Using implementation intentions to reduce self-harm

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Declaration of Authenticity and Author's Rights

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.

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Covid-19 Impact Statement

Originally, this programme of PhD work was designed to comprise two large studies. Study 1 was designed to test the effects of an implementation intention intervention (volitional help sheet) on self-harm behaviour in the community, at three months post-intervention. It was also designed to examine whether motivational and volitional constructs moderate the effectiveness of the intervention on self-harm behaviour. Study 2 was a clinical trial designed to test the effectiveness of an implementation intention intervention on self-harm related outcomes in people admitted to hospital using objective and self-report outcome measures, three months after intervention delivery. The study had also been designed to test the extent to which objectively measured cognitive abilities moderate the effects of the intervention on self-harm related outcomes. As a result of the covid-19 pandemic, the work had to be reviewed and adjusted substantially.

Study 1 was unaffected by the pandemic and is presented in this thesis in chapter 4. However, study 2 needed to be terminated. Prior to covid-19, the clinical trial had started in one NHS hospital in Scotland. This study was intended to be the main study in this programme of research, taking up the majority of development and data collection time. Eight months was spent planning and preparing the study, including: selecting and developing measures; arranging access to an NHS hospital and meeting with the psychiatric liaison team to identify the most appropriate recruitment procedures; securing NHS and university ethical approval; multiple supervisory team meetings; and addressing supervisory and ethical committee feedback. Data collection for the clinical trial started in January 2020. However, the study was paused six weeks later when lockdown measures were imposed in Scotland in March 2020.

As there was no knowledge of when clinical research could resume at the time, especially in hospital settings, the first six weeks of lockdown was spent monitoring the situation to identify if the research could resume. It became evident after these six weeks that the pandemic was escalating and a date for returning to the hospital to continue the research would be unknown for the foreseeable future. The clinical trial comprised patients who had been admitted to hospital for an episode of self-harm and the study protocols involved face-to-face cognitive testing. It was not possible to adapt this methodology in order to allow the research to continue amid the pandemic. Just 13 patients were recruited before the research was terminated. Baseline (pre-intervention) data were collected from these 13 participants. However, it was not possible to follow-up any participants three months later, due to covid-19 restrictions. By the time restrictions allowed the participants to be tested, too much time had passed since baseline. There was therefore no choice but to terminate the clinical trial.

As a result, a new study had to be developed to mitigate against the effects of covid-19 and to fulfil the requirements of a PhD degree. Study 2 presented in this thesis (chapter 5) was developed to replace the clinical trial. Time was therefore set aside to identify new aims and objectives which were in line with the wider literature and compatible with the research that had already taken place during the PhD (i.e., study 1). As face-to-face data collection was also not expected to be possible for a significant length of time, study 2 in this thesis therefore needed to be carried out online. It also needed to focus on a student sample in order to ensure a suitably sized sample could be collected during the periods of national lockdowns. The identification of measures that were suitable for online data collection while still allowing the broad aims of the PhD to be addressed, was also essential.

The clinical trial (originally planned as study 2), progressed to a stage where it could serve as a pilot and feasibility study of the protocols that were developed to administer the measures and interventions. This study presented in chapter 6 of this thesis.

Abstract

Implementation intentions (IMPs) are IF-THEN plans that require people to specify critical situations (e.g., situations that tempt a behaviour, such as self-harm) and link those situations with goal-directed responses (e.g., coping strategies). This research tested the effectiveness of an intervention technique (a volitional help sheet) designed to encourage the formation of IMPs to avoid self-harm thoughts and behaviour in the wider community. Chapter 1 discusses the prevalence and detrimental impact of self-harm behaviour and thoughts, and existing interventions. Chapter 2 introduces the concept of IMPs and reviews evidence suggesting that IMP interventions are likely to reduce self-harm. Potential motivational, volitional, and cognitive moderators of IMPs are also considered.

Following a consideration of key methodological issues relating to the design of the present research (chapter 3), study 1 is presented in chapter 4. Study 1 showed that an IMP intervention reduced self-harm behaviour in the critical situations specified in participants' plans. In line with expectations, this effect was observed only when individuals were motivated to reduce self-harm and experienced high levels of self-harm and suicide-related mental imagery. No effects were observed on other measured outcomes: self-harm in unspecified critical situations, suicidality, anxiety, and depression. Exposure to self-harm by friends and family did not moderate the effects of the intervention on any outcome measure.

Study 2 (chapter 5) showed that the IMP intervention reduced self-harm thoughts in the participants' specified critical situations. Consistent with study 1, this effect was observed only when individuals were motivated to stop thinking about self-harm. No effects of the intervention were largely observed on other outcome measures. Cognitive abilities (attention, and prospective and retrospective memory) did not moderate the

effects of the intervention on self-harm thoughts, suicidality, anxiety or depression. However, there was evidence that they moderated the effects of the intervention on self-harm behaviour.

Chapter 6 presents a pilot study for a clinical trial to test the effects of IMPs, and the moderators investigated in this thesis, on patients admitted to hospital for self-harm. A reflection on the pilot's methods and results is presented with a view to a future, full-scale clinical trial.

The overall findings across the three studies are discussed in chapter 7. Implications for practice and future research are presented.

Chapter 1: Introduction

Suicide is a global public health issue recognised by the World Health Organisation (WHO, 2021) with worldwide statistics showing that it is the fourth leading cause of death for people aged 15-29 (WHO, 2021). In the UK, the age-standardised suicide rate, for all ages, was 6.9 per 100,000 in 2019 (WHO, 2021). When comparing the suicide rates across the four regions in the UK, statistics showed that Scotland had the highest suicide rate with 14 per 100,000 in 2021 (Samaritans, n.d.). As suicide is an area of concern in the UK, national governments have developed national suicide prevention strategies. For example, 'Creating Hope Together' is the 10-year strategy published by the Scottish Government (2022a). It is recognised that one of the key risk factors for eventual suicide is engagement in self-harm (Geulayov et al., 2019; Hawton et al., 2020; Olfson et al., 2017).

There is therefore a need to focus on intervention development for self-harm to reduce suicide. This has been recognised in Scotland where a commitment has been made to develop a national self-harm strategy to go together with the national suicide prevention strategy (Scottish Government, 2022a). In addition, self-harm thoughts have been identified as a risk factor for self-harm behaviour (O'Connor & Kirtley, 2018). There is therefore also a need to focus on intervention development for self-harm thoughts as it may prevent future self-harm behaviour from occurring and thus also possibly reduce suicide. The broad aim of the research presented in this thesis was to develop interventions based on psychological theory, more specifically implementation intentions (Gollwitzer, 1993) and test their efficacy with respect to reductions in self-harm thoughts and behaviours. This thesis also aimed to identify groups of people for

whom implementation intentions are most efficacious with respect to reductions in self-harm and who subsequently could be targeted with this form of intervention.

The purpose of this first chapter is to provide background information about self-harm thoughts and behaviour. More specifically, the chapter will review the various definitions of self-harm that have been put forward by researchers and practitioners to arrive at an understanding of what constitutes self-harm and therefore specifying what target behaviour this thesis will focus on. The chapter will then report on the prevalence of self-harm thoughts and behaviour in the UK, to illustrate the extent of the problem. The impact of self-harm thoughts and behaviour on the individual and their loved ones and the wider impact on the economy will then be discussed further emphasising the need for effective interventions. Finally, the effectiveness of the current interventions that are used in an attempt to reduce self-harm thoughts and behaviour (i.e., pharmacological, psychological, brief contact, and digital) will be reviewed, in order to provide a context for the intervention developed and tested in the work subsequently presented in this thesis.

1.1 Definitions of self-harm

There is no one universal definition of self-harm in the literature. Rather, this is an area in which there is regular debate and nomenclatures have thus far not reached an international consensus (Goodfellow et al., 2020; Silverman, 2011; Silverman & De Leo, 2016). Some of the terms used across different parts of the world include ‘self-harm’, ‘non-suicidal self-injury’, ‘non-suicidal self-harm’, and ‘suicide attempt’. Likewise, various terms are used for self-harm thoughts which include ‘suicidal ideation’, ‘suicidal thoughts’, ‘non-suicidal self-injurious thoughts’ and ‘non-suicidal self-harm thoughts’. Clinical guidelines in the UK use the term ‘self-harm’ which is defined as the “intentional self-poisoning or self-injury irrespective of the apparent purpose of the act” (National

Institute of Health and Clinical Excellence [NICE], 2022, p.46). This definition was developed specifically for self-harm behaviour although it has also been used by researchers in the UK when studying both self-harm thoughts and behaviour (e.g., Kirtley et al., 2015; Nielsen et al., 2017). As the research presented in this thesis was primarily in the UK, the definition for the term 'self-harm' provided by NICE (2022) was deemed appropriate for the programme of work. It is recognised that some researchers choose to define self-harm with or without suicidal intent separately. The terms observed across UK research include 'non-suicidal self-harm', 'suicide attempt' 'non-suicidal self-harm thoughts'; and 'suicidal thoughts' (McManus et al., 2019; O'Connor et al., 2018). While a general agreement has been observed for what defines a suicide attempt (De Leo et al., 2021) definitions for self-harm without suicidal intent are found to differ between the UK and other parts of the world. For instance, in North America the term non-suicidal self-injury (NSSI; Klonsky, 2011) has been used to define self-harm without suicidal intent, but it specifically excludes 'self-poisoning' as a method of self-harm. As it has been found that individuals can engage in self-poisoning without suicidal intent (e.g., Chartrand et al., 2016; Cleare et al., 2021) excluding self-poisoning from the NSSI definition can mean that an individuals' behaviour is incorrectly classified (Kapur et al., 2013). Alternatively, in the UK, the term 'non-suicidal self-harm' includes self-poisoning in addition to self-injury. Thus, the scope of behaviours included within this definition is broader.

Although the terms 'suicide attempt' and 'non-suicidal self-harm' consider various methods of self-harm and clearly distinguish between the presence and absence of suicidal intent in the UK, researchers who support the NICE (2022) terminology (i.e., 'self-harm') have put forward the argument that intent to die cannot solely be relied upon to categorise behaviour (e.g., Kapur et al., 2013). This is because studies have

demonstrated that individuals report multiple motives for their self-harm (e.g., de Beurs et al., 2018; McAuliffe et al., 2007; Rasmussen et al., 2016). Likewise, there can be ambivalence in intent. This has been shown through individuals reporting an internal struggle between both a wish to live and die (Bryan, 2020), and feelings of disappointment following self-harm and later feeling grateful they had survived (Chesley & Loring-McNulty, 2003). The terminology and broad definition provided by NICE (2022) therefore could be argued to better capture the complexity of self-harm as its inclusion of behaviours is regardless of the motivation.

Overall, the definition for 'self-harm' provided by NICE (2022), that self-harm is intentional self-poisoning or injury irrespective of the apparent purpose of the act, will be used in this thesis[1]. This is because it is the definition most commonly used in contemporary UK research. As such, it will allow the results of the present programme of research to be compared with existing work. The NICE (2022) definition is also likely to be useful in the context of developing self-harm interventions as its inclusion of self-harm regardless of the purpose for the act will likely mean it can reach the maximum number of people who engage in self-harm. The next section of this thesis will review the prevalence statistics for self-harm to demonstrate that interventions are needed.

1.2 Prevalence of self-harm thoughts and behaviours

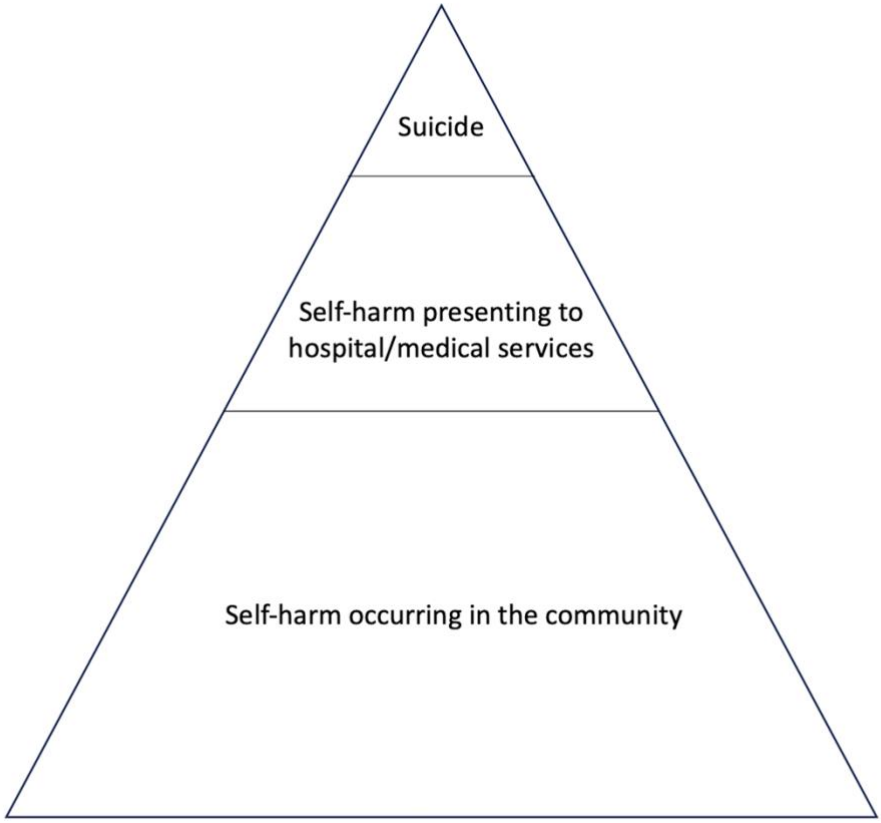
Evidence suggests that self-harm is a prevalent behaviour. All four nations in the UK, record official statistics on the number of people who present to medical services for self-harm. Public Health Scotland provide the most up to date statistics for inpatients (i.e., individuals admitted to hospital) diagnosed with self-harm for both adults and children. In

[1] For comparability with previous research, the term 'suicidality' which encompasses suicidal thoughts and behaviours will also be used to refer to one of the outcome measures used across the programme of work. This is described in further detail in Chapter 3 (section 3.4.1).

2021, 7,583 adults and 1,707 children were inpatients diagnosed with self-harm related injuries in Scotland (Marini, 2022). In England, 42,793 hospital admissions for self-harm in people aged 10-24 were reported in 2021/22 (Office for Health Improvement and Disparities, 2023). This equated to 427 per 100,000 persons. In Wales, approximately 5,500 admissions to hospital for self-harm occur each year (Welsh Government, 2015). In Northern Ireland, the national registry of self-harm reported a total of 8,945 self-harm presentations, by 6,196 individuals, to its 12 emergency departments in 2019/20 which equated to an overall age-standardised rate of 351 per 100,000 persons (Public Health Agency, 2022).

While hospital data provide a useful insight into the prevalence of self-harm, the actual number of people who carry out this behaviour is likely to be substantially higher than the hospital data suggest. This is because there are many cases of self-harm which do not come to the attention of medical services (McManus et al., 2019). This is demonstrated through the iceberg model of self-harm (Figure 1; reproduced based on Hawton et al., 2012). This model states that suicide is a rare event. Suicide cases therefore represent the tip of the iceberg. Self-harm cases that present to hospital and other medical services are more prevalent than suicide cases. They are therefore represented by the next section of the iceberg, below suicide cases. Subsequently, self-harm that occurs in the community and does not present to medical services is the most prevalent group of people (Hawton et al., 2012). This group is represented by the base of the iceberg, which is submerged and therefore hidden. In accordance with the iceberg model, it has been estimated that the incidence of self-harm in the community is approximately 10 times more than in people who present to hospital (Geulayov et al., 2018).

Figure 1. *Iceberg model of self-harm (recreated from Hawton et al., 2012)*



Information about the prevalence of self-harm in the general population comes from health surveys in both England and Scotland. In England, the Adult Psychiatric Morbidity Survey is specifically administered to collect information about the mental health and wellbeing in the adult population in England. This is administered every seven years. The 2014 survey found that 7.3% of adults reported ever having engaged in non-suicidal self-harm. Additionally, 6.7% of adults reported a suicide attempt in their lifetime (McManus et al., 2016). In Scotland, prevalence information for self-harm is informed by the Scottish Health Survey annually. The health survey results reported in 2021 (Scottish Government, 2022b) showed that the number of people having ever engaged in non-suicidal self-harm increased from 3% to 7% between 2008/9 and 2018/19 and that this

subsequently increased again in 2021 to 10%. The number of people reporting having ever made a suicide attempt increased from 4% to 7% between 2008/09 and 2018/19 and was a similar level in 2021 (6%).

Prevalence statistics relating to self-harm thoughts come mainly from data that are collected about suicidal ideation. Unlike data about the prevalence of self-harm behaviour, data about suicidal ideation are not routinely gathered via official statistics across the UK. The one exception is Northern Ireland where the Registry of Self-Harm reports the number of suicidal ideation presentations made to hospital. In the year 2019/20, 5,696 suicidal ideation presentations were made by 4,062 individuals in Northern Ireland and the overall age-standardised rate of ideation was 229 per 100,000 persons (Public Health Agency, 2022). In other parts of the UK, data about the prevalence of suicidal ideation is available from surveys rather than official data. For example, in England, the Adult Psychiatric Morbidity Survey found that 20.6% of adult respondents reported ever having thoughts about suicide and that 5.4% reported having so in the last year (McManus et al., 2016). In Wales, a recent wellbeing study that was launched due to Covid-19 found that 9.3% of adult respondents had experienced suicidal thoughts in the 11-16 weeks since the start of the pandemic (Knowles et al., 2022). The authors of this study acknowledged that this prevalence statistic was likely higher than pre-pandemic levels and referred to the 5.4% who reported experiencing suicidal thoughts in the past year in the Adult Psychiatric Morbidity Survey as a UK estimate (McManus et al., 2016). In Scotland, a national prevalence study of young adults between the ages of 18 and 34 years old, found that 22.8% of respondents reported suicidal ideation in their lifetime and 10.4% reported experiencing these thoughts in the last 12 months (O'Connor et al., 2018).

It is also worth noting that official data and data from health surveys about the prevalence of suicidal ideation taps into thoughts about self-harm with the purpose of suicide only (i.e., suicidal intent); they do not take into account non-suicidal self-harm thoughts. It is therefore likely that the above cited prevalence estimates for self-harm thoughts, provided by official data (for Northern Ireland) and surveys (for England, Wales and Scotland) on suicidal ideation, represent an under-estimate the total number of people in the population that are negatively impacted by self-harm thoughts. Although, in Scotland, the prevalence of self-harm thoughts without suicidal intent was also investigated by O'Connor et al. (2018). In addition to the prevalence statistics for suicidal ideation reported above, the authors found that 15.7% of young adults reported having non-suicidal self-harm thoughts within their lifetime and 7.3% reported having them in the past 12 months.

Overall, from the prevalence statistics provided in this subsection, both self-harm thoughts and behaviour are an area of concern across the UK. Official statistics show that a large number of people present to hospital for self-harm and self-harm thoughts. In addition, a lot of self-harm is hidden and does not present to medical services. The next subsection will discuss the detrimental effects self-harm has on an individual and their loved ones and on the economy.

1.3 The detrimental effects of self-harm

As mentioned above, self-harm is one of the key risk factors for future suicide. Self-harm has been found to increase the risk of suicide in the UK (e.g., Geulayov et al., 2019; Hawton et al., 2020; Hawton et al., 2015; Murphy et al., 2012) and other countries (Beckman et al., 2016; Chen et al., 2011; Kuo et al., 2012; Olfson et al., 2017). In the UK, it has been found that those who had presented to hospital for self-harm were more likely to have their life expectancy reduced by 30 years, compared to the general population

(Bergen et al., 2012). As such, self-harm can result in premature death, which is measured as years of life lost. The Global Burden of Disease Study 2019 reported that for young people aged 10-24, across 31 countries in Europe, self-harm was the leading contributor for years of life lost, across all mental health conditions, reporting 319.6 years of life lost per 100,000 population (Castelpietra et al., 2022). Self-harm can also have other detrimental effects on an individual. For example, an individual may cut a nerve when engaging in self-harm. This can result in short-term consequences where the individual needs to let the injury heal for a few weeks. However, if an injury cannot heal because of nerve damage, an individual may experience long-term consequences, such as reduced mobility where the damage occurred (Scottish Public Health Observatory, 2018). These types of consequences reduce the number of years an individual spends in full health which is measured as years lived with disability. The Global Burden of Disease Study 2019 reported a total count of 2,621 years lived with disability due to self-harm (Castelpietra et al., 2022).

Self-harm thoughts also have negative consequences. Those who experience self-harm thoughts only have been found to report greater emotional pain sensitivity and pain specific cognitions (e.g., feelings of distress) compared with individuals who have no history of self-harm thoughts or behaviours (Kirtley et al., 2015). Furthermore, individuals who experience self-harm ideation, which includes thoughts, urges and/or the drive to self-harm, have reported significantly higher depression scores and significantly lower scores for reappraisal coping (i.e., being able to reinterpret or readdress a situation) compared to those who do not. This is the case even if they do not engage in self-harm behaviour (Nielsen et al., 2017).

Self-harm is also known to have detrimental effects on the friends and relatives of the individual who engages in the behaviour. For example, research has consistently

shown that there is a psychological impact on parents when a young person self-harms. This includes feelings of guilt, shame, sadness, shock, and fear in response to the young person's self-harm (e.g., Buus et al., 2014; Ferrey et al., 2016; Hughes et al., 2017; Townsend et al., 2022). Additionally, an individual's other relationships (e.g., spouses, siblings, and a close friend) have also reported negative experiences when the person presents to hospital following an episode of self-harm. These include physical and psychosomatic responses such as shock and feelings of nausea. Psychological responses including anger, stress and feelings of anxiety have also been reported by these individuals. A feeling of being on 'high alert' was also reported by participants following the episode of self-harm in case their loved one engaged in further self-harm leading to them taking their own life (Spillane et al., 2020). Siblings have also reported feelings of responsibility to care for their family member who engaged in self-harm which had a negative effect on them (e.g., feelings of isolation and worry; Spillane et al., 2020). The negative effect of self-harm on friends and family has also been found to have a detrimental effect on the individual who engaged in self-harm, including feelings of guilt and shame, when thinking about the effect their behaviour has on their loved ones (Hambleton et al., 2020; Wadman et al., 2018; Woodley et al., 2021).

Self-harm has also been observed to have an economic impact. This has been shown in a study that estimated the hospital costs of self-harm in England in 2013 to be £128.6 million (Tsiachristas et al., 2020). The economic costs of self-harm that are incurred by hospitals include the provision of services. These include a psychosocial assessment, which is used to identify a person's needs and vulnerabilities and to help prepare subsequent care (NICE, 2022), medical treatment costs which include attendance to emergency departments, treatment in the emergency department and hospital wards, and a stay as an inpatient. In addition, it has been found that there can be additional costs

following an episode of self-harm. The largest proportion of these costs have been reported for psychiatric care (69%) in the year following an episode of self-harm (Sinclair et al., 2011). This was followed by social service costs (13%) which included social service visits and residential placements. It is therefore likely that the true cost of an episode of self-harm that presents to hospital is greater than what is currently known.

The evidence in this subsection has shown that self-harm and self-harm thoughts have a detrimental impact on the individual and their loved ones and have economic consequences. These negative impacts of self-harm therefore emphasise the need for effective interventions. The next subsection in this thesis will therefore consider existing interventions for self-harm and self-harm thoughts.

1.4 Interventions for self-harm thoughts and behaviours

There are four types of intervention that have been used to reduce self-harm: pharmacological, psychological, brief contact, and digital. This section of the thesis will review the evidence for the effectiveness of these interventions in adults. The effectiveness of these different interventions will be considered in terms of their ability to reduce self-harm behaviour. The effectiveness of the different types of intervention are also reflected on in their ability to reduce suicidal ideation on account of suicidal ideation being able to provide information about self-harm thoughts (see section 1.2).

1.4.1 Pharmacological interventions

Pharmacological interventions for self-harm include antidepressants, antipsychotics, mood stabilisers and natural products (e.g., omega-3 essential fatty acid). Generally, pharmacological treatments aim to help individuals manage mental health conditions through the administration of medications (e.g., selective serotonin reuptake inhibitors are an antidepressant medication designed to treat the chemical imbalance of serotonin). As self-harm is typically not the primary reason for the administration of a

pharmacological intervention, there are therefore few studies testing the effects of pharmacological interventions on self-harm as a primary outcome.

1.4.1.1 Effects on self-harm behaviour

For the most part, pharmacological interventions tested in patients presenting to hospital for self-harm, have not been found to significantly reduce self-harm behaviour when compared to a control condition (Hallahan et al., 2007; Lauterbach et al., 2008; Montgomery et al., 1983). For the antidepressant paroxetine it was also observed that there was no overall difference between conditions. However, when adjusting for the previous number of suicide attempts, a significant reduction in future suicide attempts was observed for the intervention condition compared to the control group (Verkes et al., 1998). In addition, two studies have produced mixed results for antipsychotics. In the first study, a significant reduction in the repetition of self-harm behaviour was observed over a six-month period for participants being treated with flupenthixol compared with a placebo condition (Montgomery et al., 1979, as cited in Witt et al., 2021a). However, in the second study, participants treated with a low dose of the antipsychotic medication fluphenazine showed no significant reduction in self-harm at six-month follow-up compared with participants treated with an ultra-low dose (Battaglia et al., 1999). As two different medications were tested in these two different studies and different approaches were taken for the control condition (i.e., placebo vs. alternative dose), further research would be required to explain the conflicting findings with regards to the effectiveness of pharmacological drugs for reducing self-harm behaviour.

In addition to the two studies cited above, a Cochrane review summarising the empirical evidence for the effectiveness of pharmacological interventions on self-harm identified one ongoing study testing the effects of ketamine on non-suicidal self-injury

(Witt et al., 2021a). However, this is not estimated to be complete until 2024 (National Library of Medicine, date accessed 15/06/23).

1.4.1.2 Effects on suicidal ideation

In the above cited Cochrane review (Witt et al., 2021a), two studies were identified that tested the effects of pharmacological interventions on suicidal ideation (i.e., Hallahan et al., 2007; Lauterbach et al., 2008). In the first study, Hallahan et al. (2007) found that a significantly greater number of individuals in the intervention group (who took an omega-3 fatty acid supplement) reported no suicidal ideation at 12-week post-intervention compared to the control condition (who took a placebo supplement). However, this study was limited as it used a measure of auto-aggression (aggression towards the self) to indicate suicidal ideation. It is unclear how auto-aggression is a measure of suicidal ideation; a direct frequency measure of suicidal ideation would be more suitable (e.g., Chang & Chang, 2016). In the second study that was included in Witt et al.'s (2021a) review, Lauterbach et al. (2008) found that a mood stabiliser (i.e., lithium) did not reduce the number of patients who reported experiencing suicidal ideation at post-intervention compared to the control condition who received a placebo. Another empirical review by Wilkinson et al. (2018) provided a meta-analysis of $n = 8$ comparison intervention trials in patients receiving clinical treatment for a psychiatric disorder. The review showed that a single dose of ketamine (a drug used for the treatment of depression) significantly reduced suicidal ideation in the short term, at both one day and one week follow-up, compared to a control group who either received a placebo (i.e., saline solution) or alternative medication (i.e., midazolam).

1.4.1.3 Conclusions about pharmacological interventions

Overall, evidence that pharmacological interventions represent an effective means for reducing self-harm behaviour and suicidal ideation is currently limited. Across the

small number of studies that have tested the effects of pharmacological interventions on self-harm behaviour and suicidal ideation, the evidence is mixed. Any reductions in self-harm behaviour or suicidal ideation tend to be based on single trials. A possible reason for a generally demonstrated lack of effectiveness of pharmacological treatments on self-harm behaviour and suicidal ideation is that pharmacological treatments are prescribed for another purpose than self-harm (e.g., depression; NICE, 2022). Therefore, they are not a sole treatment for self-harm behaviour or suicidal ideation. For this reason and also because the NICE (2022) guidelines advise against the use of pharmacological interventions, alternative interventions are therefore necessary.

1.4.2 Psychological interventions

Psychological interventions for self-harm include cognitive behavioural therapy-based psychotherapy (Slee et al., 2008), dialectal behavioural therapy (Linehan et al., 2006), collaborative assessment and management of suicidality (Jobes, 2023), emotion-regulation psychotherapy (Gratz & Gunderson, 2006), and mentalisation-based therapy (Bateman & Fonagy, 2009). Psychological interventions aim to reduce distress by using various techniques which include psychoeducation (information about self-harm is provided by the therapist to the individual), developing problem solving skills, and identifying triggers for self-harm and developing coping responses. These psychological approaches for reducing self-harm are typically delivered face-to-face at an individual- (i.e., the person discusses their thoughts, feelings and/or behaviours one-to-one with a therapist) and/or group-level (i.e., working alongside others to discuss their thoughts, feelings and/or behaviours with a therapist).

While psychological interventions are designed to be delivered over the longer-term (e.g., Andreasson et al., 2016) there are also brief psychological interventions. These include safety planning (Stanley & Brown, 2012), the attempted suicide short

intervention programme (Gysin-Maillart et al., 2016), motivational interviewing (Britton et al., 2011), and the teachable moment brief intervention (O'Connor et al., 2015). These interventions also aim to reduce distress by using various techniques including the identification of triggers for self-harm and the development of coping responses, psychoeducation and discussing what led to the most recent episode of self-harm. Brief psychological interventions are also typically administered face-to-face and can be completed in one to three sessions (Conner et al., 2021; O'Connor et al., 2015). A Cochrane review has identified that both psychological and brief psychological interventions have primarily been tested in patients admitted to hospital for self-harm (Witt et al., 2021b).

1.4.2.1 Effects on self-harm behaviour

In comparison to pharmacological interventions, there is a larger proportion of evidence testing the effectiveness of psychological and brief psychological interventions for reducing self-harm. These studies have predominately been tested in patients who present to hospital for self-harm or who were clinically referred for treatment (i.e., they had seen a health professional). Many studies have shown that cognitive behavioural therapy-based psychotherapy and dialectical behavioural therapy can reduce self-harm outcomes (e.g., McMain et al., 2017; Priebe et al., 2012; Rudd et al., 2015; Slee et al., 2008). Although the evidence for other psychological (e.g., emotion-regulation psychotherapy) and brief psychological interventions (e.g., safety planning) comes from a smaller number of studies the evidence shows that they too can reduce self-harm (e.g., Gratz et al., 2014; Stanley et al., 2018). While, the collaborative assessment and management of suicidality, has not been found to reduce self-harm, it has shown encouraging findings for suicidal ideation. In addition, most psychological interventions are delivered in an individual-based format (e.g., cognitive behavioural therapy-based

psychotherapy and safety planning) or use a combination of individual-and group-based activities (i.e., dialectical behavioural therapy). While evidence for group-based therapy being delivered on its own comes from a smaller number of studies they have also been found to reduce self-harm outcomes (e.g., Gratz & Gunderson, 2006).

Whilst it is promising that many psychological and brief psychological interventions can reduce self-harm outcomes, the evidence for these interventions is mixed overall. Some studies have shown that psychological interventions can reduce self-harm behaviour (Bateman & Fonagy, 2009; Bateman et al., 2021; Brown et al., 2005; Gratz & Gunderson, 2006; Gratz et al., 2014; Linehan et al., 2006; McMain et al., 2017; Priebe et al., 2012; Rudd et al., 2015; Slee et al., 2008; Turner et al., 2000). However, other studies have provided null results (Andreasson et al., 2016; Jobes et al., 2017; Lin et al., 2020; McAuliffe et al., 2014; McMain et al., 2009; Ryberg et al., 2019; Santel et al., 2023; Tyrer et al., 2003; Pistorello et al., 2020; Walton et al., 2020; Wei et al., 2013). On a similar note, some studies have demonstrated encouraging findings for the effectiveness of brief psychological interventions to reduce self-harm (Bryan et al., 2017; Gysin-Maillart et al., 2016; Stanley et al., 2018) but others have shown little effect (Arvilommi et al., 2022; Conner et al., 2021; O'Connor et al., 2022). One reason for these differences is that many studies providing null results have not been adequately powered to perform the statistical analyses that are required to test the effectiveness of the intervention in comparison to a control group (e.g., Conner et al., 2021; O'Connor et al., 2022; Pistorello et al., 2020; Santel et al., 2023; Wei et al., 2013). Another possible reason is that, in several studies providing null results, the control conditions have received an alternative psychological treatment that is equally as effective at generating reductions in self-harm outcomes as the experimental intervention (e.g., Andreasson et al., 2016; Arvilommi et al., 2022; McMain et al., 2009; Walton et al., 2020).

1.4.2.2 Effects of suicidal ideation

With respect to psychological interventions, several studies show that both cognitive behavioural therapy-based interventions (Guthrie et al., 2001; Hatcher et al., 2011; Husain et al., 2014) and the collaborative assessment and management of suicidality (Jobes et al., 2017; Ryberg et al., 2019) significantly reduce suicidal ideation in the short-term (3-6 months) relative to a control condition. Additionally, reductions in suicidal ideation due to cognitive behaviour therapy-based psychotherapy have been found to be maintained in the longer-term (i.e., one year; Hatcher et al., 2011). While some studies have not reported significant reductions in suicidal ideation due to these interventions (Pistorello et al., 2020; Santel et al., 2023; Weinberg et al., 2006), they have been pilot or feasibility studies or recruited a small sample and therefore not sufficiently powered to detect intervention effects. Additionally, even though these studies may have been underpowered, one study has shown that the collaborative assessment and management of suicidality is associated with a small effect size at five-month follow-up (d = 0.20; Santel et al., 2023).

With regards to studies of brief psychological interventions, the majority have not been found to significantly reduce suicidal ideation relative to a control condition (Arvilommi et al., 2022; Britton et al., 2020; Gysin-Maillart et al., 2016; O'Connor et al., 2015; O'Connor et al., 2020). Possible reasons are that the studies were underpowered (e.g., O'Connor et al., 2015; O'Connor et al., 2020) or that the brief psychological interventions were equally as effective as the alternative interventions or treatment as usual provided to control participants. An exception was a crisis planning (i.e., an abbreviated form of safety planning) intervention which showed that participants in the intervention group had a significantly lower suicidal ideation score at six-month follow-up compared to the control condition (Bryan et al., 2017).

1.4.2.3 Conclusions about psychological interventions

Overall, there is evidence that psychological interventions in particular cognitive behavioural therapy-based psychotherapy and dialectical behavioural therapy can reduce self-harm. Cognitive behavioural therapy-based psychotherapy has also been found to generate changes in suicidal ideation over the short- and long-term. In addition, the collaborative assessment and management of suicidality intervention has also been found to reduce suicidal ideation over the short-term. There is also some evidence that brief psychological interventions, namely safety planning and the attempted suicide short intervention programme can also reduce self-harm behaviour. There is some evidence that safety planning can reduce suicidal ideation, although this comes from one study. While the results for these interventions are encouraging, it is recognised that both psychological and brief-psychological interventions are resource intensive as they require a health professional to deliver them (Milner et al., 2015). Interventions that do not rely on a health professional, namely brief contact interventions, will therefore be reviewed next.

1.4.3 Brief contact interventions

Brief contact interventions aim to maintain long-term contact with patients who presented to hospital for self-harm (Milner et al., 2015). These interventions do not involve face-to-face contact with a health professional. Instead, they involve contact through either verbal (e.g., telephone calls) or written (e.g., letters, postcards, or the provision of emergency/green cards) communications. They communicate support for patients and provide the means (e.g., contact details) for them to engage with services (e.g., primary care provider) again at a later date. Consistent with pharmacological and psychological interventions, this type of intervention has primarily been tested in patients admitted to hospital for self-harm.

1.4.3.1 Effects on self-harm behaviour

Brief contact interventions have typically not been found to reduce self-harm behaviour when compared to a control condition (Beautrais et al., 2010; Cedereke & Öjehagen, 2002; Evans et al., 2005; Evans et al., 1999; Morgan et al., 1993; Vaiva et al., 2018). However, a series of studies by Carter et al. (2005, 2007, 2013) have shown the benefits of using postcards to make brief contact with patients discharged from hospital following an episode of self-harm. In the study by Carter et al. (2005), participants in the intervention group received treatment as usual and eight postcards over a 12-month period. The postcards stated that they hoped the participants were well and that they could contact the researcher if they wished. The number of these individuals who reported engaging in self-harm at 12-months follow-up did not differ from the number who reported engaging in self-harm in a treatment as usual condition (e.g., psychiatric assessment). However, they were less likely to present to hospital for self-harm (Carter et al., 2005) and this benefit was maintained at 24-months and five-year follow-up (Carter et al., 2007, 2013). Additionally, a postcard intervention reduced suicide attempts in Iran over a 12-month (Hassanian-Mogahaddamha et al., 2011) and 24-month period (Hassanian-Mogahaddam et al., 2017).

1.4.3.2 Effects on suicidal ideation

The evidence for the effectiveness of brief contact interventions on suicidal ideation has been tested in a small number of studies and the results has been mixed (Cedereke & & Öjehagen, 2002; Hassanian-Moghaddam et al., 2011; Hassanian-Moghaddam et al., 2017). A telephone intervention which involved contacting participants at four and eight months after their episode of self-harm did not report significant differences in the reduction of suicidal ideation relative to a control condition which received treatment as usual (Cedereke & & Öjehagen, 2002). Rather, both conditions reported significant

improvements in suicidal ideation over time and the attrition at follow-up may have meant that the study was underpowered to detect statistical differences between the groups. However, a postcard study conducted in Iran, which was sufficiently powered, found a significant reduction in the proportion of participants reporting suicidal ideation in the intervention group relative to the control group (Hassanian-Moghaddam et al., 2011; Hassanian-Moghaddam et al., 2017).

1.4.3.3 Conclusions about brief contact interventions

Overall, there is limited evidence that brief contact interventions are effective in reducing self-harm behaviour or suicidal ideation. The exception seems to be postcard interventions (e.g., Carter et al., 2005, 2013, 2017; Hassanian-Moghaddam et al., 2011; Hassanian-Moghaddam et al., 2017). However, it should be noted that the research by Hassanian-Moghaddam et al. was conducted in a non-western country where follow-up care for self-harm has been rated as 'generally poor' (Hassanian-Moghaddam et al., 2011). Hassanian-Moghaddam et al.'s findings may therefore be attributable to the standard of care that was provided by their brief postcard interventions being able to easily outperform the standard of care that is normally provided for self-harm.

More generally, a possible reason for the lack of evidence for the effectiveness of brief contact interventions is that that they have not been developed with a clear explanation as to how or why they should work (O'Connor et al., 2011) or based on theories that specify the underlying reasons for self-harm. Rather the mechanisms for how these are expected to have worked have been suggested retrospectively by some authors to explain results (e.g., Carter et al., 2005). Meanwhile, in health behaviour change, more generally, it is known that greater use of theory when developing interventions has been found to produce larger behaviour change than interventions not based on theory (e.g., Webb et al., 2010). While there is only limited evidence that brief

contact interventions may be effective at reducing self-harm, their format means they have the potential to attain wide 'reach'. They are also likely to be less expensive to administer than face-to-face interventions that require a therapist or other health professional. Additionally, shame and stigma are some of the reasons people do not seek help for their self-harm (Long, 2018; Mughal et al., 2021; Samaritans, 2023; Troya et al., 2019). Individuals may therefore be more accepting of an intervention that does not require face-to-face treatment. An effective intervention, which does not require face-to-face contact, and is easy to distribute widely, would be beneficial.

1.4.4 Digital Interventions

An alternative approach to delivering interventions which does not require face-to-face contact, and which can have wide 'reach' is via a digital format (e.g., web- or smartphone-based). This type of intervention aims to increase accessibility and availability to mental health support by providing self-administered psychological interventions (e.g., cognitive behavioural therapy) and access to support services (Cliffe et al., 2021). As mentioned in section 1.2, a large proportion of self-harm is hidden and does not present to hospital for self-harm (e.g., McManus et al., 2019). Digital interventions potentially help overcome the barrier of accessibility and availability to psychological interventions as many people have access to digital devices, in particular a mobile phone (Statista, 2023). Unlike pharmacological, psychological, and brief contact interventions, which have been tested primarily using samples of people who have been admitted to hospital for self-harm, many digital interventions have been tested in samples of people who self-harm in the community more generally.

1.4.4.1 Effects on self-harm behaviour

Few studies have tested the extent to which digital interventions can reduce self-harm behaviour in adults (Franklin et al., 2016; Hooley et al., 2018), although the effects

of a digital intervention on a measure of urges to self-harm has also been tested (Rizvi et al., 2016). Whilst the results of these studies have all shown reductions in self-harm outcomes, only one identified a significant reduction in the frequency of self-harm for a digital intervention compared to a control group (Franklin et al., 2016). The results of the remaining studies may therefore be attributable to other unknown factors (Rizvi et al., 2016) or the control conditions received an alternative digital intervention that is equally as effective at generating reductions in self-harm as the experimental intervention (Hooley et al., 2018). The researchers in the study by Franklin et al. (2016) conducted three randomised controlled trials to test a therapeutic evaluation app that was designed to increase liking towards the self and decrease liking towards self-harm. During the month when participants had access to the app there was a significant reduction in the frequency of self-harm (cutting) for participants randomised to receive the therapeutic app in comparison to participants who were randomised to a control condition and received a control version of the app. However, these effects were not maintained in the post-treatment follow-up month when participants no longer had access to the app.

1.4.4.2 Effects on suicidal ideation

Several studies have evaluated the effectiveness of digital interventions based on therapeutic models (i.e., cognitive behavioural therapy or dialectical behaviour therapy) at reducing suicidal ideation. Some studies have reported a significant reduction in suicidal ideation in a digital intervention condition in comparison to a control condition at post-intervention (De Jaegere et al., 2019; Torok et al., 2022; van Spijker et al., 2014). These results were maintained at six-week (De Jaegere et al., 2019) and three-month follow-up (Torok et al., 2022). Meanwhile, other studies have not found significant differences between a digital intervention and control condition for suicidal ideation (Bush et al., 2017; Eylem et al., 2021; van Spijker et al., 2018; Wilks et al., 2018). This is primarily

due to limited power to detect statistically significant effects, which has been caused by pilot/feasibility designs (Eylem et al., 2021; Wilks et al., 2018) or time constraints in achieving the target sample size (van Spijker et al., 2018). Additionally, even though these studies were underpowered, one pilot study has shown that an online dialectal behaviour therapy intervention was associated with potentially large effects at two-month (d = -0.72) and four-month (d = -1.06) follow-up (Wilks et al., 2018).

1.4.4.3 Conclusions about digital interventions

Only a small number of studies have evaluated the effectiveness of digital interventions at reducing self-harm behaviour in adults. There is limited evidence, from a single study, that they can reduce self-harm (cutting) while in use relative to an active control group. However, these reductions are not maintained when the intervention is no longer accessible. There is more evidence that digital interventions can reduce suicidal ideation at post-intervention and up to three months later. Similar to brief contact interventions, digital interventions do not require a health professional in order for them to be administered. They are therefore likely to overcome the problems caused by shame and stigma associated with self-harm that can prevent people from seeking help. Once developed, digital interventions could also be widely distributed given the availability of the internet and smartphones. In addition, people who self-harm and experience suicidal ideation have also expressed a high degree of acceptability for digital interventions although engagement has also been found to decline over time (Arshad et al., 2020).

