STRATHCLYDE INSTITUTE OF PHARMACY & BIOMEDICAL SCIENCES

University of Strathclyde Science

Impact of a Large-Scale Robotics Adoption on the Hospital Pharmacy Workforce

Thesis submitted by

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in fulfilment of the requirements for the degree of Master of Philosophy

May 2015

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I. Declaration

This thesis is the result of the author's original research. It has been composed by the author and has not been previously submitted for examination which has led to the award of a degree.

Signed 

Date: 15/12/23

II. Summary

The National Health Service (NHS) regularly adopts new technologies which often result in the redesign of services, where large numbers of staff undergo organisational change. The NHS is made up of teams of people, all of whom continue to work interdependently providing safe and effective care throughout these times of change. Automation in pharmacy is becoming popular, with recent advancements involving the automation of the medicines supply chain. Previous ventures involving Automated Dispensing Systems (ADS) have been small-scale. Maximising efficiencies through automation relies on the effective introduction of technologies as well as the alignment of technical and social change, and there has been little exploration of how automation impacts on the staff experience and team effectiveness. In the literature there are numerous models available against which to compare and analyse the success of teams more generally. Underpinning many of these models is the Hackman model which proposes that team effectiveness is influenced by: the effort team members exhibit; the knowledge and skills team members possess; and the appropriateness of the performance strategies implemented. There is a gap in the literature on the impacts large-scale automation has on teams (and their success) in healthcare, specifically in pharmacy.

Approved in August 2008, NHS Greater Glasgow & Clyde (GG&C) initiated a large-scale redesign (the PPSU Acute Pharmacy Redesign Programme). The Programme aimed to; provide a single procurement department for Glasgow pharmacy; have a centralised Pharmacy Distribution Centre (PDC); introduce ward-level ordering; and improve the current staff skill-mix while promoting the use of patients' own medicines in hospital (Making the Most of Your Medicines or MMyM). Since opening in September 2010, the PDC (comprising 9 robots in total) is now the single facility responsible for the procurement and distribution of medicines to approximately 4000 destinations, and affected approximately 530 hospital pharmacy staff. This scale of pharmacy redesign has not been seen in any other automated schemes in the UK.

The aim of the first study was to describe and evaluate NHS GG&C pharmacy staff experiences over the programme duration by different job roles/locations. Interviews were conducted with 36 pharmacy staff members from 4 hospital sites and the PDC, and 9 stakeholders, identified by members of the project Steering Group. Staff were interviewed about their experiences before, during and after the redesign. An inductive content analysis was performed, which produced two main themes: "The Work I Do" and "The Context of My Work". The first theme allowed the exploration of the changes in staff job role, with a focus on tasks, work pace/control, morale, training/progression opportunities and voice/relationships. The second theme focused on social

impacts of the redesign, including support, leadership, praise, reliability and trust of co-workers. Results showed that there was a lack of training available and morale was low in part due to this. There was no cohesive vision among participants as to why the redesign was happening. Hospital staff training was in theory available, yet completing training, and progressing into higher pay bands was not always feasible. Management were concerned with PDC technicians losing their clinical-skills as a result of a change in job location. PDC support workers experienced a gradual depletion of medicines knowledge due to this transition. The pharmacist role was seen as more social. Experiences between MMyM and non-MMyM staff were different in terms of how challenging, varied and social the work was. All roles within the PDC appeared to be less social compared with hospital roles.

The aims of the second study were to apply Hackman's model of team effectiveness in the context of the pharmacy team dynamics and performance and (based on this model) discuss the extent to which these teams were successful in the adoption of the automation. Hackman's characteristics were applied to the pharmacy staff interviews (n=36). The results indicated that PDC and hospital teams exhibited 8 of the 23 characteristics: members have a variety of high-level skills; members contribute and are motivated equally; members are equally committed; members have personal and professional skills; relevant education and training is present; learning should be collective; members self-regulate; and there is clarity about task requirements, constraints, resources available and who the service user is. The "minimising of performance slippages" characteristic could be observed in one hospital team but not in the PDC. The teams did not exhibit 5 of the characteristics, indicating less success in these areas: autonomy is available; adequate feedback is available; excellent performance is rewarded; team size is appropriate; and relevant education and training is actually available. Nine of Hackman's characteristics could not be commented on due to a lack of illustrative data.

This thesis adds to the limited literature on the exploration of automation in healthcare, specifically pharmacy. Three main lessons can be concluded:

- Staff consultation and engagement is critical to the successful redesign of services driven by technology
- Ensuring job role components are appropriate for job tasks is essential- technology adoption may require new skill sets and also cause other pre-existing skill sets to become lost

- Team effectiveness is an important focus within any organisational change programme, but less up-to-date models of team effectiveness may not be ideally applicable to teams utilising technology.

These lessons align with current Scottish Government policy on pharmacy innovation and provide valuable key points for change implementers to support the continued adoption of automation locally, nationally and internationally.

III. Acknowledgments

I would like to thank my supervisor Professor Marion Bennie and co-supervisor Dr Robert Van Der Meer for their continued supervision, patience and encouragement. The development of my thesis, as well as my own personal development as a researcher, has benefited greatly from their support and guidance. I would also like to thank Dr Trevor Bushell for his continued support and guidance.

Thank you to the NHS staff who participated in the interviews detailed in this project. Their time and honesty was of great value and I am sincerely thankful. Thanks are also extended to the Pharmacy Prescribing Support Unit team, especially Professor Norman Lannigan, and the wider NHS Pharmacy team for their continued support and cooperation throughout this project.

Thanks also go to Professor Patricia Findlay, Johanna Commander and Dr Colin Lindsay of the University of Strathclyde Human Resource Management department for their collaboration during the data collection period.

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Bennie, M., Corcoran, E. D., Findlay, P., Commander, J., Lindsay, C., Van Der Meer, R. (2013). Impact of Robotics-Led Organisational Change on the Pharmacy Workforce: Preliminary Findings. NHS Report

Publications

Van Der Meer, R., Bennie, M., Corcoran, E. D. & Lannigan, N. (2013). Early-stage experiences of the implementation of a large-scale robotic storage and distribution system in a hospital pharmacy service within a large UK health authority. *European Journal of Hospital Pharmacy*, 20:362-367

Lindsay, C., Commander, J., Findlay, P., Bennie, M. Corcoran, E. D & Van Der Meer, R. (2014). 'Lean', new technologies and employment in public health services: employees' experiences in the National Health Service. *The International Journal of Human Resource Management*. 25(21): 2941-2956

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Findlay, P., Commander, J., Lindsay, C., Bennie, M., Van Der Meer, R. & Dunlop, E. (2013) New distribution technologies and the restructuring of public sector work: evidence from the NHS in Scotland. *Society for the Advancement of Socio-Economics Conference*, Milan, Italy.

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Lannigan, N., Bennie, M., Van Der Meer, R., & Corcoran, E. D. (2015) Improving the Delivery of Pharmaceutical Care for Patients Through the Use of Large-Scale Pharmacy Automation. *European Association of Hospital Pharmacists Conference, Hamburg, Germany.*

Lindsay, C., Commander, J., Findlay, P., Bennie, M., Corcoran, E. D. & Van Der Meer, R. (2015) Collaborative Innovation, New Technologies and Work Redesign: Employees' Experiences in Regional Public Health Services in the UK: Abstract for Theme E. *Innovation and Knowledge Economies Regional Studies Association Conference, Glasgow UK.*

VIII. List of Abbreviations

ADS	Automated Dispensing System
APR	Acute Pharmacy Redesign
CD	Controlled Drug
DCT	Dispensing Checking Technician
EDC	Emma Dunlop Corcoran
ENT	Ear, Nose and Throat
GP	General Practitioner
HEPMA	Hospital Electronic Prescribing and Medicines Administration
HIS	Health Improvement Scotland
HR	Human Resources
JC	Johanna Commander
KPI	Key Performance Indicator
MMyM	Making the Most of Your Medicines
NHS	National Health Service
NHS GG&C	National Health Service Greater Glasgow & Clyde
PDC	Pharmacy Distribution Centre
PPSU	Pharmacy Prescribing Support Unit
SASE	Society for the Advancement of Socio-Economics
SBT	Simulation Based Training
SIPBS	Strathclyde Institute of Pharmacy and Biomedical Sciences
SOPs	Standard Operating Procedures

1. CHAPTER 1: General Introduction

Organisational change in the healthcare setting has been well documented, and has been described as "*hard to achieve and slow to take hold*" (1). The NHS regularly adopts new innovations in science and technology which often result in the redesign of services (2). This is perhaps applicable to the ever changing nature of the NHS, where large numbers of staff undergo organisational changes on various scales on a regular basis; from small departmental changes in Standard Operating Procedures (SOPs), to large Health Board-wide redesigns. One approach to organisational redesign utilised by the NHS is the introduction of automation. A large amount of the previous literature on automation and robotics in healthcare has focused on the use of robotics in surgery (3-26). In the pharmacy environment, studies have only detailed examples on a hospital or community pharmacy dispensary-based scale (27-46) . The introduction of automation in the pharmacy setting, particularly robotics, is however becoming more popular, with recent technology advancements in the medicines supply chain focusing mainly on the automation of the supply of medicines to hospitals, wards and clinics, and the dispensing of medicines for individual patients. Maximising efficiencies through automation relies on the effective introduction of technologies as well as the alignment of technical and social change resulting in the delivery of new job roles and the effective utilisation of skills, management and Human Resource (HR) practice.

A survey of six Scottish Health Boards (47) in 2010 identified that pharmacy distribution functions in NHS Tayside, NHS Greater Glasgow & Clyde, NHS Forth Valley, NHS Grampian and NHS Ayrshire & Arran, have all implemented some form of Automated Dispensing System (ADS). However, these ventures into ADS have been relatively small-scale and are physically located within hospital sites, meaning that any cultural changes associated with the technological transformation have been more gradual as opposed to sudden. Health Boards such as NHS Grampian and NHS Tayside have also benefited from existing centralized distribution models. For example, in March 2011, Ninewells hospital in Dundee welcomed a new robotics distribution system, serving a population of 399,550 people across NHS Tayside and dispensing 18,500 medicines each month (48). The system is responsible for the preparation and distribution of medicines to all hospitals, clinics, community nursing, GPs and Out of Hours services across the health board.

Although the introduction of automation in the hospital pharmacy in the previous published research has evolved around the opportunity to contain or reduce costs, improve clinical accuracy and release pharmacy staff to more patient-centred tasks (49-52), there has been little exploration of how automation and robotics in the workplace impact on the staff experience at work. Some research suggests that introducing effective innovation strategies require staff at all levels to be consulted, in order to help shape and be actively involved in the redesign process (40, 53). This

mirrors wider debates on organisational change, many of which recommend extensive consultation with all staff involved (54, 55).

Managing the social and human challenges throughout the introduction of automation in the healthcare setting is often neglected (56), yet is as important as ensuring all of the technical and robotic components are working optimally and in partnership. Staff in the NHS (particularly in hospital Pharmacy) work in team-based environments, and the introduction of automated elements to the team has the potential to present its own set of challenges as well as opportunities for staff growth and development. Some of the published research highlights how the introduction of automation can change various aspects of the team dynamic; including the work the team does, at what pace and how the team interacts with one another. Automation can shift the boundaries between staff groups, expanding and collapsing the roles of each, resulting in both positive and negative outcomes for staff of different levels (29).

The previous literature has also highlighted the positive effects of involving staff in the development and implementation of automation in healthcare settings (40), emphasising that ensuring the technology acts and is accepted as part of the team as such could result in a more harmonious, safe and efficient working environment. There is however a significant gap in the literature on the impact large-scale automation projects have on teams in pharmacy.

1.1. NHS GG&C Pharmacy Prescribing Support Unit (PPSU) Acute Pharmacy Redesign (APR) Programme: The Journey

NHS Greater Glasgow & Clyde (NHS GG&C) is Scotland's largest Health Board, and serves a population of around 1.3 million people (57).

The programme's main aims were:

- To provide a single procurement department for NHS Greater Glasgow & Clyde Pharmacy
- To have a centralised Pharmacy Distribution Centre (PDC) for all of NHS GG&C
- To introduce ward-level ordering covering multiple hospital sites
- To improve the current staff skill-mix in order to facilitate the delivery of the Making the Most of Your Medicines (MMyM) service.

The main objectives of the Acute Pharmacy Redesign (APR) Programme were to centralise services with the use of technology, to improve patient care and reduce waste in order to have a more efficient and cost-effective pharmacy service.

Prior to the redesign, the pharmacy service (with an annual expenditure on medicines of around £120million) was delivered through 14 main hospital sites, with a staff count of approximately 530 people (including pharmacists, pharmacy technicians and various levels of support staff). The previous system saw all hospital sites order their medicines from multiple suppliers. Approved in August 2008, NHS GG&C initiated a large-scale service redesign programme, which sees all 11 hospital sites in NHS GG&C source their medicines from the new Pharmacy Distribution Centre (PDC) located on the outskirts of Glasgow City Centre (three of the 14 main hospital sites were small in nature, and pre-PDC had begun sharing pharmacy stores; therefore the PDC actually replaced 11 different in-hospital pharmacy stores.)

Since September 2010, the PDC is now the single facility responsible for the procurement and automated distribution of medicines to replenish ward and site pharmacy stocks for all hospitals and community clinics in the Health Board (approximately 4000 destinations). Figure 1 compares the old and new medicines procurement systems.

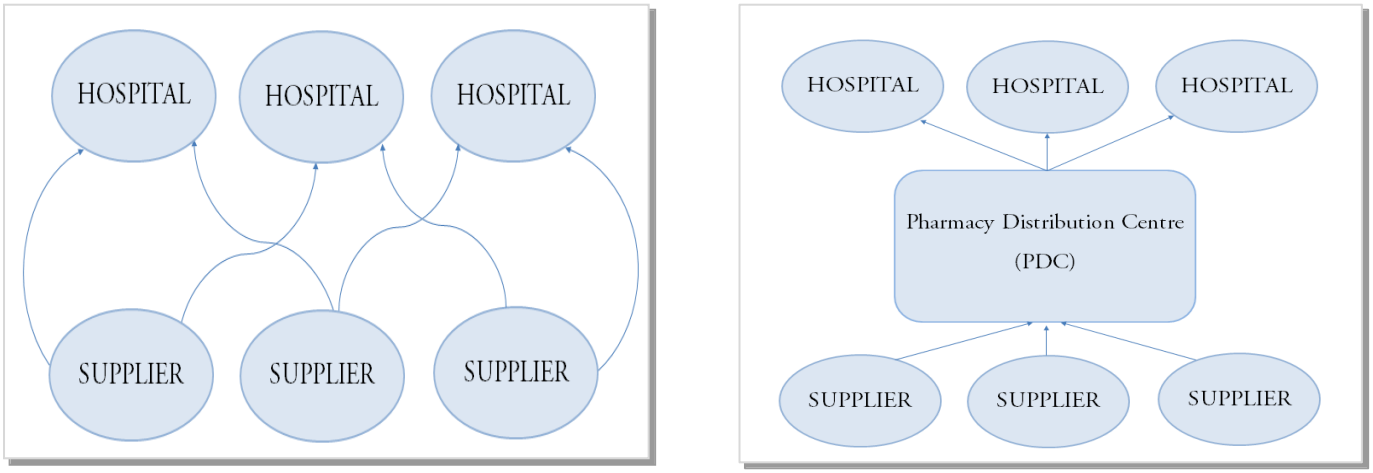


Figure 1: Comparison of the Medicines Procurement Systems in NHS GG&C Pre and Post Redesign

To the knowledge of the pharmacy and research teams, this scale of pharmacy redesign has not been seen in any other automated schemes in the UK. Within the PDC, eight robots are working together as an integrated storage and distribution system, with an additional robot installed within a vault for safe and secure handling of Controlled Drugs (CDs). The PDC also has a number of manual

areas; one for unlicensed medicines, one for vaccines and refrigerated items, and one area for all medicines contained in packaging non-compliant with the robot (e.g. glass bottles etc.).

This redesign also ran parallel with the introduction of the MMyM scheme, which encouraged patients to bring their own medicines into hospital with them in order to improve clinical accuracy, encourage the increase of pharmacist/patient counselling and interaction, and reduce medicines wastage. A number of support workers and technicians had their job roles redesigned to specifically include MMyM in their job title and description (58).

1.2. Job Roles: Before and After the Redesign

Figures 2- 4 display the pre and post-redesign general job roles of Support Workers, Technicians and Pharmacists pre and post redesign.

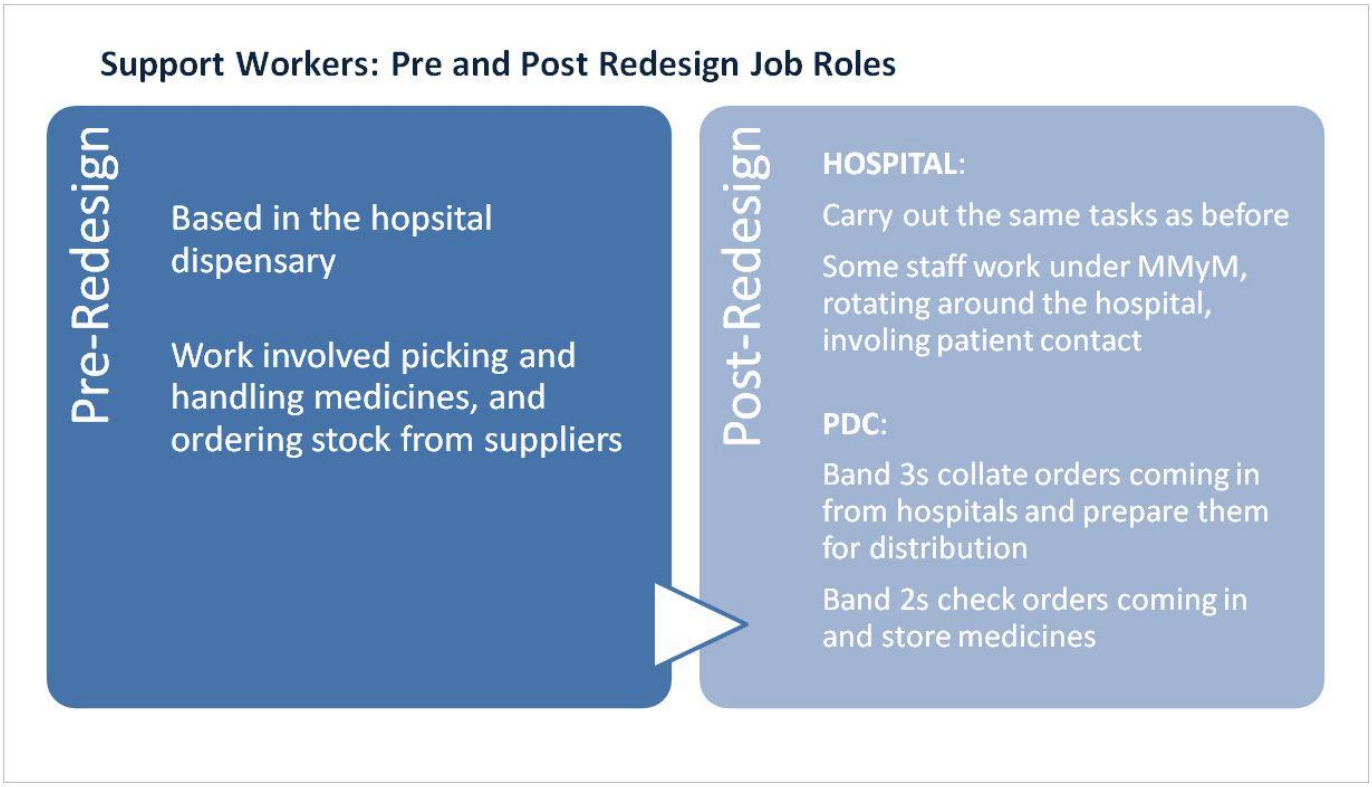


Figure 2: Support Worker Day-To-Day Job Features Pre and Post Redesign

Support workers in the hospital dispensary had a generic role whereby they were involved in picking, handling and storing medicines. They would interact with various members of the pharmacy team as well as with hospital porters. The redesign did not bring a lot of change to the core tasks of the pharmacy support worker. Some support workers would now be labelled under the MMyM scheme resulting in a rotational aspect to their work. MMyM support workers within hospitals would work between various different satellite dispensaries (e.g. the main dispensary, aseptic etc.) which also entailed an element of patient contact not present in the pre-redesign role. Support workers who relocated to the PDC would also be picking and handling medicines, compiling them as per orders that came through from the hospitals and preparing them for checking before they were distributed. The main difference observed here was the change in job environment. The PDC is a warehouse-like environment with zero patient contact and little contact with other healthcare professionals out with the PDC itself.

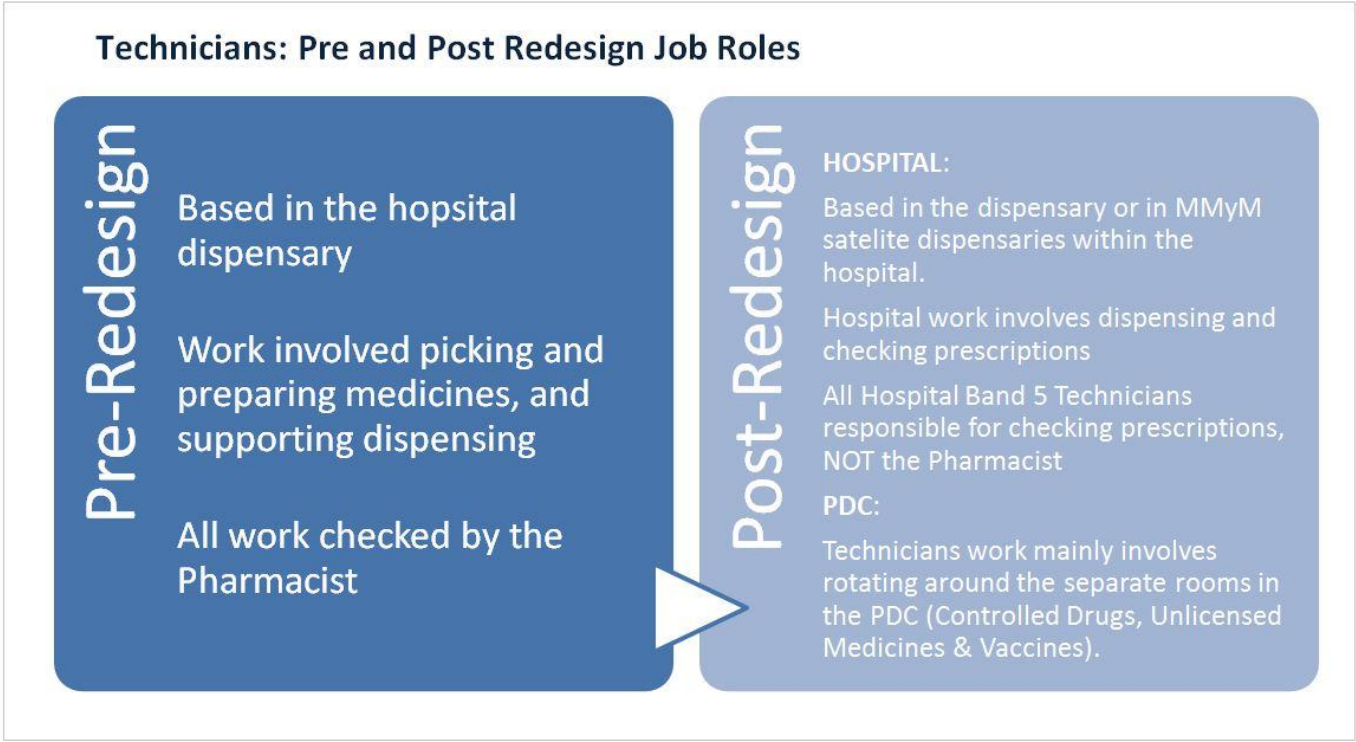


Figure 3: Technician Day-To-Day Job Features Pre and Post Redesign

Pre-redesign, pharmacy technicians were based in the hospital dispensary and would pick and handle medicines. They also had a role in supporting the dispensing of prescriptions. All work completed by the technician in preparing prescriptions would be given a final check by the

pharmacist before it would be dispensed. Hospital technicians post-redesign had a new responsibility bestowed upon them, in that all Band 5 technicians would have the ability and the expectation to check prescriptions. Furthermore, technicians were now both based in the dispensary, but MMyM technicians would have a similarly rotational role as with the MMyM support workers throughout the hospital, again resulting in increased patient contact and job variety. PDC technicians mainly work in a rotational nature between all of the separate manual pick areas within the PDC, dealing with specialist items such as CDS, unlicensed medicines and vaccines. Similar to PDC support workers, the job environment was industrial in nature and involved zero patient and little healthcare professional contact.

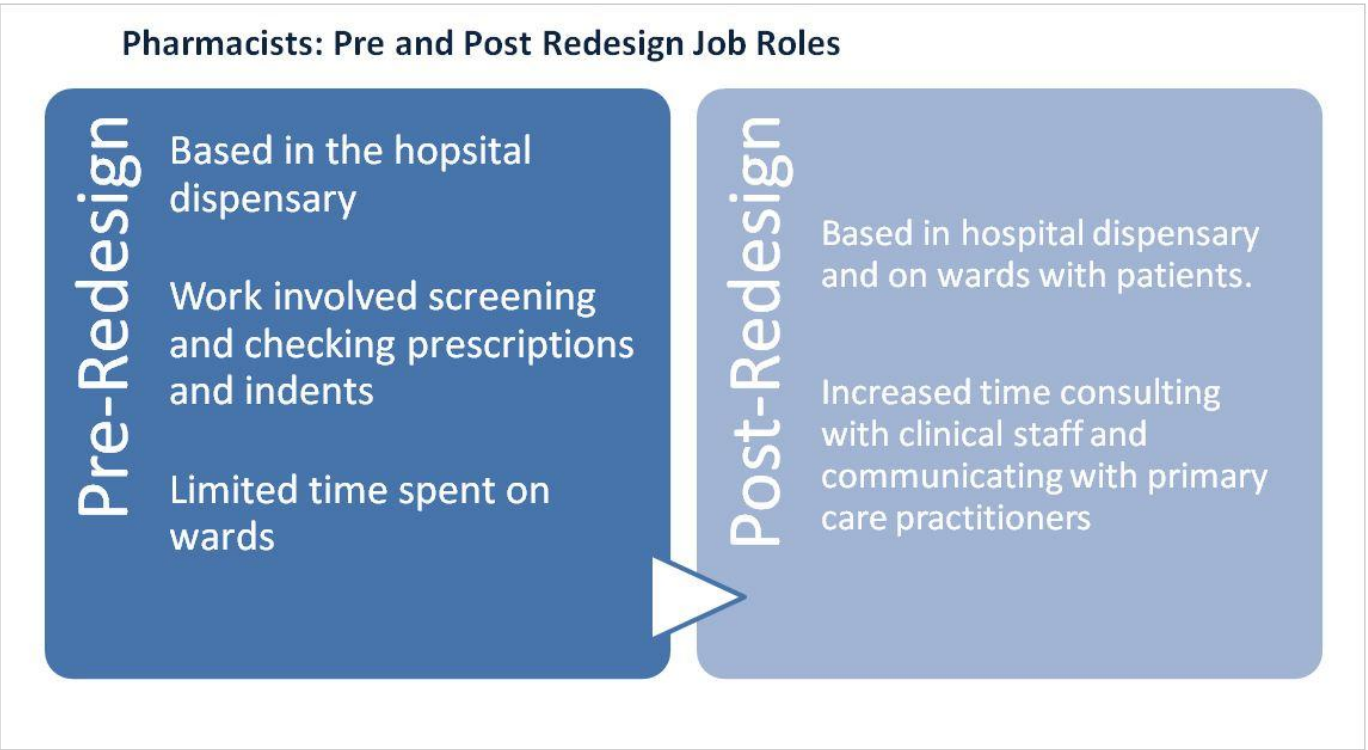


Figure 4: Pharmacist Day-To-Day Job Features Pre and Post Redesign

One of the aims of the redesign was to free up the time of the pharmacist, so that less time was spent in the dispensary and more time was spent on more patient-facing activities. In theory by transferring the role of checking prescriptions to Band 5 technicians, the pharmacist would be spending less time on this activity and more time speaking with patients, clinical members of the team and other healthcare professionals in primary care. There are no positions for pharmacists at

the PDC; therefore the clinical work environment from pre-redesign times remained the same (with the only change involving the increase in time spent in the ward environment).

This automation project involved a major organisational change programme with significant implications for jobs, work and employees. NHS GG&C commissioned the University of Strathclyde to support the redesign at two key time points.

1.1.1 Phase 1 PPSU Acute Pharmacy Redesign Evaluation: 2010

In 2009, NHS GG&C PPSU engaged the Strathclyde Institute of Pharmacy and Biomedical Sciences (SIPBS) and the Department of Management Science from the University of Strathclyde in a project to capture the early organisational learning (first 6 months) gained from the initial implementation phase of the PDC.

The researchers adopted an action research approach (59), utilising a number of data collection methods and analysis tools. Qualitative methodologies included observations and informal interviews with staff while they worked. Interviews were not recorded as due to the sensitive and highly emotional nature of the situation, it was decided that recording participants' accounts of the redesign may deter participation altogether. A number of analyses from colleagues in the Business School were employed in order to understand the workflow change from pre to post PDC, including balanced scorecards and workflow analyses. Furthermore, project documentation, such as Steering Group meeting minutes, reports and the PPSU Work Positive Survey (60) were consulted in order to gain a broad perspective on the full extent and impact of the redesign.

This study identified a number of technical, system and social challenges associated with the organisational redesign and the introduction of robotic technology in the system, and these are outlined in Figure 5.

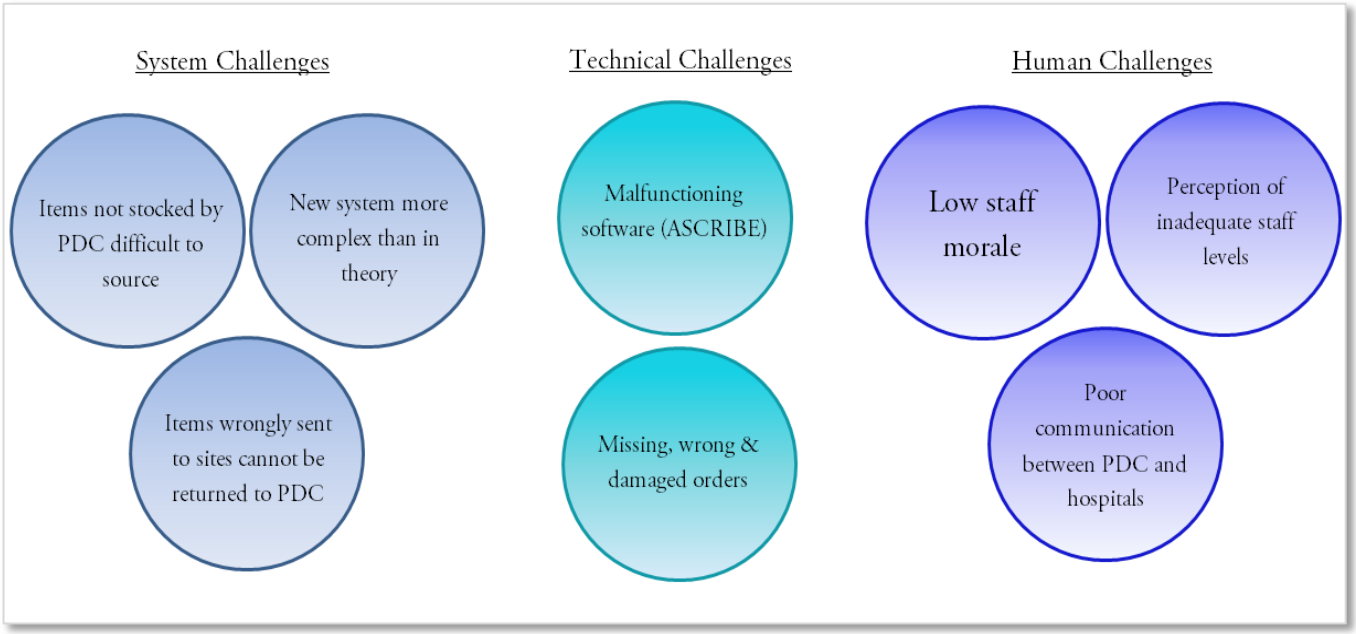


Figure 5: Main themes arising from PPSU APR Phase 1 Evaluation (2010)

This programme of work was completed in December 2010 with results published through an NHS Report and other reports (2, 61). The data was accepted for publication in the European Journal of Hospital Pharmacy (62). This work was also presented at the European Association of Hospital Pharmacists 19th Annual Congress in Barcelona in 2014 in the form of a poster with accompanying presentation (63).

