The Effectiveness of Psychological Interventions for Loneliness

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Part I. Executive Summary

1. Overview

The overarching aim of the thesis is to examine what works for whom in the area of psychological interventions for loneliness. Loneliness has been defined as a distressing feeling that occurs when there is a discrepancy between desired and achieved social interaction (Peplau & Perlman, 1982). Chronic loneliness is a public health issue, being a risk factor for a myriad of both physical and mental health conditions (Cacioppo, Fowler & Christakis, 2009). Indeed, longitudinal research indicates that the strength of loneliness as a predictor of mortality is equivalent to that of established risk factors such as obesity, physical inactivity and smoking (Holt-Lunstad et al., 2015). Furthermore, now is an apt time to be studying loneliness as it has been proposed that a major consequence of the global COVID-19 pandemic will be an upsurge in social isolation and reported loneliness (Holmes et al., 2020).

The thesis consists of two interrelated parts – a systematic review and meta-analysis, and an empirical study – each of which investigates a question associated with the role of psychological interventions in loneliness. In the systematic review and meta-analysis the fundamental question, 'Are psychological interventions effective in alleviating loneliness?' is asked, and the empirical study gives further consideration to 'What are the predictors of treatment outcome in psychological therapy for loneliness?'.

2. Systematic Review

Chronic loneliness is a significant risk factor for many mental health conditions, including depression, psychosis and social anxiety (Meltzer et al., 2013). In addition, loneliness increases the risk of cardiovascular disease (Caspi et al., 2006), Alzheimer's disease and cognitive impairment (Wilson et al., 2007). However, despite the significant

consequences of chronic loneliness on both physical and mental health, the development and dissemination of evidence-based interventions for chronic loneliness is still in its relative infancy compared to those for specific mental health disorders (Mann et al., 2017).

Although a number of systematic reviews have attempted to synthesise the results of loneliness interventions, nearly all have focused exclusively on interventions for older adults. Additionally, they do not focus solely on interventions for loneliness. A meta-analysis of loneliness interventions (Masi et al., 2011) found that the effect size of four RCTs with interventions addressing maladaptive social cognitions was significantly larger than the effect sizes for social support, social skills and social access interventions. However, due to the small number of RCTs included, there is a gap in knowledge regarding evidence-based strategies that address the individual, internal and psychological factors that contribute to chronic loneliness (Eccles & Qualter, 2020; Goodman et al., 2015).

The systematic review and meta-analysis in the thesis has three aims: (a) to summarise and synthesise the findings of RCTs that address psychological interventions for loneliness across the all ages; (b) to ascertain the overall effectiveness of the psychological interventions compared to the control conditions; and (c) to explore the heterogeneity of the interventions and assess whether there were significant moderators of change.

Methods

Five databases (Ovid Embase, Ovid Medline, PsycINFO, Web of Science and CINAHL) were systematically searched to identify potentially relevant studies. A number of search terms were used for the two key concepts of loneliness and psychological intervention.

The inclusion criteria for studies were that they should: (a) have been peer-reviewed as identified by the journal; (b) use quantitative methodology; (c) have an RCT design; (d) have loneliness as a primary outcome or part of the primary construct; (e) use a psychological

intervention based on a psychological theory; (f) be available in the English language; and (g) have been published from the year 2000 onwards.

Articles were identified, screened and assessed following PRISMA's guidelines. Two independent reviewers each examined the abstracts of all 3,138 publications obtained through the search strategy. 78 papers appeared to meet the inclusion criteria and required a full text review, of which 74 were accessible and, following the text review, 25 were included. The necessary statistical information for meta-analysis was obtained from 21 of the 25 included studies.

Results

The systematic review included studies from 12 diverse countries. The total number of participants across all studies was 3,532. Sample sizes at baseline ranged from 17 to 1,138 (*Mdn* = 79). The age of participants ranged from eight years to 78 years (*M* = 46.17). The average percentage of females across all the studies was 62.54%.

The interventions on which the studies reported drew on a range of psychological approaches, with CBT, integrative approaches and mindfulness-based interventions the most common. Psychological treatments lasted between five days and 52 weeks (*M* = 9.91 weeks) and sessions were mostly delivered weekly. Fifteen of the interventions were group-based. Twenty of the interventions were face-to-face and five were delivered over the phone or via the internet.