1.4.5 Summary of existing interventions

In general, there is a lack of evidence for the effectiveness of pharmacological interventions at reducing self-harm behaviour and thoughts. As pharmacological drugs are typically not administered to solely treat self-harm and rather are used to treat other co-morbidities (e.g., depression) they are not recommended as an intervention strategy for

helping people reduce their self-harm behaviour or thoughts (NICE, 2022). However, despite some conflicting evidence from studies that have methodological limitations (e.g., pilot/feasibility studies that lack power to detect significant effects), there is some evidence that psychological and brief psychological interventions can reduce self-harm behaviour and thoughts (specifically suicidal ideation). In particular, the evidence for cognitive behavioural therapy-based psychotherapy and safety planning has shown that these interventions can reduce self-harm outcomes. Cognitive behavioural therapy-based psychotherapy and safety planning might be particularly effective at reducing self-harm behaviour and thoughts because there are a range of reasons for self-harm. These include emotional distress, wanting to punish oneself, wanting to die, and interpersonal problems (e.g., de Beurs et al., 2018; Gardner et al., 2021; Gillies et al., 2018; Rasmussen et al., 2016). Cognitive behavioural therapy-based psychotherapy and safety planning may have been found to be effective at reducing self-harm behaviour and thoughts because they both help an individual identify triggers for their self-harm. These interventions then help an individual develop coping strategies which could be used in future stressful situations when the triggers identified arise. However, while psychological and brief psychological interventions, such as cognitive behavioural therapy-based psychotherapy and safety planning, may help individuals identify triggers for their self-harm behaviour and thoughts, and implement coping responses, they are resource intensive. Health professionals are required to administer them. Consequently, this may limit the ability to deliver these interventions on a large-scale and make them accessible to everyone who needs them.

Unfortunately, the evidence for the effectiveness brief contact interventions which have been developed to reduce the resources required to deliver self-harm support is limited. With the exception of a small number of studies testing the effectiveness of

postcard interventions, which encourage engagement with and provide contact details for self-harm services, brief contact interventions have not been shown to reduce self-harm outcomes. In addition, the evidence for digital interventions, which also reduce the resources required to deliver self-harm support, is limited to a small number of studies with one study showing favourable results for a therapeutic evaluation app while in use. Meanwhile, there is more evidence that digital interventions based on therapeutic models (i.e., cognitive behaviour therapy and dialectical behaviour therapy) can reduce suicidal ideation. Digital interventions may have been found to be effective at reducing suicidal ideation because similar to the face-to-face delivery of these interventions, digital formats involve identifying automatic thoughts and strategies for managing these thoughts (e.g., van Spijker et al., 2014).

A possible reason for the lack of evidence for the effectiveness of brief contact interventions is that they have not been developed with a clear explanation as to how or why they should work (O'Connor et al., 2011) or based on theories that specify the underlying reasons for self-harm. In addition, it has been retrospectively proposed that the underlying mechanisms through which brief contact interventions aim to reduce self-harm outcomes include the enhancement of knowledge about suicide prevention (e.g., information about available services) and social support (Milner et al., 2016). Enhancing knowledge and social support have been found to motivate people to reduce self-harm through generating favourable attitudes towards seeking self-harm support and reducing feelings of loneliness and hopelessness (Cooper et al., 2011; Hassanzadeh et al., 2010; Tham et al., 2020). However, it is widely known that increasing motivation is not necessarily sufficient to evoke behaviour-change (Rhodes & Dickau, 2012; Webb & Sheeran, 2006).

In the present context, studies of self-harm have shown that sample means on measure of goal intention (measures of overall motivation to self-harm) tend to be between the bottom and middle of the measurement scales (Armitage et al., 2016; O'Connor & Armitage, 2003; O'Connor et al., 2006), indicating that there is a general orientation towards the avoidance of self-harm in people who carry out this behaviour nevertheless. A self-administered intervention, based on psychological theory, which has the capability of translating motivation into action would therefore be desirable. As engagement with digital interventions has been found to decline over time (Arshad et al., 2020), any intervention developed would need to be brief to prevent this unwanted outcome.

1.5 Conclusion

In conclusion, this chapter has shown that self-harm thoughts and behaviours are prevalent across the UK and that they have detrimental effects on the individual and their loved ones as well as having wider economic implications. Interventions for self-harm thoughts and behaviours have therefore been developed. Pharmacological, psychological, brief contact and digital interventions have been identified as existing interventions designed to reduce self-harm and suicidal ideation. The effectiveness of these interventions is mixed, and each has its own limitations which include being resource intensive, limited accessibility, loss of engagement over time, or not being based on behaviour change theory.

As studies have demonstrated that individuals are motivated to avoid self-harm, the development of a brief intervention which can be self-administered, and which is based on a psychological theory that translates motivation into action would be desirable. Furthermore, many interventions identified in the sections above were tested in patients admitted to hospital for self-harm. However, we know from section 1.2 that it has been

estimated that the incidence of self-harm in the community is approximately 10 times more than in people who present to hospital (Geulayov et al., 2018). Additionally, many individuals in the community do not seek support for their self-harm (e.g., McManus et al., 2019). A task therefore is to develop a brief self-administered intervention that helps individuals in the community, as well as patients admitted to hospital for self-harm, translate their motivation into action. The next chapter in this thesis will introduce the psychological concept of implementation intentions (Gollwitzer, 1993), which has been successfully used to change many health and social behaviours, including self-harm related outcomes.

Chapter 2: Implementation Intentions

2.1 Chapter overview

The previous chapter showed that self-harm thoughts and behaviour are prevalent and increase the risk of eventual suicide and other negative outcomes. It also showed that psychological interventions, in particular cognitive behavioural therapy-based psychotherapy and dialectical behaviour therapy, can be effective at reducing self-harm outcomes. These interventions help people identify triggers for their self-harm behaviour and thoughts and implement coping responses. However, they are resource intensive, meaning that their 'reach' is limited. Brief contact interventions are designed to overcome this problem, but they have not typically been shown to be effective at reducing self-harm and they are not typically based on psychological theories. They also aim to dissuade people from self-harm. While this is not unimportant, dissuading people from harming themselves is likely to have limited effectiveness because people tend to be already motivated to avoid this behaviour. A brief intervention, based on psychological theory is therefore needed to help people identify and cope with triggers for self-harm, and translate goal intentions to avoid self-harm into action.

This chapter will introduce the concept of 'implementation intentions' (Gollwitzer, 1993). Implementation intentions represent a brief, self-administered, theoretically based, behaviour-change strategy, which is designed to translate motivation (e.g., to avoid self-harm) into action (e.g., the avoidance of self-harm). Implementation intentions, therefore, potentially address the intervention requirements for reducing self-harm that were identified in chapter 1. The theoretical background to implementation intentions will be presented next. Subsequently, a review of previous research on implementation intentions

will be presented and key gaps in the literature will be identified, which the empirical research presented in this thesis will address.

2.2 Implementation intentions

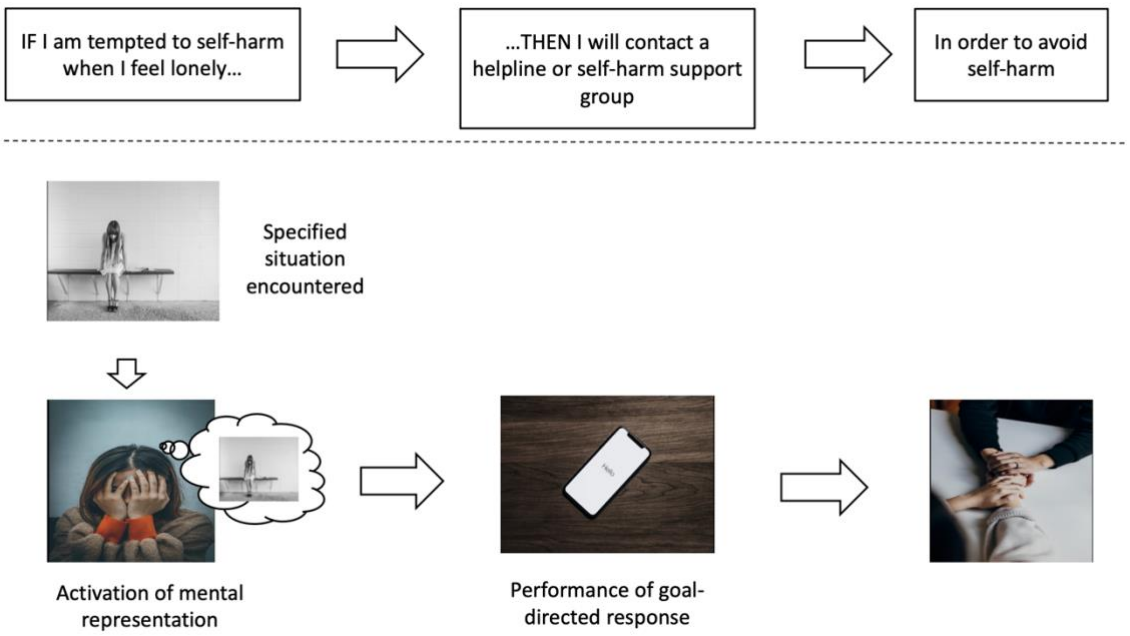
The theoretical framework for implementation intentions comes from Heckhausen and Gollwitzer's (1987) model of action phases. According to this model, individuals must pass through two key phases before they will successfully change their behaviour (e.g., reduce self-harm). First, consistent with predictive models of behaviour such as the reasoned action approach (e.g., Fishbein & Ajzen, 2011), and its predecessors, the theory of reasoned action (Fishbein & Ajzen, 1975) and planned behaviour (Ajzen, 1985), individuals must pass through a motivational phase. This results in the formation of a goal intention (e.g., I intend to avoid self-harm). However, goal intentions are not always sufficient to ensure the subsequent performance of behaviour (e.g., Webb & Sheeran, 2006). Reasons for this include forgetting to act upon goal intentions when an opportunity presents itself, not seizing an opportunity to enact a goal intention because the opportunity was not identified in the moment or encountering situations which tempt an individual to perform a behaviour which is not consistent with their goal (Gollwitzer & Sheeran, 2006). Consistent with this, meta-analyses show the proportion of variance in behaviour that is accounted for by goal intentions ranges from 18% to 29% (Armitage & Conner, 2001; Cooke et al., 2016; Cooke & French, 2008; McEachan et al., 2011; McEachan et al., 2016). These proportions of variance are viewed as moderate-to-large sized effects in the social sciences (Cohen, 1992) and means that many people act in line with their goal intentions. However, the above cited meta-analytic findings also show that 71% to 82% of the variance in behaviour is not accounted for by goal intentions. This indicates that there is sizeable gap between goal intentions and behaviour, which means that there are also many people who do not act in line with their goal intentions.

Research into discrepancies in the intention-behaviour relationship has found that the gap between intentions and behaviour is mainly attributable to "inclined abstainers" (Godin & Conner, 2008; Orbell & Sheeran, 1998; Rhodes & de Bruijn, 2013; Sheeran, 2002). These are individuals who want (i.e., are inclined) to perform a behaviour (e.g., avoid self-harm), yet they do not do so (i.e., abstain). For example, an estimated 47% of people were found to be "inclined abstainers" in a meta-analysis of meta-analyses of the intention-behaviour relationship (Sheeran, 2002). For this reason, the model of action phases proposes that individuals must pass through a second, a volitional phase of action, after they have formed their goal intentions. This phase is concerned with translating the goal intention into action. Implementation intentions (Gollwitzer, 1993, 1999) are relevant to this second, volitional phase of Heckhausen and Gollwitzer's (1987) model.

Implementation intentions are IF-THEN plans. In the IF component of an implementation intention, an individual is required to specify a critical situation in which they will perform a goal intended behaviour, or a situation that would tempt them to do otherwise. For example, an individual who intends to reduce the extent to which they self-harm might specify: "If I am tempted to self-harm when I feel lonely …". This serves to encode a representation of the critical situation to memory. When that situation is subsequently encountered, the mental representation is "activated". This makes the encountered situation highly salient, meaning that a good opportunity to perform the goal-intended behaviour is not missed (Webb & Sheeran, 2004; 2008 [study 2]). In the THEN component of an implementation intention, an individual is required to link the specified critical situation with a goal-directed response (i.e., a strategy) that helps increase the likelihood of the goal intended behaviour. For example, an individual might link the critical situation specified above with: "…then I will contact a helpline or a self-harm support group". This link is also represented in memory and serves to initiate the

goal-directed response when the mental representation of the critical situation has been activated (Webb & Sheeran, 2004; 2008 [study 2]). Figure 2.1 outlines the process for how implementation intentions are expected to work.

Figure 2.1. *Implementation intentions process*



The initiation of the goal-directed response, specified in the THEN component of an implementation intention, is theorised to be automatic when the critical situation, specified in the IF component, is encountered. This means that environmental cues associated with the specified critical situation trigger the specified goal-directed response immediately (Gollwitzer & Brandstätter, 1997, study 3), efficiently (Brandstätter et al., 2001) and with little conscious effort (Bayer et al., 2009, study 2). The behaviour produced by implementation intentions is therefore similar to the behaviour produced by habits (Verplanken, 2006). However, habits develop through past experiences and therefore can be counter-intentional (e.g., a person who holds a goal intention to avoid

self-harm might find themselves engaging in the behaviour as a habitual response to a triggering situation because they have learned to associate the two). On the other hand, the behaviour produced by implementation intentions has been referred to as 'strategic' (Gollwitzer, 1999, 2014). This is because it is the result of conscious planning to ensure that it aligns with an individual's goal intention (e.g., avoidance of self-harm).

There are two key reasons for expecting implementation intentions to be effective at reducing self-harm. First, implementation intentions are subordinate to goal intentions (Gollwitzer, 1999). This means that people must, first, be motivated to perform the required behaviour (e.g., avoid self-harm) before the act of forming an implementation intention will be able to generate behaviour-change (e.g., reduce self-harm). As already mentioned, it was established in the last chapter that many people have a general motivational orientation towards avoiding self-harm (see section 1.4.5).

Second, implementation intentions help people behave in line with their goal intentions by helping them overcome self-regulatory problems (e.g., Gollwitzer & Sheeran, 2006). In the present context, triggers for self-harm behaviour represent self-regulatory problems that people need to overcome if they are to successfully reduce the extent to which they harm themselves. These triggers are well-established and can be interpersonal or intrapersonal in nature (Klonsky et al., 2015; May & Klonsky, 2013). Intrapersonal triggers include emotional distress, a wish to die and/or self-punishment (de Beurs et al., 2018; Gillies et al., 2018; McAuliffe et al., 2007; McManus et al., 2019; Rasmussen et al., 2016; Townsend, Wadman et al., 2016; Troya, Dikomitis, et al., 2019; Wadman et al. 2017). Interpersonal triggers include communicating feelings of distress to others and relationship difficulties (Bryant et al., 2021; Edmondson et al., 2016; Miller et al., 2021; Taylor et al., 2018; Troya, Dikomitis, et al., 2019). More specifically, these triggers represent critical situations that increase the likelihood of self-harm. Given that

implementation intentions provide strategies (goal-directed responses) for coping with critical situations, they are likely to constitute a useful strategy for self-harm reduction.

2.3 Previous research on implementation intentions

Implementation intention interventions have been found to be effective at changing many behaviours. A meta-analysis conducted by Gollwitzer and Sheeran (2006), included 94 independent studies across numerous health and social behaviours. It showed that implementation intention interventions generated a moderate-to-large sized effect on behaviour-change overall (d = 0.65). The effect sizes varied across different behavioural domains (e.g., academic achievement vs environmental behaviour vs prosocial behaviours). Most notably, with respect to the present programme of work, implementation intentions were found to generate moderate-to-large sized changes in health behaviours (d = 0.59). Other meta-analyses evaluating the effectiveness of implementation intention interventions in specific areas of health have shown that they can produce improvements in dietary behaviours (Adriaanse et al., 2011), physical activity (Bélanger-Gravel et al., 2013), substance use (Malaguti et al., 2020), smoking cessation (McWilliams et al., 2019), and goal-achievement in people with mental health problems (Toli et al., 2016). The average effect sizes in these meta-analyses have ranged from d = 0.24 to 0.99 (i.e., small- to large-sized effects).

One meta-analysis has also tested the effectiveness of implementation intention interventions on affect-based outcomes (Webb et al., 2012). Across 29 studies, asking participants to form implementation intentions to regulate their emotions was found to be effective at reducing feelings of fear, disgust, and anxiety, compared with control conditions that were provided with no instructions to regulate their emotions (d = 0.91) or asked to form goal-intentions to regulate their emotions only (d = 0.53). Implementation intentions have therefore been found to be effective at changing internal states in addition

to many overt behaviours. As such, implementation intentions may be a useful intervention strategy for reducing both self-harm behaviour (i.e., overt action) and thoughts (i.e., internal state).

Previous research has also provided strong evidence that the behaviour-change generated by implementation intentions is a result of strategic automaticity (i.e., the automatic performance of a specified goal-directed response after a specified critical situation has been encountered). Lab-based studies, including electrocortical (i.e., EEG) research, have shown that participants asked to form implementation intentions respond more quickly (i.e., immediately) to specified critical situations compared to control participants (Brandstätter et al., 2001; Gollwitzer & Brandstätter, 1997; Schweiger-Gallo et al., 2009, study 3). Laboratory studies have also demonstrated that the performance of a behaviour is efficient following implementation intentions formation. For instance, participants who specify implementation intentions perform just as well as control conditions on primary tasks while, at the same time, responding more quickly to specified situational cues in a secondary task (Brandstätter et al., 2001). Similarly, participants who form implementation intentions report significantly more correct responses to the specified critical situation compared to control participants, while also initiating alternative responses to the same extent as the control participants (Parks-Stamm et al., 2007). This means that the specification of a goal-directed response is not associated with a reduced availability to initiate other responses when needed to achieve goal-intended behaviour.

In addition, there is evidence that behaviour is carried out with little conscious effort following implementation intention formation. When cues associated with specified critical situations are presented subliminally (i.e., without conscious attention), performance of goal-directed responses is faster for participants who have been asked to

form implementation intentions than it is for control participants (Bayer et al., 2009). Likewise, fMRI research (Gilbert et al., 2009; Hallam et al., 2015) has shown the brain areas that are activated when completing a task under implementation intention instructions (e.g., "If I see REAPPRAISE, then I will tell myself that 'these are just pixels on a screen and the picture can't get to me!") are associated with automatic 'top-down' processing (e.g., medial rostral prefrontal cortex and orbitofrontal cortex). On the other hand, the brain areas that are activated when completing a task under goal intention instructions (e.g., "When viewing pictures preceded by REAPPRAISE you should adopt a detached and unemotional attitude") are associated with effortful 'bottom-up' processing (e.g., lateral rostral prefrontal cortex and dorsolateral prefrontal cortex).

While research has provided strong support for the effectiveness of implementation intentions and the processes through which they are expected to change behaviour, there are only two published studies, to date, which have tested the effectiveness of an implementation intention intervention at reducing self-harm related outcomes. Both studies have focused on patients admitted to hospital for self-harm. In the first study, Armitage et al. (2016) randomly allocated 226 patients (mean age = 30.03, 69% female), who had been admitted to hospital following an episode of self-harm (regardless of suicidal intent), to one of two experimental conditions or a control condition. In the first experimental condition, the participants were asked to specify their own (i.e., self-generated) implementation intentions to avoid self-harm. In the second experimental condition, the participants were asked to specify implementation intentions using a volitional help sheet, which provided a list of critical situations for participants to select and a list of goal-directed responses for them to link with their chosen critical situations (these methods for generating implementation intentions will be discussed further in chapter 3). The participants in the control condition were provided with the same critical

situations and goal-directed responses as the participants in the second experimental (volitional help sheet) condition but they were not asked to link the two, thus not forming implementation intentions. The outcome variables were four separate items from a measure of suicidality (i.e., the Suicidal Behaviour Questionnaire – Revised: SBQ-R; Osman et al., 2001). These outcomes were: suicidal ideation and behaviour ("Have you thought about or attempted to kill yourself?"); frequency of suicidal thoughts ("How often have you thought about killing yourself over the last year?"); threats to die by suicide ("Have you told someone that you were going to die by suicide or that you might do it?"); and the likelihood of a future suicide attempt ("How likely is it that you will attempt suicide someday?").

The results from Armitage et al.'s (2016) study showed that both experimental conditions scored significantly lower than the control condition on the suicidal ideation and behaviour item at 3-month post-intervention. In addition, the volitional help sheet condition scored significantly lower than the control condition on the items relating to threats to die by suicide and the likelihood of a future suicide attempt. The effect sizes ranged from small to moderate (d = 0.29 - 0.59), demonstrating that the implementation intention interventions, designed to reduce self-harm, were effective at reducing suicidality outcomes in a sample of people who had been admitted to hospital for self-harm.

In the second study to have previously tested an implementation intention intervention in the context of self-harm, O'Connor et al. (2017) randomly allocated 518 patients (mean age = 36.29, 62.5% female), who had been admitted to hospital following a suicide attempt, to either an experimental or a control condition. The experimental condition received treatment as usual and was additionally asked to form implementation intentions to reduce self-harm using the volitional help sheet produced by Armitage et al.

(2016). The control condition received hospital treatment as usual only. There were no differences between the conditions in the number of re-presentations to hospital for self-harm over the subsequent six months. However, exploratory binomial regressions showed that forming implementation intentions was associated with a 69% lower risk of self-harm re-presentation at 6-month post-intervention for those with at least one hospital admission in the last 10 years. Therefore, while this research did not find a sample-wide reduction in self-harm presentations to hospital following intervention, it suggested that implementation intentions may be effective for reducing self-harm hospital presentations in a sub-group of individuals, namely those with a known previous history of this behaviour.

2.4 What gaps are addressed by the present thesis?

The research reported in this thesis sought to address two key gaps that were identified from the existing literature reviewed above.

2.4.1 Testing implementation intention interventions for self-harm within the community

As stated in section 2.3, two studies have tested the ability of implementation intention interventions to reduce self-harm related outcomes in patients admitted to hospital (Armitage et al., 2016; O'Connor et al., 2017). Despite the promising results reported in those studies, implementation intention interventions to reduce self-harm have not been tested in the wider community. It is important to test the effectiveness of implementation intention interventions in the community because, as stated in section 1.2, the prevalence of self-harm is higher for the general population compared with those individuals who present to hospital. It was also specified in section 1.2 that many individuals in the wider community do not present for medical or psychological treatment for their self-harm. Thus, they do not see a health practitioner (McManus et al., 2019).

This has an impact on their accessibility to treatment for self-harm because approaching medical services has been identified as an entry point (Williams et al., 2020). Reasons individuals do not want to seek treatment include feelings of shame and stigma, and confidentiality concerns (Long, 2018; Troya, Chew-Graham, et al., 2019; Williams et al., 2020). A brief self-administered intervention, such as implementation intentions, would therefore be an important addition to existing treatments to help overcome these barriers. Additionally, self-harm in the community also tends to be underpinned by a variety of reasons including emotional distress, wanting to punish oneself and communicating distress (e.g., Lockwood et al., 2023; Rasmussen et al., 2016; Troya, Dikomitis, et al., 2019). It is important, therefore, to test interventions in the wider community, in addition to hospital patients, to ensure they are effective at managing the wide range of reasons for self-harm.

While the effects of implementation intention interventions on self-harm outcomes (e.g., self-harm behaviour or thoughts) have not been tested previously in the community, the acceptability of an online implementation intention intervention designed to prevent and reduce self-harm has been assessed in a community sample (Keyworth et al., 2021). A national sample of adults (n = 514) in the UK reported on the acceptability of the intervention in a survey that included Likert items and open-ended questions. The responses to the survey were encouraging. The sample means were above the scale mid-point on the Likert items designed to measure: how good or bad participants felt when completing the intervention, how confident they felt about using the intervention, how confident they felt that they understood the intervention and how it worked, and how confident they felt that the intervention was likely to achieve its purpose of reducing self-harm. Open-ended comments included participants reporting they were ‘positive about its [the intervention’s] usefulness and helpfulness’ and that the intervention was ‘easy to

use'. Interviews also suggested that the implementation intention intervention was acceptable with participants reporting they felt it would be 'helpful' and 'straightforward' (Keyworth et al., 2022). The results of the study therefore suggest that an implementation intention intervention for self-harm would be welcomed by people in the community. The first aim of this thesis, therefore, was to develop and test the effectiveness of implementation intentions at reducing self-harm in a community sample.

2.4.2 Moderators of implementation intentions

Research outside the context of self-harm has shown that there are moderators of implementation intentions (Brewster et al., 2015; Carrero et al., 2019; Cooke et al., 2023; Elliott & Armitage, 2006; Prestwich & Keller, 2014; Webb et al., 2007). Implementation intention interventions do not therefore represent a 'one size fits all' approach to behaviour-change. Rather, they modify behaviour more effectively for some types of people than others. Identifying the types of people for whom an intervention does and does not change behaviour is important. It helps identify who should be targeted with an intervention and who might need additional, or alternative, interventions (e.g., Cooke et al., 2023). The second aim of this thesis was to test whether implementation intentions designed to reduce self-harm behaviour and thoughts were moderated by motivational, volitional, and cognitive moderators. Each of these moderators will be discussed separately in the following sub-sections.

2.4.2.1 Motivational moderators

As described in section 2.2, the model of action phases (Heckhausen & Gollwitzer, 1987) proposes that, before behaviour change can occur, an individual must have gone through a motivational phase of action that culminates in the development of a goal intention (e.g., an overall motivational tendency to perform a behaviour such as the avoidance of self-harm). Subsequently, an individual will enter the second, volitional

phase of action where the goal intention needs to be realised (i.e., converted into action), and implementation intentions are theorised to aid this process (see above). Goal intentions have therefore been tested as a moderator of implementation intentions in several studies. Consistent with the idea that people need to possess the required goal intention before implementation intentions can generate behaviour-change through the process of intention realisation, it has been observed that implementation intentions evoke greater behaviour-change in those who possess high (mean +1*SD*) levels of goal intention compared with those who possess low (mean -1*SD*) levels. This has been found for a range of behaviours including drivers' speeding behaviour, sunscreen use, and number of hours spent independently studying for university courses (d = 0.23 to 0.35; Elliott & Armitage et al., 2006; Sheeran et al., 2005; van Osch et al., 2008). However, goal intentions have not yet been tested as a moderator of implementation intentions in the context of self-harm. Consistent with previous research, it would be expected that implementation intentions would be more effective at reducing self-harm when the motivation to avoid self-harm is high as opposed to low. Subsequently, this would inform whether implementation intention interventions should be targeted at those who possess the goal intention to avoid self-harm only and whether they should be supplemented with additional motivational interventions to generate the required goal intention, prior to their delivery.

2.4.2.2 Volitional moderators

One of the key theoretical models in the literature on suicidal behaviour that can be used to identify the underlying causes of self-harm is the Integrated Motivational-Volitional Model for Suicidal Behaviour (O'Connor, 2011; O'Connor & Kirtley, 2018). The Integrated Motivational-Volitional Model for Suicidal Behaviour highlights that

defeat and entrapment motivate people to engage in self-harm by generating self-harm ideation. Subsequently, the transition from self-harm ideation to self-harm behaviour is guided by volitional moderators. Two key volitional moderators specified by the model are mental imagery and exposure to self-harm.

Mental imagery refers to the frequency with which people experience suicide-related images, including images of self-harm (Wetherall et al., 2018). Exposure to self-harm is typically operationalised as the extent to which people have experience of significant others (e.g., family or friends) who engage in this behaviour (Dhingra et al., 2015). Research has shown that mental imagery and exposure to self-harm both increase the likelihood that an individual will engage in self-harm (Branley-Bell et al., 2019; Dhingra et al., 2015; Mars et al., 2019; Wetherall et al., 2018). Mental imagery can increase the likelihood of self-harm because they prime self-harm behaviour when people experience triggers for self-harm (e.g., emotional distress) (O'Connor & Kirtley, 2018). Similarly, exposure to significant others who self-harm can increase the likelihood that individuals will carry out this behaviour themselves as a result of social learning (Bandura, 1977). Individuals who experience high levels of mental imagery and self-harm exposure may therefore have difficulties regulating their behaviour when faced with triggering situations. They are, therefore, likely to benefit from an implementation intention intervention because it provides them with self-regulatory strategies (i.e., goal-directed responses) for managing critical situations (e.g., triggers for self-harm). On the other hand, individuals with low levels of mental imagery or exposure are likely to find it easier to regulate their behaviour without the need of an intervention and, therefore, they are likely to benefit less from an implementation intention intervention. Consistent with this line of reasoning, research in other domains has shown that implementation intention interventions are more effective at generating changes in behaviour for individuals who

are less able to self-regulate their behaviour (Webb et al., 2007). However, no previous studies have examined potential volitional moderators of implementation intention interventions in the context of self-harm.

2.4.2.3 Cognitive moderators

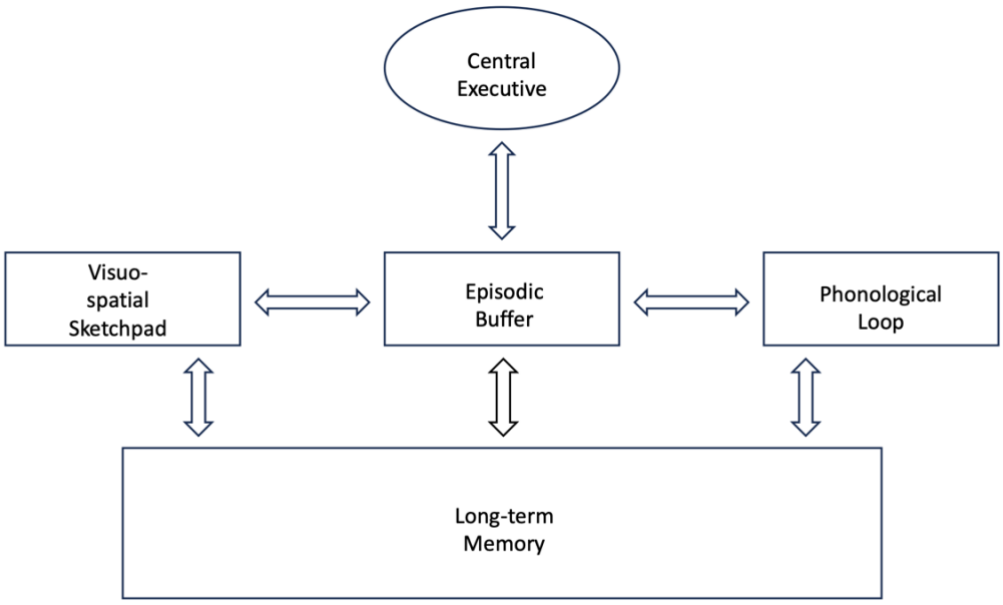
As implementation intentions are a cognitive based intervention, cognitive abilities should be required to ensure they generate behaviour-change. Although it is argued that implementation intentions are expected to work via strategic automaticity, for the process of strategic automaticity to occur an individual must first cognitively encode, learn, and store their implementation intentions. These early-stage processes are therefore where cognitive abilities are likely to be particularly relevant. If cognitive abilities are needed to encode and learn implementation intentions, it may be that this intervention produces behaviour change more effectively in individuals who have higher levels of the cognitive abilities required for these processes, compared to those with lower levels. This is a particularly important issue to address because, if implementation intentions benefit those with greater cognitive ability, this could mean that other interventions or modifications are needed to be put in place to support those with lower cognitive performance. For example, this could include explicit rehearsal of the implementation intentions after they have been formed. The consideration of cognitive abilities is also particularly important in the context of self-harm. For example, co-morbidities such as depression and anxiety, which can have a detrimental effect on a person's cognitive abilities (Bowman et al., 2019; Semkovska et al., 2019; Whitehouse et al., 2019), co-exist with self-harm (May & Klonsky, 2016). It should also be considered that the process of strategic automaticity through which implementation intentions are expected to work may also benefit cognitive ability as it is expected to reduce demand on an individual's cognitive resources when a

critical situation is encountered (Gollwitzer, 1999). The key cognitive moderators tested in this thesis were working memory, long-term memory, and prospective memory.

Working memory

One key model for everyday, moment-to-moment cognition that includes key cognitive processes which are likely to influence the effectiveness of implementation intentions is Baddeley's (2000, 2012) multicomponent working memory model (see Figure 2.2a). The model provides an account of how information is encoded, processed, temporarily retained, and transferred to and from long-term memory. It has been applied to a range of everyday cognitive activities and clinical contexts (Baddeley et al., 2020).

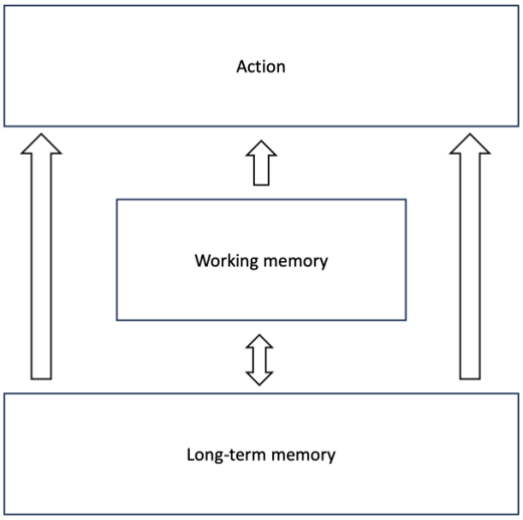
Figure 2.2a. *Multi-component model of working memory (recreated from Baddeley et al., 2020)*



Working memory is described as a limited capacity resource for the temporary storage and processing of information, supporting cognition and action (Baddeley, 2000, 2012, 2020). As shown in Figure 2.2a, there are four components to working memory. The central executive is the attentional control system, which can direct the operation of the other sub-systems (Baddeley et al., 2020). The central executive is expected to rely on executive resources, including focusing and shifting an individual's attention, and inhibiting irrelevant information (Baddeley, 2012; Friedman & Miyake, 2017). The two specialised sub-systems are the phonological loop and the visuo-spatial sketchpad. These systems perform the temporary storage and active rehearsal of particular modalities of information. More specifically, the phonological loop is responsible for auditory or verbal information whereas the visuo-spatial sketchpad operates on non-verbal information. Storage may last only approximately 2 seconds, in the absence of rehearsal. For example, if unrehearsed, a verbally encoded telephone number will rapidly be forgotten. The fourth and final component in the model, the episodic buffer, is a temporary, multi-modal storage system which can represent bound visuo-spatial and phonological information together into unified constructs, to which the individual has conscious access. The contents of working memory may be transferred for storage in the essentially unlimited capacity long-term memory system, especially when well-rehearsed.

Figure 2.2b further elaborates upon Figure 2.2a to show how working memory is a link between cognition (i.e., long-term memory) and action while also acknowledging that information can be retrieved from long-term memory to initiate action without going through working memory directly.

Figure 2.2b. *Working memory as an interface between cognition and action (recreated from Baddeley et al., 2020)*



Attentional capacity is likely to be of particular importance at the encoding stage of implementation intentions. This is because individuals need to attend to the task of forming implementation intentions, if relevant information (e.g., critical situations and goal-directed responses) is to be processed and rehearsed in working memory, which in turn helps ensure successful encoding to long-term memory. An individual's ability to attend to the task can also be inferred by their ability to suppress irrelevant or conflicting information (i.e., inhibition). In the context of successful implementation intention formation, being able to inhibit irrelevant information is likely to be important because it helps an individual to ignore distractions (e.g., ongoing thoughts) that might interfere with forming and encoding implementation intentions to memory. More specifically, this would mean that individuals can fully attend to selecting critical cues and linking them with goal-directed responses. It also means that the irrelevant information does not take up valuable working memory resources. In particular, working memory has a capacity to process four 'chunks' of information at once (Cowan, 2010). If working memory capacity

is used to process irrelevant information, implementation intentions may not be sufficiently well encoded into long-term memory for future activation.

Processing speed is also important to consider as this has been found to be associated with working memory performance (Carlozzi et al., 2014; Carlozzi et al., 2015). This could also therefore influence the successful encoding and learning of implementation intentions. Processing speed is defined as the time is takes individuals to process a specific amount of information and/or make a response (Carlozzi et al., 2015). When interventions encourage or allow individuals to form multiple implementation intentions (e.g., Armitage, 2016; Brewster et al., 2015; McGrath et al., 2020), the information from the first implementation intention will need to be held in working memory while subsequent plans are formed. The simultaneity mechanism (Salthouse, 1996) dictates that the longer it takes individuals to form subsequent implementation intentions, the more likely it is that information about the earlier ones will be lost. This would lead to individuals not being able to hold all the implementation intentions together in working memory for rehearsal. As a result, all implementation intentions would not be sufficiently encoded and thus not stored in long-term memory for activation in the future.

Several studies have investigated the moderating effects of working memory or its executive resources (i.e., inhibition) on implementation intentions (Buckard et al., 2014; Hall et al., 2012; Meeks et al., 2015). However, the outcome measures have been performance on a prospective memory task or correspondence between intention and behaviour. These studies have shown mixed results. One study has shown that working memory moderate's implementation intentions at high levels of this cognitive ability on a prospective memory task (Buckard et al., 2014) whereas others have shown improvement on prospective memory tasks and intention-behaviour correspondence at low levels of working memory and inhibition (Hall et al., 2012; Meeks et al., 2015). Nevertheless, none

of these studies have tested the moderating effects of these cognitive abilities on a behaviour measure (e.g., self-harm), apart from one which investigated the moderating effects of executive function on implementation intentions designed to increase physical activity (Hall et al., 2014). The results of this study showed that participants who formed implementation intentions and who had high levels of executive function completed significantly more physical activity at post-intervention, compared to those with low levels of executive function. Executive function therefore seems to be an important determinant of whether implementation intentions can generate behaviour-change on an overt behaviour outcome.

Given only one study has tested the moderating effects of a cognitive ability (i.e., executive function) on a behaviour outcome and especially in light of the mixed results reported on the other outcomes mentioned above, further research is warranted. In line with the theoretical rationale above and Hall et al. (2014), it is expected that high levels of working memory, and its executive resources, and processing speed ability, will benefit the processing and storage of implementation intentions compared to people with low levels of these abilities.

Long-term memory

Long-term memory stores an individual's prior knowledge and previous life events (e.g., episodes of self-harm) (Camina & Güell, 2017). As shown in Figure 2.2a, information from working memory can be transferred to long-term memory for storage. Implementation intentions need to be transferred to long-term memory where they can be stored and made available for activation in the future when needed (i.e., by encountering the specified critical situations). Importantly, long-term memory will also be required when initially forming and learning implementation intentions.

Retrospective memory

Retrospective memory is the ability to remember information from the past (Crawford et al., 2003). This information is retrieved from two types of long-term memory, namely episodic and semantic memory (Camina & Güell, 2017). Semantic memory is memory for learnt facts and knowledge. Episodic memory is memory for specific life events and is known as autobiographical memory when it relates to memory of one's own life events (Tulving 1972, 2002). Episodic memory is likely to be particularly relevant when forming and learning implementation intentions. This is because implementation intention formation requires the identification of critical situations that are likely to tempt an individual to perform a behaviour (e.g., self-harm) in the future. In order to identify the most relevant situations, past life events (i.e., the situations that have tempted an individual to perform the behaviour in the past) need to be recalled from episodic memory. If an individual does not identify the situations that are most relevant to them, and instead select situations which seldom occur or do not tempt the unwanted behaviour, it is likely that the situations they do encounter will be unable to activate appropriate coping strategies (i.e., goal-directed responses) and there will be missed opportunities to act (e.g., to engage in self-harm reduction strategies). Individuals with superior retrospective memory ability, in particular superior episodic memory will therefore be more likely to successfully form and encode their implementation intentions during and following intervention delivery. Implementation intention interventions are therefore more likely to be effective at reducing self-harm for people with superior retrospective memory ability than for people with poorer retrospective memory ability.

Prospective memory

Prospective memory is defined as a person's ability to remember to perform an action in the future (Einstein & McDaniel, 2005). Successful performance of the action relies on an individual being able to identify that an opportunity to perform a planned action has presented itself (i.e., a specified critical situation has been encountered) and, subsequently, executing that planned action (i.e., goal-directed response). Importantly, while some theoretical accounts (e.g., preparatory attentional and memory processes theory; Smith & Bayen, 2004) recognise this as a conscious process, others (e.g., multi-process theory of prospective memory; Einstein et al., 2005) state that it can also be automatic, in line with the strategic automaticity processes underlying implementation intentions. More specifically, the multi-process theory of prospective memory (Einstein et al., 2005) proposes opportunities to act (i.e., critical situations) can be detected automatically, meaning conscious attention (i.e., executive resources) is not required. It could therefore be expected that implementation intentions are most likely to be effective for those with superior prospective memory because they will be better able to recognise (automatically or otherwise) critical situations when they are encountered, which then trigger (help a person remember automatically, or otherwise) the linked goal-directed responses.

To date, research has investigated whether implementation intentions can impact prospective memory and found that implementation intentions improve performance on prospective memory tasks when compared to a control condition (e.g., Chen et al., 2015; McFarland & Glisky, 2012; Shelton et al., 2016). However, it cannot be inferred from these studies that prospective memory performance impacts the effectiveness of implementation intentions on behaviour-change. In this thesis, the moderating effect of prospective memory will therefore be tested.

2.5 Conclusions

Implementation intentions are designed to ensure that goal intentions (e.g., to avoid self-harm behaviour or thoughts) are translated into action. They require people to identify critical situations (e.g., triggers for self-harm) and mentally link them with goal-directed responses (i.e., coping strategies). They therefore address the intervention requirements within the context of self-harm that were identified in chapter 1. Previous research has demonstrated that implementation intentions represent an effective intervention strategy for a range of health and social behaviours and affect-based outcomes. However, just two previous studies have tested the effectiveness of implementation intentions at reducing self-harm related outcomes and both studies focused on patients admitted to hospital for self-harm (Armitage et al., 2016; O'Connor et al., 2017). Research is therefore needed to test the effectiveness of implementation intention interventions at reducing self-harm more generally, in the wider community, where research suggests they would be well-received (Keyworth et al., 2021, 2022).

Additionally, research is needed to identify variables that moderate the effects of implementation intentions on self-harm outcomes in order to better understand the types of people for whom they constitute a useful intervention strategy and who might need additional, or alternative, interventions. Various motivational (goal intentions), volitional (exposure to self-harm and mental imagery), and cognitive (working memory, long-term memory, and prospective memory) constructs are likely to moderate the effects of implementation intentions on self-harm outcomes. However, they have not been tested widely in studies of implementation intentions and they have not been tested at all in the specific context of self-harm. The overall aim of this programme of research, therefore, was to test the effectiveness of implementation intentions at reducing self-harm outcomes (behaviour and thoughts) in the wider community and the above cited potential

moderators of implementation intentions. The next chapter in this thesis outlines the methodology applied to this programme of study to address these research gaps.

