend medications for sore or cracked nipples, medication to increase the breast milk, or referral to the doctor for mastitis.	
Al Mazrouei et al. (2021) (180)	Virtual pharmacy service: Not specified	Virtual pharmacy service (includes remote consultation, remote prescription refills, remote medication review, and home delivery of medications). Types of pharmacist interventions on potential OTC abuse and misuse in virtual pharmacy; 1) Provide instructions about the medications. 2) Suggest another medication.	Clinical: - Identify and intervene in the abuse and misuse of OTC medicine. - Pharmacist interventions on misuse of OTC medications were significantly higher in pharmacies with virtual care.

3) Ask the patient to seek the advice of their physicians.

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(2022)
(138)

**E-prescribing -
wasfaty:**
Not specified

Humanistic:
- Patients expressed moderate satisfaction, with the highest ratings given to community pharmacy knowledge, communication skills, counselling skills, therapy management, openness and approachability
- Moderate satisfaction levels for the pharmacy premises-related features in terms of the facilities and accessibility
- Moderate satisfaction levels for patient experience with Wasfaty in terms of availability of pharmacists, procedures for refills, waiting time, privacy, confidentiality, clarity of instructions on medications, and medication delivery service.
- Patients were less satisfied with medication availability and communication between

			pharmacists and prescribers
Alshammari et al. (2023) (139)	E-prescribing - wasfaty: Diabetes		Economic: - Wasfaty substantially saves costs in comparison to the pre-Wasfaty period - The mean difference between was USD 109.18 (SAR 530.99. - The saving costs include the cost per patient, the cost of prevented medication errors (eg, duplicate therapy, contraindication, and drug-drug interactions), and savings from the prevention of undesirable adverse events, costs for human resources and pharmacies' operations - The total savings were USD258,762,981 to 274,972,971 (SAR 970,361,178 ± 1,031,148,640)
Mohamed Ibrahim et al. (2021) (181)	Traditional vs. Tele-pharmacy: Not specified	Tele-pharmacy (including video conferencing, filling prescriptions, medication reviews, patient counselling, and home delivery of medication).	Clinical: - The incidence of dispensing errors in pharmacies with tele-pharmacy, 15.8%, was significantly lower than in

			the control group, 19.43%. - Improved medication dispensing safety by reducing medication dispensing error rates.	
Khardali et al. (2022) (137)	E-prescribing - wasfaty: Not specified	Community pharmacists claimed that Wasfaty's service enables them to provide pharmaceutical care, including dispensing patients' medications, searching for alternative medications, and providing medication education and instructions.		Attitude: - Community pharmacists were unsatisfied with using Wasfaty in their routine practice. Perceived advantages of Wasfaty: -Reducing the number of medication dispensing errors and offering more time to provide medication education -Reducing medication waste - Facilitating the process of medication refill Perceived disadvantages: -Few community pharmacies are adopting the Wasfaty service - Increasing workload - Not all patient medications are available in one pharmacy, with some types unavailable, and restrictions on dispensing alternatives not listed on the Wasfaty website - Doesn't allow pharmacists to contact physicians for clarification, prescribe alternatives, or adjust patient medication doses

			Perceived facilitators: - Prepared infrastructure includes a waiting area, an automated machine for waiting number tickets, and a private area for counselling -Additional staff
Ibrahim et al. (2022) (182)	Traditional vs. Telepharmacy: Patient with hypertension (HTN)	Tele-pharmacy (including remote filling of prescriptions, virtual counselling, and home delivery of medications). Pharmacist interventions in the tele-pharmacy group were higher than interventions in the traditional pharmacy group. The types of pharmacist interventions provided: patient education, discontinuation of drug therapy, adjustment of drug dose, and initiation of drug therapy.	Humanistic: - The knowledge of HTN symptoms, risk factors, and healthy lifestyle was significantly improved in the tele-pharmacy group at 12-month follow-up. Clinical: - Controlling BP, improving medication adherence in patients with HTN, and identifying and preventing drug-related problems. - The mean SBP of patients in tele-pharmacy at all follow-up periods was significantly lower than that of patients in traditional pharmacy (all p values<0.05). - The mean score of medication adherence was significantly increased at all follow-up periods. - identifying a greater

			number of drug-related problems.	
Jirjees et al. (2022) (183)	Telepharmacy: Not specified	Tele-pharmacy (including online sales, home delivery, phone and/or phone messaging applications such as WhatsApp, Messenger, and Instagram). Providing pharmaceutical services by tele-pharmacy was more common in group or chain pharmacies than in individual pharmacies. The policy of offering telepharmacy services was more prevalent in larger pharmacies.		Barriers: -lack of time -Lack of training -Lack of financial support
Almalag et al. (2022) (140)	Independent prescribing of oral contraceptives: Married women/ family planning	Self-reported practice: -Most community pharmacists reported prescribing more than six prescriptions for oral contraceptives every week.		Knowledge and attitude: - Community pharmacists were knowledgeable about and willing to prescribe oral contraceptives independently. Barriers: - Patient safety - Increased workload - Lack of training -Lack of patient trust -Physician resistance - Religious perspectives

Sadeq et al. (2022) (185)	Independent prescribing: Various conditions (minor ailments and chronic conditions)	Self-reported practice: -The highest perceived competence was in managing minor illnesses such as pain, acne and allergic conjunctivitis. -The lowest perceived competence was for chronic diseases such as hypertension, diabetes mellitus and asthma.	Attitude: -Community pharmacists have a positive attitude and are highly confident in independent prescribing. Barriers: - Physicians' resistance - Lack of access to the patient's medical records -Lack of a private consultation area
Alzahrani et al. (2023) (131)	Smoking cessation-health promotion: Smokers	Self-reported practice: -Less than half of the community pharmacists claimed they assess the interest of their patients in quitting when they identified them as smokers, offer brief advice on how to quit, and discuss the negative impacts of smoking on other family members. - They recommend OTC nicotine replacement therapies NRT to tobacco smokers, develop a cessation plan and provide quit materials. - Some community pharmacists claimed that they follow up with their patients to quit smoking. -Some community pharmacists reported directing their patients to a smoking cessation programme or referring them to other healthcare professionals.	Attitude: Community pharmacists were interested in providing smoking cessation services and were willing to help patients quit smoking. Barriers: -Inability to follow up with patients -Lack of counselling space, educational materials, and lack of time.

Alzubaidi et al. (2022) (178)	Smoking cessation-health promotion: 1. A young cigarette smoker who needs the pharmacist's help in quitting 2. A young adult who has recently quit, is incorrectly using nicotine lozenges and thus still suffering from cravings and withdrawal symptoms.	Observed practice: -None of the pharmacists used best practices in providing cessation support. -Community pharmacists' performance in smoking cessation-specific patient assessment and therapeutic planning, intervention, and follow-up was insufficient. - Less than half of pharmacists assessed the patients' level of nicotine dependency and explained that medications are available to reduce the severity of cravings and withdrawal symptoms. - No pharmacist asked patients about their medical or medication histories, explained the need for or helped set an appropriate quit date. In scenario 2, a few pharmacists assessed the current nicotine dose patients were using and explained that it was lower than recommended. - None of the pharmacists took a medical or medication history, nor did they determine how the patients attempted to quit previously, the success of previous quit attempts, or the smoking triggers.
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El Hajj et al. (2012) (202)	Smoking cessation-health promotion: Smokers	Self-reported practice: -A few pharmacists claimed that they ask their patients about their smoking status. -When the patients' smoking status was identified, most community pharmacists reported discussing with patients the benefits of smoking cessation and advising them to quit. -For patients willing to quit, most of the pharmacists recommend the use of nicotine patches or gum or counselled the patients on behavioural techniques for smoking cessation; a few of them provided written smoking cessation educational materials and suggested getting a prescription for Bupropion.	Attitude: -Community pharmacists were interested in providing smoking cessation services and had positive attitudes toward smoking cessation counselling. Barriers: -Lack of time, -Lack of patients' interest in discussing smoking cessation, -Lack of educational materials
Babiker et al. (2014) (208)	Medication Use Review (MUR): Patients with chronic disease or polypharmacy		Attitude: -Community pharmacists have demonstrated a willingness to be involved in medication review services. Barriers: -Lack of consultation area, -Lack of IT support system Facilitators: -Training and education programmes, -Availability of consultation areas, -Incentives

Alfahmi et al. (2023) (134)	Potentially inappropriate medication (PIM) detection and prevention - Medication review: Elderly	Knowledge and attitude: - Community pharmacists showed a better understanding of PIMs in comparison to hospital pharmacists. -Pharmacists showed a high degree of self-confidence in detecting PIMs in older adults. Barriers: -Lack of communication between healthcare professionals, time, pharmacists' commitment, and lack of guidelines or references.
Alshehri et al. (2022) (135)	Medication Therapy Management (MTM): Patients with polypharmacy	Attitude: -Pharmacists strongly intended to provide MTM services; had a positive attitude towards providing MTM; perceived social pressure to provide MTM; felt confident in their ability to provide MTM; and had good knowledge of them -Pharmacists with pharmacy residency had better knowledge of MTM and strongly intended to provide MTM services
Alhaddad (2019) (136)	Medication Therapy Management (MTM): Patients' monthly medications and health-related issues	Attitude: -Most patients perceived the MTM to be beneficial for patients' care and believed that pharmacists are qualified to provide MTM services -They were willing to register for the MTM programme if implemented at community pharmacies

Khan et al. (2020) (53)	Diabetic education- chronic disease management: Patients with diabetes	Let's Talk About Diabetes (LTAD) is a 1:1 face-to-face session consisting of four 20- minute modules: My Medicines, My Lab Tests, My BG and My Doctor Visits. LTAD is an 'education only' approach, with no changing or adjusting of medications. Modules were scheduled at 1–3-week intervals over a 2–4-month period.	Humanistic: -Patients' awareness of the HbA1C test results and how to interpret them had improved at follow- up. - Significant improvement in patients' diabetes behaviours, attitudes and beliefs. - Patients reported less skipping or forgetting to take medications. - Patients adhered to their physician's instructions for daily BG monitoring. -Reduction in the number of patients reported having diabetes distress. -Significant improvement in using diet and meal plans as part of the treatment plan and engaging in exercise and physical activity. Clinical: -Significant reduction in the HbA1C results, and significant improvement in medication adherence at follow-up.
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Abduelkarem and Sackville (2009) (169)	Diabetic education-chronic disease management: Patient with diabetes	Reminder packages: clear, concise, standardised information on different regimens of diabetes self-care was provided to patients each week during the first three months. The reminders covered body weight, physical activity, dietary habits, self-testing, foot care, smoking habits, BP and dyslipidaemia.	Humanistic: -Significant improvement in patients' behaviour and self-care activities at 3-month follow-up, including diet and exercise behaviours, foot care and self-testing. - Improvement in patients' compliance and adherence to medication. Clinical: -A significant reduction in the average BMI at 24-month follow-up.	Attitude: Patients' views on pharmacists' ability to assist in controlling and reducing BG improved after the intervention.
Katoue et al. (2013) (211)	Management of metabolic syndrome: weight management, blood pressure, blood sugar measurement-chronic disease management: Patients with metabolic syndrome	Self-reported practice: -More than half of the pharmacists reported providing height and weight measurement services. -Most pharmacies reported providing BP and BG measurement services. - Lipid profile measurements were the least provided services. -Most pharmacists reported providing counselling on lifestyle modifications, including physical activity, weight reduction diet, salt restriction, smoking cessation, cholesterol-lowering diet and increasing soluble fibre consumption. - Most pharmacists reported		

		encouraging patients' adherence to the prescribed treatment, selling equipment for home monitoring, advising patients on routine weight, BP and BG monitoring and about nonprescription treatment. -All pharmacists reported referring patients to physicians if required.	
Eshbair et al. (2022) (174)	Diabetes management-chronic disease management: Patient with diabetes	Self-reported practice: -A minority of the pharmacists reported providing recommendations on appropriate drug therapy, educating patients on the risk of CVD, counselling diabetes patients on foot care, offering regular screening of neuropathic pain and retinopathy, educating patients on lifestyle modifications, and offering a smoking cessation programme.	Attitude: -Pharmacists expressed their willingness towards the management of diabetes-related comorbidities. Barriers: -Lack of time, -workload, -Lack of reimbursement, -Lack of motivation, -Lack of privacy, -Lack of patient motivation -Lack of knowledge in the pharmacist's role. -Inadequate health insurance -Patient hesitation in discussing their diseases
Ibrahim and Ibrahim (2013) (177)	Breast cancer health promotion: Public health	Self-reported practice: - Most pharmacists reported never having participated in breast cancer health promotion activities. -A few pharmacists were engaged in breast cancer health promotion activities.	Attitude: -Most pharmacists were highly interested in providing breast cancer health promotion and receiving breast cancer education. Barriers: -Lack of educational materials, -Lack of time,

			-Lack of staff, -Lack of reimbursement
El Hajj and Hamid (2013) (204)	Breast cancer health promotion: Public health	Self-reported practice: -Most pharmacists reported never having participated in breast cancer health promotion activities. -Poor involvement of community pharmacists in breast cancer health promotion.	Attitude: -Most pharmacists were highly interested in providing breast cancer health promotion and receiving breast cancer education. Barriers: -Lack of educational materials, -Lack of staff, -Lack of public recognition of the pharmacist's role -Lack of time.
Alshahrani and Alsheikh (2021) (129)	Sexual and reproductive health promotion: Public health	Self-reported practice: - Counselling on reproductive health was very popular. -Most community pharmacists reported counselling their patients very often on sexual and reproductive health.	Attitude: -Almost half of the community pharmacists perceived themselves as highly competent to provide sexual and reproductive health education -The majority expressed willingness to participate in educational programmes to improve their knowledge Barriers: -Incomplete patient records - Fear of responsibility and liability -Lack of social responsibility and acceptability -Gender differences
Awad and Abahussain (2010) (209)	Health promotion and education: Public health	Self-reported practice: -Pharmacists were involved in counselling on taking drugs as prescribed and on knowledge	Attitude: - Most pharmacists indicated their willingness to participate in continuing education programmes.

		about drug contents and side effects, but were less involved in counselling on personal health-related behaviours. -Weight management, diet modification and stress reduction were the most practised health promotion activities.	Barriers: -Lack of pharmacists' and patients' time, -Lack of training, -Lack of privacy -Lack of patients' trust in the pharmacists Facilitators: -Training and education programmes - Educating patients about the role of pharmacists. -Designing private areas for counselling.
Almanasef et al. (2021) (130)	Public health activities: weight management, screening, immunisation, lifestyle education, smoking cessation, drug and alcohol dependence, sexual health, dental health	Self-reported practice: -More than half of the pharmacists reported being involved in health promotion activities such as weight management, sexual health, healthy eating, and physical activity promotion. - Less than half of the pharmacists reported being involved in dental health, smoking cessation, disease screening, alcohol dependence and drug misuse counselling, and vaccination.	

Al-Arifi (2008) (132)	Mental health care: Patients with mental illness	Attitude: -Pharmacists reported feeling uncomfortable counselling, solving drug-related problems or monitoring adherence among patients with mental illness. Barriers: -Lack of training, therapeutic knowledge, documentation skills, communication skills, -Lack of a private area, -Lack of time, -Lack of staff, -Lack of drug information resources, -Lack of patient demand, -Lack of support from owners - Negative attitudes of the physicians and negative attitudes of the pharmacists Facilitators: -Training and education programmes -Communication and collaboration with other health care providers - Availability of adequate drug information resources -Education of the patients on the importance of pharmaceutical care - Increasing pharmacy staff -Improving clinical knowledge and skills -Private space for counselling
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Samorinha et al. (2022) (179)	Mental health care: Patient with mental illness	Self-reported practice: -Community pharmacists reported adopting a precautionary practice during dispensing and counselling people with mental illness, avoiding evaluating prescriptions, and not providing counselling beyond what has been provided by the prescriber. - Their role was mostly limited to counting pills, dispensing prescriptions, and medication counselling, including counselling the patient about how to take each medication, asking if the patient knew how to use the medication, counselling the patient about what each medication is for, and asking if the patient has any questions/concerns about their medications. -The least common practice was asking if the patient had experienced side effects.	Attitude: -Community pharmacists perceived patients with mental illnesses as more difficult to deal with, more sensitive, and requiring special treatment. Challenges: -Emotional discomfort, anxiety, and fear when dealing with patients with mental illness. -Lack of awareness and training on effective communication with patients with mental illnesses. Strategies to address challenges: -Raise the public and pharmacists' awareness about mental illness -community pharmacists-physicians collaboration
Shami et al. (2022) (205)	Mental health care: Patient with depression	Self-reported practice: -The poor involvement in depression care. - The community pharmacist's role is limited to encouraging adherence to antidepressants, providing information about the time course of response to antidepressant medication, and the	Barriers: -Lack of access to patients' medical profiles, -Lack of patients' awareness of major depression and the importance of treatment, -Lack of knowledge and training on mental health -Lack of a private area

		purpose of antidepressant medication. -Most pharmacists reported they rarely or never screened patients for major depression or followed up with patients.	
Siddique et al. (2022) (119)	Traditional pharmaceutical care services: Not specified	Self-reported practice: -Most pharmacists reported they always collect information from patients before dispensing the prescribed drug, identify prescription errors, contact the doctor to discuss drug-related problems and advise the patient about lifestyle modifications and nonpharmacological therapy. -Some pharmacists claimed they follow up with patients.	Barriers: -Lack of collaboration/communication with other health-care professionals, -Lack of education and training, -Lack of confidence in pharmaceutical care, -Lack of space and privacy
Hasan et al. (2015) (188)	Primary care services: Not specified	Suggested primary care services: Screening for disease, monitoring of disease control, referral, health advice, lifestyle and preventive care, counselling, patient record keeping, and chronic disease management.	Attitude: - Most patients expressed willingness to utilise all suggested services if provided. -They supported receiving more information about medications, advice on using devices like inhalers or insulin injections, pharmacists helping in self-management and monitoring, and performing preventive roles. -Patients were less supportive of pharmacists intervening in the medication management of chronic disease or keeping medication

				records. Facilitators: -Ensuring privacy -Training
Al-Hassan (2009) (109)	Traditional services: Not specified	Self-reported practice: -Most pharmacists' working hours were spent in dispensing and stocking, with less than 25% of working time devoted to counselling. -Pharmacist ranked counselling as their favourite activity. -The non-counselling tasks include dispensing prescribed only and OTC drugs, stocking and purchasing drugs, stocking and purchasing non-drugs related items, preparing daily accounts and bills, contacting physicians and preparing the annual budget.		Attitude: -Less than half of the community pharmacists were fully satisfied with their profession.
Almanasef (2023) (22)	Traditional services, and Future services: Not specified	Selecting OTC products and non-pharmaceuticals, management of minor ailments, counselling on using medications, medication therapy management, dental health, screening for diseases, smoking cessation, disease counselling, healthy eating, physical activity promotion, vaccination and immunisation, sexual health, weight management, counselling on	Humanistic: More than half of the consumers were satisfied with the current role of pharmacists.	Attitude: -Most consumers were willing to use community pharmacy services, including selecting OTC products, minor ailments management, selecting non-pharmaceuticals, counselling on medication use, MTM, dental health, screening, smoking cessation, disease counselling, healthy eating, physical activity promotion, and vaccination.

		alcohol dependence and drug misuse.	- They were unwilling to use services like counselling on sexual health, weight management services, or counselling on alcohol dependence and drug misuse services. Barriers: -Lack of privacy, -Busyness of the pharmacist -Lack of awareness of the ability of the pharmacist, -Lack of trust in the pharmacist and fear of asking the pharmacist
Rasheed et al. (2023) (23)	Patient-centred care services-extended services: Not specified	Self-reported practice: -Community pharmacists from chain pharmacies possess better practice, knowledge, and attitudes to conduct patient-centred care services than those from independent pharmacies. -Smoking cessation clinics, educating pregnant women, reviewing and identifying medication errors and discussing the importance of medication adherence were practised more by community pharmacists from chain pharmacies.	Barriers: -Inaccessibility to patient medical records - Workload - Limited access to online pharmacy literature -Lack of training -Lack of a private area.
Hasan et al. (2012) (162)	Enhanced and traditional services: Not specified	Self-reported practice: -Most pharmacies are involved in dispensing pharmaceutical (prescription and OTC medications) and non-	

		pharmaceutical products, including herbal and nutritional supplements, weight-reduction preparations, and wound-care products. -A minority provided specialised compounding of prescribed medications. - A minority of pharmacists regularly provided counselling or provided printed medication information. - The provision of screening services such as testing for blood glucose and blood pressure, and peak-flow measurements, was only provided by a small number of pharmacies in the UAE. -Health promotion activities, such as smoking cessation and health education, were not undertaken to a large extent in most pharmacies. -A minority of pharmacists claimed that they always report medication errors and adverse drug reactions.	
Bawazir (2004) (108)	Extended community pharmacy services: Not specified		The most favoured suggested new services by consumers were monitoring BP, measuring weight, height, and temperature, monitoring glucose and cholesterol levels, and keeping patient medication records. Facilitators: Availability of a private area.