As part of the review, all of the studies were quality assessed using the Cochrane Risk of Bias Tool (Higgins & Altman, 2008). Eight were rated as having a low risk of bias, eight as having some concerns and nine as having a high risk of bias. The most common problems that affected the quality were blinding of personnel and selective reporting of outcomes.

21 studies (N = 2,232) were included in a meta-analysis of pre- to post-treatment effect sizes, which found that psychological interventions significantly reduced loneliness scores compared to control groups (p = 0.002). The meta-analysis yielded a medium effect size, with effect sizes for individual studies ranging from -0.42 to 3.04.

There was considerable heterogeneity in outcomes and to address this subgroup analysis and meta-regressions were conducted. These showed that whereas study quality, age of participants, percentage female of sample and intervention format were not significant moderators of the effectiveness of the interventions on loneliness outcome, type of psychological intervention (CBT-informed or not) was. However, differences in effectiveness between types of psychological intervention could not adequately be further explored and this was an area for future investigation.

Discussion

The effectiveness of psychological interventions for loneliness is a compelling finding that should inform policy makers, researchers and clinicians going forward and particularly in the context of the COVID-19 pandemic and its social consequences.

A strength of the systematic review is its methodological rigour, including the use of two independent coders for screening abstracts and full texts and the use of a gold standard tool to check the risk of bias in RCTs.

A limitation of the review is that, by including only psychological interventions, it was not possible to compare their effectiveness with other strategies such as community interventions. A limitation of the included studies is that they often targeted populations indirectly associated with loneliness rather than screening for chronic loneliness. There was also a high attrition rate in some of the studies (up to 58.7%).

An implication of the review is that future interventions should be co-produced with individuals with lived experience of chronic loneliness and designed specifically with loneliness in mind, incorporating a theoretical understanding of the triggers and maintaining factors for chronic loneliness. Additionally, interventions should be tailored to the individual rather than using a "one size fits all" approach (Perese & Wolf, 2005; Victor et al., 2018). Therefore, needing to know what works for whom in loneliness interventions emerges strongly as a key area that needs further research.

Overall, it is concluded that psychological interventions are effective for loneliness across the lifespan. The effectiveness of different types of psychological intervention warrants additional exploration.

3. Empirical Study

It is evident from its prevalence and adverse consequences that chronic loneliness needs effective, efficient interventions to alleviate it. The systematic review and meta-analysis outlined above found support for the effectiveness of psychological interventions. However, it also found considerable heterogeneity between the studies that requires further investigation.

The empirical study that accompanies the review examined the question: 'What are the predictors of treatment outcome in psychological therapy for loneliness?'. Identifying differences in response to specific interventions is a key research objective in clinical psychology (Kirmayer & Gomez-Carrillo, 2019). Building knowledge around the question, "What works best for whom?" in treatment for loneliness could enhance treatment type allocation, improve outcomes and improve the cost-effectiveness and efficiency of treatment systems. One way to help build an understanding of who benefits from which interventions is to examine predictors of treatment outcome.

The empirical study examined predictors of treatment outcome through the secondary analysis of RCT data collected by the SOLUS 2.0 team in Sweden. This RCT compared two interventions for loneliness: Internet-delivered Cognitive Behavioural Therapy (ICBT) and Internet-delivered Interpersonal Therapy (IIPT) to a waitlist control.

Prior to this thesis, no well-established predictor variables were available in relation to outcomes of loneliness interventions. This meant that exploratory analysis of several potential predictor variables was required. The selection of variables was in line with theory and the existing evidence base. Variables that were hypothesised to be influential were grouped into five categories: (a) social/demographic; (b) clinical; (c) outcome measures; (d) loneliness-specific; and (e) process.

Research then aimed to establish which of these variables were predictors of loneliness outcome:

1. across all three conditions (ICBT, IIPT and waitlist control)
2. for individuals in the ICBT group
3. for individuals in the IIPT group.

Methods

The SOLUS 2.0 RCT recruited individuals through social media, posters and newspaper articles. Those who applied to participate completed an online screening process which consisted of a series of psychological questionnaires and socio-demographic questions. All prospective participants also received telephone calls to administer a structured assessment using the Mini-International Neuropsychiatric Interview (MINI) 7.0 (Sheehan et al., 1998) and to assess suicidality and level of risk.