A number of key recommendations were made by the research team in order to tackle the current issues identified and encourage the success of the programme detailed in Figure 6.

Standardise processes, improving quality and sharing best practice by:	Improve staff morale by:	Inventory management by:
•Ensuring each follows the same procedures for inventory management, recording data and reporting issues •Creating a tool for staff to source information about operational aspects of the system •Maintaining a culture of quality improvement e.g. through Kaizen workshops •Implementing system checks aletring sites of the current level of operation at the PDC, encouraging appropriate alteration of ordering behaviours.	•Holding regular well-structured staff meetings to feedback news, share new ideas and listen to feedback from staff •Continuing to use the PPSU Work Positive Survey to improve upon issues identified by staff	•Examining and/or adjusting each site's parameters for medicines re-order, as well as the PDC's re-order parameters •Investigating and attempting to eliminate any causes of delay or failure of medicines delivery from supplier to the PDC •Reviewing the functionality of the Ascribe software, and investigate the feasibility of enhancements in the software's performance

Figure 6: Recommendations made to PPSU APR Team Following Phase 1 Evaluation

Given the scale of the redesign and its critical role in supporting the intended improvements in the quality of patient care and pharmacy service, a follow up study was proposed. Due to some unavoidable data collection restrictions, and the sensitive and stressful nature of the early redesign period, some data was not collected in the Phase 1 evaluation, for example, the stakeholder experience and the views of the PDC staff; therefore some continued investigation was required in order to fill these gaps in the data set, as well as build upon the data already collected. Evaluating the service after the acute implementation stage would also provide the research team with a number of new opportunities to explore the pre, mid and post-redesign experiences of staff and key stakeholders.

1.1.2 Phase 2 PPSU Acute Pharmacy Redesign Investigation: 2012

Based on the findings and recommendations from the Phase 1 evaluation, the research team from SIPBS together with the Departments of Management Science and Human Resource Management at the University of Strathclyde were commissioned to conduct a follow-up investigation of the NHS GG&C APR Programme.

Phase 2 aimed to gather a wider perspective on the successes and challenges of the redesign, who the redesign involved and affected, and how the work changed over the 2 years encompassing before, during and after the redesign. Phase 2 data collection involved hospital, PDC and key stakeholder staff. The main findings and recommendations were presented to the PPSU group as an NHS report (64) and have been presented as a conference paper for the Society for the Advancement of Socio-Economics 25th Annual Conference in Milan, Italy in 2013 (65). It is the data collected in Phase 2 that is the subject of analysis in this MPhil Thesis.

1.3. Scope of the MPhil Thesis

This MPhil thesis will comprise two key studies, each with their own methods, results and summary analysis of findings, followed by an overall discussion of the full findings. Chapter 2 of this thesis focuses on exploring the experience of the change process for staff (inductive) whereas Chapter 3 focuses predominantly on staff experiences and their performance as a team post-redesign from a model-based perspective (deductive).

Chapter 2

- To conduct a review of the literature on organisational change and the use of robotics in healthcare, focused on pharmacy
- To describe and evaluate NHS GG&C pharmacy staff experiences over the programme duration by different job roles and job locations through an inductive content analysis

Chapter 3

- To apply Hackman's model of team effectiveness in the context of the pharmacy team dynamics and performance observed
- To discuss the extent to which these teams were successful in the adoption of the new robotic system based on Hackman's characteristics of successful teams

Chapter 4

- To examine the findings from the analyses in Chapters 2 and 3 to generate key messages and proposals for future work.

2. CHAPTER 2: PPSU Acute Pharmacy Redesign Investigation: 2012

2.1. Introduction

Goundrey-Smith (66) provides a useful summary of the current state of knowledge on the use of automation in pharmacy, with special attention to the situation in the UK. However, most of the literature has so far focused on relatively small-scale dispensing systems which have reported efficiencies in terms of: reductions in time needed to dispense medicines; more reliable tracking of medicines and reduced losses; quicker response to ward-based emergencies; reduced dispensing errors; more efficient stock control and purchasing; and improved monitoring of the association between medicines dispensed and clinical outcomes (67-71). Such efficiency benefits have the potential to feed into both cost savings and improved clinical outcomes.

Maximising efficiencies through automation depends on the effective introduction of technologies as well as the related alignment of technical and human dimensions to deliver new job roles and effective skills utilisation, management and Human Resource (HR) practice. While there is some evidence on the potential financial and clinical benefits of automation projects, less information is available on the implications of automation on staff, on jobs and on workforce development within the healthcare setting. Some research within UK public sector settings suggests that effective innovation strategies require staff at all appropriate levels to be consulted, to be actively involved in shaping and influencing, and to invest themselves into the change process (53). This aligns with wider debates on the management of organisational change, many of which recommend extensive consultation with all stakeholders at all appropriate levels in order to facilitate effective organisational change (54, 55).

2.2. Aims

Aims

- To conduct a review of the literature on organisational change and the use of robotics in healthcare, focused on pharmacy
- To describe and evaluate NHS GG&C pharmacy staff experiences over the programme duration by different job roles and job locations through an inductive content analysis

2.3. Literature Review

A literature search was conducted to gain a broad understanding of organisational change in healthcare in addition to an examination of the use of robotics in healthcare with a focus on pharmacy robotics.

The online databases Science Direct, Web of Knowledge/Science and Wiley Online were searched. Individual searches from 1993-2014 including the following search terms were made:

- "organisational change"
- "organisational change" AND "healthcare"
- "robotics" AND "healthcare"
- "robotics" AND "pharmacy"

Where possible, keywords were searched for within the abstract, although some databases only allowed for the full-text or the general topic to be searched.

In total, these searches yielded a result of 5457 journal articles. Appendix 1 represents the results by each keyword search. As the results were more limited for the searches involving more than one keyword (e.g. "organisational change" AND "healthcare) and are more related to the current research project than the more general terms, the articles discovered in these searches were focused on. Furthermore, any articles or other references cited by these papers deemed as relevant were also sourced and referenced in the literature review. It should be noted that the articles sourced are not exclusive to the database they were sourced from. Therefore, the numbers stated in the table reflect the total results produced from the literature search, and not the number of unique individual articles on each topic.

2.3.1. Organisational Change in Healthcare Literature

Organisational change in UK and worldwide healthcare settings has been extensively documented in the previous literature, with studies exploring the experiences of various professions including, but not limited to, doctors, health policy makers, nurses, surgeons and anaesthetists (1, 72-75). Dawson (76, 77) and Pettigrew & Whipp (78) are of the opinion that examining the process of change (that is, how change occurs) is just as important as examining the actual change itself. Change is often one of the most consistent aspects of an organisation, in that it happens frequently. However, more than

half of all organisational changes either fail or do not reach the intended goals, with reasons cited ranging from the organisational culture, the timing of change to the role of change (79).

A wide array of factors associated with the success (or otherwise) of organisational change can be identified from the literature. However, there are some recurring factors which are seen in many published models and explorations of organisational redesign. These include: adequate and effective communication; employee self-efficacy; increased/maintained skills and knowledge; and the management of change-associated stress. Furthermore, the staff commitment to providing good patient care is explored in relation to organisational change within a healthcare setting.

Adequate and effective communication is an important factor identified in the success of any organisational change. Poor communications lead to rumours spreading and resistance to change, resulting in employees focusing purely on the negative aspects of change. Communication serves to inform employees as well as create a supportive culture and conditions for high job commitment and trust, and successful organisational change can be dependent on good communication levels, providing employees with opportunities to express their own concerns and receive adequate information about the redesign (79). Good communications can allow staff members to feel like they belong to their organisation and share similar attitudes with their colleagues. Employees who are fully informed of, and involved in, organisational decision making are more committed and productive (80). It should not be assumed, however, that an increase in communications is inherently associated with a more positive change experience. Neonatal intensive care unit healthcare professionals undergoing organisational reform in Canada reported feeling overwhelmed by the information they were provided during an organisational redesign, stating that there needed to be a more careful selection of channels through which information was shared. The level of communication of the rationale for change is not always reported as ideal (81), therefore it is more useful to consider the impact of appropriate communications on the experiences of staff during organisational change, as opposed to the sheer quantity of communications present.

The previous published literature has also explored the importance of each individual employee's behaviour in the success of organisational change, involving all levels of the organisation in becoming motivated towards making change work. This concept comes from the social cognitive models of behaviours (82), where the effects at a micro level have a larger effect at the macro level. Bandura's (82) work on ***self-efficacy*** is particularly relevant when preparing any workforce for change. This is

important in terms of promoting a sense of ownership and self-efficacy among employees, but also for determining the success of the change itself.

Furthermore, the importance of keeping skills and knowledge up-to-date is crucial, as ***increased skills and knowledge*** promotes self-confidence in the workforce. However, in situations where new job roles for staff can cause further anxiety and complication, guided training opportunities as opposed to self-motivated learning can ease this transition and may result in a more confident and efficient workforce (83).

Times of organisational change can be stressful for staff members. Tavakoli (84) suggests that increased stress levels generally occur as a result of the way that staff are treated during the time of change, and are not as a result of the actual changes themselves. Acts must take place in the ***management of change-associated stress*** in order to avoid resistance to change and project failure, such as: encouraging staff to be involved in change processes; discussion of the gains to be had as a result of the change; increased organisational justice and fairness for staff; provide honest and clear communications about the change processes; create a supporting work environment; and provide training which equips staff sufficiently to work in their new environment.

However, when considering organisational change within healthcare specifically, it is important to consider this unique caregiving environment. While staff are subjected to change processes, the provision of care must continue without fault in order to ensure that those receiving care are not directly affected by any negative experiences or consequences of change. Häggström and colleagues' (85) research involving caregivers of older adults in Sweden found that increased stress levels associated with organisational change could have affected the level of care provided. Wynne's (86) exploration of the Australian healthcare system reform in the 1990s explored a large-scale redesign involving the creation of new healthcare networks spanning three levels (healthcare networks, hospitals within the networks and units within the hospital), resulting in $218 million worth of budget cuts, the reduction of full-time staff by approximately 2000, the closing of many public hospitals and the reduction of beds within some hospitals. Staff were experiencing a more intense and increased workload, and struggled with the dichotomy of providing good patient care and working appropriately under the new system. A strong sense of ***commitment to patient care*** and to the nursing team was identified, yet led to staff becoming stressed and overworked. Caregivers' feelings of responsibility towards patients can feel compromised or threatened during times of organisational unrest and this is an inherent factor that should be considered when exploring any organisational change in any healthcare system.

It would appear that there are a limited but specific set of factors associated with what could be described as successful organisational change. The literature previously discussed does allude to examples in the wider healthcare setting and not to pharmacy specifically. Additionally, there is a lack of previous research conducted on large-scale organisational redesigns, specifically involving robotic automation, both in the wider healthcare setting and also in pharmacy.

2.3.2. Robotics in Pharmacy

Much of the research on the use of robotics in healthcare relates to the benefits of robotics in surgery (3-26). The most frequent application of robotics in pharmacy has been through the use of automation in the pharmacy dispensing process. As the human element is greatly reduced in the handling of medicines through adoption of robots, it is assumed that the use of automation will increase accuracy and speed, while ensuring the safe and effective use of medicines (27, 30-32, 34, 36, 37, 39, 42, 43, 45, 46, 50, 87, 88). Those staff that would normally have completed dispensing tasks manually are then made available for more patient-facing activities, such as medicines counselling and review.

Although the evidence base is small, automated dispensing/distribution systems (ADS) are becoming more popular. A number of brands were found via the literature search and are detailed in Table 1, modified and updated from the Lehnbom and colleagues' (46) table. Not all published papers and reports provided details of the automated systems.

Table 1: ADS Brand Names and Examples (table modified from Lehnbom et al (2013) (46))

Description	Brand Name	Published Reports
Pharmacy-based ADS		
• Medications stored on designated shelves • Dispensing order entered, robotic arm or picking device selects medication from shelf and transfers to delivery station • Checked and labelled by pharmacy staff	Rowa Speedcase PackPicker®	• Franklin et al (2008)(34) • NHS Trust King College Report (69)
	Cytocare	• Seger et al (2012) (50)
	APOTECAChemo	• Palma & Bufarini (2012) (40) • Masini et al (2014) (37) • Milani et al (2012) (39) • Yaniv & Knoer (2013) (45)
	ARx	• Whittlesea & Morgan (2005) (44)
	Parata Max	• Walsh et al (2011) (43)
	RxOBOT	• Crawford et al (1998) (33)
	Swisslog PillPick® consisting of PillPicker (packaging), DrugNest (storage) and PickRing (dispensing)	• McMaster & Lytle (2007) (38)
	ScriptPro SP-200	• Lin et al (2007) (36)
Ward-based ADS		
• Medications stored in electronically controlled cabinet linked to computer • To access medications, nurse enters password and patient details • Drawer containing selected medication opened • Nurse administers medication • System tracks who accessed the cabinet and for whom medications were selected	McLaughlin Dispensing System	• Barker et al (1984) (89)
	Medstation Rx	• Borel & Rascati (1995) (90)

By 2011, 63% of all hospitals in the United States of America were using some form of automation in their dispensing systems, compared with 22%, 9 years earlier (41). Of the 40% of American hospitals with a decentralised inpatient medication distribution system, 89% of those used Automated Dispensing Cabinets, and 10.8% utilised a robotic distribution system automating the dispensing of unit dose inpatient medications in a centralised distribution system. In Saudi Arabia, approximately 49% of hospitals in the Kingdom utilise robotic or automated technology in the pharmacy drug distribution system (28).

Levels of Success in ADS Projects

Of the published reports detailed in Table 1, those which the researcher had full access to and included qualitative or quantitative elements focused on successes or challenges of the implementation were reviewed further. Table 2 summaries those identified service improvements and challenges.

The introduction of automation in the pharmacy environment can help improve patient safety (91), however unintended consequences and failures in design and implementation can and have occurred in the past (92-94). It would appear therefore that although the introduction of automation in the pharmacy setting can provide the service with gains and successes, other challenges need to be anticipated and potentially met.

Table 2: Service Improvements and Challenges Observed in Published Examples of ADS including Qualitative or Quantitative Data on ADS Impact

	Reference	Description
Successes	Lin et al (2007) (36)	• Investigated the effects of the ScriptPro prescription-filling system on hospital pharmacy staff activities • Reported a statistically significant drop in time spent on prescription filling despite an increase in the amount of prescriptions.
	Masini et al (2014) (37)	• Investigated the APOTECAchemo system installed in an Italian cancer institute • Manual preparation of drugs was deemed as high in quality as automated preparation • Automated preparation took longer, yet a lower mean variable unit cost was observed as well as cost savings generally in pharmacy staff time.
	NHS Trust Kings College Report (2006) (69)	• Investigated the Rowa Speedcase pharmacy-based original pack dispensing system in King's College Hospital • All 9 project aims were met (Included: reducing agency expenditure; reducing dispensing errors; reducing dispensing waiting times; releasing of staff to near-patient tasks; facilitating patients bringing their own medicines into hospital; and improving service reliability. • Dispensing errors were reduced by 65% • The service was running optimally 99.7% of the time. • Stock holding was reduced by £534k.
	Franklin et al (2008) (34)	• Involved comparison of two different ADS systems installed within a large UK trust hospital Significant reductions were seen in dispensing errors involving wrong content in both systems • The time required for picking items for dispensing also reduced.
Challenges		
	Yaniv & Knoer (2013) (45)	• Investigated the APOTECAchemo system implemented in an American cancer centre pharmacy serving 94 infusion chairs and 1300 beds • Of the doses emitted by APOTECA requiring manual modification, almost 73% of those were due to a necessary modification (i.e. doses produced by the robot that varied by 4% or more) • Mechanical and IT issues included malfunctioning software and robotic parts unable to hold chemotherapy bags • Twelve instances of human error were also reported.
	Walsh et al (2011) (43)	• Investigated installation of automated robotic prescription-filling device in a rural American community pharmacy • Although a non-significant yet clear reduction in prescription filling time was observed (a saving of 40 seconds per prescription), a number of workflow interruptions negated these gains.

Staff Experiences

Staff experiences of pharmacy automation have not been widely researched. Most publications focusing on the automation of pharmacy services generally investigate the cost, safety and workflow impacts of automation as opposed to the impacts on staff morale and experiences of implementation.

From the studies found, it appears that the introduction of ADS is often met with some staff resistance. However, before and after studies have shown that staff opinions towards ADS do improve over time (31, 34, 71). For example, the use of the APOTECAchemo cytotoxic preparation system was welcomed by pharmacy staff utilising the technology in Italy, with staff stating that they much preferred the automated process as opposed to the previous manual system. Staff perceived a higher likelihood of obtaining information in preparation errors, therefore their focus on patient and medicines safety resulted in a more favourable attitude towards the automated system in place (37).

One of the main sources of anxiety for staff experiencing the implementation of automation within the pharmacy has been the level of communication and information provided to them by senior management about the impending change (33). Pharmacy technicians have exhibited the most concern about automation as opposed to pharmacists (33, 64). In generally however, technicians have responded favourably towards automation. Other areas for concern have been identified, including concerns over malfunctioning machinery/software and job security (44, 71). Recommendations have been made to implementers of change in terms of how best to elicit a positive staff experience of automation. Such recommendations are focused around explaining the need for automation, fully outlining changes in job role associated with automation and providing adequate opportunity for staff issues to be discussed and debated (44).

Excluding those few studies focusing solely on qualitatively investigating staff experiences, some other investigations have included minimal exploration into the staff experience of ADS, often in the form of opinion polls attached to workflow analyses or a small collection of questions in a larger efficiency survey. Few studies were found which focused solely on the experiences and attitudes of staff of an automated pharmacy system over time.

Unfortunately, all of the aforementioned research focuses on the implementation of ADS within hospital pharmacies or on hospital wards, and does not investigate the introduction of any automated pharmacy distribution system responsible for distributing all medicines to all hospital facilities within one given health area. The previous literature has shown that ADS can have a positive impact on patient and medicine safety and on the productivity of staff time; however a number of challenges were also identified. It is possible that similar successes and challenges will be realised in the implementation of ADS on a larger distribution-led level, yet there is a distinct lack of previous published research in this specific area, especially in the staff experiences of automation on a large scale.

2.4. Methods

This was a qualitative study, and appropriate research tools were developed, including: an extensive structured interview schedule for interviews with hospital site and PDC staff; participant information sheets and consent forms (Appendices 2-4); and a timeline of events detailing landmark milestones to facilitate participant recall of their experiences since 2008 (Figure 7).

2.4.1. Subjects & Settings

The PDC and four hospital sites across NHS GG&C were selected in which to conduct interviews with staff about their experiences of the organisational change. The sites were selected for three reasons: (1) the sites included 2 workplaces sampled in the Phase 1 investigation as well as 3 new sites; (2) the Project Steering Group provided anecdotal evidence (such as receiving feedback from sites on their experiences during the redesign) for these sites which warranted further exploration; (3) and the Project Steering Group advised that these sites would be motivated to engage in the research. Two university researchers were provided with contact details for team leads at each site and interview days and times were agreed. All participants had been working for the NHS long enough to have experienced the redesign (i.e. since at least 2010). Interviews with staff were subsequently arranged through the team leads, involving pharmacists, technicians and support workers (n = 36), ranging from NHS rate-of-pay Bands 2 to 8b. Table 3 illustrates the distribution of participants interviewed at each site.

The research team also recruited key stakeholders (n=9) who were instrumental in the design and successful delivery of the programme, both internal and external to pharmacy. These participants were invited to participate on the recommendations of the Steering Group.

Table 3: Characteristics of Selected Study Sites

Site	Beds (n)	Specialist Clinics	Go-Live Date
PDC	NA	NA	April 2010
Site 1	465	Infectious Diseases, Renal Dialysis, Opthalmology, Orthopaedics, Medicine for the Elderly, Surgery (General and Vascular), ENT (General Surgery), Surgical High Dependency, Gastrointestinal Surgery, Respiratory Medicine, Haemato-oncology, Urology, Surgical, Medical	18/10/2010
Site 2	720	Audiology/ENT, Renal Operations, Cardiac Rehabilitation, Diabetes Clinic, Gynaecology, Ophthalmic, Orthodontic, Podiatry, Renal Dialysis, Rheumatology, Gastroenterology, Nuclear Medicine, Day Surgery, Dermatology, Cardiology, Oral Surgery, Plastics Operations, Surgical, Medical	01/09/10
Site 3	650	Cardiology, Children's Ward, Community Maternity, Coronary Care Unit, ENT, Gastroenterology, High Dependency, Intensive Care, Maternity, Medical, Haematology, Medicine for the Elderly, Mental Health for Older People, Orthopaedics, Special Care Baby Unit, Surgery, Urology	29/03/2010
Site 4	632	Cardiology, Coronary Care Unit, Endocrinology, High Dependency, Intensive Care, Gastroenterology, Rheumatology, Respiratory, Orthopaedic Surgery, Surgical, Medical, Medicine for the Elderly	15/03/2010

2.4.2. Development of Research Tools

Participant Information Sheet, Consent Form & Demographics Collection

In addition to the participant information sheet, a consent form was devised for all participants to complete. The information sheet detailed the aims and objectives of the research, as well as provided information on their rights as participants to withdraw from the study at any time if they wished. Researcher contact details were also included. The consent form used reiterated all participant rights to anonymity, voluntary participation and withdrawal, and had to be signed by both participant and researcher before data collection could ensue. Participants were also asked to verbally provide demographic information such as age, gender, years in post, years working the NHS etc. This data was recorded on an iPad through the surveying app *Form Connect*. A screen shot of the electronic form used is provided in Appendix 5.

Site Structured Interview Schedule & Timeline of Events

A structured interview schedule (Appendix 2) was developed to cover a broad range of perspectives based on the literature review, with particular areas of expertise of the research team, NHS customer requirements and the analysis from the Phase 1 report influencing the composition, while maintaining cohesion in order that it was operational as a whole. Any duplicate or similar questions were omitted by the team and a final schedule was agreed upon. The interview schedule questions therefore fell under the following headings:

- Demographic Data
- Current Job
- Team/Group Work
- Pace of Work
- Control over Work
- Performance Expectations
- Training, Development and Progression
- Voice, Engagement and Influence
- Relations with Management and Non-Pharmacy Staff
- Job Commitment & Satisfaction
- The Pharmacy Redesign Project

As participants would be asked about their experiences as far back as 2008 (4 years prior to data collection), it was decided that some kind of memory aid might be helpful in guiding participants to consider their experiences before, during and after the redesign. Through consulting Steering Group meeting notes and redesign documentation, as well as considering the findings from Phase 1, a timeline of events was developed to accompany the interview schedule during interviews (Figure 7). Participants were asked questions and invited to consider them with three time points in mind; before the PDC, during the redesign, and now (2012) that the redesign is complete. Other events or points in time were included in this visual aid, such as the PDC opening date, and when the PDC introduced a night shift. These events were extracted from information exchanged during redesign project meetings.

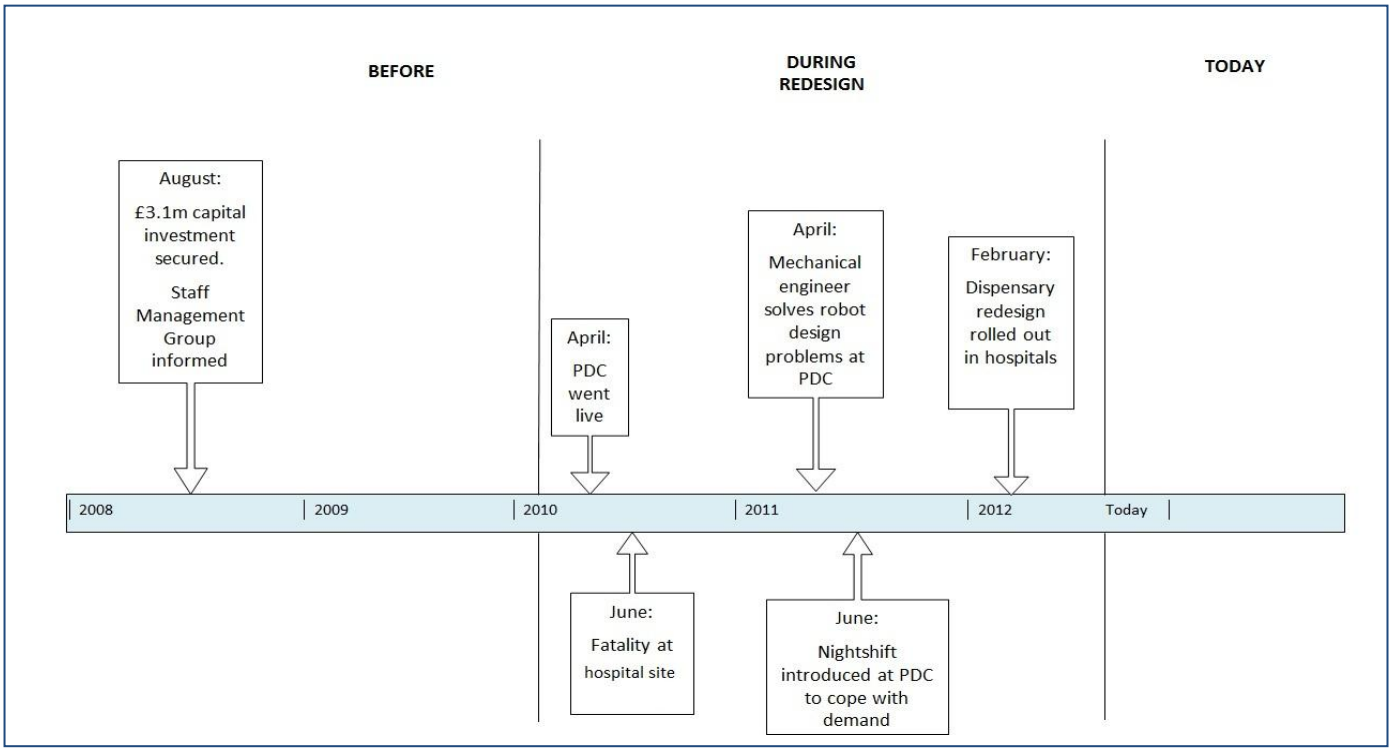


Figure 7: Timeline of Key Events from 2008-2012 (Participant Memory Aide)

Stakeholder Semi-Structured Interview Schedule

Semi-structured one-to-one interviews were held with stakeholders (n=9) in their place of work or in a suitable NHS building during work hours. Stakeholders were asked what their role was during the redesign and about their experience of the programme. The site structured interview schedule was used as a general guide for stakeholder interviews. However, researchers asked other less defined questions principally around strategic aspects relating to their role in the redesign, especially the early planning stages. Stakeholders read the same participant information sheet and signed the same participant consent form as PDC and hospital site staff participants.

2.5. Data Collection

A one-page document was drafted by the research team for potential participants (Appendix 6). The aim of the document was to inform potential participants about why the team was interested in their experiences of the redesign and what participation would involve. Team leads were asked to circulate this document in accessible and frequented areas such as tea rooms, staff rooms or locker rooms.

Structured one-to-one interviews were conducted with all participants in their workplace during work hours. Interviews with site staff (n=36) lasted approximately between 45 minutes and 1.5 hours each in length. Interviews with stakeholders (n=9) lasted approximately 1.5-2.5 hours in length. As the interviews

were being conducted during work hours, participants were informed that they could leave the room at any point to deal with any pressing work-related issues or queries, and that interviews could be stopped and resumed at a later date if necessary. This situation did not occur. All participants read the information sheet and provided signed consent.

All interviews were audio recorded and transcribed by the *First Class* transcription company using an intelligent verbatim approach (utterances such as "mmm hmm", "uh huh", and hesitations and stutters were not transcribed due to their irrelevance).

2.6. Data Analysis

Published research has suggested that in order to better explore behavioural factors during times of organisational change, qualitative methodologies and analyses should be applied (83). Content analysis is a well-implemented analysis method used in the exploration of specific organisational change, both within and out with healthcare settings. An inductive qualitative content analysis approach was adopted in this data analysis of the PDC and hospital site interviews. This kind of approach was seen as appropriate as it allows relevant themes or categories to be extracted from the data using a traceable and monitored methodology. Although content analysis provides the opportunity to count the instances a theme or category appears in the data set, it is not limited to this and provides an opportunity to "allow researchers to understand social reality in a subjective but scientific manner" (95).

2.6.1. Content Analysis: General Methodology

Content analysis has been used in health research and in organisational change research extensively (1, 81, 86, 91, 96-105). Content analysis was first used to analyse the content of hymns, articles, advertisements and political speeches in the 19th century (106) but has been used more recently on a general level, as well as in nursing research and healthcare research. Content analysis has also been utilised specifically in the hospital setting and with a variety of healthcare professionals including pharmacists (1, 91, 96, 98-101, 107-117). The combination of interviews and content analysis is widely used (1, 91, 96, 107-109, 112, 113, 115, 116).

Three main approaches are used, namely inductive (categories or codes are derived completely from the data), deductive (the categories or codes have some basis in previous literature, theory or concepts), or summative (a mixture of the two where an original list of deduced codes are developed but inducing from the data) (95, 118). Content analysis enables the researcher to analyse a wide range of data, and acts well

in cases where little previous theory or literature is present to build upon an analysis. As per Zhang & Wildemuth's methodology (95), content analysis involves a series of steps:

1. Data preparation involves transforming whatever data that has been chosen for analysis into written text
2. Categories are then developed from the data through inductive, deductive or summative analysis. When using multiple researchers or "coders", defining a clear coding strategy or even producing a coding manual or set of rules is recommended so that the coding strategies of all researchers is consistent. Coding strategies should be tested on a sample of text to begin with in order to determine how suitable it is for the whole data set
3. Once it has been tested and the coding strategies of all coders involved are checked, adjustments can be made if necessary and it can be applied to the entire data set. Coders are encouraged to check the consistency of their strategy post-coding in order to account for fatigue or human error
4. Once all of the data is coded, the organising and re-organising of categories can begin. This step can be aided with computer programs which neatly store data on each category and allow the researcher to run reports and queries based on categories and participant or data characteristics and demographics
5. The reporting of any findings is the final stage of the content analysis process.

Duriau et al (97) highlight content analysis is suitable for discussing complex organisational phenomena. They identify a number of benefits in using content analysis to explore organisational phenomena specifically; the methodology is robust enough that it can be replicated over a series of data sets or over a period of time while the methodology is flexible in that it allows for quantitative and in-depth qualitative analyses. Errors in coding strategies can be corrected as the analysis progresses due to these checks being inherent in the methodology; and such checks increase the assurance of a reliable methodology. Figure 8 represents inductive and deductive content analysis methodologies adapted from Elo & Kyngas' (118) and Zhang & Widemuth's (95) methodologies. The inductive approach taken in this study is highlighted in colour (Figure 8).