Alhazmi et al. (2022) (120)	Dispensing and counselling: Not specified	Self-reported practice: Most pharmacists reported that they always explain the dose, frequency, and administration, and ensure patients understand the dosage regimen. However, they are less likely to explain the side effects.	
Palaian et al. (2022) (86)	Extended community pharmacy services: Not specified	Occasionally provided extended services: BP and cholesterol measurement, counselling on family planning, dietary supplements and pregnancy testing. Rarely provided extended services: weight management, diabetes monitoring, BMI calculation, counselling on oral contraceptives, back pain management, care to pregnant patients, and assessments of peripheral neuropathy.	Attitude: -Community pharmacists expressed willingness to provide services like BP measurement, pregnancy testing and BMI measurement. -Some pharmacists were willing to provide testing and laboratory work. -Only a minority were willing to provide medication therapy management services. Barriers: -Lack of incentive, -Lack of documentation, -Lack of time, -Lack of motivation, -Lack of patient demand
Al-Arifi (2012) (110)	Counselling, providing instruction, and ensuring patient compliance: Not specified	Reported practice by patients: -About half of the patients reported that pharmacists provide clear instructions about medication. -Some patients reported that pharmacists ensure their compliance with medication,	Attitude: -Patients had positive perceptions of the community pharmacists' role. -Patients perceived community pharmacists as an effective part of the healthcare system and a health awareness provider.

		provide counselling without asking, and help solve medication-related problems.	
Rayes et al. (2015) (168)	Dispensing and counselling: Not specified	Self-reported practice: -More than half of the pharmacists reported explaining frequency, precautions, and possible side effects, and contacting physicians in cases of clarification and possible drug-drug interaction. -Almost half of the pharmacists reported spending an average of 3–5 min with patients for explanation and consultation. - Some pharmacists reported consulting patients on the use of nutritional supplements, on different choices of diet plans, and answering questions about skincare. - More than half of the pharmacists claimed to assess patients' signs and symptoms and dispense proper medication for patients. -Less than half of the pharmacists ask patients about their medication and medical histories.	
Hamoudi et al. (2011) (193)	Counselling and consultation: Not specified	Patients: -The majority of patients reported that pharmacists provide them with full instructions.	Perceived requirement for effective counselling: -Training - More staff

		-Half of the patients reported visiting the pharmacy for medical recommendations and drug compounding. - A minority of patients reported visiting the pharmacy for BP. Pharmacists: -Pharmacists reported receiving inquiries related to medication and dose recommendations from both patients and physicians.	- Medication information leaflet /educational material.
Alahmad et al. (2023) (191)	Extended community pharmacy services: Not specified	Suggested extended service: lifestyle modification, resolving drug-related problems, monitoring treatment outcomes, managing minor ailments, and independent prescribing.	Attitude: - Most physicians believed that pharmacists should expand their roles beyond traditional roles, have access to patient medical information, and assess patients for treatment-related problems. -Most physicians supported the traditional role of pharmacists as drug information and counselling specialists, who improve patient adherence, provide drug information to physicians, and evaluate and resolve drug-related problems. -Most physicians did not support pharmacists' independent refilling of repeat prescriptions, therapeutic substitution, and treatment of minor ailments. - Most physicians supported generic substitution by

			pharmacists, and many of them supported adjusting drug therapy based on physician-approved protocols. - Some physicians supported counselling on lifestyle modifications.
Panda et al. (2022) (122)	Traditional and extended services: Not specified	Reported practice by patients: -Most patients agreed that community pharmacists provide medication counselling, maintain their privacy, provide enough time to discuss problems, have enough knowledge to answer drug-related queries, check the accuracy of dosing and medications and label medication with dose and usage instructions. -More than half of patients agreed that community pharmacists inquire about medication history, counsel about the disease, drug interaction or adverse effects, and engage in public health promotional activities. -Less than half agreed that community pharmacists perform diagnostic testing, and help monitor and manage chronic conditions.	Attitude: Patients had a positive attitude towards the role of community pharmacists and felt comfortable seeking advice from community pharmacists.

El-Kholy et al. (2022) (121)	Traditional and extended services: Not specified	Reported practice by patients: -More than half of patients reported that community pharmacists were willing to answer their questions, spend enough time with them, solve medication-related problems, and give them clear instructions on medication use. -Less than half of patients reported that community pharmacists collect information on current medical conditions or medication and counsel on lifestyle modifications. -A minority reported that community pharmacists provide BP, BG, temperature, and weight measurement services.	Humanistic: Most patients were generally satisfied with the role of community pharmacists and the pharmacy services offered.	Barriers: Lack of a private area.
Rasheed et al. (2020) (25)	Current and extended services: Not specified	Reported practice by stakeholders: -Community pharmacists are primarily limited to selling and dispensing medicine. -Some of the chain pharmacies in the KSA have initiated diabetic clinics, chronic disease management clinics, and immunisation programmes.		Supported services by the stakeholders: preventive services, public education about chronic diseases, lifestyle modifications counselling, reconciliation and more specialised services like providing anticoagulation monitoring, HBA1c testing, asthma medication review and education, antihypertensive education, HTN management, counselling on contraceptives, medications during pregnancy, and care for minor illnesses. Barriers: -Lack of economic benefits,

			profitability, automation, access to patient data, tools, and a lack of pharmacy technicians to support the pharmacist in the administrative work. -Public image of community pharmacists. Facilitators: -Provide community pharmacists with adequate tools, time, education, and incentives to sustain services. -Collaboration with stakeholders and enforcing any updated regulations.
Kharaba et al. (2022) (190)	Pharmaceutical care during COVID-19 tele-pharmacy, medication review, and education: Not specified	Self-reported practice: Pharmaceutical care in the UAE has changed after COVID-19, the majority of pharmacists practice teleconsultation, remote prescriptions, patient education, and medication review.	
Hasan et al. (2015) (187)	Extended community pharmacy services: Not specified		Attitude: -Physicians argued that pharmacists lack suitable education and need special clinical training -They expressed fear of mismanagement or exacerbation of chronic conditions -Most physicians supported the traditional role of checking the appropriateness of dosing

regimens, treatment duplications, interactions or errors in prescriptions and counselling on medication use

-Many physicians did not support the involvement of pharmacists in minor ailment management

-Some Physicians supported screening in community pharmacies as this might be cheaper, more convenient and accessible than visiting a doctor, and could increase health awareness and reduce the workload in medical clinics

Conditions for screening service:

-should only be available in selected pharmacies to allow better control,

-Clear guidelines should be established,

-Not used to advertise a specific product or machine

Alzubaidi et al. (2018) (189)	Extended pharmacy services: screening services, Medication used review, and chronic disease management: chronic disease	Self-reported practice: -Pharmacists reported monitoring patients' compliance and adherence to medication instructions and communicating with physicians about medication errors. -Some pharmacists reported counselling patients with hypertension and diabetes. -POC testing for diabetes, hypertension, or dyslipidaemia levels was not performed in community pharmacies in the UAE due to legal restrictions. Health screening services were also not offered.	Attitude: -Most pharmacists were willing to provide health screening, chronic disease management, and medication use reviews. Barriers: -Negative perceptions about pharmacists, -Lack of time, -Lack of dedicated areas, -Lack of supportive staff Facilitators: -Training -Regulatory approvals - Appropriate supportive systems such as patient management records and scheduling and follow-up software, access to patient medical records, and clear criteria for referral or communication with physicians -More staff -Incentives.
Zolezzi et al. (2019) (206)	CVD assessment and management - chronic condition management: Patient asks for Aspirin or Crestor (rosuvastatin) for CVD prevention.	Observed practice: -The majority of pharmacists did not ask the simulated patient about lifestyle, family history of CVD, age, or smoking status. - One pharmacist performed CVD risk calculation. - Some pharmacists asked about the presence of medical conditions. - Less than half of the pharmacists'	Attitude: Pharmacists perceived themselves as well prepared and confident to provide CVD risk assessment and management. Barriers: -Lack of time, -Lack of resources, -Lack of space, -Lack of support,

		counsel about CVD risk. -Most pharmacists recommended either Aspirin® or Crestor® to the simulated patients. - A minority recommended physical activity, weight management and smoking cessation. -Most pharmacists advised the simulated patient to consult physicians and have regular check-ups.	-Lack of training opportunities. -Poor public acceptance.
El Hajj et al. (2016) (207)	CVD health promotion, hypertension and dyslipidemia management-chronic condition health promotion and education: Patients with CVD risk factors	Self-reported practice: -About half of the pharmacists often or always counsel patients on the importance of early detection of CVD risk factors and refer patients to doctors for CVD management. -Most pharmacists always or often counsel the patients on the appropriate time to administer anti-hypertensive and anti-dyslipidaemia drugs, and counsel on the importance of lifestyle modifications and self-monitoring.	Attitude: Almost all pharmacists expressed their interest in receiving CVD-related training. Barriers: -Lack of CVD-related educational materials, -Lack of a private area -Lack of time

Hasan et al. (2021) (173)	Asthma assessment and management - chronic condition management: Patient with uncontrolled asthma, complaining of cough at night (dry, non-productive and accompanied by wheezing)	Observed practice: -More than half of the community pharmacists asked about the need for the albuterol inhaler and the history of asthma. -A minority asked about other medications the patient was taking for asthma, assessed patient adherence to their asthma medication, and only one pharmacist asked the patient to demonstrate the inhaler technique to assess patient compliance. -A minority asked about the severity and frequency of the symptoms and the presence of any side effects from the medications. -More than half of the community pharmacists inappropriately supplied cough syrup with an albuterol inhaler. - The majority referred the patient to a physician for proper management. -One pharmacist gave complete information, while others gave incomplete or poor information about the medications for asthma. - A minority gave information about the inhaler technique, which was mostly incomplete.
Alotaibi et al. (2016)	Asthma education- chronic condition	Self-reported practice: -The majority of community

(123)	management: Patient with asthma	pharmacists reported that they educate the patients about the proper techniques of inhalers and basic facts about asthma, they ask about other medications, identify and manage the triggers of asthma, counsel patients about the side effects and ADRs, and explain the role of each medication to the patients. - The majority reported providing patients with instructions about (how much to take, how to take the drug, when to take it, and when to seek medication cure).
Khan and Azhar (2013) (51)	Asthma education-Metered Dose Inhaler (MDI)counselling - chronic condition management: Asthmatic patients using MDI	Observed practice: -Community pharmacists were not aware of the correct way to use inhalers. -Most community pharmacists counselled the patient on MDI by explaining four steps: breathe the air slowly out of the lungs, tilt back your head slightly, place the inhaler mouthpiece in an upright position, close your lips and breathe in slowly for 3–5 s. -Less than half of community pharmacists explained to breathe out before taking a puff and to take a deep inhalation after the puff.
Adnan et al. (2015)	Asthma education-Metered Dose	Observed practice: -Most community pharmacists

(52)	Inhaler (MDI)counselling-chronic condition management: Patients with asthma using MDI	failed to demonstrate complete and correct inhalation technique. - Most community pharmacists explained 5 steps: remove the cap and shake the inhaler, hold the inhaler in the upright position, insert the mouthpiece into the mouth between closed lips, depress the canister once and at the same time begin slow deep inhalation, remove the inhaler with closed lips. -The remaining 3 steps: breathing out slowly and completely, holding breath for 10–15 s, and waiting for 20–30 s before starting the second puff, were demonstrated only by a minority of pharmacists. - A minority of pharmacists demonstrated the complete technique of MDI when counselling patients.	Attitude: Community pharmacists perceived a good knowledge, attitude, and practice regarding pain management in children.
Jairoun et al. (2022) (176)	Pain management-Minor ailment management: Pain in children	Self-reported practice: - Most community pharmacists are involved in providing drug-related information, patient counselling, referrals, vaccination awareness, lifestyle modification and disease prevention, including hypertension	Attitude: Community pharmacists had a satisfactory level of willingness and positive attitude toward their involvement in public health services. Barriers:
Alzarea et al. (2023) (146)	Extended pharmacy services: Public health	Self-reported practice: - Most community pharmacists are involved in providing drug-related information, patient counselling, referrals, vaccination awareness, lifestyle modification and disease prevention, including hypertension	Attitude: Community pharmacists had a satisfactory level of willingness and positive attitude toward their involvement in public health services. Barriers:

		screening, and weight management. - Fewer community pharmacists are involved in dyslipidaemia screening, physical activity promotion or counselling on sexual health.	-Lack of patients' time , -Lack of coordination with other healthcare professionals, -Lack of access to training programmes, - Shortage of pharmacist assistants or technicians. Facilitators: -Education and awareness, -Training
Thomas et al. (2023) (194)	Vaccination: Not specified		Attitude: Community pharmacists showed high willingness and preparedness to provide vaccination services. Facilitators: -Training, -Health regulatory authority support
Jairoun et al. (2024) (195)	Diabetes management-chronic disease management: Patient with diabetes	Self-reported practice: Community pharmacists were moderately active in providing counselling and health promotion services to individuals with diabetes, including advising on medication and insulin use, disease education, risk factors, and the importance of screening.	Barriers: -Lack of coordination with other health care professionals, -Lack of knowledge or clinical skills, -Lack of time, -Lack of access to training programmes.
Alzahrani et al. (2024) (147)	E-prescribing - wasfaty: Not specified		Humanistic: Community pharmacy consumers (wasfaty users) reported lower satisfaction with the availability of medications, pharmacists' explanation

			of prescriptions, and waiting time compared to patients using primary health care centre pharmacies.	
Mohammed et al. (2024) (196)	Hypertension clinic - chronic disease management: Patient with hypertension	-Monthly BP monitoring and continued patient care for up to 6 months: Measuring BP, physician referral for management of hypertension, verifying medications, lifestyle, diet, and medication counselling.	Humanistic: High level of patient satisfaction. Clinical: Reductions in SBP and DBP levels with the continued care of the pharmacist.	Attitude: Some patients were willing to pay for the service.
Almaghaslah (2024) (148)	Sexual and reproductive health promotion: Public health	Self-reported practice: The majority of community pharmacists reported their involvement in selling pregnancy and ovulation tests and providing patients with education regarding the use of test kits, selling combined hormonal contraceptives and emergency contraception pills and providing patients with education on these contraceptive methods.		Attitude: Community pharmacists had positive attitudes and a high willingness to be involved in sexual and reproductive health promotion.
Salem et al. (2024) (149)	Diabetes management- chronic disease management: Patient with diabetes	Self-reported practice: -Most community pharmacists reported their involvement in counselling on insulin administration, handling and storage, advising on antidiabetic drugs timing and missed doses.		Barriers: -Lack of time, -Lack of diabetic patients visiting the pharmacy, -Low patient expectations regarding pharmacists' role -Cultural barriers,

		-Some community pharmacists also provided counselling on disease and risk factors, glucose meter use, lifestyle modifications and the importance of regular screening.	-Lack of diabetes training and education programs, -shortage of personnel
Kurdi et al. (2024) (150)	Dispensing and Counselling: Topical corticosteroids	Self-reported counselling practice: community pharmacists frequently counselled patients on the frequency of application, treatment duration, and contraindications. However, they rarely explained expected effectiveness, side effects, what to do in case of ADRs, dose, strength or storage instructions.	Barriers: Lack of time
Jairoun et al. (2024) (197)	Health screening: chronic kidney disease	The chronic kidney disease (KCD) screening program for high-risk patients utilised the PICCOLO device for on-site blood analysis, to estimate Glomerular Filtration Rate (eGFR), collects demographic information, lifestyle and health habits through questionnaire. Community pharmacists provide comprehensive medication reviews, referrals and lifestyle modification guidance.	Clinical: Of 400 participants,38.8% (155 individuals) were found to have undiagnosed CKD stages 3–5, demonstrating the service's effectiveness in early risk identification.
Rasheed et al. (2024) (151)	E-prescribing - wasfaty: Not specified		Humanistic: Most patients were satisfied with Wasfaty services in terms of Attitude: Participants had a positive attitude and believed that Wasfaty services

			adequate availability and easy accessibility, longer working hours, access to a wide variety of medicines, easier prescription renewals and refills, time-saving, access to pharmacy services, medication counselling, clinical advice and disease monitoring by community pharmacists.	improved the quality of pharmacy services and access to medicines Suggestions: -including home delivery of medicines. - providing medication use reviews -adding more medicines and therapeutic options
Albahrain et al. (2024) (152)	Medication Therapy Management (MTM): Patients with Diabetes	-Certified ambulatory care pharmacist Conducted MTM in a community pharmacy setting for patients with uncontrolled diabetes: including face-to-face visits where pharmacists assess patients' understanding of their medications, review medications and home monitoring data (BG, BP), identify and resolve any drug-related problems, provide an additional education session and refer patients to healthcare providers, if needed. -Follow up with patients over 6 months either by phone calls or clinic visits. -3-month and 6-month visits.	In comparison to the control group with standard care, the results for patients in the MTM arm showed: Humanistic: High patient satisfaction. Clinical: -Significant reduction in the HbA1c at the 6-month -Significant reduction in SBP and DBP readings at 6-month -Significant reduction in SCr readings at 6-month -Significant drop in drug-related problems at 3-month and 6-month follow-up	