In order to be included in the study, prospective participants needed to be: (a) reporting chronic loneliness and consequent distress associated with it; (b) at least 18 years

old; (c) able to write, speak and read Swedish; (d) an internet user via computer/smartphone; (e) if applicable, on a stable regime of psychiatric medication; (f) willing to participate in the study regardless of the group that randomisation would put them in.

Applicants were excluded if they: (a) were undergoing another psychological intervention; (b) reported severe mental illness which required more comprehensive treatment or; (c) loneliness was not their primary problem.

A total of 175 individuals registered their interest on the SOLUS 2.0 website, of whom 145 completed the initial screening and were subsequently contacted to arrange a telephone interview. Out of this group, 122 completed the telephone screening. Six prospective participants were excluded. The final sample size was 116 participants, with 46 randomised to each treatment condition and 24 randomised to the waitlist control condition.

The primary outcome measure was the UCLA Loneliness Scale–Version 3 (UCLA-LS-3: Russell, 1996).

The five categories of potential predictor variables were:

1. Social/demographic: Participants reported their: (a) sex; (b) age; (c) civil status; (d) employment status; (e) level of education; and (f) if they had children. All individuals were also asked about their living arrangements including: (g) where they lived (large city, small city, town, rural), (h) with whom they lived; and (i) the number of people in their household.
2. Clinical: Individuals were asked if: (a) they had a psychiatric diagnosis; (b) they were currently or previously on medication for their mental health; and (c) they had received previous psychological treatment for their mental health.
3. Outcome Measures: Participants were asked to complete measures for depression (PHQ-9), anxiety (GAD-7), social interaction anxiety (SIAS), quality of life (BBQ), behavioural activation (BADS) and interpersonal competence (ICQ-15).

4. Loneliness-specific: Participants were asked to state the duration of their loneliness, if they considered that their loneliness was attributable to a specific event and how old they were when their loneliness started to become a problem.
5. Process: Participants completed the Working Alliance Inventory (WAI). A subjective rating of mood and well-being during the study was also undertaken (CGIS).

Results

In order to explore the predictors of post-intervention loneliness, Least Absolute Shrinkage and Selection Operator (LASSO) regressions (Tibshirani, 1996) were performed in order to exclude variables that covaried strongly with others and did not improve predictive value. Once the number of predictors had been shrunk, the remaining predictors were entered into linear regression models to establish which predictors were statistically significant.

The LASSO regressions reduced the number of predictors from 29 to 16 across all conditions, 17 in the CBT condition and 15 in the IPT condition.

The multiple linear regressions found several statistically significant predictors:

1. Across all conditions, higher baseline loneliness and higher baseline anxiety predicted higher post loneliness. Subjective rating of positive change in mood and wellbeing predicted lower post loneliness.
2. In the CBT condition, post loneliness was predicted by higher baseline loneliness, a depression or anxiety diagnosis and being male. Subjective rating of change in mood and wellbeing and having children predicted lower post loneliness.
3. In the IPT condition, higher baseline loneliness predicted higher post loneliness. Previous psychological therapy and subjective rating of change in mood and wellbeing predicted lower post loneliness.

Additionally, preliminary analysis, which will be further examined by the SOLUS 2.0 team, found that ICBT was effective at reducing loneliness compared to the control group. There were no significant differences between IPT and control, or CBT and IPT.

Discussion

The difference in predictors of outcome found across conditions is key to beginning to answer the question of what works for whom in loneliness, which could in turn inform treatment allocation and consequently allow for improvements in individual outcomes.

A strength of the SOLUS 2.0 trial is that it examined the effectiveness of innovative and novel interventions developed by experts in the field. Additionally, the finding that ICBT is effective at alleviating loneliness is of particular relevance given that the number of individuals in the UK experiencing loneliness has been reported to have doubled due to the COVID-19 pandemic (Mental Health Foundation, 2020).

A limitation of the research is that other variables such as personality factors may have been predictors of outcome and it would have been beneficial to examine these. A limitation of the outcome measure used (the UCLA-LS-3) is that it measures frequency of loneliness but fails to capture intensity, duration and the impact of loneliness.

Future research could usefully adopt the Personalized Advantage Index (PAI) statistical approach proposed by DeRubeis and colleagues (2014) to identify which of the treatments for loneliness is predicted to produce the better outcome for a given individual. Additionally, future research should involve a replication of the predictors for treatment outcome across different cultures.