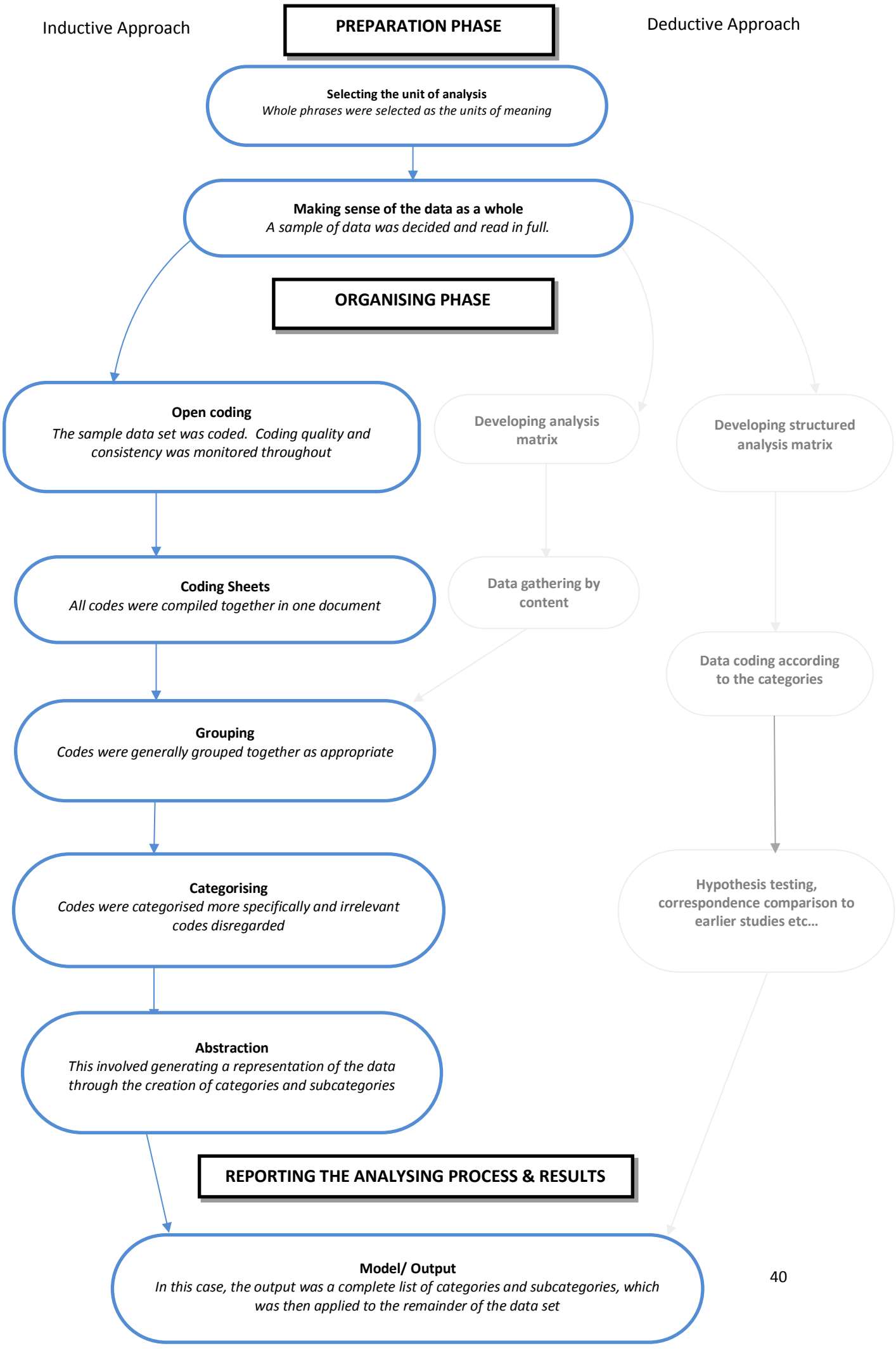


Figure 8: Content Analysis Used (Elo & Kyngas' Model and Zhang & Wildemuth's Methodology)

2.6.2. Content Analysis: Study Methodology

The data set was large, and the interview schedule extensive, therefore it was an appropriate analysis tool to use to interpret the data. An inductive approach was taken, which involved generating categories during the reading of transcripts, not before in order to maintain objectivity while coding the transcripts. Data was categorised at a data level and not based on any pre-existing theory or framework. The categories were then organised into main and sub-categories.

During Phase 2 of the evaluation, all 45 interviews were coded using the software *NVivo 10*, with the structured interview schedule as a guide for the coding structure or node tree. This coding structure was agreed between two researchers (EDC and JC). Two researchers worked as a pair to initially read and code the data (100, 107, 112). The interview transcripts were divided in half for coding between them. Once all of the interviews were coded, the two researchers discussed any issues with categorising and a random check of a number of *NVivo* nodes (categories) ensured that the categorising strategies of both researchers were consistent. Attributes were attached to each participant, for example job title/band, sex, employment status (full-time/part-time) etc. for the purpose of sorting.

In order to ensure coding validity for this MPhil thesis, a number of interviews were re-categorised. A sample of 9 interview transcripts were read and categorised by hand and the transcripts were selected in order to maintain an inclusive representation of site and job roles. All of the handwritten categories on each transcript were then copied onto over 700 individual post-it notes and arranged and organised manually. Electronic analysis commenced with the development of a list of categories derived from this reorganisation of the data, and applied to the remaining transcripts. The software *NVivo 10* was used to populate this list or tree of categories and sub-categories. This step ensured that no new nodes were found and that the original category tree from Phase 2 was inclusive and appropriate for this MPhil thesis. Any new categories found were very similar to the pre-existing nodes and were added into the original node tree where appropriate. The completed node tree can be found in Appendix 7.

It was possible to run queries on *NVivo* by codes and also by participant attributes when necessary. Using these queries and other functions on *NVivo*, such as word frequency searches (which could involve the searching of synonyms and related phrases) as well as the generation of various visual representations, it was therefore possible to identify important quotes as well as select the categories already identified at a participant group level, further aiding the write-up of the analysis.

The Stakeholder interview data was analysed using the same content analysis approach as with the site participant data, yet the stakeholder data was not amalgamated with the other participant data. The Stakeholder interviews did not follow a the exact same structure of the site interviews, and were conducted on an individualised level, appreciating that those interviewed had very different positions within the change process and would have different experiences. Also, less emphasis was spent on aspects of job change with the stakeholder interviews, as the majority of the discussion was based on the change process and the implications for others as opposed to the stakeholders themselves. The stakeholder and site staff data were presented separately but under the same categories and using the same methodology approach.

2.7. Results

The site staff participant group comprised 25 females and 11 males from the PDC and the 4 hospital sites. Participants ranged in age from 28 years to 63 years (Mean= 41yrs, Median= 42, SD= 10.24)[1] and had worked for the NHS for between 4 years and 40 years (Mean= 14.7yrs, Median= 11.5, SD= 8.67), although time at current site ranged from as little as 1 month to 40 years (Mean=7.7yrs, Median= 4, SD=8.25). The ratio of full-time to part-time employees was 5:1. The stakeholder participant group comprised 9 staff members. This group comprised of 7 females and 2 males, and had been in post between 1 and 4 years, although some participants did not provide this information. All stakeholders were in full-time positions. Job roles included management positions, as well as representatives from Trade Unions, Partnership and Human Resources. Data on age, time in post and time working for NHS were not collected for this group as participants could be too easily identified from this information. Table 4 provides a general overview of participant numbers and job roles from each site.

[1] Note: Two participants did not provide their age.

Table 4: Overview of Participant Numbers and Job Roles by Group

Participant Group	Participants (n)	Job Titles (n)
PDC	8	Support worker (n=4) Technician (n=4)
Site 1	8	Support worker (n=3) Technician (n=3) Pharmacist (n=2)
Site 2	8	Support worker (n=3) Technician (n=4) Pharmacist (n=1)
Site 3	4	Support worker (n=1) Technician (n=2) Pharmacist (n=1)
Site 4	7	Support worker (n=3) Technician (n=2) Pharmacist (n=2)
Stakeholders	9	*NA**

***Specific job roles omitted to ensure anonymity**

Figure 9 represents the organisational structure of the participants recruited for this study. The first level indicates the PPSU stakeholders or "change implementers" who were influential in the change process. The second level represents local site management, comprising lead technicians and pharmacy dispensing managers. The third level represents pharmacy staff located in the hospital and PDC sites, comprising pharmacists, technicians, and support workers.

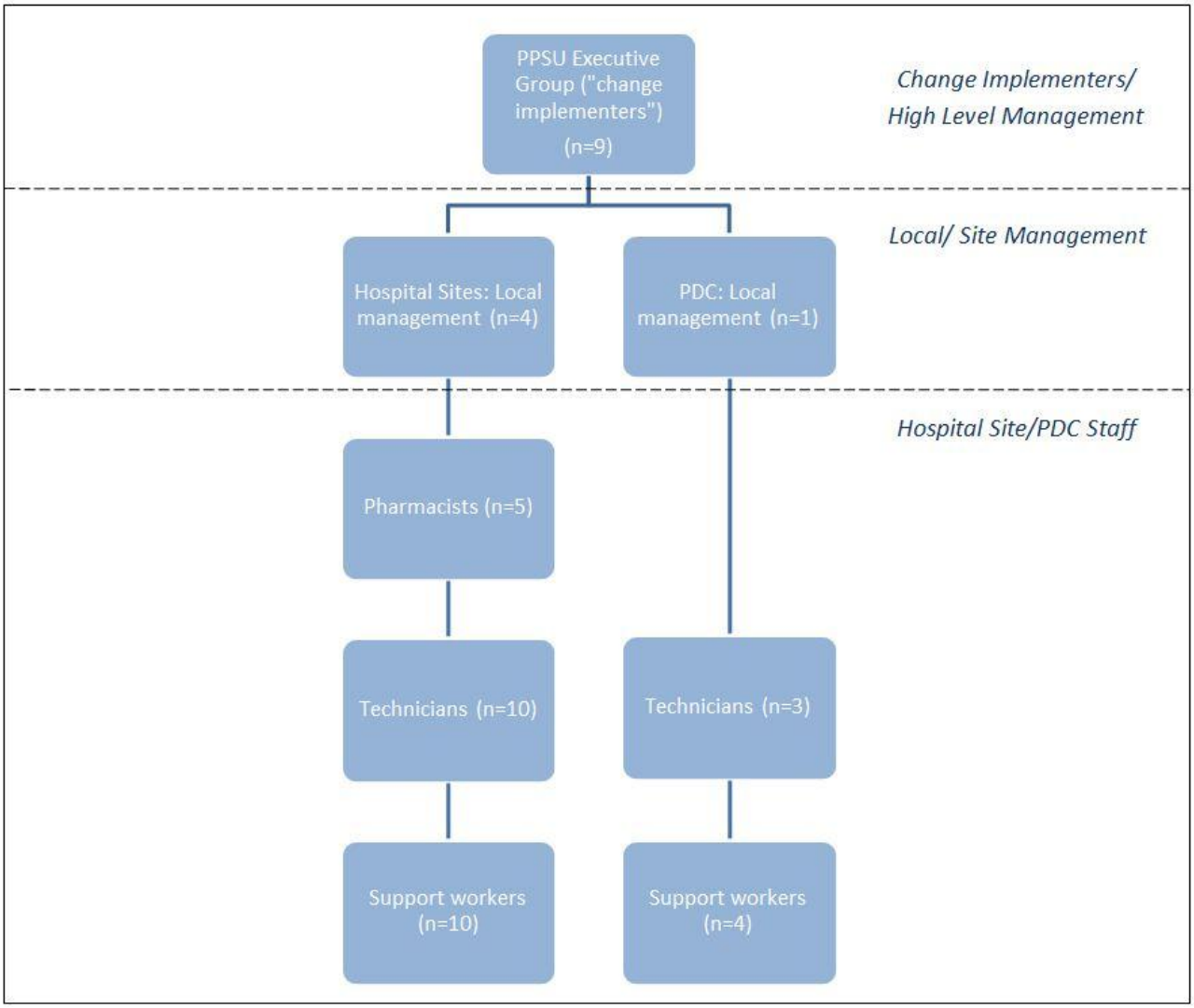


Figure 9: NHS GG&C APR Pharmacy Team: Organisational Chart of Participants

The analysis firstly presents categories relating specifically to the redesign and how that was experienced by staff. Categories pertaining to how the redesign has changed aspects of work then follow. Some categories were common across job roles. These categories are presented per job role in Figures 10-12. Other categories and subcategories are then presented which may not be representative of all job role or locations.

The structure of the categories and subcategories derived from the interview data with pharmacy support workers, technicians, pharmacists, local management and stakeholders/change implementers is presented as follows:

- The Redesign
- Early Redesign Work
- Redesign Motivation and Vision

- Impacts of Automation & New Technology
- The Job Role: The Work I Do, Then and Now
- Staff Profile: Pharmacy Support Workers
- Staff Profile: Pharmacy Technicians
- Staff Profile: Pharmacists
- Other Categories: Social and Personal Impacts
- Support, Leadership and Praise
- Trust

2.7.1. The Job Role: "The Work I Do, Then & Now"

This category includes comments participants made around their pre-redesign jobs roles and tasks, how they changed as a result of the redesign and the impacts these changes had on the work they completed and how they felt about that. How these changes ultimately impacted on each staff group is presented visually in the staff profiles (Figures 10, 11 and 12). These profiles provide concluding comments on the changes undergone for each staff group affected by the redesign (pharmacy support workers, pharmacy technicians and pharmacists). As the experiences of stakeholders were quite different to those of staff, and as the focus of the analysis was to investigate the impacts of the redesign on the operational staff groups, stakeholder data is included throughout the examination of data by job profile where it can add value to the exploration of staff impacts and experiences; stakeholders themselves are not presented within a staff profile.

Comparisons are made on a number of aspects, including:

- Job Role
- Work Pace & Control
- Voice & Relationships
- Morale
- Training & Career Progression

Categories are presented per job role based on relevance; some participants had little to say about some categories, and these are therefore not included in these instances. The staff profiles are accompanied by more in-depth textual analyses of some of the categories where more detail is required. It should be

noted that the PDC does not employ any pharmacists; therefore no PDC comparison is presented for this staff group.

Hospital Site & PDC Support Workers

Job Role

All pre-PDC support worker tasks involved manually picking and handling medicines from stock in the pharmacy or ordering medicines from suppliers. All support workers in hospitals would have been based solely in the dispensary. Hospital site support workers carry out the same tasks as they did pre-redesign, yet due to PDC order errors and the PDC not accepting returns, there is still an unofficial distribution function within the hospital pharmacy that support workers are (on paper) no longer involved in. The MMyM scheme as part of the redesign has introduced a structured rotational system to the job, covering satellite dispensaries and main dispensary in hospital sites. Some support workers have the opportunity to cover different wards on different days while other support workers can be based in one specific area (such as dispensary, aseptic and controlled drugs) for a number of weeks. Therefore the MMyM system has aimed to increase interactions between support workers and patients by allowing this rotational system, exposing those workers who would have continuously been based in the dispensary to patient-based areas on a regular basis.

Support workers in the PDC have a very different working environment, going from a hospital dispensary to a warehouse-like environment. The main task of PDC Band 3 support workers is to collate orders ready to be distributed via van to the hospital sites, including both scheduled and last-minute "priority" orders. Band 2 support workers complete tasks not dissimilar to the work involved in hospital sites, in that it mainly involves the checking of orders received and storing medicines in their allocated storage areas. PDC support workers may be dealing with a wider range of medicines than they were pre-PDC.

Work Pace & Control

Hospital Band 3 support workers reported an increase in work pace as well as a decrease in staff numbers:

> ***"Respondent**: I would probably say it was a slower pace before the redesign. My job was at a slower pace, because there was more of us to do the work. Whereas now there's less of us, so*

*we're going at a faster pace to try and get things done, I would say…**Interviewer**: What do you prefer with regard to pace … before or? Respondent: Now." (Hospital Support Worker)*

All support workers reported little change as a result of the redesign to the level of control over their methods of work as they continue to work to SOPs, with the PDC ordering times now becoming measured against which work was completed. Support workers did report feeling less flexible in terms of being able to respond to last minute requests or emergencies:

"Although we had times for ordering things before … it's either got to be through for 12 o'clock or whatever the afternoon time is, 4 o'clock … You know, so you are kinda stuck that way." (Hospital Support Worker)

It should be noted that any comments made on the pace of work at the PDC are framed by initial difficulties experienced when the PDC first opened. All participants commented on the chaotic and frantic experience and pace of work during the first year of the redesign. Some participants did comment that although their work environment and pace of work may not be ideal, it has certainly improved since the first year of operating with the robotic system and that anything in comparison was seen as an improvement:

"… It's different now from the beginning because at the beginning everybody was stressed, you know, people were crying, breaking down, going into the toilet, it was awful. But the pace is the same but we have that blip in the morning that we can catch up, you feel you can get stuff done, then the boxes out." (PDC Support Worker)

Morale

Hospital support workers perceived being subject to increased expectations from management as a result of the redesign. Staff preferred the more challenging faster-paced work they were faced with post-redesign, especially being more ward-based and having an increase in knowledge of drugs and of other skills:

"[The work is] more interesting and more challenging, more complex… Because we're here and we're doing a rotation, you're getting to see every aspect…it's stuff you don't get to see. So I would certainly say more interesting, more varied, definitely…It's obviously more difficult because it's different." (Hospital Support Worker)

In contrast, PDC support workers described how their role had become detached from pharmacy and felt more like warehouse work as a result of the redesign. Their familiarity with individual medicines was becoming less focused as they were now exposed to a wider variety of medicines at a less detailed level:

"When I worked with the drugs in the [hospital] I was taking the drugs in, checking them in and it had to be right, you had to get the strength right, the quantity right. Now we're just making sure the orders are right…I am learning different things but just not as drug orientated…we are not on a one-to-one with the drugs it's just about the orders" (PDC Support Worker)

Although it was recognised that morale had improved somewhat since the chaotic work environment of the PDC opening, staff looked back upon their previous roles pre-PDC as much more enjoyable. The impact of having staff on long-term sickness created a vicious cycle of increased workload, increased stress and decreased morale. Some staff reported feeling left to complete work while others took time off due to stress and anxiety:

Well, I think the redesign hasn't helped… the lack of staff is putting whoever's left under great pressure. I mean, I know here there's been quite an issue with long term sick, people just going off having had enough. And that has a knock on effect on workloads (Hospital Support Worker)

Training & Career Progression

In theory, the MMyM system should allow hospital staff access to a greater breadth and depth of work-related experiences as they will be exposed to different working environments and require support in each of these environments. However, some support workers were critical of the lack of formal training they had received in preparation for their redesigned job roles, with many reporting on-the-job learning experiences as their only form of training:

"I got dumped in that dispensary on my first day, having never worked in a general hospital, and got paired up with a student technician. And that was my training; on you go, you can work a computer." (Hospital Support Worker)

Both hospital and PDC staff reported being informally trained by a colleague on how to operate within the system, as well as how to use any new technology (e.g. computers, software, the PDC robots etc.). The support from fellow colleagues as well as site/PDC management was seen as essential. Progression onto

other higher grades was limited by a lack of motivation from support staff (some did not express an interest in career progression due to age or contentment with their current job) as well as limited opportunities for retraining and pay band re-grading due to time constraints and a lack of higher posts available (Figure 10).

Staff Profile:

Support Workers

	Impacts of Redesign	
	Hospital Support Workers	PDC Support Workers
Job Role	↑ Support Workers now have **more experience** in other wards and in other areas (e.g. aspectic etc). ↓ Staff feel **under pressure** due to the still-existing distribution area of the dispensary.	*NA*
Work Pace & Control	↑ Band 2 support staff **prefer** the increased pace of work. ↓ Staff are **less able** to respond to last minute/emergency indents.	*NA*
Voice & Relationships	↓ Staff have **minimal** input into decision making ↑ Support staff have **better** opportunities to forge relationships with other staff.	*NA*
Morale	↑ Staff **enjoy** the more challenging work as their knowledge of drugs has increased. ↓ Morale is generally **low**.	↓ Support staff feel **removed** from the traditional pharmacy environment. ↓ Support staff feel that their knowledge of drugs is **deteriorating**.
Training & Career Progression	↓ Staff **dissapointed** by the lack of formal training.	↓ **No formal training** offered at PDC for support staff. ↓ Staff felt **under pressure** as any training offered was on-the-job.

Figure 10: Staff Profile of Hospital site & PDC Support Workers, Impacts Pre and Post Redesign

Hospital & PDC Technicians

Job Role

Few technicians perceived any change in the general objective of their role insofar that the service provided to the patient remained their central concern. There was still a strong focus on providing the patient with the appropriate medicines in a safe and timely fashion:

"At the moment, I'd say we're much the same because we're still doing the same job in there with the same patients, so my job is the same." (Hospital Technician)

Pre-redesign, the role of most technicians was dispensary-based and involved picking, preparing and supporting the dispensing of prescriptions, with any work completed being checked by a pharmacist. Post-redesign, hospital-based technicians are primarily focused on dispensing and checking prescriptions either within dispensaries or MMyM satellite dispensaries. In addition, all Band 5 technicians now have a responsibility for checking dispensing; therefore the level of responsibility bestowed upon the technician role has increased with automation.

At the PDC, the role of the technician has changed significantly. Band 4 technicians rotate between the three 'side rooms' of the PDC; unlicensed medicines, vaccines and CDs. Greater product awareness and concentration is therefore required due to the rotational and wide ranging nature of the work. Band 5 technicians undertake supervisory duties checking that work on the main floor is operating smoothly.

Work Pace & Control

The experiences of hospital technicians varied across sites according to how well the MMyM service was perceived to be working. In two sites where MMyM was reported as working well, the pace of work within the dispensary was said to have barely changed. In contrast, the other two sites who reported on-going issues with MMyM had an increase in the pace of work dealing with more orders, queries and complaints regarding ordered stock from the PDC not received. The MMyM technicians were mostly positive about the pace of work.

In all sites the majority of technicians reported a loss of control over the maintenance of, and communication around, stock levels. Where technicians had previously been able to access information about a medicine and consider alternative options if unavailable, they were now faced with a '*waiting game'* to see what items arrived from the PDC.

Voice & Relationships

Most technicians reported an increase in the number of issues they raised with management compared with instances pre-PDC, but were unsure if their voice was being heard as responses from management were rarely fed back. In some sites, technicians reported a loss of formal mechanisms through which to raise concerns, as sector chiefs (middle management) were essentially viewed as part-time management given their multi-site remit. In contrast, the higher pay-graded technicians believed that they had better opportunities to voice their opinions and reported some success in being listened to.

The dispensary technicians perceived more of a shift in their opportunities to engage with management than MMyM technicians. Also, most dispensary-based technicians reported that relations with non-pharmacy staff (e.g. nurses, ward staff etc.) had become problematic:

> *"… [The wards will] phone up when you're snowed under with prescriptions and want you to deal with why they didn't get [their order]…..they want you to do it now; they want you to deal with it. And we can't always do that. And so you get anger from them because you're not dealing with them at that point … a lot of these problems, we felt should have gone to PDC." (Hospital Technician)*

Morale

Many MMyM technicians reported feeling satisfied in their roles if their work for the day was completed and they had a clear work space:

> *"When you're getting everything done and everything's going well and you've got enough staff and you've got enough time when you're talking to a patient to see if they've got their own meds and things like that. That's quite pleasing but, when you're running ragged and you can't do that and it's a quick in and out and all that, that's not so good." (Hospital Technician)*

MMyM technicians articulated how the potential for increased patient contact had enforced the idea that all staff members were working towards caring for individuals and supporting their families.

There remains a feeling that technicians are carrying out tasks meant for those in higher pay grades in order to get the work done but are not receiving the appropriate training or being offered a reward

(either monetary or in the form of job progression) for their efforts, creating a further demoralising effect:

"Now, it's just kind of crisis management all the time...it's very, very difficult in here just now…it's just everything. It's the direction that everything's heading in…I think within pharmacy, certainly in Glasgow and very much in this department, people feel very undervalued…it would just be nice for someone to recognise the amount of work that you're doing." (Hospital Technician)

Training & Career Progression

Technicians reported that prior to the pharmacy redesign much of their training was informal and experiential, supported by more senior technicians and pharmacists. This informal training, alongside rotation through the different functions within hospital pharmacies, was seen as important in developing and maintaining technicians' skills. Some technicians had taken advantage of more formalised training to improve their skills, qualifications and career prospects, notably by becoming dispensing checking technicians (DCTs).

The redesign programme required that new roles for technicians were met with additional and more formalised training opportunities, and technicians reported having undergone quite a wide array of training to enable them to fulfil their revised responsibilities. Formalised training was generally positively viewed, partly due to the transferable nature of the qualifications gained:

"Well it means that I'm an SVQ Assessor, it means if I leave here I can take it with me!" (Hospital Technician)

In contrast, training for technicians at the PDC was reported as variable; some staff reported that their training was informal and lacked any planning and structure, with one participant stating that they were *"just dumped straight in";* others noted that they had received useful training from the robotic software and hardware manufacturer's support staff, when it was available. Almost as many technicians reported the refusal of a request for training as those who received training, and surmised that low staffing levels were stopping formal training from taking place due to time pressures.

As they were far removed from the patient and the clinical environment of the hospital, technicians at the PDC felt that the nature of their work did not require them to maintain the more clinical skills that their job did not allow them to use:

"You've got to be registered with the General Pharmaceutical Council and part of that to be a technician is to do this CPD, if you don't do it then that's you, you can't work as a technician… I mean I can understand it in certain areas, but not in an environment like this, in a warehouse where there is a certain limit to what you can continually personally develop yourself in…If someone can come in and do their job effectively and competently … Why are they put under pressure to learn other stuff?" (PDC Technician)

Both technicians and key stakeholders expressed significant concerns over technician progression opportunities. Specifically, these concerns were around whether PDC technicians had the same progression opportunities as technicians based in hospital sites, and whether PDC technicians were maintaining important skills (e.g. DTC skills) or amassing the right skills to move to band 5 or 6 posts elsewhere in the clinical settings of the NHS if they chose to do so:

"One of the areas that we've identified is that we've got no good mechanisms in place currently for succession planning going forward because the old models, everybody would have been trained in all areas and rotated through all the areas, but now that we've got this new one service PDC in one area we've very little staff movement." (Stakeholder)

See Figure 11 for tabulated summary of the analysis.

Staff Profile:

Technicians

	Impacts of Redesign	
	Hospital Support Workers	PDC Support Workers
Job Role	↓ Band 5 technicians' time is tied up with dispensing and resolving PDC order issues, **impinging** on contracted tasks.	↑ Band 4 technicians view their greater product awareness **positively**.
Work Pace & Control	↓ Technicians have **less control** over maintenance of dispensary stock due to stock level inaccuarcies. ↑ Where MMyM has worked well, the increased pace of work is viewed **positively**.	↓ There is an **unwelcome** lack of work control as well as an increased pace of work due to staff issues
Voice & Relationships	↑ Band 5 technicians **positively** perceive more formal opportunities to raise concerns with management. ↕ The pharmacy/ward relationship **varies**, with MMyM staff having a more positive experience than non-MMyM.	*NA*
Morale	↑ MMyM helps keep the whole pharmacy team **focused** on patient care. ↓ Technicians have **less time** with patents in reality than previously planned.	*NA*
Training & Career Progression	↑ The new potential training opportunities available are **welcomed** as they provide transferable skills. ↓ Access to training in reality is **hindered** due to job location and staffing, which may result in barriers to progression.	↓ There is a **lack** of formalised training. ↓ There is **concern** that technicians will lose traditional pharmacy skills due to the warehouse-like working environment.

Figure 11: Staff Profile of Hospital site & PDC Technicians, Impacts Pre and Post Redesign

Pharmacists

Job Role

Pharmacists indicated their pre-PDC base as the hospital dispensary and that their role included screening and checking prescriptions and orders/indents, although they did spend limited time on wards. Following the redesign, pharmacists' time was freed with Band 5 technicians now checking prescriptions, and they were therefore able to spend more time on the wards interacting with patients and clinical staff regarding medicines use and communicating with primary care practitioners including General Practitioners.

Voice & Relationships

The majority of the pharmacists voiced concerns over a lack of feedback during the redesign. Additionally, pharmacists in the more senior roles reported little difference to relationships with management after the redesign, whereas those in the lower pay grade described confusing and complex relationships with multiple line managers post-PDC:

> *"You don't know who to go to, to get certain operational things sorted out…. I've got three line managers only one of them is based here, the rest are all over Glasgow, I only correspond with them by email, I've not actually met them….. so just very odd. I think people feel in certain situations there is no one you can go to, if you have an emergency on the day, ……. and so it's just really difficult to get someone to make that decision." (Pharmacist)*

Training & Career Progression

Pharmacists reported that they did not receive a lot of formalised training beyond basic grade positions but had on-going CPD requirements. Some pharmacists reported engaging in management training, which they found challenging. Pharmacists did not seem to present with issues around job progression. Interestingly, some pharmacists indicated that they would prefer what in grading terms was a regression, to focus only on clinical work rather than management, but that the rewards of a position with managerial responsibilities kept them in post:

*"***Interviewer: What are the sort of progression and promotion opportunities available to you?** *Respondent: I'd say very slim, to be honest…I would go back to doing a purely clinical role, if I could afford it…that would be so I just do purely clinical and ignore the management stuff. I could quite easily go back to doing that. I loved doing that." (Pharmacist)*

See Figure 12 for the tabulated summary of the data.

Staff Profile:

Hospital Pharmacists

Impacts of Redesign	
Job Role	**Increased** contact with patients and other healthcare professionals. More social role has been met **favourably.**
Work Pace & Control	**Less** control over work, as staffing issues result in pharmacists being asked to complete technician tasks or to cover other wards. Work volume increased **unfavourably**.
Voice & Relationships	Lower graded pharmacists have **decreased** opportunities to forge relationships with (now) otherwise-located multiple line managers.
Training & Career Progression	Access to training **hindered** due to time constraints, cost restrictions and access difficulty in accessing external training. Progression to a Management role **not favourable** to Pharmacists, therefore some would prefer to *regress* to have a more clinically-focused role.

Figure 12: Staff Profile of Hospital site Pharmacists, Impacts Pre and Post Redesign

2.7.2. Social & Personal Impacts: "The Context of my Work"

The following sub-categories all relate to comments made about the assistance and support staff felt they received before, during and after the redesign, from members of management but also from other staff. Categories relate to direct examples of support as well as more indirect examples, such as the reliability of other staff and how trusted co-workers are. Not all staff groups interviewed provided comments relating to all of the following sub-categories.

Support, Leadership & Praise

Participants made comments around the extent to which they felt supported by management throughout the redesign. More positive experiences included staff feeling that direct management asked their opinions about the redesign as well as on smaller local decisions. Direct and more senior local management were generally perceived as approachable and understanding and most cited having a good relationship with management:

> **"I: Tell me about management and how well you work with them?** ***R:*** *My line manager I work really well with…She is realistic about what we can do. We understand her role in everything so we're quite clear amongst the medical directorate of pharmacists as to what her role is and where we would go from that*." (Pharmacist)

Some staff members felt that management were not entirely visible during the redesign, and that this lack of visibility had extended beyond the project and into current working life:

> *"**R:** I think people feel in certain situations there is no one you can go to…you're spending an hour trying to get hold of the person who is somewhere in Glasgow or at a meeting somewhere else and so it's just really difficult to get someone to make that decision…for the interim period from the redesign until now, it's been quite difficult to get certain things sorted out…there has been no one here to take a lead*…**I: So if I asked you if you felt that management were quite a supportive role?** *R: No it's difficult when you don't see them*." (Pharmacist)

Local management themselves felt supported by change implementers during the redesign, stating that they could easily contact them if need be. However, any questions or queries they had were not necessarily responded to immediately, yet they knew there were recognised and utilised communication

channels in place:

> *"I know that I could have went to [change implementer] or anybody…I would say [I was] supported yes... I know if I had a question I could email... they might not get back to me that day, that week, but if I met them elsewhere or if I was travelling through the site I would just ask them."* (Hospital Technician)

Conversely, site staff reported little support from change implementers, not regarding them as direct sources of support. There was a general feeling that change implementers were seen to be distanced from site staff and were more involved with the high-level operational and decision making aspects of the redesign. However, some PDC staff did report frequent interactions with the project lead, mainly because they themselves spent time on the PDC floor as well as having an office based within the building. This contrasts with the opinions of site staff, where many of them had never met or seen the project lead previously until roadshow events explaining the nature of the redesign, and also reported having not seen the project lead on a semi-regular basis thereafter.