Chapter 3: Methodological Considerations

3.1 Chapter overview

The overall aim of the research presented in this thesis was to test the effectiveness of implementation intention interventions at reducing self-harm behaviour and thoughts in the community. It also aimed to test the influence of motivational (goal intentions), volitional (exposure to self-harm and mental imagery) and cognitive (working memory, long-term memory, and prospective memory) moderators on the effectiveness of the implementation intention interventions (see chapter 2). This chapter will therefore review the key methodological considerations related to: the experimental design of intervention research (section 3.2); the development of implementation intention interventions (section 3.3); and the measurement of the relevant outcome and moderator variables (section 3.4).

3.2 Experimental design considerations

Research testing the effectiveness of interventions (e.g., implementation intentions) can be categorised into true- or quasi-experimental studies (Gribbons & Herman, 1996). Both types of studies involve the administration of an intervention and the measurement of outcome variables (e.g., how often participants engage in self-harm behaviour or think about self-harm). This allows intervention effectiveness (or non-effectiveness) to be established, usually by means of tests which identify whether any improvements in outcome measures from pre-to post-intervention are observed in an experimental (intervention) condition relative to a control (or alternative intervention) condition. The key difference between true- and quasi-experimental studies is that the participants are allocated at random to the experimental and control conditions in true experimental studies. In quasi-experimental studies, the participants are, instead, assigned to the conditions based on key characteristics such as age or gender to ensure an equal balance

between the conditions (e.g., Vives-Cases et al., 2019). Alternatively, they can be assigned to conditions based on some other, non-random, variable such as the order in which they entered the study (e.g., Law et al., 2016) or self-selection (e.g., Chang et al., 2022; Männistö et al., 2019). Quasi-experimental studies may also not include a control group at all (Harris et al., 2006). For example, an intervention might be administered to all participants in a study with pre- and post-intervention outcome measures being used to gauge intervention effectiveness (e.g., Harris et al., 2006).

Researchers may choose to implement a quasi-experimental design when randomly allocating participants to an experimental or control group is not feasible or ethical (Britton, 2010). However, without random assignment to both experimental and control conditions, it is difficult to attribute changes in an outcome to the intervention. This is because changes in outcomes could, instead, be attributable to potential confounding variables or a statistical phenomenon known as regression to the mean (Harris et al., 2006). A confounding variable is a variable that co-occurs with the intervention being tested and is associated with the outcome variable. For example, in a study testing an implementation intention intervention to reduce self-harm, participants could be exposed to other factors in addition to the intervention. These may be known (e.g., a national self-harm prevention campaign) or unknown. In a quasi-experimental study with no control condition, these factors could explain any improvements in outcomes (e.g., reductions in self-harm) from pre-to post-intervention. Likewise, in quasi-experimental studies, there can be differences between experimental and control conditions other than the intervention being tested. Again, these can be known (e.g., differences on pre-intervention measures that have not been used for matching purposes) or unknown. These variables might increase or decrease participants' susceptibility to the intervention and could therefore explain any changes in outcomes in the experimental relative to the control

condition (i.e., improvement or any lack of improvement). Regression to the mean is a statistical principle which predicts that extreme measurements on an outcome variable will naturally be followed by less extreme measurements, which are more in line with the norm (i.e., closer to the mean). In quasi-experimental studies, this could potentially explain improvements in outcomes from pre- to post-intervention if extreme measurements (e.g., high levels of self-harm at pre-intervention) occur to a greater extent in one (e.g., the experimental) condition relative to the other.

These problems with quasi-experimental studies are resolved in true experimental studies. This is because the random allocation means that individual participants have just as much chance of being allocated to the intervention group as they do a control group. Participant personal characteristics (e.g., demographics, goal intentions and other psychological variables) and experiences, and the likelihood of extreme observations that could have an effect on the outcome, are therefore balanced out across conditions (Akobeng, 2005). Any improvements in measured outcomes (e.g., self-harm behaviour or thoughts) can therefore be attributed to the intervention administered to the experimental condition because everything else between the conditions is equalised. Randomised controlled designs are therefore recognised as 'gold-standard' in intervention research (Hariton & Locascio, 2018). Given also that most studies of implementation intentions utilise a randomised controlled design (Armitage et al., 2016; Bélanger-Gravel et al., 2011; Malaguti et al., 2020; McWilliams et al., 2019; O'Connor et al., 2017), they were employed in this programme of research.

Testing the effectiveness of an intervention also requires careful consideration of the task used in the control condition. Consistent with many studies of behaviour-change interventions (e.g., Schulz et al., 2013), earlier studies of implementation intentions tended to use 'passive' control conditions (e.g., Orbell et al., 1997; Sheeran & Orbell,

1999; Sheeran et al., 2005 [study 1]). In these studies, the participants in the experimental condition were asked to form implementation intentions to change their behaviour. The participants in the control condition did not receive any intervention or additional task. This means that the experimental participants had greater demand placed upon them to encourage behaviour–change. Any improvements in behaviour observed in the experimental relative to the control condition may therefore have been the result of this 'demand effect' (Rosenthal, 1966) rather than the implementation intention intervention *per se*.

More recently, to overcome the limitation of potential demand effects, 'active' control groups have become more commonplace when testing the effectiveness of implementation intention interventions (e.g., Armitage et al., 2017; Brewster et al., 2015; Elliott et al., 2021). Participants in an active control condition are presented with an alternative intervention, or a task, that is designed to place a demand on them to change their behaviour, similar to the experimental condition. This means that demand effects can be ruled out as an explanation for any observed differences between the conditions. In recent studies of implementation intentions, the participants in the active control conditions have been presented with alternative interventions (e.g., educational materials) designed to cause behaviour-change (Ahn et al., 2021; Brewster et al., 2015; Brewster et al., 2016; Luszczynska et al., 2016; Valshtein et al., 2020 [study 2]). Alternatively, they have been asked to specify the components of implementation intentions, similar to the participants in the experimental condition. However, whereas the participants in the experimental conditions have been asked to specify critical situations and link them with goal-directed responses, the participants in the active control conditions have been asked to specify critical situations only (e.g., Elliott et al., 2021; Paterson et al., 2023) or both critical situations and goal-directed responses but without linking the two (e.g., Armitage

et al., 2016; Armitage et al., 2017; Armitage & Arden, 2012; Epton & Armitage, 2017; McGrath et al., 2020). Active control conditions therefore provide a stringent test of implementation intentions and enable researchers to rule out the possibility that any improvements in outcomes measures are the result of demand effects. Specifically, they enable researchers to rule out the possibility that any improvements in outcome measures are attributable to the participants in the experimental conditions just thinking about and selecting the critical situations (e.g., triggers for self-harm) and goal directed responses (e.g., strategies to reduce self-harm). Rather, the improvements can be reasonably attributed to the act of forming implementation intentions (i.e., linking critical situations with goal-directed responses). Active control conditions were therefore used in this programme of research.

3.3 Implementation intention intervention considerations

Researchers have used various intervention methods to encourage participants to form implementation intentions. In most previous field studies focusing on real-world behaviours (e.g., health behaviours), researchers have employed interventions that encourage 'self-generated' implementation intentions. In these studies, participants are asked to identify their own critical situations and link these with goal-directed response that they have also identified for themselves. This method of encouraging implementation intention formation provides individuals with the opportunity to develop a bespoke plan for how they will change their behaviour, which is tailored to their own specific needs and circumstances (e.g., the critical situations that they think will be most relevant for them). It has also been found to effectively change many different health and social behaviours (e.g., Armitage & Arden, 2008; Hagger et al., 2012; Sheeran et al., 2005 [study 1]). However, it has been acknowledged that 20-40% of participants do not follow planning intervention instructions (Sniehotta, 2009). The quality of these types of plans

are therefore expected to vary across participants (Sniehotta, 2009). Indeed, critical situations and goal directed responses can be vaguely specified and the required IF (specification of critical situation) - THEN (specification of goal-directed response) planning format that is essential for implementation intentions to be effective at changing-behaviour (see discussion of Armitage, 2008, below) can be violated (Elliott, 2006)

A potential way to overcome the limitation of self-generated implementation intentions is to ask participants to form their implementation intentions with the aid of a health professional who can help ensure that the most relevant critical situations and goal-directed responses are well-selected, and the required planning (IF-THEN) format is followed (Armitage, 2009). This method has been used in previous research to test the effectiveness of implementation intentions at generating weight loss (e.g., Luszczynska et al., 2007). However, as this approach requires a health professional, it is likely to be costly and resource intensive with limited reach (i.e., a limited number of people could receive the intervention). In addition, as mentioned in chapter 1 (section 1.4.3.3), many people do not seek medical services to seek face-to-face support for their self-harm, due to feelings of shame and stigma associated with the behaviour (e.g., Long, 2018). This approach to encourage implementation intention formation therefore would not address the intervention requirements identified in chapter 1.

Another way to overcome the limitations of self-generated implementation intention interventions is to use 'experimenter-provided' implementation intentions. This method has been used in laboratory studies where participants have typically been provided with a single pre-defined critical situation and goal-directed response. For example, Webb and Sheeran (2007) presented participants in an experimental condition with the following 'experimenter-generated' implementation intention: 'If I see *avenda* [a

non-word presented on the screen] then I will press the key [a key labelled 'non-word'] especially quickly!'. Subsequently, these participants responded significantly faster to the target stimuli ('avenda') when it was presented on a computer screen than did the control participants, who familiarised themselves with the non-word 'avenda' only. However, while such experimenter-generated implementation intentions have been shown to improve performance in laboratory studies, they have been criticised for typically being based on the intuition of the researchers rather than theoretical research evidence (e.g., Armitage, 2008). They are also unlikely to generalise effectively to real-world behaviours, such as self-harm. As discussed in section 2.2, there are many triggers (i.e., critical situations) for self-harm, and these vary across individuals (Doyle et al., 2017; Hetrick et al., 2020; Townsend, Wadman et al., 2016). Similarly, there are many different strategies (i.e., goal-directed responses) that people could use to cope with their triggers for self-harm. These include social support, sensation techniques (e.g., holding ice cubes), distraction techniques (e.g., listening to music) and relaxation, with the perceived usefulness of strategies varying across individuals (e.g., Davies et al., 2022; Fenton & Kingsley, 2023; Wadman et al., 2020). Additionally, the importance of possessing a repertoire of strategies has also been emphasised by people who engage in self-harm (Hetrick et al., 2020). The provision of a singular, experimenter-provided implementation intention (one critical situation and one linked goal directed response) is therefore unlikely to be appropriate for reducing self-harm.

An alternative approach that overcomes the above-cited limitations of experimenter-provided implementation intentions is a volitional help sheet (Armitage, 2008). The first volitional help sheet was developed to reduce smoking (Armitage, 2008). It was a presented on one side of a single piece of paper. On the left-hand side of the page, there was a list of 20 critical situations that are known to tempt people to smoke.

These were presented as IF statements (e.g., “If I am tempted to smoke when I am extremely depressed”). On the right-hand side of the page, there was a list of 20 goal-directed responses that could be used to resist the temptation to smoke. These were presented as THEN statements (e.g., Then I will tell myself I can quit if I want to). The critical situations (IF statements) were taken from Velicer et al.’s (1990) temptations to smoke scale. This scale includes a range of situations that are known from empirical evidence to tempt people to smoke. The goal-directed responses (THEN statements) were adapted from a short form of Prochaska et al.’s (1988) processes of change scale. This scale was based on the Transtheoretical Model (Prochaska & DiClemente, 1983), which specifies 10 processes through which people can change their behaviour. These are:

(1) Consciousness raising (acquiring information about the problem behaviour)
(2) Self-liberation (choosing and making a commitment to the change the problem behaviour and believing in one’s ability to do so)
(3) Dramatic relief (experiencing and expressing emotions about the consequences of the problem behaviour)
(4) Counter-conditioning (substituting the problem behaviour with alternatives)
(5) Stimulus control (avoiding the stimuli that elicits the problem behaviour)
(6) Helping relationships (seeking social support for changing the problem behaviour)
(7) Environmental re-evaluation (assessing the effects of the problem behaviour on physical and social environment)
(8) Social liberation (acknowledging societal support for changing the problem behaviour)
(9) Self re-evaluation (assessing how one thinks and feels about oneself with respect to the problem behaviour)

(10) Reinforcement management (use of rewards for changing the problem behaviour).

In Armitage's (2008) volitional help sheet, two goal-directed responses mapped onto each of the processes of change. Armitage (2008) tested his volitional help sheet by randomising participants to one of two experimental conditions or one of two control conditions. All participants completed a pre-intervention questionnaire measuring their smoking behaviour, self-regulation, self-efficacy, and goal intentions to quit smoking. The participants in the experimental conditions were additionally given the volitional help sheet. In one experimental condition, the participants were asked to tick the critical situations that they thought would tempt them to smoke over the next month and goal-directed responses that they thought would help them overcome the temptation to smoke ('if-then list condition'). In the other experimental condition, the participants were asked to draw a link between the critical situations that they felt would tempt them to smoke and the goal-directed responses they would employ should those critical situations be encountered ('if-then link condition'). The participants in the control conditions were asked to either complete the baseline questionnaire only ('passive control condition') or to complete the baseline questionnaire and write their own plans to quit smoking in a space provided at the end of the questionnaire. The results of the study showed that at one-month post-intervention there was a significant reduction in the number of participants who quit smoking in the if-then link condition compared to any other condition. Similarly, the participants in the if-then link condition smoked significantly fewer cigarettes at follow-up compared to the other conditions. This study therefore supports the use of volitional help sheets to help participants form implementation intentions. In particular, it emphasises the importance of forming links between the

provided if (critical situation) and then (goal-directed response) statements in order to generate effective behaviour-change.

Since the first test of the volitional help sheet by Armitage (2008), several studies have used this method for encouraging participants to form implementation intentions. Those studies have shown that volitional help sheets can generate significant changes in real-world behaviours including alcohol consumption (e.g., Arden & Armitage, 2012; Armitage, 2015; Armitage & Arden, 2012), weight loss (e.g., Armitage et al., 2017; Armitage et al., 2014), physical activity (e.g., Armitage & Arden, 2010; Chapman et al., 2018), drivers' speeding behaviour (e.g., Brewster et al., 2015, Brewster et al., 2016), and mobile phone use while driving (e.g., Elliott et al., 2021). A volitional help sheet was also the method used in Armitage et al. (2016) and O'Connor et al. (2017) to encourage the formation of implementation intentions to reduce self-harm. As discussed in chapter 2 (section 2.3), these studies have shown promising results in reducing self-harm related outcomes in patients admitted to hospital. In addition, a recent meta-analytic review of 16 studies by Cooke et al. (2023) reported greater behaviour-change in studies where implementation intentions were formed using a volitional help sheet (d = -0.34) rather than alternative interventions, specifically ones encouraging the formation of self-generated implementation intentions (d = - 0.07). Similar results have also been found in single studies in which researchers have directly compared the effectiveness of volitional help sheet-generated and self-generated implementation intentions (e.g., Chapman et al., 2018). As a result, a volitional help sheet was the chosen method for forming implementation intentions in this thesis.

The volitional help sheet used in the research that is subsequently presented in this thesis was based on the volitional help sheet that was developed by Armitage et al. (2016) and used in both that study and the one by O'Connor et al. (2017). This volitional help

sheet contained 11 critical situations (IF statements). These were selected from items that had been used in previous studies to measure people's reasons for self-harm (e.g., Hjelemand et al., 2002; Madge et al., 2008). It also contained 11 goal-directed responses (THEN statements). These were identified from items used to measure the processes of change, specified in the transtheoretical model (Prochaska & DiClemente, 1983). While the critical situations and goal-directed responses were designed for use with patients admitted to hospital for self-harm, they were also deemed appropriate for use in the present research because they represented relevant triggers (e.g., 'want to get relief from a terrible state of mind') and coping strategies (e.g., 'think about the impact of my self-harming on the people around me') regardless of whether self-harm results in hospitalisation (e.g., Gardner et al., 2021; Gelinas & Wright, 2013; Gillies et al., 2018; Hambleton et al., 2020; Rasmussen et al., 2016). They were therefore considered to be appropriate for inclusion in the volitional help sheets administered in the current programme of research for reducing self-harm in the community.

The volitional help sheets used in the present research programme also included supplementary critical situations and goal-directed responses in addition to those used by both Armitage et al. (2016) and O'Connor et al. (2017) (see Table 3.1). The additional critical situations were identified from theoretical models that have specified key triggers that lead to the engagement of self-harm behaviour (Joiner, 2005; O'Connor & Kirtley, 2018; Van Orden et al., 2010). The additional goal-directed responses were identified from existing resources for self-harm reduction (e.g., the Mental Health Foundation, date accessed: October 2018; Mind, date accessed: October 2018, updated 2020; National Self-Harm Network, 2007; the Scottish Association for Mental Health, date accessed: October 2018). They were also adapted from goal-directed responses in volitional help sheets for other health behaviours, which were not used by Armitage et al. (2016) and

O'Connor et al. (2017) but contained coping strategies that could be adapted to suit self-harm reduction (e.g., Armitage, 2008; Brewster et al., 2015; Elliott et al., 2021). Consistent with previous research, these additional strategies were also mapped onto Prochaska and DiClemente's Transtheoretical Model (1983). In total there were, 20 critical situations and 22 goal-directed responses in the volitional help sheets developed for this programme of research.

Table 3. *Critical situations and goal-directed responses used in the volitional help sheet(s)*

Critical situations	Goal-directed responses
I want to get relief from a terrible state of mind	Remind myself about the benefits of not self-harming
I want to punish myself	Recall all that I know about the dangers of self-harming
I want to die	Do something instead of self-harming (e.g., doing some exercise, squeeze an ice cube, draw on yourself in red pen)
I want to show how desperate I am feeling	Take prescribed medication to stop me feeling this way
I want to find out whether someone really loves me	Tell myself that I can avoid self-harming if I want to
I want to get some attention	Remember that I have made a commitment not to self-harm
I want to frighten someone	Tell myself that society is changing in ways that make it easier for people to avoid self-harming
I want to get my own back on someone	Remind myself that there are groups in society that now provide support to people who feel this way (e.g., Samaritans, the National Self-Harm Network Forum, Harmless)
I feel hopeless	Make sure I am rewarded by others if I don't self-harm
I feel trapped by a situation (e.g., work, a relationship, obligations)	Make sure I reward myself if I don't self-harm
I feel trapped inside myself by my own thoughts and feelings	Think about the impact my self-harming would have on the people around me
I feel powerless	Think about how harming myself might affect how people view me
I feel like I have lost my standing in the world	Remember that I get upset when I think about harming myself
I feel that I don't belong	Think about the guilt or shame that I might feel after harming myself
I feel lonely	Tell myself that any feelings of relief due to harming myself will only be temporary

Table continues on next page…

Table 3. (continued). *Critical situations and goal-directed responses used in the volitional help sheet(s)*

Critical situations	Goal-directed responses
I feel people I like don't like me back	Remember that there are people in my life who care for me
I have no one to turn to	Put things around my home or place of work (e.g., photographs of friends or loved ones, or reminders of happy times) that help me manage these feelings
I feel like I am a burden	Try to avoid putting myself in situations that make me feel this way in the future
I feel like others would prefer me not to be here	Seek out someone trustworthy who I can talk to about these feelings
I hate myself	Contact a helpline (e.g., Samaritans) or a self-harm support group
-	Tell myself that I do not deserve to be hurt
-	Remind myself that these feelings do not define who I am, and they do not mean I need to harm myself

Note: The critical situations and goal-directed responses provided in this table are worded for use in the volitional help sheet developed for self-harm behaviour

In this research, the implementation intention intervention was an online volitional help sheet which presented participants with critical situations and goal-directed responses. The critical situations were presented as IF statements and the goal-directed responses were presented as THEN statements in a series of drop-down lists. The participants were first asked to select the critical situation that they felt would tempt them the most to self-harm or think about self-harm over the next three months. They were then asked to link the chosen critical situation with a goal-directed response which they felt would help them overcome the temptation to self-harm or think about self-harm. The participants were asked to complete this task a further three times, thus forming four implementation intentions. Previous research has also demonstrated that specifying more than one implementation intention is more effective at changing behaviours compared to one alone (e.g., Elliott & Armitage, 2006).

The rationale for four implementation intentions is derived from previous research which demonstrated a larger number of plans specified led to a larger change in behaviour, with the optimal number being four or five plans (Wiedemann et al., 2012). To ensure that the effects of each implementation intention are not weakened by each additional plan, a concern noted by Webb (2006), the maximum number of plans that have been formed in previous research which have been found to effectively change behaviour was four (e.g., Brewster et al., 2015; Elliott et al., 2021). Thus, participants were invited to form four implementation intentions in the research presented in this programme of research. These interventions are presented in Appendix 1 (intervention for reducing self-harm behaviour) and Appendix 2 (intervention for reducing self-harm thoughts).

3.4 Measurement considerations

3.4.1 The outcome measures

Self-report represents a widely accepted method in the social sciences (e.g., Haeffel & Howard, 2010) and is used to measure many behaviours (e.g., Evans et al., 2019; Fraschetti et al., 2021; Meyer et al., 2020; Szinay et al., 2019), including self-harm (Griffin et al., 2023; Rasmussen et al. 2023; Russell et al., 2020). While self-reported measures can be criticised for being potentially vulnerable to cognitive (Fulcher, 2003), affective (Watkins et al., 1996), and self-presentational (Paulhus, 2002) biases, which can result in an individual over-or under-estimating the extent to which they have engaged in a behaviour, an objective measure of self-harm (e.g., admission to hospital statistics) is only able to capture a sub-group of those who engage in the behaviour as mentioned in chapter 1 (section 1.2; see also Figure 1). Additionally, an individual may engage in self-harm more times than they present to hospital which would potentially lead to an under-estimation of intervention effects. Self-report measures may therefore usefully overcome these limitations and they have also been found to correlate with objective measures of many health and social behaviours (Elliott et al., 2007; Davies et al., 2020; Teas & Friedman, 2021; Zettergren et al., 2023). Furthermore, meta-analytic evidence by Gollwitzer and Sheeran (2006) shows that implementation intentions generate similar effects on behaviour change regardless of whether self-reported (d = 0.63) or objective (d = 0.67) behaviour measures are used.

Also, as self-harm is a personal, sensitive, and private behaviour, self-reported measurement may be preferred because it can provide participants with anonymity, which has been found to be valued and preferred by participants when disclosing self-harm related information (Cliffe & Stallard, 2023; Coulson et al., 2017; Jones et al., 2011). In turn, providing anonymity can reduce concerns surrounding privacy which is an

identified reason for attrition in health research (Young et al., 2006). Self-reports of self-harm behaviour and thoughts were therefore used as primary outcome measures in the present research.

As mentioned in chapter 2 (section 2.3), it is acknowledged that previous studies testing the effects of implementation intentions with samples of hospital patients have used established self-report measures that relate to suicidality (i.e., the Suicide-Behaviour Questionnaire – Revised; Osman et al., 2001). This is appropriate because, suicidal thoughts and behaviours, as measured by the Suicide-Behaviour Questionnaire – Revised are more likely to be observed in hospital patients rather than community samples (Farabaugh et al., 2015; Osman et al., 2001; Robinson et al., 2021). In addition, there are a wider range of triggers for self-harm (see chapter 2, section 2.2) and these triggers can also vary across individuals (e.g., Lockwood et al., 2023; Rasmussen et al., 2016). Primary outcome measures that capture how often people self-harm or think about self-harm when they encounter their individual triggers (e.g., as specified in the IF component of their implementation intentions) are therefore needed to reduce the risk of unduly underestimating intervention effects. Furthermore, focusing on the frequency of self-harm behaviour or thoughts in the critical situations that are specified in the IF components of participants' implementation intentions ensures that the primary outcome measures align with the theoretical proposition that implementation intentions generate behaviour change when people encounter the salient features of the specified critical situations (see chapter 2, section 2.2). Previous research on other health-related behaviours has supported this theoretical proposition by showing that implementation intentions generate behaviour-change in measures of behaviour in specified situations (or situations that are contextually very similar) but not unspecified critical situations (e.g., Brewster et al., 2016; Elliott et al., 2021). The primary outcome measures used in this research therefore were the

frequency of self-harm behaviour or thoughts, in the critical situations specified in the IF components of participants' implementation intentions.

In line with the studies just cited, self-harm thoughts and behaviours in other, unspecified, critical situations were included as secondary outcome measures to gauge whether there are any spill-over effects from specified to unspecified critical situations (i.e., generalisation effects). The procedures employed by Brewster et al. (2015) and Elliott et al. (2021) were adapted for use in this research. The participants were asked how many times they had harmed themselves in each of the situations they could have selected from the volitional help sheets using 9-point scales (1 = *No times* to 9 = *Many times*). The means of the items that corresponded to the critical situations selected by the participants were used as the measures of self-harm behaviour or thoughts in specified critical situations. The measures of self-harm behaviour and thoughts in unspecified critical situations were calculated by taking the means of the items that corresponded to the remaining, unchosen, critical situations. The previous studies cited above have shown that these measures generate reliable data with Cronbach's alpha over 0.70 (i.e., α = .85 - .94).

Furthermore, it was also deemed appropriate to include the measure of suicidality referred to above as a secondary outcome measure to determine whether any reductions in the primary outcome translated to changes in suicidality, for comparability with previous research. The Suicide-Behaviour Questionnaire – Revised (Osman et al., 2001), which was employed by Armitage et al. (2016), was therefore used. The first item from the SBQ-R measures suicidal ideation and behaviour: "Have you thought about or attempted to kill yourself over the LAST 3 months?" (1 = *Never* to 6 = *I have attempted to kill myself, and really hoped to die*). The second item measures frequency of suicidal thoughts: "How often have you thought about killing yourself over the LAST 3 months?"

(1 = *Never* to 5 = *Very often [5 or more times]*). The third item measures threat to die by suicide: "Have you told someone that you were going to commit suicide or that you might do it over the LAST 3 months?" (1 = *No* to 5 = *Yes more than once and really wanted to do it*). The fourth item measures the likelihood of future suicide attempts: "How likely is it that you will attempt suicide over the NEXT 3 months?" (1 = *No chance at all* to 6 = *Very likely*). Following Armitage et al. (2016), the four items were used as separate outcome measures.

In addition, measures of anxiety and depression were included as secondary outcomes. The rationale for including anxiety and depression as secondary outcomes was to permit tests of potentially unintended and detrimental or desirable intervention effects. As self-harm is often used as a strategy to cope with negative emotions (e.g., Bryant et al., 2021; Edmondson et al., 2018; Mughal et al., 2023; Ogden & Bennett, 2015), preventing people from using this strategy may mean people are left experiencing feelings of distress. As a result, this could unintentionally increase feelings of anxiety and depression which are associated with self-harm (Müller et al., 2016; O'Connor et al., 2010; Russell et al., 2020). Alternatively, as self-harm is associated with anxiety and depression, an intervention which reduces self-harm may have additional desirable effects on these states (i.e., reduce anxiety and depression symptoms). Previous research has not investigated this possibility when testing the effectiveness of implementation intentions at reducing self-harm related outcomes (Armitage et al., 2016; O'Connor et al., 2017). However, ruling out unintended consequences such as increases in anxiety and depression is particularly important when considering the value of an intervention and whether to implement it (Oliver et al., 2019).

The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) was used to measure anxiety and depression. The HADS is a recognised measure of anxiety

and depression which includes a total of 14 items (seven items measure anxiety symptoms and seven items measure depression symptoms). Shortened versions of the measure have also been proposed (e.g., Maatoug & Gorwood, 2019; Straat et al., 2013). The measures of anxiety and depression produced by the full and shortened versions of the HADS have been found to produce reliable and valid data (Bjelland et al., 2002; Christensen et al., 2020; Maatoug & Gorwood, 2019; Michopoulos et al., 2008; Straat et al., 2013). In this research, five items were used to measure anxiety: I feel tense or wound up" (Not at all [scored 0] to Most of the time [scored 3]); "I have been getting a sort of frightened feeling, as if something awful is about to happen" (Not at all [scored 0] to Very definitely and quite badly [scored 3]); "Worrying thoughts have gone through my mind" (Only occasionally [scored 0] to A great deal of the time [scored 3]); "I have been getting sudden feelings of panic" (Not at all [scored 0] to Very often indeed [scored 3]); and "I have been able to sit at ease and feel relaxed" (Definitely [scored 0] to Not at all [scored 3]). Five items were also used to measure depression: I have still been enjoying the things I used to" (Definitely as much [scored 0] to Hardly at all [scored 3]); "I have lost interest in my appearance" (I take just as much care as ever [scored 0] to Definitely [scored 3]); "I have been able to laugh and see the funny side of things" (As much as I always could [scored 0] to Not at all [scored 3]); "I have been looking forward with enjoyment to things" (As much as I ever did [scored 0] to Hardly at all [scored 3]) and "I have felt cheerful" (Most of the time [scored 0] to Not at all [scored 3]). Final measures of anxiety and depression were calculated by taking the mean of the individual items in this research.

3.4.2 The moderator variables

Motivational moderators

Many previous studies of implementation intentions have included measures of goal intention (Armitage, 2007; Armitage et al., 2016; Brewster et al., 2015; Chapman et al., 2009; Elliott et al., 2021). This was to rule out the possibility that changes in behaviour observed in an experimental (i.e., implementation intention intervention) condition, could be explained by an increase in motivation (e.g., increasing the intention to avoid engaging in self-harm). It could therefore be concluded more confidently that the observed changes in behaviour were due to existing goal intentions being translated into action, in line with the theoretical expectation, as outlined in chapter 2 (section 2.1). As also mentioned in chapter 2 (section 2.4.2.1), this theoretical expectation will be directly tested in this research by investigating whether goal intentions moderate the effects of implementation intentions at reducing self-harm outcomes. Typically, measures of goal intention are based on widely accepted items recommended by Fishbein and Ajzen (e.g., Fishbein & Ajzen, 2010). For instance, participants are asked to indicate how much they will try, intend, plan, and want to perform a behaviour (e.g., avoid self-harm) using unipolar scales (e.g., 1 = not at all to 9 = very much). The mean of the separate items is typically used as the final measure of goal intention. These existing measures of goal intention have been found to possess high levels of reliability and validity (Armitage & Conner, 2001; Armitage et al., 1999; Brewster et al., 2015; Cooke et al., 2016; Elliott et al., 2003; McEachan et al., 2011). This approach to measuring goal intentions to avoid self-harm behaviour and thoughts was therefore used in this research.

Volitional moderators

As also stated in chapter 2 (section 2.4.2.2), this thesis will examine the extent to which key volitional moderators specified in the Integrated Motivational-Volitional Model of Suicidal Behaviour (O'Connor & Kirtley, 2018) moderate the effects of implementation intentions on behaviour-change (reductions in the overt act of self-harm).

The two key moderators chosen were suicide and self-harm related mental imagery and exposure to self-harm. These constructs have also been measured in previous studies using self-reports (del Carpio et al., 2020; Dhingra et al., 2015; Holaday & Brausch, 2015; O'Connor et al., 2012; Wetherall et al., 2018). Typically measures for exposure to self-harm have asked about participants exposure to friends and family self-harm separately. For instance, participants are asked 'Has anyone among your close friends [your family] attempted suicide or deliberately harmed themselves?' (e.g., O'Connor et al., 2012).

For mental imagery, previous research has used the suicidal cognitions interview (e.g., Hale et al., 2011; Holmes et al., 2007) which has been adapted into a self-report measure by Holaday (2013). The adapted measure includes a list of the types of images participants could experience including "an image of when you tried to hurt yourself in the past" and "an image of yourself planning/preparing to harm yourself or make a suicide attempt" using a unipolar scale (e.g., 0 = never to 2 = often; Holaday, 2013). These existing measures of exposure to self-harm and mental imagery have been found to produce high levels of reliable and valid data (Dhingra et al., 2015; Holaday & Brausch, 2015; Mars et al., 2019; O'Connor et al., 2012; Wetherall et al., 2018). These items were therefore chosen for use in this research.

Cognitive moderators

The present research will also examine the extent to which cognitive abilities moderate the effects of implementation intentions on behaviour-change (i.e., reductions in self-harm thoughts and the overt act of self-harm behaviour; see chapter 2, section 2.4.2.3). Cognitive abilities can be measured using either self-report or objective measures. Self-reported measures of attention and prospective and retrospective memory have reported high internal and test-retest reliability (Crawford et al., 2003; Judges et al.,

2017; Pereira & Albuquerque, 2018; Seidenberg et al., 1994; Yang et al., 2022). They have also demonstrated validity through correlations with lab-based and naturalistic measures (Gryffydd et al., 2020; Seidenberg et al., 1994). For this reason, self-report measures of these abilities were included in the programme of research.

Specifically, in this research the attention sub-scale from the Multiple Ability Self-Report Questionnaire (MASQ; Seidenberg et al., 1994) was used to measure difficulties in attention. The sub-scale contains eight items, half of which are reverse scored: "I can do simple calculations in my head quickly" (reverse scored); "I ask people to repeat themselves because my mind wanders during conversation"; "I am alert to things going on around me" (reverse scored); "I have difficulty sitting still to watch my favourite TV programs"; "I am easily distracted from my work by things going on around me"; "I can keep my mind on more than one thing at a time" (reverse scored); "I can focus my attention on a task for more than a few minutes at a time" (reverse scored); and "I find it difficult to keep my train of thought going during a short interruption". Participants respond to each item using a 5-point scale (1 = *Never* to 5 = *Always*). The mean of the separate items has been used as a final measure of attention in previous research (e.g., Nicholls et al., 2021). This approach to measuring attention was therefore used in this research.

In addition, the Prospective and Retrospective Memory Questionnaire (PRMQ; Smith et al., 2000) was used to measure errors in both prospective and retrospective memory in this research. The PRMQ consists of 16 items which are scored on a 5-point scale (1 = *Never* to 5 = *Very Often*). Eight items measure everyday prospective memory errors: "Do you decide to do something in a few minutes' time and then forget to do it?"; "Do you forget to tell someone something you had meant to mention a few minutes ago?"; "Do you fail to do something you were supposed to do a few minutes later even

though it's there in front of you, like take a pill or turn off the kettle?"; "Do you intend to take something with you, before leaving a room or going out, but minutes later leave it behind, even though it's there in front of you?"; Do you forget appointments if you are not promoted by someone else or by a reminder such as a calendar of diary?"; "If you tried to contact a friend or relative who was out, would you forget to try again later?"; "Do you forget to by something you planned to buy, like a birthday card, even when you see the shop"?. Likewise, there are eight items to measure retrospective memory errors: "Do you forget something that you were told a few minutes before?"; "Do you mislay something, that you have just put down, like a magazine or glasses?"; "Do you fail to recognise a character in a radio or television show from scene to scene?"; "Do you look at something without realising you have seen it moments before?"; Do you fail to recall things that have happened to you in the last few days?"; Do you forget what you watched on television the previous day?"; "Do you fail to recognise a place you have visited before?"; Do you repeat the same story to the same person on different occasions?". The mean of these items is typically used as the final measures of prospective and retrospective memory (e.g., Piauilino et al., 2010). This approach was therefore used in this research.

Objective measures of cognitive abilities were also included within this programme of research, where face-to-face research was conducted. These measures were derived from standardised tests contained within the National Institutes of Health Toolbox – Cognition Battery (NIHTB-CB; National Institutes of Health and Northwestern University, 2018), and from the Royal Prince Alfred Prospective Memory Test (Radford et al., 2011).

The tests chosen from the NIHTB-CB which are subsequently described have reported good test-retest reliability and both convergent and discriminant validity against

other standardised cognitive tests (Carlozzi et al., 2015; Dikmen et al., 2014; Tulsky et al., 2014; Weintraub et al., 2013; Weintraub et al., 2014; Zelazo et al., 2014). The following measures from the NIHTB-CB were used:

- List sorting working memory test to measure working memory
- Picture sequence memory test to measure episodic memory
- Flanker inhibitory control and attention test to measure inhibition
- Pattern comparison processing speed test to measure processing speed

List sorting: In this working memory test participants are asked to sort and sequence information (i.e., animals and food) presented to them visually and auditorily on an iPad (National Institutes of Health and Northwestern University, 2018). In a given trial, an item is presented on the screen for two seconds and accompanied by an audio recording naming the item, followed by further items, depending on the length of the sequence to be remembered in the trial. When the sequence is finished, the participants are asked to verbally repeat the sequence back to the experimenter, in size order from smallest to largest. For example, when elephant, mouse, and cat are presented, the correct response would be mouse, cat, elephant; Tulsky et al., 2014). This requires the ability not only to retain the items, but also to process them meaningfully, before providing the response. The test begins with a 1-category version of the task (i.e., listing animals or food only). With each correct sequence response, the number of items presented in the subsequent trial increases by one, up to a maximum of seven. When an incorrect response is provided, the participant is given a second trial with the same number of stimuli. If a subsequent incorrect response is provided, the 1-category task is ended. Upon completion or termination of the trials in the 1-category version, a 2-category version of the task begins. This version involves two categories being presented within the same sequence

(i.e., animals and food). Here, participants are required to organise the stimuli from smallest to biggest, within categories, stating all the food objects in size order first. For example, when hamburger, bird, and cherry are presented, the correct response would be cherry, hamburger, bird (Tulsky et al., 2014). With each correct sequence response, the number of items presented in the subsequent trial increases by one, up to a maximum of seven. In this version, when an incorrect response is provided, the participant is given a second trial of the same number. If a subsequent incorrect response is provided at the same sequence level, the task terminates. The total number of correctly recalled and sequenced items across both versions of the test provides the final test score for working memory between 0-26 which is calculated automatically in the app (National Institutes of Health and Northwestern University, 2021).

Picture sequence: In this episodic memory test participants are asked to view and reproduce a sequence of related pictures on an iPad screen (e.g., 'playing in the park'; National Institutes of Health and Northwestern University, 2018). In this task, participants are presented with a picture and an auditory description of the object/activity in the image (e.g., 'feed the ducks'). The picture moves to a fixed position around the edge of the screen, according to the order of events, allowing the next picture/activity to be described. This process is continued until all the pictures and their descriptions have been presented and placed in their fixed, ordered positions around the screen. They are then scrambled into a random order across the screen. The participants are asked to reproduce the order of events by placing the pictures back into order, where they had previously been (i.e., their earlier fixed positions). The participants first complete a practice trial with four images and, if this is completed successfully, they are subsequently presented with two trials, one with 15 images and a subsequent trial with an additional three images added (Dikmen et al., 2015; National Institutes of Health and Northwestern University, 2018).

The final score for episodic memory ability is calculated based on the number of correctly placed adjacent images (Dikmen et al., 2015; National Institutes of Health and Northwestern University, 2021). One point is awarded for each pair of images that is correctly placed adjacent to each other (e.g., one point if slots 1 and 2 are correctly filled, one point if slots 2 and 3 are correctly filled, etc.). The total possible score for one trial is therefore one less than the total number of images/events presented within that sequence which provides a final normative score between 0-31 for episodic memory which is calculated automatically in the app (National Institutes of Health and Northwestern University, 2021).

Flanker: In this inhibition test participants are asked to identify whether an arrow presented in the centre of the iPad screen is pointing left or right (National Institutes of Health and Northwestern University, 2018). At the same time, participants must ignore (i.e., inhibit) the stimuli presented on each side of the centre arrow. These stimuli are arrows (i.e., 'flankers') pointing in either the same (i.e., congruent) or opposite (i.e., incongruent) direction. Participants are first presented with two arrow buttons (one facing left and the other facing right) and are asked to press the button which corresponds to the direction the central arrow is facing as quickly as possible. Participants are then provided with practice trials before proceeding with the 20 test trials. Before each trial, the participants are presented with the word "MIDDLE" to remind them to focus on the arrow in the centre. Accuracy and reaction time are calculated in the app to provide a final score of inhibition. Accuracy is considered first when calculating the final computed score. If a participant has an accuracy score less than or equal to 80%, the final computed score calculated in the app, reflects the accuracy score only (i.e., a score between 0-5). If a participant has an accuracy score greater than 80%, the final computed score calculated in the app reflects both accuracy and reaction time providing an overall computed score

between 0-10 (National Institutes of Health and Northwestern University, 2021; Zelazo et al., 2014).

Pattern comparison: In this processing speed test, participants are asked to report, as quickly as possible, if two images presented on the iPad screen are the same or different (National Institutes of Health and Northwestern University, 2018). The images presented are either the same or they differ on one of the two characteristics: colour, or the addition or removal of part of the image (e.g., two matching or different coloured flowers; National Institutes of Health and Northwestern University, 2018). The final number of correct responses provides a normative score for processing speed between 0-130 which is calculated automatically in the app (National Institutes of Health and Northwestern University, 2021).

In addition, items from the Royal Prince Alfred Prospective Memory Test (Radford et al., 2011) were adapted and administered as an objective measure of prospective memory. For this test, participants are provided with the prospective memory task instructions at the beginning of the testing session. Participants are informed that they can use any techniques which they think would help them remember to perform the tasks. Additionally, before proceeding with the testing session, participants are asked to confirm that they understood the task instructions. The test items are separated by other tasks in the testing session (e.g., between a pre-intervention questionnaire and other measures of cognition). Each item is scored on a 6-point scale (i.e., 0 = no response; 0 = incorrect response, >2 minutes delay or ahead or time; 1 = correct response > 5 minutes delay or ahead of time; 2 = correct response, 2-5 minutes delay; 2 = incorrect response up to 2 minutes delay; 3 =correct response, up to 2 minutes delay). A final score of prospective memory between 0-6 could therefore be calculated. This test has also demonstrated good

inter-rater reliability and ecological validity (Radford et al., 2011). Items from this measure were therefore adapted for use in this research.

3.5 Conclusions

This chapter has shown that research testing implementation intention interventions should use true experimental (i.e., randomised controlled) designs and active control groups. It has also shown that volitional help sheets are likely to be the most effective method for encouraging people to form implementation intentions to reduce self-harm behaviour and thoughts. This chapter has also identified the primary outcome measures for use in this thesis (self-harm behaviour and thoughts, specifically in the critical situations that participants specify in their implementation intentions), the secondary outcome measures (self-harm behaviour and thoughts in unspecified critical situations, suicidality, anxiety, and depression), and the measures of the motivational, volitional, and cognitive moderators. The next chapter in this thesis describes the first empirical study that was conducted in this programme of research.

Chapter 4: Study 1: Testing the effectiveness of implementation intentions at reducing self-harm behaviour in a community sample[2]

4.1 Introduction

This chapter presents the first empirical study that was conducted in this programme of doctoral research. The study was designed to test the extent to which an implementation intention intervention (a volitional help sheet) could reduce self-harm behaviour (the overt act of self-harm). It was also designed to test whether motivational (goal intention) and volitional constructs (suicide and self-harm related mental imagery and exposure to self-harm) moderate the effectiveness of implementation intentions on self-harm, following the rationale provided in chapter 2 (see sections 2.4.2.1 and 2.4.2.2). The hypotheses were as follows:

- Hypothesis 1: The experimental (implementation intention intervention) condition will, subsequently, at post-intervention, report engaging in self-harm behaviour less frequently than will the control condition.