To conclude, there were several significant predictors of treatment outcome and these differed across conditions. By incorporating these findings into personalising and allocating interventions, treatments should in future be more effective at alleviating loneliness.

4. Integration, Impact and Dissemination

Integration

The systematic review and accompanying empirical study have a high degree of synergy. The key finding from the review was that psychological interventions were effective in alleviating loneliness, however, there was considerable heterogeneity which was not explained by the range of moderator analyses. The empirical study directly addresses the difference in effectiveness of two distinct psychological interventions and explores the predictors of outcome that could explain some of the heterogeneity.

Both the review and the empirical study highlight the complex relationship between mental health and loneliness, indicating a need for loneliness interventions to give consideration to mental health difficulties, in line with the *transdiagnostic model* of loneliness and the associated modular approach for the treatment of chronic loneliness (Käll, Shafran & Lindegaard, et al., 2020).

Challenges for the systematic review included establishing precise and reliable inclusion criteria and conducting a meta-analysis and meta-regressions using advanced statistical software. Challenges when conducting the empirical study included changing project, learning and executing complex machine learning-based statistical procedures and being unable to consult with individuals with lived experience of chronic loneliness due time constraints and COVID-19.

Impact

The thesis has a range of real-world implications and potential for significant clinical impact. Key beneficiaries include individuals experiencing chronic loneliness, mental health services, charities, the UK Government and academia. In order to achieve high clinical impact, it is recommended that GPs, mental health services and relevant charities screen for

loneliness using the UCLA-LS-3. Training in psychological interventions could be offered to mental health professionals so that IAPT services and charities are able to offer psychological interventions for loneliness.

Barriers to impact, such as stigma around loneliness, should continue to be addressed. Additionally, to reach those who are most at risk of chronic loneliness, adaptations to interventions should be considered. Internet-delivered interventions could be used as a means of reaching marginalised or isolated groups, especially while social distancing measures are in place due to the COVID-19 pandemic.

Dissemination

A multicomponent dissemination strategy is proposed, through research presentations, peer reviewed publications and accessible summaries being published online. Dissemination has already begun through findings being shared with members of the Royal Holloway University Clinical Psychology Doctorate course. The findings will also be disseminated to my collaborators who conducted the SOLUS 2.0 trial in Sweden, the IPT UK network via their London meeting, University College London's Loneliness and Social Isolation in Mental Health research network and mental health professionals at The Tavistock and Portman Mental Health NHS Trust.

Publication is also planned in a high impact, peer-reviewed journal such as the *Clinical Psychology Review* or the *Journal of Personality and Social Psychology* by October 2020. Bullet point summaries of the key messages and findings will be shared with charities, commissioners and policy makers. Importantly, an accessible summary of the findings will be shared online through social media. Loneliness experts by experience will also be consulted to gain their feedback and insights.

Part II.

The effectiveness of psychological interventions for loneliness: A systematic review and meta-analysis

Abstract

Loneliness is a public health issue due to its range of serious mental and physical health consequences. Yet there is a lack of robust evidence regarding the effectiveness of interventions for alleviating loneliness. Previous theory and research indicate that psychological interventions have promise for alleviating loneliness, however, there have been no reviews or meta-analyses to ascertain the effectiveness of these interventions across the lifespan. Therefore, this study aimed to synthesise, meta-analyse and explore the heterogeneity in RCTs on psychological interventions for loneliness in order to establish their effectiveness.

Five databases (Ovid Embase, Ovid Medline, PsycINFO, Web of Science and CINAHL) were systematically searched in order to identify relevant studies. Included studies were required to be peer-reviewed RCTs examining psychological interventions for loneliness. Two independent coders examined the abstracts of the 3,138 studies and 74 full texts, finding 25 studies that met inclusion criteria, 21 of which with enough statistical information to be included in the meta-analysis. The quality of included studies was assessed using the Cochrane Risk of Bias Tool.

The 25 studies (N = 3,138) that were included in the systematic review were conducted in a diverse range of cultures, age groups and populations. The interventions were of mixed quality and were mostly face to face, group-based and delivered weekly. The most common type of intervention was CBT.