Some site staff felt underappreciated by all levels of management. After going through a difficult period at the beginning of the redesign, staff felt that their extra efforts both then and now were not fully recognised by their superiors:

> *"You don't get any praise or anything. Nobody ever says, 'You've done a great job there', or something…The only time you ever see [management] is when something negative happens."* (Hospital Support Worker)

A lack of reward or verbalised praise was identified by some site staff, stating that they were often not thanked for their effort at work. This left some staff feeling that their efforts to go above and beyond in order to make the new service work were not fully recognised by their superiors.

Reliability and Trust of Co-workers

Staff were sympathetic towards their co-workers both on-site and in other sites, and were understanding when faced with the early challenges of the redesign, right through to the post-redesign working of 2012:

"I: What gels your team?...*R:* *I would like somebody to come and help me, or try and help me to figure out what I'm going to do kind of thing. And I think it is because we've been friends as well…And we all socialise together as well a lot of the time. And we don't like seeing people upset either at their work."* (Hospital Support Worker)

Hospital and PDC staff provided a number of examples where fellow colleagues appeared not to be reliable cooperative team members. Some staff were putting pressure on the system from the beginning of the redesign. Absence was highlighted as an issue. Not only did genuine absence cause hospital and PDC teams to feel more pressured, but some staff felt that there were colleagues who were perhaps were taking advantage and causing unnecessary strain:

"Well there's just, there's a few repeat offenders which seem to do it every year… I think it's known to management. It's not talked about or anything, because obviously it's personal, but there's people that are long term, three months, six months, a year that do it all the time. And it gets you down. Because you're left to, covering their slack…With certain people I would say it's a case of they know how to play the system." (Hospital Technician)

This participant then went on to describe how the long-term sickness of certain staff members had impacted on other staff members obtaining annual leave. Those staff members "*playing the system*" were causing dips in staff morale around taking holidays:

"*And then it's now in turn affecting when you can have annual leave. It never used to. Sickness never used to get taken into the equation, but now because it's so dire, well you might not be able to get that because there's nobody to cover…these people are affecting everybody else's life*." (Hospital Technician)

This perceived lack of consideration from their fellow colleagues left this staff member, and others, feeling that they could not rely on their own team in a time of uncertainty and anxiety in the workplace.

Although some levels of animosity were detected by some hospital-site staff members regarding the quality of customer services at the PDC, it appeared that these comments were not in reference to the personal nature of staff, but were aimed at the appropriateness of some staff being placed on customer services when their knowledge of products was not as complete as it could have been. A lack of training on the wide range of drugs available, as well as the uses for certain drugs was highlighted. One participant discussed an incident earlier on in the redesign where they were attempting to order drug which is commonly used for

constipation, yet the intended use was for something else. They explained the challenges they faced with PDC customer services:

> *"I'm working a gastro ward and I've got alcoholics on it and they use Lactulose which is a laxative. But it's not used as a laxative in gastro, it's used with the alcoholics to prevent a build-up of ammonia, that causes brain swelling…I had ordered whatever I needed and it didn't come…I phoned them and I said, 'look, I need this'…[PDC customer services replied], 'It's only for constipation.'…They don't understand the importance of the meds."* (Hospital Technician)

The participant then went on to hypothesise that it perhaps would not be appropriate to allocate a higher-trained staff member solely for use on the telephone, but that an adjustment of attitude rather than training or knowledge would be more appropriate; the fact that the medicine did not arrive was a more pertinent detail than what the medicine was for. Generally, hospital site staff held PDC staff in high regard as PDC staff would have been members of the previous hospital pharmacy teams before the redesign, and were therefore ex-colleagues. Hospital site staff and members of local management sympathised with PDC staff during the early stages of redesign and recognised that any failures were not at the hands of PDC site staff incompetency.

The issue of trust in relation was relevant, with many site staff reporting having little or no trust especially in the change implementers. Site staff felt there were discrepancies between the vision they were "sold" and the eventual outcomes of redesign, and also felt that their perceived input into the redesign was not as extensive in reality. This resulted in a lack of trust in those responsible for the change:

> **"I: Did you trust those who were implementing the redesign?** …***R:*** *No, because I think they had made their mind up anyway. Before we put pen to paper, they had decided what was happening*." (Hospital Technician)

There was also an element of distrust in the non-human entities of the team; the PDC robots and associated software. Although there was a good level of empathy present between hospital and PDC site staff, hospital site staff had the initial difficult stage of the redesign still in mind whereby the PDC was producing correct and complete orders relatively infrequently. Over time the level of trust in the efficiency and accuracy of the PDC waned and resulted in a decreased level of reliability. It was highlighted however that the PDC was performing better in recent months and that measures were in place to quantify and assure accuracy:

"The sites will argue they've got no trust in the PDC. But that trust is now growing. PDC is performing better than it ever did…we're issuing 98.6 per cent of items when you request them the first time …you'll see the sites who were sitting with 40 days of stock their stock holding…so that's our benchmark, their stock holdings are coming down." (PDC Technician)

2.8. Results Summary

The main themes derived from the interview data focused mainly on the mechanics of the redesign, the changes in each job role (and associated location) between pre and post redesign, and the social and personal impacts which occurred as a result of the introduction of the PDC.

Opinions were generally positive around the preparatory activities which occurred in anticipation of the redesign. Negativity was reported around the lack of training at this time however. Mixed reports were given around the perceived motivation for the redesign, and there was no single cohesive vision among participants as to why the redesign was happening. Participants were able to provide detail in terms of how their jobs had evolved through the redesign, although specific written job descriptions were not available. The redesign was intended to reassign certain responsibilities across the workforce and free up pharmacists' time to be spent on patient-centred activities. The introduction of the MMyM scheme was also tailored to facilitate this increased patient interaction, as well as offer MMyM staff a more varied job experience. MMyM was also designed to have other benefits, including the reduction in medicines waste.

Hospital support workers' and technicians' pace of work favourably increased, although at times staff felt under pressure. The increase in workload also presented an increase in the variety of work done, including more social interactions. However the redesign meant that staff had less flexibility to respond to emergency or unexpected situations. Although some positive outcomes were present as a result of the redesign, morale was generally low, partly due to the lack of training offered to support workers at the time of the redesign. Although hospital technicians felt positively about the increased potential for completing trainings, in reality completing training and/or progressing into higher pay bands was not feasible or practical which further decreased morale. PDC technicians also experienced similar concerns regarding training, with management being particularly concerned that this group would lose their transferable clinical skills. PDC support workers had a less positive experience, with morale generally being low as a result of a lack of formal training opportunities, a gradual depletion of drug knowledge due to the non-clinical environment and an increase in work pressure. Although PDC technicians did report having greater product knowledge than pre-PDC times, any formal learning opportunities were few and

far between. The pharmacist role was seen as more social than before the redesign, yet pharmacists experienced less control over their work due to an almost unmanageable increase in workload. Access to training and/or progression seems to have been a concern for all participant groups, not excluding pharmacists.

MMyM appeared to elicit a more favourable redesign experience for staff than for those who were not involved in MMyM. Pharmacists felt that the redesign and the MMyM scheme was obtaining the goal or creating more interesting and social job roles for staff. Experiences between MMyM and non-MMyM staff were every different in terms of how interesting, challenging and varied the work was, and to what extent staff were able to interact with a greater range of people. Job location also played a role in the contrasts seen between staff in their experiences of the redesign. PDC staff were in a highly unique situation, in that their job roles, locations and teams were entirely newly constructed. All roles within the PDC appeared to be less social (in that there was a lack of patient contact and limit as to which and how many staff members one could interact with), as well as a real concern around the extremely limited and specific set of skills staff would develop, ultimately paired with the more transferable skills more suitable to a clinical environment that staff may ultimately lose.

3. CHAPTER 3: Application of a Team Effectiveness Model to the PPSU APR Programme

3.1. Introduction

The NHS is made up of teams of people, all working on interdependent tasks with a view to ultimately providing safe and effective patient care. In a world where there are continuous pressures on the healthcare system to better respond to ever-evolving and increasing patient needs, there is evidence to suggest that channelling the energies of healthcare staff more actively and purposefully as teams (and not merely existing as groups of people) may be a useful approach (119). There is no general consensus in the literature as to what the term "team" refers to, but some previous definitions have stipulated that a team is a formally-established group of employees which is assigned some (varying) level of autonomy, and which performs tasks independently (to varying degrees) from each team member (120) . Teams have also been described as a grouping of people who share a common purpose, goals and approach which they reach through the utilisation of their complimentary skills (121-128). Furthermore, the characteristics of an effective team go towards defining the team itself, with researchers stipulating that in order for a group of individuals to be classed as a team, they should engage in regular communication, coordinate well together and conduct interdependent tasks (129-137). Ahmed and colleagues (129) also hypothesise that the two main issues faced by teams are the tasks at hand as well as how the group works together.

Salas & colleagues (138) in their literature review discuss the future of team research. They identified that studying teams "*in the wild*" would be beneficial to the development of the understanding of teams, how they work and of what makes effective teams successful. The data collected from the PPSU APR Programme has been useful in identifying the challenges and opportunities present in this large-scale organisational change involving the use of technology. Staff presented themselves as hardworking and personally flexible to an increasing workload and felt a great sense of responsibility to their end user. However, lack of training, staffing issues, communication and relationship difficulties both across and between different levels of teams meant that aspects of this team were less successful than others. Furthermore, during such an emotionally and professionally fraught time as a period of massive organisational change, the effectiveness of a team to not only responds appropriately to change but to also continue in providing the same level of service as before. This is particularly important when the service provided is healthcare-based.

The success of a team can arguably be defined and quantified in a number of ways, yet there are numerous models available against which to compare and analyse examples of teams and team working. Identifying and applying an empirical yet relevant model of team success to the current phenomenon is

helpful in beginning to explore the apparent success of the teams within the redesign, as well as working towards identifying opportunities for further improvement in the current and future redesigns.

3.2. Literature Review

The recent decades have been described as a "golden age" of interest in team research, reflected in a recent literature review where over 130 models of team effectiveness were identified (138). Mickan and Rodger (80) provide a helpful literature review of effective team models, while also applying their analysis to a healthcare working environment. They highlight that previous quantitative evaluations of specific interventions have been inconclusive, thus further emphasising the need for further qualitative research (139). Mickan and Rodger summarised that the previous published literature identified a common number of factors associated with effective teams, which typically fell under 3 headings: factors pertaining to organisational structure, factors pertaining to individual employee contributions and factors pertaining to team processes. Table 5 displays the common effective team factors identified in the literature by Mickan and Rodger under these headings.

Table 5: Mickan and Rodger's (80) Categories from Literature Review on Successful Teams

Organisational Structure	Individual Contribution	Team Processes
Clear purpose	Self-knowledge	Coordination
Specified task	Trust	Communication
Distinct Roles	Commitment	Cohesion
Suitable leadership	Flexibility	Decision making
Relevant members		Conflict management
Appropriate culture		Social relationships
Adequate resources		Performance feedback

Table 6 highlights some of the individual sub-factors identified under Mickan and Rodger's 3 headings, as well as a number of other relevant publications and one additional sub-factor not found in Mickan and

Rodger's literature review (due to them being more recent or not included). These additional publications and sub-factor are highlighted in an alternative colour for clarity

Table 6: Common Team Success/Effectiveness Factors and Sub-Elements Identified in Mickan and Rodger's Literature Review and Other Publications

Team Success Factors	References
Organisational Elements	
Clear purpose	Salas, Cooke & Rosen (2008)(138) Vinokur-Kaplan (1995) (140) Entin & Serfaty (1999) (141) Naylor & Amazeen (2004) (142) Bucholz & Roth (1987) (132) West (1994) (143) Varney (1989) (137) Ahmed et al (2008) (129)
Clear specified tasks	Headrick, Wilcock & Batalden (1998) (144) Basoff (1983) (145)
Distinct staff roles	Blechert, Christiansen & Kari (1987) (131)
Suitable team leadership	Capko (1996) (146) Ahmed et al (2008) (129)
Relevant team members with a balance of skills	Pearce & Ravlin (1987) (136) Bucholz & Roth (1987) (132) Ahmed et al (2008) (129)
Appropriate work environment / culture	Loxley (1997) (147) Xiao et al (1996) (148) Bucholz & Roth (1987) (132)
Appropriate Training / Resources	Xiao et al (1996) (148) Ahmed et al (2008) (129)
Team Processes	
Positive social relationships / team cohesion	Hackman (1990) (149) Ahmed et al (2008) (129)
Positive communications / feedback	Firth-Cozens (1998) (133) Bucholz & Roth (1987) (132)

	Varney (1989) (137) Ahmed et al (2008) (129)
Appropriate decision-making	Blechert, Christiansen & Kari (1987) (131) Green & Taber (1980) (150) Mohammed & Dumville (2001) (151) Bucholz & Roth (1987) (132) Ahmed et al(2008) (129)
Conflict Resolution	Ahmed et al (2008) (129) Maple (1987) (152)
Individual Elements	
Awareness of self / self-knowledge	Sunderstorm, Meuse & Futrell (1990) (153) Maple (1987) (152)
Flexibility within team	Basoff (1983) (145) Loxley (1997) (147) Entin & Serfaty (1999) (141) Naylor & Amazeen (2004) (142)
High commitment levels	Goleman (1998) (154) Basoff (1983) (145) Varney (1989) (137)
Positive well-being / morale	Ahmed et al (2008) (129) Vinokur-Kaplin (1995) (140)
Trust	Ahmed (2008) (129) Maple (1987) (152)
Outcomes & Projections	
Standards are met	Vinokur-Kaplin (1995) (140) Ahmed et al (2008) (129)
Team is focused on future & change	Bucholz & Roth (1987) (132) Ahmed et al (2008) (129)
Rapid response to developments	Bucholz & Roth (1987) (132)

From the PPSU APR Programme, two of the main issues at play in threatening the overall success of the project were the lack of training in preparation for the change and the introduction of new technology as a stressor for staff. Appropriate training has a positive effect on team working and team performance as it would appear that increasing workforce skills, confidence and competency has a positive effect on the tasks at hand but also on how staff feel about completing those tasks. Specifically, simulation-based training (SBT) has been shown to be particularly effective in improving team performance, providing a realistic and dynamic opportunity to be trained for work while receiving applicable and realistic feedback on their performance (155). Another finding from Mickan and Rodger's literature review also referred to the ever increasing emergence of the presence of technology within teams, stipulating that well-designed technology can actually improve team performance. The authors do highlight however that as with training, the insertion of technology into the team does not guarantee an improvement in team performance, and the appropriateness of any use of technology should be assessed before implementation.

3.2.1. The Hackman Model of team Effectiveness and Success

Underpinning many of the aforementioned models of team success is the Hackman (156) model of team effectiveness. Hackman articulated his view of the factors associated with team effectiveness (and the barriers to team effectiveness) over a number of key books and articles dating mainly between the 1970s and 1990s (157-161). Hackman identifies the potential downsides to working in a group paradigm (e.g. the potential for wasted time, low productivity, bad decision making, destructive conflict etc.), yet recognised that at the time of publication, the use of groups and teams within the organisation was becoming more popular. Hackman points out that much of the previous research on teams was laboratory-based. Although an artificial environment, it ensured that certain variables could be better controlled (e.g. teams tasks etc.) resulting in a more comprehensive exploration of team characteristics. However, Hackman identified that the influence of the experimenter can be too great to derive real-world conclusions of how teams actually perform in realistic settings, and that examining teams in the context of organisations, and developing a model from there, would be more useful. Hackman's model is based on the theory and literature on team effectiveness available at the time, as well as the descriptive research available on how organisations use teams. Hackman argues in his earlier work that social psychology at the time had little to offer in terms of proposing what characteristics are associated with successful teams (162). Hackman's model of team effectiveness was therefore derived from the recent

trends in organisational practice to use groups of people (whether it be quality groups, work groups, project teams, and so on and so forth).

As most research and theory of the time was descriptive in nature, it purely described how effective teams might behave. This is reflected in McGrath's (163) proposal and is illustrated in the input-process-output framework for analysing group behaviours (Figure 13). This framework proposes that various individual, group and environmental factors can affect team outputs via how the team interacts with these variables.

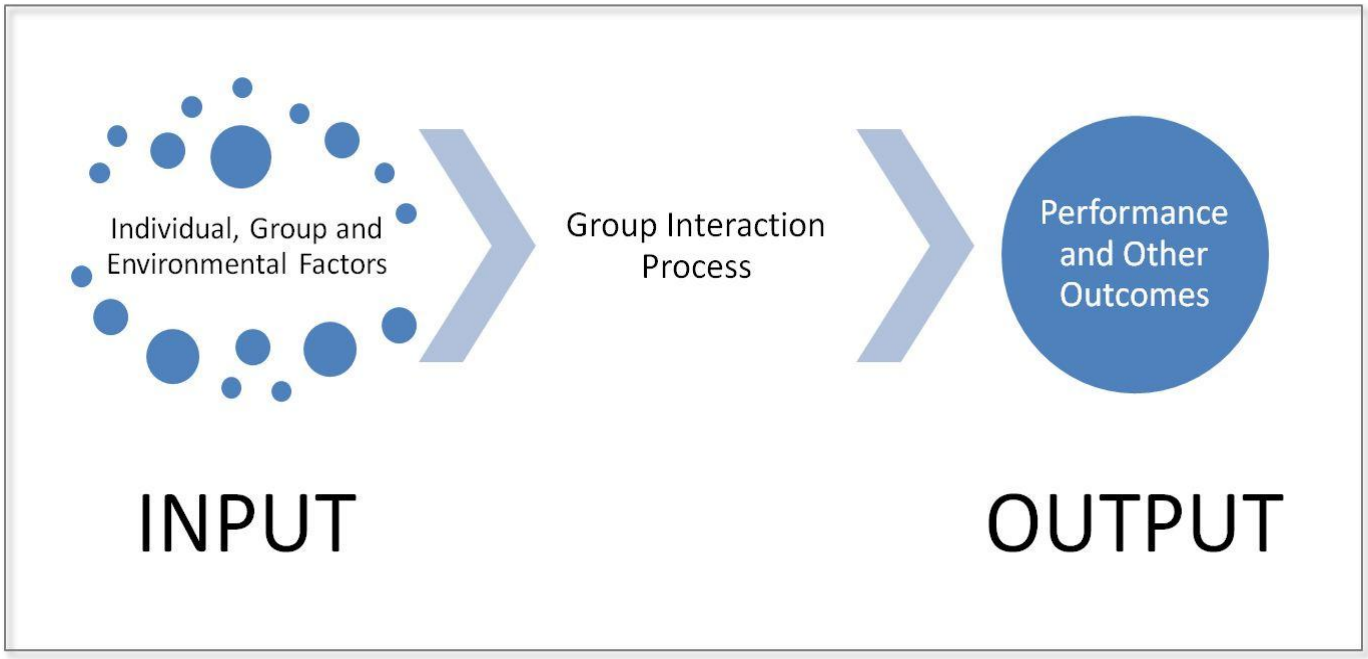


Figure 13: McGrath Framework for Analysing Group Behaviour

However, Hackman hypothesized that this framework was not necessarily the most effective way to fully understand what makes teams effective. Any previous generalisations from descriptive research were neither strong enough nor distinct enough in order to inform organisations as to what makes a team effective. Furthermore, any statistically significant associations between effectiveness and input tended to be dependent on particular tasks or contexts within which teams operated. Finally, some of the recommendations made from the previous descriptive research were not always practical to implement and were therefore of little use. Hackman's aim was to take the premise of the description framework of team effectiveness and transform it into a more action-oriented, normative framework, "*emphasising those factors that can be used to improve performance effectiveness, rather than focusing on description*

of how groups actually behave" (156). Therefore, Hackman's aim was to develop a normative model that identified the factors most associated with team effectiveness with a view to influence constructive change within organisations (fully detailed in Table 7). Hackman then stipulates that this normative model could be transformed into an *action* model of team effectiveness; a tool which can be used by any team, leaders of teams and managers in order to address those less effective or absent success characteristics in teams to improve performance. As this Chapter is interested in exploring the level of success in the teams in question, Hackman's normative model will be applied.

Hackman begins by defining team effectiveness and divides this concept into three distinct areas:

- The outputs of the team must meet or exceed the standards of those who receive or review the output
- The social processes relating to the team's work must enhance the members and promote working together
- Being part of the team should satisfy the personal needs of individual team members.

The basic hypothesis of Hackman's model proposes that team effectiveness is a triple effort comprising:

- The level of **effort** each team member exhibits (i.e. is the team working hard enough?)
- The level of **knowledge and skills** team members possesses (i.e. does the team know what they are doing?)
- The appropriateness of the **performance** strategies implemented by the team (i.e. is what the team is doing relevant to the task?)

Hackman identifies that in order to influence change within an organisation, it is therefore useful to identify what factors of a group can be manipulated in order to facilitate change. The following three variables can therefore be manipulated in order to positively influence team effectiveness:

- The **design** of the team (structure, the task, group norms etc.)
- The **organisational context** (reward, education, training, CPD, information systems, resources etc.)
- The **group synergy** (team member's interactions and relationships at work etc.)

Moving towards an action-based model of team effectiveness, Hackman points out real-life teams are dynamic and subject to change that theoretical paradigms or models simply cannot take into consideration. Elements that contribute towards group effectiveness vary from team to team depending on their task and the nature of work. How authority is distributed also matters. Considering the PPSU APR

Programme, it would appear that the managerial configuration at play were self-managing work groups (i.e. management has responsibility for the context and design of the team, but the team members are responsible for executing the task), both at the PDC and in each hospital site, as management were responsible for the composition and design of teams but the responsibility of whether the work was completed to a sufficient standard was down to each team member.

Table 7: Hackman's Model of Effective Teams (comprising effort, knowledge & skill, and performance elements)

	EFFORT	KNOWLEDGE & SKILLS	PERFORMANCE
DESIGN	• Members have variety of high-level skills • Task is meaningful • Outcome has significant impact for other people/service user • Autonomy is available • Adequate feedback is available	• Members have expertise relevant to task • Team size is appropriate • Members have personal and professional skills • Team members are diverse	• Team members self-regulate • Team norms support responsive working and strategy planning

ORAGNISATIONAL CONTEXT	• Objectives are clear and challenging
	• Excellent performance is rewarded at a team level
		• Relevant education and training is present
		• Relevant education and training is actually available
			• There is clarity about:
			  • Task requirements
			  • Task constraints
			  • Resources available
			  • Who the service user/reviewer is
			• There is access to data about likely consequences of different strategies

GROUP SYNERGY	• Team members contribute and are motivated equally • Team members are equally committed	• Team members should contribute equally • Learning should be collective	• Minimising of performance slippage • Creating innovative strategy plans

Hackman also articulated that team member characteristics as well as the infrastructure and planning around which organisational teams work have an important bearing on how successful they are. Six common mistakes made are highlighted in his work, “Why Teams Don’t Work” (see Figure 14) (164). These points emphasise that the team members themselves, the environment within which they work and the work that they do are all subject to influence and impact by those in authority and the effects of said impact can have significant ramifications on the success and effectiveness of any team.

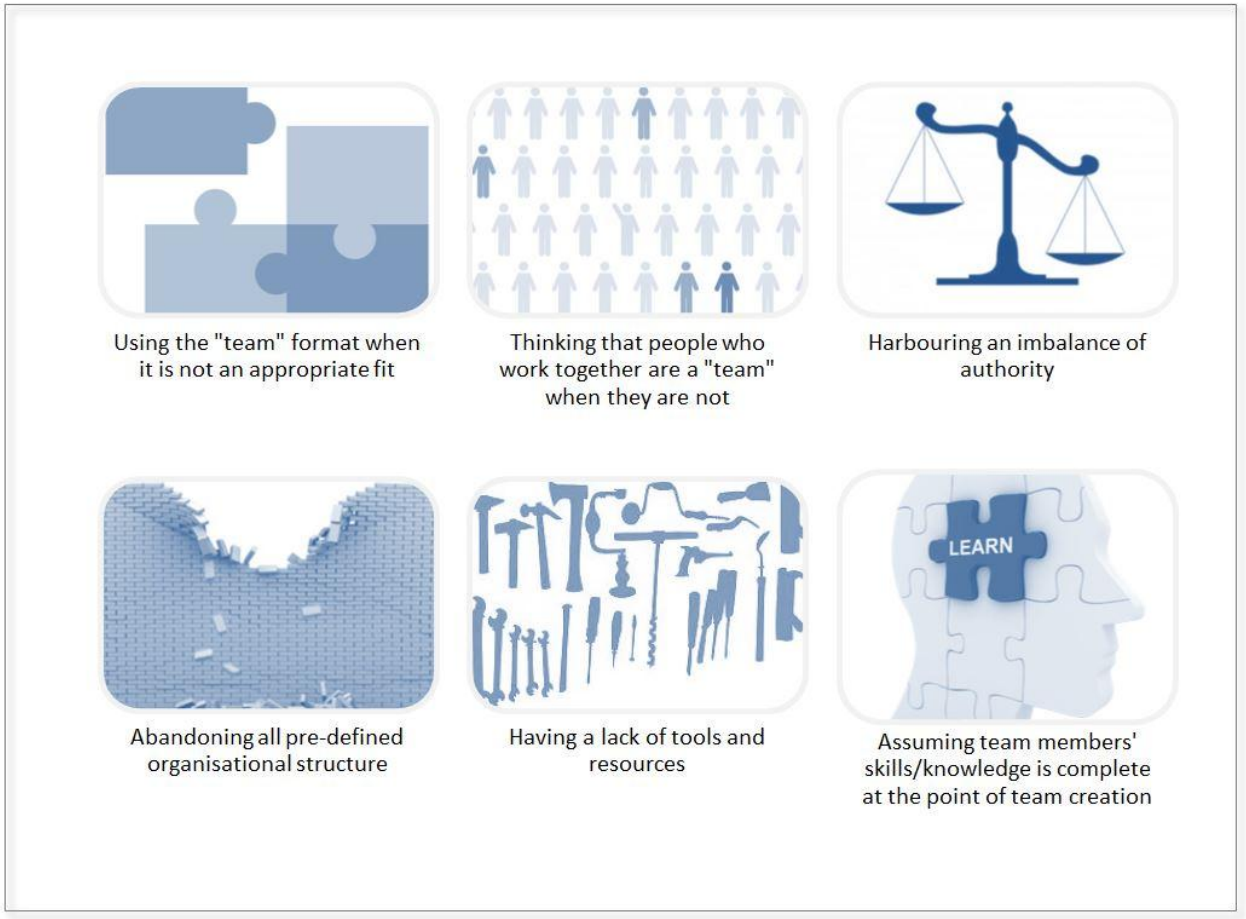


Figure 14: Hackman’s 6 Common Managerial Mistakes- Titles Adapted from Hackman’s Theory

Hackman stipulates that organisational leaders must first be sure that the use of a team to complete whatever task is at hand is at first appropriate. Not all tasks can benefit from the input of a team. Mistake two discusses perhaps what could be referred to as the misconception of the true definition of “team”. Hackman argues that because a group of people work together on a common task does not inherently make them a team. In fact, compiling an effective team takes hard work and preparation, and does not come into existence purely because a number of people happen to work together. It is therefore essential to carefully select team members with a view to them operating as a single entity and not as individuals

linked merely by task or geography. Harbouring an imbalance of authority is another mistake made by team creators. Thinly spread authority across a team can result in unclear direction and a lack of synergy in the group. Alternatively, assigning too much authority to a managerial figure can result in a loss of some of the important features of a true team. Almost paired with this mistake is another relating to the abandonment of structure. Especially in times of change, previous organisational structures can be eradicated in order to develop a new working environment for newly established teams. However, a lack of any familiar predefined structure can be detrimental to newly reorganised teams. It would appear that maintaining a clear view on work task, compiling an appropriate group of individuals and importantly maintaining clear structural norms, allowing room for the team to develop their own additional norms over time, seems to be the most efficient and effective way of providing newly formed teams with some pre-existing structure without constraining them so much that there is no room to grow and adapt.

Mistake 5 refers to the balance of task versus resources. Teams can meet challenging objectives with enthusiasm yet it is important to ensure that teams have the appropriate materials and resources needed to complete these tasks. “Resources” do not only refer to material elements such as equipment or money, but also to the organisational resources including educational/feedback, reward and information systems. The final mistake highlighted in Hackman’s publication is around the skills status of team members and the maintenance of the team. It should not be assumed that when a team is formed that all team members have all the relevant skills needed for the task at hand, or that the focus of the team will not change and thus the skills of the team require no further adaption. Hackman suggests that leaders and managers should provide coaching for team members not necessarily on their work skills but importantly on their team skills, and at various points throughout their work journey. This may involve education and training opportunities.

Hackman however does not rest the weight of team effectiveness on avoiding these six common mistakes. Another obstacle to team effectiveness is a scenario whereby an organisation develops true teams but insists that they work under a fully pre-established set of organisational norms and structures, leaving no room for manoeuvre. As discussed previously, some predefined norms and rules can be beneficial but asking a newly formed team to operate within a pre-existing framework which was developed and honed in absence of said team, according to Hackman, can result in a decrease in output as well as a decrease in individual commitment to the cause over time. It is therefore important to remember that although the elements identified as pertaining to successful teams are mere indicators of what success or effectiveness might look like in a team. Under the surface, a large number of interdependent factors can be at play, resulting in varying levels of success across many different

scenarios. Hackman's work aims to provide an action-based (and arguably the first of its kind) approach to identifying why teams that work work, and why those that don't don't.

Examples of work showing application and/or testing of the Hackman model are rare, yet Vinokur- Kaplan (140) applied the model to teams working within a healthcare setting. The authors conducted their own statistical analyses on team effectiveness based on questionnaire data, then applied a separate analysis of Hackman's model characteristic against the data on individual and team-based levels in order to test the appropriateness of the model. The results demonstrated that the characteristics within Hackman's model did not deviate statistically from those found in the authors' own analysis. This paper also support Hackman's notion that for teams to be successful they require excellent set up and maintenance, as Vinokur-Kaplan's results suggest that meeting standards as well as collaboration and cohesion n are strong indicators for team success. Although the Hackman model is not the most recent approach to exploring and describing team effectiveness, and there are limited examples of its application (either quantitatively or qualitatively) to team data, it is considered a founding theory with the fundamental categories found in many other more recent and less established theories of team success.

3.3. Study Aims

- To apply Hackman's model of team effectiveness in the context of the pharmacy team dynamics and performance observed in the data
- To discuss the extent to which these teams were successful in the adoption of the new robotic system based on Hackman's characteristics of successful teams.

3.4. Analytical Approach

As detailed in Chapter 2 (Section 2.4.2.), the interview schedule used was developed by two researchers (EDC and JC) and was not directly influenced by any particular theory or approach. This allowed for the inductive analysis of participant data. Consequently, the questions asked were not derived directly from Hackman's theory of team effectiveness. However, as Table 8 shows, all of the interview schedule questions or topics can be linked with Hackman's characteristics. Table 9 lists those questions in the interview schedule which did not directly align with, or would not elicit answers specifically relating to, Hackman's characteristics, including general questions about the redesign process itself. The choice to avoid directly asking participants about aspects of their work with direct influence from Hackman's model meant that an inductive exploration into those aspects which were most important to participants was feasible.

Table 8: Interview Schedule Questions Which Align with Hackman's Characteristics of Effective Teams

	EFFORT	KNOWLEDGE & SKILLS	PERFORMANCE
DESIGN	• For the most part, does your current job involve monotonous tasks? • For the most part does your job involve complex tasks? • Does your job involve working at very high speed and if so, to what extent? • Does your job involve working to tight deadlines? • Are you able to choose/ change your speed or pace of work? • Are you able to choose or change the order of your tasks? • Are you able to choose or change your methods of work? • Are you able to choose or change the timing/hours of your work? • Can you take a break when you wish?	• What knowledge and skills do you need to do your current job? • What things do you need to know about? • What things do you need to be able to do? • Is your current job well matched to your knowledge and skills?	• Generally, does your job involve assessing yourself the quality of your own work?
ORAGNISATIONAL CONTEXT	• Does your work group or team have common tasks and can it plan its work?	• For the most part, does your current job involve learning new things? • Have you undergone any training to improve your skills in the last 12 months / since mid-2010 when the PDC went live? • If you have not undergone training, have you asked for training and been refused?	• Who do you regard as the end users of the service you provide? • Can you tell me about what you typically do on a shift? • What determines your pace of work? • Do you have enough time to get the job done? • Do you know what is expected of you at work? • Does your employer provide everything you need to work? • What do you think your organisation should provide for you to work? • Generally, does your job involve meeting precise quality standards?
GROUP SYNERGY	• Does your job involve rotating tasks between yourself and colleagues? • Tell me about management and how well you work with them. Does this vary by level of management? • Tell me about your relations with non-pharmacy staff and how well you work with them? Does this vary by their occupation/role? • Overall, how motivated/enthusiastic are you with your current job?	• Are you involved in improving the work organisation or work processes of your department or organisation? • Are you consulted before targets for your work are set?	• Generally, does your job involve solving unforeseen problems on your own? • Can you influence decisions that are important for your work?