			-Lower odds of healthcare utilisation -Improvement in medication adherence at 6-month -Significant reduction in diabetes distress.
Alfadly et al. (2024) (153)	Diarrhoea management - Minor ailments management:	Assessment and history-taking practice: Reported practice: most community pharmacists reported that they usually assess patient history by asking about 3-5 indicators: child's age, onset, duration or frequency of diarrhoea, presence of blood in stool, presence of mucus in stool and fever. Observed practice: fewer community pharmacists assessed patient history by asking about condition indicators, usually asking about 2 or fewer indicators. Treatment recommendation: Reported practice: Most community pharmacists reported that they prescribe oral rehydration solution (ORS) alone or prescribe other drugs like Kaolin. Observed practice: most community pharmacists prescribed ORS plus other drugs or dispensed other drugs alone, like Kaolin,	

		metronidazole, loperamide, probiotics, and lactose-free milk. Counselling practice: Reported practice: The majority of community pharmacists reported explaining the recommended treatment to patients. They also reported providing dietary advice, such as increasing fluid intake. Observed practice: less than half of the community pharmacists explained the treatment to the simulated patient. Most of them did not provide any dietary advice.	
Alotaibi et al. (2023) (154)	Medication Therapy Management (MTM): Older adult population (polypharmacy)		Knowledge and Attitude: -Most community pharmacists showed a high level of knowledge about the MTM service and had a positive attitude. -Most community pharmacists showed a high willingness to provide the service for older adults in the community pharmacy or by personal home visits. Barriers: -Lack of a private room -Lack of training
Alotaibi et al. (2023) (155)	Vaccination: COVID-19 vaccines	Providing COVID-19 vaccines in community pharmacies with scheduled appointments.	Advantages: -Gain more trust in community pharmacists -Personal satisfaction -Enhance the accessibility

			-Reduce the pressure on healthcare system Barriers and Facilitators: -workload and capacity -Lack of staff -Lack of sufficient space or a private room -Lack of training - lack of patient willingness due to their lack of awareness about the role of community pharmacists - lack of incentives and rewards
Alnezary et al. (2024) (156)	Diarrhoea management - Minor ailments management:	Observed practice: Inadequate practice was observed in 3 different scenarios. History taking: most community pharmacists only asked about patients' identity and age. Treatment recommendations: most community pharmacists inappropriately prescribed treatment, including Kaolin or Pectin, and some community pharmacists inappropriately prescribed metronidazole antibiotics without a prescription. -A few recommended the use of oral rehydration solution (ORS) -Few community pharmacists made the appropriate referrals to physicians. Some community pharmacists provided no intervention.	

		Counselling: Most community pharmacists provided appropriate counselling on the dispensed medication.	
Alrasheed et al. (2024) (157)	Dispensing and Counselling: Doxycycline self-medication in pregnant women	Observed practice: Most community pharmacists requested a prescription before dispensing the medication, and some of them advised the simulated patient to consult a physician. A few community pharmacists inquired about the pregnancy status.	
Khardali (2024) (158)	ADRs reporting: ADRs	The majority of community pharmacists reported observing and reporting ADRs to the SFDA at least once per month.	Attitude: Community pharmacists had a positive attitude toward ADR reporting and believed it was essential for patient care. Barriers: -Lack of incentives and rewards -Lack of time Facilitators: -Public awareness -Incentives -Feedback on previously submitted reports -Surveillance system
Alzahrani et al. (2024) (159)	E-prescribing - wasfaty: Not specified	Humanistic: The majority of patients were satisfied with the services of the community pharmacists	

			and the Wasfaty system, including medication availability, pharmacists' explanations of prescriptions, waiting times, ease of use and clarity of Wasfaty's instructions.
Alsaahli et al. (2023) (160)	E-prescribing - wasfaty: Not specified		Humanistic: Most community pharmacists were unsatisfied with Wasfaty service. Advantage: Improved patient safety, reduced medication errors, decreased prescription drug abuse and promoted management of patient medications. Problems: -Unavailability of some medication -Incorrect, incomplete and inaccurate information entered into the system. -Technical issues with the system
Jairoun et al. (2023) (198)	CVD management-chronic disease management: Patients with CVD	Reported practice: -Most community pharmacists reported their involvement in lifestyle modification counselling, selling BP and BG monitoring devices, advising patients on the prescribed treatment, and encouraging patients to follow the treatment. -Few community pharmacists reported their involvement in screening and measuring weight, glucose levels, and BP, monitoring	Barriers: -Lack of coordination with other healthcare providers. -Lack of time -Lack of knowledge or clinical skills -Lack of patient interest

		treatment, maintaining medical records, and reviewing medication refill histories.	
Alghamdi et al. (2023) (161)	Extended pharmacy services and automated pharmacy system:	Reported practice: -Most community pharmacists reported that they are not utilising automated systems such as robotic dispensing systems, electronic prescriptions, or printed labels. -Most community pharmacists reported that they are not involved in providing extended services such as: health screening services, public health programmes, vaccination services, MTM or treatment monitoring. - A few community pharmacists reported minimal involvement in some extended services and automated systems.	Attitude: Most had positive attitudes and a high willingness to provide extended services. Barriers: -Inadequate training -Lack of communication skills -Lack of knowledge and skills to solve clinical problems -Lack of collaboration with physicians -Consumers' financial situation -Negative perception about the role of community pharmacists -Lack of a private area -Shortage of staff -Lack of drug information resources -Lack of support from managers -Lack of access to patients' medical records -Lack of remuneration -Legislative issues

CVD: cardiovascular diseases, OTC: over the counter, ADRs: adverse drug reactions, MTM: medication therapy management, MUR: medication use review, MDI: metered dose inhaler, POC testing: Point of care testing, TC: total cholesterol, LDL: low-density lipoprotein, HDL: high-density lipoprotein, BG: blood glucose, HbA1c: glycated haemoglobin, BP: blood pressure, SBP: systolic blood pressure, DBP: diastolic blood pressure, ASCVD: atherosclerotic cardiovascular diseases, T2DM: type-2 diabetes mellitus, H2RA: histamine 2 receptor antagonist, HTN: hypertension.

Appendix A5: Reporting checklist

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	Page 29
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	Page 30-32
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	Page 31-32
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	Page 32-33 + table 3.1
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	Page 32
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	Page 35
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	Page 34-35
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Page 35+ Appendix A1, Page 267-270
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	Page 35-36
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	Page 36
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	Page 36
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	Not applicable
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	Page 37

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	Page 38 + Figure 3.1
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Page 39-40
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	Not applicable
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Appendix A3, A4.
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	Page 42-53 + Table 3.3 and Table 3.4
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	Page 61-65
Limitations	20	Discuss the limitations of the scoping review process.	Page 66
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	Page 67-68
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	Not applicable

Appendix B: Chapter 3 appendices

Appendix B1: Search strategy

Database: Ovid MEDLINE(R) ALL <1946 to May 24, 2024>

Search Strategy:

- 1** Cardiovascular.mp. or Cardiovascular Diseases/ (722632)
- 2** CVD.mp. (54671)
- 3** Hypertension/ or Blood Pressure/ or HTN.mp. (482697)
- 4** Dyslipidemias/ or dyslipidaemia.mp. or Cardiovascular Diseases/ (200347)
- 5** Coronary Artery Disease/ or Cardiovascular Diseases/ or Atherosclerosis/ or atherosclerotic disease.mp. or Arteriosclerosis/ (356615)
- 6** comorbidities.mp. or Comorbidity/ (240381)
- 7** 1 or 2 or 3 or 4 or 5 or 6 (1451102)
- 8** screening.mp. or Mass Screening/ (802653)
- 9** risk screening.mp. or Risk Assessment/ (315207)
- 10** disease screening.mp. (2521)
- 11** diagnostic screening.mp. (1901)
- 12** CVD-screening.mp. (151)
- 13** CVD risk screening.mp. (82)
- 14** 8 or 9 or 10 or 11 or 12 or 13 (1095274)
- 15** community pharmacy.mp. (8760)
- 16** community pharmacy services.mp. or Community Pharmacy Services/ (6275)
- 17** Community Pharmacy Services/ or community pharmacy-based.mp. (6120)
- 18** community pharmacists.mp. or Pharmacists/ (24536)
- 19** community pharmacists-led.mp. (5)
- 20** 15 or 16 or 17 or 18 or 19 (28489)
- 21** Program Development/ or development.mp. (3471409)
- 22** service development.mp. (1925)
- 23** Implementation Science/ or implementation.mp. (385675)
- 24** Community Pharmacy Services/ or service implementation.mp. (6325)
- 25** designing.mp. (108679)
- 26** service designing.mp. (5)
- 27** 21 or 22 or 23 or 24 or 25 or 26 (3864373)
- 28** 7 and 14 and 20 and 27 (114)

Appendix B2: The nine Expert Recommendations for Implementing Change (ERIC) implementation strategies

Overview of the nine Expert Recommendations for Implementing Change (ERIC) implementation strategies, with examples and definitions to clarify their application (288, 289)

The nine ERIC implementation strategies	Example of implementation strategies “definition”
Use evaluative and iterative strategies	- Develop a formal implementation blueprint: “Develop a formal implementation blueprint that includes all goals and strategies. The blueprint should include the following: 1) aim/purpose of the implementation; 2) scope of the change (e.g., what organisational units are affected); 3) timeframe and milestones; and 4) appropriate performance/progress measures. Use and update this plan to guide the implementation effort over time” - Stage implementations scale up: “Phase implementation efforts by starting with small pilots or demonstration projects and gradually move to a system-wide rollout” - Audit and provide feedback: “Collect and summarise clinical performance data over a specified time period and give it to clinicians and administrators to monitor, evaluate, and modify provider behaviour”
Provide interactive assistance	- Provide local technical assistance: “Develop and use a system to deliver technical assistance focused on implementation issues using local personnel” - Centralise technical assistance: “Develop and use a centralised system to deliver technical assistance focused on implementation issues”
Adapt and tailor to context	- Tailor strategies: “Tailor the implementation strategies to address barriers and leverage facilitators that were identified through earlier data collection” - Promote adaptability: “Identify the ways a clinical innovation can be tailored to meet local needs and clarify which elements of the innovation must be maintained to preserve fidelity” - Use data warehousing techniques: “Integrate clinical records across facilities and organisations to facilitate implementation across systems”
Develop stakeholder interrelationships	- Promote network weaving: “Identify and build on existing high-quality working relationships and networks within and outside the organisation, organisational units, teams, etc., to promote information sharing, collaborative problem-solving, and a shared vision/goal related to implementing the innovation” - Build a coalition: “Recruit and cultivate relationships with partners in the implementation effort” - Conduct local consensus discussions: “Include local providers and other stakeholders in discussions that address whether the chosen problem is important and whether the clinical innovation to address it is appropriate”

	- Develop academic partnerships: “Partner with a university or academic unit for the purposes of shared training and bringing research skills to an implementation project” - Organise clinician implementation team meetings: “Develop and support teams of clinicians who are implementing the innovation and give them protected time to reflect on the implementation effort, share lessons learned, and support one another’s learning” - Obtain formal commitments: “Obtain written commitments from key partners that state what they will do to implement the innovation” - Use advisory boards and workgroups: “Create and engage a formal group of multiple kinds of stakeholders to provide input and advice on implementation efforts and to elicit recommendations for improvements” - Use an implementation advisor: “Seek guidance from experts in implementation”
Train and educate stakeholders	- Conduct ongoing training: “Plan for and conduct training in the clinical innovation in an ongoing way” - Develop educational materials: “Develop and format manuals, toolkits, and other supporting materials in ways that make it easier for stakeholders to learn about the innovation and for clinicians to learn how to deliver the clinical innovation” - Distribute educational materials: “Distribute educational materials (including guidelines, manuals, and toolkits) in person, by mail, and/or electronically” - Use train-the-trainer strategies: “Train designated clinicians or organisations to train others in the clinical Innovation” - Work with educational institutions: “Encourage educational institutions to train clinicians in the innovation”
Support clinicians	- Facilitate relay of clinical data to providers: “Provide as close to real-time data as possible about key measures of process/outcomes using integrated modes/channels of communication in a way that promotes use of the targeted innovation” - Develop resource sharing agreements: “Develop partnerships with organisations that have resources needed to implement the innovation” - Revise professional roles: “Shift and revise roles among professionals who provide care, and redesign job Characteristics” - Create new clinical teams: “Change who serves on the clinical team, adding different disciplines and different skills to make it more likely that the clinical innovation is delivered (or is more successfully delivered”
Engage consumers	- Use mass media: “Use media to reach large numbers of people to spread the word about the clinical innovation”

	- Increase demand: “Attempt to influence the market for the clinical innovation to increase competition intensity and to increase the maturity of the market for the clinical innovation”
Utilise financial strategies	- Alter incentive/allowance structures: “Work to incentivise the adoption and implementation of the clinical innovation” - Alter patient/consumer fees: “Create fee structures where patients/consumers pay less for preferred treatments (the clinical innovation) and more for less-preferred treatments” - Fund and contract for the clinical innovation: “Governments and other payers of services issue requests for proposals to deliver the innovation, use contracting processes to motivate providers to deliver the clinical innovation, and develop new funding formulas that make it more likely that providers will deliver the innovation” - Use capitated payments: “Pay providers or care systems a set amount per patient/consumer for delivering clinical care”
Change infrastructure	- Change record systems: “Change record systems to allow better assessment of implementation or clinical outcomes” - Change physical structure and equipment: “Evaluate current configurations and adapt, as needed, the physical structure and/or equipment (e.g., changing the layout of a room, adding equipment) to best accommodate the targeted innovation” - Create or change credentialing and/or licensure standards: “Create an organisation that certifies clinicians in the innovation, or encourage an existing organisation to do so. Change governmental professional certification or licensure requirements to include delivering the innovation. Work to alter continuing education requirements to shape professional practice toward innovation”

Appendix C: Chapter 4 appendices

Appendix C1: Participant information sheet, consent form and demographic information questionnaire

Appendix C1.1. Participant information sheet



Participant Information Sheet

Name of department: Strathclyde Institute of Pharmacy and Biomedical Sciences

Title of the study: Co-design and development of community pharmacy-based cardiovascular risk screening service in Saudi Arabia: Multi-stakeholders Nominal Group Technique Consensus.

Introduction

Cardiovascular diseases (CVDs) are the leading cause of death worldwide. In Saudi Arabia, CVDs are responsible for 42% of all deaths, making their prevention a top public health priority. The development of a national CVD risk screening programme in primary care with multiple access points has been recommended. Community pharmacies, which are easy to access, could play a significant role in offering these screening services. Several community pharmacy-based CVD screening programmes have been successfully implemented and evaluated in various countries worldwide, showing promising results. In Saudi Arabia, previous studies found that stakeholders support the idea of community pharmacy-based CVD risk screening. However, there is no agreement yet on the model or guidelines for the service.

This project is a part of PhD thesis for a PhD student (Solafa Noorsaeed) at the University of Strathclyde, aiming to develop a community pharmacy-based CVD risk screening service.

What is the purpose of this research?

This study will identify the needs and priorities regarding CVD risk screening services in Saudi Arabia and achieve consensus on the appropriate model for screening services to be implemented in Saudi Arabia.

Do you have to take part?

No, your participation in this study is voluntary. Choosing not to participate or withdrawing later will not affect you. If you decide to take part, you will be asked to sign a consent form and confirm your decision again on the meeting day. You can withdraw at any time without giving a reason. If you choose to take part, you will be offered a 50£ gift voucher to thank you for your time.

What will you do in the project?

If you decide to take part you will first be asked to complete a personal information questionnaire, to allow us to ensure we are recruiting the targeted participants and a pre-meeting questionnaire, to collect your ideas on the topic. In the pre-meeting questionnaire, you will be asked to review the pre-identified lists from the literature related to service targeted population, screening processes, and post-screening interventions. You will be provided with a space for free-text comments to suggest any additional ideas (if any). After completing the questionnaire, you will be contacted to schedule the meeting, which will be held in Riyadh. We will have a structured face-to-face discussion with the expert panel on the day of the meeting. The meeting will be moderated by 2 facilitators, the primary researcher (Solafa Noorsaeed) and another researcher (Hadi Almansour). The discussion will be focused on three main ideas: service-targeted populations, screening processes, and post-screening interventions, to help identify and design an appropriate model for the service. The discussion involves several steps:

- 1) The pre-identified lists and the generated ideas from the pre-meeting questionnaire will be presented to all participants on the meeting day.
- 2) You will be involved in a discussion with the whole group about the proposed ideas, and clarify, modify, and group those ideas. This will take up to 30 minutes for each topic.
- 3) You will be provided with a ranking sheet to independently rank those ideas, with the highest score to be provided for the most favourable item, and the lowest score for the least favourable item. This will take up to 10 minutes for each topic.
- 4) The researcher will present and discuss the ranking scores with the group to achieve agreement and decide on the ideas that should be prioritised. If variation in ranking influences the decision, you will be asked to re-rank again until the agreement is achieved.

***The meeting will take up to 3 hours.**

Why have you been invited to take part?

We are inviting different groups of people with different expertise, including:

- 1) Experts in CVD prevention or management such as cardiologists and clinical pharmacists.
- 2) Service providers including community pharmacists and general practitioners (primary care physicians).
- 3) Policymakers or experts in health and pharmaceutical policy or service implementation in Saudi Arabia such as representatives from the Ministry of Health (MOH), community pharmacy CEO/manager, and representatives from public health organisations.

Thus, you have been invited as you are one of those experts who could help in decision-making regarding service development.

To take part, you must belong to one of the above-listed groups and

- be a resident of Saudi Arabia.
- be able to communicate in English (verbally and written).
- Be able to consent for yourself.

What are the potential risks to you in taking part?

As the discussion will be in front of groups of experts with varied degrees of expertise, you might feel uncomfortable or stressed from expressing your opinions and ideas. The researcher will create a comfortable discussion environment that values each contribution and ensures confidentiality. You can take a short break to relax and reduce any built-up stress. You can also withdraw from the study at any time without any consequences.