- Hypothesis 2: There will be a two-way interaction between condition and goal intention to avoid self-harm in the prediction of subsequent self-harm behaviour; the experimental condition will report engaging in self-harm less

[2] This research has been published in the British Journal of Health Psychology: Paterson, A., Elliott, M.A., Nicholls, L.A.B., & Rasmussen, S. (2023). Evidence that implementation intentions reduce self-harm in a community sample. *British Journal of Health Psychology*, *98*(4), 1241-1269.. http://doi.org/10.1111/bjhp.12682.

This research was also presented at the European Symposium for Suicidal Behaviour: Paterson, A., Elliott, M.A., Rasmussen, S., & Nicholls, L.A.B. (2022, 24-27 August). Evidence that implementation intentions reduce self-harm in the community. 19th European Symposium for Suicidal Behaviour Copenhagen, Denmark. This was also accepted for presentation at the BPS Social Psychology Section Annual Conference 2022.

frequently than will the control condition, at high (mean +1*SD*) but not low (mean -1*SD*) levels of goal intention to avoid self-harm.

- Hypothesis 3: There will be a two-way interaction between condition and mental imagery in the prediction of subsequent self-harm behaviour; the experimental condition will report engaging in self-harm less frequently than will the control condition, at high (mean +1*SD*) but not low (mean -1*SD*) levels of mental imagery.

- Hypothesis 4: There will be a two-way interaction between condition and exposure to self-harm in the prediction of subsequent self-harm behaviour; the experimental condition will report engaging in self-harm less frequently than will the control condition, at high (mean +1*SD*) but not low (mean -1*SD*) levels of exposure to self-harm.

Following the procedures outlined in chapter 3 (see section 3.4.1), these main and moderator effects were tested primarily using measures of self-harm behaviour in specified critical situations. Following the procedures outlined in chapter 3, they were also tested using measures of: self-harm behaviour in unspecified critical situations, to gauge whether there may be any spill-over effects (i.e., from specified to unspecified critical situations); suicidality, to determine whether any reductions in self-harm behaviour (the overt act of self-harm) translated into reductions in these outcomes, and anxiety and depression, to test for potential unintended negative outcomes (i.e., increases in anxiety and depression) and possible desirable outcomes (i.e., decreases in anxiety and depression).

4.2 Method

4.2.1 Participants

The sample comprised 469 participants, all of whom had reported self-harming in the three months prior to the study. The socio-demographic profile of the sample is shown in Table 4.1. These data are broadly consistent with those normally found in previous research on self-harm (e.g., Branley-Bell et al., 2019; Kaniuka et al., 2020; Wetherall et al., 2018). Power analyses indicated that a final sample of n = 259 was required to detect d = 0.35, at alpha = 0.05 and power = 0.80 (Cohen, 1992), using G*Power 3.1. Given the achieved sample exceeded the target sample, it was deemed that the analyses were appropriately powered.

Table 4.1. *Socio-demographic characteristics of the sample*

Demographic Characteristic	*n*	%
Gender		
Female	405	86.4
Male	32	6.8
Transgender (male to female)	3	0.6
Transgender (female to male)	11	2.3
Transgender (do not identify as male or female)	9	1.9
Not sure	7	1.5
Declined to state	2	0.4
Marital Status		
Married	27	5.8
In a relationship, but not married	181	38.6
Single	250	53.3
Separated	3	0.6
Divorced	5	1.1
Widowed	3	0.6
Employment Status		
Full-time paid work	101	21.5
Part-time paid work	56	11.9
Full-time voluntary (unpaid) work	2	0.4
Part-time voluntary (unpaid) work	7	1.5
Full-time education	219	46.7
Fart-time education	17	3.6
Homemaker	11	2.3
Unemployed	56	11.9
UK resident		
Yes	324	72.6
No	122	27.4

Note. $N = 469$. Participants were on average 23.09 years old ($SD = 6.76$).

4.2.2 Design and Procedure

As mentioned in chapter 3, a randomised-controlled design was used. The participants were randomised to either an experimental (implementation intention intervention) or active control condition and completed both a pre- and post-intervention questionnaire. Advertisements were placed on social media (e.g., Facebook, Twitter, Reddit), online recruitment platforms and forums (e.g., Call for Participants, National Self-Harm Network, Postgraduate JiscMail) and the University of Strathclyde's psychology participation pool[3]. The advertisement stated that the study was being carried out to understand the factors that underlie self-harm in the general population. It asked for volunteers who were aged 18+ years and had self-harmed in the three months prior to the study. Potential participants were asked to click on a link within the advertisement, which directed them to an online participant information sheet. The participant information sheet was held in Qualtrics (software for survey design and administration). It informed participants that the purpose of the study was to better understand self-harm in the general population. This was done to avoid any potential bias in results by disclosing that the study was an intervention. The information sheet also specified participants' ethical rights, stated that participation was confidential and told the participants that they would be invited to complete two questionnaires, three months apart. Potential participants were also informed that as soon as the two questionnaires were matched, any identifying information would be deleted to ensure anonymity. At this point, the participants were also provided with the contact details for self-harm and suicide support organisations (e.g., Scottish Association for Mental Health and Samaritans). If participants wished to

[3] Self-harm support groups were initially contacted to share the research; however, due to the low response rate and a manager of a self-harm support group reporting concerns about sharing the study, recruitment through these groups was not continued.

continue, they were invited to provide informed consent before beginning the online pre-intervention questionnaire.

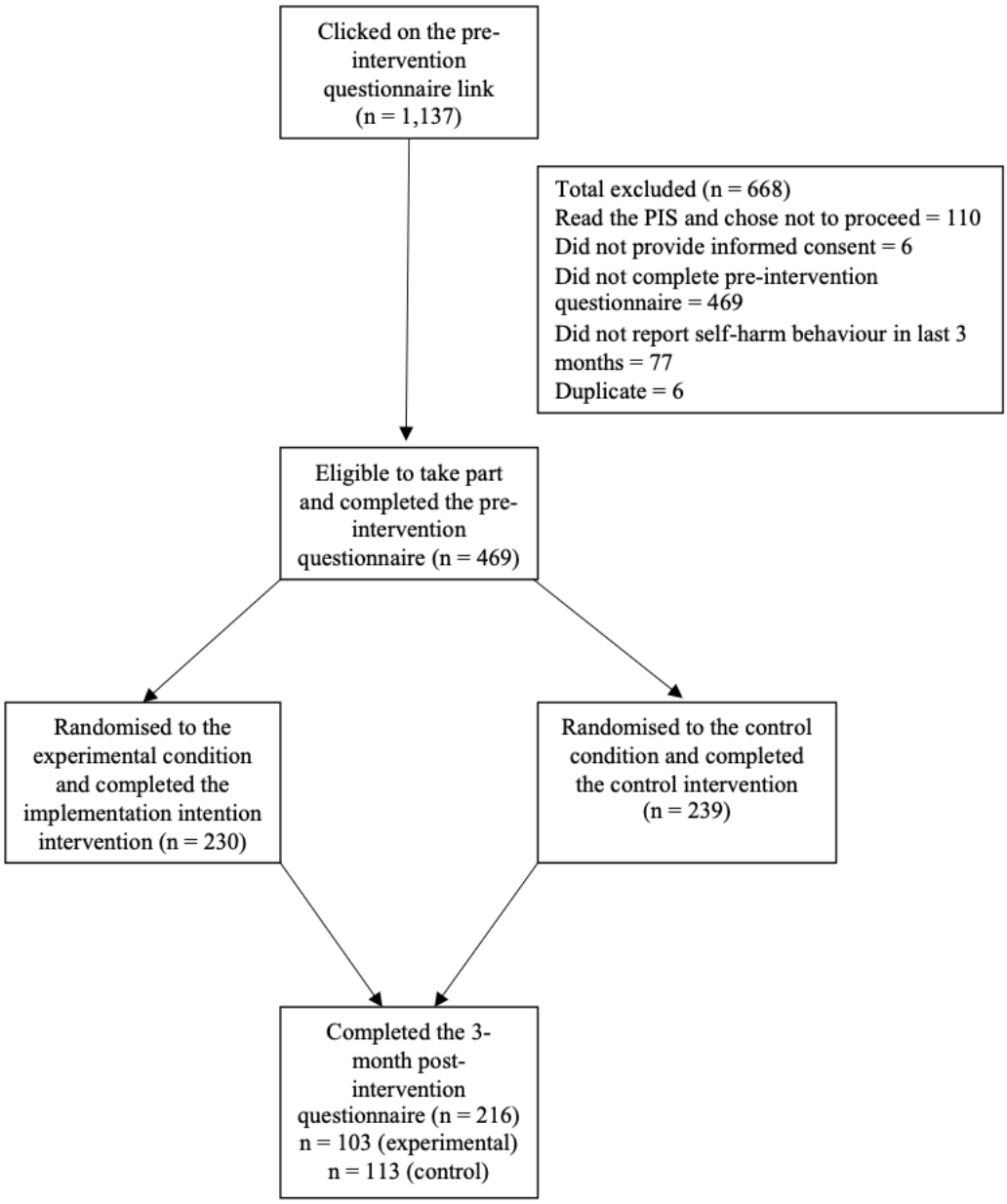
The pre-intervention questionnaire was developed and administered using Qualtrics. Participants first completed standard items to measure socio-demographic variables (see Table 4.1 for details of the socio-demographic measures and the response options) and were asked for their email address so they could be sent the post-intervention questionnaire three months later. Next, the participants were asked to complete standard items to measure the outcome variables (frequency of self-harm in both specified and unspecified critical situations, suicidality, anxiety, and depression) and the moderators (goal intention, mental imagery, and exposure to self-harm) that were required to address the stated aims and hypotheses. The items to measure the outcome variables and moderators were presented in a pseudo random order and approximately half of the response scales were reversed in order to reduce consistency and response set biases, respectively (Budd, 1987; Coolican, 2014). On completion of these items, Qualtrics automatically randomised the participants to an experimental (n = 230) or a control (n = 239) condition (see Figure 4.1). The experimental condition was presented with an intervention (a volitional help sheet) that asked participants to link critical situations with goal-directed responses to avoid self-harm (i.e., form implementation intentions). As mentioned in section 3.2, an active control condition was used consistent with previous implementation intention studies (e.g., Brewster et al., 2015; Elliott et al., 2021). The control condition was presented with an intervention that asked them to select critical situations only and to try to avoid self-harm when those situations were encountered. At the start of the pre-intervention questionnaire, the participants were presented with an example question and the definition of self-harm used in this research: "By self-harm we mean self-injury or self-poisoning regardless of the apparent purpose of

the act". At the end of the pre-intervention questionnaire, the participants were thanked for their time, informed they would be contacted in three months' time and reminded of the contact details for the self-harm and suicide support organisations.

After three months, all participants who completed a pre-intervention questionnaire were emailed a link to an online post-intervention questionnaire in Qualtrics. The post-intervention questionnaire measured the outcome variables using the same items as the pre-intervention questionnaire. At the end of the post-intervention questionnaire, the participants were, once again, thanked them for their time and provided the contact details for key self-harm support agencies. They were also provided with a debriefing sheet that informed them about the study aims and procedures used to test the implementation intention intervention. The debrief sheet also contained the implementation intention intervention in order to ensure that treatment was not withheld from the participants in the control condition.

The pre- and post-intervention data were matched using unique codes that were generated from information provided in both questionnaires (the first initial of their first name, the last initial of their surname, the last two digits of their phone number and the last two letters of their postcode). Once the data were matched, the unique codes and any other identifying information (e.g., email addresses) was deleted to ensure participant anonymity. Figure 4.1 shows the participants' progress through the study. Ethical approval was granted by the University's Research Ethics Committee.

Figure 4.1. *Flow chart showing the participants' progress through the study*



Note. Data were analysed using intention to treat analyses. The pre-intervention observations were carried through to post-intervention for the participants who dropped out of the study prior to the 3-month post-intervention follow-up (Hollis & Campbell, 1999).

4.2.3 The implementation intention intervention

As stated in chapter 3 (see section 3.3), the implementation intention intervention was an online volitional help sheet (see Appendix 1). It was placed at the end of the pre-intervention questionnaire. It provided the participants who were randomised to the experimental condition with pre-specified critical situations and goal-directed responses. As mentioned in chapter 3 (section 3.3), the critical situations in the volitional help sheet were selected from items used to measure people's reasons for self-harm and theoretical models that have specified key triggers that lead to the engagement of self-harm behaviour (Hjelemand et al., 2002; Madge et al., 2008; O'Connor & Kirtley, 2018). The goal-directed responses were mapped onto Prochaska and DiClemente's (1983) processes of change specified in the transtheoretical model. The participants in the experimental condition were presented with a drop-down list of 20 critical situations, formulated as IF statements (see Table 4.2 for the full list of critical situations). From this list, they were asked to select the critical situation that they felt would tempt them the most to self-harm over the next three months. Next, the participants were presented with a drop-down list of 22 goal-directed responses, formulated as THEN statements (see Table 4.3 for the full list of goal-directed responses). They were asked to select a goal-directed response from another dropdown menu, thus specifying an implementation intention to avoid self-harm. The participants completed this task a total of four times, thus forming four implementation intentions.

4.2.4 The control intervention

As mentioned in chapter 3 (see section 3.2), an active control group was used to compensate for the possible demand placed on the experimental condition by the volitional help sheet (e.g., Rosenthal, 1966). The control intervention contained the same

list of 20 critical situations that was used in the implementation intention intervention. However, the critical situations were presented as WHEN statements rather than IF statements (e.g., 'I am most likely to self-harm WHEN I feel hopeless'). Consistent with the participants in the experimental condition, the control participants were asked to select the four critical situations that would tempt them the most to self-harm. However, rather than link each critical situation with a goal-directed response, and therefore form implementation intentions, they were asked to try to avoid self-harming in their chosen critical situations over the next three months.

Table 4.2. *Percentage of sample selecting each critical situation by condition*

Critical situation	%	
	Experimental Condition (If I am tempted to self-harm when…)	Control Condition (I am most likely to self-harm when…)
… I want to get relief from a terrible state of mind	60.9	55.6
… I want to punish myself	41.3	25.9
… I feel trapped inside myself by my own thoughts and feelings	37.0	38.9
… I feel hopeless	31.3	32.2
… I hate myself	29.6	33.5
… I want to die	26.4	21.8
… I feel trapped by a situation (e.g., work, a relationship, obligations)	22.2	20.9
… I feel like I am a burden	17.4	15.5
… I feel lonely	16.1	9.2
… I have no one to turn to	13.5	16.3
… I feel that I don’t belong	11.7	7.1
… I feel powerless	7.8	15.1
… I want to show how desperate I am feeling	7.4	5.0
… I feel like others would prefer me not to be here	5.7	4.2
… I feel people I like don’t like me back	5.2	2.9
… I want to get some attention	2.2	1.3
… I feel like I have lost my standing in the world	2.2	7.5
… I want to find out whether someone really loves me	0.9	0.0
… I want to frighten someone	0.4	0.0
… I want to get my own back on someone	0.4	0.4

Table 4.3. *Percentage of the experimental condition participants selecting each goal-directed response*

Goal-directed responses (Then I will…)	%
… Do something instead of self-harming (e.g., doing some exercise, squeeze an ice cube, draw on yourself in red pen) (CC)	48.7
… Seek out someone trustworthy who I can talk to about these feelings (HR)	28.3
… Think about the guilt or shame that I might feel after harming myself (DR)	23.5
… Remember that there are people in my life who care for me (HR)	27.8
… Tell myself that I do not deserve to be hurt (SR)	23.0
… Remind myself that these feelings do not define who I am, and they do not mean I need to harm myself (SR)	20.4
… Remind myself about the benefits of not self-harming (CR)	20.0
… Think about the impact my self-harming would have on the people around me (ER)	20.0
… Tell myself that any feelings of relief due to harming myself will only be temporary (DR)	17.8
… Take prescribed medication to stop me feeling this way (CC)	16.5
… Contact a helpline (e.g., Samaritans) or a self-harm support group (HR)	13.5
… Remember that I have made a commitment not to self-harm (SL)	10.4
… Make sure I reward myself if I don't self-harm (RM)	10.0
… Put things around my home or place of work (e.g., photographs of friends or loved ones, or reminders of happy times) that help me manage these feelings (SC)	9.6
… Think about how harming myself might affect how people view me (ER)	9.1
… Tell myself that I can avoid self-harming if I want to (SL)	7.8
… Try to avoid putting myself in situations that make me feel this way in the future (SC)	7.4
… Remind myself that there are groups in society that now provide support to people who feel this way (e.g., Samaritans, the National Self-Harm Network Forum, Harmless) (SocLib)	5.2
… Remember that I get upset when I think about harming myself (DR)	4.8

Table continues on next page…

Table 4.3 (continued). *Percentage of the experimental condition participants selecting each goal-directed response*

Goal-directed responses (Then I will…)	%
… Tell myself that society is changing in ways that make it easier for people to avoid self-harming (SocLib)	3.0
… Recall all that I know about the dangers of self-harming (CR)	2.2
… Make sure I am rewarded by others if I don't self-harm (RM)	1.3

Note: Acronyms in parentheses indicate the processes of change (Prochaska & DiClemente, 1983) that the goal-directed responses were designed to tap as described in chapter 3 (section 3.3): CC = counter conditioning; CR = consciousness raising; DR = dramatic relief; ER = environmental reevaluation; HR = helping relationships; RM = reinforcement management; SC = stimulus control; SL = self liberation; SocLib = social liberation; SR = self reevaluation

4.2.5 Measures

The primary outcome measure was self-harm behaviour in specified critical situations and the secondary outcome measures were self-harm behaviour in unspecified critical situations, suicidality, anxiety, and depression. All outcome variables were measured at both pre- and post-intervention. Goal intention to avoid self-harm, mental imagery, and exposure to self-harm were the moderators and were measured at pre-intervention only.

4.2.5.1 The outcome variables

Self-harm behaviour in specified and unspecified critical situations. As stated in chapter 3 (section 3.4.1), the method used in previous studies for measuring behaviour in specified and unspecified critical situations was followed (e.g., Brewster et al., 2015; Elliott et al., 2021). The participants were asked: 'How many times, over the LAST 3 months, have you harmed yourself in the following situations?' They were then presented with the 20 critical situations that were contained in the interventions (see Table 4.2). For each situation, the participants responded on a 9-point scale (1 = *No times* to 9 = *Many times*). The arithmetic mean of the items that corresponded to the four critical situations selected by the participants in the interventions was used as the final measure of self-harm behaviour at both pre-intervention ($\alpha = .90$) and post-intervention ($\alpha = .94$). The final measures of self-harm behaviour in unspecified critical situations were calculated by taking the arithmetic mean of the items that corresponded to the remaining, unchosen, situations ($\alpha = .91$ at pre-intervention and $\alpha = .94$ at post-intervention).

Suicidality. As specified in chapter 3 (section 3.4.1), the four items from the Suicide Behaviour Questionnaire-Revised (SBQ-R; Osman et al., 2001) were used as separate measures, consistent with Armitage et al. (2016). Recall, that the first item from the SBQ-R measures suicidal ideation and behaviour: "Have you thought about or attempted to kill

yourself over the LAST 3 months?" (1 = *Never* to 6 = *I have attempted to kill myself, and really hoped to die*). The second item measures frequency of suicidal thoughts: "How often have you thought about killing yourself over the LAST 3 months?" (1 = *Never* to 5 = *Very often [5 or more times]*). The third item measures threat to die by suicide: "Have you told someone that you were going to commit suicide or that you might do it over the LAST 3 months?" (1 = *No* to 5 = *Yes more than once and really wanted to do it*). The fourth item measures the likelihood of future suicide attempts: "How likely is it that you will attempt suicide over the NEXT 3 months?" (1 = *No chance at all* to 6 = *Very likely*)[4].

Anxiety and Depression. As stated in chapter 3 (section 3.4.1), anxiety and depression were measured with a shortened version of the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) to minimise the effects of survey response fatigue (Choi & Pak, 2005; Krosnick, 1999). The participants used 4-point scales to indicate their responses to all the items. Five items were used to measure anxiety: "I feel tense or wound up" (Not at all [scored 0] to Most of the time [scored 3]); "I have been getting a sort of frightened feeling, as if something awful is about to happen" (Not at all [scored 0] to Very definitely and quite badly [scored 3]); "Worrying thoughts have gone through my mind" (Only occasionally [scored 0] to A great deal of the time [scored 3]); "I have been getting sudden feelings of panic" (Not at all [scored 0] to Very often indeed [scored 3]); and "I have been able to sit at ease and feel relaxed" (Definitely [scored 0] to Not at all [scored 3]). Five items were used to measure depression: "I have still been enjoying the things I used to" (Definitely as much [scored

[4] In several studies of self-harm, the SBQ-R items have been scored slightly differently than in this research and used as either single items or a composite scale of suicidality (e.g., Akram et al., 2020; Cramer et al., 2019; Lew et al., 2020; Osman et al., 2001). In the present research, the SBQ-R was used in the same as way as Armitage et al. (2016) for synergy with the relevant evidence-base (i.e., implementation intentions). Note, however, that all possible methods of scoring the SBQ-R generated the same overall findings as reported in this chapter.

0] to Hardly at all [scored 3]); "I have lost interest in my appearance" (I take just as much care as ever [scored 0] to Definitely [scored 3]); "I have been able to laugh and see the funny side of things" (As much as I always could [scored 0] to Not at all [scored 3]); "I have been looking forward with enjoyment to things" (As much as I ever did [scored 0] to Hardly at all [scored 3]) and "I have felt cheerful" (Most of the time [scored 0] to Not at all [scored 3]). The arithmetic mean of the five anxiety items (α = .77 at pre-intervention; α = .84 at post-intervention) and the five depression items (α = .81 at both pre- and post-intervention) were used as the final measures of anxiety and depression.

4.2.5.2 The moderator variables

Goal intention. As specified in chapter 3 (see section 3.4.2), standard items recommended by Fishbein and Ajzen (2010) were used in this research to measure goal intentions. In this study, goal intentions to avoid self-harm behaviour were measured using four items. The participants responded to each the following four items using 9-point scales: "To what extent do you intend to avoid harming yourself over the NEXT 3 months?" (1 = *No extent at all* to 9 = *A great extent*); "To what extent do you want to avoid harming yourself over the NEXT 3 months?" (1 = *No extent at all* to 9 = *A great extent*); "To what extent will you try to avoid self-harming over the NEXT 3 months?" (1 = *No extent at all* to 9 = *A great extent*); and "How likely or unlikely is it that you will try to avoid harming yourself over the NEXT 3 months?" (1 = *Extremely unlikely* to 9 = *Extremely likely*). The arithmetic mean of the four items was taken to produce the final measure of goal intention to avoid self-harm (α = .78).

Mental imagery. As stated in chapter 3 (see section 3.4.2), a version of the suicide cognitions interview which assesses the frequency with which individuals engage with suicide and self-harm related mental imagery was modified into a self-report format (Holaday, 2013). Six items from the modified version of the scale were used to measure

mental imagery in the present study. The participants were presented with the sentence stem "How often do you find yourself…". Next, they were presented with six different images they may have experienced: "thinking about a distressing image of a real event that has happened to you in the past (e.g., traumatic event)"; "thinking about a time when you tried to hurt yourself in the past"; "imagining yourself planning or preparing to self-harm"; "imagining the things you are trying to escape from"; "imagining what might happen if you died"; "imagining how other people would react if you died". The participants responded to each item using a 9-point scale (1 = *Never* to 9 = *Often*). The final measure of mental imagery was calculated by taking the arithmetic mean of the six items (α = .78).

Exposure to self-harm. As specified in chapter 3 (section 3.4.2), two items identified from previous studies (e.g., Dhingra et al., 2015; O'Connor et al., 2012) were used to measure exposure to self-harm: "Has anyone among your close friends attempted suicide or harmed themselves in the LAST 3 months?"; and "Has anyone among your family attempted suicide or harmed themselves in the LAST 3 months?" (both scored as 1 = *None of them* to 9 = *Many of them*). The two items were not correlated (r = -.02, N = 469, p = .610) so were treated as separate measures of exposure in the subsequent data analyses, consistent with previous research (see del Carpio et al., 2020; Mars et al., 2019; O'Connor et al., 2012).

4.3 Results

4.3.1 Response Rates and Tests of Attrition and Randomisation

As shown in Figure 4.1, a total of 469 participants completed a pre-intervention questionnaire (n = 230 in experimental condition and n = 239 in control condition) and 216 completed a post-intervention questionnaire (n = 103 in the experimental condition and n = 113 in the control condition). This compares favourably with previous studies of

implementation intentions (e.g., Armitage et al., 2016; Norman et al., 2019; van Osch et al., 2008) and self-harm more generally (e.g., Mars et al., 2014; Rasmussen et al., 2016; Russell et al., 2020).

Analyses of Variance (ANOVAs) were carried out to test for potential pre-intervention differences between the study completers (n = 216) and dropouts (n = 253). The dependent variables were the outcome and moderator variables at pre-intervention. The independent variable was attrition (0 = dropouts; 1 = study completers). As Table 4.4 shows, the only detectable differences between the study completers and dropouts were for the measures of self-harm in unspecified critical situations, goal intention and exposure to self-harm by friends. Compared with the dropouts, the study completers reported self-harming less frequently in unspecified critical situations (M = 4.45, SD = 1.56 versus M = 4.83, SD = 1.87), higher goal intention to avoid self-harm (M = 6.07, SD = 1.66 versus M = 5.70, SD = 1.96) and lower exposure to self-harm by their friends (M = 2.69, SD = 2.14 versus M = 3.42, SD = 2.56). Given the detectable differences between the study completers and dropouts, the intention to treat procedure (Hollis & Campbell, 1999) was used in the subsequent data analyses. The participants who dropped out of the study at post-intervention were treated as “no-changers” by imputing their pre-intervention scores into the post-intervention measures. This is a standard technique that is commonly used in intervention research because it preserves the initial sample. This prevents the loss of power due to attrition and provides conservative estimates of intervention effects that are derived from the full sample, rather than a potentially biased sample of study completers only.

Table 4.4. *Analyses of Variance (ANOVAs) testing pre-intervention differences between dropouts versus study completers, and control versus experimental conditions*

Dependent variable	*F* (*df* = 1, 467)	*MSE*	*p*	*d*
Attrition (0 = Dropouts; 1 = Study Completers)				
Self-harm in specified situations	0.05	3.79	.823	-0.02
Self-harm in unspecified situations	5.85	3.00	**.016**	0.22
Suicidal ideation and behaviour	0.61	2.03	.437	0.07
Frequency of suicidal thoughts	0.07	2.03	.790	-0.03
Threat to die by suicide	0.17	1.91	.682	0.04
Likelihood of a future suicide attempt	3.11	1.74	.079	0.16
Anxiety	0.21	0.36	.649	0.03
Depression	2.84	0.48	.093	0.16
Goal intention	4.84	3.34	**.028**	-0.20
Mental imagery	2.45	3.48	.119	0.15
Exposure to friend self-harm	10.88	5.64	**.001**	0.31
Exposure to family self-harm	0.15	7.38	.702	0.04
Condition (0 = Control; 1 = Experimental)				
Self-harm in specified situations	0.14	3.79	.707	-0.03
Self-harm in unspecified situations	1.23	3.03	.269	-0.10
Suicidal ideation and behaviour	0.04	2.04	.833	-0.02
Frequency of suicidal thoughts	0.08	2.03	.773	-0.03
Threat to die by suicide	0.59	1.91	.443	-0.07
Likelihood of a future suicide attempt	0.87	1.74	.352	0.08
Anxiety	1.27	0.36	.260	0.10
Depression	4.48	0.48	**.028**	0.20
Goal intention	1.65	3.37	.199	-0.12
Mental imagery	1.75	3.49	.186	0.12
Exposure to friend self-harm	0.90	5.76	.343	0.09
Exposure to family self-harm	0.92	7.37	.337	0.09

Note. Bold p-values indicate significant findings for the benefit of the reader

4.3.2 Tests of randomisation

Another series of one-way ANOVAs was carried out to test for potential differences at pre-intervention between the experimental and control conditions. The dependent variables were the outcome and moderator variables at pre-intervention. The independent variable was condition (0 = control; 1 = experimental). As Table 4.4 shows, the only difference between the conditions was for the measure of depression. The control condition reported higher levels of depression (M = 1.58, SD = 0.69) than did the

experimental condition (M = 1.44, SD = 0.69). Randomisation to conditions was therefore deemed to be successful overall but depression was included as a covariate in the subsequent analyses to control for the detectable difference at pre-intervention (note that the findings were the same regardless of whether depression was included in the analyses as a covariate).

4.3.3 Descriptive Statistics

Table 4.5 shows that the sample reported a moderate-to-high frequency of self-harm in specified critical situations (i.e., the sample means on this measure were between the mid-point [5] and top [9] of the scale). Participants also reported: a moderate frequency of self-harm in unspecified critical situations; moderate levels of suicidal ideation and behaviour and suicidal thoughts; infrequent threats to die by suicide; a low likelihood of a future suicide attempt; moderate-to-high levels of anxiety; moderate levels of depression; high levels of goal intention to avoid self-harm; high levels of mental imagery; and low levels of exposure to self-harm. It is noteworthy that the mean for the pre-intervention measure of self-harm in specified situations was higher than was the mean for the pre-intervention measure of self-harm in unspecified situations. This difference was found to be statistically significant for both the experimental condition, $t(229) = 29.80$, $p < .001$, $d = 1.96$, and control condition, $t(238) = 29.73$, $p < .001$, $d = 1.92$. This suggests that the participants in both conditions were selecting the critical situations that would most tempt them to engage in self-harm, as instructed.

Table 4.5. *Pre- and post-intervention means and standard deviations, and one-way Analyses of Covariance (ANCOVAs) to test the differences between the conditions*

	M (*SD*)				ANCOVA				
	Pre-intervention		Post-intervention		*F*	*df*	*MSE*	*p*	*d*
	CONT	EXP	CONT	EXP					
Self-harm (specified situations)	7.27(1.95)	7.34(1.94)	6.71(2.44)	6.53(2.56)	1.59	3,465	2.81	.208	0.12
Self-harm (unspecified situations)	4.57(1.73)	4.75(1.75)	4.28(1.90)	4.37(2.01)	0.62	3,465	1.07	.432	0.10
Suicidal ideation and behaviour	3.04(1.40)	3.07(1.45)	3.05(1.49)	3.10(1.47)	0.04	3,465	1.57	.853	-0.02
Frequency of suicidal thoughts	3.53(1.41)	3.57(1.44)	3.45(1.44)	3.50(1.44)	0.04	3,465	1.59	.839	-0.02
Threat to die by suicide	1.84(1.35)	1.93(1.42)	1.80(1.32)	1.98(1.40)	1.11	3,465	1.31	.292	-0.10
Likelihood of a future suicide attempt	2.43(1.35)	2.32(1.29)	2.51(1.45)	2.33(1.34)	1.56	3,465	1.26	.212	0.12
Anxiety	2.10(0.58)	2.04(0.62)	1.98(0.63)	1.95(0.67)	1.18	3,465	0.15	.278	-0.10
Depression	1.58(0.69)	1.44(0.69)	1.47(0.73)	1.40(0.73)	1.56	2,466	0.16	.212	-0.10
Goal intention	5.76(1.82)	5.98(1.85)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Mental imagery	6.44(1.84)	6.21(1.89)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exposure to friend self-harm	3.18(2.39)	2.97(2.41)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Exposure to family self-harm	2.61(2.79)	2.38(2.63)	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Note. In addition to the corresponding pre-intervention measure, depression was included as a covariate in all analyses because of the difference between the conditions at pre-intervention (see 'Tests of randomisation' section). The findings were the same regardless of whether depression was included or not.
CONT = control condition. EXP = experimental condition

Table 4.2 shows the percentage of participants who selected each critical situation from the lists provided in the interventions. The most and least frequently selected critical situations (e.g., "when I want to get relief from a terrible state of mind" and "when I want to get my own back on someone") were broadly similar across the conditions. Table 4.3 shows the percentage of participants in the experimental condition selecting each goal-directed response. The most commonly chosen goal-directed responses were: "Then I will do something instead of self-harming (e.g., doing some exercise, squeeze an ice cube, draw on yourself in red pen)" and "Then I will seek out someone trustworthy who I can talk to about these feelings". The least commonly selected were: "Then I will make sure I am rewarded by others if I don't self-harm" and "Then I will recall all that I know about the dangers of self-harming".

4.3.4 The effect of implementation intentions on self-harm in specified critical situations

An Analysis of Covariance (ANCOVA) was conducted to test whether the experimental condition reported self-harming less frequently than the control condition at post-intervention in specified critical situations (hypothesis 1). The dependent variable was self-harm in specified critical situations at post-intervention. The covariate was self-harm in specified critical situations at pre-intervention. The independent variable was condition (0 = control; 1 = experimental). Contrary to hypothesis 1, there was no statistically significant difference between the conditions (see Table 4.5)[5].

[5] The intention to treat procedure used in the data analysis ensured that the achieved sample (n = 469) exceeded the required sample reported in the 'participants' section (n = 259). The analyses were therefore sufficiently powered. However, given the sample of study completers (n = 216) was lower than the required sample, all the ANCOVAs presented in Table 4.5 were re-run as ANOVAs. Power analyses indicted that these ANOVAs required a sample of n = 204. Both the intention-to-treat sample and the sample of study completers exceeded this requirement, and the ANOVA findings were the same as the ANCOVA findings presented in Table 4.5 (i.e., there were still no significant differences between the experimental and control conditions on any outcome measure). Also note that the target sample reported in the 'participants' section was the largest sample that was required for any of the reported analyses. These were the ANCOVAs. A power analysis indicated that a sample of n = 114 was required for moderated linear regressions, which are reported later in the text. Both the intention-to-treat sample and the sample of study completers exceeded this requirement.

To test whether goal intention (hypothesis 2), mental imagery (hypothesis 3), and exposure to self-harm (hypothesis 4), moderated the effect of implementation intentions on the frequency of self-harm in specified critical situations, a moderated multiple regression was conducted with follow-up simple slopes analyses of any significant interactions (Aiken & West, 1991). The dependent variable was self-harm in specified critical situations at post-intervention. The independent variables were self-harm in specified situations at pre-intervention, depression at pre-intervention, condition (0 = control; 1 = experimental), the potential moderators (i.e., goal intention, mental imagery, exposure to friend self-harm and exposure to family self-harm) and the two way-interactions between condition and each potential moderator. Potential multicollinearity was reduced by mean centring the independent variables prior to the computation of the two-way interactions (see Aiken & West, 1991).

As Table 4.6 shows, the regression model accounted for 57% of the variance. Consistent with the ANCOVA findings, the standardised beta weights showed that condition did not predict self-harm in specified critical situations at post-intervention. However, the condition x goal intention and condition x mental imagery interactions were independent predictors. In support of hypotheses 2 and 3, respectively, the follow-up simple slopes analyses showed that the experimental condition reported lower levels of self-harm in specified critical situations than did the control condition at high (mean +1*SD*) but not at low (mean -1*SD*) levels of both goal intention (Figure 4.2) and mental imagery (Figure 4.3). Given that the two-way interactions between condition and the two exposure to self-harm measures were not statistically significant (Table 4.6), hypothesis 4 was not supported.

Table 4.6. *Multiple linear regression predicting post-intervention self-harm behaviour in specified situations*

Variables	R^2	F	β	d
Pre-intervention Self-Harm in Specified Situations	.57	57.29	.84***	1.27
Pre-intervention Depression			.16	0.12
Condition			-.15	-0.09
Goal intention			-.07	-0.10
Mental imagery			.18**	0.25
Exposure (Friends)			.02	0.04
Exposure (Family)			.01	0.02
Condition x Goal Intention			-.22*	-0.23
Condition x Mental Imagery			-.23**	-0.25
Condition x Exposure (Friends)			.02	0.03
Condition x Exposure (Family)			.05	0.08

Note. Depression was included as an independent variable because the conditions differed on this measure (see 'Test of randomisation' section). Note that the findings were the same regardless of whether depression was included or not.
* $p < .05$. ** $p < .01$. *** $p < .001$

Figure 4.2. *Simple slopes analyses for the effect of condition on post-intervention self-harm behaviour in specified critical situations at high (mean +1SD) and low (mean – 1SD) levels of goal intention to avoid self-harm*

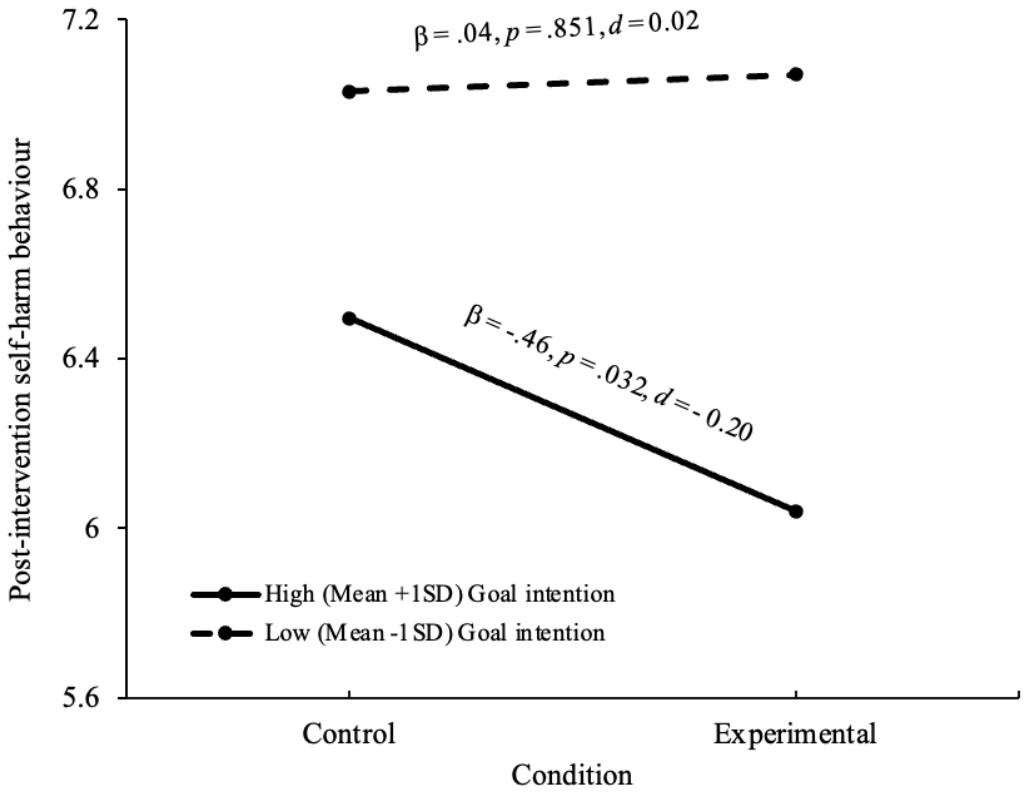
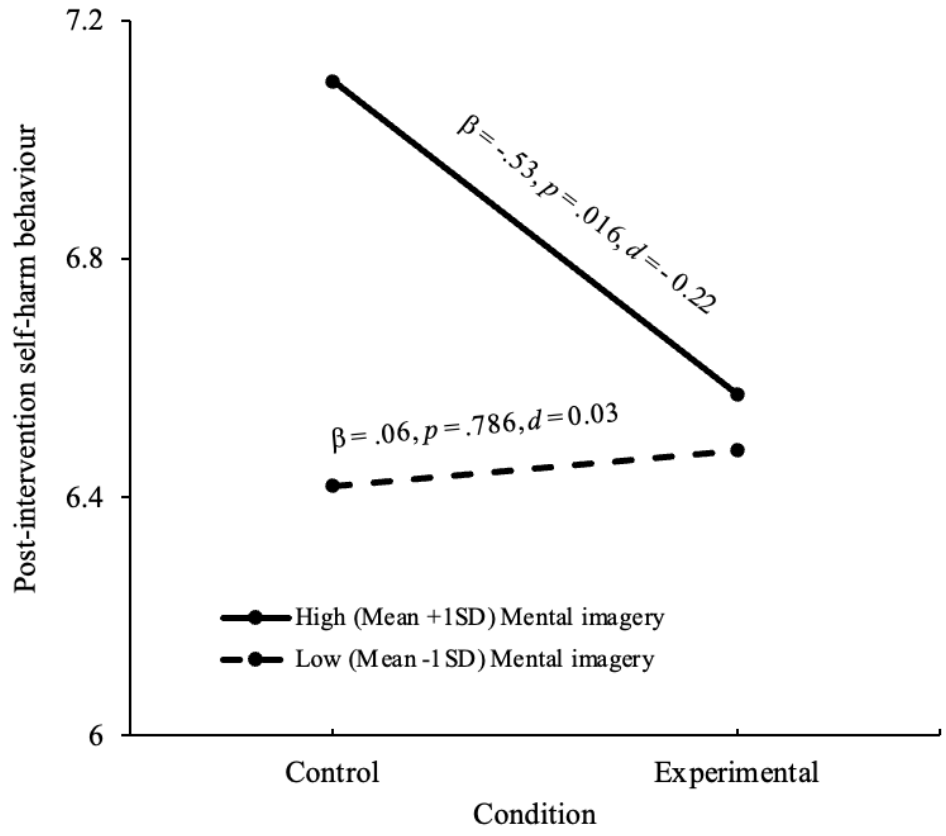


Figure 4.3. *Simple slopes analyses for the effect of condition on post-intervention self-harm behaviour in specified critical situations at high (mean +1SD) and low (mean – 1SD) levels of suicide and self-harm related mental imagery*



4.3.5 The effect of implementation intentions on the other outcome variables

The same statistical procedures, as reported above (ANCOVAs and moderated multiple regressions with follow-up simple slopes analyses), were used to test the effects of implementation intentions on the other outcome variables: self-harm in unspecified critical situations, suicidal ideation and behaviour, frequency of suicidal thoughts, threat to die by suicide, likelihood of a future suicide attempt, anxiety, and depression.

The ANCOVAs showed that there were no differences between the conditions on the outcome variables (see Table 4.5). The regression analyses (see Tables 4.7a - 4.7g) revealed that the only interaction effects were for condition x goal intention and condition x mental imagery in the prediction of self-harm behaviour in unspecified critical situations (see Table 4.7a). However, the simple slopes analyses showed that condition was not a statistically significant predictor of self-harm behaviour in unspecified critical situations at either high (mean +1*SD*) or low (mean -1*SD*) levels of goal intention (β = -.22, p = .105, d = -0.15 and β = .11, p = .395, d = .08, respectively) or mental imagery (β = -.25, p = .063, d = -0.17 and β = .10, p = .450, d = .07, respectively).