21 studies (N = 2,232) were included in a meta-analysis, which found that psychological interventions significantly reduced loneliness compared to control groups,

yielding a medium effect size. Subgroup analysis and meta-regressions were conducted in order to explore heterogeneity and found that a significant moderator of intervention effectiveness was type of psychological intervention. However, this could not be adequately explored and warrants future research.

In conclusion, the effectiveness of psychological interventions for loneliness across the lifespan is a compelling finding that should inform policy makers, researchers and clinicians going forward, especially in the context of increased loneliness due to the COVID-19 pandemic. However, there was considerable heterogeneity in the effectiveness of the interventions, suggesting that future research should explore what works for whom.

1. Introduction

1.1 Overview

Chronic loneliness is emerging as an important public health issue in the UK, with its adverse impact on physical health equivalent to obesity and smoking (Holt-Lunstad et al., 2015). It is also a significant risk factor for many mental health conditions (Meltzer et al., 2013). Furthermore, decreased employee health caused by loneliness has a major economic consequences, costing UK employers an estimated £2.5 billion per year (Abdallah et al., 2017). Given the adverse impact of loneliness on individuals and society, it has in recent years increasingly been the focus of research and government policy initiatives, including the Jo Cox Commission on Loneliness and the UK Government's strategy for reducing loneliness (Department for Digital, Culture, Media and Sport, 2018). It is also an apt time to be studying loneliness as early research is finding that a major consequence of the global COVID-19 pandemic has been a surge in social isolation and reported loneliness (Holmes et al., 2020; Mental Health Foundation, 2020). However, along with growing awareness of loneliness as an issue that needs to be addressed is an increased recognition amongst researchers of the lack of robust evidence to indicate the effectiveness of the available interventions in alleviating loneliness (Victor et al., 2019). The systematic review and meta-analysis in this thesis aim to address this gap in research.

1.2 Definitions

Loneliness has been defined as a distressing feeling that occurs when there is a discrepancy between desired and achieved social interaction (Peplau & Perlman, 1982), with the importance of subjective perception in this definition making the concept inherently psychological. Loneliness is often thought of as being synonymous with social isolation – an objective lack of social contact – though these are distinct concepts which are only weakly

correlated (Coyle & Dugan, 2012; Perissinotto & Covinsky, 2014). Indeed, the quality of social relationships and perceptions about them have been found to be more influential in contributing to loneliness than any absolute number of relationships (Schwarzbach et al., 2014).

One important typology of loneliness is based on its duration: *Chronic loneliness* is a stable state related to a lack of satisfying social relationships over an extended period of time. *Situational loneliness* is experienced after a stressful life event such as a loss to one's social network. And *transient loneliness* is a short bout of loneliness that most people will experience periodically and is often followed by a period of recovery and repair in social relationships (Shiovitz-Ezra & Ayalon, 2010).

1.3 Prevalence

In the UK, more than a quarter of adults report experiencing bouts of transient loneliness and around 6% report chronic loneliness (Victor & Yang, 2012). The COVID-19 crisis is expected to increase these rates (Patel & Clark-Ginsberg, 2020) as a result of the widespread implementation of disease control measures such as social distancing. This prediction is supported by longitudinal data from 2,221 adults which indicates that the prevalence of loneliness in the UK has more than doubled during the COVID-19 lockdown, suggesting that millions of people in the UK are currently experiencing feelings of loneliness (Mental Health Foundation, 2020). The age group that this study finds has been most impacted is young adults, with 44% of individuals aged 18–24 reporting having felt lonely during the lockdown period and nearly half reporting concerns about those feelings. This statistic is particularly worrying given the mental health, self-harm and suicide risk for this demographic (Hawton et al., 2012; Powers & Casey, 2015).

1.4 Impact

Chronic loneliness is a risk factor for a myriad of both physical and mental health conditions. Holt-Lunstad et al.'s (2015) meta-analytic review, which analysed data from 70 independent studies with 3,407,134 participants, found that loneliness increased the likelihood of mortality by 26% even after controlling for multiple covariates. This means that loneliness rivals well-established morbidity risk factors such as physical inactivity, smoking and obesity (Holt-Lunstad et al., 2015). Loneliness also predicts less restorative sleep (Hawkley et al., 2010), increased systolic blood pressure (Hawkley & Cacioppo, 2010), reduced immune functioning (Pressman et al., 2005) and increased vulnerability to heart failure, coronary heart disease and strokes (Caspi et al., 2006; O'Luanaigh & Lawlor, 2008).