What information is being collected in the project?

Information collected will include personal information such as gender, place of living, expertise, and what group you belong to, to help us understand who has taken part in the study. The collected data will also include your proposed ideas and opinions throughout the discussion and your ranking scores.

Who will have access to the information?

Only the primary researcher (Solafa Noorsaeed) and her supervisors at the University of Strathclyde will have access to any of your information. Your participation will be confidential, and your information will be anonymised throughout the study. The results and the anonymised information will be included in the PhD thesis or may also be written into a report, presentation, or published in a research journal.

Where will the information be stored and how long will it be kept for?

All data will be securely stored in a password-protected system. According to the [UK GDPR and Data Protection Act 2018 regulations](#), followed by the University of Strathclyde, the data will be destroyed 10 years after the study period. All personal data will be processed in accordance with data protection legislation. Please read our [Privacy Notice for Research Participants](#) for more information about your rights under the legislation.

Thank you for reading this information – please ask any questions if you are unsure about what is written here.

What happens next?

If you are happy to participate, please sign the consent form on the next page and complete the personal information questions. We will contact you soon to proceed with the next stage (send you the pre-meeting questionnaire and schedule the meeting day).

We recommend that you keep a copy of this document for your records.

If you have read this information sheet and do not wish to be involved, thank you for your attention.

Researcher contact details:

The details of the primary researcher of this project:

Solafa Noorsaeed (PhD student at the University of Strathclyde)

Email: solafa.noorsaeed@strath.ac.uk

Phone: +966 542947060

Chief Investigator details:

If you have any questions or would like more information, please contact Amanj Kurdi at the University of Strathclyde at:

Prof Amanj Kurdi (Chief Investigator)

Email: amanj.baker@strath.ac.uk

Phone: 01415482181

This research was granted ethical approval by the Strathclyde Institute of Pharmacy and Biomedical Sciences Ethics Committee.

If you have any questions/concerns, during or after the research, or wish to contact an independent person to whom any questions may be directed or further information may be sought from, please contact:

Strathclyde institute of pharmacy and biomedical science (SIPBS) Ethics committee

Prof Margaret Watson

Email: sipbs-ethics@strath.ac.uk

Appendix C1.2. Consent form



Start of Block: Consent form

Consent Form

Please carefully read each statement below:

- I confirm that I have read and understood the Participant Information Sheet for the above project and the researcher has answered any queries to my satisfaction.
- I confirm that I have read and understood the Privacy Notice for Participants in Research Projects and understand how my personal information will be used and what will happen to it (i.e. how it will be stored and for how long).
- I understand that my participation is voluntary and that I am free to withdraw from the project at any time, up to the point of completion, without having to give a reason and without any consequences.
- I understand that I can request the withdrawal from the study of some personal information and that whenever possible researchers will comply with my request. This includes the following personal data:
 - audio recordings of discussions that identify me
 - my personal information from the demographic information questionnaire.
- I understand that anonymised data (i.e. data that do not identify me personally) cannot be withdrawn once they have been included in the study.
- I understand that any information recorded in the research will remain confidential and no information that identifies me will be made publicly available.
- I consent to being a participant in the project. -I consent to be audio recorded as part of the project.

*** if you agree and consent, please select "I agree" , type your name, and proceed to the personal information page by clicking the "Next" button. If you do not wish to consent, thank you for your time.**

- ☐ I agree, and my name is _____
- ☐ I don't agree

Skip To: End of Survey If Consent Form = I don't agree

Appendix C1.3. Demographic questionnaire



Demographic Information

Please respond to the following questions by selecting or providing the appropriate answer. This will help us ensure that we are recruiting the targeted participants.

Q1: Which of the following professionals do you belong to?*

- ☐ Cardiologist
- ☐ General practitioner/ Primary care physician
- ☐ Clinical pharmacist
- ☐ Community pharmacist
- ☐ A representative from the Ministry of Health
- ☐ A representative from a public health organisation
- ☐ A representative from a community pharmacy (e.g., manager, CEO)

Page Break

The questions on this page are optional. You may skip them if you prefer.

Q2: For how long (in years) have you been in this position?

Q3: What is your area of speciality or expertise (If any)?

Q4: Which organisation do you represent?

Q5: What is your role within the organisation?

Page Break

Q6: Where do you currently live?*

- ☐ Riyadh province
- ☐ Makkah province
- ☐ Madinah province
- ☐ Eastern Province
- ☐ Al-Qassim province
- ☐ Hail province
- ☐ Tabuk province
- ☐ Northern Borders province
- ☐ Jazan province
- ☐ Najran province
- ☐ Al-Bahah province
- ☐ Al-Jawf province
- ☐ Asir province

Page Break

Q7: What is your gender? (optional)

- ☐ Male
- ☐ Female

Page Break

Thank you for completing the previous questions.
In this section, we would like to know your preferred day and time for the meeting.
Please complete the following questions to help us arrange the next stage of the study.

Q1: What is your preferred day to schedule the meeting?*

*you can select more than one option.

☐ Weekday

☐ Weekend

Q2: What time of the day do you prefer for the meeting?*

*you can select more than one option.

☐ Morning (9:30 am - 12:30 pm)

☐ Afternoon (1:30 pm - 4:30 pm)

☐ Evening (7:00 pm - 10:00 pm)

Q3: What is your preferred date period to schedule the meeting? *

*you can select more than one option and suggest specific preferred date(s).

☐ Late January 2025

☐ Early February 2025 (SIPHA25 conference week)

End of survey

Thank you for taking the time to complete this survey.
Your response has been recorded, and we will contact you soon to proceed with the next stage.
If you have any questions, please feel free to contact me.

Appendix C2: Pre-NGT meeting questionnaire



The ideas presented in this survey have been collected from a literature review of various community pharmacy-based Cardiovascular diseases (CVDs) risk screening service models implemented in different countries worldwide.

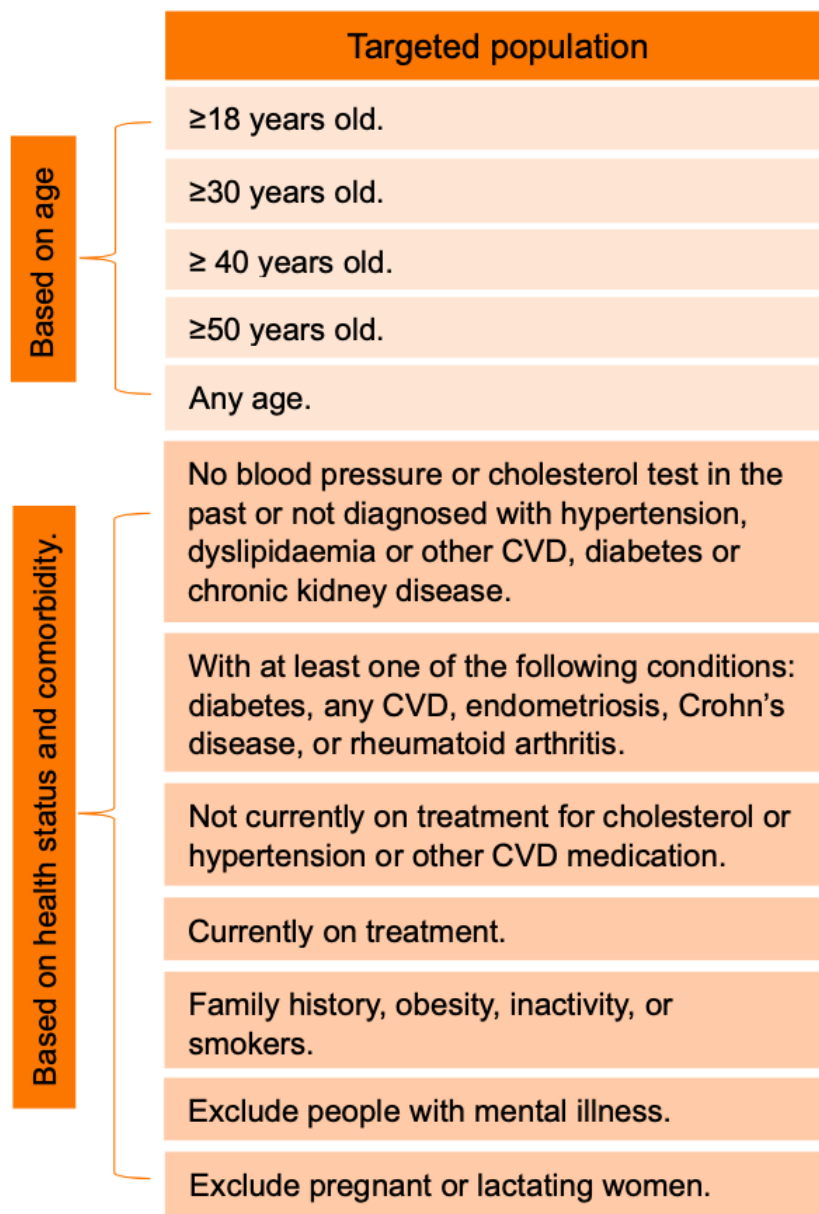
Please review these ideas and suggest any additional ideas you might have related to community pharmacy-based CVD risk screening services, including the targeted population, screening processes, and post-screening interventions.

If you have no suggestions, please carefully review the provided list of ideas in preparation for the expert panel meeting, where you will discuss and rank these ideas.

*These ideas, along with any additional suggestions you provide, will be discussed during the expert panel meeting.

A list of Ideas collected from the literature regarding the Community pharmacy-based cardiovascular disease (CVD) risk screening service.

	Targeted population	Assessment and Screening	Post-screening interventions
Based on age	≥18 years old.	Collect data on demographics, family/medical history, medications, and lifestyle status.	Offer written and verbal education on CV risk factors, smoking cessation, diet, and physical activity.
	≥30 years old.		
	≥40 years old.	Anthropometric measurements: weight, height, waist circumference, and body mass index.	Communicate the results to the physician.
	≥50 years old.	Point of care testing: lipid profile, blood pressure, blood glucose.	Refer high-risk individuals to the physician.
	Any age.	Calculate the CVD risk score using a validated screening tool.	Follow up with patients.
Based on health status and comorbidity	No blood pressure or cholesterol test in the past or not diagnosed with hypertension, dyslipidaemia or other CVD, diabetes or chronic kidney disease.	Atrial Fibrillation screening with handheld Electrocardiogram (ECG).	Offer treatment recommendations to physicians.
	With at least one of the following conditions: diabetes, any CVD, endometriosis, Crohn's disease, or rheumatoid arthritis.	Diabetes risk assessment, offer Haemoglobin A1C testing if high risk for diabetes or high blood pressure identified.	Prescribing treatment.
	Not currently on treatment for cholesterol or hypertension or other CVD medication.	Stroke risk assessment.	Monthly counselling sessions/ post-physician visit counselling sessions.
	Currently on treatment.	Assess medication adherence if patients were on treatment.	Medication therapy management/ review following physician visits.
	Family history, obesity, inactivity, or smokers.		
	Exclude people with mental illness.		
	Exclude pregnant or lactating women.		



Please suggest any additional ideas (if any) regarding **the age group and population characteristics** you believe should be targeted for the CVD risk screening service in Saudi Arabia. If you have no suggestions, please leave this blank.

Assessment and Screening

Collect data on demographics, family/medical history, medications, and lifestyle status.

Anthropometric measurements: weight, height, waist circumference, and body mass index.

Point of care testing: lipid profile, blood pressure, blood glucose.

Calculate the CVD risk score using a validated screening tool.

Atrial Fibrillation screening with handheld Electrocardiogram (ECG).

Diabetes risk assessment, offer Haemoglobin A1C testing if high risk for diabetes or high blood pressure identified.

Stroke risk assessment.

Assess medication adherence if patients were on treatment.

Please suggest any additional ideas (if any) regarding **the screening processes** you believe should be included as part of the CVD risk screening service in Saudi Arabia. If you have no suggestions, please leave this blank.

Post-screening interventions

Offer written and verbal education on CV risk factors, smoking cessation, diet, and physical activity.

Communicate the results to the physician.

Refer high-risk individuals to the physician.

Follow up with patients.

Offer treatment recommendations to physicians.

Prescribing treatment.

Monthly counselling sessions/ post-physician visit counselling sessions.

Medication therapy management/ review following physician visits.

Please suggest any additional ideas (if any) regarding **post-screening interventions** you believe should be included as part of the CVD risk screening service in Saudi Arabia. If you have no suggestions, please leave this blank.

Appendix C3: NGT meeting workbook



Workbook

Topic 1: Targeted populations.

Q: who should be targeted for CVD risk screening in community pharmacies?

Prompt: targeted age, targeted risk factors, individuals with certain conditions or on certain medications, etc.

<u>Discussion Notes</u>	
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Topic 2: Screening processes and post-screening interventions

What should the community pharmacy-based CVD risk screening services involve?

"Think about how the screening service should look like"

Prompt: required information, tests, measurements, interventions, etc.

<u>Discussion Notes</u>	
-------------------------	--

Participant name:

Ranking for Topic 1: Service-targeted populations

Please rank the following ideas from highest to lowest priority, with 6 representing the highest and 1 representing the lowest. This will help prioritise the ideas for developing the community pharmacy-based CVD risk screening.

Based on age

	Ideas	Ranking
1	≥18 years old	
2	≥30 years old	
3	≥ 40 years old	
4	≥50 years old	
5	Any age	
6	18 - 40 years old	

Based on health status and other criteria

Please rank the following ideas from highest to lowest priority, with 12 representing the highest and 1 representing the lowest. This will help prioritise the ideas for developing the community pharmacy-based CVD risk screening.

	Ideas	Ranking
1	No blood pressure or cholesterol test in the past year or not diagnosed with hypertension, dyslipidaemia or other CVD, diabetes or chronic kidney disease.	
2	With at least one of the following conditions: pre-diabetes/diabetes, hypertension, dyslipidaemia, or any CVD, endometriosis, Crohn's disease, or rheumatoid arthritis.	
3	Not currently on treatment for cholesterol or hypertension or other CVD medication.	
4	Currently on any treatment: metformin, clopidogrel/aspirin, antihypertensives, statins, nitroglycerin.	
5	Currently on medications that cause CV harm.	
6	Family history, obesity, inactivity, unhealthy diet, smokers or former smokers.	
7	Exclude pregnant or lactating women.	
8	Exclude people with mental illness.	
9	Socioeconomic status (deprived population)	
10	Gender	
11	Bodybuilders	
12	People with disabilities	

Participant name:

Ranking for Topic 2: Service components

Assessment and screening processes:

Please rank the following ideas from highest to lowest priority, with 10 representing the highest and 1 representing the lowest. This will help prioritise the ideas for developing the community pharmacy-based CVD risk screening.

	Ideas	Ranking
1	Collect data on age, gender, ethnicity, socioeconomic, residence area family/medical history, medications, smoking, diet, physical activity status and health literacy .	
2	Anthropometric measurements: weight, height, waist circumference, and body mass index.	
3	Point of care or venipuncture testing: lipid profile, blood pressure, blood glucose.	
4	Calculate the CVD risk score using a validated screening tool.	
5	Diabetes risk assessment using validated tool.	
6	Atrial Fibrillation screening with a handheld Electrocardiogram (ECG), if the patient has a history of diabetes or hypertension .	
7	Heart Rate Variability (HRV) assessment .	
8	Stroke risk assessment.	
9	Assess medication adherence if patients were on treatment.	
10	Oral health assessment .	

Participant name:

Post-screening interventions:

Please rank the following ideas from highest to lowest priority, with 8 representing the highest and 1 representing the lowest. This will help prioritise the ideas for developing the community pharmacy-based CVD risk screening.

	Ideas	Ranking
1	Offer written and verbal education on CV risk factors, smoking cessation, stress reduction, weight reduction , diet, and physical activity / Lifestyle and behaviour modification coaching (for all regardless of risk) .	
2	Communicate the results to the physician.	
3	Refer individuals to the physician, dietician, or wellness clinic and follow up with the patient for referral uptake (depending on the risk) .	
4	Follow up with patients within a specific timeframe (depending on the risk) .	
5	Offer treatment recommendations to physicians.	
6	Prescribe treatment.	
7	Monthly counselling sessions/ post-physician visit counselling sessions.	
8	Medication therapy management and follow-up with the patient for the provided intervention (depending on the risk) .	