Table 9: Interview Schedule Questions (without prompts) which Do Not Directly Align with Hackman's Characteristics (By Schedule Topic)

Your Current Job
Where do you work? Did you choose / were redeployed/ always worked here?
Team / Group Work
Do you work mainly on your own or as a team?
Who decides the structure and timing of the work?
Training, Development & Progression
What sort of progression/promotion opportunities are available to you?
Commitment
What do you like best and least about your job?
Do you experience stress in your work?
Does your job give you the feeling of work well done?
Overall, how satisfied are you with your current job?
The Pharmacy Redesign Project
How were you informed about the objectives of the pharmacy redesign project before it happened?
What did you understand to be the reason for the pharmacy redesign project?
Thinking back to those objectives of the redesign project, do you think that these improvements that were envisaged have been realised?
Has your view of these improvements changed during the life of the Redesign Programme?
Was the project the best approach to achieve better clinical pharmacy care for patients?
Did managers/advocates of the Redesign Programme provide evidence to justify the changes being made? Describe how this was done.
Were you given enough information to understand what would happen to the service?
Were you given enough information to understand what would happen to your job?
Were you given an opportunity to influence the redesign project at the outset?
Were you given an opportunity to influence the redesign project at any stage?
How useful were NHS partnership structures in involving you in decision making around the redesign project?
What were your expectations of how your job would change? What were your views about that?
What did you expect of management at the time? Have your expectations changed? Were they different that before?
Did you trust those implementing the pharmacy redesign programme?
Did you feel supported by management at different times during the lifetime of the pharmacy redesign programme implementation? What about now?
How do you feel about what management "sold" to you versus the situation that occurred? Were they the same? If not, how did you cope?
Has your employer ever failed to meet any obligations that were promised to you since mid-2010 when the PDC went live?
What changes would you recommend to improve the quality of pharmacy distribution services in NHS GG&C?

It is important to first consider what teams will be discussed in relation to Hackman's model. The following analysis uses interview data focusing on before, during and after redesign, provided by pharmacists, technicians and support workers from the hospital sites and PDC (as analysed in Chapter 2 of this thesis). Although interviews were conducted with a number of other local and senior members of management, it was deemed more appropriate to explore the success of the working teams from the perspective of operational staff executing day-to-day process, as opposed to those more senior staff members who are in management roles. The focus of this chapter is therefore not to look at the success

of management in the implementation of this redesign (and the work carried out thereafter), or the success of setting up the teams, but to look at the success of the teams "on the ground" in the wake of this large-scale and innovative redesign.

The following distinction between two main groups of teams has been made: hospital staff teams and the PDC staff team. It was deemed appropriate to divide the participants into these two distinct groups for the following reasons:

- Hospital staff (comprising 4 separate teams, 1 per site)
  - have a geographically similar work environment to each other
  - have regular, or at least the potential for, patient interaction
  - generally work in the same hospital as they did pre-PDC, due to most staff receiving their first choice in where to work
  - generally work with a similar group of individuals as they did pre-PDC, with some changes in terms of the introduction of rotation and bank staff
  - have the same task goal as they did pre-PDC (i.e. order medicines from a supplier and dispense for the patient) although the tasks themselves have changed
  - work in a clinical environment.

- PDC staff (comprising 1 team, 1 per site):
  - work in the same environment as each other
  - have zero patient interaction
  - work in an entirely new geographical location as they did pre-PDC, although chosen to do so
  - work with a brand new set of individuals than they did pre-PDC, as staff have come from a variety of locations in the health board
  - have a different set of tasks than hospital-based staff (i.e. maintain and monitor medicines stock and prepare orders for hospital pharmacies)
  - work in a non-clinical warehouse-like environment.

These two groups of teams have very different work environments, tasks and experiences of levels (and types) of change as a result of the redesign. The job roles of support worker, technician and pharmacist were not deemed as an appropriate way to separate staff members into "teams" as each of those jobs witness different impacts depending on their job location. That is not to say, for example, that all support

workers from hospital sites have the same experiences or tell the same story, but they have an overall alternative experience of what it is like to be in their team than those working in the PDC. The following analysis will not however ignore the differences between job role groups across sites as there are some local examples present that are important. As the pharmacists, technicians and support workers are spread across 4 separate hospital sites, it would be fair to say that although they would share and experience the commonalities of working in a hospital environment, these staff members could be said to belong to four separate teams due to the geographical and service differences between hospital sites. Therefore, some of Hackman's categories may apply to some hospital sites, but not to others.

The following analysis will be presented with each of Hackman's categories that are present in the NHS GG&C APR Programme data, with commentary and illustrative quotes under each heading. Those categories of Hackman's not illustrated in the data will not be discussed, but will be highlighted as such in the chapter summary table contained within the results section (Table 9).

3.5. RESULTS: Application of Hackman's Model of Team Effectiveness

This analysis uses the Hackman model of team effectiveness, outlines in Table 7 and is focused on participant statements about their jobs 2 years post-redesign (in 2012). Any comments made by participants about the pre or mid-redesign period of time that are included in this analysis are only done so due to them still being significant for the participant at the2 year post-redesign point in time (i.e. those pre or mid-redesign experiences still appear to be significantly shaping how they experience their jobs).

A. EFFORT EXHIBITED

a. Design of the Team

Members have variety of high-level skills

Participants were asked what skills and knowledge was required for their current post-redesign job roles. Responses varied depending on what group of participants were being interviewed and also by job location.

Pharmacists reported needing the relevant degree as well as a working knowledge of medicines. Hospital technicians and support workers reported needing excellent communication skills, good interpersonal skills, an understanding of medicines, the ability to multi-task, organisation skills, patience and common

sense, among others. The difference between hospital staff and PDC staff was that PDC staff felt that knowledge of drugs was not entirely relevant for their role. Participants were then asked if they felt the knowledge and skills required for their jobs matched the knowledge and skills they already possessed, the general consensus was that this was the case. Some staff did identify that when the PDC opened, they did not have a working knowledge of the technology involved. However, the challenges this proposed was not about the work itself being challenging but more about being in a high-pressure unfamiliar position that has improved over time:

> *"When we first came in [to the PDC] we were doing everything, because we were, practically, the first here. We got a wee bit of the robot, you know, help fixing the robots, et cetera...looking over [people's] shoulder sometimes, you know, just to pick up certain things, so, you don't need to keep calling them out all the time." (PDC support worker)*

Another issue was that PDC staff in particular possessed skills and knowledge that was no longer required in this warehouse environment, far removed from any clinical environment they had worked in previously:

> *"I've lost a lot of my skills…I've not dispensed for over 2 years, things change in dispensary all the time, so, I'd need to get a crash course, if I was to go back to the hospital sites I'd need a crash course in all these things. CD's, I could do, because I still do them here, occasionally…I've learnt skills here, but I've lost a lot from leaving the sites." (PDC technician)*

Therefore, the work itself was not a challenge to staff, and in actual fact PDC staff were at times over skilled for the jobs they were currently fulfilling. However, staff were able to identify a great range of skills and knowledge they possessed, as well as various required and superfluous qualifications.

Autonomy is available

Staff were asked about the level of control they had over their work post-redesign. All staff had previously worked in a hospital pharmacy setting prior to the redesign. Staff reported mixed experiences of the level of control they exerted over their work. Some reported the weeks' work being very similar over time, therefore work was more predictable and flexibility was sometimes possible when need be.

Some staff reported working in smaller and more familiar teams, which also harboured a working environment based around routine, and thus allowed room for control over work:

> *"There was more flexibility, you know, sometimes, I, actually, done the dressing and sundries side as well, I did all that as well as the pharmacy stuff that came in, so, and I helped sometimes, some days were quiet, I helped the porters take it up to the wards, et cetera, done all that sort of thing, which was good, you know, you get out and about."*
> *(PDC support worker)*

Other staff reported that their levels of control or autonomy over their work had changed little since the redesign; however those who explicitly stated there was little change have remained in the hospital setting.

Lack of time, specific deadlines and the required methods of work meant staff had certain constraints that were not possible to alter. Staff generally felt that the tasks themselves requiring completion were out of their control; staff could not control what tasks had to be completed. Deadlines or daily events also constrained what control staff had over the work, for example the need for ward top-ups, or PDC staff dealing with orders coming in from hospitals. Staff decided what work had to be completed first, yet these tasks absolutely had to be prioritised (namely dealing with medications for patients who were waiting to be discharged or were waiting for ambulance transfer, and meeting PDC order deadlines). Most staff in both settings did report that the methods via which work was completed were not explicitly set out (although SOPs are in place to control for safety and quality), and that completing the work safely and efficiently was the aim. PDC staff had arguably less control over how the work was completed as most tasks involved the use of the robot which required the user to work within a specific framework. Furthermore, demand and lack of time were cited as constraints within which all staff in all settings worked, which resulted in little freedom to change working methods or the order in which tasks were completed.

Adequate feedback is available

The presence of adequate feedback is seen as important in the model. PDC staff reported that at the beginning of the redesign, team meetings on the warehouse floor were relatively frequent (approximately weekly). However, staff reported that these meetings had become less regular and there was no longer the same emphasis placed on having all staff attending as before:

"We were having really regular team briefs, but unfortunately it was just the same going over and over again… you can go and speak to anybody, it's whether actually anything will be done or not." PDC support worker

The team briefs on the warehouse floor occurred weekly in 2010, but were no longer seen as a useful source of feedback from management. The meetings had also served as a sounding board for staff to air their views, but were not always seen as effective. Staff reported team briefs occurring less frequently now.

Hospital staff also reported the occurrence of team meetings in the dispensary, but again their effectiveness and frequency had come into question:

"Department meetings used to consist of everybody meeting outside there [in the dispensary]…if anybody had opinions they would all get voiced…everything's really cloak and dagger now I think. It consists of [the dispensary manager], a couple of the pharmacists and again band s… if we were all to attend the one meeting, there would be nobody to man the pharmacy…I had an email a couple of weeks ago of minutes from a meeting, [and I thought] when was that?...I feel there's a massive lack of communication between people here. You're only told what people think that you should know." (Hospital technician)

This particular staff member commented that meetings had occurred fairly regularly and were inclusive in nature, but that it only more senior members of staff engaged in meetings. Although pulling all staff members from their tasks at the one time to have a meeting was seen as impractical, there was a definite lack of engagement and a lack of adequate feedback being provided to staff in the hospital setting.

b. Organisation Context

Excellent performance is rewarded at a team level

Hackman also proposed staff should receive reward in response to excellent performance. Some staff did indicate that they received no recognition for any extra efforts they made during the redesign to get through the increased workload:

"I'm no longer willing to put [in the extra work]…you don't get a thank you for it, you know, they don't recognise the fact that you're invested in your job…it's almost as if you're not really a team player unless you're willing to [stay late unpaid]…But that's because the redesign's affected here, it's so demoralising." (Hospital support worker)

Aside from thanks, none of the participants described any other sort of reward that may or may not be available to them in response to excellent or above standard performance. The redesign had resulted in some sustained challenges for staff and many felt that they had worked above and beyond in order to make the service work, even when they felt unsupported and underappreciated:

"Most days I absolutely love my job…but people have been here longer than I have…I was saying things like "oh it's not that bad", and [my colleague] was like, "you've only been here three months, they'll batter it out of you". And you're like is that what you've got to look forward to? And these are people who are conscientious workers, you know, who don't mind going a wee bit above and beyond the call of duty when it's required, who are now just saying, "do you know what, I'm not doing it, no longer doing it"… And I think that redesign process, they achieved what they had to achieve on paper…but when it came at this part, then it was just a case of "oh, you'll just deal with it" …nobody down here at this level, ATOs, technicians, DCTS or pharmacists would ever have agreed to what we've been left with." (Hospital support worker)

c. Group Synergy

Team members contribute and are motivated equally / Team members are equally committed

Team members contribute to the work and are motivated equally to do so. It is difficult to assess whether staff members in reality contribute equally to one another without performing data collection activities on time spent on tasks etc., but some staff members discussed other members of the team and how their contributions may not be of an equal level to their own. Some comments were made about a small number of staff being on long-term sick leave when their cause for absence may not be genuine. This kind of long-term and perceived insincere absence was a pressure on those it affected:

"Most of [the people off sick] are people that we've had the problem with for a number of years…they know how to work the system and they use it to their full advantage…But they've got it worked out to the day and hour, they know exactly how much they need to work and not work in order to maintain their sick pay." (Hospital Technician)

One staff member did comment that when the new system was initially up and running, some more senior members of staff as well as the hospital pharmacists were less likely to stay behind after work hours to help finish the day's work. It should be noted however that staff were not being paid extra to do this and were not formally asked by management to stay behind. As seen previously those staff that did stay behind felt that they did not receive any extra thanks or reward for their efforts. Not all comments were negative in nature, and m some examples were given where participants commented that their colleagues were equally hard working.

B. KNOWLEDGE & SKILLS POSSESSED

a. Design

Team size is appropriate

Staff were asked about substitutability with regards to how easily are their roles could be filled in the face of sickness and absence. Staff made also comments generally about the redesign and how they were equipped staffing-wise to deal with the changes. Many commented that not only was there a lack of staff to deal with absence and annual leave, but that generally there was a pressure felt in terms of a lack of staff for day-to-day operations, resulting in cross-over of responsibilities:

"I think if you ask anybody, they'll tell you there's a lack of staff. Obviously, when the PDC came into play, an awful lot of staff got pulled. And what got left here is minimum staffing, as far as I can see…But what will happen is, if this technician's off, I'll be expected to do the same amount of work as a technician; which I'm doing just now, but in effect, without the qualification. So that's a staffing issue for me." (Hospital support worker)

Some PDC staff highlighted that temporary "bank" staff were employed at the point of redesign. This can be assumed as a reasonable measure as it is possible that additional staff would be required at such a

time of prolific change. However, staff expressed that many of these bank staff were still in place and had been made more permanent employees due to the lack of staff. Hospital staff also felt that they lacked staff and additional help would alleviate some of the pressure.

Members of the team have personal and professional skills

Participants were asked if they felt that they had the knowledge and skills appropriate for their job roles. They were not asked to provide evidence of the acquisition of these knowledge and skills. As discussed previously, PDC staff generally that felt their knowledge and skills they had acquired throughout their clinical career had been rendered redundant or were at least in need of updating now that they worked within a warehouse setting. Hospital staff felt that their knowledge and skills matched those required to fulfil their roles relatively well:

"I: **Do you think that the skills that you've got and the knowledge you've got is quite well-matched to your job? Are there skills that you don't use in your job?**

R: *No, mine is pretty well-matched, I would say." (Hospital technician)*

For hospital staff there were few examples of skills not currently possessed, for example, one staff member felt that their IT skills were lacking now that they were expected to work with technology. They did not own a computer at home so therefore did not have as much experience with computers as they would have liked. Some staff referenced skills and assets they had brought with them from previous job roles prior to their roles in pharmacy. Those hospital staff who had MMyM as part of their job description also had a rotational aspect to their roles, therefore this variety of work may lead to increased professional and personal skills as time progresses.

Staff were asked generally what skills were required for their job roles. Many hospital staff members stated that interpersonal and communication skills, as well as patience were required and that they felt these skills matched the skills they possessed well. Communications and Interpersonal skills were not as prominently sited by PDC staff, perhaps due to the decreased interaction with a variety of staff members and the lack of patient interaction.

b. Organisational Context

Relevant education and training is present

When asked about training, hospital staff could cite a number of different programmes that were in theory available to them. Examples included various CPD courses and health and safety training.

PDC staff cited minimal training for the PDC system itself. Some did cite being shown the robots and explained the system as part of an induction, but not to an extent that could constitute as a formal training. It was perceived that that this was not adequate for dealing with all eventualities, only the basics:

> *"[The training] was enough but just sometimes something would happen in the robot and you didn't know why that happened and there's nobody to turn to, to ask." (PDC technician)*

Many participants did however cite receiving informal on-the-job training from their co-workers. Some PDC staff reported being offered, or being aware of, other training opportunities not related to the redesign or the robots, including health and safety training, top-up of unlicensed medicines training and DCT training.

Relevant education and training is actually available

When it came to discussing what training was actually available and accessible for staff, both PDC and hospital staff identified barriers to their professional development. Hospital staff did not report being formally trained on how the new system would work. Some staff members had been given a presentation by the Project Lead but this was not inclusive to all staff due to holidays and absence. Staff reported incidences of on-the-job training, relying on their colleagues to help them in the process of learning. Hospital staff reported lack of promotions or posts (and associated funds) as reasons cited for lack of access to training:

> *"I asked about training, they said training was available. Got there, no money for training…You can apply for the student technician's post, can't be guaranteed a job at the end of it. So why would I do that? I've got kids, I've got a mortgage." (Hospital support worker)*

Training opportunities were rare, as were opportunities to progress onto higher posts. Additionally, even if training was completed there would be no guarantee of a higher job role or the staff member's current job being available at the end of it. For many staff this was a concern due to the lack of job security, so although in theory training and progression opportunities existed, it was not necessarily practical or possible to progress.

There were specific concerns about PDC staff training and progression opportunities, as the work environment was particularly specialized, restricted, newly-formed and of a non-clinical nature:

> *"There are courses and things that are in place you can do via NES to help you [with being a technician]…I mean I can understand it in certain areas, but not in an environment like this, in a warehouse where there is a certain limit to what you can continually personally develop yourself in, relevant knowledge, there is only so much you can do." (PDC technician)*

This staff member felt as though there were limits to the work due to the warehouse-like environment, and that traditional pharmacy training did not apply anymore to PDC staff. There is a risk that PDC staff will lose any clinical skills and knowledge due to the nature of the working environment, and will therefore find it difficult to progress both within and out with the PDC and wider healthcare environment.

c. Group Synergy

Learning should be collective

Hackman stipulated that any team learning should be done collectively. Although there was little formal training offered in preparation for the redesign (collective or not), what learning did occur was on-the-job and was therefore in a team environment and usually involved staff showing or teaching other members of their team. Although not explicitly stated, PDC staff who worked in more isolated roles, for example in vaccines or in unlicensed medicines, may have had a more solo learning experience at the point of redesign than those staff working in a hospital dispensary, for example.

Some staff members, from hospital sites and from the PDC, reported learning from the behaviours and experiences of their colleagues, relying heavily on peer support during the redesign:

> *"We got trained but because it was so hectic we just got shown what we had to do and that was that… we just came and got shown [the robot by our manager], we never had*

like a slot where this was the training time, it was just 'this is what you do, there's the keys and you press that button'." (PDC support worker)

PDC staff would have had a very different learning experience at the time of redesign than those staff working in hospitals. Most hospital staff reported being allocated to a job role and job location that they requested and/or had previously assumed prior to the redesign. However, all PDC staff (although allocated job roles and locations requested) were forming a brand new team in a brand new job location, providing a brand new service. This team lacked the norms and culture reserved for those who have previously been in existence, therefore all experiences of this phenomenon would have been new. This includes the learning experiences of staff (including all aspects, such as the learning method, the tasks being learned, and those being learned with). Although not explicitly stated in the interviews, it could be argued that the PDC staff may have had a much more collective learning experience because of their shared experience of working in a brand new environment.

C. PERFORMNCE STRATEGIES

a. Design

Team members self-regulate

Hackman argued that the ideal team possesses members that self-regulate, i.e. they monitor their own work and progress (with assumed monitoring from managerial figures). Although staff were not asked about self-regulation, they were asked about autonomy, control and about their relationship with management. Some comments were made about the lack of involvement or interaction with management, due to some managers not being physically present because of shared roles across different hospital sites. Some staff lacked interaction with management due to them not working directly with them on a daily basis:

*"**I: Tell me about management and how well you work with your management.***

***R:** Okay, you don't really have much to do with your management, it's more the Band 6s [you interact with]…You don't really have much to do [with them] – [one manager's] got other things to do so you don't really see her any more, it is more the Band 6s that you see." (Hospital technician)*

Many staff spoke of prioritising their own workload and managing their time, as opposed to having their time and priorities managed for them:

"You need to know how to delegate and how to prioritise and how to manage people."
(Hospital support worker)

PDC staff cited seeing management around the workplace more often than hospital staff did. PDC staff also felt that management were approachable. However, in terms of regulation some staff still were responsible for their own work and their own prioritisation. One staff member spoke of their work in the vaccines area of the PDC:

"I suppose, I've got an area that I'm running myself, where at the [hospital] I was going round 5 different areas, so, I was, kind of, going in under somebody else, there would always be a band 5, and a pharmacist there. Whereas I'm up [in vaccines] working on my own, so, I really have to manage my time, so, I suppose, I'm working for myself in the vaccine area, I'm totally responsible for myself, and the guys that's working with me."
(PDC technician)

Although there were regulations and SOPs in place, there seemed to be little frequent daily regulation by management, and the culture of the team was to regulate one's own work.

b. Organisational Context

There is clarity about task requirements, task constraints, resources available and who the service user/reviewer is

Staff appeared to be highly aware of the requirements of the task. No one interviewed said they were unsure of what their work should involve. Staff were well aware of what the nature of the task was and what had to be done (and when). In terms of awareness of task constraints, staff commented on a few which were present but not necessarily those task constraints which may or may not have been pre-defined by management. Time was a lacking resource discussed by many participants from both the hospital sites and the PDC:

"I think to get everything completed to the level that I would be happy with…then [there is] not always [enough time]. I think sometimes it's quite difficult to follow up certain

things, like obviously on a day to day basis I could see the patients, know they're safe, we're treating them appropriately…but we obviously have things to do with formulary decisions on, what drugs should be used over which other ones, based on price and efficiency and this kind of thing. Then we have initiatives for reporting usage of certain drugs, so for certain antibiotics you need to report, fill out forms and this kind of thing. You don't always get time during the day to do all those things and they build up and build up, so it's trying to find time. If you get a spare minute you're going back to that to try and get that all sorted out." (Hospital pharmacist)

Many listed a number of resources needed but not available to them. At times, resources were listed as needed were at present but subpar:

"We struggle with resources…Well there are certain books that we're supposed to have that we have asked for and we've still never got; and a lot of it now we can get electronically. So there is that. But there are certain things that we don't have and we're working on old resources and that in itself is a risk which I'm not entirely comfortable with." (Hospital pharmacist)

Finally, staff were extremely clear about who their end user was, although it varied depending on where each staff member worked. Hospital staff generally considered the patient as the end user, whereas PDC staff considered the hospitals (and where appropriate GP surgeries) as the end users of the service. This may be down to the fact that PDC staff are in a less clinical and patient-facing environment, and are therefore more inclined to consider the receiver of the orders they send (the hospitals) as the end user rather than individual patients. However, neither of these judgments can be considered wrong or misinformed, as all staff were clear about who they felt their end user was.

c. Group Synergy

Minimising of performance slippages

Staff made no explicit reference to prominent strategies in place to minimise performance slippage. PDC staff did reference two events suggested and supported by staff which directly minimised performance slippage; the remodelling of one of the robot chutes and the introduction of the nightshift.

Soon after the redesign in 2010, it was noted that one of the robot chutes was encountering jams on a regular basis, and staff made their frustrations around this known to management. Orders were being held up as a result, and inaccuracies were occurring as at times medicines were being directed to the wrong boxes for the wrong hospital because of the blockage:

> *"In April 2011, they brought the mechanical engineer in at the PDC, and they fixed one of the chutes, so when the drugs fall down the chute, everything was getting stuck. So this was meant to help things. It was a source of a lot of errors and things that were coming through." (Hospital support worker)*

Management liaised with engineers and the chute was remodelled so as to minimise the risk of blockage in the future. It appeared to alleviate the situation.

Another issue which was identified around the time soon after the redesign was the issue of the robots loading medicines via their conveyer belts through the night. Medicines would be left on the input conveyer to be loaded by the robot overnight while the PDC was not operational. Frequently a jam or error would occur and staff would return in the morning to find that little to no medicines were stocked into the robot overnight. These kinds of errors and jams occurred frequently during the day, yet their effect was less impactful due to their being staff on hand to address the issue. The night time jams added additional work as well as additional time and medicines supply pressures. PDC staff expressed their angst about this issue to management and a nightshift was trialled. The effects were undeniably positive:

> *"We're much more in control now I would say than we were. And with no nightshift stuff had piled up against the wall …'One box of tablets had come in…we need to find it, and it's worth £700…'where can it be?' It was a nightmare! … People were coming in the morning and nothing had been taken in [by the robot]." (PDC technician)*

Although staff did not discuss day-to-day strategies in place to minimise performance slippage, these two distinct events had a significant impact of the performance of the PDC. This meant that orders would be more reliably delivered as accurate, undamaged and complete to hospital sites, resulting in fewer issues at both ends of the supply chain.

Creating innovative strategy plans

The final Hackman characteristic of successful teams is that a team should create innovative strategy plans. Staff appeared to work in a responsive way but within the framework of SOPs, Key Performance Indicators (KPIs) and a general inherent commitment to the end user.

However, thinking of NHS GG&C or more specifically and PPSU as an overarching team, the APR Programme can certainly be considered an innovative strategy plan in itself. The topic of team strategy was not explicitly discussed with participants during interviews, and the actual questions asked regarding the redesign did not align with Hackman's characteristic of creating innovative strategy plans (i.e. it was not appropriate to ask the question "Are there innovative strategy plans being created?" as this was already known- the redesign). However, it would be negligent to ignore the existence of the redesign as an innovative strategy plan in itself, therefore it will be discussed briefly here.

The introduction of automated ordering at such a scale was the first of its kind in Europe at the time. Generally, staff agreed that the redesign was innovate, yet the general opinion was that it may not have been as successful as hoped or as appropriate now that some time had passed since the initial go-live period:

*"I***: What about the quality of service that PDC provides… not an overwhelming success yet?**

R*: No, I don't think so." (Hospital technician)*

Some staff did feel that the aim of improving cost-efficiency was probably being met, but many were unsure as to the true success of the full redesign:

*"***I: Do you feel in its entirety then the redesign was, there was some cost efficiencies to be made within the PDC and there was this vision of service improvement, gold standard that they were talking about?**

R*: Uh huh…I think to some extent, I think the cost savings are probably being achieved to some extent.*

*I***: I mean is it providing safer care for patients is there less error in the way that things are being done now?**

R: *I don't know to be honest.*" (Hospital Pharmacist)

The hospital and PDC teams themselves however have little direct impact on creating or influencing any higher level innovative strategies. There were some examples of innovation or problem solving at local levels, but only at a scale which would solve localised issues unless that learning and that planning was shared as standard across all teams. For example, one site who had a particular issue with medicines which were received in error created an organised system whereby these "unwanted" medicines could be used:

> *"We've got a sort of pool in our room of [unwanted] medication…if we put the stuff in a plus pack we're left with, maybe, 70 or 60 per cent of the box… so all these ones sit in alphabetical boxes, so when we get the indents [we] go through the boxes. If we've got any of the meds, score it off the indent rather than re-ordering." (Hospital technician)*

This innovative strategy was not instigated by management yet it addressed a very real issue for this particular hospital dispensary. It also contributed towards the reduction of medicines wastage and financial losses at this site.

Tables 10 summarises the findings around Hackman's characteristics of successful teams as applied to the APR Programme data for the hospital team(s) and the PDC team. What categories were present in the data, as well as to what extent each team could be described as successful according to each category, are listed. Any useful additional comments to attempt to clarify any results are also featured. Those categories which were either completely unexplored or could not be fully illustrated by the data are highlighted.

Table 10: Hackman's Characteristics of Successful Teams within the Hospital Teams and PDC Teams Data

		RESULT	COMMENT	SUCCESS?
EFFORT				
Design	Members have a variety of high-level skills	**HOSPITAL**: Staff are well-skilled	-	✓
		PDC: Staff are perhaps over-skilled	*Some skills redundant*	✓
	Task is meaningful	*Not explored*	-	
	Outcome has significant impact for other people/service user	*Not explored*	-	
	Autonomy is available	**HOSPITAL**: Lack of autonomy	*Due to meeting time deadlines*	✗
		PDC: Lack of autonomy	*Staff had more autonomy in hospital setting than PDC*	✗
	Adequate feedback is available	**HOSPITAL**: Feedback not available	*Feedback sessions pre-PDC were more inclusive*	✗
		PDC: Feedback not available	*Feedback sessions at point of redesign were more frequent*	✗
Organisational Context	Objectives are clear and challenging	*Not fully explored*	-	
	Excellent performance is rewarded at team level	**HOSPITAL**: Reward/praise is not received	-	✗
		PDC: Reward/praise is not received	-	✗
Group Synergy	Team members contribute and are motivated equally	**HOSPITAL**: Contribution, motivation and commitment equal	*Few localised exemptions of abuse of annual leave/sickness*	✓
		PDC: Contribution, motivation and commitment equal	-	✓
	Team members are equally committed	**HOSPITAL**: Commitment equal	*Few localised exemptions of abuse of annual leave/sickness*	✓

		PDC: Commitment equal	-	✓
KNOWLEDGE & SKILLS				
Design	Members have expertise relevant to task	*Not explored*	-	
	Team size is appropriate	**HOSPITAL**: Team size is not appropriate	-	✗
		PDC: Team size is not appropriate	*Bank staff have become regular staff members due to shortages*	✗
	Members of the team have personal and professional skills	**HOSPITAL**: Skills required generally match skills possessed by team	-	✓
		PDC: Skills required generally match skills possessed by team	*PDC staff cited less communications/interpersonal skills needed, and perhaps are professionally over skilled*	✓
	Team members are diverse	*Not explored*	-	
Organisational Context	Relevant education & training is present	**HOSPITAL**: Adequate general training exists	*Lack of automation training*	✓
		PDC: Adequate general training exists	*Lack of automation training*	✓
	Relevant education & training is actually available	**HOSPITAL**: Training and associated promotions not accessible	-	✗
		PDC: Training not accessible	*Lack of training means reduced opportunities for progression*	✗
Group Synergy	Team members should contribute equally	*No evidence*	-	
	Learning should be collective	**HOSPITAL**: Learning informal but collective	*No formal learning, collective or otherwise*	✓
		PDC: Learning informal but collective	*Some isolated roles do not enable collective learning*	✓

PERFORMANCE				
Design	Team members self-regulate	**HOSPITAL**: Self-regulation with influence from SOPs	*Local management's presence not felt*	✓
		PDC: Self-regulate particularly in PDC rooms	*Senior and local management very visible*	✓
	Team norms support responsive working and strategy planning	Not fully explored		
Organisational Context	There is clarity about task requirements, task constraints, resources available and who the service user/reviewer is	**HOSPITAL**: Clear on all aspects	*End user seen as patient*	✓
		PDC: Clear on all aspects	*End user seen as hospital*	✓
	There is access to data about likely consequences of different strategies	Not explored	-	
Group Synergy	Minimising of performance slippages	**HOSPITAL**: No specific examples given out with general day-to-day work	-	✗
		PDC: Slippage minimised in specific manner	*Workforce and mechanical alterations made*	✓
	Creating innovative strategy plans	Not explored	-	

3.6. Results Summary

The success of the hospital and PDC teams subjected to the APR Programme was explored in relation to Hackman's model of successful teams. Participants were divided into groups; the PDC team and the hospital teams, one per site (although hospital teams were considered to have several characteristics in common due to the shared clinical nature of their work environment). From the data, 14 of the 23 of Hackman's characteristics could be discussed in terms of to what extent they were (or were not) presented in the data. It was clear that there was little overall diversity between the successes of the hospital versus PDC teams, although smaller differences could be observed at a more detailed level.