Cacioppo and Patrick (2008) suggest that there are five causal pathways which lead chronic loneliness to adversely affect health: (1) detrimental health behaviours, for example consuming more calories; (2) increased exposure to stress; (3) higher perceived levels of stress and difficulties in coping; (4) impact on the immune and cardiovascular systems; and (5) difficulty sleeping, which in turn has negative effects on metabolic, neural and hormonal regulations.

Moreover, chronic loneliness is a significant risk factor for many mental health conditions (Hawkley & Cacioppo, 2010; Meltzer et al., 2013) including social anxiety (Lim et al., 2016), depression (Cacioppo et al., 2010; Vanhalst et al., 2012), eating disorders (Levine, 2012) and both suicidal ideation and suicidal action (Mezuk et al., 2014; Stickley & Koyanagic, 2016). A cross-sectional UK study of 7,461 adults by Meltzer and colleagues (2013) found that the likelihood of being lonely is eight times greater in individuals with diagnosed mental health difficulties. Additionally, these odds are increased 20-fold for those with two or three mental health diagnoses compared to those without a diagnosis (Meltzer et al., 2013). In addition, a rapid review of 63 studies and 51,576 children with good mental

health found that loneliness increased the risk of depression and anxiety at the time in which loneliness was measured and also up nine years later (Loades et al., 2020)

Loneliness and depression have a particularly strong association, with the likelihood of being lonely 11 times greater in individuals with depression, even after adjusting for age, sex, ethnicity, marital status and employment (Meltzer et al., 2013). Longitudinal analysis of older adults has also found that higher loneliness scores are associated with poorer treatment outcomes (Holvast et al., 2015). Indeed, this particular research found that those with higher loneliness scores showed more severe symptoms of depression and lower rates of remission at two-year follow-up compared with non-lonely participants, even after controlling for social network size. Additionally, a sample of 594 primary care patients showed that loneliness, when left untreated, can independently predict worse anxiety and depression symptoms one year later (van Beljouw et al., 2010).

Research is also finding that an adverse consequence of the COVID-19 pandemic is an increase in mental health difficulties linked to rises in social isolation and loneliness (Torales et al., 2020). Whilst social distancing measures are important for maintaining physical health during a pandemic, they have the potential for adverse psychological outcomes. Initial evidence from 1,210 individuals has found that common psychological reactions to the pandemic in China have been moderate to severe symptoms of anxiety (16.5%) and depression (28.8%) as well as self-reported stress (8.1%) (Wang et al., 2020). A sample of 500 adults in the US associated being in lockdown with greater health anxiety, financial worry and loneliness (Tull, 2020) whilst other research is indicating that individuals with pre-existing mental health disorders may be at a higher risk of relapse due to the impact of social distancing measures on isolation and loneliness (Rajkumar, 2020). For children, enforced isolation and quarantine in previous pandemics, resulted in loneliness and a five times higher likelihood of needing to use mental health services (Loades et al., 2020). This

indicates that loneliness associated with COVID-19 may be particularly problematic for young people and result in an increase in mental health difficulties within this group (Loades et al., 2020; Young Minds, 2020)

The picture presented by existing research into the impacts of loneliness suggest that future research into interventions for reducing loneliness is needed urgently and that such interventions should have the potential to reduce not only the distress associated with loneliness but also the risk of loneliness precipitating or worsening mental health difficulties.

1.5 Theoretical Models

It is important to consider theoretical models of the formation and maintenance of chronic loneliness in order to inform the evaluation of interventions that could be utilised to alleviate it.