Table 4.7a. *Multiple linear regression predicting post-intervention self-harm behaviour in unspecified situations*

Variables	R^2	*F*	β	*d*
Pre-intervention Self-Harm in Unspecified Situations	.73	115.35	.91***	1.53
Pre-intervention Depression			-.02	-0.03
Condition			-.05	-0.05
Goal intention			-.04	-0.08
Mental imagery			.07	0.17
Exposure (Friends)			.00	0.01
Exposure (Family)			-.00	-0.01
Condition x Goal Intention			-.13*	-0.23
Condition x Mental Imagery			-.13*	-0.23
Condition x Exposure (Friends)			.02	0.06
Condition x Exposure (Family)			.02	0.05

Note. Depression was included as an independent variable because the conditions differed on this measure (see 'Test of randomisation' section). Note that the findings were the same regardless of whether depression was included or not.
* $p < .05$. ** $p < .01$. *** $p < .001$

Table 4.7b. *Multiple linear regression predicting post-intervention SBQ-R item for suicidal ideation and behaviour*

Variables	R^2	*F*	β	*d*
Pre-intervention Suicidal Ideation and Behaviour	.28	17.20	.56***	0.93
Pre-intervention Depression			-.14	-0.13
Condition			.02	0.02
Goal intention			-.07	-0.14
Mental imagery			-.03	-0.06
Exposure (Friends)			-.00	-0.01
Exposure (Family)			.00	-0.00
Condition x Goal Intention			.05	0.06
Condition x Mental Imagery			.07	0.10
Condition x Exposure (Friends)			.00	0.00
Condition x Exposure (Family)			-.02	-0.04

Note. Depression was included as an independent variable because the conditions differed on this measure (see 'Test of randomisation' section). Note that the findings were the same regardless of whether depression was included or not.
* $p < .05$. ** $p < .01$. *** $p < .001$

Table 4.7c. *Multiple linear regression predicting post-intervention SBQ-R item for frequency of suicidal thoughts*

Variables	R^2	*F*	β	*d*
Pre-Intervention Frequency of Suicidal Thoughts	.25	15.36	.41***	0.72
Pre-Intervention Depression			-.17	-0.16
Condition			.04	0.03
Goal intention			-.12*	-0.22
Mental imagery			.05	0.10
Exposure (Friends)			-.01	-0.03
Exposure (Family)			-.02	-0.08
Condition x Goal Intention			.02	0.03
Condition x Mental Imagery			.10	0.13
Condition x Exposure (Friends)			-.02	-0.04
Condition x Exposure (Family)			.01	0.02

Note. Depression was included as an independent variable because the conditions differed on this measure (see 'Test of randomisation' section). Note that the findings were the same regardless of whether depression was included or not.
* $p < .05$. ** $p < .01$. *** $p < .001$

Table 4.7d. *Multiple linear regression predicting post-intervention SBQ-R item for threat to die by suicide*

Variables	R^2	*F*	β	*d*
Pre-intervention Threat to Die by Suicide	.29	18.17	.54***	1.06
Pre-intervention Depression			-.13	-0.13
Condition			.11	0.10
Goal intention			-.01	-0.02
Mental imagery			.02	0.05
Exposure (Friends)			-.01	-0.02
Exposure (Family)			-.02	-0.06
Condition x Goal Intention			-.00	-0.00
Condition x Mental Imagery			-.01	-0.01
Condition x Exposure (Friends)			.00	0.01
Condition x Exposure (Family)			.02	0.05

Note. Depression was included as an independent variable because the conditions differed on this measure (see 'Test of randomisation' section). Note that the findings were the same regardless of whether depression was included or not.
* $p < .05$. ** $p < .01$. *** $p < .001$

Table 4.7e. *Multiple linear regression predicting post-intervention SBQ-R item for likelihood of future suicide attempt*

Variables	R^2	*F*	β	*d*
Pre-Intervention Likelihood of Future Suicide Attempt	.36	25.34	.64***	1.08
Pre-Intervention Depression			-.24**	-0.24
Condition			-.12	-0.11
Goal intention			-.09*	-0.20
Mental imagery			-.03	-0.06
Exposure (Friends)			-.03	-0.11
Exposure (Family)			-.01	-0.05
Condition x Goal Intention			.00	0.01
Condition x Mental Imagery			.03	0.04
Condition x Exposure (Friends)			.08	0.17
Condition x Exposure (Family)			.03	0.08

Note. Depression was included as an independent variable because the conditions differed on this measure (see 'Test of randomisation' section). Note that the findings were the same regardless of whether depression was included or not.
* $p < .05$. ** $p < .01$. *** $p < .001$

Table 4.7f. *Multiple linear regression predicting post-intervention anxiety*

Variables	R^2	*F*	β	*d*
Pre-intervention Anxiety	.65	75.28	.82***	1.43
Pre-intervention Depression			.05	0.13
Condition			.05	0.12
Goal intention			-.01	-0.04
Mental imagery			.02	-0.14
Exposure (Friends)			.02*	-0.20
Exposure (Family)			.01	0.05
Condition x Goal Intention			.00	-0.00
Condition x Mental Imagery			-.00	-0.02
Condition x Exposure (Friends)			-.01	-0.06
Condition x Exposure (Family)			-.01	-0.07

Note. Depression was included as an independent variable because the conditions differed on this measure (see 'Test of randomisation' section). Note that the findings were the same regardless of whether depression was included or not.
* $p < .05$. ** $p < .01$. *** $p < .001$

Table 4.7g. *Multiple linear regression predicting post-intervention depression*

Variables	R^2	F	β	d
Pre-Intervention Depression	.70	112.13	.83***	1.56
Condition			.05	0.13
Goal intention			-.04*	-0.22
Mental imagery			.02	0.12
Exposure (Friends)			.01	0.07
Exposure (Family)			.01	0.13
Condition x Goal Intention			.02	0.09
Condition x Mental Imagery			.01	0.06
Condition x Exposure (Friends)			-.01	-0.05
Condition x Exposure (Family)			-.02	-0.15

* $p < .05$. ** $p < .01$. *** $p < .001$

4.4 Discussion

This study was conducted to provide the first test of whether an implementation intention intervention can reduce overt self-harm behaviour in the community. It was hypothesised that self-harm in specified critical situations would be reported less frequently by the experimental (implementation intention) condition than the control condition (hypothesis 1). It was also hypothesised that a lower frequency of post-intervention self-harm in specified critical situations would be observed in the experimental (versus control) condition at high, but not low, levels of goal intention (hypothesis 2), mental imagery (hypothesis 3), and exposure to self-harm (hypothesis 4). The main and moderator effects were also tested using measures of self-harm in unspecified critical situations and suicidality, to explore potential spill-over effects, and anxiety and depression, to check for any potential unintended negative outcomes (i.e., increases in these states) and possible desirable outcomes (i.e., decreases in these states).

Contrary to hypothesis 1, no overall difference was found between the experimental and control conditions in the frequency of self-harm behaviour in specified critical situations at 3-month post-intervention. However, as expected, there was evidence that goal intentions and mental imagery moderated the implementation intention intervention. In support of hypothesis 2, the experimental condition reported self-harming less often in specified critical situations than did the control condition at high (mean +1*SD*) but not low (mean -1*SD*) levels of goal intention to avoid self-harm (d = -0.20). While this was a small effect size (Cohen, 1992), it is within the range of effect sizes that have been found in previous studies of implementation intentions for other health and social behaviours (e.g., Cooke et al., 2023; Gollwitzer & Sheeran, 2006; Malaguti et al., 2020) and suicidality outcomes in people who present to hospital for self-harm (Armitage et al., 2016), reviewed in chapter 2. Also, consistent with previous studies outside the context of self-harm (e.g., Brewster et al., 2015;

Elliott & Armitage, 2006; Sheeran et al., 2005 [study 1]; van Osch et al., 2008), this finding is in line with the theoretical proposition that implementation intentions are subordinate to goal intentions (Gollwitzer, 1999). In the present context, this finding demonstrates, for the first time, that implementation intentions can reduce self-harm in the community, specifically for those people who are theoretically appropriate to target with this type of intervention (i.e., those with the necessary goal intention to avoid self-harm).

In support of hypothesis 3, the experimental condition also reported self-harming less often than did the control condition at high (mean +1*SD*), but not low (mean -1*SD*) levels of mental imagery (d = -0.22). However, in contrast to hypothesis 4, exposure to self-harm did not moderate the effects of implementation intentions. While reasons for null results are never known, a possible explanation for the lack of moderation of implementation intentions by the exposure to self-harm variables is that the mean scores were towards the lower end of the scale in the present study, suggesting that the sample, on average, were not readily exposed to self-harm by friends or family. Exposure to friends' and/or family members' self-harm has received a lot of empirical attention, with support being provided for its role in predicting self-harm behaviour (Branley-Bell et al., 2019; Dhingra et al., 2015; O'Connor et al., 2012), hence its inclusion in the present study. However, exposure to self-harm through other means (e.g., the internet and incidental exposure; Kirtley et al., 2021), might be worth studying in future research to test whether they can moderate the effects of implementation intentions. Although exposure did not moderate the effects of implementation intentions, the findings provide some evidence that implementation intention interventions can change the behaviour of those individuals who are at greatest risk of self-harm and who have difficulty regulating their behaviour (e.g., those who experience high levels of self-harm and suicide related mental imagery). The present findings therefore attest to the efficacy of implementation intentions (e.g., Adriaanse et al., 2011; Bélanger-Gravel et al., 2013;

Gollwitzer & Sheeran, 2006; Malaguti et al., 2020; McWilliams et al., 2019; Toli et al., 2016).

For the other outcome measures, there were no effects of implementation intentions, overall or at any level of the moderators. These results imply that the observed reductions in self-harm behaviour in specified critical situations (at high levels of goal intention and mental imagery) do not generalise to reductions in self-harm in unspecified situations. While this finding is consistent with some studies (e.g., Elliott et al., 2021; Webb & Sheeran, 2007), other studies have shown that implementation intentions generate behaviour-change in unspecified critical situations to the extent that those unspecified critical situations share enough salient features with the situations that are specified (e.g., Bieleke et al., 2018; Brewster et al., 2016). Future research could therefore be conducted to test the extent to which implementation intention interventions can produce reductions in self-harm that generalise to contextually similar critical situations as those specified by the participants (this point will be returned to in chapter 7).

The null results on the additional outcome measures also imply that implementation intentions are unable to reduce suicidality outcomes in a general community sample. However, Armitage et al. (2016) showed that an implementation intention intervention similar to the one used in this study reduced suicidality measures (the same ones used in this study) for patients admitted to hospital for self-harm (see chapter 2). Consistent with the reasoning for the outcome measures in this research that were outlined in chapter 3, it is possible that implementation intentions to reduce self-harm are better equipped to reduce measures of suicidality in hospital patients compared with the community because suicidal thoughts and behaviours are more likely to be observed in this population (Farabaugh et al., 2015; Osman et al., 2001; Robinson et al., 2021). Indeed, mean scores on suicidality measures are higher in hospital than community samples (e.g., Fitzpatrick et al., 2021; Osman

et al., 2001; Rueda-Jaimes et al., 2017). In accordance with this reasoning, the means on the suicidality outcomes in this study tended to be low, suggesting little scope for reductions.

The lack of any main or moderator effects on the anxiety and depression measures suggest that the implementation intention intervention did not have an adverse effect on these aspects of mental health. As mentioned in chapter 3 (section 3.4), a reason people engage in self-harm is often as a response (i.e., coping strategy) to cope with emotional distress (e.g., Bryant et al., 2021; Edmondson et al., 2016; Mughal et al., 2023; Ogden & Bennett, 2015), and interventions that prevent people from engaging in self-harm might inadvertently increase anxiety and depression. However, the present results provide no evidence for such unwanted side-effects. This may be because an implementation intention intervention provides participants with a new alternative coping strategy (i.e., a goal-directed response) when they experience a critical situation therefore participants have a means for relieving feelings of emotional distress. The lack of any main or moderator effects also suggest that the implementation intention intervention designed to reduce self-harm behaviour did not have desirable effects on anxiety and depression symptoms (i.e., did not reduce these outcomes). A possible reason for this is that the intervention was solely designed to reduce self-harm behaviour by providing goal-directed responses when critical situations are encountered and therefore was not focussed on reducing what causes feelings of distress (e.g., anxiety and depression).

The research reported in this chapter provides strong support for the effectiveness of implementation intentions at reducing self-harm for those in the community who are motivated to reduce their self-harm behaviour or who experience self-regulatory barriers (i.e., mental imagery). However, the findings should be interpreted with the following considerations in mind. First, while the present study showed that implementation intentions reduced the overt act of self-harm, self-harm thoughts also have a detrimental effect of an

individual compared to those who do not experience these thoughts (Kirtley et al., 2015; Nielsen et al., 2017). As discussed in chapter 1, interventions are needed to reduce self-harm thoughts in addition to self-harm behaviour (see section 1.2). Second, motivational (goal intention) and volitional (mental imagery and exposure to self-harm) variables were tested as moderators of implementation intentions in this study. However, as discussed in chapter 2 (see section 2.4.2.3), cognitive abilities could also potentially moderate the effectiveness of implementation intentions on behaviour-change. Finally, as mentioned in chapter 3 (see section 3.2) previous implementation intention studies utilised passive control groups meaning that any change in an intervention group could be attributed to experimental demand. To control for this, subsequent implementation intention studies used 'active control' groups (e.g., Armitage et al., 2017; Brewster et al., 2015; Elliott et al., 2021). This approach was used in the present study with the participants in the control condition being asked to select critical situations which would tempt them to self-harm over the next three months, just like the participants in the experimental condition. However, the experimental condition also linked their chosen critical situations with goal-directed responses while the control condition did not. While the control participants were asked to try to avoid self-harm in their specified critical situations, it is possible that the experimental participants had a behaviour change advantage or greater demand placed upon them due to the list of self-harm strategies (i.e., goal-directed responses) which they were asked to select from. Asking control participants to select both critical situations and goal-directed responses but without linking the two may provide a more stringent test of implementation intentions (e.g., Armitage et al., 2016; Armitage et al., 2017; Armitage & Arden, 2012; Epton & Armitage, 2017; McGrath et al., 2020).

The next study presented in this thesis was designed to address the above stated issues with study 1. Specifically, the next study will test the effectiveness of an implementation

intention intervention (volitional help sheet) at reducing the frequency of self-harm thoughts using a more stringent ‘active control’ condition and test the extent to which cognitive abilities moderate the intervention.

Chapter 5: Study 2: Testing the effectiveness of implementation intentions at reducing self-harm thoughts

5.1 Introduction

Study 1 showed that an implementation intention intervention reduced overt self-harm behaviour in the critical situations specified by participants in the IF component of their implementation intentions when they possessed the required goal intention to avoid self-harm behaviour or experienced self-harm and suicide related mental images. As discussed in chapter 2 (see section 2.3), research testing the effectiveness of implementation intention interventions has focussed mainly on changing overt actions, in line with study 1 (Adriaanse et al., 2011; Bélanger-Gravel et al., 2013; Gollwitzer & Sheeran, 2006; McWilliams et al., 2019; Toli et al., 2016). A smaller number of studies have shown that implementation intention interventions can reduce affect-based measures of fear, disgust, and anxiety (for a review see Webb et al., 2012). However, no previous studies have tested the effectiveness of implementation intention interventions at changing negative thought processes, such as self-harm thoughts. As discussed in chapter 1, these are prevalent and can lead to self-harm behaviour and other negative consequences such as greater emotional pain sensitivity and feelings of distress (see section 1.3). Additionally, according to the Integrated Motivational-Volitional Model of Suicidal Behaviour (O'Connor & Kirtley, 2018), self-harm thoughts are distinct from self-harm behaviour, therefore an intervention designed to reduce the overt action of self-harm may not reduce self-harm thoughts. Study 2, therefore, aimed to test the effectiveness of an implementation intention at reducing self-harm thoughts. Building on study 1, this aim was also addressed using a more stringent control condition in which the participants were presented with the same critical situations *and* goal-directed responses as the experimental (implementation intention intervention) condition, rather than the critical

situations only (e.g., Armitage et al., 2016; Armitage et al., 2017; Armitage & Arden, 2012; Epton & Armitage, 2017; McGrath et al., 2020).

Study 2 was also conducted to test the extent to which cognitive abilities moderate the effects of implementation intentions. Specifically, the moderating effects of attention, retrospective memory, and prospective memory were investigated. As mentioned in chapter 2 (section 2.4.2.3), attention is an executive resource involved in a variety of abilities such as inhibiting irrelevant information, focusing on details, and processing and temporarily retaining information (i.e., working memory). It is therefore likely to be important for encoding implementation intentions to long-term memory, from which they can be later retrieved (automatically or otherwise). As discussed in chapter 2, this is because an individual needs to attend to the task of forming implementation intentions if this information is to be processed in working memory and stored for activation in the future. Attention is therefore likely to moderate the effects of implementation intentions. In the present context, implementation intentions can be expected to reduce self-harm thoughts at high (mean +1 *SD*) rather than low (mean -1 *SD*) levels of attentional ability.

As also discussed in chapter 2 (section 2.4.2.3), retrospective memory is an individual's ability to remember information from the past (Crawford et al., 2003). It is likely to moderate the effects of implementation intentions because implementation intention formation requires an individual to identify critical situations in which to perform a goal-intended behaviour. To identify these critical situations, it is likely that an individual needs to be able to accurately recall events (i.e., critical situations) in which they have been tempted to perform the behaviour in the past. It can therefore be expected that reductions in self-harm thoughts will be observed at high (mean+1 *SD*) rather than low (mean-1 *SD*) levels of retrospective memory ability.

Finally, prospective memory refers to a person's ability to remember to perform an action in the future (Einstein & McDaniel, 2005). It is likely to moderate implementation intentions because as discussed in chapter 2 (section 2.4.2.3), the successful performance of an action relies on an individual being able to identify that an opportunity to perform a planned action (e.g., a goal-directed response) has presented itself (e.g., a specified critical situation has been encountered). As mentioned in chapter 2 (section 2.4.2.3) some theoretical accounts recognise the identification of the opportunity as a conscious process, while others state it can also be automatic (Einstein et al., 2005; Smith & Bayen, 2004). It can be expected, therefore, that prospective memory will moderate the effects of implementation intentions with reductions in self-harm thoughts being observed at high (mean+1 *SD*) rather than low (mean-1 *SD*) levels of prospective memory ability, as these individuals will be better able to recognise opportunities (i.e., critical situations) when they arise (automatically or otherwise).

The hypotheses for study 2 were as follows:

- Hypothesis 1: The experimental (implementation intention) condition will subsequently, at post-intervention, report thinking about self-harm less frequently than will the control condition.
- Hypothesis 2: There will be a two-way interaction between condition and attention in the prediction of subsequent self-harm thoughts; the experimental condition will report self-harm thoughts less often than will the control condition at high (mean +1*SD*) versus low (mean -1*SD*) levels of attention.
- Hypothesis 3: There will be two-way interactions between condition and both prospective and retrospective memory in the prediction of subsequent self-harm thoughts; the experimental condition will report self-harm thoughts less frequently

than will the control condition at high (mean +1*SD*) versus low (mean -1*SD*) low levels of prospective and retrospective memory.

Given that study 1 showed that implementation intentions require underlying goal intentions (e.g., "I intend to avoid self-harm") to be in place before they exert an impact on behaviour, the following hypothesises were also tested:

- Hypothesis 4: There will be a two-way interaction between condition and goal intention in the prediction of subsequent self-harm thoughts; the experimental condition will report self-harm thoughts less frequently than will the control condition at high (mean +1*SD*) but not low (mean- 1*SD*) levels of goal intention to stop thinking about self-harm.
- Hypothesis 5: There will be a three-way interaction between condition, attention, and goal intention in the prediction of subsequent self-harm thoughts; the experimental condition will report self-harm thoughts less frequently than will the control condition at high (mean +1*SD*) versus low (mean -1*SD*) levels of attention but only when goal intentions to stop thinking about self-harm at high (mean + 1*SD*).
- Hypothesis 6: There will be a three-way interaction between condition, both prospective and retrospective memory, and goal intention in the prediction of subsequent self-harm thoughts; the experimental condition will report self-harm thoughts less frequently than will the control condition at high (mean +1*SD*) versus low (mean -1*SD*) levels of prospective and retrospective memory but only when goal intentions to stop thinking about self-harm are high (mean +1*SD*).

For consistency with study 1, the primary outcome measure was self-harm thoughts in specified critical situations. Likewise, self-harm thoughts in unspecified critical situations were used as a secondary outcome measure to gauge any spill-over effects from the situations specified in participants' implementation intentions to other situations. Self-harm behaviour

(i.e., the overt act of self-harm) in specified and unspecified critical situations were also used as secondary outcome measures to explore whether any reductions in self-harm thoughts translated to reductions in self-harm behaviour. Suicidality was also included as a secondary outcome measure, for consistency with study 1 and Armitage et al. (2016). Anxiety and depression were also used as secondary outcome measures to test whether implementation intentions had any unintended negative outcomes (i.e., increases in anxiety and depression) and possible desirable outcomes (i.e., decreases in anxiety and depression), in line with study 1.

5.2 Methods

5.2.1 Participants

A total of 697 university students took part in the study. The socio-demographic profile of the sample is shown in Table 5.1. This profile is similar to the study 1 sample and previously published self-harm research in which student samples have been recruited (e.g., Cliffe & Stallard, 2023; Fitzgerald & Curtis, 2017; Lin et al., 2021). Power analyses indicated that a sample of n = 366 was required to detect d = 0.40 at alpha = 0.05 and power = 0.80 (Cohen, 1992) using G*Power 3.1. Given that the achieved sample exceeded the target sample, it was deemed that the analyses were sufficiently powered.

Table 5.1. *Socio-demographic characteristics of the sample*

Demographic Characteristics	*n*	%
Gender		
Female	536	76.8
Male	124	17.8
Transgender (male to female)	6	0.9
Transgender (female to male)	9	1.3
Transgender (do not identify as male or female)	16	2.3
Not sure	5	0.7
Decline to state	2	0.3
Marital Status		
Married	16	2.3
In a relationship, but not married	320	45.9
Single	360	51.6
Separated	0	0
Divorced	1	0.1
Widowed	0	0
Region of study		
Scotland	545	78.2
England	136	19.5
Wales	10	1.4
Northern Ireland	6	0.9
Study status		
Full-time education	653	93.7
Part-time education	44	6.3
Level of study		
Undergraduate	619	88.8
Post-graduate (Master's or equivalent)	63	9.0
Post-graduate (PhD or equivalent)	15	2.2
Home (UK) vs. International student		
Home (UK)	610	87.5
International	87	12.5

Note. $N = 697$. Participants were on average 21.44 years old ($SD = 4.57$).

5.2.2 Design and Procedure

Consistent with study 1 (chapter 4), a randomised controlled design was used with the pre- and post-intervention phases separated by three months. The study was advertised on social media (e.g., Twitter, Reddit, and Facebook), the University of Strathclyde's psychology participation pool and virtual learning environment, and academic prolific. Furthermore, 120 student unions at other UK institutions were contacted to share the study. These unions were at Scottish, English, Welsh, and Northern Irish institutions across the UK. The advertisement stated that the study was about university students' self-harm thoughts and behaviours. It asked for volunteers who were at least 18 years of age, registered at a UK higher education institution, and had experienced self-harm thoughts in the last three months.

Potential participants were asked to click on a link, within the advertisement, which led them to a participant information sheet, held in Qualtrics. This was similar to the participant information sheet in study 1 (chapter 4). It informed the participants that the purpose of the study was to better understand self-harm thoughts and behaviour in the university student population. It also provided the participants with standard information about their ethical rights (e.g., withdrawal), told the participants that they would be invited to complete two questionnaires, three months apart, and informed them that their answers would be treated confidentially. In addition, potential participants were informed that as soon as the two questionnaires were matched, any identifying information would be deleted to ensure anonymity. The information sheet also provided contact details for self-harm and suicide support organisations (e.g., Scottish Association for Mental Health and Samaritans). If participants wished to continue, they were invited to provide informed consent before being directed to a pre-intervention online questionnaire.

The pre-intervention questionnaire was designed and administered in Qualtrics. Consistent with study 1 (chapter 4), the participants completed items to measure socio-

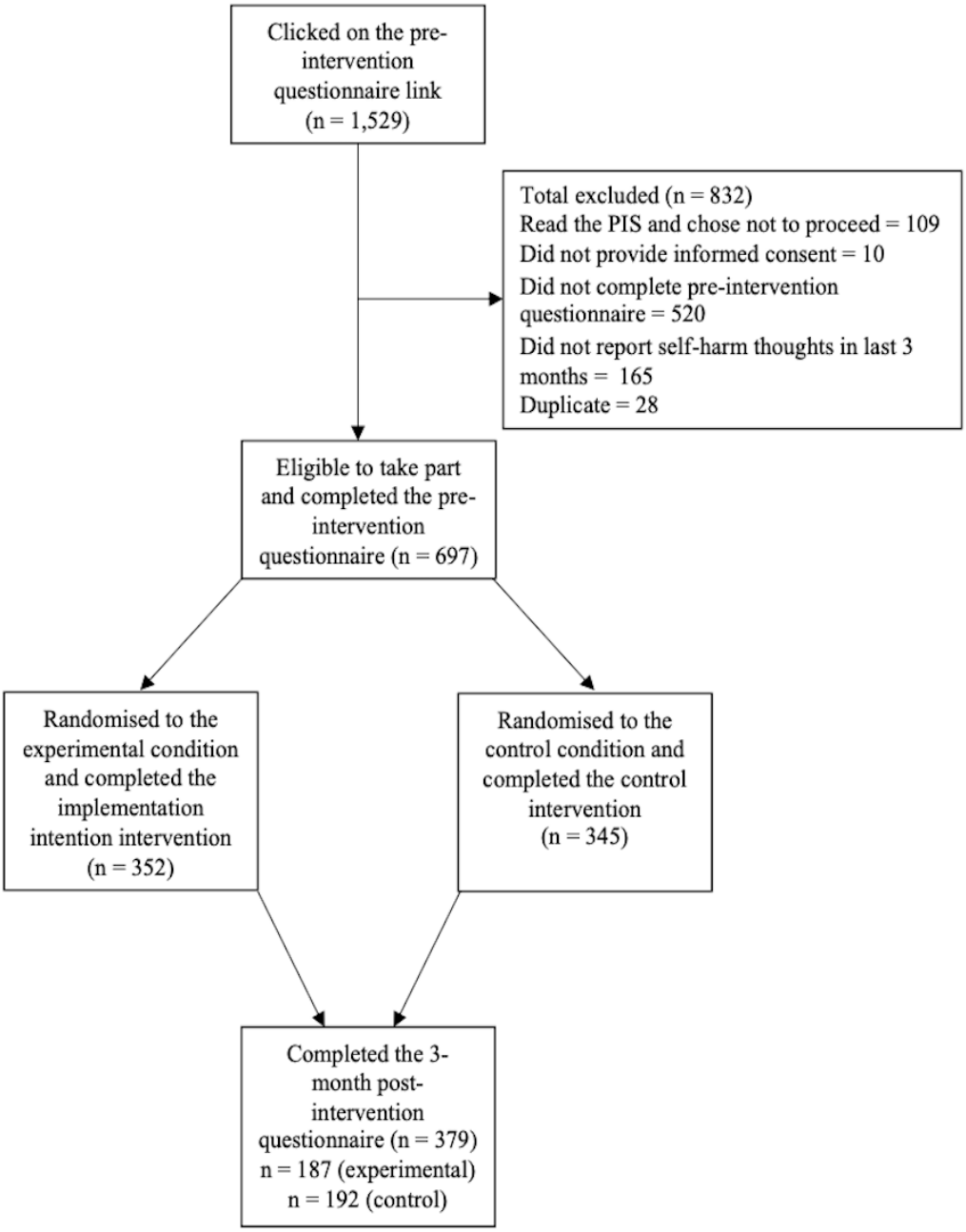
demography (see Table 5.1). Next, they were asked for their email address so that they could be sent the post-intervention questionnaire, three months later. They were then presented with standard items, commonly used in previous research, to measure the outcome variables (frequency of self-harm thoughts, frequency of self-harm behaviour, suicidality, anxiety, and depression) and moderators (goal intention, attention, prospective and retrospective memory). These items were preceded by an example question, and they were presented in a pseudo random order with approximately half of the response scales reversed to reduce consistency and response set biases (Budd, 1987; Coolican, 2014). After completing the questionnaire items, the participants were randomly assigned by Qualtrics to an experimental (n = 352) or control (n = 345) condition (see Figure 5.1). The participants in the experimental condition were presented with a volitional help sheet that asked them to select and link critical situations, which might cause them to think about self-harm, with goal-directed responses to stop their self-harm thoughts (i.e., they were asked to form implementation intentions). The participants in the control condition were presented with an intervention that contained the same critical situations and goal-directed responses as the volitional help sheet. However, it did not ask the participants to link the situations and strategies (i.e., it did not ask the control participants to form implementation intentions). At the end of the pre-intervention questionnaire, the participants were thanked for their time, told that they would be contacted in three months, and were reminded of the contact details for the self-harm and suicide support organisations.

Approximately three months later, all participants who completed the pre-intervention questionnaire were emailed a link invitation to a post-intervention questionnaire in Qualtrics. The post-intervention questionnaire contained the same outcome measures as did the pre-intervention questionnaire. At the end of the post-intervention questionnaire, the participants were provided with a debrief sheet. This informed the participants that the purpose of the

study was to test an intervention designed to reduce self-harm thoughts. It thanked the participants for their time and, once again, reminded them about the support available for self-harm and suicide. The debriefing sheet also contained the volitional help sheet that was administered to the experimental condition. This ensured that treatment was not withheld from the control condition.

The pre- and post-intervention questionnaires were matched for each participant using a unique code that was generated from information provided at both time-points (the first initial of the participants' first name, the last initial of their surname, the last two digits of their phone number and the last two letters of their postcode). Once the data were matched, the unique codes and any other identifying information (e.g., email addresses) were deleted to ensure anonymity. Figure 5.1 shows the flow of the participants through the study. Ethical approval for the study was granted by the University's Research Ethics Committee.

Figure 5.1. *Flow chart showing the participants' progress through the study*



Note. Data were analysed using intention to treat analyses. The pre-intervention observations were carried through to post-intervention for the participants who dropped out of the study prior to the 3-month post-intervention follow-up (Hollis & Campbell, 1999).

5.2.3 The implementation intention intervention

The implementation intention intervention was an online volitional help sheet (see Appendix 2). It was embedded at the end of the pre-intervention questionnaire for the participants randomised to the experimental condition. It contained the same 20 critical situations (IF statements) and 22 goal directed responses (THEN statements) as the one used in study 1 (see Tables 5.2 and 5.3). However, the IF statements were modified so that they focused on self-harm thoughts (see Table 5.2) as opposed to self-harm behaviour. The participants were instructed to select the critical situation that they felt would most likely result in them thinking about self-harm and to link that situation with the goal-directed response that they felt would most likely help them to stop their self-harm thoughts. Consistent with study 1, this task was completed a total of four times.

5.2.4 The control intervention

Following study 1, the control intervention contained the 20 critical situations from the volitional help sheet phrased as WHEN statements (see Table 5.2). In addition, the control intervention in this study also contained the 22 goal-directed responses from the volitional help sheet. The control participants were asked to select the four critical situations that they thought would tempt most people to think self-harm. Separately, they were asked to select the four goal-directed responses that they thought people would find most useful for stopping their self-harm thoughts.

5.2.5 Measures

The primary outcome measure was self-harm thoughts in specified critical situations. The secondary outcome measures were: self-harm thoughts in unspecified critical situations, self-harm behaviour in specified critical situations, self-harm behaviour in unspecified critical situations, suicidality, anxiety, and depression. All outcome variables were measured at both pre- and post-intervention. The moderators were: goal intentions to stop thinking about self-

harm, attention, and both prospective and retrospective memory. All moderator variables were measured at pre-intervention only.

5.2.5.1 The outcome variables

Self-harm thoughts in specified and unspecified critical situations: As in study 1, the approach used in previous studies for measuring behaviour in specified and unspecified critical situations was followed (e.g., Brewster et al., 2015; Elliott et al., 2021). The participants were asked: "Over the LAST 3 months, how often have you thought about harming yourself in the following situations?" They were then presented with the 20 critical situations contained in both the volitional help sheet and control intervention (see Table 5.2). For each situation, the participants responded on a 9-point scale (1 = *Never* to 9 = *Extremely often*). The arithmetic mean of the four critical situations that the participants selected in their implementation intention or control intervention was taken as a final measure of self-harm thoughts at both pre-intervention ($\alpha = .87$) and post-intervention ($\alpha = .89$).

The final measures of self-harm thoughts in unspecified critical situations, at both pre- and post-intervention, were calculated by taking the arithmetic mean of the self-harm thought items that corresponded to the unchosen critical situations from the implementation intention or control intervention ($\alpha = .92$ at pre-intervention and $\alpha = .93$ at post-intervention).

Table 5.2. *Percentage of sample selecting each critical situation by condition.*

Critical situation	%	
	Experimental Condition (If I am tempted to think about self-harm when…)	Control Condition (People are most likely to think about self-harm when…)
… I [they] want to get relief from a terrible state of mind	56	69.9
… I [they] feel trapped inside myself [themselves] by my [their] own thoughts and feelings	45.7	46.4
… I [they] feel hopeless	37.8	44.3
… I [they] hate myself [themselves]	35.5	31.9
… I [they] feel trapped by a situation (e.g., work, a relationship, obligations)	34.7	27.2
… I [they] want to punish myself/themselves	31.5	41.4
… I [they] want to die	25.3	21.7
… I [they] feel like I [they] am[are] a burden	21.9	18
… I [they] feel powerless	20.2	21.7
… I [they] feel lonely	18.8	14.2
… I [they] feel that I [they] don't belong	15.6	8.1
… I [they] have no one to turn to	14.5	18
… I [they] feel like others would prefer me [them] not to be here	11.1	6.4
… I [they] feel I [they] have lost my [their] standing in the world	9.1	7.8
… I [they] want to show how desperate I [they] am [are] feeling	7.7	13.3
… I [they] feel people I [they] like don't like me [them] back	7.1	1.7

Table continues on next page…

Table 5.2 (continued). *Percentage of sample selecting each critical situation by condition*

Critical situation	%	
	Experimental Condition (If I am tempted to think about self-harm when…)	Control Condition (People are most likely to think about self-harm when…)
… I [they] want to get my [their] own back on someone	2	0.3
… I [they] want to get some attention	1.4	5.8
… I [they] want to frighten someone	1.4	0.3
… I [they] want to find out whether someone really loves me [them]	0.9	0.4

Note: The wording of the critical situations in this table reflects the items in the experimental condition (volitional help sheet). The text is square brackets shows the modifications that were made to text for use in the control intervention

Table 5.3. *Percentage of sample selecting each goal-directed response by condition*

Goal-directed responses (THEN I will…)	%	
	Experimental condition	Control condition
…Do something instead of thinking about self-harm (e.g., do some exercise or listen to soothing music) (CC)	48.6	53.3
…Remember that there are people in my [their] life who care for me [them] (HR)	34.9	20.9
…Tell myself [themselves] that these thoughts will only be temporary, and they will pass (DR)	26.7	12.5
…Tell myself [themselves] that I [they] do not deserve to be hurt (SR)	25.9	3.8
…Seek out someone trustworthy who I [they] can talk to about these thoughts (HR)	25.3	15.7
…Remind myself [themselves] that these thoughts do not define who I [they] am, and they do not mean I [they] need to harm myself (SR)	21.9	24.3
…Think about the impact acting on my [their] self-harm thoughts would have on the people around me [them] (ER)	21.6	18.3
…Contact a helpline (e.g., Samaritans) or a self-harm support group (HR)	21.0	18.0
…Remind myself [themselves] about the benefits of stopping self-harm thoughts (CR)	16.8	13.0
…Think about the guilt or shame that I [they] might feel if I [they] acted on my [their] self-harm thoughts (DR)	16.5	3.2
…Try to avoid putting myself [themselves] in situations that make me [them] feel this way in the future (SC)	14.5	12.2
…Take prescribed medication to stop me [them] feeling this way (CC)	9.9	21.7

Table continues on next page…

Table 5.3 (continued). *Percentage of sample selecting each goal directed response by condition*

Goal-directed responses (THEN I will…)	%	
	Experimental condition	Control condition
…Put things around my [their] home or place of work (e.g., photographs of friends or loved ones, or reminders of happy times) that help me [them] manage these thoughts (SC)	8.4	12.5
…Think about how acting on my [their] self-harm thoughts might affect how people view me [them] (ER)	8.0	8.1
…Remember that I [they] have made a commitment to stop thinking about self-harm (SL)	6.8	8.4
…Tell myself [themselves] that I [they] can stop thinking about self-harm if I [they] want to (SL)	6.0	15.9
…Tell myself [themselves] that society is changing in ways that make it easier for people to talk about their self-harm thoughts (SocLib)	5.7	16.8
…Remind myself [themselves] that there are groups in society that now provide support to people who feel this way (e.g., Samaritans, the National Self-Harm Network Forum, Harmless) (SocLib)	5.7	27
…Recall all that I [they] know about the dangers of self-harm thoughts (CR)	5.7	16.5
…Make sure I [they] reward myself [themselves] if I [they] do not think about self-harm (RM)	5.4	15.1
…Remember that I [they] get upset when I [they] think about harming myself [themselves] (DR)	3.4	10.7
…Make sure I [they] am [are] rewarded by others if I [they] don't think about self-harm (RM)	0.9	20.6

Note: Acronyms in parentheses indicate the processes of change (Prochaska & DiClemente, 1983) that the goal-directed responses were designed to tap as described in chapter 3 (section 3.3): CC = counter conditioning; CR = consciousness raising; DR = dramatic relief; ER = environmental reevaluation; HR = helping relationships; RM = reinforcement management; SC = stimulus control; SL = self liberation; SocLib = social liberation; SR = self reevaluation

Self-harm behaviour in specified and unspecified critical situations: The measure of self-harm behaviour in specified situations was the same as in study 1 (see chapter 4, section 4.2.5.1). The participants were asked "Over the LAST 3 months, how often have you harmed yourself in the following situations?" They were presented with the 20 critical situations in Table 5.2 and asked to respond on a 9-point scale (1 = *Never* to 9 = *Extremely often*). The arithmetic mean of the four items that corresponded to the critical situations selected by participants in their implementation intention or control intervention was taken (α = .96 at pre-intervention and α = .95 at post-intervention).

The final measures of self-harm behaviour in unspecified critical situations, at pre- and post-intervention, were calculated by taking the arithmetic mean of the self-harm behaviour items that corresponded to the unchosen critical situations from the implementation intention or control intervention (α = .96 at pre-intervention and α = .96 at post-intervention)[6].

Suicidality: Consistent with study 1, the SBQ-R (Osman et al., 2001) was used to measure suicidality outcomes: suicidal ideation and behaviour; frequency of suicidal thoughts; threat to die by suicide; and the likelihood of a future suicide attempt. As in study 1, the single items used to measure these four outcomes were treated separately in the analyses, consistent with Armitage et al. (2016). However, all methods of scoring that are typically used in the literature on suicidality (e.g., Osman et al., 2001) generated the same findings as reported in this chapter.

Anxiety and Depression: The same 10-item version of the HADS (Zigmond & Snaith, 1983) as used in study 1 was used to measure anxiety and depression (see method

[6] The measures of self-harm behaviour in specified and unspecified situations were highly correlated (r = 0.88, $p < .01$). A single behaviour measure was computed. However, the results did not differ from when separate measures of behaviour in specified and unspecified situations were used. Therefore, for consistency with the measures of self-harm thoughts, the self-harm behaviour measures in specified and unspecified situations were kept separate in the data analyses presented in this chapter.

section in study 1; section 4.2.5.1). The arithmetic mean of the five anxiety and the five depression items were used as the final measures of anxiety (α = .80 at pre-intervention; α = .83 at post-intervention) and depression (α = .80 at both pre- and post-intervention).

5.2.5.2 The moderator variables

Goal intention to stop thinking about self-harm: Consistent with study 1, standard items based on established items recommended by Fishbein and Ajzen (2010) were used to measure goal intention. The participants responded to each of the following items on a 9-point scale: "To what extent do you intend to stop thinking about harming yourself over the NEXT 3 months?" (1 = *No extent at all* to 9 = *A great extent);* "To what extent do you want to stop thinking about harming yourself over the NEXT 3 months?" (1 = *No extent at all* to 9 = *A great extent*); and "To what extent will you try to stop thinking about harming yourself over the NEXT 3 months?" (1 = *No extent at all* to 9 = *A great extent*). The arithmetic mean of the three items was calculated to produce a final measure of goal intention (α = .60).

Attention: As mentioned in chapter 3 (see section 3.4.2), the Multiple Ability Self-Report Questionnaire (MASQ; Seidenberg et al., 1994) was used to measure attention. The MASQ attention subscale consists of eight items (e.g., "I am easily distracted from my work by things going on around me". Participants respond to these items on a five-point scale (1 = *Never* to 5 = *Always*). Higher scores on this scale are normally calculated to reflect greater difficulties with attention (e.g., Nicholls et al., 2021). However, for the sake of interpretative clarity within this thesis, the items were scored so that higher scores represented greater attentional ability. The arithmetic mean of the eight items was taken and used as the final measure of attention (α = .66).

Prospective and retrospective memory*:* As specified in chapter 3 (see section, 3.4.2), the Prospective and Retrospective Memory Questionnaire (PRMQ; Smith et al.,

2000) was used to measure errors in both prospective and retrospective memory. This questionnaire scale consists of 16 items, which are scored on a 5-point scale (1 = Never to 5 = Very Often). Eight items measure everyday prospective memory errors (e.g., "Do you decide to do something in a few minutes' time and then forget to do it?") Likewise, there are eight items to measure retrospective memory errors (e.g., "Do you fail to recognise a place you have visited before?". Higher scores on this scale are normally calculated to reflect greater errors in prospective and retrospective memory (e.g., Piauilino et al., 2010). For the sake of interpretative clarity within this thesis, the scores on each item were reversed so that higher scores represented greater ability in prospective and retrospective memory.

Separate measures of prospective and retrospective memory were produced initially by taking the arithmetic mean of the eight prospective memory error items ($\alpha = .89$) and the mean of the eight retrospective memory items ($\alpha = .86$). However, the two measures were correlated above $r = 0.70$ ($r = .87$, $p < .01$), therefore violating standard criteria for establishing independence (e.g., Tabachnick & Fidell, 2007). A factor analysis of the 16 PRMQ items also produced a one factor solution accounting for 50% of the variance. All factor loadings on the single were greater than 0.5. A single, unidimensional measure of prospective and retrospective memory ability was therefore produced by taking the arithmetic mean of all sixteen PRMQ items ($\alpha = .93$)[7].

[7] It should also be noted that a general memory construct is common across the two PRMQ sub-scales (e.g., Crawford et al., 2006). Also, when the analyses reported in the results section of this chapter were run with the separate measures of prospective and retrospective memory, the data indicated issues of multicollinearity (e.g., VIF values greater than 9). Therefore, it was deemed appropriate to use one single, general measure of memory measure. When the analyses reported in this chapter were run with separate measures of prospective and retrospective memory, rather than the single, combined measure no significant results were observed for the separate measures on any outcome.