In total, 8 of Hackman's characteristic were explored AND present in the teams (1 characteristic was present in hospital teams but not in the PDC team). In general, team members had a variety of high-level, personal and professional skills, with the PDC team perhaps being over-skilled for their job roles. All members of all teams appeared to contribute and were motivated and committed equally to their work. It was observed that in theory, relevant education and training was present yet was not practically attainable. Teams were clear about the task requirements, restraints, resources available and who their end user was (hospital teams and the PDC had differing views on who the end user was), and teams generally self-regulated with some influence from SOPs. All teams appeared to learn collectively although informally, and various examples were given of learning from staff peers or "on the job".

In total, 5 of Hackman's characteristics were explored and were not fully present in the teams. It was clear that autonomy was not available for any of the teams. The size of all teams examined seemed to be inappropriate, in that staff felt that additional staff would alleviate their current issues. There were issues around interactions with management. All teams generally did not receive a team-level reward for excellent performance, and adequate feedback was also not available from management (In the case of the hospital teams, this was exaggerated by the fact that management were not as visible as they were for the PDC team). The one characteristic whereby hospital teams and the PDC team had quite different experiences was that in relation to the minimising of performance slippages. In the PDC, there were two distinct events which occurred which drastically influenced the performance issues of the operation. However, in the hospital setting there were little day to day or large-scale events which would qualify as such.

Nine of Hackman's characteristics could not be discussed as there was either a complete lack of relevant data (or the presence of incomplete or assumed data). Furthermore, the interview schedule used was not based on Hackman's model. The interview questions used did not directly relate to all of Hackman's

characteristics, therefore participants would have not been asked about all of these elements. All 8 of those characteristics are listed as follows:

- The task is meaningful
- Outcome has significant impact for other people/service user
- Objectives are clear and challenging
- Members have expertise relevant to task
- Team members are diverse
- Team members should contribute equally
- Team norms support responsive working and strategy planning
- There is access to data about likely consequences of different strategies
- Creating innovative strategy plans.

For some of these characteristics, it would have been easy to assume they were present due to the lack of evidence on the contrary. For example, it could be assumed that all teams have meaningful tasks, as the pharmaceutical care of patients would be reasonably attributed as involving a set of meaningful tasks. However, in this example, participants did not provide any specific comments around how meaningful, relevant or important they saw their work, or the tasks by which they completed their work. Where no explicit evidence was provided in support, the characteristic was deemed as unrepresented or requiring further exploration. Overall, the number of Hackman's characteristics explored and present in the data outnumbers those explored but not present perhaps suggesting that the teams' successes outweigh their challenges. However, 9 of the 23 characteristics could not be commented on as they were not directly explored.

4. Chapter 4: General Discussion & Future Directions

The purpose of this MPhil thesis was to explore the NHS GG&C APR Programme from the perspective of those staff involved in the redesign, and also to explore how these empirical findings fit in with Hackman's model of team effectiveness.

The NHS is subject to constant overhaul and innovation. By nature it continues to strive to meet patient needs, keep up with increased demands on services and evolve with the ever-present introduction of technology. From the previous literature, it is clear that automation in healthcare, specifically in pharmacy, is becoming ever-popular. Building on the APR Programme, the next stage of robotic intervention in the delivery of pharmaceutical care has already landed globally and specifically in NHS GG&C in the form of automated ward cabinets. The innovative nature of the evolving redesign aligns well with the Scottish Government's aims outlined in *A Route Map to the 2020 Vision for Health and Social Care* (165). The report outlines the need for an accelerated area of focus on a number of key deliverables, which are set for completion over the next 5 years (165). The aims and outcomes of the APR Programme, including both the automation and the MMyM scheme, clearly align with 5 of the 12 key deliverables of the *2020 Vision:* safe care; investment in workforce; innovation; and increased efficiency and productivity. Building from this, all facets of the APR Programme align well with *Prescription for Excellence* (166), a recent Scottish Government plan of action aimed specifically at the innovation and reform of pharmaceutical care in Scotland. *Prescription for Excellence* itself aligns with 10 of 12 key deliverables in the *2020 Vision*, and this redesign specifically addresses a number of key actions outlined in the *2020 Vision*, including: developing new models to enhance the role of pharmacist through better use of pharmacy workforce, such as pharmacy technicians and pharmacy assistants; redesigning the dispensing process to release pharmacists' time for clinical care through workforce planning, and improved use of pharmacy team and automation using robotics; and establishing a public/private partnership framework to promote and increase the use of robotics.

The *2020 Vision* proposes "*a focus on workforce planning to ensure that we have the right people, in the right numbers in the right jobs*" (165). Furthermore, the use of electronic prescribing is also becoming more widespread, adding another technological element to the process. Electronic prescribing sees the transfer of prescriptions electronically between doctors and pharmacists in primary and secondary care, eliminating hand-written prescriptions, to support improved accuracy of prescriptions dispensed (167). The three key aims of Healthcare Improvement Scotland's (HIS) action plan for Hospital Electronic Prescribing and Medicines Administration (HEPMA) include: an emphasis on governance and risk management; leadership and organisational change; and interactions with other available technology. The pharmacy work environment is increasingly becoming one which is automated in nature. The

streamlining and syncing of services through the use of automation is on the horizon at all points on the pharmaceutical journey within a hospital setting; from the distribution of medicines, to the dispensing of medicines in the hospital pharmacy, to the administering of medicines at the ward or by the patient's bedside. Instead of tackling staff training in a reactive way, a more proactive approach should be taken in order to better prepare NHS staff, specifically those working in the pharmacy environment or working with medicines, by taking a planned approach to training. Integrating automation into standard practice and making it the norm will better equip current staff, as well as prepare the future pharmacy workforce.

In this ever evolving technological environment within pharmacy, this thesis presents three important key lessons for future developments in this area:

Lesson 1: Staff consultation and engagement is critical to the successful redesign of services driven by technology

Lesson 2: Ensuring job role components are appropriate for job tasks is essential- technology adoption may require new skill sets and also cause other pre-existing skill sets to become lost

Lesson 3: Team effectiveness is an important focus within any organisational change programme, but less up-to-date models of team effectiveness may not be ideally applicable to teams utilising technology.

4.1 Lesson 1: Staff consultation and engagement is important in ensuring the redesign of services, and the adoption of technology, is successful and well-received

The previous literature stipulates that organisational change should be influenced by extensive consultation with all staff involved (54, 55). Although staff in the APR Programme were consulted on the redesign, the level of consultation did not reach far beyond communicating *to* them about the programme as opposed to consulting *with* them. It appears that staff buy-in to the concept was low due to a lack of clear and widespread two-way communication regarding the ethos of the redesign. The previous literature highlights the positive effects of involving staff in the development and implementation of automation in healthcare settings (40), emphasising that ensuring the technology is accepted harbours safer and more efficient working practices and outputs. More than half of all organisational changes either fail or do not reach the intended goals, with reasons ranging from the pre-existing organisational culture, the timing of change, to the role of change itself (79). Adequate and

effective communication was identified as one of the common qualities of successful teams, including in Hackman's model (61, 62). In this redesign, communications between hospital and PDC staff and management could have been better during the change period, particularly around the time when the pharmacy teams were preparing for the redesign. A lack of communication did result in less of a buy-in from staff than management may have hoped for, as not all staff were equally informed of the full impact of the change. The demoralising effects of this were still felt by staff 2 years post-redesign. This culture of inadequate communication filtering down from high level management via middle management to operational staff may contribute to the sustained lack of communication staff experienced as a team post-redesign.

Change implementers made genuine attempts to communicate the nature of the redesign to as many staff members as possible, yet these group presentations occurred up to two years before the implementation of the redesign. Although there is some evidence to suggest that over-informing staff can result in negative feelings about redesign (81), perhaps some more regular consultation and engagement in the time between securing the funding and implementing service would have been beneficial.

It would be expected that over time, staff attitudes and acceptance of the system would become more favourable due to an increase in system familiarity, experience and perhaps an increased sense of the value automation can add, yet this did not occur in the current example. Staff reported resistance to the redesign in 2010 and many staff of different roles seemed unconvinced by the need for the automated approach even 2 years post-redesign. The analysis of staff experiences as a team post-redesign show that morale is generally low. Some feedback was provided on some improvement in the performance of the automated system (i.e. errors were less serious and less frequent) but not to the extent that staff attitudes had changed significantly. It is clear that the ramifications of the lack of involvement, communication and buy-in pre-redesign were still felt 2 years post-implementation.

Recent developments in human resource management and organizational science highlight the importance of trust in management for sustaining success on individual, team and organisational levels. The high occurrence of change across Australian organisations has provided a plentiful resource from which to learn about the impacts of trust on team effectiveness. Employee engagement or involvement has been defined as "*the exercise, by employees of influence over how their work is organized and carried out*" (168). There are of course varying degrees to which staff can be involved in organisational decision making and redesign, from input at the point of idea conception, right through to employee veto and full decision making at the other (130). Morgan and Zeffane (135) provide an interesting exploration of the association between trust, employee involvement and success in organisational change in Australia. They

highlight some of the previously cited motivations for management to involve employees in organisational change, including humanistic or democratic and pragmatic motivations, to those driven by aspirations of efficiency (130). Management may therefore engage their staff because they feel it is fairer than rendering them uninformed and unengaged, or they may see consultation as an exercise in promoting staff efficiency and effectiveness. They highlight that some of the previous non-change specific literature supports an association between the degree to which staff are involved and overall success, although some considered "success" as related to job satisfaction as opposed to job performance (169-172). A significant increase in satisfaction and performance has also been observed in staff members with above average levels of involvement compared with those with a below average level of involvement (130). Cotton et al (169) also highlight that employee involvement is not a unitary element, but that it is multifaceted and comes in many forms. Examining a variety of reviews of different approaches, they found that of the variety of employee inclusion techniques used, participation in work decisions (involving great influence on the work itself, employee veto and final decisions made by employees) has positive effects on performance, as did an informal approach (this has no formal structure within the organisation, and employees have had reportedly varying levels of involvement). Drawing from these themes, perhaps there is an association between staff buy-in and involvement at the redesign stage and staff support of the redesign post-implementation. Specifically, this lack of buy-in to the redesign as well as a lack of opportunities to share concerns can be linked to a perceived lack of access to mid-level management. Although senior management/change implementers made efforts to communicate to all staff the ethos of the redesign, it is perhaps the case that mid-level hospital management were not bought into the new system, which in turn refrained to be filtered down to operational staff. Where management were more visible (i.e. at the PDC due to staff and management working in the same building), this was still an issue but to a lesser degree, perhaps as management were more accessible due to them being located on the premises. This issue is of increasing importance as adoption of technology on such a large organisational scale may limit the feasibility of having management in close proximity to staff.

This study has highlighted the complexities of communication and engagement across a large workforce over a prolonged period (in this instance 8 years from conception (2002) to commencement of delivery, with funding secured in 2008 and the opening of the PDC in 2010) and within a public sector health system. This starts to add to the limited evidence base on the adoption of technology in healthcare at this scale, as well as of this nature. Most of the current evidence provides examples from in-hospital robotic systems used for preparing or dispensing medicines and at a small dispensary scale. It was not possible to find within the current literature any examples of technological redesign (or other redesign) spanning such length of time from conception to fruition, with actual implementation generally occurring

relatively quickly. This in itself is an underexplored phenomenon which poses a number of challenges and opportunities for learning. A potential next stage in development of this research programme would be to explore in a more comprehensive manner the full ramifications on the workforce of such style and length of redesign, utilising the current evidence-based theories and models available in the literature, with a specific emphasis on the relevance and impact of adequate engagement and communications with those staff affected, and the monitoring of knowledge and skills development to provide a sustainable and fulfilled workforce. There is the potential to take this work forward to design and test a potential new staff communications, engagement, and education and training strategy which is sustainable for large scale technology adoption, often spanning 5-10 years from conception, through funding securement to deployment in service delivery.

4.2 Ensuring job role components are appropriate for job tasks is essential. Simply increasing knowledge and skills may result in highly, yet inappropriately and narrowly, skilled staff members and teams.

The previous literature has explored the importance of the role of each individual employee in the success of organisational change, involving all levels of the organisation in becoming motivated towards making change work. The importance of keeping staff skills and knowledge up-to-date and relevant through training and education has been identified as essential for team success (129, 132, 136, 148). The more recent literature examining the effects of team learning, and the extent to which it is applied have shown that successful change implementers (involving the adoption of technology in a healthcare setting) used a number of methods to appropriately skill the workforce, as well as encourage engagement and instil confidence in any forthcoming redesign. The careful selection of team leaders to motivate the team, the introduction of designed preparatory training sessions and trials to help staff feel safe throughout the change (team psychological safety (173)), the encouragement of new working behaviours, and the promotion and encouragement of the development of new communication methods while enhancing process improvement through active team discussions were methods used in order to promote learning at a team level, as well as encourage commitment and buy-in to redesign (174). It was clear from both analyses in this thesis that developing knowledge and skills has been problematic in the APR Programme. During the time of change, staff had to focus their energy on providing the service and did not necessarily feel they could afford the time to formally have their skillset expanded. Formal training opportunities were also very limited / not available. However 2 years post-redesign, there were

reports that skills and knowledge around the new technology (and of the new system as a whole) had improved, perhaps due to staff having the time to become familiar with the new system. In contrast, the unique warehouse-like environment of the PDC meant that many PDC staff members found some of their more clinical skills and knowledge had become redundant. An *increase* in skills and knowledge is not necessarily essential to success, but ensuring that the skills and knowledge possessed by staff is *relevant* and at an *appropriate* level is more pertinent. This supports Hackman's (and the general) debate that teams should possess the knowledge, skills and expertise relevant to the task in order to move towards effectiveness. Hackman also stipulates that relevant education and training should be present and available. It is also important, as seen in the current redesign, that the education and training available for staff is set at the correct level, and that it covers an appropriate breadth of material for the task at hand. Appropriateness or relevance should be determined by the level and nature of the task, as well as what the staff member or staff group would find reasonable and satisfactory. As seen in the PDC staff interviews, clinically-trained and experienced staff felt deskilled by working in the warehouse environment of the PDC; some of their baseline knowledge of medicines was useful in the PDC context, but required to be added to for them to manage the tasks around the new robotic technology, previously not encountered. In contrast, staff did not feel they were able to use their more clinical skills in the PDC, resulting in a feeling of losing what was once a well-used and valuable skillset. This had become demotivating for staff, especially when considering opportunities for job progression.

It is important to consider the approach taken in the APR Programme and the potential implications for future workforce planning, not only within this setting but in other future redesigns. It appears that the APR Programme resulted in two distinct groups of staff with very different job roles: hospital staff completing tasks requiring specialist clinical knowledge; and PDC staff completing tasks requiring broad non-clinical knowledge. Although both groups of staff are handling and managing medicines, they are doing so in a very different way, in very different environments, and using very different sets (and dynamics) of skills. Although all staff who relocated to the PDC did so of their own will, it may not have been a consideration for them that they would have started to lose their more dispensary-appropriate skills in place of a broad and less specialised general knowledge of medicines. It may need to be a consideration for change implementers in future redesigns that career pathways be differentiated depending on job location. It is proposed that specific education and training strategies should be in place for staff relocating or being recruited into a medicines assembly environment as the adoption of automation accelerates. Medicines assembly or distribution requires a very different skillset compared to more patient-facing or clinical environments, which in itself requires an education and training strategy appropriate to the environment. The main challenge of a more holistic approach to education and

training for pharmacy staff is that the face of pharmacy is changing as the adoption of technology grows. Not all pharmacy jobs are clinical in nature, require detailed knowledge of medicine, are patient-facing or are even situated in an environment near to the patient. The hospital dispensary environment requires a more narrow and detailed knowledge of medicines, appropriate prescribing, and drug interactions, all contributing to the full range clinical skills required regardless of job level. From the analyses within this thesis, it is clear that these specific clinical skills are not appropriate for the PDC environment, where a more general and less detailed knowledge of medicines and medicines administration is needed.

It should also be taken into consideration that individuals who choose to work for the NHS in patient-facing roles may do so in order to address a personal need or desire to work in a caring clinical profession. Those staff who relocated to the PDC may have found a miss-match between their need to contribute closely to patient care and the industrial production-line nature of their new workplace (so-called "warm care" versus "cold technologies" (175). Although evidence does suggest that humans are capable of affective relations with technology, and that technology may help to develop social ties, the impact of replacing a social care-based work environment with an industrial environment is not fully realised. The fact that PDC staff raised concerns over the loss of clinical skills raises questions around the resilience and sustainability of the current redesign, as well as in terms of planning for future projects. Staff may become demotivated and dissatisfied in their job roles and seek employment elsewhere (and may even find difficulty in obtaining a clinically-oriented role as a result of their time out of the patient-facing setting). As efficiency and productivity becomes a priority in our public services, the creation and adoption of differentiated education and training strategies based not on job title, but on job location, should be seriously considered. Further exploration of any current literature on redesigns involving the movement of staff from one type of work setting to another will be needed in order to fully inform and shape the development of appropriate education and training strategies.

4.3 Lesson 3: Team effectiveness is an important focus within any organisational change programme, but less up-to-date models of team effectiveness may not be ideally applicable to teams utilising technology.

Some findings of this thesis present new insights into the little-researched area of large-scale organisational change in healthcare involving automation, and the impact this has on the effectiveness of

healthcare (mainly pharmacy) teams. The NHS GG&C APR Programme is understood to be one of the largest scale automations in Europe, comprising 8 robots performing interlinked picking in the supply of medicines to around 4000 locations across the health board. Few studies were found which focused only on the experiences and attitudes of staff and impact of working teams working in an automated pharmacy system over time, with most studies only incorporating some data on staff views (33, 34, 36-40, 43-45, 50, 69, 89, 90) . A literature review identified a vast array of models of successful teams and it was decided that Hackman's theory would be an appropriate model to initially apply, as it is considered a founding model and was frequently referenced in the literature. Additionally, the evidence of applications of the Hackman model to the healthcare service was limited and this redesign presented an ideal opportunity for this to be examined. The model provides clearly defined characteristic which aided data extraction from the study findings.

One publication found directly reflected the Chapter 3 methodology in that it was applied to data collected from interdisciplinary teams working in a healthcare setting (140). The staff sampled in Vinokur-Kaplan's work were hospital or site based but were also part of a larger health network, much like the hospital and PDC teams sampled in this thesis. Vinokur-Kaplan also provided evidence to suggest that the Hackman model is an accurate and appropriate model of team effectiveness based on their data. The purpose of Chapter 3 was not to test the model itself (as per Vinokur-Kaplan) but to apply the model to this data set and to discuss the success of those teams a) operating after an innovative organisational change and b) in a setting rarely explored.

It could be argued that the redesign having a predominantly automated component may have a significant impact on the perceived success or effectiveness of the teams in question. The literature reviews conducted in this thesis were not focused on the detailed exploration of teams and technology. Furthermore, Hackman's model does not explore any technological dimension directly, nor was it derived specifically from the technological industry. This may call into question the choice to apply Hackman's model of team effectiveness to the teams operating post-automated redesign, as Hackman's model is not specifically aligned to be applied to teams operating with robotics or automation. It may be more appropriate in moving forward this area of study to look at a more specific model of team effectiveness in which technology is a key component. One such model could be the Actor-Network Theory. This model proposes that objects are treated as part of social networks within teams, as opposed to tools utilised by social network members (176). However, the Chapter 3 analysis was intended to provide a preliminary and general insight into the effectiveness of the NHS GG&C pharmacy teams in different sites after a large-scale redesign, providing insightful findings and opening doors to potential future research opportunities and discussions.

Lemieux-Charles and McGuire (177) in their extensive review of healthcare teams literature proposed that the way in which healthcare teams have been conceptualised and examined has evolved over the years. They highlighted that in spite of the array of published work on healthcare teams, there still appears to be no cohesive healthcare team effectiveness model available partly due to the limited function of research designs and methods. They proposed that rigorous conceptualisation of team dimensions, processes and traits, and outcomes are needed. Their ITEM model clarifies the multiple dimensions of health care teams, their processes and outcomes based on the findings of their extensive literature review. Due to the multifaceted and diverse nature of healthcare teams, they propose that over-arching organisational models are not suitable for application to very diverse healthcare teams, but that the adaption of existing models would yield better results in assessing the characteristics of successful healthcare teams. It may therefore not be possible to identify or develop one single model for effective healthcare teams, yet the application of different models may be a more suitable approach depending on the nature of the team in question. This poses a further opportunity for expansion and exploration of this theoretical area and what it might mean in relation to the APR Programme.

4.4. Strengths and Weaknesses of Study Design and Analysis

The selected hospital sites were selected for a number of reasons: two of the sites (one being the PDC) were sampled from the original Phase 1 investigation to allow for follow up; three new hospital sites were identified by the Steering Group as new sites for exploration; and all sites were chosen as the Steering Group felt that they would positively engage with the evaluation program to broaden the capture of the programme rollout. Participants were identified by team leads from each site. This in itself is perhaps a limitation as participants did not offer to volunteer at the first instance, but were approached and invited to participate. However, team leads were instrumental in suggesting potential participants who they felt could articulate their experience of the redesign well, as well as identifying exclusively participants who had been working for the NHS long enough to have experienced the redesign (i.e. since at least 2010). Team leads also helped ensure that participants spanned a range of job roles and grades in order to get a broad sample experiences.

Qualitative research in itself has limitations due to the subjective nature of the investigation. It can be confidently stated that measures were taken in this thesis to standardise and regulate the appropriateness of the research tools, data collection methods and analysis. The qualitative approach poses limitations in terms of the limited participant numbers it can accommodate. In 2012, the time of data collection, there were over 500 people working in the NHS GG&C acute hospital pharmacy setting

(178), yet only 36 people were interviewed. However, it would be neither feasible nor appropriate to have interviewed a large percentage or proportion of Pharmacy staff due to time and resource constraints. Furthermore, the aim of qualitative research methodologies is not to provide generalisable data, but to allow the detailed exploration of a limited number of human experiences on the same phenomenon. Qualitative methodologies can be useful when attempting to explore such a large-scale intervention in other ways. For example, if a more generalised data set was of interest, the current exploratory data and results from this MPhil thesis could inform the development and dissemination of a questionnaire to the complete workforce affected by this redesign. This would result in a focused quantitative data collected technique, not aimed at seeking general opinions from staff but their views on specific aspects of the redesign (such as communication/engagement and education and training) on a larger scale.

The interview schedule was extensive, allowing for thorough exploration of all elements of the redesign pre, during and post, and the topics contained within covered a vast array of relevant themes and job-related characteristics. The schedule itself was devised between two researchers and the questions decided by consensus. Interviews were also conducted in a methodologically robust manner, with participants being made fully aware of what participating involved and what their rights were.

The interview schedule contained a vast number of questions due to the interdisciplinary approach taken by the researchers who compiled the document. It could be argued that the schedule was overly-structured and specific. Many of the questions required factual responses from participant (e.g. years in job role, working hours, team structure etc.) that could have been answered using a written questionnaire, or through consultation with middle and senior management. The inclusion of these questions obviously made the interview process a lengthier one, which was not always suitable in the busy [pharmacy environment. Furthermore, participants were asked to reflect back to their pre, mid and post-redesign working experiences and apply the questions asked to all three points in time. This may not have been easy for some participants and there may have been some inaccuracies or difficulties in memory recall. The questions themselves were not designed to directly reflect Hackman's characteristics as the schedule was drawn up some time previous to the commencement of this MPhil. However, the questions asked (and topics covered) were reflected in Hackman's model. However in cases where data was not illustrative in either supporting or negating a characteristic, this was potentially due to participants not providing specific testimony related to these characteristics. The purpose of developing an interview schedule informed by theory is to make the interview a more open and objective exercise. However, it is recognised that it would have been of value to know whether those of Hackman's

characteristics that could not be commented on due to lack of data provided occurred as a result of a lack of participant response or an incompatibility of the Hackman model.

It may have been more desirable to conduct interviews with staff before, during and after the redesign in order to obtain accurate reflections of their experiences. A more semi-structured interview schedule and more developed demographics questionnaire in order to capture the more factual data in a convenient and time-efficient manner may have been more appropriate and efficient. Furthermore, if a specific aim of any future project is to apply the characteristics of a certain model to a specific phenomenon, then it would be more useful and methodologically robust if all of the model characteristic were reflected in the interview schedule questions. Additional questions could be asked where appropriate if need be. However, it was not the purpose of this MPhil project to test the applicability of the Hackman model, yet being able to explore all aspects of Hackman's model (if possible) would have been of interest.

The analysis and write up of the data commenced at least one year after the data had been collected. This did provide the researcher with ample opportunity to re-analyse the data and test the validity of the originally derived themes, as well as fully reflect on the lessons to be learned and the impact they would have on theoretical and practice-based levels. Objectivity was supported by a well organised data set. The interview data had been adequately recorded and stored in a way that was easily accessible and understandable, even after such time had passed. The analysis method chosen (content analysis) was considered a tested and robust method due to its previous extensive use in analysing qualitative data. Content analysis is also particularly applicable to data gathered in a healthcare setting (97-99, 101, 106, 118, 179-181).

The fact that the current scenario was depicting a large-scale organisational change may also impact on the outcomes of how appropriate a model may appear when applied to the data. Hackman's model does not stipulate specifically whether it can be applied to teams who have undergone an organisational change. However, in Chapter 2 the main focus was on the testimony provided by staff on their current jobs i.e. post-redesign. The data was collected a number of years post-redesign, therefore the focus of the interview was not to assess job experience at the point of redesign, but to get an overall picture of staff experiences including at the post-redesign time point. Although staff did provide comments about the redesign period, the focus of the Chapter 2 analysis was on the situation 2 years post-redesign. As data was collected 2 years post-redesign, it could be assumed that participants making comments on the shortfalls made at the point of redesign had a significant impact 2 years later, perhaps even only on an emotional level. This is therefore an important finding, as the conduct of change-implementers and the

decisions they make during a redesign could still have significant impacts on a team and on team performance years post-redesign.

The definitions of success or team effectiveness are of course debatable, given the quantity and variation of models available. No one singular model will be wholly applicable to every team scenario. The current redesign in question was highly complex in nature, involving major organisational change affecting approximately 513 Acute Hospital Pharmacy Staff (178), the introduction of a new physical premises for many staff, the reassignment of job roles, the introduction of technology and the introduction of a non-clinical job elements into a clinical job environment (for some), and all at a time when previous implementation examples were (and at this scale are still) very limited and not evidenced within the literature. Although Hackman's model provides an excellent starting point for exploring team success, it also provides the opportunity to identify areas of weakness and opportunities for further and deeper exploration.

One concept explored in the previous literature that was not directly addressed in this thesis was the role and impact of staff stress. Hackman's model does not encompass any team-based stress-management strategies specifically, and is therefore currently deficient in this theme. Times of organisational change can be stressful for staff members. Tavakoli (84) suggests that stress levels generally occur as a result of the way that staff are treated during the time of change, and are not as a result of the actual changes themselves. The previous literature states that acts must take place in the management of change-associated stress in order to avoid resistance to change, which mainly focused around communicating the ethos behind change and encouraging staff to participate fully and positively. Although it was clear from Chapter 2 that stress levels were high at the time of the redesign in 2010, staff did not report any specific attempts by management to address stress specifically. Although efforts were made to communicate the ethos of the change to staff, to involve them in decision-making, and to provide communications about the change, these efforts although well-meaning were not widespread enough in order to have an impact. The effectiveness of training on the reduction of staff stress cannot be commented on as formal staff training was non-existent in cases, although it may be relevant that staff training was low (and for some, absent) at a time when stress levels were high. The lack of engagement, the limited training and the early technological errors appeared to be early sources of stress which still impacted emotionally on staff 2 years post-redesign. Considering Häggström and colleagues' (85) research on the quality of healthcare and the levels of stress during organisational change are associated, as well as Wynne's (86) exploration of the Australian healthcare system reform in the 1990s where staff experienced high levels of stress, it would be of value to consider stress as an important factor both during the change process as

well as in the maintenance period afterwards. One factor detailed in the previous literature and supported by this thesis is the fact that the healthcare environment sees staff possess a sense of personal responsibility to safely and effectively care for the patient, perhaps heightening stress levels compared to other less person-centred or care-focused industries. Chapter 2 and 3 analyses demonstrated that staff were clear on who their end "consumer" was (generally the patient) and the sense of responsibility felt towards them was evident. The healthcare environment may therefore be uniquely stressful compared to other industries which do not involve a critical element of duty of care or safety. Some non-caring specific models of team effectiveness (and those characteristics relating to commitment to work and the associated stress levels) may not be inclusive enough for the patient and safety-focused Pharmacy work environment.

One other concept explored in the previous literature that was not directly addressed in this thesis was the relationship between increased skills and knowledge and confidence in staff members. None of Hackman's characteristics, or any of the interview schedule questions, directly addressed confidence levels at work, yet they did address the concept of knowledge, skills and training. Koch et al (83) highlighted that guided training as opposed to self-motivated training was useful in assisting an easy transition between pre and post change times, and resulted in a more confident workforce. Although confidence was not directly explored in this MPhil thesis, the impact on the adequate promotion of skills, knowledge and training appropriate for the job role was. It may not have been possible to assess levels of confidence due to the lack of any formal training present in the redesign; therefore there would have been no available data on the impact of any training strategy on confidence levels due to there being none. What this MPhil thesis adds is an interesting discussion on the importance of adequate and appropriate training, and not the methods or style in which training is provided, or knowledge and skills improved.

4.5. Recommendations for Potential NHS Strategy

Automation is currently and will continue to be implemented in the current NHS Pharmacy service, and aligns with current government policy. The lessons outlined in sections 4.1-4.3 of this thesis argue that staff commitment to, understanding of, and acceptance of automated organisational change in healthcare is key to the handling of the associated challenges. Understanding the level of job tasks and skills is important for the current and future technologically-based working environment of Pharmacy.

Although the Hackman model and/or other models of team effectiveness can provide a useful introductory exploration of the main challenges and successes of organisational redesign involving automation, it could be unsuitable for application in a redesign in healthcare involving the introduction of technology. These lessons can be applied to the pre-existing APR Programme as well as the current efforts to roll-out ward automation in Scotland in order to facilitate a smoother and more successful transition through the following recommendations for the NHS:

- Work should proceed to explore current models of team success with a technology focus that can be applied to healthcare teams at a post-redesign stage
- Specific strategies should be in place to enhance the communication channels with operational staff via middle management to better engage staff, hopefully resulting in an increase in buy-in and commitment to change. A realistic and sustainable level of consultation and influence awarded to front-line staff should be decided upon carefully, with staff morale and management commitment balanced well
- Current education and training strategies should be expanded to allow the appropriate skilling of staff depending on the nature and location of their work environment, ensuring full ramifications of a non-patient-facing work environment are made clear to staff transitioning from a clinical to an industrial work setting.
- Sustainable strategies should be developed and implemented to ensure that pharmacy staff do not lose their valuable clinical skills while working in a non-patient facing environment.

4.6. Conclusions

Research into large-scale automation within a healthcare setting is rare, therefore this redesign project, as well as this investigation into team experiences and the success of those teams, adds a new breadth and depth to what is already available. As automation in pharmacy is becoming increasingly popular, it may be a consideration for policy makers and theorists to explore and apply perhaps various healthcare models of team effectiveness, or team effectiveness models encompassing automation, that can be used as a tool pre-redesign to better prepare teams for redesign, and that can be applied post-redesign in order to track and shape success.

This MPhil thesis shows that although there will be technology-based issues and complications in any automated system, staff commitment to innovation, genuine staff buy-in to the ethos behind any redesign and the filtering of that ethos from high-level management through mid-level management to operational staff can be hugely contributing factors to the resolution of any issues, the development of

coping strategies, as well as the ultimate success and the perception of the service overall. It is not feasible to allow staff at all levels complete control and/or input to all aspects of a redesign. It is however essential that where appropriate and sustainable, staff at all levels are provided a genuine opportunity to provide council on decisions made, or at least to be communicated with in full about the overall impact of a redesign, as well as how it will affect them. Ensuring staff have access to education and training at an appropriate level, directly relating to job task, and that can be sustained in a way that is affordable and that inspires staff to continue working for the NHS and feel fulfilled by their job role is essential to the success of change, especially when involving a new technological element arguable far-removed form the clinical and social environment of the hospital pharmacy. Promoting the appropriate training may ease the staff turnover process and fulfil the Scottish Government's aim of ensuring the right people in the right numbers are in the right jobs, as well as result in a happier, more fulfilled workforce.