Appendix C4: Thematic analysis codebook

Name	Description
1. Drivers of Strategic Decision-Making	This category presents all reported justifications that influence the group's decision to include or exclude ideas.
1.1. Challenges and limitations	
Data accessibility challenge	
Irrelevance	
Legal boundaries	
Practicality challenge	
Setting Challenge	
Time Challenge	
tool limitation	
1.2. Consumer characteristics and public awareness	Consumers' demographics, needs, behaviours and awareness as factors that influence the group's priorities.
Consumer characteristics	
Awareness	
1.3. Evidence of CVD risk	The level of risk as an indicator in determining whether to prioritise certain ideas.
1.4. Pharmacists' capability and responsibility	Prioritising ideas based on the pharmacist's role and capabilities including skills, knowledge, and training.
1.5. Practicality, and impact consideration	Justifying priorities based on their importance and practical considerations, including simplicity, affordability, feasibility, setting preparedness, and data accessibility, and assessing their influence on achieving the desired outcome.
Affordability	
Applicability and feasibility	
Comprehensiveness	
Easy and quick	
Importance	
Optimising service outcomes	
2. Facilitators for Sustainable Implementation	This theme focuses on the proposed strategies and recommendations to simplify and facilitate the service implementation for greater impact.
2.1. Empowering pharmacists	Need for adequate training to prepare the pharmacists and ensure their qualifications as well as reimbursement structures to support pharmacists and optimise service quality.
Pharmacists' Preparedness	
Reimbursement structure	
2.2. Protocol and regulation	Requirement for clear guidance, a structured framework, protocol and supportive regulations.
2.3. Stakeholder Involvement and Collaboration	Promoting shared responsibility and partnerships among key stakeholders: Pharmacist-physician collaboration, supporting collaborative agreement, insurance companies' involvement, and private-public partnership.
2.4. System and infrastructure preparedness	Strengthening integrated systems and ensuring the availability of approved and easy tools, well-equipped private areas, and other necessary infrastructure to support effective service implementation, + promising supportive initiatives.
Integrated system	
setting recommendation	
Tools	

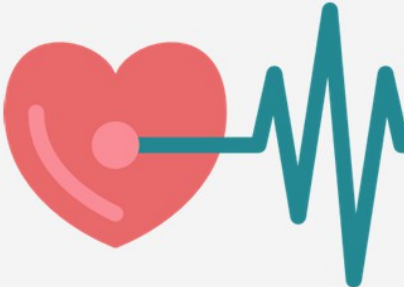
Appendix C5: Reporting checklist

Item No.	Section	Checklist Item (<i>help text</i>)	Page No.
T1	Title	Identify the article as reporting a consensus exercise and state the consensus methods used in the title. <i>For example, Delphi or nominal group technique.</i>	118
I1	Introduction	Explain why a consensus exercise was chosen over other approaches.	122
I2		State the aim of the consensus exercise, including its intended audience and geographical scope (national, regional, global).	122
I3		If the consensus exercise is an update of an existing document, state why an update is needed, and provide the citation for the original document.	NA
M1	Methods Registration	If the study or study protocol was prospectively registered, state the registration platform and provide a link. If the exercise was not registered, this should be stated. <i>Recommended to include the date of registration.</i>	124
M2	Selection of SC and/or panellists	Describe the role(s) and areas of expertise or experience of those directing the consensus exercise. <i>For example, whether the project was led by a chair, co-chairs or a steering committee, and, if so, how they were chosen. List their names if appropriate, and whether there were any subgroups for individual steps in the process.</i>	126
M3		Explain the criteria for panellist inclusion and the rationale for panellist numbers. State who was responsible for panellist selection.	126-127
M4		Describe the recruitment process (how panellists were invited to participate). <i>Include communication/advertisement method(s) and locations, numbers of invitations sent, and whether there was centralised oversight of invitations or if panellists were asked/allowed to suggest other members of the panel.</i>	127
M5	Preparatory research	Describe the role of any members of the public, patients or carers in the different steps of the study.	NA
M6		Describe how information was obtained prior to generating items or other materials used during the consensus exercise. <i>This might include a literature review, interviews, surveys, or another process.</i>	128
M7		Describe any systematic literature search in detail, including the search strategy and dates of search or the citation if published already. <i>Provide the details suggested by the reporting guideline PRISMA and the related PRISMA-Search extension.</i>	128 + Chapter 4
M8		Describe how any existing scientific evidence was summarised, and if this evidence was provided to the panellists.	128-129 + Figure 5.1 page 123
M9	Assessing consensus	Describe the methods used and steps taken to gather panellist input and reach consensus (for example, Delphi, RAND-UCLA, nominal group technique). <i>If modifications were made to the method in its original form, provide a detailed explanation of how the method was adjusted and why this was necessary for the purpose of your consensus-based study.</i>	125 Table 5.1
M10		Describe how each question or statement was presented and the response options. State whether panellists were able to or required to explain their responses, and whether they could propose new items. <i>Where possible, present the questionnaire or list of statements as supplementary material.</i>	130-131 (Table 5.1) Appendix C2, C3
M11		State the objective of each consensus step. <i>A step could be a consensus meeting, a discussion or interview session, or a Delphi round.</i>	130-131 (Table 5.1)
M12		State the definition of consensus (for example, number, percentage, or categorical rating, such as 'agree' or 'strongly agree') and explain the rationale for that definition.	5 (Table 1)
M13		State whether items that met the prespecified definition of consensus were included in any subsequent voting rounds.	4-5 (Table 1)
M14		For each step, describe how responses were collected and whether responses were collected in a group setting or individually.	4-5 (Table 1)
M15		Describe how responses were processed and/or synthesised. <i>Include qualitative analyses of free-text responses (for example, thematic, content or cluster analysis) and/or quantitative analytical methods, if used.</i>	134
M16		Describe any piloting of the study materials and/or survey instruments. <i>Include how many individuals piloted the study materials, the rationale for the selection of those individuals, any changes made as a result and whether their responses were used in the calculation of the final consensus. If no pilot was conducted, this should be stated.</i>	129
M17		If applicable, describe how feedback was provided to panellists at the end of each consensus step or meeting. <i>State whether feedback was quantitative (for example, approval rates per topic/item) and/or qualitative (for example, comments, or lists of approved items), and whether it was anonymised.</i>	Table 5.1
M18		State whether anonymity was planned in the study design. Explain where and to whom it was applied and what methods were used to guarantee anonymity.	130
M19		State if the steering committee was involved in the decisions made by the consensus panel. <i>For example, whether the steering committee or those managing consensus also had voting rights.</i>	NA
M20	Participation	Describe any incentives used to encourage responses or participation in the consensus process. <i>For example, were invitations to participate reiterated, or were participants reimbursed for their time.</i>	131
M21		Describe any adaptations to make the surveys/meetings more accessible.	130

		<i>For example, the languages in which the surveys/meetings were conducted and whether translations or plain language summaries were available.</i>	
R1	Results	State when the consensus exercise was conducted. List the date of initiation and the time taken to complete each consensus step, analysis, and any extensions or delays in the analysis.	128
R2		Explain any deviations from the study protocol, and why these were necessary. <i>For example, addition of panel members during the exercise, number of consensus steps, stopping criteria; report the step(s) in which this occurred.</i>	NA
R3		For each step, report quantitative (number of panellists, response rate) and qualitative (relevant socio-demographics) data to describe the participating panellists.	134 (Table 5.2)
R4		Report the final outcome of the consensus process as qualitative (for example, aggregated themes from comments) and/or quantitative (for example, summary statistics, score means, medians and/or ranges) data.	136-154 (Table 5.3 and 5.4, Figure 5.4)
R5		List any items or topics that were modified or removed during the consensus process. Include why and when in the process they were modified or removed.	137 (Table 5.4)
D1	Discussion	Discuss the methodological strengths and limitations of the consensus exercise. <i>Include factors that may have impacted the decisions (for example, response rates, representativeness of the panel, potential for feedback during consensus to bias responses, potential impact of any non-anonymised interactions).</i>	158-160
D2		Discuss whether the recommendations are consistent with any pre-existing literature and, if not, propose reasons why this process may have arrived at alternative conclusions.	155-158
O1	Other information	List any endorsing organisations involved and their role.	NA
O2		State any potential conflicts of interests, including among those directing the consensus study and panellists. Describe how conflicts of interest were managed.	NA
O3		State any funding received and the role of the funder. <i>Specify, for example, any funder involvement in the study concept/design, participation in the steering committee, conducting the consensus process, funding of any medical writing support. This could be disclosed in the methods or in the relevant transparency section of the manuscript. Where a funder did not play a role in the process or influence the decisions reached, this should be specified.</i>	NA

Appendix D: Chapter 5 appendices
Appendix D1: Advertisement poster





Help Us Innovate Community Pharmacy Service for Better Heart Health!

We are launching an important research project to co-design and develop a community pharmacy-based cardiovascular disease (CVD) risk screening service to be implemented in Saudi Arabia.





We are seeking experts in CVD prevention or management, pharmaceutical policy, service implementation, and health service providers to help in co-designing a community pharmacy-based CVD risk screening service.

**Cardiologists, General practitioners, Clinical pharmacists**

**Community pharmacists**

**Community pharmacy CEOs/managers**

**Representatives from the Ministry of Health, or Public Health Authority**

The study will involve 3 rounds of online Delphi-questionnaires.

Round 1:
Will focus on the service model, to help achieve a national-level consensus on the appropriate model.

Round 2:
Will focus on evaluating the proposed service model, and prioritising other service components and implementation strategies.

Round 3:
This round aims to refine the service and seek consensus.





Your knowledge and experience are crucial in shaping a service that can make a real difference in preventing CVDs. Join us in this mission to enhance public health through innovative pharmacy practices!

CLICK HERE Please follow the [link](https://qualtricsxmb2vth9p9g.qualtrics.com/ife/form/SV_1RKG76OZ06V3EeW) to learn more about the study and how to participate

https://qualtricsxmb2vth9p9g.qualtrics.com/ife/form/SV_1RKG76OZ06V3EeW



For more information or questions, please feel free to contact me at: solafa.noorsaeed@strath.ac.uk

Appendix D2: Participant information sheet, consent form, and demographic questionnaire

Appendix D2.1. Participant information sheet



Participant Information Sheet

Name of department: Strathclyde Institute of Pharmacy and Biomedical Sciences

Title of the study: Co-design and development of community pharmacy-based cardiovascular disease risk screening service in the Kingdom of Saudi Arabia: Multi-stakeholders e-Dephi Consensus.

Introduction

Cardiovascular diseases (CVDs) are the leading cause of death worldwide. In Saudi Arabia, CVDs are responsible for 42% of all deaths, making their prevention a top health priority. The Saudi government has recommended the development of a national CVD risk screening programme in primary care with multiple access points. Community pharmacies, which are easy to access, could play a significant role in offering these screening services. Several community pharmacy-based CVD screening programmes have been successfully implemented and evaluated in various countries worldwide, showing promising results. In Saudi Arabia, previous studies found that stakeholders support the idea of community pharmacy-based CVD risk screening. However, there is no agreement yet on the model or guidelines for the service.

This research is a part of a PhD project for a PhD student (solafa Noorsaeed) at the University of Strathclyde, aiming to develop a community pharmacy-based CVD risk screening service.

What is the purpose of this research?

This study will identify the needs and priorities regarding CVD risk screening services in Saudi Arabia and achieve a national-level agreement on the appropriate model for screening services to be implemented in Saudi Arabia.

Do you have to take part?

No, your participation is voluntary. Choosing not to participate or withdrawing later will not affect you. If you decide to take part, you will be asked to sign a consent form and confirm your decision again by the end of the questionnaire. You can withdraw at any time without giving a reason, even after consenting. If you choose to take part, you will be offered a 50£ gift voucher when completing all three rounds of the questionnaire, to thank you for your time.

What will you do in the project?

If you decide to take part you will first be asked to complete questions about your personal information, to allow us to ensure we are recruiting the targeted participants. Then, you will be involved in completing three questionnaires in three separate rounds, which will each take approximately 10-15 minutes to complete.

Round 1: you will be provided with priority lists regarding the community pharmacy-based CVD risk screening service model, including service-targeted population, screening processes and post-screening interventions, generated from a previous study in Saudi Arabia, which involved multiple stakeholders from the region. You will be asked to vote for each item (from 1 to 5), with 1 representing the highest disagreement and 5 representing the highest agreement. You will be provided with a space for free-text comments with each statement to allow you to justify your opinions.

Round 2: This questionnaire will be divided into three parts:

Part 1: you will be provided with the decision on the service model based on the results from round 1, including the collective results of what other participants thought and why.

Part 2: you will be asked to evaluate the proposed service model in terms of the perceived acceptability, practicality, effectiveness, affordability, side effects, and equity.

Part 3: you will be provided with lists of ideas regarding the screening tools, recruitment criteria, referral criteria and implementation strategies. You will be asked to rate or rank different options from highest to least priority.

In each part, you will be provided with a space for free-text comments to allow you to justify your opinions.

Round 3: you will be provided with the results from round 2, including the collective results of what other participants prioritised and why. You will have the opportunity to re-vote/rank again to refine the service.

Why have you been invited to take part?

We are inviting different groups of people with different expertise, including:

- 1) Experts in CVD prevention or management, such as cardiologists, and clinical pharmacists.
- 2) Service providers including community pharmacists and general practitioners (primary care physicians)
- 3) Policymakers or experts in health and pharmaceutical policy or service implementation in Saudi Arabia such as representatives from the Ministry of Health (MOH), community pharmacy CEO/manager, and public health representatives.

Thus, you have been invited as you are one of those experts who could help in decision-making regarding service development.

To take part, you must belong to one of the above-listed groups and

- be a resident of Saudi Arabia.
- be able to read and write in English.
- Be able to consent for yourself.

What information is being collected in the project?

Information collected will include personal information such as gender, position, expertise, and what group you belong to, to help us understand who has taken part in the study. The collected data will also include your opinions of the community pharmacy-based CVD risk screening service models and components presented to you and your voting/ranking scores.

Who will have access to the information?

Only the primary researcher (Solafa Noorsaeed) and her supervisors at the University of Strathclyde will have access to any of your information. Your participation will be confidential, and your information will be anonymised throughout the study.

The results and the anonymised information will be included in the PhD thesis or may also be written into a report, presentation, or published in a research journal.

Where will the information be stored and how long will it be kept for?

All data will be securely stored in a password-protected system. According to the [UK GDPR and Data Protection Act 2018 regulations](#), followed by the University of Strathclyde, the data

will be destroyed 10 years after the study period. All personal data will be processed in accordance with data protection legislation. Please read our [Privacy Notice for Research Participants](#) for more information about your rights under the legislation.

Thank you for reading this information – please ask any questions if you are unsure about what is written here.

What happens next?

If you are happy to participate, please sign the consent form on the next page and complete the personal information part first. Once we confirm your eligibility, we will send you the first questionnaire. After completing round 1, we will contact you again within 1 month to ask you to complete round 2 and then will contact you again after 1-2 months of completing round 2, asking you to complete round 3.

The consent form will be obtained again by the end of the questionnaires and before submission. The questionnaire will finish with the following statement: by clicking the “submit” button below, you are consenting to participate in this study.

*We recommend that you complete the questionnaires using a large screen, in a comfortable and quiet place to minimise distractions and reduce any potential stress.

We recommend that you keep a copy of this document for your records.

If you have read this information sheet and do not wish to be involved, thank you for your attention.

Researcher contact details:

The details of the primary researcher of this project:

Solafa Noorsaeed (PhD student at the University of Strathclyde)

Email: solafa.noorsaeed@strath.ac.uk

Phone: +966 542947060

Chief Investigator details:

If you have any questions or would like more information, please contact Amanj Kurdi at the University of Strathclyde at:

Prof. Amanj Kurdi (Chief Investigator)

Email: amani.baker@strath.ac.uk

Phone: 01415482181

This research was granted ethical approval by the Strathclyde Institute of Pharmacy and Biomedical Sciences Ethics Committee.

If you have any questions/concerns, during or after the research, or wish to contact an independent person to whom any questions may be directed or further information may be sought from, please contact:

Strathclyde institute of pharmacy and biomedical science (SIPBS) Ethics committee

Prof Margaret Watson

Email: sipbs-ethics@strath.ac.uk

Appendix D2.2. Consent form

* Consent Form

Please carefully read each statement below:

-I confirm that I have read and understood the Participant Information Sheet for the above project and the researcher has answered any queries to my satisfaction.

-I confirm that I have read and understood the Privacy Notice for Participants in Research Projects and understand how my personal information will be used and what will happen to it (i.e. how it will be stored and for how long).

-I understand that my participation is voluntary and that I am free to withdraw from the project at any time, up to the point of completion, without having to give a reason and without any consequences.

-I understand that I can request the withdrawal from the study of some personal information and that whenever possible researchers will comply with my request. This includes the following personal data:

-my personal information from the demographic information questionnaire.

-I understand that anonymised data (i.e. data that do not identify me personally) cannot be withdrawn once they have been included in the study.

-I understand that any information recorded in the research will remain confidential and no information that identifies me will be made publicly available.

-I consent to being a participant in the project.

*** if you agree and consent, please select "I agree" , type your name, and proceed to the personal information page by clicking the "Next" button. If you do not wish to consent, thank you for your time.**

☐ I agree, and my name is

☐ I don't agree

Appendix D2.3. Demographic information questionnaire

Demographic Information

Please respond to the following questions by selecting or providing the appropriate answer.

This will help us ensure that we are recruiting the targeted participants.

*Which of the following professionals do you belong to?

- ☐ Cardiologist
- ☐ General practitioner/ Primary care physician
- ☐ Clinical pharmacist
- ☐ Community pharmacist
- ☐ A representative from the Ministry of Health
- ☐ A public health expert
- ☐ A representative from a community pharmacy (e.g., manager, CEO)

The questions on this page are optional. You may skip them if you prefer.

For how long (in years) have you been in this position?

What is your area of speciality or expertise (If any)?

Which organisation do you represent?

What is your role within the organisation?

*Where do you currently live?

- ☐ Riyadh province
- ☐ Makkah province
- ☐ Madinah province
- ☐ Eastern Province
- ☐ Al-Qassim province
- ☐ Hail province
- ☐ Tabuk province
- ☐ Northern Borders province
- ☐ Jazan province
- ☐ Najran province
- ☐ Al-Bahah province
- ☐ Al-Jawf province
- ☐ Asir province

What is your gender?

- ☐ Male
- ☐ Female

What is your nationality?

- ☐ Saudi
- ☐ Non-Saudi

*What is the highest level of education you have completed?

☐ BPharm

☐ PharmD

☐ Residency training

☐ Master's degree

☐ PhD degree

☐ Other (please specify)

*Have you ever had experience conducting CVD risk screening in community pharmacies outside Saudi Arabia?

☐ No

☐ Yes (please specify the country of practice)

*What is your preferred contact method?

This will allow us to send you the questionnaires and the gift vouchers.

*you can select more than one method.

☐ Email (please type your email)

☐ WhatsApp (please type your number)

☐ Other (please specify)

Thank you for taking the time to complete this survey.

Your response has been recorded, and we will contact you soon to proceed with the next stage.

If you have any questions, please feel free to contact me at: solafa.noorsaeed@strath.ac.uk

Appendix D3: e-Delphi questionnaires

Appendix D3.1. Round 1 e-Delphi questionnaire

The priority lists in the following questions regarding the community pharmacy-based CVD risk screening service were generated from a previous study through discussions involving multiple stakeholders from Saudi Arabia. Please rate your agreement with these priority lists on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree).

Targeted population:

Q1: To what extent do you agree or disagree that the following populations should be the top priority for the service?

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
Aged ≥ 40 years old.	☐	☐	☐	☐	☐
With at least one of the following: pre-diabetes/diabetes, pre-hypertension/hypertension, dyslipidaemia, endometriosis, Crohn's disease, rheumatoid arthritis or currently on treatment for diabetes, hypertension, or dyslipidaemia.	☐	☐	☐	☐	☐
Have a family history of CVDs, or have any risk factors like overweight, obesity, inactivity, unhealthy diet, bodybuilders, smokers or former smokers.	☐	☐	☐	☐	☐
Currently on medications that cause CV harm.	☐	☐	☐	☐	☐
Have no blood pressure or cholesterol test in the past year or not diagnosed with hypertension, dyslipidaemia or other CVDs, diabetes or chronic kidney disease.	☐	☐	☐	☐	☐
Not currently on treatment for dyslipidaemia, hypertension, or other CVDs medication.	☐	☐	☐	☐	☐

You are welcome to provide any justification for your rating.

Assessment and screening processes:

Q2: To what extent do you agree or disagree that the following assessment and screening processes should be the top priority?

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
Calculate the CVD risk score using a validated and approved screening tool for the Saudi population	☐	☐	☐	☐	☐
Check/collect data on age, gender, ethnicity, socioeconomic, residence area, family/medical history, medications, smoking, diet, physical activity status and health literacy.	☐	☐	☐	☐	☐
Point of care or venipuncture testing: lipid profile, blood pressure, and blood glucose (diabetes assessment).	☐	☐	☐	☐	☐
Anthropometric measurements: weight, height, waist circumference, and body mass index.	☐	☐	☐	☐	☐
Assess medication adherence if patients were on treatment.	☐	☐	☐	☐	☐

You are welcome to provide any justification for your rating.