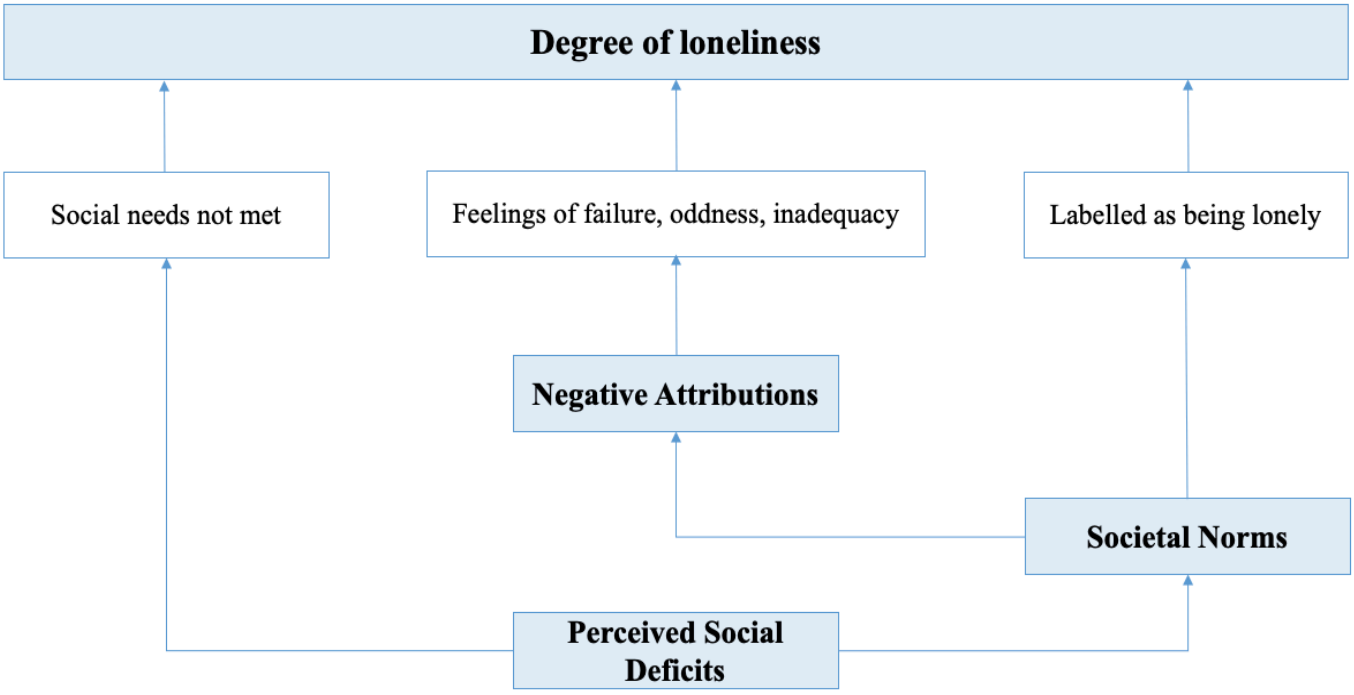
The model of loneliness devised by Kupshik and Murphy (1992; See Figure 1.) suggests that a combination of three elements – societal norms, a deficit in social contact and negative attribution – contribute to the formation of loneliness. If individuals feel that the amount of social contact they have is lacking when compared to the norm in their society then they may attribute negative meaning to this deficiency, resulting in feelings of loneliness. This model hypothesises that if the interaction between an individual and their perception of societal norms for social contact remains unchanged then the experience of loneliness is maintained.

The social-cognitive model of loneliness (Figure 2) proposed by Cacioppo and Hawklet (2009) suggests that chronic loneliness can increase hypervigilance and cognitive biases towards social threat, leading lonely individuals to anticipate negative social interactions and favour remembering negative social information (Cacioppo et al., 2016). As a result, lonely individuals may exhibit hostile or pessimistic behaviours which elicit exactly

the unwanted responses from others that confirm their negative expectations. According to the model, this self-fulfilling prophecy then leads individuals actively to distance further from others in a self-reinforcing loop. It is hypothesises that this loneliness loop is accompanied and compounded by other psychological factors, such as stress, hopelessness, anxiety and low self-esteem, as well as by neurobiological and behavioural mechanisms that contribute to adverse health consequences (Cacioppo & Hawkey, 2009; McDade et al., 2006).