5.3 Results

5.3.1 Response rates and tests of attrition

As shown in Figure 5.1, a total of 697 participants completed the pre-intervention questionnaire and 379 (54%) completed the post-intervention questionnaire. These response rates are similar to study 1 (see chapter 4) and those achieved in previous studies of self-harm (e.g., Russell et al., 2020).

A series of one-way Analyses of Variance (ANOVAs) was conducted to determine whether there were any pre-intervention differences between the study completers (n = 379) and study drop-outs (n = 318). The dependent variables were the pre-intervention measures of the outcome and moderator variables. The independent variable was attrition (0 = dropouts; 1 = study completers). As Table 5.4 shows, the only detectable difference between the study completers and dropouts was for the measure of anxiety. Compared with the study completers, the dropouts reported fewer symptoms of anxiety (M = 1.80, SD = 0.69 versus M = 1.91, SD = 0.65). Intention to treat (Hollis & Campbell, 1999) was therefore subsequently used, consistent with the analytical procedure used in study 1 (see chapter 4, section 4.3.1).

Table 5.4. *Analyses of Variance (ANOVAs) testing pre-intervention differences between dropouts versus study completers, and control versus experimental conditions*

Dependent variable	*F* (*df* = 1, 695)	*MSE*	*p*	*d*
Attrition (0 = Dropouts; 1 = Study Completers)				
Self-harm thoughts in specified situations	2.47	4.20	.117	0.12
Self-harm thoughts in unspecified situations	0.08	2.74	.777	0.02
Self-harm behaviour in specified situations	0.12	9.67	.727	-0.02
Self-harm behaviour in unspecified situations	0.52	3.87	.472	-0.05
Suicidal ideation and behaviour	0.16	1.23	.686	0.03
Frequency of suicidal thoughts	0.28	1.88	.595	0.04
Threat to die by suicide	1.14	1.04	.285	0.09
Likelihood of a future suicide attempt	1.45	1.11	.230	0.10
Anxiety	4.96	0.45	**.026**	0.16
Depression	0.92	0.42	.338	0.05
Attention	0.74	0.37	.391	0.07
(Prospective + Retrospective) Memory	0.56	0.70	.453	-0.06
Goal intention to stop thinking about self-harm	0.01	3.47	.943	0.01
Condition (0 = Control; 1 = Experimental)				
Self-harm thoughts in specified situations	2.58	4.20	.109	0.12
Self-harm thoughts in unspecified situations	3.16	2.73	.076	-0.13
Self-harm behaviour in specified situations	0.26	9.67	.608	0.04
Self-harm behaviour in unspecified situations	0.54	3.87	.464	-0.06
Suicidal ideation and behaviour	0.05	1.23	.823	-0.01
Frequency of suicidal thoughts	1.00	1.87	.319	-0.07
Threat to die by suicide	1.47	1.04	.225	-0.10
Likelihood of a future suicide attempt	4.06	1.10	**.044**	-0.15
Anxiety	0.00	0.45	.992	0.00
Depression	1.78	0.42	.183	-0.09
Attention	0.03	0.37	.857	-0.00
(Prospective + Retrospective) Memory	1.26	0.70	.262	0.08
Goal intention to stop thinking about self-harm	0.11	3.47	.739	0.03

Note. Bold p-values indicate significant findings for the benefit of the reader.

5.3.2 Tests of randomisation

A further series of one-way ANOVAs was carried out to test for potential differences at pre-intervention between the control and experimental conditions. The dependent variables were the outcome and moderator variables at pre-intervention. The independent variable was condition (0 = control; 1 = experimental). As Table 5.4 shows, the only detectable difference between the conditions was for the measure of the likelihood of a future suicide attempt. The control condition reported a higher likelihood of a future suicide attempt (M = 1.91, SD = 1.12) compared to the experimental condition (M = 1.75, SD = 0.97). Randomisation to conditions was therefore deemed to be mostly successful. However, the likelihood of a future suicide attempt measure was included as a covariate in the subsequent analyses to control for the pre-intervention difference that was detected between the conditions.

5.3.3 Descriptive statistics

The means and standard deviations for all the pre- and post-intervention measures are shown in Table 5.5. On average, a moderate-to-high frequency of self-harm thoughts in specified situations was reported (i.e., the mean score was between the mid [5] and top [9] of the scale). In addition, the sample reported a low-to-moderate frequency of self-harm thoughts in unspecified critical situations, a moderate frequency of self-harm behaviour in specified situations and a low-to-moderate frequency self-harm behaviour in unspecified situations. With regards to the suicidality items (Osman et al., 2001), the sample reported low-to-moderate suicidal ideation and behaviour, a moderate frequency of suicidal thoughts, few threats to die by suicide and a low likelihood of a future suicide attempt. Participants reported moderate levels of anxiety symptoms and low-to-moderate depressive symptoms. The participants also reported on average, moderate-to-highly

positive goal intentions to stop thinking about self-harm and moderate levels of ability in attention and (prospective + retrospective) memory.

Furthermore, the mean for the pre-intervention measure of self-harm thoughts in specified critical situations was higher than was the mean for the pre-intervention measure of self-harm thoughts in unspecified critical situations. This difference was found to be statistically significant for both the experimental condition, $t(351) = 35.01$, $p < .001$, $d = 1.87$, and the control condition, $t(344) = 28.46$, $p < .001$, $d = 1.53$. As in study 1, this implies that the participants in both conditions were completing their interventions as instructed (i.e., selecting the critical situations that would most tempt them [experimental condition] or 'most people' [control condition] to think about self-harm).

Table 5.5. *Pre- and post-intervention means and standard deviations, and one-way Analyses of Covariance (ANCOVAs) to test the differences between the conditions*

	M (*SD*)				ANCOVA				
	Pre-intervention		Post-intervention		*F*	*df*	*MSE*	*p*	*d*
	CONT	EXP	CONT	EXP					
Self-harm thoughts (specified)	6.50(2.09)	6.75(2.01)	6.03(2.31)	6.14(2.41)	0.71	3,693	2.08	.400	-0.06
Self-harm thoughts (unspecified)	4.33(1.68)	4.11(1.62)	4.07(1.72)	3.91(1.70)	0.28	3,693	0.92	.596	0.04
Self-harm behaviour (specified)	4.42(3.05)	4.54(3.17)	4.26(3.02)	4.11(3.07)	1.84	3,693	3.93	.176	-0.08
Self-harm behaviour (unspecified)	2.96(2.01)	2.85(1.92)	2.89(1.99)	2.69(1.87)	1.30	3,693	1.43	.255	-0.17
Suicidal ideation and behaviour	2.37(1.08)	2.36(1.14)	2.31(1.09)	2.23(1.13)	0.82	3,693	0.49	.367	-0.07
Frequency of suicidal thoughts	2.92(1.34)	2.82(1.40)	2.80(1.38)	2.72(1.42)	0.12	3,693	0.54	.732	0.03
Threat to die by suicide	1.58(1.07)	1.48(0.97)	1.49(1.01)	1.45(0.97)	0.46	3,693	0.46	.499	0.06
Likelihood of a future suicide attempt	1.91(1.12)	1.75(0.97)	1.82(1.05)	1.72(0.98)	0.18	2,694	0.42	.673	0.03
Anxiety	1.86(0.67)	1.86(0.67)	1.80(0.71)	1.76(0.72)	1.48	3,693	0.17	.225	-0.07
Depression	1.26(0.66)	1.20(0.64)	1.23(0.66)	1.18(0.64)	0.03	3,693	0.19	.875	0.02
Attention	2.48(0.58)	2.48(0.63)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
(Prospective + Retrospective) Memory	2.89(0.80)	2.90(0.87)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Goal intention to stop thinking about self-harm	6.73(1.88)	6.78(1.85)	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Note. In addition to the corresponding pre-intervention measure, the likelihood of a future suicide attempt was included as a covariate in all analyses because of the difference between the conditions at pre-intervention (see 'Tests of randomisation' section). The findings were the same regardless of whether the likelihood of a future suicide attempt was included or not. CONT = control condition. EXP = experimental condition

Table 5.2 shows the percentage of participants who selected each critical situation from the lists provided in the experimental and control conditions. Table 5.3 shows the percentage of participants who selected each goal-directed response in both the experimental and control conditions. As can be seen in Table 5.2, the most and least frequently selected critical situations were broadly similar across the conditions. The most commonly chosen critical situation was: 'I [they] want to get relief from a terrible state of mind'. The least commonly chosen critical situation was 'I [they] want to find out whether someone really loves me [them]'. As can be seen in Table 5.3, there was more variation between the conditions in the most and least selected goal-directed responses. However, many of the goal-directed responses were still selected frequently in both conditions (e.g., 'Do something instead of thinking about self-harm') and others were selected infrequently (e.g., 'Remember that I [they] have made a commitment to stop thinking about self-harm').

5.3.4 The effect of implementation intentions on self-harm thoughts in specified critical situations

A one-way Analysis of Covariance (ANCOVA) was conducted to test hypothesis 1, that the experimental condition would report fewer self-harm thoughts in specified critical situations than would the control condition, at post-intervention. The dependent variable was the measure of self-harm thoughts in specified critical situations at post-intervention. The independent variable was condition (0 = control; 1 = experimental). The covariates were the pre-intervention measures of self-harm thoughts in specified critical situations and SBQ-R likelihood of a future suicide attempt (as stated in the tests of randomisation section, above, the SBQ-R measure was used as a covariate to control for the observed difference at pre-intervention between the conditions). No statistically significant difference between the conditions on the post-intervention measure of self-

harm thoughts in specified critical situations was observed. Hypothesis 1 was, therefore, not supported (see Table 5.5).

A moderated linear regression (Aiken & West, 1991) was used to test the moderating effects of attention, (prospective + retrospective) memory, and goal intention to stop thinking about self-harm (hypotheses 2-6). The dependent variable in the regression was the post-intervention measure of self-harm thoughts in specified critical situations. The independent variables were the pre-intervention measures of self-harm thoughts in specified critical situations and SBQ-R likelihood of a future suicide attempt, condition (0 = control; 1 = experimental), attention, (prospective + retrospective) memory, and goal intention. The two-way interactions between condition and attention (test of hypothesis 2), condition and (prospective + retrospective) memory (test of hypothesis 3), and condition and goal intention (test of hypothesis 4) were also included as independent variables, as were the three-way interactions between condition, attention and goal intention (test of hypothesis 5), and condition, (prospective + retrospective) memory, and goal intention (test of hypothesis 6). Consistent with the procedure for testing interactions outlined by Aiken and West (1991), the independent variables were mean centred before the interaction terms were computed in order to reduce multicollinearity.

As shown in Table 5.6, the regression model accounted for 63% of the variance. Consistent with the ANCOVA findings, the standardised beta weights show that condition was not a statistically significant predictor. The two-way interactions between condition and attention, and condition and (prospective + retrospective) memory, were also not statistically significant, meaning that hypotheses 2 and 3 were not supported (i.e., there was no evidence that the cognitive abilities moderated the effects of implementation intentions on self-harm thoughts). However, the two-way interaction between condition

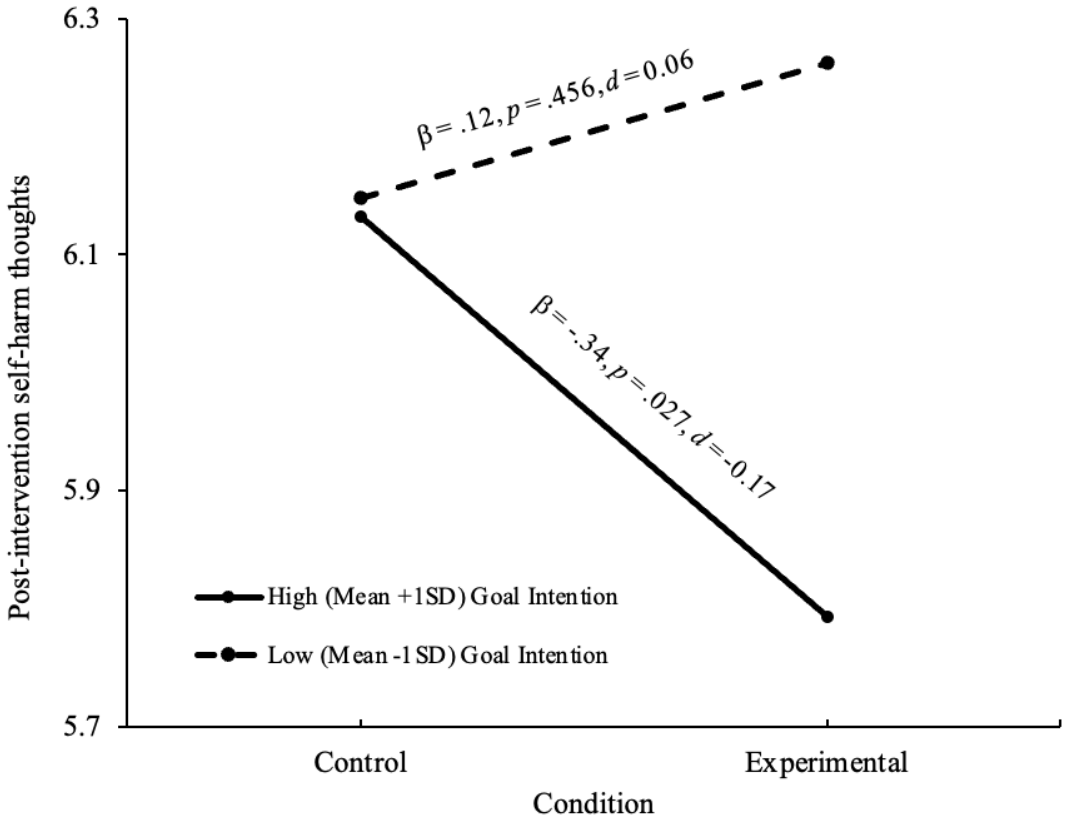
and goal intention was a statistically significant predictor. Simple slopes analyses (Aiken & West, 1991) were used to decompose the condition x goal intention interaction. Consistent with hypothesis 4, the experimental condition reported fewer self-harm thoughts in specified critical situations at high (mean +1*SD*) but not low (mean -1*SD*) levels of goal intention to stop thinking about self-harm (see Figure 5.2). None of the three-way interactions were statistically significant predictors, meaning that hypotheses 5 and 6 were not supported. There was therefore no evidence that the cognitive abilities moderated the effects of implementation intentions on self-harm thoughts at any level of goal intention to stop thinking about self-harm.

Table 5.6. *Multiple linear regression predicting post-intervention self-harm thoughts in specified critical situations*

Variables	R^2	F	β	d
Pre-Intervention Self-Harm thoughts (Specified)	.63	92.62	.86***	1.48
Pre-Intervention Likelihood of Future Suicide Attempt			.11	0.14
Condition			-.10	-0.07
Attention			-.16	-0.07
(Prospective + Retrospective) Memory			-.04	-0.02
Goal intention			.01	0.01
Condition x Attention			.18	0.06
Condition x (Prospective + Retrospective) Memory			-.12	-0.06
Condition x Goal Intention			-.13*	-0.17
Attention x Goal Intention			-.06	-0.05
(Prospective + Retrospective) Memory x Goal Intention			-.05	-0.06
Condition x Attention x Goal Intention			.03	0.02
Condition x (Prospective + Retrospective) Memory x Goal Intention			.12	0.11

Note. Likelihood of a future suicide attempt was included as an independent variable in the analysis because the conditions differed on this measure (see 'Tests of randomisation' section). Note that the findings were the same regardless of whether likelihood of a future suicide attempt was included or not.
* = $p < .05$, ** = $p < .01$, *** = $p < .001$

Figure 5.2. *Simple slopes analyses for the effect of condition on post-intervention self-harm thoughts in specified critical situations at high (mean + 1SD) and low (mean – 1SD) levels of goal intention to stop thinking about self-harm*



5.3.5 Exploring the effects of implementation intentions on other outcome measures

The same statistical procedures that were used to analyse the primary outcome measure (self-harm thoughts in specified critical situations) were used to explore the effects of implementation intentions on the secondary outcome measures: self-harm thoughts in unspecified critical situations, self-harm behaviour in specified and unspecified critical situations, suicidality outcomes (suicidal ideation and behaviour, frequency of suicidal thoughts, threat to die by suicide and likelihood of a future suicide attempt), anxiety, and depression.

The ANCOVAs showed that there were no statistically significant differences between the experimental and control conditions on any of the post-intervention secondary outcomes (see Table 5.5). Consistent with the ANCOVA results, condition was also not a statistically significant predictor of any post-intervention secondary outcome in the regression analyses (see Tables 5.7a – 5.7i). The regression analyses did, however, reveal a statistically significant two-way interaction between condition and (prospective + retrospective) memory on the measures of self-harm behaviour in specified critical situations and self-harm behaviour in unspecified critical situations (see Tables 5.7b and 5.7c). Follow-up simple slope analyses showed that the experimental condition reported self-harming less frequently than did the control condition, in both specified (see Figure 5.3) and unspecified (see Figure 5.4) critical situations, when (prospective + retrospective) memory ability was high (mean + 1*SD*), but not low (mean – 1*SD*).

The regression analyses also showed that there was a statistically significant two-way interaction between condition and (prospective + retrospective) memory for two of the suicidality (SBQ-R) measures: ‘threat to die by suicide’ (see Table 5.7f) and ‘likelihood of a future suicide attempt’ (see Table 5.7g). However, simple slopes analyses showed that condition did not significantly predict either ‘threats to die by suicide’ or ‘the

likelihood of a future suicide attempt at any level of (prospective + retrospective) memory (for threats to die by suicide: β = -.10, p = .186, d = -0.10 and β =.14, p = .058, d = 0.14 at high and low levels of prospective + retrospective memory, respectively; for the likelihood of a future suicide attempt: β = -.08, p = .268, d = -0.08 and β = .12, p = .084, d = 0.13 at high and low levels of prospective + retrospective memory, respectively).

No statistically significant three-way interactions between condition, attention, and goal intention, or condition, (prospective + retrospective) memory, and goal intention, was found for any secondary outcome measure (see tables 5.7a to 5.7i).

Table 5.7a. *Multiple linear regression predicting post-intervention self-harm thoughts in unspecified situations*

Variables	R^2	F	β	d
Pre-Intervention Self-Harm Thoughts (Unspecified)	.69	119.32	.82***	1.53
Pre-Intervention Likelihood of Future Suicide Attempt			.06	0.12
Condition			.03	0.03
Attention			-.08	-0.06
(Prospective + Retrospective) Memory			.01	0.01
Goal Intention			.00	0.01
Condition x Attention			.12	0.06
Condition x (Prospective + Retrospective) Memory			-.12	-0.09
Condition x Goal Intention			-.06	-0.12
Attention x Goal Intention			-.03	-0.04
(Prospective + Retrospective) Memory x Goal Intention			-.04	-0.06
Condition x Attention x Goal Intention			-.08	-0.08
Condition x (Prospective + Retrospective) Memory x Goal Intention			.10	0.14

Note. Likelihood of a future suicide attempt was included as an independent variable in the analysis because the conditions differed on this measure (see 'Tests of randomisation' section). Note that the findings were the same regardless of whether likelihood of a future suicide attempt was included or not.
* = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 5.7b. *Multiple linear regression predicting post-intervention self-harm behaviour in specified situations*

Variables	R^2	F	β	d
Pre-Intervention Self-Harm Behaviour (Specified)	.58	74.63	.72***	1.44
Pre-Intervention Likelihood of Future Suicide Attempt			.20*	0.19
Condition			-.23	-0.12
Attention			-.15	-0.05
(Prospective + Retrospective) Memory			.34*	0.16
Goal Intention			-.04	-0.06
Condition x Attention			.31	0.08
Condition x (Prospective + Retrospective) Memory			-.56*	-0.19
Condition x Goal Intention			-.07	-0.06
Attention x Goal Intention			-.00	-0.00
(Prospective + Retrospective) Memory x Goal Intention			-.12	-0.10
Condition x Attention x Goal Intention			-.10	-0.05
Condition x (Prospective + Retrospective) Memory x Goal Intention			.19	0.12

Note. Likelihood of a future suicide attempt was included as an independent variable in the analysis because the conditions differed on this measure (see 'Tests of randomisation' section). Note that the findings were the same regardless of whether likelihood of a future suicide attempt was included or not.
* = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 5.7c. *Multiple linear regressions predicting post-intervention self-harm behaviour in unspecified situations*

Variables	R^2	*F*	β	*d*
Pre-intervention Self-Harm Behaviour (Unspecified)	.62	86.52	.74***	1.48
Pre-Intervention Likelihood of Future Suicide Attempt			.10*	0.15
Condition			-.11	-0.09
Attention			-.05	-0.03
(Prospective + Retrospective) Memory			.13	0.10
Goal intention			-.01	-0.03
Condition x Goal Intention			-.00	-0.00
Condition x Attention			.15	0.06
Condition x (Prospective + Retrospective) Memory			-.30*	-0.17
Attention x Goal Intention			-.01	-0.01
(Prospective + Retrospective) Memory x Goal Intention			-.03	-0.04
Condition x Attention x Goal Intention			-.03	-0.03
Condition x (Prospective + Retrospective) Memory x Goal Intention			.03	0.03

Note. SBQ-R Likelihood of a future suicide attempt was included as an independent variable in all analyses because the conditions differed on this measure (see 'Tests of randomisation' section). Note that the findings were the same regardless of whether likelihood of a future suicide attempt was included or not.
* = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 5.7d. *Multiple linear regression predicting post-intervention SBQ-R item for suicidal ideation and behaviour*

Variables	R^2	F	β	d
Pre-intervention Suicidal Ideation and Behaviour	.61	85.94	.69***	1.29
Pre-Intervention Likelihood of Future Suicide Attempt			.11***	0.26
Condition			-.06	-0.08
Attention			-.10	-0.10
(Prospective + Retrospective) Memory			.10	0.13
Goal Intention			-.06**	-0.24
Condition x Attention			.07	0.05
Condition x (Prospective + Retrospective) Memory			-.15	-0.14
Condition x Goal Intention			.02	0.06
Attention x Goal Intention			-.07	-0.13
(Prospective + Retrospective) Memory x Goal Intention			-.02	-0.06
Condition x Attention x Goal Intention			.04	0.06
Condition x (Prospective + Retrospective) Memory x Goal Intention			.02	0.03

Note. SBQ-R Likelihood of a future suicide attempt was included as an independent variable in all analyses because the conditions differed on this measure (see 'Tests of randomisation' section). Note that the findings were the same regardless of whether likelihood of a future suicide attempt was included or not.
* = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 5.7e. *Multiple linear regression predicting post-intervention SBQ-R item for frequency of suicidal thoughts*

Variables	R^2	*F*	β	*d*
Pre-intervention Frequency of Suicidal Thoughts	.73	142.33	.82***	1.55
Pre-Intervention Likelihood of Future Suicide Attempt			.06	0.14
Condition			.02	0.02
Attention			-.14	-0.13
(Prospective + Retrospective) Memory			-.00	-0.00
Goal intention			-.02	-0.06
Condition x Attention			.18	0.12
Condition x (Prospective + Retrospective) Memory			-.08	-0.08
Condition x Goal Intention			-.01	-0.02
Attention x Goal Intention			-.06	-0.11
(Prospective + Retrospective) Memory x Goal Intention			-.00	-0.11
Condition x Attention x Goal Intention			.07	0.09
Condition x (Prospective + Retrospective) Memory x Goal Intention			-.01	-0.02

Note. SBQ-R Likelihood of a future suicide attempt was included as an independent variable in all analyses because the conditions differed on this measure (see 'Tests of randomisation' section). Note that the findings were the same regardless of whether likelihood of a future suicide attempt was included or not.
* = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 5.7f. *Multiple linear regression predicting post-intervention SBQ-R item for threat to die by suicide*

Variables	R^2	F	β	d
Pre-intervention Threat to die by Suicide	.54	63.46	.66***	1.33
Pre-Intervention Likelihood of Future Suicide Attempt			.11***	0.29
Condition			.04	0.06
Attention			-.04	-0.04
(Prospective + Retrospective) Memory			.15**	0.20
Goal intention			-.02	-0.07
Condition x Attention			.03	0.02
Condition x (Prospective + Retrospective) Memory			-.16*	-0.15
Condition x Goal Intention			-.04	-0.10
Attention x Goal Intention			-.01	-0.01
(Prospective + Retrospective) Memory x Goal Intention			.04	0.09
Condition x Attention x Goal Intention			-.03	-0.04
Condition x (Prospective + Retrospective) Memory x Goal Intention			-.03	-0.06

Note. Likelihood of a future suicide attempt was included as an independent variable in the analysis because the conditions differed on this measure (see 'Tests of randomisation' section). Note that the findings were the same regardless of whether likelihood of a future suicide attempt was included or not.
* = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 5.7g. *Multiple linear regression predicting post-intervention SBQ-R item for likelihood of future suicide attempt*

Variables	R^2	F	β	d
Pre-Intervention Likelihood of Future Suicide Attempt	.60	86.99	.73***	1.49
Condition			.02	0.03
Attention			-.07	-0.07
(Prospective + Retrospective) Memory			.06	0.09
Goal intention			-.03	-0.13
Condition x Attention			.08	0.06
Condition x (Prospective + Retrospective) Memory			-.15*	-0.16
Condition x Goal Intention			-.01	-0.02
Attention x Goal Intention			-.02	-0.04
(Prospective + Retrospective) Memory x Goal Intention			.02	0.05
Condition x Attention x Goal Intention			-.02	-0.02
Condition x (Prospective + Retrospective) Memory x Goal Intention			.00	0.01

* = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 5.7h. *Multiple linear regression predicting post-intervention anxiety*

Variables	R^2	F	β	d
Pre-intervention Anxiety	.67	107.71	.83***	1.49
Pre-Intervention Likelihood of Future Suicide Attempt			.02	0.08
Condition			-.04	-0.09
Attention			-.08	-0.12
(Prospective + Retrospective) Memory			.01	0.02
Goal intention			-.01	-0.05
Condition x Attention			-.02	-0.02
Condition x (Prospective + Retrospective) Memory			-.00	-0.00
Condition x Goal Intention			-.01	-0.03
Attention x Goal Intention			.01	0.04
(Prospective + Retrospective) Memory x Goal Intention			-.00	-0.01
Condition x Attention x Goal Intention			-.02	-0.05
Condition x (Prospective + Retrospective) Memory x Goal Intention			.00	0.01

Note. Likelihood of a future suicide attempt was included as an independent variable in the analysis because the conditions differed on this measure (see 'Tests of randomisation' section). Note that the findings were the same regardless of whether likelihood of a future suicide attempt was included or not.
* = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 5.7i. *Multiple linear regression predicting post-intervention depression*

Variables	R^2	F	β	d
Pre-intervention Depression	.56	68.49	.68***	1.34
Pre-Intervention Likelihood of Future Suicide Attempt			.05**	0.22
Condition			.00	0.01
Attention			-.02	-0.02
(Prospective + Retrospective) Memory			.05	0.11
Goal intention			.01	0.05
Condition x Attention			-.03	-0.03
Condition x (Prospective + Retrospective) Memory			.01	0.01
Condition x Goal Intention			-.02	-0.08
Attention x Goal Intention			-.01	-0.04
(Prospective + Retrospective) Memory x Goal Intention			.00	0.01
Condition x Attention x Goal Intention			-.01	-0.03
Condition x (Prospective + Retrospective) Memory x Goal Intention			.03	0.08

Note. Likelihood of a future suicide attempt was included as an independent variable in the analysis because the conditions differed on this measure (see 'Tests of randomisation' section). Note that the findings were the same regardless of whether likelihood of a future suicide attempt was included or not.
* = $p < .05$, ** = $p < .01$, *** = $p < .001$

Figure 5.3. *Simple slopes for the effect of condition on post-intervention self-harm behaviour in specified critical situations at high (mean + 1SD) and low (mean – 1SD) levels of (prospective + retrospective) memory*

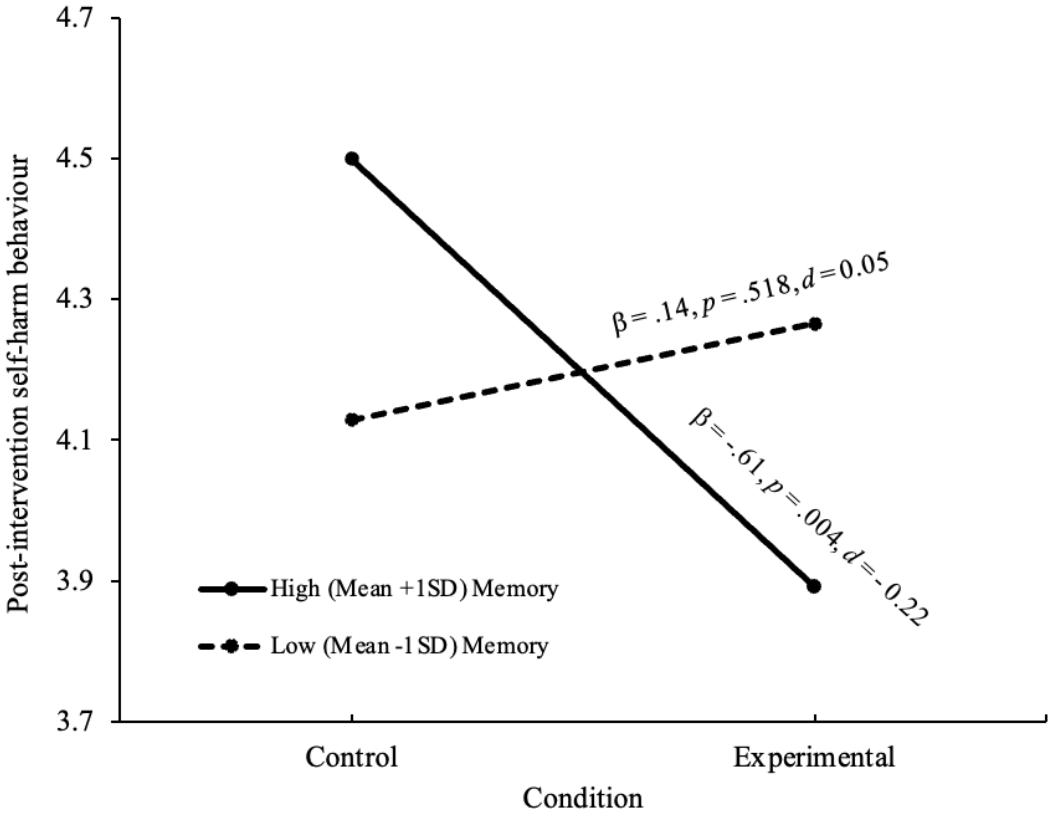
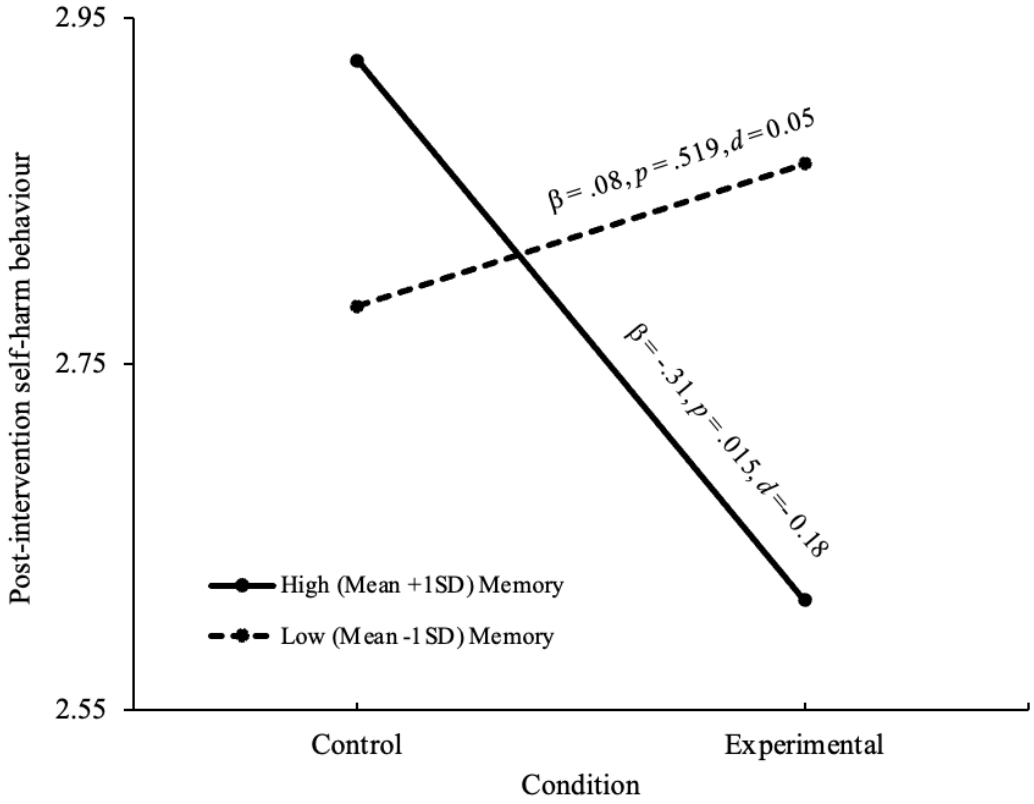


Figure 5.4. *Simple slopes for the effect of condition on post-intervention self-harm behaviour in unspecified critical situations at high (mean +1SD) and low (mean –1SD) levels of (prospective + retrospective) memory*



5.4 Discussion

Study 2 was conducted to build upon study 1 (chapter 4) by testing whether an implementation intention intervention can reduce self-harm thoughts. A more stringent active control group was used than in study 1. As with the experimental condition, the control condition was asked to specify both self-harm related critical situations and goal-directed responses (but without linking them to form implementation intentions) rather than just specify critical situations. The study was also conducted to test whether key cognitive abilities (attention, prospective memory, and retrospective memory) moderate implementation intentions on self-harm thoughts.

It was hypothesised that self-harm thoughts would be reported less frequently by the experimental (implementation intention) condition than the control condition (hypothesis 1). It was also hypothesised that attention, prospective memory, and retrospective memory would moderate the effects of implementation intentions (i.e., condition) on the subsequent (3-month post-intervention) frequency of self-harm thoughts. Two-way interactions between condition and attention, and condition and both prospective and retrospective memory, were also hypothesised in the prediction of subsequent self-harm thoughts. The experimental condition was hypothesised to report a lower frequency of post-intervention self-harm thoughts than the control condition at high, but not low, levels of attention (hypothesis 2). It was also hypothesised that the experimental condition would report a lower frequency of post-intervention self-harm thoughts than the control condition at high, but not low, levels of both prospective and retrospective memory (hypothesis 3).

Given study 1 (chapter 4) showed that implementation intentions require underlying goal intentions to be in place before they exert an impact of behaviour, it was also hypothesised that goal intention would moderate the effects of implementation intentions on post-intervention self-harm thoughts and the moderation of implementation intentions by the

cognitive abilities would be sensitive to goal intentions. Thus, a two-way interaction between condition and goal intention was hypothesised in the prediction of post-intervention self-harm thoughts: the experimental condition was hypothesised to report a lower frequency of post-intervention self-harm thoughts than the control condition at high, but not low levels of goal intention to stop thinking about self-harm (hypothesis 4). Similarly, three-way interactions between condition, goal intention and the cognitive abilities were hypothesised in the prediction of post-intervention self-harm thoughts: the experimental condition was hypothesised to report self-harm thoughts less frequently than the control condition at high, but not low, levels of both goal intentions to stop thinking about self-harm and attention (hypothesis 5), and at high, but not low levels, of both goal intentions to stop thinking about self-harm and prospective and retrospective memory (hypothesis 6).

As in study 1, the main and moderator effects were tested using a primary outcome measure of self-harm thoughts in the critical situations specified in participants' implementation intentions. They were also tested using measures of self-harm thoughts in unspecified situations to gauge if there were any potential spill-over effects, and self-harm behaviour in both specified and unspecified critical situations to gauge whether any reductions in self-harm thoughts were accompanied by reductions in self-harm behaviour. Consistent with study 1 and Armitage et al. (2016), a measure of suicidality was also included as a secondary outcome measure as were anxiety and depression to check if the intervention had any unintended negative or potentially desirable outcomes on these measures.

Contrary to expectations, hypothesis 1 was not supported as no overall difference was found between the experimental and control conditions in the frequency of self-harm thoughts in specified critical situations, or any secondary outcome measure at 3-month post-intervention. Likewise, in contrast to hypotheses 2 and 3, attention and prospective and retrospective memory did not moderate the effects of implementation intentions on the

primary outcome measure or most of the secondary outcomes. The exception to the finding that cognitive abilities did not moderate the effects of implementation intentions was for (prospective + retrospective) memory.

This construct was found to moderate the effectiveness of implementation intentions on the measures of self-harm behaviour in both specified and unspecified critical situations. It was found that the experimental condition reported self-harming less frequently than did the control condition at high, but not low levels of (prospective + retrospective) memory. This is consistent with the rationale provided in chapter 2 (see section 2.4.2.3) where high levels of retrospective memory are expected to be required when forming implementation intentions because an individual is asked to identify the critical situations most relevant to them (i.e., critical situations in which they have been tempted to perform the behaviour in the past). This finding is also consistent with the rationale that prospective memory is required to identify critical situations when they are encountered in the environment (automatically or otherwise) which then trigger the goal-directed response. Although, as the two constructs were highly correlated, and could therefore not be distinguished, it is unclear whether one or both of these cognitive abilities moderate the effectiveness of implementation intentions on behaviour-change. Also, as prospective memory theory proposes that retrospective memory processes are involved in the performance of prospective memory tasks, it is perhaps not unexpected that a correlation was observed (Einstein & McDaniel, 1990; Smith & Bayen, 2004). Objective measures of these cognitive abilities may overcome this issue.

Furthermore, while (prospective + retrospective) memory moderated the effectiveness of implementation intentions at reducing self-harm behaviour in specified and unspecified situations, it is unclear why this effect occurred when the implementation intention intervention was designed to target self-harm thoughts specifically. However, it should be recognised that the two self-harm behaviour measures (i.e., self-harm behaviour in specified

situations and self-harm behaviour in unspecified situations) were highly correlated (see section 5.2.5.1). It should also be acknowledged that (prospective + retrospective) memory was not found to moderate the effects of implementation intentions on the primary outcome or any of the secondary outcome measures. Nor were any significant three-way interactions between the cognitive measures, goal intention to stop thinking about self-harm and condition observed for any of the outcome measures. Goal intention to stop thinking about self-harm therefore did not influence the moderating effects of the cognitive abilities on implementation intentions (hypotheses 5 and 6 were therefore not supported). There is therefore limited evidence that cognitive abilities moderate the effects of implementation intentions.

A possible reason for the general lack of observed moderation effects of implementation intentions on self-harm related outcomes by the cognitive abilities is that cognitive abilities were measured in this study using self-reports. As mentioned in chapter 3, self-report measures are a valuable methodology for researchers in the social sciences, especially for participants who may prefer anonymity on sensitive issues such as self-harm (Cliffe & Stallard, 2023; Coulson et al., 2017; Jones et al., 2011). However, as also mentioned in chapter 3, self-reports can be susceptible to biases (e.g., Fulcher, 2003; Paulhus, 2002; Watkins et al., 1996). In the case of cognitive abilities, it is possible that an individual can over- or under-estimate their skills, meaning that the measures could be inaccurate representations for actual cognition (e.g., Cauvin et al., 2019). Additionally, the sample in this study comprised university students. While self-harm thoughts and behaviour are prevalent in university populations (e.g., Clements et al., 2023; Griffin et al., 2023; Sivertsen et al., 2019), it is possible that student samples provide insufficient variation in cognitive abilities to permit detection of moderation effects, such as those tested in this study. Indicative evidence for this was observed in the standard deviations for the cognitive ability measures, which were very

low (see Table 5.5). Objective measures of cognitive abilities (also see chapter 3) and a sample of non-students may resolve these issues.

Although there was limited support for the cognitive abilities acting as moderators of implementation intention effects on self-harm thoughts, goal intention moderated the effects of implementation intentions on self-harm thoughts in specified critical situations (supporting hypothesis 4). In line with the findings of study 1 for self-harm behaviour, the experimental condition reported thinking about self-harm less often in specified critical situations that did the control condition at high (mean +1*SD*) but not low (mean -1*SD*) levels of goal intention to stop thinking about self-harm. The effect size (d = -0.17), was also in line with the one found in study 1. While this is recognised as a small effect size (Cohen, 1992), it is broadly consistent with the range of effect sizes that have been found in previous studies of implementation intentions for a range of health and social behaviours (e.g., Cooke et al., 2023; Gollwitzer & Sheeran, 2006; Malaguti et al., 2020), and suicidality outcomes in people who present to hospital for self-harm (Armitage et al., 2016). The finding that goal intentions moderated the effectiveness of implementation intentions on self-harm thoughts is also consistent with previous studies outside the context of self-harm which have shown that implementation intentions are subordinate to goal intentions (e.g., Brewster et al., 2015; Elliott & Armitage, 2006; Sheeran et al., 2005 [study 1]; van Osch et al., 2008). The findings in the present study extend study 1 and the existing literature cited above because they have demonstrated for the first time that implementation intentions can be used to reduce detrimental internal thought processes compared to overt actions (e.g., Adriaanse et al., 2011; Gollwitzer & Sheeran, 2006; McWilliams et al., 2019) or affect-based outcomes (Webb et al., 2012). The findings also provide support for the expected usefulness of delivering implementation intentions in therapeutic settings, such as in counselling sessions (e.g., Gonzalez Salas Duhne et al., 2020). In the present study, the results therefore suggest that

implementation intentions are an effective strategy for reducing self-harm thoughts for people who possess the necessary motivation (i.e., to stop thinking about self-harm).

In addition, no effects of implementation intentions were observed, at any level of goal intention, on the measure of self-harm thoughts in unspecified critical situations, the measure of self-harm behaviour in both specified and unspecified critical situations, and the measure of suicidality. Consistent with study 1, there was no evidence that the effect of implementation intentions observed at high levels of goal intention to stop thinking about self-harm, translated from specified to unspecified critical situations (also see Elliott et al., 2021; Webb & Sheeran, 2007). Similarly, there was also no evidence that the effect of implementation intentions at high levels of goal intention to stop thinking about self-harm led to reductions in self-harm behaviour (in both specified and unspecified critical situations) or suicidality. Although, as the present intervention was designed to target self-harm thoughts specifically, the ability of the intervention to change this outcome should be the primary focus when judging its effectiveness. As self-harm thoughts are found to have a detrimental impact on an individual (e.g., feelings of depression and lower reappraisal coping; Nielsen et al., 2017), regardless of whether the individual engaged in self-harm behaviour (see chapter 1, section 1.3) an intervention which can reduce the frequency of self-harm thoughts would be expected to prevent the subsequent detrimental impacts an individual experiences.

As stated in chapter 4, there may be limited scope to reduce suicidality outcomes in wider community samples, such as the present student sample, because of low baseline scores typically observed on these measures. As was the case in study 1, the mean scores of measures of suicidality were low suggesting little scope for change. This is in accordance with previous research showing that students typically report low levels of suicidality (Akram et al., 2020; Becker et al., 2020; Farabaugh et al., 2015; Osman et al., 2001).