Post-screening interventions

Q3: To what extent do you agree or disagree that the following interventions should be the top priority to be provided post-screening?

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
Offer written and verbal education on the risk results, CVD risk factors, smoking cessation, stress reduction, weight reduction, diet, and physical activity / Lifestyle and behaviour modification coaching (for all regardless of risk).	☐	☐	☐	☐	☐
Refer individuals to the physician, dietician, or wellness clinic, with a referral note communicating the results to the physician and recommending a treatment plan + follow-up with the patient for referral uptake within a specific timeframe (depending on the risk).	☐	☐	☐	☐	☐
Medication therapy management/ or post-physician visit counselling sessions + follow-up with the patient for the provided intervention within a specific timeframe (depending on the risk).	☐	☐	☐	☐	☐

You are welcome to provide any justification for your rating.

We thank you for your time spent taking this survey.

Your response has been recorded.

Appendix D3.2. Round 2 e-Delphi questionnaire

Welcome to the second round of our survey.

This study aims to co-design and develop a community pharmacy-based cardiovascular disease (CVD) risk screening service through stakeholder involvement and a consensus-building process. You can review and [download](#) the Participant Information Sheet for more details about the study.

In the first round, we asked you to prioritise key elements of the proposed service: *the target population, screening process, and post-screening interventions*, to help design a consensus-based service model. In this round, we will present the results from the first round for your review. Two statements regarding the targeted population did not reach consensus and will require re-rating.

In this second round, you will be asked to:

- 1. Review** the results from Round 1 and **re-rate** the two statements that did not achieve consensus.
- 2. Evaluate** the potential service model based on six criteria: *Acceptability, Practicality, Effectiveness, Affordability, Side Effects, and Equity*.
- 3. Prioritise** additional components of the service, including 1) *recruitment methods*, 2) *screening tools*, 3) *referral mechanisms*, 4) *service funding methods*, and 5) *implementation strategies*.

Your input is essential to developing a feasible and impactful CVD risk screening service for community pharmacy settings. Thank you for your continued participation.

*A £50 gift voucher will be offered upon completion of all three rounds of the questionnaire.

Please select your profession and enter your years of experience before proceeding to the questions.

*This information will help us understand how responses may vary based on professional background and level of expertise.

	Profession	Experience Years of experience
Personal Information		

1. Review of Round 1 Results:

The image below shows the results from the first round, highlighting which items reached consensus and which did not. You will be asked to re-rate the items that did not achieve consensus to determine whether they should be included in or excluded from the service model.

*Please review round 1 results below before proceeding to the questions. Kindly [download](#) the image for your reference, as you may need to view it again while answering the following question.

Consensus results from the first-round questionnaire on the service model.



Targeted population	Screening processes	Post-screening interventions
☒ Aged ≥ 40 years old. With at least one of the following: pre-diabetes/diabetes, pre-hypertension/hypertension, dyslipidaemia, endometriosis, Crohn's disease, rheumatoid arthritis or currently on treatment for diabetes, hypertension, or dyslipidaemia.	☒ Calculate the CVD risk score using a validated and approved screening tool for the Saudi population. ☒ Check/collect data on age, gender, ethnicity, socioeconomic status, residence area, family/medical history, medications, smoking, diet, physical activity status and health literacy.	☒ Offer written and verbal education on the risk results, CVD risk factors, smoking cessation, stress reduction, weight reduction, diet, and physical activity / Lifestyle and behaviour modification coaching (for all regardless of risk).
☒ Have a family history of CVDs, or have any risk factors like overweight, obesity, inactivity, unhealthy diet, bodybuilders, smokers or former smokers.	☒ Point of care or venipuncture testing: lipid profile, blood pressure, and blood glucose (diabetes assessment).	☒ Refer individuals to the physician, dietician, or wellness clinic, with a referral note communicating the results to the physician and recommending a treatment plan + follow-up with the patient for referral uptake within a specific timeframe (depending on the risk).
☒ Currently on medications that cause CV harm.	☒ Anthropometric measurements: weight, height, waist circumference, and body mass index.	☒ Medication therapy management/ or post-physician visit counselling sessions + follow-up with the patient for the provided intervention within a specific timeframe (depending on the risk).
☐ Have no blood pressure or cholesterol test in the past year or not diagnosed with hypertension, dyslipidaemia or other CVDs, diabetes or chronic kidney disease.	☒ Assess medication adherence if patients were on treatment.	
☐ Not currently on treatment for dyslipidaemia, hypertension, or other CVDs medications.		

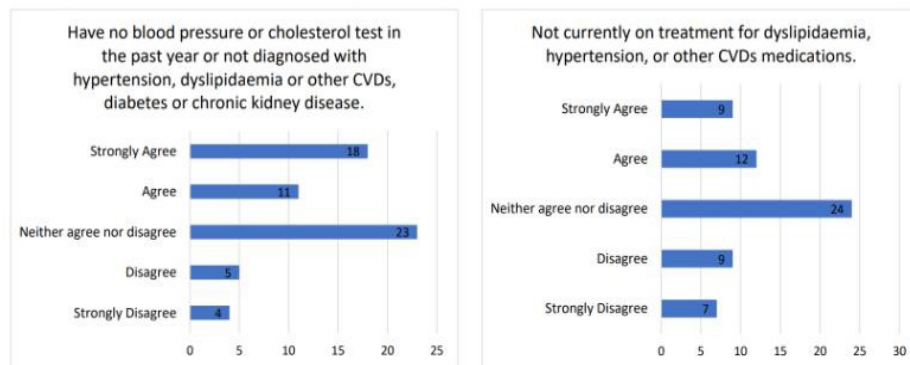
☒ Items achieved consensus and will be included in the service model.
 ☐ Items did not achieve consensus and require re-rating.

The image below presents participants' responses to the two statements regarding the targeted population that did not reach consensus in Round 1. You can also review and download the results [here](#).

***Please review the results carefully and re-rate these statements by responding to the following question.**



Participants' responses to the two statements regarding the targeted population that did not reach consensus.



Number of participants in the first round = 61

The median score for these two statements in the first round = 3 (Neither agree nor disagree)

Summary of participants' comments on these statements:

- It is meaningful to follow them for preventative measures, but not as the top priority. The same mindset is seen in the insurance companies that would most likely pay for such services in the future.
- What if they are healthy at baseline with no lab data for the past year? Do we target people without documented lab work, even if they have no apparent risk factors, only because they're above 40?

Q: To what extent do you agree or disagree that the following populations should be targeted for the service?

***Please rate your agreement on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree).**

	Strongly Disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly Agree (5)
Have no blood pressure or cholesterol test in the past year or not diagnosed with hypertension, dyslipidaemia or other CVDs, diabetes or chronic kidney disease.	☐	☐	☐	☐	☐
Not currently on treatment for dyslipidaemia, hypertension, or other CVDs medications.	☐	☐	☐	☐	☐

You are welcome to provide a justification for your answer (optional)

2. Round 2: Evaluation of the service model:

In this section, you will be asked to evaluate the potential service model based on six criteria: *Acceptability, Practicality, Effectiveness, Affordability, Side Effects, and Equity*.

***Please carefully review the potential service model, which is based on the results from Round 1, before proceeding to the evaluation question. You may also [download](#) the image for your reference.**



The potential service model, based on the results from Round 1.

Targeted population	Screening processes	Post-screening interventions
☐ Aged ≥ 40 years old. With at least one of the following: pre-diabetes/diabetes, pre-hypertension/hypertension, dyslipidaemia, endometriosis, Crohn's disease, rheumatoid arthritis or currently on treatment for diabetes, hypertension, or dyslipidaemia. ☐ Have a family history of CVDs, or have any risk factors like overweight, obesity, inactivity, unhealthy diet, bodybuilders, smokers or former smokers. ☐ Currently on medications that cause CV harm.	☐ Calculate the CVD risk score using a validated and approved screening tool for the Saudi population. ☐ Check/collect data on age, gender, ethnicity, socioeconomic status, residence area, family/medical history, medications, smoking, diet, physical activity status and health literacy. ☐ Point of care or venipuncture testing: lipid profile, blood pressure, and blood glucose (diabetes assessment). ☐ Anthropometric measurements: weight, height, waist circumference, and body mass index. ☐ Assess medication adherence if patients were on treatment.	☐ Offer written and verbal education on the risk results, CVD risk factors, smoking cessation, stress reduction, weight reduction, diet, and physical activity / Lifestyle and behaviour modification coaching (for all regardless of risk). ☐ Refer individuals to the physician, dietician, or wellness clinic, with a referral note communicating the results to the physician and recommending a treatment plan + follow-up with the patient for referral uptake within a specific timeframe (depending on the risk). ☐ Medication therapy management/ or post-physician visit counselling sessions + follow-up with the patient for the provided intervention within a specific timeframe (depending on the risk).

Q: To what extent do you agree with the following statements regarding the potential service model in terms of its **Acceptability, Practicality, Effectiveness, Affordability, Side effects, and Equity**?

***Please carefully read and rate your agreement with each statement on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree).**

	Strongly Disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly Agree (5)
Acceptability (this service model is acceptable to all key stakeholders)	☐	☐	☐	☐	☐
Practicality (this service model can be practically implemented as designed using the available resources within the community pharmacy settings)	☐	☐	☐	☐	☐
Effectiveness (this service model will be effective and cost-effective in achieving its intended objectives in the targeted population)	☐	☐	☐	☐	☐
Affordability (this service model will be affordable to implement at the intended scale)	☐	☐	☐	☐	☐
Positive side effects (this service model will lead to unintended beneficial outcomes)	☐	☐	☐	☐	☐
Negative side effects (this service model will lead to unintended adverse outcomes)	☐	☐	☐	☐	☐
Positive equity (this service model will help decrease health differences between advantaged and disadvantaged groups in society)	☐	☐	☐	☐	☐
Negative equity (this service model will increase health differences between advantaged and disadvantaged groups in society)	☐	☐	☐	☐	☐

You are welcome to provide a justification for your answer (optional)

3. Round 2: Prioritisation of other components:

In this section, you will be asked to prioritise other components for the service, including 1) *recruitment methods*, 2) *screening tools*, 3) *referral mechanisms*, 4) *service funding methods*, and 5) *implementation strategies*.

*** Please read each question and its options carefully, and rank/rate them based on their priority.**

1) Recruitment methods:

Q: How should the target population be recruited for the community pharmacy-based CVD risk screening service in Saudi Arabia?

***Please rank the following recruitment methods from highest to lowest priority, with 5 representing the highest priority and 1 representing the lowest. Each score can be used only once.**

	1	2	3	4	5
Invitation of the targeted population from local authorities every 5 years (programmatic screening).	☐	☐	☐	☐	☐
Community pharmacists interview and invite individuals when entering the pharmacy (Opportunistic screening).	☐	☐	☐	☐	☐
Requested by the consumer in response to advertising.	☐	☐	☐	☐	☐
During the dispensing of new prescriptions or refills of chronic medication.	☐	☐	☐	☐	☐
Referral or recommendation from other healthcare providers.	☐	☐	☐	☐	☐

Q: Do you have any additional suggestions for recruitment methods? If so, please describe your idea and specify how you would rank its priority (optional)

You are welcome to provide a justification for your answer (optional)

2) CVD risk screening tools:

Based on the results from the first round, the use of validated screening tools to calculate CVD risk scores was proposed as part of the screening process.

Q: Which CVD risk screening tool should be prioritised for use in the proposed community pharmacy-based CVD risk screening service in Saudi Arabia?

***Please rank the following screening tools from highest to lowest priority, with 6 representing the highest priority and 1 representing the lowest. Each score can be used only once.**

	1	2	3	4	5	6
Specific validated and approved tool for the Saudi Population (doesn't exist yet, to be developed).	☐	☐	☐	☐	☐	☐
QRISK® Calculator (10-year risk, in the UK) Predictors: Age (25–84 years), sex, ethnicity, deprivation index, body mass index, smoking, blood pressure, cholesterol levels, diabetes, family history, chronic kidney disease, atrial fibrillation, rheumatoid arthritis, systemic lupus erythematosus, mental illness, migraine treatment for hypertension, antipsychotics, steroids, and erectile dysfunction treatment.	☐	☐	☐	☐	☐	☐
Modified New Zealand Absolute CVD Risk Calculator (5-year or 10-year risk, in New Zealand, but modified for other settings internationally) Predictors: Age (30–74 years), sex, ethnicity, deprivation index, body mass index, smoking, blood pressure, cholesterol levels, diabetes, family history, creatinine level, history of hospitalisation with atrial fibrillation, use of lipid-lowering, antihypertensive, or antithrombotic medications.	☐	☐	☐	☐	☐	☐
ASCVD Risk Calculator (10-year or lifetime risk, in USA) Predictors: Age (40–79 years), sex, race, blood pressure, cholesterol levels, diabetes, smoking, family history, use of antihypertensives, statins, and aspirin.	☐	☐	☐	☐	☐	☐
Framingham Risk Calculator (10-year risk, in USA and internationally) Predictors: age (30–74 years), sex, blood pressure, cholesterol levels, smoking, diabetes, and antihypertensive treatment.	☐	☐	☐	☐	☐	☐
SCORE2 (10-year risk, in Europe) Predictors: Age (40–65 years), sex, blood pressure, cholesterol levels, smoking, and risk region.	☐	☐	☐	☐	☐	☐

Q: Do you have any additional suggestions for a screening tool? If so, please describe your idea and specify how you would rank its priority (optional)

You are welcome to provide a justification for your answer (optional)

3) Referral mechanisms:

Based on the results from the first round, referring patients to a physician after being identified as at risk during the screening was proposed as part of the post-screening intervention.

Q: How should these individuals be referred to a physician?

***Please rank the following referral options from highest to lowest priority, with 2 representing the highest priority and 1 representing the lowest priority. Each score can be used only once.**

1 2

Written reports provided to patients, advising patients to see their physicians (Passive referral).

☐ ☐

Direct referral through an integrated system (Active referral).

☐ ☐

Q: Do you have any additional suggestions for a referral mechanism? If so, please describe your idea and specify how you would rank its priority (optional)

You are welcome to provide a justification for your answer (optional)

4) Service funding methods:

Q: How do you think the proposed community pharmacy-based CVD risk screening service should be funded?

***Please rank the following funding methods from highest to lowest priority, with 4 representing the highest priority and 1 representing the lowest. Each score can be used only once.**

1 2 3 4

Unfunded:

Pharmacists provide the service as routine care without charging patients or receiving reimbursement.

☐ ☐ ☐ ☐

Patient funded:

Patients pay out of pocket to access the service.

☐ ☐ ☐ ☐

Government-funded:

The government funds the service by reimbursing pharmacies, but patients do not pay anything.

☐ ☐ ☐ ☐

Health insurance funded:

The service is funded by health insurance, with pharmacies reimbursed by insurers and minimal or no cost to insured patients.

☐ ☐ ☐ ☐

You are welcome to provide a justification for your answer (optional)

5) Implementation strategies:

Q: How important are the following strategies for ensuring the successful and sustainable implementation of the proposed community pharmacy-based CVD risk screening service in Saudi Arabia?

*Please rate the importance of each of the following implementation strategies on a scale of 1 to 5 (1 = Not at all important and 5 = Extremely important).

	Not at all important (1)	Slightly important (2)	Moderately important (3)	Very important (4)	Extremely important (5)
Use evaluative and iterative strategies: Standardised protocol and clear framework for service delivery, pre-piloting and evaluation of service, government supervision, and quality control.	☐	☐	☐	☐	☐
Provide interactive assistance: Technological innovation (telehealth) or an integrated system to support data accessibility, service delivery, referral process and patient follow-up.	☐	☐	☐	☐	☐
Adapt and tailor to context: Culturally appropriate protocols and tools, documentation, and record-keeping.	☐	☐	☐	☐	☐
Develop stakeholders' interrelationships: Pharmacist-physicians collaboration, collaborative agreement, service development with stakeholders and collaboration with different professional bodies.	☐	☐	☐	☐	☐
Train and educate stakeholders: Offering ongoing specialised training for pharmacists and educational materials and resources.	☐	☐	☐	☐	☐
Support clinicians: Ensure adequate staff/ clinical teams, Government/ MOH support, and availability of resources.	☐	☐	☐	☐	☐

Engage consumers:

Raise public awareness about the role of pharmacists and promote the service.

☐☐☐☐☐**Utilise financial strategies:**

Financial support from the government or insurance for service costs, incentives and rewards for pharmacists.

☐☐☐☐☐**Change Infrastructure:**

Prepared physical environment (private area prepared with equipment, simple screening tool, resources and integrated record system).

☐☐☐☐☐

Q: Do you have any additional suggestions for implementation strategies? If so, please describe your idea and specify how you would rate its importance (optional)

You are welcome to provide a justification for your answer (optional)

Q: Do you have any comments or suggestions that you think we should consider regarding the development of the community pharmacy-based CVD risk screening service in Saudi Arabia? (optional)

Thank you for taking the time to complete this survey.
Your response has been recorded, and we will contact you soon to proceed with the next stage.
If you have any questions, please feel free to contact me at: solafa.noorsaeed@strath.ac.uk

Appendix D3.3. Round 3 e-Delphi questionnaire

Welcome to the third round of our survey.

This study aims to co-design and develop a community pharmacy-based cardiovascular disease (CVD) risk screening service through stakeholder involvement and a consensus-building process. You can review and [download](#) the Participant Information Sheet for more details about the study.

In the first 2 rounds, we asked you to **prioritise** key elements of the proposed service, **evaluate** the potential service model, and **prioritise** additional components of the service, including 1) *recruitment methods*, 2) *CVD risk screening tools*, 3) *referral mechanisms*, 4) *funding methods*, and 5) *implementation strategies*, to help design a consensus-based service model.

In this round, you will be provided with the results from the previous round for your review. You will be asked to:

A) Review the final service model and **vote** on whether you agree or disagree with it.

B) Review the round 2 results on 1) *referral mechanism*, 2) *funding method*, 3) *recruitment method* and 4) *CVD risk screening tool priorities*, and **vote** on whether you agree or disagree with the priorities that reached full consensus, and **re-rate** the priorities that did not reach full consensus.

Your input is essential to developing a feasible and impactful CVD risk screening service for community pharmacy settings. Thank you for your continued participation.

*A £50 gift voucher will be offered upon completion of this third round of the questionnaire.

Please select your profession and enter your years of experience before proceeding to the questions.