Although the APR Programme presented a number of successes and challenges, there was a general consensus of disappointment and some unmet expectations, yet coupled with a willingness to provide a successful service and a commitment to the patient and the organisation as a whole. However, regardless of the performance outcomes of any redesign, good or bad, ensuring staff are committed to and supportive of any change is crucial to the long-term success of the team. This engagement extends to the preparation of staff for the introduction of new systems (in this case, automation) through appropriate training. It is arguable that due to the large-scale nature of the innovation, the same performance standard issues (and subsequent resolution of those issues) may have still occurred even if appropriate measures had taken place to better prepare the workforce. What may have transpired in the face of more team-focused preparation could have been a more positive staff experience of the redesign and the development of better coping mechanisms in the face of adversity and challenge.

IX. References

1. Nikbakht-Van de Sande CVMV. Why a carefully designed, nurse-led intervention failed to meet expectations: the case of the care programme for palliative radiotherapy. European Journal of Oncology Nursing. 2014;18:151-8.

2. Bennie M, Van Der Meer R, Chalmers D, Dunlop E, Puangpee P, Jindal K, et al. NHS Greater Glasgow & Clyde Acute Pharmacy Redesign Programme. 2010.

3. Robinson S, Krishnan S, Hodge JC, Foreman A. Robot-assisted, volumetric tongue base reduction and pharyngeal surgery for obstructive sleep apnea. Operative Techniques in Otolaryngology-Head and Neck Surgery. 2012;23(1):48-55.

4. Gherman B, Pisla D, Vaida C, Plitea N. Development of inverse dynamic model for a surgical hybrid parallel robot with equivalent lumped masses. Robotics and Computer-Integrated Manufacturing. 2012;28(3):402-15.

5. Carbonnel M, Goetgheluck J, Frati A, Even M, Ayoubi JM. Robot-assisted laparoscopy for infertility treatment: current views. Fertility and Sterility. 2014;101(3):621-6.

6. Yoshimitsu K, Tanaka T, Ohnuma K, Miyawaki F, Hashimoto D, Masamune K. Prototype development of scrub nurse robot for laparoscopic surgery. International Congress Series. 2005;1281(0):845-50.

7. Tapper AM, Hannola M, Zeitlin R, Isojärvi J, Sintonen H, Ikonen TS. A systematic review and cost analysis of robot-assisted hysterectomy in malignant and benign conditions. European Journal of Obstetrics & Gynecology and Reproductive Biology. 2014;177:1-10.

8. Nezhat C, Lavie O, Lemyre M, Unal E, Nezhat CH, Nezhat F. Robot-assisted laparoscopic surgery in gynecology: scientific dream or reality? Fertility and Sterility. 2009;91(6):2620-2.

9. Lambaudie E, Narducci F, Bannier M, Jauffret C, Pouget N, Leblanc E, et al. Role of robot-assisted laparoscopy in adjuvant surgery for locally advanced cervical cancer. European Journal of Surgical Oncology 2010;36(4):409-13.

10. Bansal D, Cost NG, Bean CM, Vanderbrink BA, Schulte M, Noh PH. Infant robot-assisted laparoscopic upper urinary tract reconstructive surgery. Journal of Pediatric Urology. 2014;10(5):869-74.

11. Ghani KR, Trinh QD, Sammon J, Jeong W, Dabaja A, Menon M. Robot-assisted urological surgery: current status and future perspectives. Arab Journal of Urology. 2012;10(1):17-22.

12. Dong X, Raffles M, Guzman SC, Axinte D, Kell J. Design and analysis of a family of snake arm robots connected by compliant joints. Mechanism and Machine Theory. 2014;77(0):73-91.

13. Pisla D, Szilaghyi A, Vaida C, Plitea N. Kinematics and workspace modeling of a new hybrid robot used in minimally invasive surgery. Robotics and Computer-Integrated Manufacturing. 2013;29(2):463-74.

14. Elgezua I, Kobayashi Y, Fujie MG. Survey on current state-of-the-art in needle insertion robots: open challenges for application in real surgery. Procedia CIRP. 2013;5(0):94-9.

15. Fine HF, Wei W, Goldman RE, Simaan N. Robot-assisted ophthalmic surgery. Canadian Journal of Ophthalmology. 2010;45(6):581-4.

16. Schomburg JL, Haberman K, Willihnganz-Lawson KH, Shukla AR. Robot-assisted laparoscopic ureteral reimplantation: A single surgeon comparison to open surgery. Journal of Paediatric Urology. 2014;10(5):875-9.

17. Hassanein AH, Mailey BA, Dobke MK. Robot-assisted plastic surgery. Clinics in Plastic Surgery. 2012;39(4):419-24.

18. Pal B. Robot-assisted laparoscopic surgery: Just another toy? Apollo Medicine. 2012;9(3):239-41.

19. Farghaly SA. Current surgical treatment option, utilizing robot-assisted laparoscopic surgery in obese women with endometrial cancer: Farghaly's technique. Journal of the Egyptian National Cancer Institute. 2013;25(2):57-61.

20. Moradi Dalvand M, Shirinzadeh B. Motion control analysis of a parallel robot assisted minimally invasive surgery/microsurgery system (PRAMiSS). Robotics and Computer-Integrated Manufacturing. 2013;29(2):318-27.

21. Wen R, Tay WL, Nguyen BP, Chng CB, Chui CK. Hand gesture guided robot-assisted surgery based on a direct augmented reality interface. Computer Methods and Programs in Biomedicine. 2014;116(2):68-80.

22. Pisla D, Gherman B, Vaida C, Suciu M, Plitea N. An active hybrid parallel robot for minimally invasive surgery. Robotics and Computer-Integrated Manufacturing. 2013;29(4):203-21.

23. Lee SJ, Lee SC, Ahn HS. Design and control of tele-matched surgery robot. Mechatronics. 2014;24(5):395-406.

24. Weizer AZ, Ye Z, Hollingsworth JM, Dunn RL, Shah RB, Wolf JS, et al. Adoption of new technology and healthcare quality: surgical margins after robotic prostatectomy. Urology. 2007;70(1):96-100.

25. Mutter D, Bouras G, Marescaux J. Digital technologies and quality improvement in cancer surgery. The Journal of Cancer Surgery. 2005;31:689-94.

26. Bogue R. Robots in healthcare. Industrial Robot: An International Journal. 2011;38(3):218-23.

27. Agrawal A. Medication errors: prevention using information technology systems. British Journal of Clinical Pharmacology. 2009;67(6):681-6.

28. Alsultan MS, Khurshid F, Mayet YA, Al-jedai AH. Hospital pharmacy practice in Saudi Arabia: Dispensing and administration in the Riyadh region. Saudi Pharmaceutical Journal. 2012;20(4):307-15.

29. Barrett M, Oborn E, Orlikowski WJ, Yates J. Reconfiguring boundary relations: robotic innovations in pharmacy work. Organization Science. 2012;23(5):1448-66.

30. Bufarini C, Marinozzi A, Milani M, Omodeo Sale E, Paolucci D, Rosini V. Risk assessment of cytotoxic compounding: manual vs robotic. European Association of Hospital Pharmacists 18th Congress; Paris, France2013.

31. Chapuis C, Roustit M, Bal G, Schwebel C, Pansu P, David-Tchouda S, et al. Automated drug dispensing system reduces medication errors in an intensive care setting. Critical care medicine. 2010;38(12):2275-81.

32. Chen WH, Shen LJ, Guan RJ, Lin Wu FL. Assessment of an automatic robotic arm for dispensing of chemotherapy in a 2500-bed medical center. Journal of the Formosan Medical Association. 2013;112(4):193-200.

33. Crawford SY, Grussing PG, Clark TG, Rice JA. Staff attitudes about the use of robots in pharmacy before implementation of a robotic dispensing system. American Journal of Health-System Pharmacy. 1998;55(18):1907-14.

34. Franklin BD, O'Grady K, Vonica L, Popoola J, Jacklin A. An evaluation of two automated dispensing machines in UK hospital pharmacy. International Journal of Pharmacy Practice. 2008;16:47-53.

35. James LR, Demaree RG, Mulaik SA, Ladd RT. Validity generalisation in the context of situational models. Journal of Applied Psychology. 1992;77(1):3-14.

36. Lin AC, Huang YC, Punches G, Chen Y. Effect of a robotic prescription-filling system on pharmacy staff activities and prescription-filling time. American Journal Health-Systems Pharmacy. 2007;64(17):1832-9.

37. Masini C, Nanni O, Antaridi S, Gallegati D, Marri M, Paolucci D, et al. Automated preparation of chemotherapy: quality improvement and economic sustainability. American Journal of Health-System Pharmacy. 2014;71:579-85.

38. McMaster A, Lytle C. Pharmacy Robot and Bar Coding At The Nebraska Medical Center: Ensure Patient Safety. Nebraska Medical Centre, 2007.

39. Milani M, Rosini V, Omodeo Sale E. New technologies applied to anticancer drugs preparation. European Conference of Oncologypharmacy; Budapest, Hungary2012.

40. Palma E, Bufarini C. Robot-assisted preparation of oncology drugs: the role of nurses. International Journal of Pharmaceutics. 2012;439:286-8.

41. Pedersen CA, Schneider PJ, Scheckelhoff DJ. ASHP national survey of pharmacy practice in hospital settings: Dispensing and administration—2011. American Journal of Health-System Pharmacy. 2012;69(9):768-85.

42. Ruhle F, Braun R, Ostermann H. Impact of robotic dispensing machines in German pharmacies on business performance indicators. Libyan Journal of Medicine. 2009;4(4):146-51.

43. Walsh KE, Chui MA, Kieser MA, Williams SM, Sutter SL, Sutter JG. Exploring the impact of an automated prescription-filling device on community pharmacy technician workflow. Journal of the American Pharmacists Association : JAPhA. 2011;51(5):613-8.

44. Whittlesea C, Morgan C. Pharmacy technicians' views on automation. Hospital Pharmacy Europe. 2005.

45. Yaniv AW, Knoer SJ. Implementation of an i.v.-compounding robot in a hospital-based cancer center pharmacy. American Journal of Health-System Pharmacy. 2013;70(22):2030-7.

46. Lehnbom EC, Oliver KV, Baysari MT, Westbrook JI. Evidence briefings on interventions to improve medication safety. Australian Institute of Health Innovation, University of New South Wales, 2013 Contract No.: 2.

47. Jindal K, Puangpee P. Medicines Supply Chain - Examination of Robotic Systems for NHS Greater Glasgow & Clyde Glasgow. Glasgow, UK: University of Strathclyde; 2010.

48. Launch of the robotic pharmacy. Spectra. Scotland: NHS Tayside; 2011.

49. Enright SM. Supporting pharmaceutical care through automation. Topics in Hospital Pharmacy Management. 1992;12(3):73-82.

50. Seger AC, Churchill WW, Keohane AA, Belisle CD, Wong ST, Sylvester KW, et al. Impact of robotic antineoplastic preparation on safety, workflow, and costs. Journal of Oncology Practice. 2012;8(6):344-50.

51. Klein EG, Santora JA, Pascale PM, Kitrenos JG. Medication cart-filling time, accuracy, and cost with an automated dispensing system. American Journal of Health-System Pharmacy. 1994;51(9):1193-6.

52. Thielke TS. Automation support of patient-focused care. Topics in Hospital Pharmacy Management. 1994;14(1):53-9.

53. Osborne S, Brown L. Innovation, public policy and public services delivery in the UK. The word that would be king? Public Administration. 2011;89:1335-50.

54. P. KJ. Leading Change. Boston, MA: Harvard Business School Press; 1996.

55. M. KR, Stein BA, Jick TD. The Challenge of Organizational Change. New York: The Free Press; 1992.

56. Blackler F, Brown C. Evaluation and the impact of information technologies on people in organizations. Human Relations. 1985;38(3):213-31.

57. GP Workforce & Practice Populations - Introduction: Information Services Division; 2013 [cited 2014 12/05/2014]. Available from: http://www.isdscotland.org/Health-Topics/General-Practice/Workforce-and-Practice-Populations/.

58. Making the Most of My Medicines (MMyM): NHS GG&C; 2013 [12/05/2014]. Available from: http://www.nhsggc.org.uk/content/default.asp?page=s903_16.

59. Lewin K. Action Research and Minority Problems. Journal of Social Issues. 1946;2(4):34-46.

60. Work Positive Survey Results Oct 08 & May 09 comparison graphs. Pharmacy Prescribing Support Unit; 2009.

61. Bennie M, Van Der Meer R, Chalmers D, Corcoran ED, Puangpee PO, Jindal K, et al. Robotics within the medicines supply chain in NHS Scotland – results from a national survey. Glasgow: 2010 Contract No.: Commissioned report.

62. Van Der Meer R, Bennie M, Corcoran ED, Lannigan N. Early-stage experiences of the implementation of a large-scale robotic storage and distribution system in a hospital pharmacy service within a large UK Health Authority. European Journal of Hospital Pharmacy: Science and Practice. 2013;20(6):362-7.

63. Corcoran ED, Bennie M, Van Der Meer R, Lannigan N, editors. Early stage experiences of the implementation of a large scale robotic storage and distribution system in a hospital pharmacy service within a large UK Health Authority2014 2014/3.

64. Bennie M, Corcoran ED, Findlay P, Commander J, Lindsay C, Van Der Meer R. Impact of robotics-led organisational change on the pharmacy workforce - preliminary findings. Glasgow: 2013 Contract No.: Commissioned report.

65. Commander J, Lindsay C, Findlay P, Bennie M, Corcoran ED, Van Der Meer R, editors. 'Lean', new technologies and employment in public health services. Employees' Experiences in the National Health Service in Scotland; 2013 2013/6.

66. Goundrey-Smith S. Information Technology in Pharmacy. London: Springer-Verlag 2013.

67. Colquhoun A. Could automation improve efficiency and help pharmacies with cost saving? The Pharmaceutical Journal. 2010;285:587-91.

68. Fung E, Leung B. Do automated dispensing machines improve patient safety? . Canadian Journal of Hospital Pharmacy. 2009;62:516-9.

69. Brinklow N. A report assessing the impact of an automated dispensing system at King's College Hospital NHS Trust, London. King's College Hospital, 2006.

70. Fitzpatrick R, Cooke P, Southall C, Kuldhar K, Waters P. Evaluation of an automated dispensing system in a hospital pharmacy dispensary. . Pharmaceutical Journal. 2005;274:763-5.

71. Coleman B. Hospital pharmacy staff attitudes towards automated dispensing before and after implementation. Hospital Pharmacy. 2004;1:248-51.

72. Baumann A, Giovannetti P, O'Brien-Pallas L, Mallette C, Deber R, Blythe J, et al. Healthcare restructuring: the impact of job change. Nursing Leadership (CJNL). 2001;14(1):14-20.

73. Drainoni ML, Strickler G, Omans J. Redeployment of staff from state institutions: issues for state health policy makers. Administration and Policy in Mental Health. 1995;22(5):226-562.

74. McDonald R, Waring J, Harrison S. At the cutting edge? Modernisation and nostalgia in a hospital operating theatre department. . Sociology. 2006;40:1097-115.

75. Nettleton S, Burrow R, Watt I. Regulating medical bodies? The consequences of the 'modernisation' of the NHS and the disembodiment of clinical knowledge. Sociology of Health & Illness. 2008;30(3):333-48.

76. Dawson P. Organisational Change: A Processual Approach. london: Paul Chapman; 1994.

77. Dawson P. Beyond conventional change models: a processual perspective. Asia Pacific Journal of Human Resources. 1996;34(2):57-70.

78. Pettigrew A, Whipp R. Managing Change for Competitive Success. Cambridge: Blackwell; 1991.

79. Elving WJL. The role of communication in organisational change. Corporate Communications: An International Journal. 2005;10(2):129-38.

80. Mickan S, Rodger S. Characteristics of effective teams: a literature review. Australian health Review. 2000;23(3):201-8.

81. Stevens B, Lee SK, Law MP, Yamada J, Group CNNES. A qualitative examination of changing practice in Canadian neonatal intensive care units. Journal of Evaluation in Clinical Practice. 2007;13:287-94.

82. Bandura A. Self-Efficacy: The Exercise of Control. USA: W.H. Freeeman and Company; 1997.

83. Koch M, Englander M, Tegelberg Å, Wolf E. Successful clinical and organisational change in endodontic practice: a qualitative study. European Journal of Dental Education. 2013:n/a-n/a.

84. Tavakoli M. A positive approach to stress, resistance, and organizational change. Procedia - Social and Behavioral Sciences. 2010;5(0):1794-8.

85. Häggström E, Skovdahl K, Fläckman B, Kihlgren AL, Kihlgren M. Work satisfaction and dissatisfaction – caregivers' experiences after a two-year intervention in a newly opened nursing home. Journal of Clinical Nursing. 2005;14(1):9-19.

86. Wynne R. Ten autralian ICU nurses' perceptions of organisational restructuring. Australian Critical Care. 2004;17(1):16-24.

87. Bates DW. Using information technology to reduce rates of medication errors in hospitals. British medical Journal. 2000;320:788-91.

88. Brinklow N. A Report Assessing tthe Impactt of an Automated Dispensing System (ADS) at King's College Hospital NHS Trust. Kings College Hospital: Kings College Hospital

2006.

89. Barker KN, Pearson RE, Hepler CD, Smith WE, Pappas CA. Effect of an automated bedside dispensing machine on medication errors. American journal of hospital pharmacy. 1984;41(7):1352-8.

90. Borel JM, Rascati KL. Effect of an automated, nursing unit-based drug-dispensing device on medication errors. American Journal of Health-Systems Pharmacy. 1995;52(17):1875-9.

91. Novak LL, Holden RJ, Anders AH, Hong JY, Karsh BT. Using a sociotechnical framework to understand adaptions in health IT implementation. International Journal of Medical Informatics. 2013;82:e331-e44.

92. Ash JS, Berg M, Coiera E. Some unintended consequences of information technology in health care: the nature of patient care information system-related errors. Journal of the American Medical Informatics Association. 2004;11(2):104-12.

93. Koppel R, Wetterneck T, Telles JL, Karsh BT. Workarounds to barcode medication administration systems: their occurrence, causes, and threats to patient safety. Journal of the American Medical Informatics Association. 2008;15(4):408-23.

94. Han YY, Carcillo JA, Venkataraman ST, Clark RS, Watson RS, Nguyen TC, et al. Unexpected increased mortality after implementation of a commercially sold computerised physician order entry system. Pediatrics. 2005;116(6):1505-12.

95. Zhang Y, Wildemuth BM. Qualitative Analysis of Content. Applications of social research methods to questions in information and library science. Westport, CT. : Libraries Unlimited; 2009. p. 308-19.

96. Clark T, Holmes S. Fit for practice? An exploration of the development of newly qualified nurses using focus groups. International Journal of Nursing Studies. 2007;44:1210-20.

97. Duriau VJ, Reger RK, Pfarrer MD. A Content analysis of the content analysis literature in organization studies: research themes, data sources, and methodological refinements. Organizational Research Methods. 2007;10(1):5-34.

98. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. Nurse Education Today. 2004;24:105-12.

99. Holdford D. Content analysis methods for conducting research in social and administrative pharmacy. Research in Social and Administrative Pharmacy. 2008;4:173-81.

100. Martikainen S, Viitanen J, Korpela M, Laaveri T. Physicians' experiences of participation in healthcare IT development in Finland: willing but not able. International Journal of Medical Informatics. 2012;81:98-113.

101. McNeese-Smith DK. A content analysis of staff nurse descriptions of job satisfaction and dissatisfaction. Journal of Advanced Nursing. 1999;26(6):1332-41.

102. Murray MA, Smith Higuchi KA, Edwards N, Greenough M, Hoogeveen K. Practice change in long-term care facilities in Ontario: views of managers and staff. Geriatric Nursing. 2011;32(6):418-28.

103. Salm N, Yetter E, Tluczek A. Informing parents about positive newborn screen results: parents' recommendations. Journal of Child Health Care. 2012;16:367-81.

104. Tovey EJ, Adams AE. The changing nature of nurses' job satisfaction: an exploration fo sources of satisfaction in the 1990s. Journal of Advanced Nursing. 1999;30(1):150-8.

105. Williamson K, Williams KJ. Organisational justice, trust and perceptions of fairness in the implementation of agenda for change. Radiography. 2011;17:61-6.

106. Harwood TG, Garry T. An overview of content analysis. The Marketing Review. 2003;3:479-98.

107. Campbell C, Scott K, Madanhire C, Nyamukapa C, Gregson S. A 'good hospital': nurse and patient perceptions of good clinical care for HIV-positive people on antiretroviral treatment in rural Zimbabwe- a mixed-methods qualitative study. International Journal of Nursing Studies. 2011;48:175-83.

108. Skaperdas E, Tuepker A, Nicolaidis C, Robb JK, Kansagara D, Hickman DH. Congestive heart failure self-management among US veterans: the role of personal and professional advicates. Patient Education & Counselling. In press.

109. Saulo B, Walakira E, Darj E. Access to healthcare for disabled persons: how are blind people reached by HIV services? Sexual & Reproductive Healthcare. 2012;3:49-53.

110. Hamrosi KK, Raynor DK, Aslani P. Pharmacist and general practitioner ambivalence about providing written medicine information to patients- a qualitative study. Research in Social and Administrative Pharmacy. 2013;9:517-30.

111. Takman C, Severinsson E. A description of healthcare providers' perceptions of the needs of significant others in intensive care units in Norway and Sweden. Intensive and Critical Care Nursing. 2006;22:228-38.

112. Ammerman DJ, Watters J, Clinch JJ, Bebert PC, Wilson KG, Morris DB, et al. Exploring quality of life for patients undergoing major surgery: The perspectives of surgeons, other healthcare profesisonals, and patients. Surgery. 2007;141(1):100-9.

113. Kilpatrick K, Lavoie-Tremblay M, Ritchie JA, Lamothe L, Doran D, Rochefort C. How are acute care nurse practitioners enacting their roles in healthcare teams? A descriptive multiple-case study. International Journal of Nursing Studies. 2012;49:850-62.

114. Hidiroglu S, Ay P, Topozoglu A, Kalafat C, Karavus M. Resistance to vaccination: the atitudes and practices of primary healthcare workers confronting the H1N1 pandemic. Vaccine. 2010;28:8120-4.

115. Hollenberg D, Lytle M, Walji R, Cooley K. Addressing provider shortage in underserviced areas: the role of traditional, complimentary and alternative medicine (TCAM) providers in Canadian rural healthcare. European Journal of Integrative Medicine. 2013;5:15-26.

116. Salleh SH, Yusof NAM. A preliminary study on prepared culture amongst healthcare practitioners for nuclear and radiological emergency in Malaysia. Procedia- Social and Behavioural Sciences. 2013;81:416-21.

117. Murphy E, Dingwall R, Greatbatch D, Parker S, Watson P. Qualitative research methods in health technology assessment: a review of the literature. Health Technology Assessment. 1998;2(16).

118. Elo S, Kyngas H. The qualitative content analysis process. Journal of Advanced Nursing 2007;62(1):107-15.

119. Ingram H, Desombre T. Teamwork in healthcare: lessons from the literature and from good practice around the world. Journal of Management in Medicine. 1999;136(1):51-8.

120. Rasmussen TH, Jeppesen HJ. Teamwork and associated psychological factors: a review. Work & Stress. 2006;20(2):105-28.

121. Michalski W, King D. Forty Tools for Cross-Functional Teams. Portland OR: Productivity Press; 1998.

122. Kraft R. Utilizing Self-Managing Teams: Effective Behaviour of Team Leaders. Hamden, CN: Garland; 1999.

123. Needle D. Business in Context: An Introduction to Business and its Environment. 3rd Edition ed. London: Thomson Learning; 2001.

124. Hofstede G. Cultures and Organizations: Software of the Mind. London: McGraw-Hill; 1991.

125. Ghoshal S, Lampel J, Mintzberg H, Quinn JB. The Strategy Process. London: FT Prentice Hall; 2003.

126. Drucker P. The coming of a new organisation. Harvard Business Review. 1998;January-February:45-53.

127. Dixon R. Management Theory and Practice. Oxford: Butterworth-Heinemann; 1991.

128. Huczynski A, Buchanan D. Organizational Behaviour: An Introductory Text. 6th Edition ed. London: Prentice Hall; 2006.

129. Ahmed A, Siantonas G, Siantonas N. The 13 Key Performance Indicators for Highly Effective Teams. Sheffield: Greenleaf Publishing Limited; 2008.

130. Black JS, Gregersen HB. Participative decision-making: an integration of multiple dimensions. Human Relations. 1997;50(859-878).

131. Blechert TF, Christiansen MF, Kari N. Intraprofessional team building. American Journal of Occupational Therapy. 1987;41(9):576-82.

132. Bucholz S, Roth T. Creating The High Performance Team. Canada: John Wiley & Sons, Inc; 1987.

133. Firth-Cozens J. Celebrating teamwork. Quality in Health Care. 1998;7(supplement):S3-S7.

134. Gladstein DL. Groups in context: a model of task group effectiveness. Administrative Science Quarterly. 1984;29(4):499-517.

135. Morgan D, Zeffane R. Employee involvement, organizational change and trust in management. The International Journal of Human Resource Management. 2003;14(1):55-75.

136. Pearce JA, Ravlin EC. The design and activation of self-regulating work groups. Human Relations. 1987;40(11):751-82.

137. Varney GH. Building productive teams: An action guide and resource book. San Fransisco: Josey-Bass, Inc.; 1989.

138. Salas E, Cooke NJ, Rosen MA. On teams, teamwork and team performance: discoveries and developments. Human Factors: The Journal of the Human Factors and Ergonomics Society. 2008;50:540.

139. Schwartzmann HB. Research in Work Group Effectiveness: An anthropological critique. In: Associates PG, editor. Designing Effective Work Groups. San Francisco: Jossey-Bass; 1986.

140. Vinokur-Kaplan D. Treatment teams that work (and those that don't): an application of Hackman's group effectiveness model to interdisciplinary teams in psychiatric hospitals. Journal of Applied Behavioral Science. 1995;31(3):303-27.

141. Entin EE, Serfaty D. Adaptive team coordination. Human Factors: The Journal of the Human Factors and Ergonomics Society. 1999;41:312-25.

142. Naylor YK, Amazeen EL. The size-weight illusion in team lifting. Human Factors 2004;46:349-57.

143. West MA. Effective Teamwork. 1st edition ed. Leicester: British Psychological Society; 1994.

144. Headrick L, Wilcock PM, Batalden PB. Interprofessional working and continuing medical education. British Medical Journal. 1998;316(7):771-4.

145. Basoff BZ. Interdisciplinary education as a facet of health care policy: the impact of attitudinal research. Journal of Allied Health. 1983;3:280-6.

146. Capko J. Leadership teams key to succeed with managed care. American Medical News. 1996;39(30):34-6.

147. Loxley A. Collaboration in Health and Wellfare. London: Jessica Kingsley Publishers; 1997.

148. Xiao Y, Hunter WA, Mackenzie CF, Jefferies NJ, Horst RL. Task complexity in emergency medical care and its implications for team coordination. Human Factors 1996;38:636-45.

149. Hackman RJ. Groups That Work (and Those That Don't): Creating Conditions for Effective teamwork. San Francisco, CA: Joey Bass Inc., Publishers; 1990.

150. Green SG, Taber TD. The effects of three social decision schemes on decision group process. Organisational Behavious and Human Performance. 1980;25:97-106.

151. Mohammed S, Dumville BC. Team mental models in a team knowledge framework: expanding theory and measure across disciplinary boundaries. Journal of Organisational Behaviour. 2001;22:89-103.

152. Maple G. Early intervention: some issues in cooperative team work. Australian Occupational Therapy Journal. 1987;34(4):145-51.

153. Sunderstorm E, De Meuse KP, Futrell D. Work teams: applications and effectiveness. American Psychologist. 1990;45(2):120-33.

154. Goleman D. Working with Emotional Intelligence. London: Bloomsbury 1998.

155. Gorman JC, Cooke NJ, Amazeen PG, Winner JL, Duran JL, Pedersen HK, et al. Knowledge training versus process training: the effects of training protocol on team coordination and performance. Proceedings of the Human Factors and Ergonomics Society 51st Annual Meeting; Santa Monica, CA: Human Factors & Ergonomics Society; 2007. p. 382-7.

156. Hackman RJ. The design of work teams. In: Lorsch J, editor. Handbook of Organisational Behaviour. Englewood Cliffs, NJ: Prentice-Hall; 1987. p. 315-42.

157. Janis IL. Groupthink. 2nd ed ed. Boston: Houghton Miflin; 1982.

158. Whyte WF. Money and Motivation: An Analysis of Incentives in Industry. New York: Harper; 1955.

159. Agyris C. The incompleteness of social-psychological theory: exmaples from small group, cognitive consistency, and attribution research. American Psychologist. 1969;24(10):893-908.

160. Davis JH. Group Performance. Reading, Massacheusets: Addison-Wesley; 1969.

161. Steiner ID. Group Processes and Productivity. New York: Academic Press; 1972.

162. Hackman RJ, Brousseau KR, Weiss JA. The interaction of task design and group performance strategies in determining group effectiveness. Organisational Behaviour and Human Performance. 1976;16:350-65.

163. McGrath JE. Social Psychology: A Brief Introduction. New York: Holt, Reinhart & Winston; 1964.

164. Hackman RJ. Why Teams Don't Work. In: Scott Tindale R, Heath L, Edwards J, Posavac EJ, Bryant FB, Suarez-Balcazar Y, et al., editors. Theory and Research on Small Groups. New York: Plenum Press; 1998.

165. A Route Map to the 2020 Vision for Health and Social Care. Scotland: Scottish Government; 2013.

166. Prescription for Excellence: A Vision and Action Plan. Scotland: Scottish Government; 2013.

167. Implementing an Electronic Prescribing and Medicines Administration System: A Good Practice Guide. Health Improvement Scotland; 2014.

168. Fenton-O'Creevy M. Employee Involvement and the middle manager: saboteur or scapegoat? Human Resource Management Journal. 2001;11(1):24-40.

169. Cotton J, Vollrath DA, Froggatt KL, Lengnick-Hall ML, Jennings KR. Employee participation: diverse forms and different outcomes. Academy of Management Review. 1988;13(1):8-22.

170. Dachler HP, Wilpert B. Conceptual dimensions and boundaries of participation in organizations: a critical evaluation. Administrative Science Quarterly. 1978;23:1-39.

171. Miller KI, Mongue PR. Participation, satisfaction, and productivity: a meta-analytic review. . Academy of Management Journal. 1986;29:727-53.

172. Locke EA, Schweiger DM. Participation in decision-making: one more look. Research in Organizational Behavior. 1979;1:265-339.

173. Edmondson AC. Psychological safety and learning behavior in work teams. Administrative Science Quarterly. 1999;44:350-83.

174. Edmondson AC, Bohmer RM, Pisano GP. Disrupted routines: team learning and new technology implementation in hospitals. Administrative Science Quarterly. 2001;46:685-716.

175. Pols J, Moser I. Cold technologies versus warm care? On affective and social relations with and through care technologies. European Journal of Disability Research. 2009;3:159-78.

176. Latour B. On actor-network theory: a few clarifications. Soziale Welt. 1996;47:369-81.

177. Lemieux-Charles L, McGuire WL. What do we know about health care team effectiveness? a review of the literature. Medical Care Research and Review. 2006;63(3):263-300.

178. Pharmacy Workforce and Vacancies by Location of Service Delivery, Band, NHS Region and NHS Board: Information Services Division; 2012 [cited 2015 23rd April]. Available from: http://www.isdscotland.org/Health-Topics/Workforce/Publications/data-tables.asp#859.

179. Krippendorff K. Reliability in content analysis: some common misconceptions and recommendations. Human Communication Research. 2004;30(3):411-33.