Finally, no significant changes in levels of anxiety and depression were observed as a result of receiving the implementation intention intervention in line with the findings reported in study 1. This provides further evidence that an implementation intention intervention does not have unintended consequences such as increases in anxiety and depression in the context of self-harm.

Overall, study 2 built upon the findings of study 1 by providing evidence that an implementation intention intervention (a volitional help sheet) can reduce self-harm thoughts in specified critical situations for those who possess the motivation to stop thinking about self-harm. While (prospective + retrospective) memory was found to moderate the effects of implementation intentions on self-harm behaviour, it was not clear whether one or both of these cognitive abilities had a moderating role due to the constructs being highly correlated. There was also no evidence that cognitive abilities moderated the effects of implementation intentions on any other outcomes. Possible reasons for these findings were that the cognitive abilities were measured in this study using self-report and the sample used (i.e., university students), may have provided insufficient variation in cognitive abilities. The next chapter proposes a protocol for a large-scale clinical trial designed to address these issues.

Chapter 6: Pilot study: Testing the effectiveness of implementation intentions at reducing self-harm in a clinical sample[8]

6.1 Introduction

The research presented in the previous chapters of this thesis showed that implementation intentions can reduce self-harm behaviour (study 1) and thoughts (study 2) in the community when individuals have the necessary goal intentions in place (e.g., to avoid self-harm). Study 1 (chapter 4) additionally provided evidence that implementation intentions reduced self-harm behaviour if individuals experienced self-harm and suicide related mental images. Study 2 (chapter 5) focused on the moderating effects of cognitive abilities. However, it provided only limited evidence that they moderated the effects of implementation intentions. As discussed at the end of the previous chapter, self-report measures were used in Study 2 to estimate cognitive abilities, which may be limited because they can be susceptible to biases (e.g., Fulcher, 2003; Paulhus, 2002; Watkins et al., 1996). In the case of cognitive abilities, it is possible that an individual will over- or under-estimate their skills meaning that the measures could be an inaccurate representation for actual cognitive ability (e.g., Cauvin et al., 2019). Also, the sample used in Study 2 showed little variation in cognitive abilities.

A test of implementation intentions using a clinical sample of patients admitted to hospital for self-harm would potentially overcome both of the above stated issues. and, therefore, provide a more sensitive test of the extent to which cognitive abilities moderate the effects of implementations intentions on self-harm related outcomes. First, it is more feasible

[8] This study was originally intended as the main study for this programme of research. It was designed as a clinical trial to test the effects of an implementation intention intervention (volitional help sheet) on self-harm related outcomes and the extent to which cognitive abilities moderated those effects. However, due to the covid-19 pandemic, this study was terminated after six weeks, meaning that baseline data were collected only for a small sample of $N = 13$ participants (see covid-19 statement). The study did however proceed to a stage where it could be used within this thesis as a pilot of the methodology that was developed.
The results and reflections section of this chapter have been published online in an end of research report for the Health Research Authority. It can be found at: https://www.isrctn.com/ISRCTN42425293.

to administer objective measures of cognitive abilities to people admitted to hospital for self-harm than in the community. This is because the objective measures are typically delivered face-to-face (e.g., Erdodi & Abeare, 2020; Hackett et al., 2018; Hogan et al., 2020; Shields et al., 2020) and hospital patients are available for this type of testing (e.g., in a hospital ward recovering after an episode of self-harm prior to discharge). Second, patients admitted to hospital for self-harm can be expected to have more variation in their cognitive abilities compared to people in the general population, as used in studies 1 and 2. This is because patients admitted to hospital for self-harm vary, not only in their occupation and education status, but also the presence of certain psychiatric disorders (e.g., anxiety and depression), which could result in a range of cognitive abilities observed across the sample (Hawton et al., 2013; Kapur et al., 2008; Lunde et al., 2020; Townsend, Ness et al., 2016). Indeed, larger standard deviations in measures of cognitive abilities have been found in patients with a history of self-harm relative to healthy controls (Jollant et al., 2013; Richard-Devantoy et al., 2012).

As discussed in chapter 1 (section 1.2), it is important to reduce self-harm in the community (studies 1 and 2), because many individuals do not present for treatment for their self-harm. However, the importance of reducing self-harm in individuals who have been admitted to hospital for their self-harm is also acknowledged because this can increase the risk of a person taking their own life within one year (Carrol et al., 2014). Also, compared with studies 1 and 2, there is potentially more scope for implementation intention interventions to generate reductions in suicidality outcomes if tested on people who have been admitted to hospital for self-harm (e.g., Armitage et al., 2016). Chapter 1 also reviewed existing brief interventions designed to reduce self-harm which are typically administered to hospital patients after presenting for self-harm. However, there has been limited evidence for their effectiveness. It would therefore be useful to determine whether the implementation

intention intervention developed in this doctoral programme of research also has the capacity to reduce self-harm in patients admitted to hospital. Furthermore, testing the intervention using a sample of patients admitted to hospital for self-harm would enable the use of objective self-harm outcomes (i.e., readmittance to hospital) in addition to self-reported outcomes. Also, as discussed in chapter 2 (section 2.3), there have only been two previous studies testing the effects of implementation intentions on patients admitted to hospital for self-harm (Armitage et al., 2016; O'Connor et al., 2017). The existing evidence base is therefore small, and it would be important to provide additional tests of the effectiveness of implementation intentions at reducing self-harm behaviour in patients admitted to hospital to build upon the previous findings and it would be useful scientifically in respect to replicability (e.g., Shrout & Rodgers, 2018).

In addition, previous research, including studies 1 and 2 in this thesis, has tended to test the effects of implementation intentions on behavioural outcomes following a single administration of the intervention (e.g., Brewster et al., 2016; Elliott et al., 2021; McGrath et al., 2020). These studies have shown that a one-off administration of an implementation intention intervention can successfully change behaviour. However, implementation intentions are not found to successfully change behaviour for all participants (e.g., Brewster et al., 2015; Cooke et al., 2023; Webb et al., 2007). As mentioned in chapter 2 (section 2.4.2), moderating variables might explain some of this between-participant variance in the effectiveness of implementation intentions on behaviour-change. In this thesis, a key focus has been on testing the extent to which cognitive abilities moderate the effects of implementation intention on self-harm outcomes. While the research presented in this thesis has thus far shown limited evidence for the moderating effect of cognitive abilities, more variation in cognitive abilities may be observed in clinical samples when measured objectively. If that is the case, methods for addressing deficits in cognitive abilities are likely

to be required. In particular, difficulties encoding implementation intentions to long-term memory, where they need to be stored for future activation, might be addressed with an implementation intention rehearsal task. As discussed in chapter 2, information (e.g., implementation intentions) that is attended to and rehearsed in working memory is more likely to be successfully stored in long-term memory (see section 2.4.2.3, Figure 2.2a).

Previous implementation intention studies have acknowledged the role of cognition by providing participants with the opportunity to rehearse their plan by writing them, saying them out loud, and/or imagining the components of the plan during the testing session (Armitage et al., 2011; Bieleke et al., 2018; Knäuper et al., 2009; McFarland & Glisky, 2011; Meeks & Marsh, 2010; Zimmerman & Meier, 2010). Other studies have re-administered volitional help sheets or the means for participants to re-specify their plans at a later point in time (Chapman & Armitage, 2010; O'Connor et al., 2017). However, few studies to date have tested whether a reinforcement task produces larger behaviour-change effects compared to a standard one-off administration of an implementation intention intervention (Chapman & Armitage, 2010; Prestwich et al., 2009). In the few studies that have addressed this issue, there have been promising results. For example, Chapman and Armitage (2010) found that, compared to a single administration implementation intention condition, participants who had the opportunity to form implementation intentions at baseline and again three months later reported a significant increase in fruit and vegetable consumption at 6-month post-intervention. Additionally, Prestwich et al. (2009) found that SMS reminders of previously specified implementation intentions or a participant's own tailored content significantly increased exercise behaviour at four-week post-intervention. This was compared to an implementation intention condition that did not receive SMS reminders. When investigating the content of the SMS reminders, it was found that participants who received SMS reminders of their previously specified implementation intentions significantly increased their

exercise behaviour compared to those who received other tailored content (e.g., that they did not want coronary heart disease). Future research could therefore usefully provide an additional test of whether a reinforcement task (i.e., rehearsal) of implementation intentions at baseline can boost behaviour-change, alongside a test of whether cognitive abilities moderate the effectiveness of implementation intentions on self-harm outcomes.

A clinical trial could therefore be used to test the extent to which: (a) implementation intentions reduce self-harm related outcomes in patients admitted to hospital, using objective (re-admissions to hospital for self-harm) and self-reported measures (e.g., self-harm behaviour in specified critical situations); (b) cognitive abilities moderate the effects of implementation intentions on self-harm; and (c) reinforcing implementation intentions through a rehearsal task can boost the effects of behaviour-change at post-intervention.

This chapter reports an initial pilot study to assess the feasibility of a protocol to address the above stated aims of a full, large-scale clinical trial. This pilot study could be used as part of an iterative process prior to the execution of a full-scale clinical trial in order to ensure it is appropriate for addressing the aims (Skivington et al., 2021). The following sub-sections describe the methodology that was applied and provides an assessment of its feasibility on the data that was collected with a view to informing a full clinical trial in the future.

6.2 Methodology

6.2.1 Design and procedure

Consistent with studies 1 and 2 in this thesis, a randomised controlled design was used, with the baseline and follow-up phases separated by three months. The participants were patients aged 18 or above and were recovering in one hospital in Scotland (Forth Valley Royal Hospital) after having been admitted for an episode of self-harm. In order to recruit the participants, a member of the hospital's psychiatric liaison team determined medical fitness to

participate in the study after completing their standard patient assessment procedures. If the patients were deemed medically fit, the member of the hospital's psychiatric liaison team informed them that a study was being carried out to investigate the effectiveness of various tasks that had been designed to help reduce self-harm.

Patients who expressed an interest in the research were subsequently approached by the researcher and provided with an information sheet. The information sheet stated that the purpose of the study was to compare the effectiveness of three tasks to help the patients avoid future self-harm, and that they would be asked to complete one of the three tasks if they chose to participate in the study. It also informed potential participants that anyone agreeing to participate in the study would be asked to complete a questionnaire asking about their thoughts, feelings, and behaviour in respect to self-harm, and to complete tasks on an iPad which would test their cognitive abilities. The information sheet stated that the total session would last approximately 50 minutes. Additionally, it informed the potential participants they would be contacted in three months' time to complete a short follow-up questionnaire, over the telephone, about their thoughts, feelings, and behaviours in respect to self-harm, which would last approximately 10 minutes. Participation was also specified to be voluntary, confidential, and that anyone choosing to withdraw from the study could do so without affecting their treatment as usual. Potential participants were also informed that, once their baseline and follow-up questionnaires, cognitive test data, and readmission to hospital for self-harm data were matched, any identifying information would then be deleted to ensure anonymity in the final dataset. Finally, the participants were informed that they could request a break from participating in the study whenever they required, and that a member of the psychiatric liaison team would be available to them if needed (e.g., if they experienced any distress). If the participants were happy to proceed, they were presented with a consent form for completion.

Following informed consent, the participants were presented with a paper-and-pencil, baseline questionnaire. The participants were provided with the option to complete the questionnaire themselves or with assistance from the researcher (i.e., the researcher could read each question and the response options aloud and display the options to the participant for them to select a response verbally). In the baseline questionnaire, the participants first completed standard items to measure social-demographic variables (gender, age, marital status, employment status, number of children, years in full-time education, education level achieved, presence of neurological disorders and presence of mental health diagnoses). The participants were also asked for their telephone number and email address so that they could be contacted three months later to arrange a day/time to complete the follow-up telephone questionnaire. An example question was then presented, and the participants were provided with the definition of self-harm used in this research: 'self-injury or self-poisoning regardless of the apparent purpose of the act'.

Next, the participants were asked to complete measures surrounding the episode of self-harm that led to them being admitted to hospital on that occasion (e.g., method and intent to die) and about self-harm episodes prior to their current admission to hospital (e.g., previous hospital admittance for self-harm). Following this, the participants were asked to complete standard items used in the previous studies in this thesis to measure self-harm behaviour, suicidality, goal intention to avoid self-harm, anxiety, and depression. Consistent with studies 1 and 2, these items were presented in a pseudo-random order with several response scales being reverse scored to reduce consistency and response set biases, respectively (Budd, 1987; Coolican, 2014).

On completion of the baseline questionnaire, the participants were randomly allocated to one of three conditions: 1) an implementation intention only condition; 2) an implementation intention plus reinforcement condition; or 3) a control condition. A web-

based random number generator was used to allocate the participants to the conditions. The participants in both of the experimental conditions were presented with the same volitional help sheet as used in study 1 but in a paper-and-pencil, rather than an online, format (see Appendix 3). The paper-and-pencil version of the volitional help sheet was presented on a single piece of paper. The 20 critical situations were presented on the left-hand side of the page and the 22 goal-directed responses were presented on the right-hand side. The participants were asked to select four critical situations, from the left-hand side of the page and to link each with a goal-directed response by drawing a line (Armitage, 2008). The participants in the implementation intention only experimental condition just completed this task. The participants in the implementation intention plus reinforcement condition were additionally asked, after completing the cognitive measures (see below), if they could remember the IF-THEN plans that they formed earlier, by telling the researcher the four critical situations and goal-directed responses they had specified. The researcher subsequently wrote down the participant's verbal response and matched this to the completed volitional help sheet in order to record participants' ability to freely recall their previously formed implementation intentions plans. Regardless of how the participant performed, they were told they performed well, and that the researcher would like to go over some of the plans with them. The researcher then provided the participants with their previously completed volitional help sheet and asked them to read each plan aloud, one at a time. The researcher wrote down each plan and read it back to them. Once all four plans had been rehearsed individually with the participant, the researcher read aloud all four plans to the participant. As in study 1, the participants in the active control condition were asked to select four critical situations, from the same list provided to the experimental conditions – situations that would most tempt them to engage in self-harm over the next three months. They were also asked to try to avoid self-harm when those situations were encountered.

Following the intervention task (but prior to the rehearsal task in the implementation intention plus rehearsal condition), objective measures of cognitive abilities were taken. Cognitive tests of working memory, inhibition, processing speed, and episodic memory were administered. Before and after these tests, an objective measure of prospective memory was administered. The participants were then asked to complete a self-report measure of prospective and retrospective memory. Subsequently, the participants were thanked for their time and provided with a sheet which reminded them they would be contacted in three months' time. The sheet also provided them with contact details for support organisations.

Three months after being recruited and tested in the hospital, it was planned that all participants would be contacted via telephone or email to arrange a day/time to complete a follow-up questionnaire, which would be administered via telephone. This questionnaire had been designed to contain the same measures of self-reported self-harm behaviour, suicidality, anxiety, and depression as the baseline questionnaire. However, it was not possible to administer this questionnaire due to the covid-19 pandemic pausing the research, which led to the premature termination of the study. After completing the follow-up questionnaire, the participants would have been thanked again for their time and fully debriefed. At this point, all participants, regardless of which condition they had been randomly allocated to, would have been given the opportunity to complete all intervention components (the volitional help sheet and the reinforcement task) to ensure that potentially effective treatment was not with-held.

At three-month follow-up, medical records were accessed to collect objective data on hospital readmissions for self-harm following intervention. These data could be collected in spite of the covid-19 pandemic because it did not require any further research participation from the participants.

Ethical approval for this study was granted by the North of Scotland Research Ethics Committee 2 and endorsed by the University of Strathclyde Ethics Committee.

6.2.2 Measures

6.2.2.1 The self-reported questionnaire measures

Self-harm in specified and unspecified critical situations: All the participants were asked: "How many times, over the LAST 3 months, have you harmed yourself in the following situations?" They were then presented with the 20 critical situations that were contained in both the volitional help sheet and the control intervention. For each situation, the participants were provided with a space to indicate how many times they had engaged in self-harm in that situation. Consistent with studies 1 and 2, this permitted a measure of behaviour in specified critical situations to be calculated, for use as a primary outcome measure, by taking the arithmetic mean of the items that corresponded to the four critical situations selected by the participants in the interventions was used as the final measure of self-harm behaviour. It also permitted a measure of behaviour in unspecified critical situations to be calculated, for used as a secondary outcome measure, by taking the arithmetic mean of the items that corresponded to the remaining, unchosen, situations.

Suicidality: Consistent with studies 1 and 2, the SBQ-R (Osman et al., 2001) was used to measure suicidality which could be used as further secondary outcome measures: suicidal ideation and behaviour; frequency of suicidal thoughts; threat to die by suicide; and the likelihood of a future suicide attempt. In line with studies 1 and 2 and Armitage et al. (2016), the four items could be used as separate outcome measures of suicidality. Alternatively, they could also be combined into a total score (i.e., summative measure) consistent with other studies (e.g., Huz et al., 2016; Kaniuka et al., 2020; Nagra et al., 2016).

Anxiety and Depression: The same 10-item version of the HADS (Zigmond & Snaith, 1983) as used in studies 1 and 2 was used to measure anxiety and depression. Five items

were used to measure anxiety (e.g., “I feel tense or wound up”: Not at all [scored 0] to Most of the time [scored 3]) and five were used to measure depression (e.g., “I have lost interest in my appearance”: I take just as much care as ever [scored 0] to Definitely [scored 3]). As in the previous two studies, these items permitted overall anxiety and depression measures to be calculated (i.e., by taking the arithmetic means of the scores on the anxiety and depression items, respectively). These measures were designed to permit a test of possible unintended or desirable outcomes following the implementation intention intervention, as in studies 1 and 2.

Goal intention to avoid self-harm: Established items recommended by Fishbein and Ajzen (2010) were used to measure goal intentions, again consistent with studies 1 and 2. The participants responded to each of the following four items on a 9-point scale: ‘To what extent do you intend to avoid harming yourself over the NEXT 3 months?’ (1 = *No extent at all* to 9 = *A great extent*); ‘To what extent to do you want to avoid harming yourself over the NEXT 3 months?’ (1 = *No extent at all* to 9 = *A great extent*); ‘To what extent will you try to avoid self-harming over the NEXT three months?’ (1 = *No extent at all* to 9 = *A great extent*); and ‘How likely or unlikely is it that you will try to avoid harm yourself over the NEXT 3 months?’ (1 = *Extremely unlikely* to 9 = *Extremely likely*). These items were designed to permit a final measure of goal intention to avoid self-harm (i.e., the arithmetic mean of the scores on the response scales), which could be used as a moderator of the effects of implementation intentions on the outcome measures, as in studies 1 and 2.

Prospective and retrospective memory: The Prospective and Retrospective Memory Questionnaire (Smith et al., 2000) was administered as a self-report measure, consistent with study 2. Eight items were used to measure prospective memory (e.g., ‘Do you decide to do something in a few minutes’ time and then forget to do it’?) and eight were used to measure retrospective memory (e.g., ‘Do you forget something that you were told a few minutes before?’) all scored on a 5-point scale (1 = Never to 5 = Very Often). This would permit final

measures of prospective and retrospective memory to be calculated (i.e., the arithmetic means of the scores on the separate set of items). These measures could therefore be used as moderators of the effects of implementation intentions on the outcome measures, as in study 2.

6.2.2.2 The objective measures

Re-admission to hospital for self-harm: The hospital medical records were accessed by a member of the psychiatric liaison team to identify whether the participants had been re-admitted to hospital for self-harm over the three-month period between baseline and follow-up, and if so, how many times. The readmission to hospital data was recorded as a yes/no response and if yes was selected, the number of times provided. This was intended to provide an objective outcome measure against which the effectiveness of implementation intentions could be tested, as in O'Connor et al. (2017).

Working memory: As stated in chapter 3 (see section 3.4.2), the list sorting working memory test was selected from the National Institute of Health Toolbox – Cognition Battery to provide an objective measure of working memory (National Institutes of Health and Northwestern University, 2018). This test asks the participants to sort and sequence information (i.e., animals and food) in size order from smallest to biggest. As described in chapter 3 (section 3.4.2) there is a 1-category version (listing animals or food only) and a 2-category version (listing animals and food) of the test. The number of items that are correctly recalled and sequenced across both versions of the test would permit a final normative score of working memory, between 0-26, to be calculated automatically in the app, which could be used as a moderator of the effects of implementation intentions on the outcome measures.

Episodic memory: As mentioned in chapter 3 (see section 3.4.2), the picture sequence memory test was selected from the National Institute of Health Toolbox – Cognition Battery to provide an objective measure of episodic memory (National Institutes of Health and

Northwestern University, 2018). In this test the participants are asked to view and reproduce a sequence of related pictures for two test trials (e.g., playing in the park; National Institutes of Health and Northwestern University, 2018). The number of correctly placed adjacent pairs across the two trials would therefore permit a final normative score between 0-31 for episodic memory to be calculated in the app, which could be used as a moderator of the effects of implementation intentions on the outcome measures.

Inhibition: As stated in chapter 3 (section 3.4.2), the flanker inhibitory control and attention task was selected from the National Institute of Health Toolbox – Cognition Battery to provide an objective measure of inhibition (National Institutes of Health and Northwestern University, 2018). This test asks the participants to identify whether an arrow presented in the centre of the screen is pointing left or right as quickly as possible while at the same time ignoring irrelevant information presented on each side of the arrow (i.e., flankers) across 20 test trials. Accuracy and reaction time are calculated in the app to provide a final score of inhibition. Accuracy is considered first when calculating the final computed score. If a participant has an accuracy score less than or equal to 80%, the final computed score calculated in the app, reflects the accuracy score only (i.e., a score between 0-5). If a participant has an accuracy score greater than 80%, the final computed score calculated in the app reflects both accuracy and reaction time providing an overall computed score between 0-10. These scores could be used as a final measure of inhibition which could be used a moderator of the effects of implementation intentions on the outcome measures.

Processing speed: As mentioned in chapter 3 (see section 3.4.2), the pattern comparison processing speed was chosen from the National Institute of Health Toolbox – Cognition Battery to provide an objective measure of processing speed (National Institutes of Health and Northwestern University, 2018). In this test the participants are asked to identify if two images presented are the same or different as quickly as possible. The number of

correctly given responses within 85s results in a raw score (0-130). This then permits a final normative score of processing speed to be calculated in the app, which could be used as a moderator of the effects of implementation intentions on the outcome measures.

Prospective memory: As stated in chapter 3 (section 3.4.2) an objective measure of prospective memory was administered by adapting two items from the Royal Prince Alfred Prospective Memory Test (Radford et al., 2011). Before participants began the baseline questionnaire, they were provided with the prospective memory task instructions to remember at a later point in the session. These were: "when my mobile phone rings, please ask me for a bottle of water' and 'when I tell you that we have finished with the iPad, please ask me for a sheet of paper with a message on it'. The cues were presented after the baseline questionnaire (i.e., mobile phone ringing) and other measures of cognition, specified above (i.e., the participants were told they were finished with the iPad). Each item is measured on a 6-point scale (i.e., 0 = no response; 0 = incorrect response, >2 minutes delay or ahead or time; 1 = correct response > 5 minutes delay or ahead of time; 2 = correct response, 2-5 minutes delay; 2 = incorrect response up to 2 minutes delay; 3 =correct response, up to 2 minutes delay). This would permit a final measure of prospective memory to be calculated between 0-6 which could be used as a moderator of the effects of implementation intentions on the outcome measures.

6.3 Results

As mentioned at the start of the chapter, the study had to be terminated after six weeks due to the covid-19 pandemic. At that point in time, baseline data had been collected from and interventions had been delivered to $N = 13$ participants in Forth Valley Royal Hospital. The characteristics of the patients who took part in the study, and the scores on the baseline measures that were collected from these participants, are provided below. It is recognised that these data are from a small number of participants. However, the data are potentially useful

for determining the extent to which the recruitment procedures and measures are likely to provide an appropriate sample and data in a full-scale clinical trial.

6.3.1 Participant characteristics and baseline measures

Despite the small sample, the socio-demographic profile for the $N = 13$ participants who took part in this study (Table 6.1) showed broad similarity with those observed in other clinical studies of patients admitted to hospital for self-harm (Armitage et al., 2016; Cleare et al., 2021; O'Connor et al., 2017; Rasmussen et al., 2010). In particular, most of the sample identified as female and were not in active employment. The participants' self-harm histories and information about the episode of self-harm that resulted in their current hospital admission (Table 6.2) also showed broad similarities with the clinical studies cited above. For instance, the majority of the participants presented to hospital for self-poisoning and had previous admissions to hospital for self-harm. The characteristics reported therefore generate initial confidence that the recruitment procedures that were employed in this pilot study would likely provide a suitable sample appropriate for addressing the aims of testing the effects of an implementation intention intervention on self-harm related outcomes and the moderating effect of cognitive abilities.

Table 6.1. *Socio-demographic characteristics of the sample*

Variable	Statistic (n)
Gender	
Female	9
Male	4
Transgender: male to female	0
Transgender: female to male	0
Transgender: do not identify as male or female	0
Not sure	0
Decline to state	0
Marital Status	
Married	5
In a relationship, but not married	3
Single	5
Separated	0
Divorced	0
Widowed	0
Employment Status	
In full-time paid work	3
In part-time paid work	1
In full-time voluntary (unpaid) work	0
In part-time voluntary (unpaid) work	0
In full-time education	2
In part-time education	0
Full-time carer	1
Homemaker	1
Unemployed	5
Neurological disorders	
Yes	0
No	13
Current/previous mental health diagnoses	
Yes	9
No	4

Note: Participants were on average 36.77 years old (SD = 14.43).

Table 6.2. *Participant self-harm history and information about the episode of self-harm that resulted in the current hospital admission*

Variable	Statistic (n)
Previous admissions to hospital for self-harm	
Yes	9
No	4
Previous self-harm with intention of taking own life	
Yes	8
No	5
Current hospital admission: Method of self-harm	
Self-poisoning	9
Self-injury	2
Self-poisoning and self-injury	2
Current hospital admission: Presence of intention to take own life	
Yes	10
No	3
Current hospital admission: Presence of other reasons for self-harm	
Yes	7
No	6
Current hospital admission: Engagement in non-suicidal self-harm	
Yes	2
No	11
Current hospital admission: Suicide note	
Presence of note	3
Note written but torn up	0
Note thought about	1
Absence of note	9

Descriptive statistics for the baseline measures that were collected are summarised in Table 6.3. As can be seen in the table, participants, on average, reported engaging in self-harm in their specified critical situations more times compared to their unspecified critical situations. This is in line with studies 1 and 2, where the frequency of self-harm behaviour (study 1) and self-harm thoughts (study 2) was found to be higher in specified than unspecified situations. This finding also suggests that the participants were adhering to intervention instructions and selecting the critical situations which would most tempt them to engage in self-harm. In addition, with regards to the suicidality items, the sample reported high suicidal ideation and behaviour, moderate-to-high frequency of suicidal thoughts, and moderate threats to die by suicide and likelihood of a future suicide attempt. The means on these measures were higher than in studies 1 and 2. This is in line with expectations and provides indicative evidence that hospital patients report higher levels of suicidality compared to those in the community more generally, which is also in line with the literature (e.g., Akram et al., 2020; Osman et al., 2001; Rueda-Jaimes et al., 2017). These descriptive results, albeit based on a small sample, therefore, generate initial confidence that the methods employed in this study would be likely to result in the recruitment of a suitable sample for a full-scale clinical trial. The participants also reported moderate-to- high levels of anxiety and depression symptoms. The means on these measures were mostly higher than in studies 1 and 2. In particular, the patient sample, on average, reported higher levels of depressive symptoms.

The mean score on the measure of goal intention was above the scale mid-point indicating that, on average, the patients had a goal intention to avoid self-harm. There is therefore confidence that there would be scope for implementation intentions to promote reductions in self-harm outcomes in a full clinical trial (i.e., through converting goal intentions into behaviour; see chapter 2). For the objective cognitive ability measures, the

sample reported moderate levels of working memory, moderate-to-high executive function, low episodic memory, low processing speed, and moderate prospective memory. The means on the self-report prospective and retrospective memory measure indicated that on average participants reported moderate prospective memory and low retrospective memory ability. As can be seen in Table 6.3, the variance around the means for the cognitive ability measures, is demonstrated by the coefficient of variance statistics. For most of the measures, the standard deviations were equal to or greater than 30% of the mean values. In comparison, the coefficients of variance for the cognitive ability measures in study 2 did not exceed 29%. Even with the small number of participants, these results generate some confidence that, in line with expectations, there may be a greater likelihood of finding moderation effects of cognitive abilities in a full-scale clinical trial of hospital patients than in the community (e.g., study 2).

Four participants were also re-admitted to hospital for self-harm during the three months between baseline and follow-up. Each of these participants were re-admitted to hospital on one occasion. These results further generate initial confidence that the methodology described in this chapter will be appropriate to address the original aims of this pilot study in a full-scale clinical trial.

Table 6.3. *Baseline means, standard deviations and co-efficient of variance for the outcome and moderator variables*

Variable	Mean (SD)	Co-efficient of variation (%)
Self-harm in specified critical situations (n=13)	12.58 (20.35)	162
Self-harm in unspecified critical situations (n=13)	6.62 (11.82)	179
Suicidal ideation and behaviour (n=13)	5.08 (1.71)	34
Frequency of suicidal thoughts (n=13)	3.77 (1.64)	44
Threat to die by suicide (n=13)	2.23 (1.74)	78
Likelihood of future suicide attempt (n=13)	3.15 (2.30)	73
Anxiety (n=13)	2.05 (0.72)	35
Depression (n=13)	1.83 (0.77)	42
Intention to avoid self-harm (n=13)	5.38 (2.75)	51
Cognitive abilities (n=13)		
Working memory	15.62 (3.78)	24
Executive function	7.52 (1.12)	15
Episodic memory[a]	11.14 (8.53)	77
Processing speed	38.69(11.41)	30
Prospective memory (objective)	3.31 (2.50)	76
Prospective memory (self-report)[b]	2.46 (0.92)	37
Retrospective memory (self-report)[b]	1.88 (0.69)	37

[a] One participant stated they did not want to take part in this cognitive ability task, thus n = 12 on this measure

[b]As was done in study 2, for the sake of interpretative clarity within this thesis, the scores on each item were reversed so that higher scores represented greater ability in prospective and retrospective memory rather than errors in prospective and retrospective memory

6.3.2 Methodological experiences and considerations

An assessment of the study protocols is summarised in Table 6.4 using the framework developed by Bugge et al. (2013), based on 14 methodological issues identified by Shanyinde et al. (2011), to assist with decision making after pilot and feasibility trials. From this assessment, three key issues emerged. These should be taken into consideration in further pilot testing prior to a full large-scale clinical trial being conducted: issues concerning the recruitment procedures; issues concerning the participants' experience of completing the

measures; and issues concerning the collection of follow-up data, which will also be reflected upon in this section.

Table 6.4. *Methodological issues framework to assist with decision making after pilot and feasibility trials as specified by Bugge et al. (2013).*

Methodological issues	Findings	Evidence
1. Did the feasibility/pilot study allow a sample size calculation for the main trial?	Not able to be calculated	*N* = 13 participants were recruited at baseline and randomised to the following conditions: *N* = 5 implementation intention only *N* = 5 implementation intention plus reinforcement *N* = 3 control Due to the lack of follow-up data, reliable estimates of effect size could not be provided for a sample size calculation. Note that a sample size calculation for a main clinical trial was calculated with an effect size of *d* = 0.35 consistent with the power analysis conducted for study 1.
2. What factors influenced eligibility and what proportion of those approached were eligible?	Ineligibility to participate was mainly due to participants not being medically fit following standard assessment procedures or participants not fulfilling inclusion criteria	Of the 36 patients admitted to hospital for self-harm, 11 could not be approached for the following reasons: N = 3 declined to speak to the researcher *N* = 8 could not be approached for medical fitness or safety reasons Of the 25 patients who could be approached *n* = 12 did not take part for the following reasons: *N* = 3 did not want to take part *N* = 1 withdrew consent *N* = 2 under 18 years of age *N* = 3 did not fulfil definition criteria for self-harm (i.e., excessive alcohol consumption) *N* = 2 not medically fit (i.e., sleepy) and subsequently discharged *N* = 1 English not first language

Table continues on next page…

Table 6.4 (continued). *Methodological issues framework to assist with decision making after pilot and feasibility trials as specified by Bugge et al. (2013).*

	Methodological issues	Findings	Evidence
3.	Was recruitment successful?	Recruitment was difficult	Of the 25 participants deemed medically fit to participate, approximately half did not take part. This was due to the inclusion criteria not being fulfilled, lacking medical fitness, or not wanting to take part.
4.	Did eligible participants consent?	Yes	Initially 14 participants were eligible to take part. One participant withdrew consent.
5.	Were participants successfully randomised and did randomisation yield equality in groups?	Yes	All participants were randomised using a web-based random number generator. *N* = 5 implementation intention only *N* = 5 implementation intention plus reinforcement *N* = 3 control
6.	Were blinding procedures adequate?	Yes	A single-blinded trial was used. The participants were blinded to which intervention they received. All participants received an intervention.
7.	Did participants adhere to the intervention?	Yes	All participants completed the intervention task to which they were randomised
8.	Was the intervention acceptable to the participants?	Not directly assessed, but appeared acceptable	All participants completed the intervention task they were randomised to and did not express any difficulties
9.	Was it possible to calculate intervention costs and duration?	N/A	This was not assessed in this pilot

Table continues on next page…

Table 6.4 (continued). *Methodological issues framework to assist with decision making after pilot and feasibility trials as specified by Bugge et al. (2013).*

Methodological issues	Findings	Evidence
10. Were outcome assessments completed?	Only baseline data could be collected from participants for a short period of time due to covid-19	The majority of the participants completed all baseline measures. The exception was one participant who asked to skip one of the cognitive ability measures. However, $n = 6$ asked how much longer the study would last or commented that they were tired. The follow-up telephone questionnaire could not be administered due to covid-19. Objective data was able to be provided for all of the participants.
11. Were outcomes measured those that were the most appropriate outcomes?	Yes	The most appropriate outcome measures were chosen based on previous research (see Methodology; section 6.2)
12. Was retention to the study good?	N/A	As the follow-up telephone questionnaire could not be administered due to covid-19, retention rates could not be calculated.
13. Were the logistics of running a multicentre trial assessed?	N/A	Only one hospital was employed in this pilot study.
14. Did all components of the protocol work together?	Only the baseline protocol could be assessed	No difficulties were identified when administering the baseline protocol.

6.3.2.1 Recruitment

As noted in Table 6.4, recruitment was difficult (see methodological issue 3). As can be seen in the table, a total of 36 potential participants were in Forth Valley Royal Hospital at the time the researcher was present. Twenty-five participants agreed to speak to the researcher. However, a final number of 13 participants were recruited indicating a recruitment rate of 36% over a six-week period. Reasons for participants not taking part are summarised in Table 6.4. These included potential participants could not be approached by the researcher (e.g., not deemed medically fit), they did not fulfil inclusion criteria (e.g., did not fulfil definition criteria for self-harm), or they did not want to take part. Prior to the study being terminated, recruitment was taking place during working hours and was planned to last 15 months. Further pilot work in the future may benefit from the following considerations. First, to recruit participants at night-time (8pm – 6am) in addition to daytime (between 8am and 6pm) hours, where feasible. Given that peak times for presentation to hospital for self-harm include the hours between 8pm to 3am (Bergen & Hawton, 2007; McEvoy et al., 2023), this is likely to substantially increase recruitment. Second, participants could be recruited from a hospital with a larger number of self-harm admissions, than the hospital employed in this study, or more than one hospital could be employed for recruitment (e.g., Biddle et al., 2018; Cleare et al., 2018; Cleare et al., 2021; O'Connor et al., 2022; Rasmussen et al., 2010). The consideration of using more than one hospital would also permit an assessment of methodological issue 13 specified in Table 6.4. Third, if resources allow data recruitment and collection could be carried out by multiple researchers rather than a single researcher. Multiple researchers could rotate between day and night shifts to allow participant recruitment and testing to take place over 24 hours. This would mean that all eligible patients admitted to the hospital would potentially be captured by the recruitment procedure. Fourth, if a single

researcher was responsible for the recruitment procedures, consideration could be given to lengthening the time for recruitment. For example, it is expected that based on the recruitment rate observed in this pilot study that two years would have provided the sample size calculated for the original study to be obtained. Similar time periods for recruitment of self-harm patients have been observed in other clinical studies (e.g., Cleare et al., 2021; O'Connor et al., 2017).

6.3.2.2 Administration of the measures

There was evidence in support of the feasibility of the protocol with respect to whether outcome assessments were completed (see Table 6.4, methodological issue 10). No participants expressed any problems with the completion of the questionnaire or intervention tasks. Participants were given as much time as they needed to complete the questionnaires and the intervention tasks. They were reminded throughout the session that they could take a break when they wanted. That said, six of the participants asked questions about how much longer the study would last or commented that they were getting tired whilst they were completing the cognitive tests. A future pilot study could consider reducing the number of cognitive tests. For instance, thought might be given to removing the list sorting working memory test and/or the picture sequence memory test as these tests take approximately seven minutes to complete each whereas the flanker inhibitory and attention and picture comparison processing speed tests take approximately seven minutes to complete together. However, given that each of the cognitive tests measured a key cognitive ability expected to moderate the effectiveness of implementation intentions, as discussed in chapter 2 (section 2.4.2.3), it would be preferable to build a break into the testing session. For instance, a break could be provided between the baseline questionnaire and the interventions or following the

intervention prior to the administration of the tests from the National Institutes of Health Toolbox – Cognition Battery (National Institutes of Health and Northwestern University, 2018). Also, as the cognitive measures administered from the National Institutes of Health Toolbox – Cognition Battery (National Institutes of Health and Northwestern University, 2018) take approximately 20 minutes to complete, building breaks between the tests should also be considered to prevent participant fatigue.

6.3.2.3 Follow-up data

As previously noted, the follow-up telephone questionnaires could not be completed to obtain follow-up measures (i.e., frequency of self-harm behaviour in the situations specified in the IF component of a participant's implementation intentions). No evidence could therefore be provided in respect to retention rates in the study (see Table 6.4; methodological issue 12). Reflections on how appropriate the telephone method is for collecting follow-up information can also not be made as it was not completed (see Table 6.4; methodological issue 10). It should be noted, however, that all the participants provided their contact details for the follow-up questionnaire to be conducted over the telephone, which suggests that the method was viewed as acceptable. Future pilot testing is encouraged to test this methodology. It should also be acknowledged that it all participants gave permission for their hospital records to be accessed so that objective follow-up data about re-admissions for self-harm could be recorded. This process ran smoothly with assistance from the psychiatric liaison team at the hospital and is encouraged in future research.

6.4 Conclusions

This study comprised a pilot of a developed protocol for a large clinical study that could be conducted in the future to (a) test the effectiveness of an implementation intention intervention (volitional help sheet) on self-harm related outcomes using

objective and self-reported outcome measures in patients admitted to hospital for an episode of self-harm; (b) test the extent to which cognitive abilities moderate the effectiveness of implementation intentions on self-harm related outcomes; and (c) test the extent to which reinforcing implementation intentions through a rehearsal task can boost the effects of behaviour-change at post-intervention.

Prior to a large-scale clinical trial, to address these aims, further pilot testing is recommended to consider the following modifications to the methodological protocols specified in this chapter. First, recruiting participants during night-time hours (e.g., between the hours of 8pm – 6am) in addition to daytime working hours, where feasible. Second, recruiting and test participants across multiple hospital sites, where feasible. Third, employing multiple researchers to carry out the recruitment and data collection in hospitals, where feasible. Fourth, lengthening the time for recruitment. Finally, building breaks into the testing between the baseline questionnaire and intervention or following intervention prior to the objective cognitive tests to minimise participant fatigue. A future pilot study is also recommended to assess the follow-up procedure proposed in this chapter. This will provide an assessment of its feasibility and extend the review of methodological issues provided in this chapter.

Chapter 7: General Discussion

7.1 Introduction

This chapter will summarise the work presented in this thesis and the contributions made to theory and self-harm prevention. Recommendations for future research will be made throughout, where appropriate. The chapter will also consider possible methodological strengths and limitations and present the final conclusions.

7.2 Summary of the rationale and methodology applied to the programme of study

Chapters 1-3 of this thesis provided the overall rationale and methodological considerations for the programme of study. Chapter 1 reviewed literature showing that self-harm behaviours and thoughts are prevalent and have detrimental impacts on individuals, their loved ones, and the economy. These negative impacts therefore emphasised the need for effective interventions to reduce self-harm behaviour and thoughts.

Existing interventions that have been developed to reduce self-harm behaviour and suicidal ideation (on account of suicidal ideation being able to provide information about self-harm thoughts) were subsequently reviewed. These were pharmacological (e.g., anti-depressants), psychological and brief psychological (e.g., cognitive behavioural therapy-based psychotherapy and safety planning), brief contact (e.g., postcards), and digital (e.g., therapeutic evaluation apps) interventions. In general, there was a lack of evidence for the effectiveness of pharmacological interventions. While some psychological interventions were found to reduce self-harm behaviour and suicidal ideation (e.g., cognitive behavioural therapy-based psychotherapy), it was recognised these were resource intensive (i.e., required a health professional to administer them) which may limit their ability to be delivered on a large-scale and to be accessible to everyone who needs them.

Interventions designed to overcome this limitation (i.e., brief contact and digital interventions) were found to be largely ineffective in reducing self-harm, or results in favour of these interventions were based on single studies. Digital interventions based on therapeutic models (e.g., dialectical behaviour therapy) were found to reduce suicidal ideation (e.g., Torok et al., 2022). It was proposed that a possible reason why brief contact interventions have been shown to have limited effectiveness is that they had not been developed on the basis of established theories, which specify the underlying reasons for self-harm. Researchers in the area also acknowledge they have not previously been developed with a clear explanation as to how and why interventions should work (O'Connor et al., 2011). In addition, it was also recognised that engagement with digital interventions reduces over time. Thus, the importance of keeping interventions brief was emphasised. Since previous studies also showed that people who self-harm have a general motivational orientation to avoid this behaviour (Armitage et al., 2016; O'Connor & Armitage, 2003; O'Connor et al., 2006; Paterson et al., 2023), it was concluded that a brief intervention based on psychological theory, which can translate existing goal intentions (i.e., motivation) into action, would be desirable.

Chapter 2 therefore introduced implementation intentions (Gollwitzer, 1993) as a potential way to address the identified intervention requirements. This was because implementation intentions constitute a brief, theoretically based, behaviour-change strategy that can be self-administered in order to translate motivation (e.g., goal intentions to avoid self-harm) into action. As discussed in chapter 2, implementation intention interventions encourage people to specify critical situations in which to perform a goal-intended behaviour (e.g., avoid self-harm) or a situation which would tempt them to do otherwise (e.g., 'If I am tempted to self-harm when I feel lonely…). Implementation intention interventions also encourage people to link their specified critical situations

with goal-directed responses that will be employed when the specified critical situations are encountered (e.g., '…then I will contact a helpline or self-harm support group).