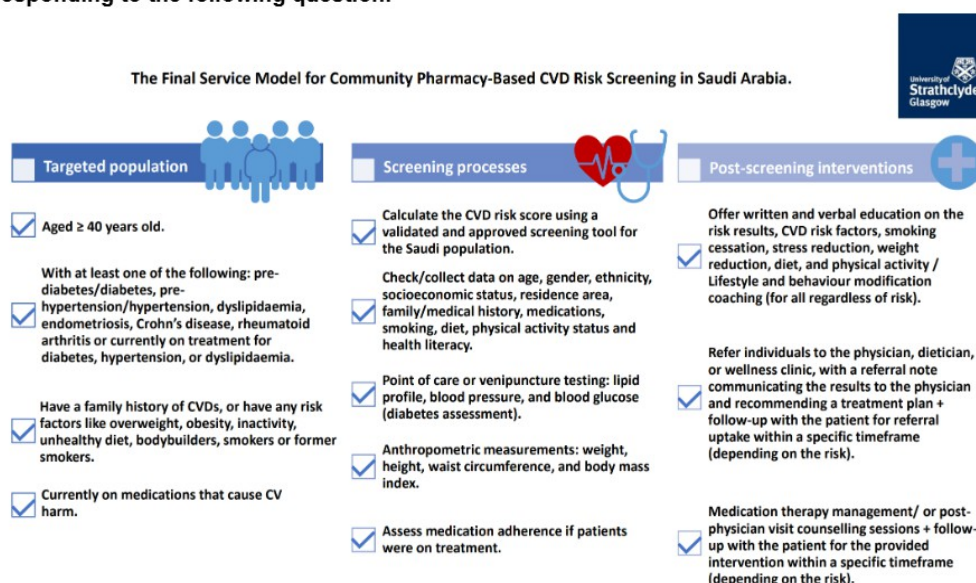
*This information will help us understand how responses may vary based on professional background and level of expertise.

	Profession	Experience
		Years of experience
Personal Information		

A) Review of the final service model:

The image below presents the final service model based on the participants' responses in the previous rounds. You can also review and download the image [here](#).

***Please review the service model carefully and vote on whether you agree or disagree with it by responding to the following question.**



Q: Do you agree with the proposed community pharmacy-based CVD risk screening service model?

Yes, I agree

No, I do not agree

*The following question displays only in case of disagreement.

Q: Which of these service components do you disagree with?

*More than one option can be selected

Targeted population

Screening processes

Post-screening interventions

Please explain your reasons for disagreement with the service model or recommend changes

B) Review of round 2 results:

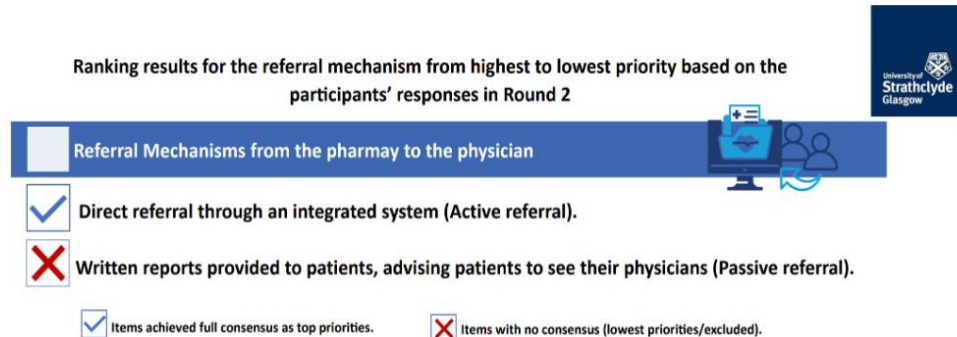
Participants in the previous round reached full consensus on the top priorities for the 1) *referral mechanism*, 2) *funding methods*, 3) *recruitment methods* and 4) *CVD risk screening tools*. One item from the top priorities for *recruitment methods* and one item from the top priorities for *CVD risk screening tools* did not reach full consensus. These priorities will be presented in this section for you to **review** and **vote** whether you agree or disagree with the priorities that achieved full consensus and **re-rate** the priorities that did not achieve full consensus.

Please carefully review the results before responding to the following questions.

1) Referral mechanisms:

The image below presents the ranking results for the *referral mechanisms* from the pharmacy to the physician ordered from highest to lowest priority based on participants' responses in the previous round. You can also review and download the image [here](#).

Please carefully review the results before responding to the question below.



Summary of participants' comments:

1. Active referral through an integrated system ensures continuity of care and timely intervention, especially in underserved or lower-literacy populations. This allows for tracking and quality improvement.
2. Passive referral is better for awareness, as the patient will be provided with a detailed report about their situation and risk, emphasising the importance of the referral, while active referral does not emphasise the importance of the referral.
3. Passive referral often results in poor follow-up and missed opportunities for prevention.

Q: Do you agree that “Direct referral through an integrated system (Active referral)” should be the top priority for the referral mechanism from the pharmacy to the physician following the community pharmacy-based CVD risk screening service in Saudi Arabia?

Yes, I agree

No, I do not agree

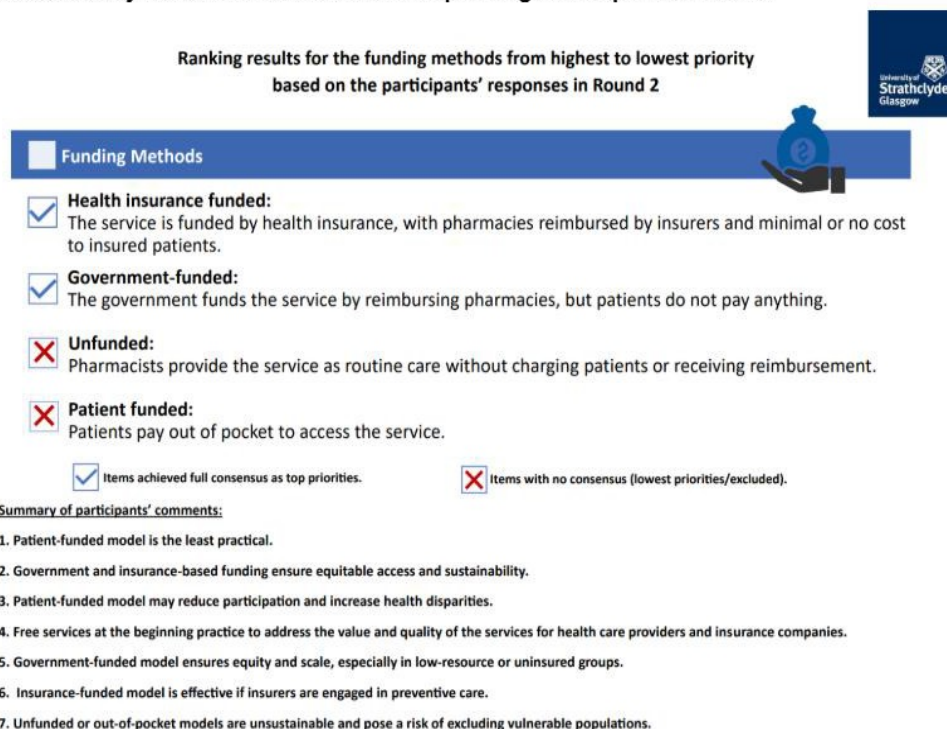
*The following question displays only in case of disagreement.

Please explain your reasons for disagreement with the prioritised referral mechanism or recommend changes

2) Funding methods:

The image below presents the ranking results for the *funding methods* ordered from highest to lowest priority based on participants' responses in the previous round. You can also review and download the image [here](#).

Please carefully review the results before responding to the question below.



Q: Do you agree that “Health insurance-funded” and “Government-funded” should be prioritised as funding methods for community pharmacy-based CVD risk screening services in Saudi Arabia?

Yes, I agree

No, I do not agree

*The following question displays only in case of disagreement.

Q: Which of these funding method priorities do you disagree with?

*More than one option can be selected

Health insurance-funded

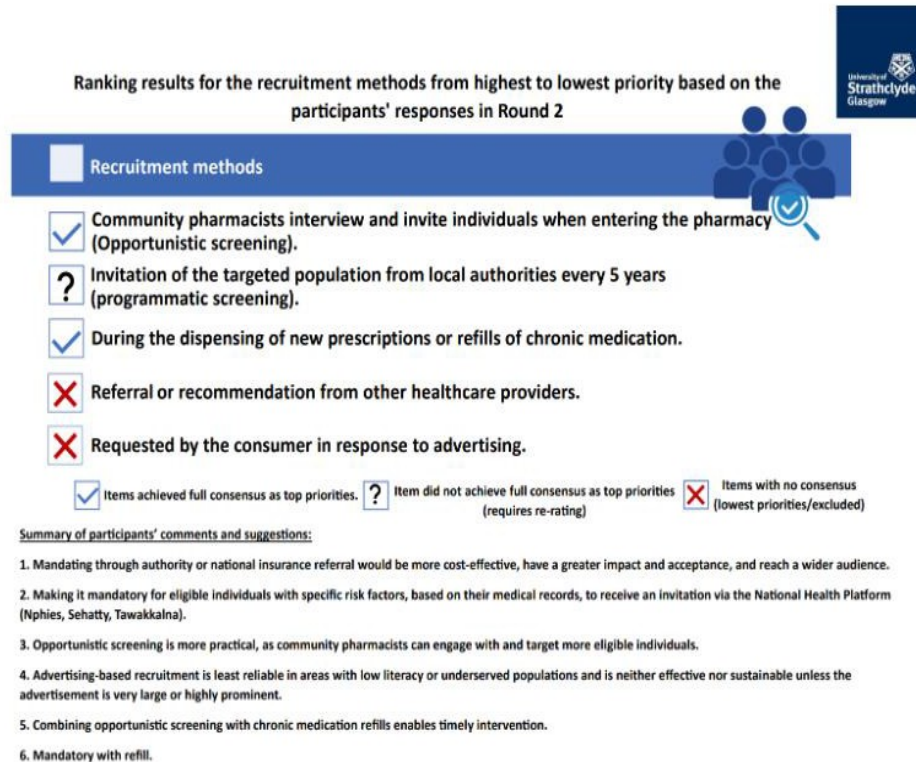
Government-funded

Please explain your reasons for disagreement with the prioritised funding methods or recommend changes

3) Recruitment methods (voting):

The image below presents the ranking results for the *recruitment methods* ordered from highest to lowest priority based on participants' responses in the previous round. You can also review and download the image [here](#).

***Please carefully review the results before responding to the following questions.**



Q: Do you agree that "Opportunistic screening: Community pharmacists interview and invite individuals when entering the pharmacy" and "recruitment during the dispensing of new prescriptions or refills of chronic medication" should be prioritised as recruitment methods for enrolling individuals into the community pharmacy-based CVD risk screening service in Saudi Arabia?

Yes, I agree

No, I do not agree

*The following question displays only in case of disagreement.

Q: which of these recruitment method priorities do you disagree with?

*More than one option can be selected

Community pharmacists interview and invite individuals when entering the pharmacy
(Opportunistic screening)

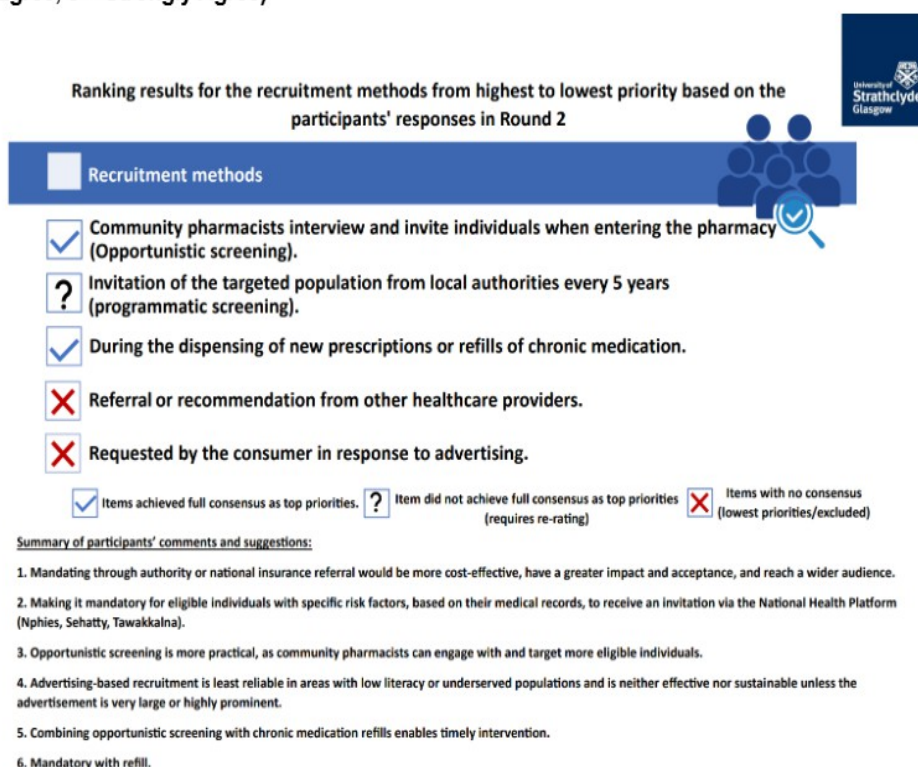
During the dispensing of new prescriptions or refills of chronic medication

Please explain your reasons for disagreement with the prioritised recruitment methods or recommend changes

3) Recruitment methods (re-rating):

The image below highlights the item that did not achieve full consensus as a top priority and therefore requires re-rating. You can also review and download the image [here](#).

Please carefully review the results and rate your agreement on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree)



Q: To what extent do you agree or disagree that the following recruitment method should also be prioritised for enrolling individuals into the community pharmacy-based CVD risk screening service in Saudi Arabia?

	Strongly Disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly Agree (5)
Invitation of the targeted population from local authorities every 5 years (programmatic screening).	☐	☐	☐	☐	☐

You are welcome to provide a justification for your answer (optional)

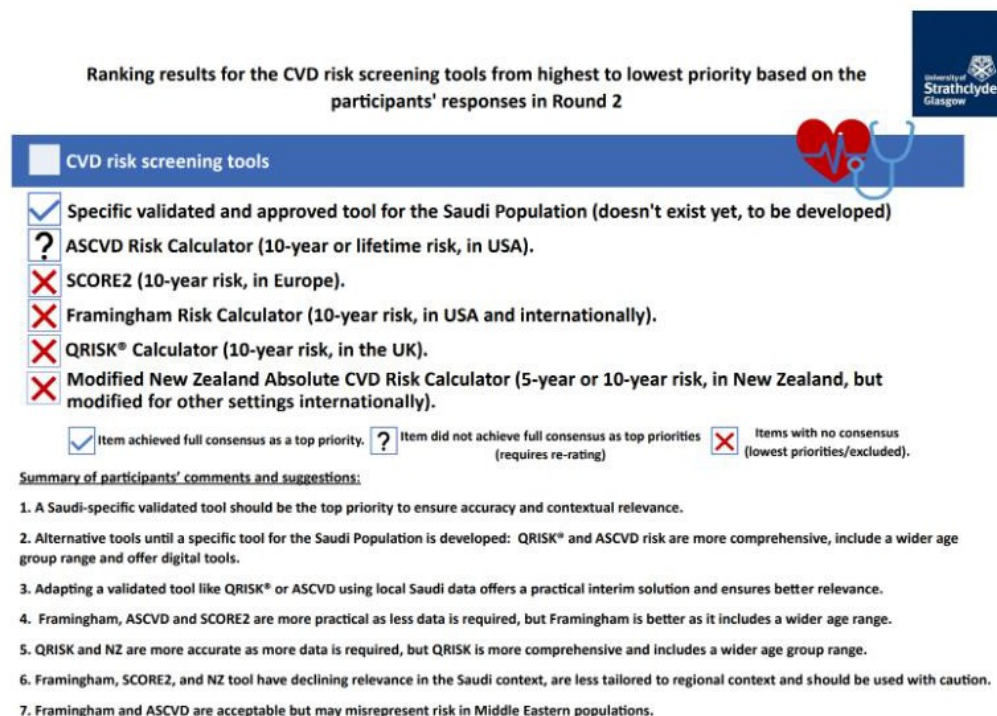
***In case of disagreement**

Please explain your reasons for disagreement with this recruitment method or recommend changes

4) CVD risk screening tools (voting):

The image below presents the ranking results for the *CVD risk screening tools* ordered from highest to lowest priority based on participants' responses in the previous round. You can also review and download the image [here](#).

***Please carefully review the results before responding to the following questions.**



Q: Do you agree that " Specific validated and approved tool for the Saudi population" should be prioritised as a CVD risk screening tool for use in the community pharmacy-based CVD risk screening service in Saudi Arabia?

Yes, I agree

No, I do not agree

***In case of disagreement**

Please explain your reasons for disagreement with the prioritised CVD risk screening tool or recommend changes

4) CVD risk screening tools (re-rating):

The image below highlights the item that did not achieve full consensus as a top priority and therefore requires re-rating. You can also review and download the image [here](#).

Please carefully review the results and rate your agreement on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree)



Ranking results for the CVD risk screening tools from highest to lowest priority based on the participants' responses in Round 2

CVD risk screening tools

- ☒ Specific validated and approved tool for the Saudi Population (doesn't exist yet, to be developed)
- ☐ ASCVD Risk Calculator (10-year or lifetime risk, in USA).
- ☒ SCORE2 (10-year risk, in Europe).
- ☒ Framingham Risk Calculator (10-year risk, in USA and internationally).
- ☒ QRISK® Calculator (10-year risk, in the UK).
- ☒ Modified New Zealand Absolute CVD Risk Calculator (5-year or 10-year risk, in New Zealand, but modified for other settings internationally).

☒ Item achieved full consensus as a top priority.

☐ Item did not achieve full consensus as top priorities (requires re-rating)

☒ Items with no consensus (lowest priorities/excluded).

Summary of participants' comments and suggestions:

1. A Saudi-specific validated tool should be the top priority to ensure accuracy and contextual relevance.
2. Alternative tools until a specific tool for the Saudi Population is developed: QRISK® and ASCVD risk are more comprehensive, include a wider age group range and offer digital tools.
3. Adapting a validated tool like QRISK® or ASCVD using local Saudi data offers a practical interim solution and ensures better relevance.
4. Framingham, ASCVD and SCORE2 are more practical as less data is required, but Framingham is better as it includes a wider age range.
5. QRISK and NZ are more accurate as more data is required, but QRISK is more comprehensive and includes a wider age group range.
6. Framingham, SCORE2, and NZ tool have declining relevance in the Saudi context, are less tailored to regional context and should be used with caution.
7. Framingham and ASCVD are acceptable but may misrepresent risk in Middle Eastern populations.