180. Taylor-Clark KA, Mebane F, SteelFisher GK, Blendon RJ. News of disparity: content analysis of news coverage of African American healthcare inequalities in the USA, 1994-2004. Social Science & Medicine. 2007;65:405-17.

181. Vaismoradi M, Turunen H, Bondas T. Content analysis and thematic analysis: implications for conducting a qualitative descriptive study. Nursing and Health Sciences. in press.

X. Appendix 1: List and Total Number of Search Terms Used during Literature Search (n)

Database	Search Terms	Results (n)*
Science Direct	"organisational change"	988
	"organisational change" AND "healthcare"	40
	"robotics" AND "healthcare"	23
	"robotics" AND "pharmacy"	7
Web of Science	"organisational change"	625
	"organisational change" AND "healthcare"	34
	"robotics" AND "healthcare"	184
	"robotics" AND "pharmacy"	44
Wiley Online	"organisational change"	3377
	"organisational change" AND "healthcare"	120
	"robotics" AND "healthcare"	12
	"robotics" AND "pharmacy"	3
	TOTAL	**5457**

n= number of results for each search, including ALL articles (relevant, non-relevant, read and unread)

XI. Appendix 2: Interview Schedule

We are looking at the pharmacy redesign programme that has seen movement in pharmacy jobs across sites and on to wards as well as the introduction of robots. We want to ask some questions about the job you do now and how this compares to your job before mid-2010 when the PDC went live. We also want to ask some questions about the Redesign Programme itself and how it was implemented.

Basic data

What is your job title?

What grade are you on?

Do you work full-time or part-time?

What kind of employment contract do you have? (*Prompt: open ended, fixed term, temporary, apprenticeship)*

How many years have you worked here?

How many years have you worked for the NHS?

Do you work fixed hours?

Do you ever work beyond your set hours?

Are you paid for working extra hours?

Your current job

Where do you work? Did you choose/ were redeployed/ always worked here?

Who do you regard as the end users of the service you provide? *(Prompt: pharmacists or medical staff or hospital patients or other?)*

Can you tell me about what you typically do on a shift?

We would also like to ask you to compare the situation now with the situation before mid-2010 when the PDC went live and since to date:

Did your job title change?

Did your place of work change?

Was there any change in the primary user/customer for your services?

Did the tasks you undertook change? If yes, did they become more or less challenging, or stay the same?

Are these changes specifically attributable to the pharmacy redesign programme? If not, what programme?

For the most part, does your current job involve:

- Monotonous tasks

- Complex tasks
- Learning new things?

How did/have these characteristics of your job (i.e. around CURRENT JOB CONTENT) changed:

- compared with before mid-2010 when the PDC went live?
- at different times during the lifetime of the pharmacy redesign programme?
- are these changes specifically attributable to the pharmacy redesign programme or another change programme?

If other, what was the programme?

What knowledge and skills do you need to do your current job?

What things do you need to know about?

What things do you need to be able to do?

Is your current job well matched to your knowledge and skills? *(Prompt: need further training to cope with duties, present skills correspond well with duties, has the skills to cope with more demanding duties)*

How did/have these characteristics of your job (i.e. around SKILLS KNOWLEDGE REQUIRED AND MATCH WITH DUTIES) changed:

- compared with before mid-2010 when the PDC went live?
- at different times during the lifetime of the pharmacy redesign programme?
- are these changes specifically attributable to the pharmacy redesign programme or another change programme? If other, what was the programme?

Team/group work:

Do you work mainly on your own or as a team?

Does your work group or team have common tasks and can plan its work? If so, who decides the structure and timing of the work? (same team, alternating teams, head of team, has this changed?)

Does your job involve rotating tasks between yourself and colleagues and if you so, how and when does that occur*? (Prompt: who decides division of task and how – by skills, gender…, has this changed?*)

Comparing the situation now with that before mid-2010 when the PDC went live and since to date, did your work group or team change:

- In composition?
- In terms of who does what?
- In terms of how the teams work is managed?
- In how far the work team can make its own decisions?

Has your team's/your organisation's aims, objectives and targets changed? If so, how?

Has your team's/your organisation's engagement with your NHS customers/stakeholders changed? If so, how?

Are these changes specifically attributable to the pharmacy redesign programme? If not, what programme?

Pace:

Does your job involve working at very high speed and if so, to what extent? *(Prompt: example?)*

Does your job involve working to tight deadlines? If so, who/what determines the deadlines?

What determines your pace of work? *(Prompt: Work done by colleagues, Direct demands from people such as customers, patients etc.., Numerical production targets or performance targets, Automatic speed of a machine or movement of a product, Direct control of your boss)*

Are you able to choose/ change your speed or pace of work?

Do you have enough time to get the job done?

Can you take a break when you wish? *(Prompt: toilet, tea, cigarette break)*

How did/have these characteristics of your job (i.e. around PACE) changed:

- compared with before mid-2010 when the PDC went live?
- at different times during the lifetime of the pharmacy redesign programme?
- are these changes specifically attributable to the pharmacy redesign programme or another change programme? If other, what was the programme?

Control:

Are you able to choose or change the order of your tasks?

Are you able to choose or change your methods of work?

Are you able to choose or change the timing/hours of your work? How did/have these characteristics of your job (i.e. around CONTROL) changed:

- compared with before mid-2010 when the PDC went live?
- at different times during the lifetime of the pharmacy redesign programme?
- are these changes specifically attributable to the pharmacy redesign programme or another change programme? If other, what was the programme?

Performance expectations:

Do you know what is expected of you at work? *(Prompt: verbal/ written communication, less/more aware than before)*

Generally, does your job involve:

- Meeting precise quality standards (probe: technical/ attitudinal)
- Assessing yourself the quality of your own work (probe: reported to whom?)
- Solving unforeseen problems on your own (probe: an example?)

Are you involved in improving the work organisation or work processes of your department or organisation? *(Prompt: consultation, partnership forum, informal day-to-day team working)*

Are you consulted before targets for your work are set? *(Prompt: consultation process)*

How did/have these characteristics of your job (i.e. around TARGETS) changed:

- compared with before mid-2010 when the PDC went live?
- at different times during the lifetime of the pharmacy redesign programme?
- are these changes specifically attributable to the pharmacy redesign programme or another change programme? If other, what was the programme?

Training, development and progression:

Have you undergone any training to improve your skills in the last 12 months and since mid-2010 when the PDC went live? If so, when and how was this training provided? *(Prompt: provided by employer, paid for by self, on-the-job training with co-workers/ supervisors)*

If you have undergone training, how has the training improved your job? (*Prompt: helped to improve the way you work, feel job is more secure because of training, prospects for future employment are better)*

If you have not undergone training, have you asked for training and been refused? If so, why was it refused?

What sort of progression/promotion opportunities are available to you?

How did/have these characteristics of your job (i.e. around TRAINING AND PROGRESSION) changed:

- compared with before mid-2010 when the PDC went live?
- at different times during the lifetime of the pharmacy redesign programme?
- are these changes specifically attributable to the pharmacy redesign programme or another change programme? If other, what was the programme?

Voice/engagement:

Can you influence decisions that are important for your work? *(Prompt: example?)*

How did/have these characteristics of your job (i.e. around VOICE) changed:

- compared with before mid-2010 when the PDC went live?
- at different times during the lifetime of the pharmacy redesign programme?
- are these changes specifically attributable to the pharmacy redesign programme or another change programme? If other, what was the programme?

Relations with management and non-pharmacy staff:

Tell me about management and how well you work with them? Does this vary by level of management? *(Prompt: support, facilitation, command/ control)*

Tell me about your relations with non-pharmacy staff and how well you work with them? Does this vary by their occupation/role?

How did/have these characteristics of your job (i.e. around RELATIONSHIPS) changed:

- compared with before mid-2010 when the PDC went live?
- at different times during the lifetime of the pharmacy redesign programme?
- are these changes specifically attributable to the pharmacy redesign programme or another change programme? If other, what was the programme?

Commitment:

What do you like best and least about your job?

Do you experience stress in your work?

How did/have these characteristics of your job (i.e. around STRESS) changed:

- compared with before mid-2010 when the PDC went live?
- at different times during the lifetime of the pharmacy redesign programme?
- are these changes specifically attributable to the pharmacy redesign programme or another change programme? If other, what was the programme?

Does your job give you the feeling of work well done?

Overall, how satisfied are you with your current job?

Overall, how motivated/enthusiastic are you with your current job?

How did/have these characteristics of your job (i.e. around SATISFACTION and MOTIVATION) changed:

- compared with before mid-2010 when the PDC went live?
- at different times during the lifetime of the pharmacy redesign programme?
- are these changes specifically attributable to the pharmacy redesign programme or another change programme? If other, what was the programme?

In general, did the Pharmacy Redesign Programme build on existing practices/roles/ ways of working or did it represent a significant change in existing practice?

The Pharmacy Redesign Project

How were you informed about the objectives of the pharmacy redesign project before it happened? By whom? When?

What did you understand to be the reason for the pharmacy redesign project?

- Was it more about service improvement in terms of providing a better service to the end users of the service?
- Better outcomes for NHS stakeholders and patients?
- Better use of your/your team's people/skills;
- Or was it more about providing pharmacy staff (at different levels) with more interesting/challenging/rewarding jobs?
- Or was it more about value for money/efficiency / keeping within budgets / limiting future spending increases?

Thinking back to those objectives of the redesign project, do you think that these improvements that were envisaged have been realised?

Has your view of these improvements changed during the life of the Redesign Programme?

Was the project the best approach to achieve better clinical pharmacy care for patients?

Did managers/advocates of the Redesign Programme provide evidence to justify the changes being made? Describe how this was done.

Were you given enough information to understand what would happen to the service?

Were you given enough information to understand what would happen to your job?

Were you given an opportunity to influence the redesign project at the outset:

- Individually?
- Through your work group?
- Through your manager?
- Through your trade union?
- Other?

Were you given an opportunity to influence the redesign project at any stage:

- Individually?
- Through your work group?
- Through your manager?
- Through your trade union?
- Other?

How useful were NHS partnership structures in involving you in decision making around the redesign project?

What were your expectations of how your job would change? What were your views about that?

What did you expect of management at the time? Have your expectations changed? Were they different that before?

Did you trust those implementing the pharmacy redesign programme?

Did you feel supported by management at different times during the lifetime of the pharmacy redesign programme implementation? What about now?

How do you feel about what management "sold" to you versus the situation that occurred? Were they the same? If not, how did you cope?

Has your employer ever failed to meet any obligations that were promised to you since mid-2010 when the PDC went live?

Does your employer provide everything you need to work?

What do you think your organisation should provide for you to work*? (Prompt: tools, space, and safety)*

What changes would you recommend to improve the quality of pharmacy distribution services in NHS GG&C?

What changes would you recommend to improve the quality of your job?

What lessons should we take from the pharmacy redesign programme for similar projects in the future?

XII. Appendix 3: Participant Information Sheet

INFORMATION FOR INDIVIDUALS PARTICPATING IN THE PHARMACY REDESIGN INVESTIGATION

PARTICIPANT INFORMATION SHEET

Please read the following information carefully. If you are unsure of anything or would like more information, please do not hesitate to contact the team.

- **What is the purpose of the study?**

NHS Greater Glasgow & Clyde, Pharmacy and Human Resources at the University of Strathclyde want to know about your experiences of the pharmacy redesign now that the hospital you work in sources it's medicines from the Pharmacy Distribution Centre, as well as the MMyM scheme.

We want to ask you about your job, how it might have changed, how you feel about these changes and what your views are on improving the situation (if any).

- **Do I have to take part?**

No, your participation is entirely voluntary. You will be asked to sign a consent form to show that you understand the nature of this project and that you are happy to take part. You are free to withdraw at any time without giving a reason. Whether you decide to participate or not, it will not affect your current role within NHSGG&C.

- **What does taking part involve?**

You can take part in 1 or 2 activities:

You can take part a one-to-one interview. In a one-to-one interview, it will just be you and the interviewer in a room talking.

You can take part in a group interview. A group interview means that you will be asked alongside other co-workers some questions about your experience of the redesign. You are encouraged to discuss your answers within the group but it is mainly about your thoughts and opinions.

You can take part in whatever activity is more convenient for you, the interviewer and your co-workers. In either the one-to-one or group interview, the interviewer will have set questions that they will want to ask, but you are welcome to ask questions too. You will be asked to give some basic background information about yourself such as your age, and the area that you live in. We will not ask for your address or any other personal details.

The interview will last for approximately 1 hour. So that the interviewer can give you their full attention, the interviews will be audio-recorded.

What happens to the information?

The information from the interviews will be used look at the whole redesign, how successful it was and what possible issues could be highlighted as important for future projects. The information from this interview will be written up as a report for NHS GG&C and may also be published in an academic journal. Any information you provide will be anonymised and the data will be stored in either a locked filing cabinet or on a password protected electronic system. All the data will be destroyed at the end of the project.

- **Will my taking part in this study be kept confidential?**

Since some interviews are in a group setting, any information you provide in a group cannot be said to be truly confidential as other people were present at the time; however, all the data will be anonymised so you cannot be recognised. Any comments you make cannot be identified back to you.

- **Who is organising and funding this service evaluation?**

This study is funded by The Bridging The Gap Fund and is being carried out by staff in the Institute of Pharmacy and Biomedical Science and Human Resources Departments at the University of Strathclyde, Glasgow.

- **Ethical approval.**

Since this project is part of an evaluation of current service, it does not require ethical approval by either the NHS or University Research Ethics Committees.

- **What if I have any further questions?**

Please keep this information sheet for your records. If you would like more information about the study and wish to speak to someone, please feel free to contact either member of the team below.

Thank you for your time and cooperation.

Mrs Emma Dunlop Corcoran (Research Assistant) Email: emma.dunlop@strath.ac.uk
Ms Johanna Commander (Researcher) Email: Johanna.commander@strath.ac.uk
Strathclyde Institute of Pharmacy & Biomedical Sciences
University of Strathclyde
The Arbuthnott Building (Robertson Wing)
161 Cathedral Street, Glasgow G4 0NR

XIII. Appendix 4: Participant Consent Form

CONSENT FORM

Please INITIAL each box

1. I confirm that I have read and understand the information provided and that I have had the opportunity to ask questions. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason. ☐

3. I understand that the interview (discussion) will be audio-recorded and transcribed. ☐

4. I understand that any information provided will be anonymous and that I will not be identifiable. ☐

5. I understand that the results of this study may be published and any quotations used will be anonymised. ☐

6. I agree to take part in the study. ☐

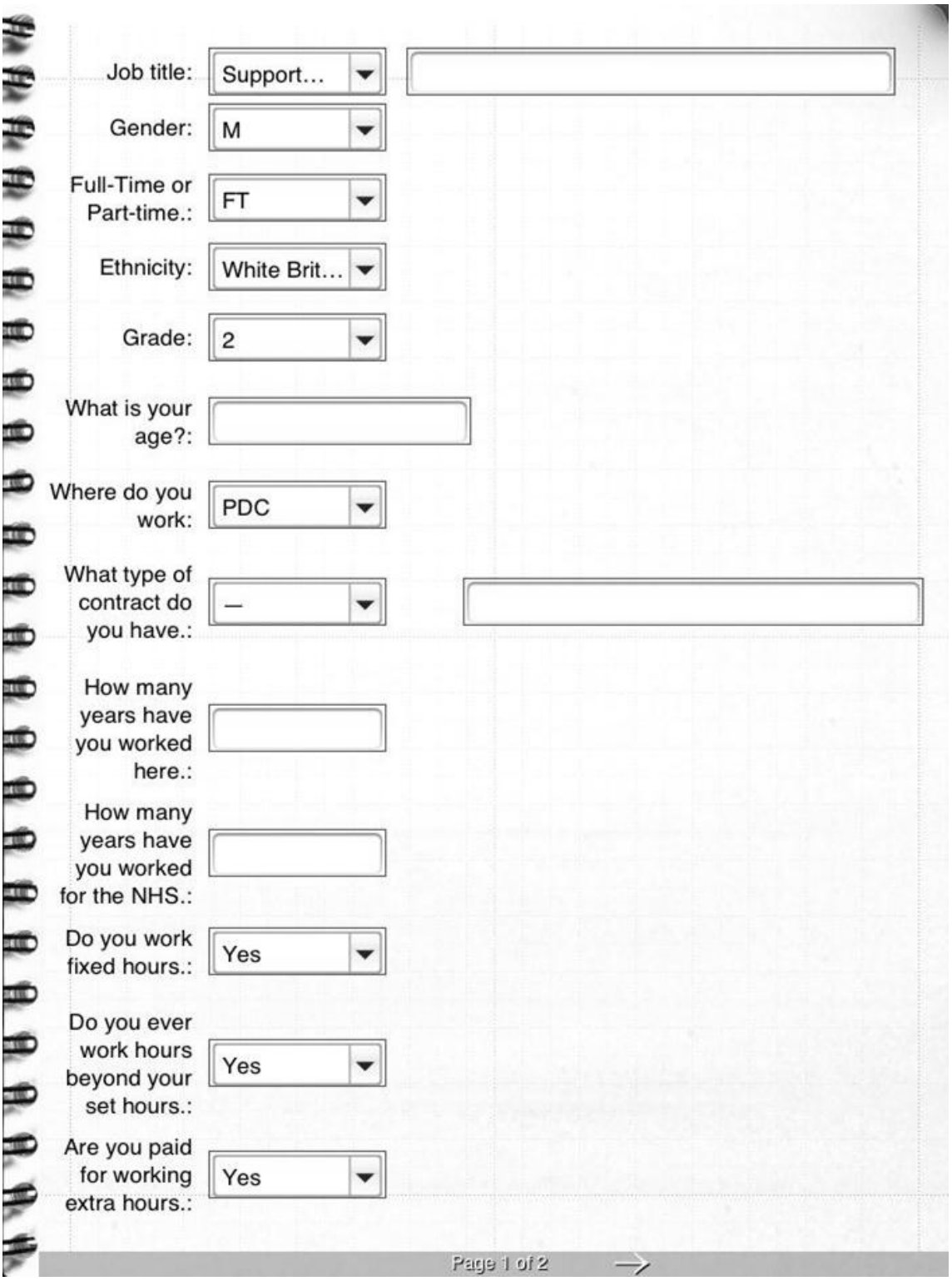
_____ _____ _____

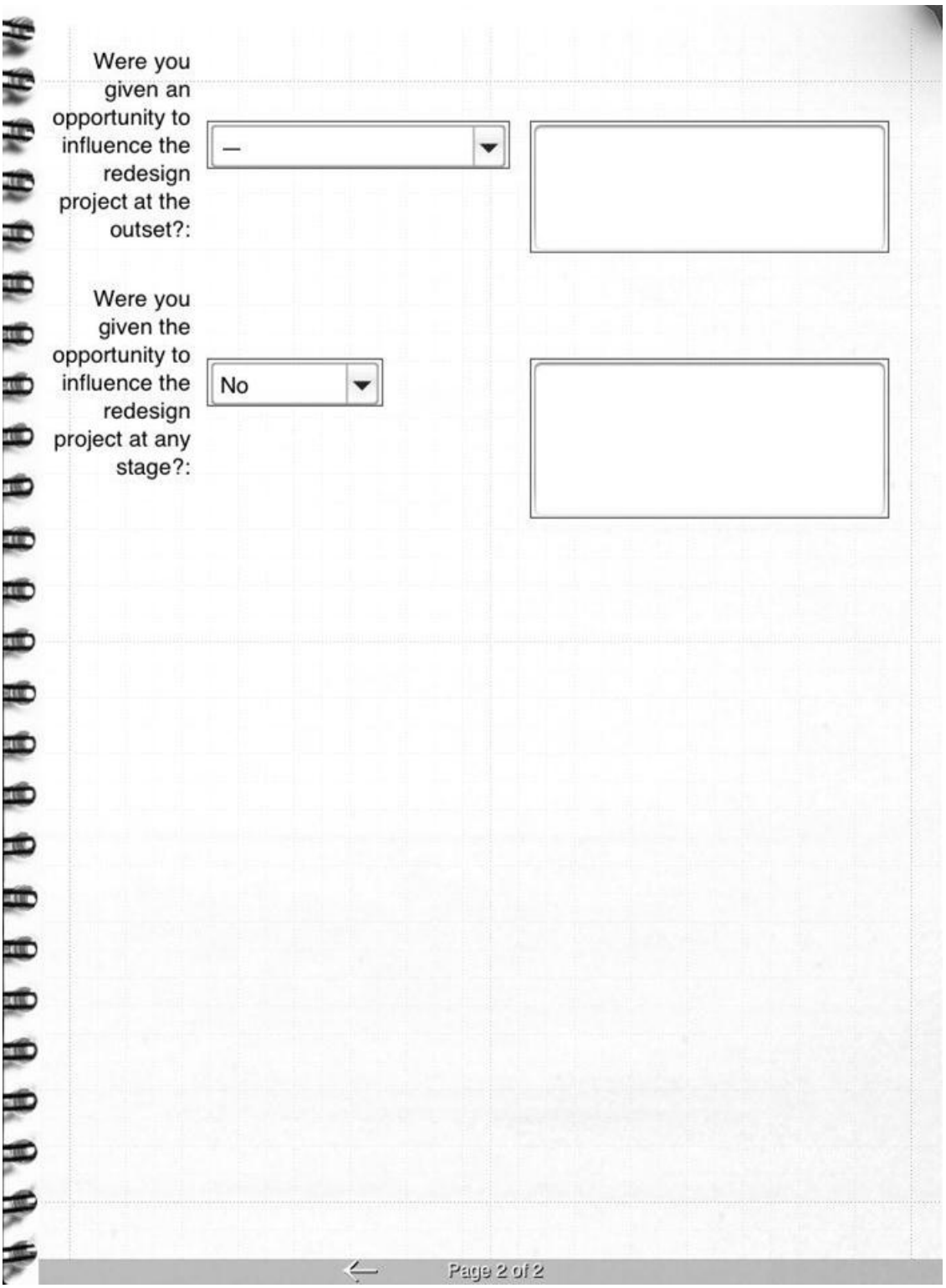
Name of Participant Date Signature

_____ _____ _____

Organiser Date Signature

XIV. Appendix 5: Participant Demographics *Form Connect* Screen Shot




Were you given an opportunity to influence the redesign project at the outset?:
—
Were you given the opportunity to influence the redesign project at any stage?:
No
Page 2 of 2

XV. Appendix 6: One-Page Potential Participant Flyer

NHS GG&C Acute Pharmacy Redesign Programme:

Experiences of NHS employees using robotic pharmacy distribution systems – lessons for policy and practice

An NHS Greater Glasgow and Clyde and University of Strathclyde Research Project

From 2010, NHS Greater Glasgow and Clyde introduced a programme to automate medicines distribution services for pharmacy. This programme has the potential to deliver important benefits in the efficient provision of pharmacy services. However, if the benefits of the programme are to be maximised, then automation must be aligned with new ways of working, and new opportunities for NHS employees to use and develop their skills.

This research project aims to examine the impact of Pharmacy Redesign Programme on NHS employees' experiences in the workplace. The project will identify good practice in HRM and training and development; but also explore the challenges encountered by NHS employees in making the Pharmacy Redesign Programme work on a day-to-day basis. Specifically, the research project aims to:

- describe the effectiveness of processes of consultation and partnership-working in re-engineering job roles and services under the Pharmacy Redesign Programme;
- identify good practice (and potential challenges) in aligning NHS employees' skills and job roles with new processes under the Pharmacy Redesign Programme;
- assess the role of the Pharmacy Redesign Programme in freeing NHS pharmacy employees to use their skills more effectively and engage in 'higher value added' tasks;
- assess the impact of the Pharmacy Redesign Programme on NHS employees' perceptions of 'job quality' and job satisfaction;
- identify lessons for policy and practice in relation to training and development, job role re-engineering, and employee consultation under future Redesign Programmes.

The research will involve in-depth interviews, undertaken in confidence with managers, employees and other relevant stakeholders at a number of NHS sites. A summary of findings and policy recommendations will be made available to all research participants.

Contacts:

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University of Strathclyde
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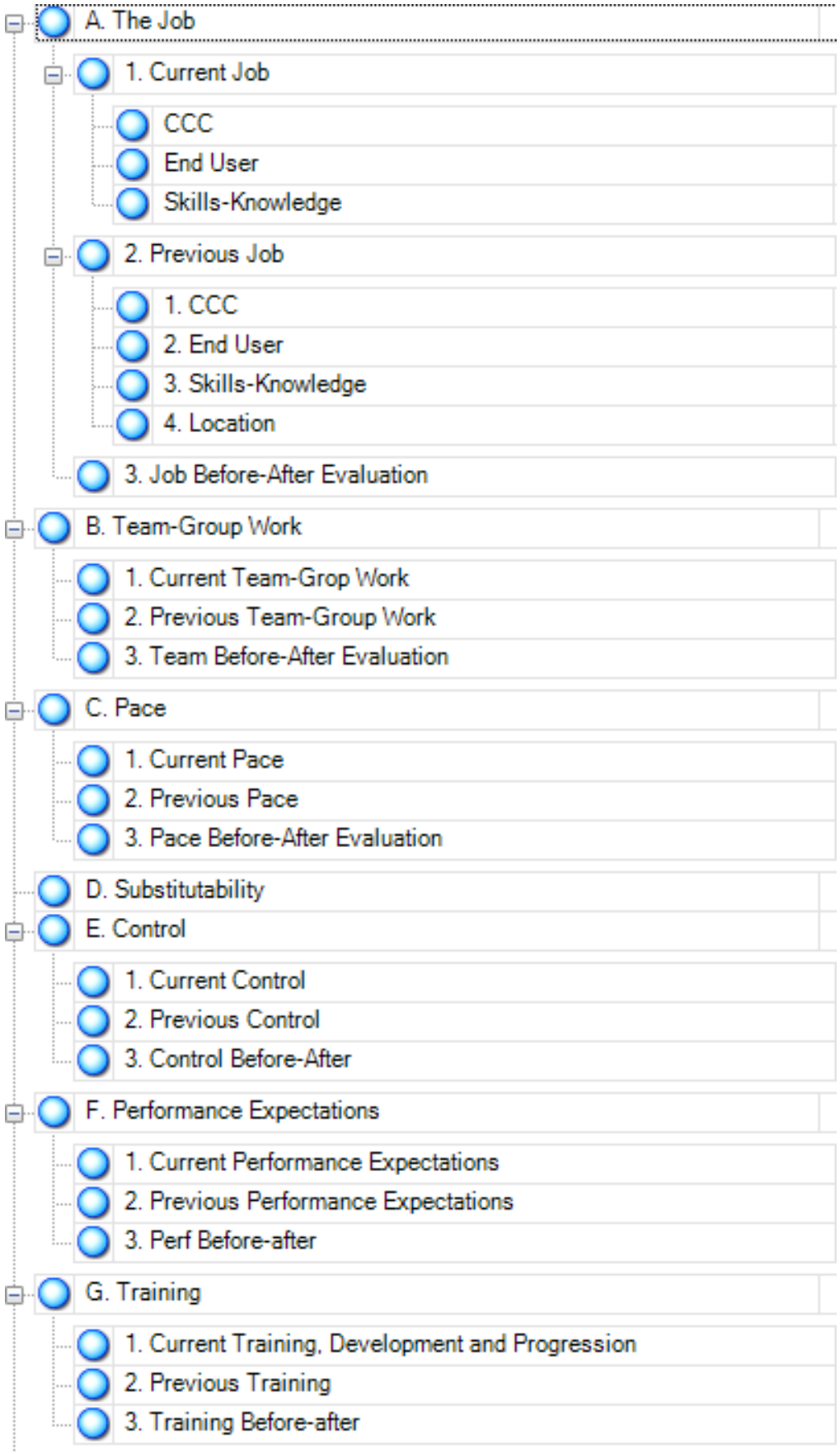
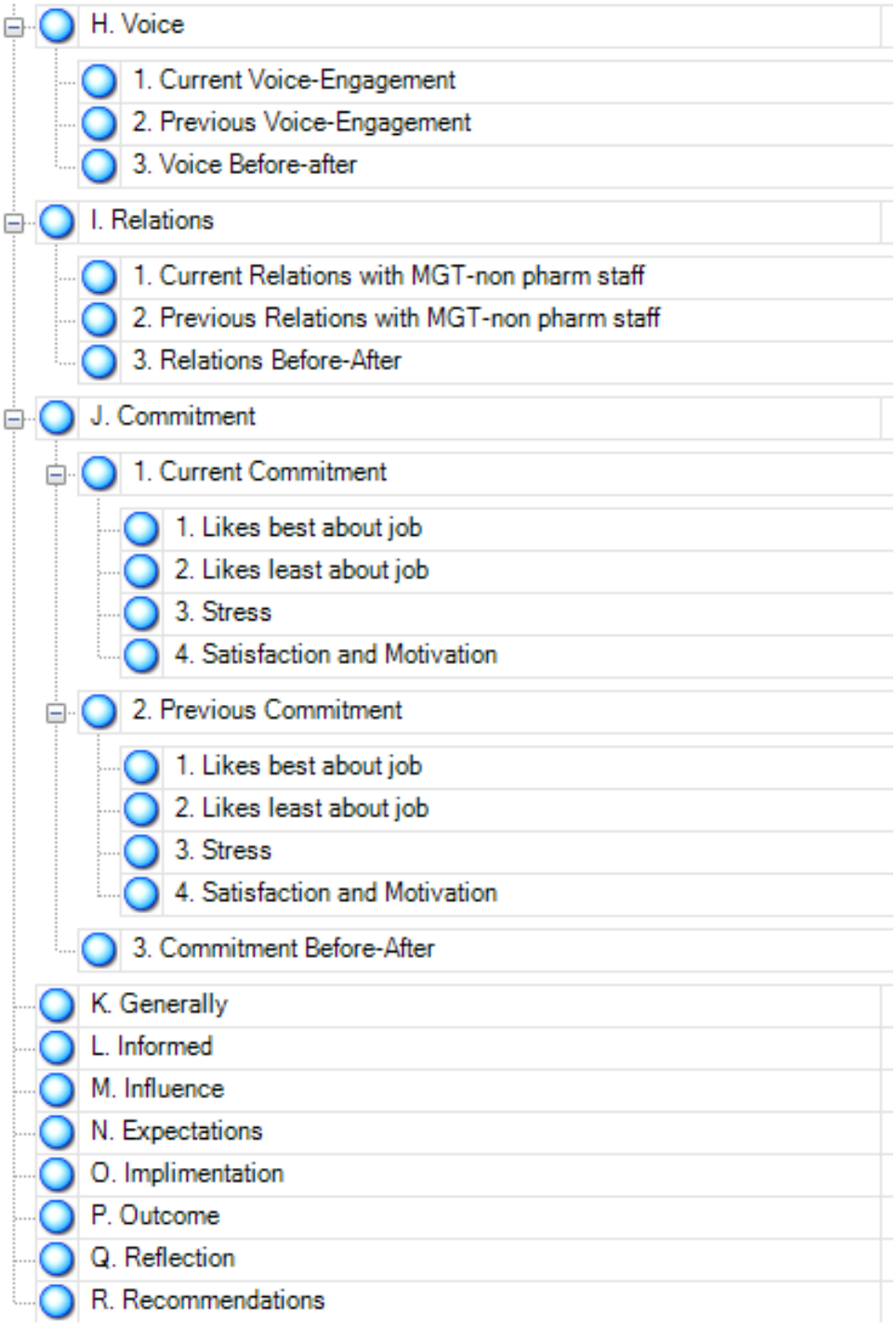
XVI. Appendix 7: *NVivo* Content analysis Node Tree




H. Voice
1. Current Voice-Engagement
2. Previous Voice-Engagement
3. Voice Before-after
I. Relations
1. Current Relations with MGT-non pharm staff
2. Previous Relations with MGT-non pharm staff
3. Relations Before-After
J. Commitment
1. Current Commitment
1. Likes best about job
2. Likes least about job
3. Stress
4. Satisfaction and Motivation
2. Previous Commitment
1. Likes best about job
2. Likes least about job
3. Stress
4. Satisfaction and Motivation
3. Commitment Before-After
K. Generally
L. Informed
M. Influence
N. Expectations
O. Implimentation
P. Outcome
Q. Reflection
R. Recommendations