Chapter 2 also reviewed existing evidence for implementation intention interventions. This evidence showed that implementation intention interventions have been found to be effective at changing many different health and social behaviours (Adriaanse et al., 2011; Bélanger-Gravel et al., 2013; Gollwitzer & Sheeran, 2006; Malaguti et al., 2020; McWilliams et al., 2019; Toli et al., 2016). Most notably, with respect to the present programme of research, two studies published, to date, have tested the effectiveness of implementation intentions at reducing self-harm related outcomes in patients admitted to hospital for self-harm (Armitage et al., 2016; O'Connor et al., 2017). These studies showed promising results, with significant reductions being observed in suicidality outcomes (Armitage et al., 2016) and re-admissions to hospital for self-harm in those with a known previous history of this behaviour (O'Connor et al., 2017).

From the existing evidence, two key gaps were identified in chapter 2, which the research in this thesis sought to address. First, the effectiveness of implementation intentions at reducing self-harm in the wider community had not yet been tested. It was identified as important to test implementation intention interventions in this population as it is where self-harm is most prevalent (e.g., Hawton et al., 2012). Additionally, it was identified that implementation intentions are not a 'one size fits all' intervention. Research was therefore needed to identify variables that moderate the effects of implementation intentions on self-harm outcomes to better understand the types of people for whom they constitute a useful intervention strategy, and who might need additional, or alternative, interventions. Motivational (goal intentions), volitional (exposure to self-harm and mental imagery), and cognitive (working memory, attention, processing speed, long-term memory, and prospective memory) constructs were identified as likely to

moderate the effects of implementation intentions on self-harm outcomes. Chapter 2, therefore, concluded that the overall aim of the programme of research should be to test the effectiveness of implementation intentions at reducing self-harm outcomes (behaviour and thoughts) in the wider community and the potential moderating role of the motivational, volitional, and cognitive constructs.

Chapter 3 subsequently outlined the key methodological considerations for the programme of work. This included a comparison of true- and quasi-experimental designs, and a review of the types of control groups which have been used in intervention research. It was concluded that a true-experimental (i.e., randomised controlled) design and an active control group should be used in the research to ensure that any reductions in self-harm behaviour and thoughts could be attributed to the implementation intention intervention rather than participant characteristics (e.g., pre-intervention differences between experimental and control conditions) or potential demand characteristics.

Chapter 3 also reviewed the different intervention methods that researchers have used to encourage participants to form implementation intentions. This included 'self-', 'experimenter-' and 'volitional help sheet-' generated implementation intentions. A volitional help sheet (Armitage, 2008) was deemed as the most appropriate method for helping people form implementation intentions to reduce self-harm thoughts and behaviours. This was because volitional help sheets allow participants to form implementation intentions based on a range of empirically derived critical situations and goal-directed responses. Subsequently, the development of the volitional help sheets used in this thesis were described. Additionally, chapter 3 identified the primary outcome measure for use in the thesis (i.e., self-harm thoughts and behaviours in the situations specified by participants in the IF component of their implementation intentions), the secondary outcomes (self-harm behaviour and thoughts in unspecified critical situations,

suicidality, anxiety, and depression) and the measures of the motivational, volitional, and cognitive moderators.

7.3 Summary of key findings

Chapter 4 presented the first study in this programme of research. Study 1 was designed to test the extent to which an implementation intention intervention (a volitional help sheet) could reduce self-harm behaviour, and whether motivational (goal intention to avoid self-harm) and volitional (suicide and self-harm related mental imagery and exposure to self-harm) constructs moderate the effectiveness of implementation intentions. Study 1 showed that, contrary to expectations, no overall difference was found between the experimental and control conditions in the frequency of self-harm behaviour in specified critical situations, three months following intervention. However, goal intention to avoid self-harm, and self-harm and suicide-related mental imagery (but not exposure to self-harm) moderated the effects of the implementation intention intervention on self-harm behaviour in specified critical situations. It was found that the experimental condition reported self-harming less often in specified critical situations than did the control condition at high (mean +1*SD*) but not low (mean -1*SD*) levels of these constructs. While the effect sizes were small (d = - 0.20 and d = - 0.22), they were within the range of effect sizes that have been found in previous studies of implementation intentions for other health and social behaviours (e.g., Cooke et al., 2023; Gollwitzer & Sheeran, 2006; Malaguti et al., 2020), and for self-harm in people who present to hospital (Armitage et al., 2016). For the other outcome measures (i.e., self-harm behaviour in unspecified critical situations, suicidality, anxiety, and depression) there were no effects of implementation intentions overall or at any level of the moderators.

Chapter 5 presented the second study in this programme of research. Study 2 was designed to test the extent to which an implementation intention intervention (a volitional

help sheet) could reduce self-harm thoughts, and whether cognitive abilities (attention, prospective memory, and retrospective memory) moderate the effectiveness of implementation intentions. Similar to study 1, study 2 showed that there was no overall difference between the experimental and control conditions in the frequency of self-harm thoughts in specified critical situations at three months post-intervention. However, and consistent with study 1, goal intention moderated the effectiveness of the implementation intention intervention. It was found that the experimental condition reported thinking about self-harm less often, compared to the control condition, at high (mean +1*SD*) but not low (mean -1*SD*) levels of goal intention to stop thinking about self-harm. Attention and (prospective + retrospective) memory were not found to moderate the effectiveness of implementation intentions on the frequency of self-harm thoughts in specified critical situations. This was the case at all levels of goal intention to avoid thinking about self-harm. In addition, the experimental condition did report engaging in overt self-harm behaviour less frequently than did the control condition, both in specified and unspecified situations, at high (mean +1*SD*) but not low (mean -1*SD*) levels of (prospective + retrospective) memory ability. However, the cognitive ability measures were not found to moderate the effectiveness of the implementation intention intervention on any other secondary outcome. Consistent with study 1, there were also no observed effects of the implementation intention intervention overall, or at any level of goal intention, on the suicidality outcomes or anxiety and depression.

Chapter 6 presented a pilot and feasibility study for a clinical trial that could be subsequently employed, in future research, to test the effects of an implementation intention intervention (a volitional help sheet) on self-harm related outcomes and the extent to which objectively measured cognitive abilities moderated these effects. This study was originally intended to be the main study in this programme of research.

However, this study could not be carried out as planned due to the covid-19 pandemic resulting in its termination after just six weeks. Data were collected at baseline and objective (but not self-report) follow-up data were provided for 13 participants only. However, the study did proceed to a stage where it could be used within the thesis as an initial pilot of the protocol developed.

While the results of the pilot study were based on a small sample, the descriptive statistics provided initial confidence that the recruitment procedures would be likely to provide a suitable sample in a future large-scale clinical trial. The participants' socio-demographic characteristics, histories of self-harm, and information about the current episode of self-harm that led to their admission to hospital showed broad similarity to samples used in previous clinical trials. Consistent with studies 1 and 2, the frequency of self-harm behaviour in specified situations was higher than in unspecified situations, implying that the participants were adhering to intervention instructions to specify critical situations that would most tempt to carry out this behaviour. In line with expectations, and the literature more generally, the means on the suicidality items were higher than in studies 1 and 2 (i.e., community samples), implying greater scope to reduce these outcomes in patients admitted to hospital for self-harm. In addition, the mean score on the measure of goal intention was above the scale mid-point. This suggests that, on average, the participants possessed the motivation to avoid self-harm, meaning there would be scope for implementation intentions to generate reductions in self-harm related outcomes (cf. Armitage et al., 2016). The variance around the means for the cognitive ability measures also suggested that there may be a greater likelihood of finding moderation effects in hospital patients relative to the community.

An assessment of the pilot study protocol, following the framework developed by Bugge et al. (2013), indicated that recruitment was difficult, with approximately half of

the participants deemed medically fit to participate not fulfilling inclusion criteria (e.g., under 18 years of age). In addition, nearly half of the participants asked questions about how much longer the study would last or commented that they were getting tired. Finally, the follow-up telephone questionnaire could not be administered due to the covid-19 pandemic pausing the research. This meant that evidence about retention rates for the follow-up questionnaire or how appropriate the telephone method was for collecting follow-up data could not be assessed. As a result, prior to a full-scale clinical trial proceeding, further pilot testing was recommended to test the following proposed revisions to the study protocols: (a) recruiting participants during the night-time hours (e.g., between the hours of 8pm-6am) in addition to daytime hours, where feasible; (b) recruiting and testing participants across multiple hospital sites rather than just one hospital site, where feasible; (c) employing multiple researchers to carry out the recruitment and data collection in hospitals, where feasible; (d) lengthening the time for recruitment; and (e) building breaks into the testing between the baseline questionnaire and intervention, or following intervention prior to the objective cognitive tests to minimise participant fatigue. A future pilot study would also permit the telephone follow-up procedure proposed in Chapter 6 to be assessed.

The findings from both studies 1 and 2, that implementation intentions did not produce overall reductions in self-harm thoughts and behaviour, is not in line with many previous studies for other health and social behaviours (e.g., Adriaanse et al., 2011; Gollwitzer & Sheeran, 2006; McWilliams et al., 2019). It is also not consistent with Armitage et al. (2016), who found that implementation intentions generated overall reductions in suicidal ideation and behaviour, threat to die by suicide, and likelihood of a future suicide attempt in patients admitted to hospital for self-harm. However, studies 1 and 2 showed that the effects of implementation intentions on self-harm behaviour and

thoughts were moderated by goal intentions. More specifically, reductions in self-harm behaviour (study 1) and self-harm thoughts (study 2) were observed in specified critical situations (i.e., the primary outcome measure) at high (mean + 1SD) but not low (mean -1 SD) levels of goal intention. These findings are comparable with O'Connor et al. (2017) who found that an implementation intention intervention (i.e., a volitional help sheet) significantly reduced re-admissions to hospital for self-harm for a sub-group of participants (i.e., those who had at least one admission to hospital for self-harm in the previous 10 years).

Additionally, as mentioned in chapter 2, according to the model of action phases (Heckhausen & Gollwitzer, 1987), an individual must pass through two phases before they will successfully change their behaviour. The first is the motivational phase where goal intention formation occurs (i.e., I intend to avoid self-harm). The second is a volitional phase of action, which is concerned with translating goal intentions into action. This means that implementation intentions are relevant only to the second, volitional phase, not the first, motivational, phase (i.e., they convert existing goal intentions into action). The finding that implementation intentions significantly reduced the frequency of self-harm behaviour (study 1) and self-harm thoughts (study 2) for individuals who possessed the necessary, already formed, goal intentions (i.e., to avoid self-harm behaviour or to stop self-harm thoughts) is therefore consistent with the theoretical predictions of the model of action phases. The findings are also in line with previous studies for other health and social behaviours in which implementation intentions have been found to have greater success in changing behaviour for those participants who possess the necessary motivation (Elliott & Armitage et al., 2006; Sheeran et al., 2005; van Osch et al., 2008). Studies 1 and 2 therefore provide empirical support, for the first

time, that the theoretical processes through which implementation intentions are expected to evoke behaviour-change, applies to the context of self-harm.

The finding from study 1 that reductions in self-harm behaviour were observed in specified critical situations at high (mean + 1SD) but not low (mean -1 SD) levels of mental imagery provides some evidence that implementation intentions help those individuals who are at the greatest risk of self-harm and who have difficulty regulating this behaviour (i.e., mental imagery increases the likelihood of self-harm behaviour, as discussed in chapter 2, section 2.4.2.2). It is acknowledged that this interpretation is not in line with the null moderation results from study 1 for exposure to friend and family self-harm. However, as discussed in chapter 4 (section 4.4), a possible reason why exposure to friend and family self-harm was not found to moderate the effects of implementation intentions on self-harm behaviour was that the mean scores on these measures were low. This suggests that the sample, on average, were not exposed to the self-harm of friends or family. Future research investigating whether other means of exposure to self-harm (e.g., the internet; Kirtley et al., 2021) moderate the effects of implementation intentions might be useful to identify who implementation intentions successfully change behaviour for and who they do not, in the context of self-harm.

It is also acknowledged that there are other volitional constructs in the Integrated Volitional-Motivational Model of Suicidal Behaviour (O'Connor & Kirtley, 2018) that might also moderate the effects of implementation intentions on self-harm outcomes (e.g., physical pain sensitivity and fearlessness about death [acquired capability] and impulsivity; O'Connor & Kirtley, 2018). Consistent with mental imagery and exposure to self-harm, these constructs also increase the likelihood of self-harm behaviour (Branley-Bell et al., 2019; Dhingra et al., 2015; Wetherall et al., 2018). High levels of acquired capability may increase the likelihood of self-harm as an individual becomes habituated

to feelings of pain and develops a lesser fear of death over time (Van Orden et al., 2010). Similarly, impulsivity can increase the likelihood of self-harm if an individual feels the need to act quickly to relieve negative feelings when a triggering situation is encountered (Hamza et al., 2015). Individuals who experience high levels of these constructs may therefore have difficulties regulating their behaviour when faced with a triggering situation. Given that study 1, found that implementation intentions benefited those experienced high levels of mental imagery, it is likely that the intervention will also benefit those who score high on acquired capability and impulsivity. This is because the intervention provides them with goal-directed responses which are activated when the triggering situation is encountered, providing an alternative to the previously performed behaviour (i.e., self-harm). Future research would be beneficial to test if implementation intentions can also overcome these self-regulatory barriers or if additional and/or alternative interventions are needed for individuals who experience high levels of these constructs.

The finding from study 2 that reductions in self-harm behaviour was observed at high (mean + 1*SD*) but not low (mean -1*SD*) levels of (prospective + retrospective) memory is in line with the rationale that retrospective memory will be required when forming implementation intentions (i.e., an individual needs to be able to identify the critical situations that are most relevant to them based on previous experiences). The finding is also in line with the rationale that prospective memory is required to identify critical situations when they are encountered in the environment (automatically or otherwise) for the strategy to be initiated. Yet as the two constructs were highly correlated in study 2, and thus could not be distinguished, it could not be concluded whether one or both of these cognitive abilities moderate the effectiveness of implementation intentions on self-harm behaviour. As prospective memory theory proposes that retrospective

memory processes are involved in the performance of prospective memory tasks, the high correlation may not be unexpected (Einstein & McDaniel, 1990; Smith & Bayen, 2004). Future research may therefore usefully administer objective measures of these constructs to assess them individually. The pilot study reported in chapter 6 proposed objective measures which could be used in such future work.

However, in general, there was limited evidence from study 2 that the measured cognitive abilities moderated the effectiveness of implementation intentions on self-harm thoughts. Possible reasons for the general lack of evidence for moderation effects in study 2 were that cognitive abilities were measured using self-report, and that the sample showed little variation in those measures, as indicated by the low standard deviations. It was proposed that a test of implementation intentions using a clinical sample of patients admitted to hospital for self-harm could potentially overcome these issues. This is because objective measures are typically delivered face-to-face (e.g., Shields et al., 2020) and hospital patients are available for this type of testing (e.g., in a hospital ward recovering after an episode of self-harm). Also, hospital patients with a history of self-harm have shown greater variability in cognitive ability measures relative to healthy controls (Jollant et al., 2013; Richard-Devantoy et al., 2012). It is therefore encouraging that the pilot study presented in chapter 6, showed greater variation in scores for most of the administered objective tests of cognition than in the self-report measures used in studies 1 and 2. In addition to the future clinical trial proposed in chapter 6, there are other possible directions for future research to contribute to our understanding of the role cognitive abilities have in the context of implementation intentions. This could include an experimental manipulation of cognitive resources (e.g., attention) by using a dual-task paradigm when participants are forming their implementation intentions to infer the impact limited cognitive resources have on the initial encoding phase.

The findings that reductions in self-harm behaviour (study 1) and thoughts (study 2) were observed in specified but not unspecified critical situations, implies that behaviour-change generated by implementation intentions is specific to the critical situations contained in participants plans. These findings are consistent with previous implementation intention studies in which researchers have found behaviour-change in specified critical situations, but not in unspecified critical situations following implementation intention specification (e.g., Brewster et al., 2016; Elliott et al., 2021; Webb & Sheeran, 2007). These results can be expected theoretically (Gollwitzer, 1999). This is because, it is proposed that, once implementation intentions have been encoded to memory, the performance of the specified goal-directed response, in the THEN component of the implementation intention, is activated when the critical situation, specified in the IF component of the plan, is encountered (see chapter 2, section 2.2). In addition, the participants in the experimental and control conditions in both studies 1 (chapter 4) and 2 (chapter 5) showed a greater frequency of self-harm behaviour (see Table 4.5) and self-harm thoughts (see Table 5.5) in the situations specified in the IF component of their plans, compared to the other, unspecified critical situations, where the frequencies of self-harm behaviour and thoughts were lower. It could be argued, therefore, that implementation intentions are beneficial for behaviour-change in the situations where people most need to change their behaviour, and there is limited scope, and arguably less need, for behaviour-change in other situations.

Nevertheless, previous research has also shown that behaviour-change generated by implementation intentions can extend to situations which are contextually similar to those specified in the IF component of a participants plan (Bieleke et al., 2018; Brewster et al., 2016). This is consistent with the idea that unspecified critical situations that share enough salient features with those that are specified in an implementation intention, can

activate the associated goal-directed response that facilitates behaviour-change (Dielenberg et al., 2001). It was not possible to test this generalisation effect in this programme of work. This was because the participants were provided with free choice over their specified critical situations (and goal-directed responses). This was to help generate reductions in self-harm outcomes in the situations that participants identified as most relevant to them. However, to provide a controlled test of the generalisation effect, the critical situations within participants' implementation intentions need to be experimentally manipulated so that behaviour-change in specified critical situations (condition 1), contextually similar critical situations (condition 2) and contextually different critical situations (condition 3) can be measured (see Bieleke et al., 2018 and Brewster et al., 2016).

Further research testing whether implementation intentions can generate self-harm behaviour-change in specified critical situations (e.g., 'when I want to get relief from a terrible state of mind), contextually similar situations (e.g., 'when I felt trapped inside myself by my own thoughts and feelings') and contextually different situations (e.g., 'when I wanted to get my own back on someone') would be a beneficial contribution to the literature. This is because critical situations that trigger self-harm can change over time (e.g., Townsend, Wadman et al., 2016). As a result, knowing whether implementation intention effects on behaviour can generalise from specified to unspecified situations becomes important as it would indicate whether earlier formed plans are likely to continue to be effective at modifying behaviour (i.e., when behaviour triggers change).

Study 2 in this thesis also provides an important contribution to the implementation intention literature as it adds to the small number of studies which have tested the effectiveness of implementation intentions at changing internal outcomes as opposed to

observable, overt behaviour. As mentioned in chapter 2 (see section 2.3), research testing the effectiveness of implementation intention interventions has focussed mainly on changing overt actions (Adriaanse et al., 2011; Bélanger-Gravel et al., 2013; Gollwitzer & Sheeran, 2006; McWilliams et al., 2019). A smaller number of studies have shown that implementation intention interventions can reduce affect-based measures of fear, disgust, and anxiety (see Webb et al., 2012 for a review). However, no previous studies have tested the effectiveness of implementation intention interventions at changing negative thought processes, such as self-harm thoughts. The significant reduction in the frequency of self-harm thoughts observed in study 2 therefore advances previous research which has focussed on affect-based outcomes and overt actions as it demonstrates that implementation intentions can also generate changes in 'cognitive behaviour' (i.e., thoughts). Future research might usefully test the extent to which implementation intention interventions (e.g., volitional help sheets) can help reduce the frequency of other distressing thoughts which have negative impacts on individual such as those associated with obsessive compulsive disorder and other clinically diagnosable conditions (e.g., Laving et al., 2023).

The findings from studies 1 and 2, that the volitional help sheets developed in this thesis did not reduce suicidality outcomes, is not consistent with the study by Armitage et al. (2016) which showed that an implementation intention intervention, similar to the one used in study 1 of this programme of work, reduced suicidality outcomes in patients admitted to hospital for self-harm. In studies 1 and 2, however, the pre-intervention mean scores indicated that the sample, on average, reported low levels of suicidality, and, therefore, there was little scope for reducing suicidality further. Consistent with the reasoning outlined in chapter 3, it is possible that implementation intentions are better equipped to reduce measures of suicidality in hospital patients compared with the

community because the types of outcomes measured (i.e., suicidal thoughts and behaviours) are more likely to be observed in hospital patients rather than community samples (Farabaugh et al., 2015; Osman et al., 2001; Robinson et al., 2021). Indeed, as previously mentioned, mean scores on the suicidality measures are found to be higher in hospital rather than community samples (Fitzpatrick et al., 2021; Osman et al., 2001; Rueda-Jaimes et al., 2017. This is also consistent with the present findings as the mean scores on the measures of suicidality were higher in the hospital patient sample used in the pilot study than in the community samples used in studies 1 and 2.

While there was no observable reduction in anxiety and depression across studies 1 and 2, the fact that there were also no observable increases in these states means that there was no evidence for any adverse intervention effects (i.e., unintended consequences). As mentioned in chapter 3 (section 3.4.1), ruling out unintended consequences is important when considering the value of an intervention and whether to implement it (Oliver et al., 2019). In the present context, the findings generate confidence that implementation intention interventions could be administered without inducing unintended effects on anxiety and depression.

7.4 Impact, theoretical contextualisation, and practical implications for self-harm prevention

The findings from studies 1 and 2 in this thesis generated support for the use of implementation intentions at reducing self-harm behaviour and thoughts in specified critical situations in community samples. While reductions in these outcomes are expected to benefit the individual given the detrimental impact self-harm behaviour and thoughts have been found to have on them, as described in chapter 1 (e.g., risk of dying by suicide in the future and greater sensitivity to emotional pain; see section 1.3), they could also have far-reaching benefits. Specifically, reductions in self-harm behaviour and

thoughts in the community may prevent people presenting to hospital for these self-harm outcomes in the future. This in turn could reduce the economic impact of self-harm and reduce the detrimental psychological, psychosomatic, and physical effects experienced by family and friends (see chapter 1, section 1.3).

Furthermore, the findings also demonstrated how suicide theory can contribute to intervention development. More specifically, in the present context, additional critical situations (i.e., situations which might tempt at individual to think about or engage in self-harm) were identified from suicide theory (Joiner, 2005; O'Connor & Kirtley, 2018; Van Orden et al., 2010). Across studies 1 and 2, it was found that these additional situations (e.g., 'I hate myself') were selected by the participants, supporting their inclusion. Suicide theory will therefore be useful for future intervention development and refinement. Future research, for instance, may refer to the Integrated Motivational-Volitional Model of Suicidal Behaviour (O'Connor & Kirtley, 2018) to include additional situations which reflect personality (e.g., socially prescribed perfectionism) and environmental (e.g., deprivation) factors.

It is also acknowledged that implementation intentions are included in the Integrated Motivational-Volitional Model of Suicidal Behaviour as the volitional moderator 'planning' (O'Connor et al., 2011). In the theory, implementation intentions are described in the context of an individual planning where, when, and how they will engage in self-harm in the future, thus increasing the risk of engagement in self-harm behaviour, compared to those who do not possess such plans. However, the results from studies 1 and 2 in this thesis demonstrated that implementation intentions (i.e., plans) designed to reduce self-harm behaviour and thoughts specified in an "if-then" format reduced these outcomes for those who possessed the necessary motivation. Suicide theory may

therefore benefit from considering that implementation intentions can also act as a protective factor preventing future self-harm behaviour and thoughts.

The findings also have important practical implications when considering possible means of implementing the volitional help sheets developed in this programme of work. As discussed in chapter 1 (section 1.4), there are existing interventions designed to reduce self-harm behaviour and thoughts (specifically suicidal ideation). The implementation intention intervention (volitional help sheet) developed in this programme of work could be usefully incorporated into these existing interventions. For instance, the volitional help sheet developed for this programme of work emphasises the importance of linking a critical situation with a goal-directed response (Armitage, 2008). This practice could be incorporated into cognitive behavioural therapy-based psychotherapy or safety planning interventions that are administered to people who self-harm (Stanley & Brown, 2012), including the Attempted Suicide Short Intervention Programme (Gysin-Maillart et al., 2016). Such interventions include the self-identification of warning signs (e.g., critical situations) and coping strategies (e.g., goal-directed responses) with the support of a clinician or therapist. However, they do not require people to link the two components together. This is known to compromise behaviour-change (Armitage, 2008). Volitional help sheets could, therefore, support these existing self-harm interventions by providing a means of helping people identify and link warning signs with effective coping strategies.

The volitional help sheet could also be incorporated into existing brief contact interventions. For example, a paper-and-pencil version of the volitional help sheet could be included along with a postcard intervention (e.g., Beautrais et al., 2010). The inclusion of a volitional help sheet alongside the brief contact intervention could enhance their effectiveness, particularly for those who do not possess the motivation to avoid self-harm. This is because, as mentioned in chapter 1, brief contact interventions have been found to

possess features which increase motivation to stop engaging in self-harm, such as social support and an increased knowledge about risk factors for self-harm (Milner et al., 2016). Once this newly formed motivation is in place, the volitional help sheet could then help translate it into action (e.g., reduce self-harm behaviour or thoughts). While these approaches would be valuable, it is expected that they would primarily be accessible to those who access medical services for their self-harm (Williams et al., 2020).

However, there are also various ways a volitional help sheet could be made accessible to the general population. For instance, one possible means of delivery could be using paper and pencil copies of volitional help sheets in self-harm support groups in community settings (e.g., Boyce et al., 2018). Although, a more far-reaching method may be to deliver the intervention digitally. The development of web-based and mobile phone app interventions is becoming more common for a range of health behaviours (e.g., substance use, physical activity, diet), mental health outcomes (e.g., stress) and for self-harm (Cliffe et al., 2021; Ghammachi et al., 2022; Harith et al., 2022; Huberty et al., 2019; Schoeppe et al., 2016; Staiger et al., 2020). In the context of self-harm, acceptability for web-based interventions has generally been good (Arshad et al., 2020; Cliffe et al., 2023). In particular, as mentioned in chapter 2 (section 2.4.1), the acceptability for an online volitional help sheet designed to reduce self-harm behaviour in the general population was also encouraging with the participants reporting they thought it would be ‘helpful’ and ‘easy to use’ (Keyworth et al., 2022).

As the implementation intention interventions (i.e., volitional sheet sheets) developed in studies 1 and 2 in this programme of work were administered online, considerations could be made to providing access to the intervention via self-harm support websites (e.g., Scottish Association for Mental Health) or to incorporate it into a mobile phone app (e.g., Samaritans Self-Help App which includes safety planning).

Delivering the volitional help sheet in this format would be beneficial as many people have access to a digital device, making it easily accessible (Statista, 2023). An online volitional help sheet would also not require the presence of a health professional as it can be self-completed, also meaning it would have the potential for wide reach. This is significant in the context of self-harm because as mentioned in chapter 1 many individuals do not present to medical services for their self-harm due to feelings of shame and/or stigma (e.g., Long, 2018). However, it is recognised there will be instances where individuals will wish to seek support for their self-harm and health professionals may be approached. GPs' have been identified as having an important role in the management of self-harm (NICE, 2022). The development of interventions which could be delivered by GPs taking into consideration the limited time available for appointments is an area which has been identified as an area where further work is needed (Mughal et al., 2020). As a volitional help sheet is a brief intervention, future research may wish to identify how a paper-and-pencil version of the volitional help sheet can be incorporated into GP appointments to aid early intervention efforts to reduce self-harm.

As mentioned above, an online volitional help sheet would have the potential to reach many people in the general population. It is acknowledged that implementation intentions were found to reduce self-harm behaviour and thoughts for those who possessed the necessary motivation (i.e., goal intentions) in studies 1 and 2. While this represents a sub-group of participants who took part in the research, it is the population who the intervention is suitable for because, as mentioned in chapter 2 (section 2.2), implementation intentions translate existing intentions into action. Such individuals are also likely to be prevalent in the population. As mentioned in chapter 1, previous studies have suggested that the avoidance of self-harm is goal-intended for many individuals (e.g., Armitage et al., 2016; O'Connor & Armitage, 2003; O'Connor et al., 2006; Paterson

et al., 2023) which the findings of study 1 were consistent with. Study 2 extended this literature by showing that on average individuals also possess the motivation to stop thinking about self-harm.

These sub-groups represent a large proportion of people a volitional help sheet could reach. For instance, in study 1, 15% of the sample scored above the mean + 1*SD* on the measure of goal intention to avoid self-harm (i.e., the level at which the experimental condition was found to report a significantly lower frequency of post-intervention self-harm than the control condition). Implementation intentions could therefore potentially benefit hundreds of thousands of people in the UK alone, given that an estimated 540,000 adults in Scotland (Scottish Government, 2022b) and 3.2 million adults in England (McManus et al., 2016) have ever reported harming themselves. Likewise, in study 2, 16% of the sample scored above the mean + 1*SD* on the measure of goal intention to stop thinking about self-harm. A large proportion of adults in England reported experiencing suicidal ideation in the past year (5.4%) and a nationally representative sample of young adults in Scotland reported experiencing both suicidal (10.4%) and non-suicidal self-harm (7.3%) thoughts in the past year (McManus et al., 2016; O'Connor et al., 2018). Implementation intentions designed to reduce self-harm thoughts could therefore also potentially benefit hundreds of thousands of people in the UK.

7.5 Methodological considerations

The findings in this programme of PhD research need to be interpreted in light of the following methodological considerations. First, the studies focused on self-harm behaviour and thoughts irrespective of motivation. This is consistent with many previous studies (e.g., Armitage et al., 2016; Geulayov et al., 2022; Nielsen et al., 2017; Quinlivan et al., 2023; Rasmussen et al., 2016; Russell et al., 2020) and UK guidelines for the management and prevention of self-harm (NICE, 2022). While this definition captures the

ambivalence around the presence or absence of suicidal intent, it is recognised that for some people the presence or absence of suicidal intent will be clear (e.g., Chartrand et al., 2016). It may therefore be useful to test the extent to which implementation intention interventions can reduce self-harm behaviours and thoughts with and without suicidal intent separately. Nevertheless, focusing on self-harm behaviours and thoughts irrespective of motivation can be considered a strength of this research because it enables greater generalisability of the intervention effects for both outcomes.

Second, self-reported measures of self-harm behaviour and thoughts were used in this research. As mentioned in chapter 3 (section 3.4.1), such measures are potentially susceptible to affective (Watkins et al., 1996), cognitive (Fulcher, 2003) and self-presentational (Paulhus, 2002) biases. However, the findings across the studies are held with confidence. This is because all outcome measures were self-reported, and the significant effects were generally exclusive to the primary outcome measure of self-harm behaviour (study 1) and thoughts (study 2) in specified critical situations only. Additionally, randomised controlled designs were used in the studies, meaning that any potential biases in self-reported measures would have been equalised across the conditions. Meta-analytic evidence also shows that implementation intentions generate similar-sized changes in self-report behaviour measures as they do in objective measures (e.g., Gollwitzer & Sheeran, 2006). Furthermore, active control conditions were used, meaning that all participants received an intervention, which reduces the possibility that demand effects accounted for the findings (e.g., Rosenthal, 1966).

Third, and related to the last point, it is acknowledged (see section 4.4 in chapter 4) that the intervention administered to the experimental condition in study 1 may have generated more demand on the participants than the control intervention. This is because the intervention administered to the experimental condition (i.e., the volitional help sheet)

required participants to select critical situations that tempt them to self-harm and link these with goal-directed responses to help them resist the temptation. The intervention administered to the control condition required participants to specify critical situations only. The findings may therefore have been attributable to the experimental condition seeing goal-directed responses per se, rather than linking them with critical situations (i.e., implementation intentions). However, the participants in the control condition were also asked to try to avoid self-harming in their chosen critical situations. In addition, study 2 was designed to provide a more stringent test of implementation intentions with participants in both conditions selecting critical situations and goal-directed responses, but only the participants in the experimental condition formed implementation intentions (see chapter 5, section 5.2). The results from study 2 were in line with the findings reported in study 1 of this thesis. That is, significant reductions were found in both studies for the primary outcome measure when participants possess high levels of goal intention to avoid self-harm behaviour (study 1) or to stop thinking about self-harm (study 2). This consistency generates confidence in the results of both studies.

Fourth, the implementation intention interventions used in this PhD were tested over a three-month period. Although a longer period may have been beneficial to demonstrate longer-term intervention effects, it should be noted that many studies have tested implementation intentions over shorter period that the one used in these studies (e.g., Adriannse et al., 2011; Carrero et al., 2019; Malaguti et al., 2020). In addition, the effects of implementation intentions have been shown in some studies to increase, rather than decrease, over time (Sheeran & Orbell, 1999) and studies using longer (e.g., 6-month or 1-year) follow-ups still observe desirable changes in outcomes following implementation intention specification (e.g., Conner & Higgins, 2010). While it may be beneficial for future research to test the effects of implementation intentions on self-harm

outcomes over longer time periods (e.g., 6 months; Arensman et al., 2011) confidence is maintained in the findings reported in this thesis.

Finally, the implementation intention interventions tested in studies 1 and 2 were administered to adult populations (aged 18+) with most of the participants aged 18-35. Future research could therefore usefully include testing the effectiveness of an implementation intention intervention (i.e., a volitional help sheet) in adolescents and older adults (65+). Previous research has shown that many critical situations, which can trigger self-harm, are similar in adolescent, adult, and older adult cohorts (Scoliers et al., 2009; McManus et al., 2016; Troya, Dikomitis, et al., 2019). However, there are some situations (e.g., problems with schoolwork or being bullied) which have greater relevance to adolescent self-harm (Madge et al., 2011) and others for older adult self-harm (e.g., immobility and lack of purpose; Wand et al., 2018). Further research with adolescents and older adults is therefore required, not only to test the effectiveness of the present intervention in these specific cohorts, but also to co-design and refine its content prior to administration. Including individuals with lived experience at the development stage of an implementation intention intervention would be beneficial as it has been found to lead to the identification of additional critical situations and goal-directed responses (Keyworth et al., 2021) with the final version of the intervention rated positively by participants (Keyworth et al., 2021; Keyworth et al., 2022).

7.6 Final conclusions

The research reported in this thesis has shown, for the first time, that implementation intentions are an effective behaviour-change strategy for reducing self-harm behaviour and thoughts, in the community. More specifically, and consistent with theoretical expectations, implementation intentions reduce these outcomes in specified critical situations and for those who possess the necessary goal intention (e.g., to avoid

self-harm). Implementation intentions were also found to reduce self-harm behaviour in those who reported experiencing high levels self-harm and suicide related mental imagery (but not exposure to self-harm), which provides some evidence that an implementation intention intervention can change the behaviour for those who are at greatest risk of self-harm. While cognitive abilities were largely not found to moderate the effectiveness of implementation intentions, future research is encouraged to contribute to our understanding of the role cognitive abilities have. Further piloting and implementation of the protocol specified in the initial pilot study presented in this thesis is recommended for addressing this issue within a clinical sample of patients admitted to hospital for self-harm.

The online volitional help sheets developed in this programme of research could potentially overcome the limitations of the existing interventions for self-harm (see chapter 1). They provide brief, self-administered interventions for reducing self-harm behaviour and thoughts, which is cost effective and has the potential for wide reach. This will be particularly beneficial for individuals who do not wish to present to medical services for their self-harm. The volitional help sheets could also be incorporated into existing interventions (e.g., cognitive behavioural therapy-based psychotherapy). This would provide individuals with a format for helping them to link self-harm triggers (i.e., critical situations) with effective coping strategies (i.e., goal-directed responses). The volitional help sheet developed in this programme of research therefore has the potential to achieve widespread reductions in self-harm thoughts and behaviours.

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Appendix 1: Volitional Help Sheet for Self-Harm Behaviour (study 1)

Research shows that individuals sometimes find themselves self-harming, even though they may not set out to do so. Research also shows that people are more likely to avoid self-harming if they identify:

(a) the situations in which they are likely to be tempted to self-harm and

(b) the strategies that they will use to overcome the temptation.

We would like you to do this now for four "tempting" situations and strategies, using the drop-down lists on the next pages.

If I am tempted to self-harm when…	**Then I will…**
I want to get relief from a terrible state of mind	Remind myself about the benefits of not self-harming
I want to punish myself	Recall all that I know about the dangers of self-harming
I want to die	Do something instead of self-harming (e.g., doing some exercise, squeeze an ice cube, draw on yourself in red pen)
I want to show how desperate I am feeling	Take prescribed medication to stop me feeling this way
I want to find out whether someone really loves me	Tell myself that I can avoid self-harming if I want to
I want to get some attention	Remember that I have made a commitment not to self-harm
I want to frighten someone	Tell myself that society is changing in ways that make it easier for people to avoid self-harming
I want to get my own back on someone	Remind myself that there are groups in society that now provide support to people who feel this way (e.g., Samaritans, the National Self-Harm Network Forum, Harmless)
I feel hopeless	Make sure I am rewarded by others if I don't self-harm

I feel trapped by a situation (e.g., work, a relationship, obligations)
I feel trapped inside myself by my own thoughts and feelings
I feel powerless
I feel like I have lost my standing in the world
I feel that I don't belong
I feel lonely
I feel people I like don't like me back
I have no one to turn to
I feel like I am a burden
I feel like others would prefer me not to be here
I hate myself

Make sure I reward myself if I don't self-harm
Think about the impact my self-harming would have on the people around me
Think about how harming myself might affect how people view me
Remember that I get upset when I think about harming myself
Think about the guilt or shame that I might feel after harming myself
Tell myself that any feelings of relief due to harming myself will only be temporary
Remember that there are people in my life who care for me
Put things around my home or place of work (e.g., photographs of friends or loved ones, or reminders of happy times) that help me manage these feelings
Try to avoid putting myself in situations that make me feel this way in the future
Seek out someone trustworthy who I can talk to about these feelings
Contact a helpline (e.g., Samaritans) or a self-harm support group
Tell myself that I do not deserve to be hurt
Remind myself that these feelings do not define who I am, and they do not mean I need to harm myself

Appendix 2: Volitional Help Sheet for Self-Harm Thoughts (study 2)

Research shows that individuals sometimes find themselves thinking about self-harm, even though they may not set out to do so. Research also shows that people are more likely to stop thinking about self-harm if they identify:

(a) the situations in which they are likely to be tempted to think about self-harm and

(b) the strategies that they will use to overcome the temptation.

We would like you to select four situations which would tempt you to think about self-harm and four strategies to overcome this temptation, using the drop- down lists on the next pages.

If I am tempted to think about self-harm when…	**Then I will…**
I want to get relief from a terrible state of mind	Remind myself about the benefits of stopping self-harm thoughts
I want to punish myself	Recall all that I know about the dangers of self-harm thoughts
I want to die	Do something instead of thinking about self-harm (e.g., do some exercise or listen to soothing music)
I want to show how desperate I am feeling	Take prescribed medication to stop me feeling this way
I want to find out whether someone really loves me	Tell myself that I can stop thinking about self-harm if I want to
I want to get some attention	Remember that I have made a commitment to stop thinking about self-harm
I want to frighten someone	Tell myself that society is changing in ways that make it easier for people to talk about their self-harm thoughts
I want to get my own back on someone	Remind myself that there are groups in society that now provide support to people who feel this way (e.g., Samaritans, the National Self-Harm Network Forum, Harmless)

I feel hopeless
I feel trapped by a situation (e.g., work, a relationship, obligations)
I feel trapped inside myself by my own thoughts and feelings
I feel powerless
I feel I have lost my standing in the world
I feel that I don't belong
I feel lonely
I feel people I like don't like me back
I have no one to turn to
I feel like I am a burden
I feel like others would prefer me not to be here
I hate myself

Make sure I am rewarded by others if I don't think about self-harm
Make sure I reward myself if I do not think about self-harm
Think about the impact acting on my self-harm thoughts would have on the people around me
Think about how acting on my self-harm thoughts might affect how people view me
Remember that I get upset when I think about harming myself
Think about the guilt or shame that I might feel if I acted on my self-harm thoughts
Tell myself that these thoughts will only be temporary, and they will pass
Remember that there are people in my life who care for me
Put things around my home or place of work (e.g., photographs of friends or loved ones, or reminders of happy times) that help me manage these thoughts
Try to avoid putting myself in situations that make me feel this way in the future
Seek out someone trustworthy who I can talk to about these thoughts
Contact a helpline (e.g. Samaritans) or a self-harm support group
Tell myself that I do not deserve to be hurt
Remind myself that these thoughts do not define who I am, and they do not mean I need to harm myself

Appendix 3: Volitional Help Sheet for Self-Harm Behaviour (study 3)[9]

Research shows that individuals sometimes find themselves self-harming, even though they may not set out to do so. Research also shows that people are more likely to avoid self-harming if they identify the situations in which they are likely to be tempted to self-harm and the strategies that they will use to overcome the temptation. We would like you to do this now using the sheet below. From the list on the left select 4 "tempting situations" (choose the ones that would most tempt you to self-harm). Then look to the list on the right and select 4 "strategies" which would help you overcome the temptation to self-harm. It is important that you make a link between the "tempting situations" and "strategies" you select. Draw a line to link each tempting situation (on the left) with a strategy (on the right).

Tempting situations "If I am tempted to self-harm when…"	Strategies "Then I will"
I want to get relief from a terrible state of mind	Remind myself about the benefits of not self-harming
I want to punish myself	Recall all that I know about the dangers of self-harming
I want to die	Do something instead of self-harming (e.g., doing some exercise, squeeze an ice cube, draw on yourself in red pen)
I want to show how desperate I am feeling	Take prescribed medication to stop me feeling this way
I want to find out whether someone really loves me	Tell myself that I can avoid self-harming if I want to
I want to get some attention	Remember that I have made a commitment not to self-harm
I want to frighten someone	Tell myself that Society is changing in ways that make it easier for people to avoid self-harming
I want to get my own back on someone	Remind myself that there are groups in society that now provide support to people who feel this way (e.g., Samaritans, the National Self-Harm Network Forum, Harmless)
I feel hopeless	
I feel trapped by a situation (e.g., work, a relationship, obligations)	Make sure I am rewarded by others if I don't self-harm
I feel trapped inside myself by my own thoughts and feelings	Make sure I reward myself if I don't self-harm
I feel powerless	Think about the impact my self-harming would have on the people around me

[9] Note this was presented to the participants on one sheet of A3 paper.

I feel I have lost my standing in the world	Think about how harming myself might affect how people view me
I feel that I don't belong	Remember that I get upset when I think about harming myself
I feel lonely	Think about the guilt or shame that I might feel after harming myself
I feel that people I like don't like me back	Tell myself that any feelings of relief due to harming myself will only be temporary
I have no one to turn to	Remember that there are people in my life who care for me
I feel like I am a burden	Put things around my home or place of work (e.g., photographs of friends or loved ones, or reminders of happy times) that help me manage these feelings
I feel like others would prefer me not to be here	Try to avoid putting myself in situations that make me feel this way in the future
I hate myself	Seek out someone trustworthy who I can talk to about these feelings
	Contact a helpline (e.g., Samaritans) or a self-harm support group
	Tell myself that I do not deserve to be hurt
	Remind myself that these feelings do not define who I am, and they do not mean I need to harm myself