Q: To what extent do you agree or disagree that the following CVD risk screening tool should be prioritised for use in the community pharmacy-based CVD risk screening service in Saudi Arabia until a specific validated tool for Saudi population become available?

	Strongly Disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly Agree (5)
ASCVD Risk Calculator (10-year or lifetime risk, in USA)	☐	☐	☐	☐	☐

You are welcome to provide a justification for your answer (optional)

*In case of disagreement

Please explain your reasons for disagreement with this CVD risk screening tool or recommend changes

Q: Do you have any final thoughts regarding the development of the community pharmacy-based CVD risk screening service in Saudi Arabia? (optional)

Thank you for completing the three rounds of the questionnaire. Your response has been recorded, and we will send you the gift voucher shortly.

If you have any question, please feel free to contact me at: solafa.noorsaeed@starth.ac.uk

Appendix D4: Detailed rating and ranking results for each participant across the three rounds

Participants' rating results for the target population, screening process, and post-screening interventions in Round 1 (n=61)

Targeted population Items	Number (%) of participants				
	Strongly Disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly Agree (5)
Aged ≥ 40 years old.	1(1.6%)	2 (3.3%)	3 (5.0%)	16 (26.2%)	39 (64.0%)
With at least one of the following: pre-diabetes/diabetes, pre-hypertension/hypertension, dyslipidaemia, endometriosis, Crohn's disease, rheumatoid arthritis or currently on treatment for diabetes, hypertension, or dyslipidaemia.	2(3.3%)	2(3.3%)	0 (0.0%)	9 (14.8%)	48 (78.7%)
Have a family history of CVDs, or have any risk factors like overweight, obesity, inactivity, unhealthy diet, bodybuilders, smokers or former smokers.	1(1.6%)	1(1.6%)	3(5.0%)	4(6.6%)	52 (85.2%)
Currently on medications that cause CV harm.	3(5.0%)	2(3.3%)	4(6.6%)	11 (18.0%)	41 (67.2%)
Have no blood pressure or cholesterol test in the past year or not diagnosed with hypertension, dyslipidaemia or other CVDs, diabetes or chronic kidney disease.	4(6.6%)	5(8.2%)	23(37.7%)	11 (18.0%)	18 (29.5%)
Not currently on treatment for dyslipidaemia, hypertension, or other CVDs medications.	7(11.5%)	9(14.8%)	24(39.3%)	12 (19.7%)	9 (14.8%)
Screening process items					
Calculate the CVD risk score using a validated and approved screening tool for the Saudi population.	0(0.0%)	3(5.0%)	1(1.6%)	9 (14.8%)	48 (78.7%)
Check/collect data on age, gender, ethnicity, socioeconomic status, residence area, family/medical history, medications, smoking, diet, physical activity status and health literacy.	0(0.0%)	3(5.0%)	2(3.3%)	12 (19.7%)	44 (72.1%)
Point of care or venipuncture testing: lipid profile, blood pressure, and blood glucose (diabetes assessment).	2(3.3%)	0(0.0%)	2(3.3%)	15 (24.6%)	42 (68.9%)

Anthropometric measurements: weight, height, waist circumference, and body mass index.	2(3.3%)	1(1.6%)	1(1.6%)	15 (24.6%)	42 (68.9%)
Assess medication adherence if patients were on treatment.	1(1.6%)	2(3.3%)	5(8.2%)	14 (23.0%)	39 (63.9%)
Post-screening intervention items					
Offer written and verbal education on the risk results, CVD risk factors, smoking cessation, stress reduction, weight reduction, diet, and physical activity / Lifestyle and behaviour modification coaching (for all regardless of risk).	2(3.3%)	0(0.0%)	3(5.0%)	5(8.2%)	51 (83.6%)
Refer individuals to the physician, dietician, or wellness clinic, with a referral note communicating the results to the physician and recommending a treatment plan + follow-up with the patient for referral uptake within a specific timeframe (depending on the risk).	1(1.6%)	1(1.6%)	0(0.0%)	10 (16.4%)	49 (80.3%)
Medication therapy management/ or post-physician visit counselling sessions + follow-up with the patient for the provided intervention within a specific timeframe (depending on the risk).	1(1.6%)	2(3.3%)	2(3.3%)	9(14.8%)	47 (77.0%)

Participants' re-rating results in round 2 (n=51) for items that did not achieve consensus in the previous round

Targeted population Items	Number (%) of participants				
	Strongly Disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly Agree (5)
Have no blood pressure or cholesterol test in the past year or not diagnosed with hypertension, dyslipidaemia or other CVDs, diabetes or chronic kidney disease.	3(5.9%)	5(9.8%)	18(35.3%)	14(27.5%)	11(21.6%)
Not currently on treatment for dyslipidaemia, hypertension, or other CVDs medications.	2(3.9%)	5(9.8%)	23(45.1%)	15(29.4%)	6(11.8%)

Participants' ranking results for the recruitment methods in round 2 (n=51)

Recruitment methods	Number (%) of participants				
	1 (Lowest priority)	2 (Fourth priority)	3 (Third priority)	4 (Second priority)	5 (Highest priority)
Invitation of the targeted population from local authorities every 5 years (Programmatic screening).	7(13.7%)	11(21.6%)	6(11.8%)	12(23.5%)	15(29.4%)
Community pharmacists interview and invite individuals when entering the pharmacy (Opportunistic screening).	5(9.8%)	9(17.6%)	7(13.7%)	7(13.7%)	23(45.1%)
Requested by the consumer in response to advertising.	24(47.0%)	9(17.6%)	10(19.6%)	6(11.8%)	2(3.9%)
During the dispensing of new prescriptions or refills of chronic medication.	3(5.9%)	9(17.6%)	16(31.4%)	20(39.2%)	3(5.9%)
Referral or recommendation from other healthcare providers.	12(23.5%)	13(25.5%)	12(23.5%)	6(11.8%)	8(15.7%)

Participants' ranking results for the referral mechanisms in round 2 (n=51)

Referral mechanisms	Number (%) of participants	
	1 (Lowest priority)	2 (Highest priority)
Written reports provided to patients, advising patients to see their physicians (Passive referral).	36(70.6%)	15(29.4%)
Direct referral through an integrated system (Active referral).	15(29.4%)	36(70.6%)

Participants' ranking results for the screening tools in round 2 (n=51)

CVD risk screening tools	Number (%) of participants					
	1 (Lowest priority)	2 (Fifth priority)	3 (Fourth priority)	4 (Third priority)	5 (Second priority)	6 (Highest priority)
Specific validated and approved tool for the Saudi Population (doesn't exist yet, to be developed).	8(15.7%)	0(0.0%)	3(5.9%)	1(2%)	2(3.9%)	37(72.5%)
QRISK® Calculator (10-year risk, in the UK).	17(33.3%)	8(15.7%)	3(5.9%)	7(13.7%)	15(29.4%)	1(2%)
Modified New Zealand Absolute CVD Risk Calculator (5-year or 10-year risk, in New Zealand, but modified for other settings internationally)	6(11.8%)	18(35.3%)	10(19.6%)	10(19.6%)	6(11.8%)	1(2%)
ASCVD Risk Calculator (10-year or lifetime risk, in the USA)	2(3.9%)	3(5.9%)	15(29.4%)	10(19.6%)	14(27.5%)	7(13.7%)
Framingham Risk Calculator (10-year risk, in the USA and internationally)	8(15.7%)	12(23.5%)	16(31.4%)	3(5.9%)	8(15.7%)	4(7.8%)
SCORE2 (10-year risk, in Europe)	10(19.6%)	10(19.6%)	4(7.8%)	20(39.2%)	6(11.8%)	1(2%)

Participants' ranking results for the funding methods in round 2 (n=51)

Funding methods	Number (%) of participants			
	1 (Lowest priority)	2 (Third priority)	3 (Second priority)	4 (Highest priority)
Unfunded: Pharmacists provide the service as routine care without charging patients or receiving reimbursement.	16(31.4%)	23(45.1%)	4(7.8%)	8(15.7%)
Patient funded: Patients pay out of pocket to access the service.	27(52.9%)	17(33.3%)	5(9.8%)	2(3.9%)

Government-funded: The government funds the service by reimbursing pharmacies, but patients do not pay anything.	4(7.8%)	5(9.8%)	31(60.8%)	11(21.6%)
Health insurance funded: The service is funded by health insurance, with pharmacies reimbursed by insurers and minimal or no cost to insured patients.	4(7.8%)	6(11.8%)	11(21.6%)	30(58.8%)

Participants' rating results for the evaluation of the service model in round 2 (n=51)

Service evaluation (APEASE)	Number (%) of participants				
	Strongly Disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly Agree (5)
Acceptability: This service model is acceptable to all key stakeholders.	0 (0.0%)	0 (0.0%)	3 (5.9%)	21 (41.2%)	27 (52.9%)
Practicality: This service model can be practically implemented as designed, using the available resources within the community pharmacy settings.	0 (0.0%)	2 (3.9%)	2 (3.9%)	26 (51.0%)	21 (41.2%)
Effectiveness This service model will be effective and cost-effective in achieving its intended objectives in the targeted population.	0 (0.0%)	0 (0.0%)	2 (3.9%)	23 (45.1%)	26 (51.0%)
Affordability This service model will be affordable to implement at the intended scale.	1 (2.0%)	0 (0.0%)	6 (11.8%)	27 (52.9%)	17 (33.3%)
Positive side effects This service model will lead to unintended beneficial outcomes.	0 (0.0%)	6 (11.8%)	6 (11.8%)	13 (25.5%)	26 (51.0%)
Negative side effects* This service model will lead to unintended adverse outcomes.	15 (29.4%)	18 (35.3%)	9 (17.6%)	7 (13.7%)	2 (3.9%)

Positive equity This service model will help decrease health differences between advantaged and disadvantaged groups in society.	0 (0.0%)	2 (3.9%)	4 (7.8%)	22 (43.1%)	23 (45.1%)
Negative equity* This service model will increase health differences between advantaged and disadvantaged groups in society.	23 (45.1%)	8 (15.7%)	7 (13.7%)	12 (23.5%)	1 (2.0%)

Participants' rating results for the importance of the implementation strategies in round 2 (n=51)

Implementation strategies	Number (%) of participants				
	Not at all important (1)	Slightly important (2)	Moderately important (3)	Very important (4)	Extremely important (5)
Use evaluative and iterative strategies: Standardised protocol and clear framework for service delivery, pre-piloting and evaluation of service, government supervision, and quality control.	1 (2.0%)	1 (2.0%)	8 (15.7%)	6 (11.8%)	35 (68.6%)
Provide interactive assistance: Technological innovation (telehealth) or an integrated system to support data accessibility, service delivery, referral process and patient follow-up.	0 (0.0%)	1 (2.0%)	3 (5.9%)	12 (23.5%)	35 (68.6%)
Adapt and tailor to context: Culturally appropriate protocols and tools, documentation, and record-keeping.	1 (2.0%)	0 (0.0%)	5 (9.8%)	15 (29.4%)	30 (58.8%)
Develop stakeholders' interrelationships: Pharmacist-physicians collaboration, collaborative agreement, service development with stakeholders and collaboration with different professional bodies.	0 (0.0%)	3 (5.9%)	2 (3.9%)	9 (17.6%)	37 (72.5%)
Train and educate stakeholders: Offering ongoing specialised training for pharmacists and educational materials and resources.	0 (0.0%)	2 (3.9%)	1 (2.0%)	11 (21.6%)	37 (72.5%)

Support clinicians: Ensure adequate staff/ clinical teams, Government/ MOH support, and availability of resources.	0 (0.0%)	0 (0.0%)	5 (9.8%)	13 (25.5%)	33 (64.7%)
Engage consumers: Raise public awareness about the role of pharmacists and promote the service.	0 (0.0%)	1 (2.0%)	7 (13.7%)	10 (20.0%)	33 (64.7%)
Utilise financial strategies: Financial support from the government or insurance for service costs, incentives and rewards for pharmacists.	0 (0.0%)	3 (5.9%)	5 (9.8%)	15 (29.4%)	28 (54.9%)
Change Infrastructure: Prepared physical environment (private area prepared with equipment, simple screening tool, resources and integrated record system).	0 (0.0%)	1 (2.0%)	5 (9.8%)	14 (27.5%)	31 (60.8%)

Appendix D5: Reporting checklist

Delphi studies in social and health sciences – recommendations for an interdisciplinary standardized reporting (DELPHISTAR)

Topic	Section	Item	Checklist Item	Location where item is reported	Exemplary wording
I Title and Abstract		1	Identification as a Delphi study in the title	Page 162	What is a public health intervention? Results of a Delphi study.
		2	Identification as a Delphi study in the abstract	Thesis abstract xii	A Delphi study was selected to answer the research question.
		3	Structured abstract	Thesis abstract	e.g., background, method, results and discussion
II Context	Formal	4	Information about the sources of funding	Not applicable	The Delphi study was funded by [SOURCE].
		5	Information about the team of authors and/or researchers (e.g., discipline, institution)	Not applicable	The Delphi study was conducted by an interdisciplinary team with representatives from medicine, public health, and health promotion.
		6	Information about method consulting	Not applicable	The study group was advised by experts from [INSTITUTION] regarding statistics. Or: No consulting in regard to method took place.
		7	Information about the project background	Page 163-165	The Delphi study was part of a mixed-methods study on [AIM].
		8	Information about the study protocol	Page 166	The study protocol is available at [LINK].
	Content	9	Justification of the chosen method (Delphi) to answer the research question	Page 167	The Delphi method is suitable for answering the research question because it systematically gathers the judgments of different expert groups and can identify agreement and disagreement.
		10	Aim of the Delphi study (e.g., consensus, forecasting)	Page 166	The aim of the Delphi study is to find consensus on criteria to define a public health intervention.
III Method	Body & Integration of knowledge	11	Identification and elucidation of relevant expertise, spheres of experience, and perspectives (e.g., theory, practice, affected groups, disciplines)	Page 168	The experts represent the sciences and clinical practice because [REASON].
		12	Handling of knowledge, expertise and perspectives which are missing or have been deliberately not integrated	Page 168	If it is not possible to recruit experts specialized in [AREA], this will be openly communicated to the other experts during the Delphi study.
		13	Basic definition of expert ¹	Page 168	A person who has been active in the area for at least [NUMBER] years is considered to be an expert.
	Delphi variant and modifications	14	Identification of the type of Delphi variant and potential modifications (e.g., classic Delphi, real-time Delphi, group Delphi)	Page 167 +Figure 6.1	A classic Delphi study was used [LITERATURE REFERENCE].
		15	Justification of the Delphi variant and modifications, including during the Delphi study, if applicable	NA	If the willingness to participate clearly decreases between the first and second round, a third round will not be held.

Topic	Section	Item	Checklist Item	Location where item is reported	Exemplary wording
	Sample of experts	16	Selection criteria for the experts (per round, per expert group if applicable)	Page 168	All of the experts who met the definition were invited to the first round. All of the experts who completed the previous round were invited to participate in the subsequent round.
		17	Identification of the experts	Page 168	The experts were identified based on publications in [DATABASE].
		18	Information about recruiting and any subsequent recruiting of experts	Page 168-169	The experts were informed about the Delphi study and invited to participate.
	Survey	19	Elucidation of the content development for the questionnaire ²	Page 169-171	The questionnaire was developed based on the results of systematic reviews [LITERATURE REFERENCE].
		20	Description of the questionnaire (content and structure)	Page 169-173	The questionnaire was divided into three segments on [TOPICS]. The statements made in the questionnaire were evaluated using standardized items, with the option to comment in free-text boxes.
	Delphi rounds	21	Number of Delphi rounds	Page 169	Three Delphi rounds were held.
		22	Information about the aims of the individual Delphi rounds	Page 169-173 +Figure 6.2	The first Delphi round focused on exploring relevant aspects. These aspects were then presented to the experts in the second Delphi round for standardized evaluation.
		23	Disclosure and justification of the criterion for discontinuation	Page 169	The number of rounds was defined in advance to be a maximum of three rounds.
	Feedback	24	Information about what data was reported back per round	Page 169-173	In terms of feedback, we shared the statistical results plus the summary of the open responses.
		25	Information on how the results of the previous Delphi round were fed back to the experts surveyed (e.g., via frequencies, mean values, measures of dispersion, listing of comments)	Page 169-173, 175-176	Mean values, standard deviations and percentage frequency distributions were reported.
		26	Information on whether feedback was differentiated by specific groups (e.g., by field of expertise, institutional affiliation)	NA	The feedback was aggregated across all expert groups.
		27	Information about how dissent and unclear results were handled	Page 175-176	The results showing dissent were presented again for evaluation in the next Delphi round.
	Data analysis	28	Disclosure of the quantitative and qualitative analytical strategy	Page 174-176	The quantitative items were descriptively analyzed. The open-ended items were analyzed using thematic analysis [LITERATURE REFERENCE].
		29	Definition and measurement of consensus	Page 175-176	Consensus was defined as percentage agreement, meaning that agreement was assumed if at least 80% of the respondents agreed on an item.

Topic	Section	Item	Checklist Item	Location where item is reported	Exemplary wording
		30	Information on group-specific analysis or weighting of experts (e.g., theory vs. practice, discipline-specific analysis)	NA	In the analysis, the mean values for percent agreement are weighted for each expert group in terms of the number of group members.
IV Results	Delphi process	31	Illustration of the Delphi study (e.g., in a flow chart)	Page 169 (Figure 6.2)	A summary of the Delphi study is illustrated in a flow chart (Figure 1).
		32	Information about special aspects during the Delphi study (e.g., deviations from the intended approach with justification)	NA	During the Delphi study the political discussion mentioned climate change and the effects on health. It is possible that this influenced the experts' responses.
		33	Number of experts per round (both invited and participating)	Page 176+ table 6.1	The number of experts participating in the first Delphi round was [NUMBER], and the number of experts in the second round was [NUMBER]. This corresponds to a response rate of [NUMBER]% in the first round and [NUMBER]% in the second round.
	Results	34	Presentation of the results for each Delphi round and the final results	Page 181-194 (tables 6.2-6.5)	In the first Delphi round [NUMBER]% of the experts agreed, in the second [NUMBER]%, and in the third [NUMBER]%.
V Discussion	Quality of findings	35	Highlighting the findings from the Delphi study	Page 196	The central findings can be summarized as follows: [STATE FINDINGS].
		36	Validity of the results (e.g., transferability of the findings)	Page 197-204	The results are not transferable to other countries due to different legal regulations.
		37	Reliability of the results (e.g., split half, inter-rater reliability)	Page 202-204	The responses in the free-text comments were analyzed by two independent reviewers [SPECIFY].
		38	Reflection on potential limitations (e.g., number of experts, response bias)	Page 202-204	The results are to be viewed critically with regard to the composition of the panel because [REASONS].