Figure 1

Three-Factor Model (reproduced from Kupshik & Murphy, 1992)

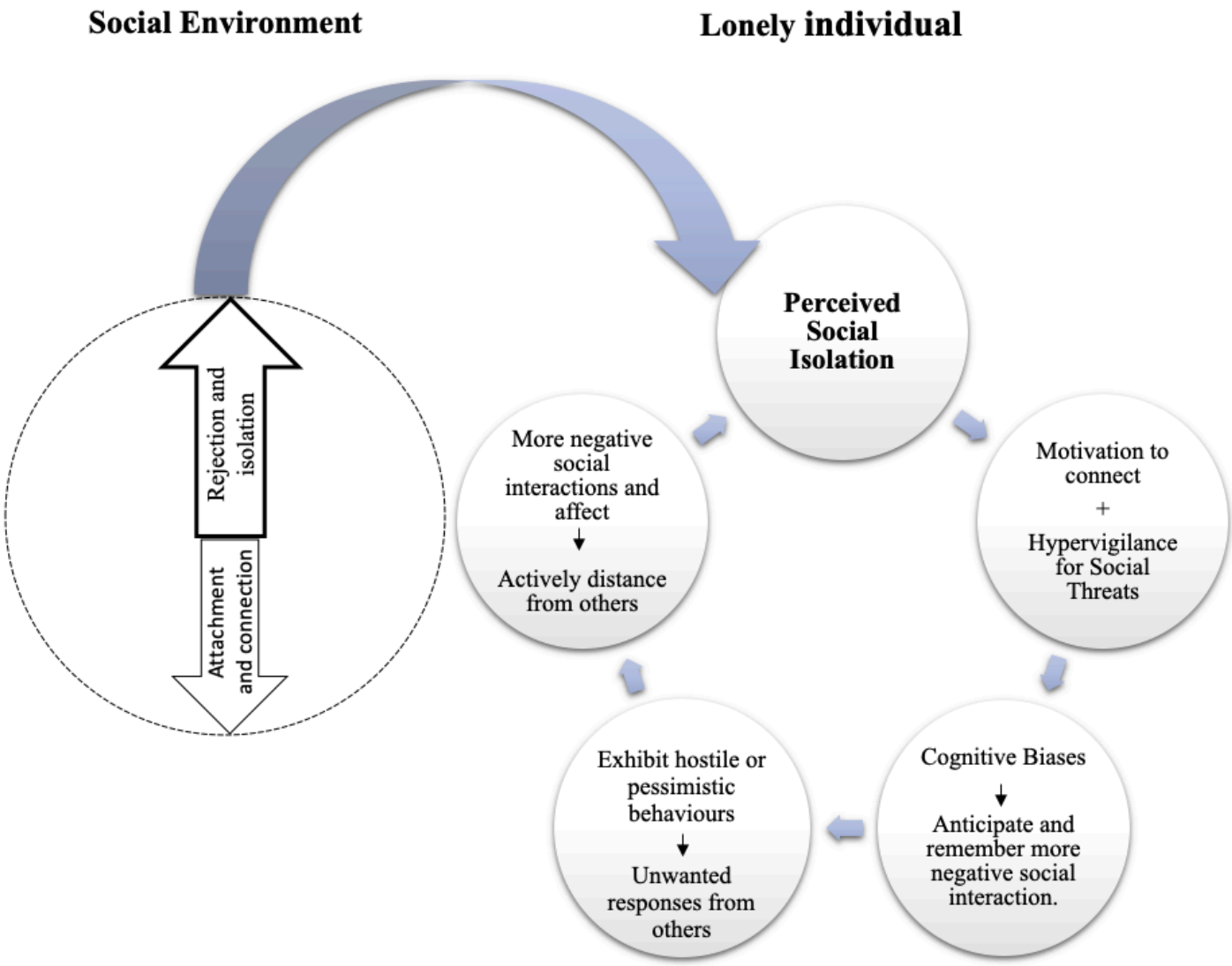


Building on social-cognitive models, a transdiagnostic model of the maintenance of chronic loneliness has been proposed by Käll, Shafran and colleagues (2020) (Figure 3). This proposes that an interpersonal trigger or context, in addition to a value attributed to the importance and worth of relationships, can lead to a perceived discrepancy between desired and actual social situations. These feelings then lead to negative interpersonal appraisals and emotional responses which can result in counter-productive behavioural and cognitive

consequences, such as avoidance, self-focused attention and maladaptive cognitive biases. The challenge of social interaction may also be compounded by individual difficulties such as social skills deficits, health issues or mobility difficulties. The overall consequence is that a negative self-image is established, along with a desire to avoid social contact, resulting in chronic feelings of loneliness.

Figure 2

Cognitive Model of Loneliness (Adapted from Cacioppo & Hawkley, 2009)

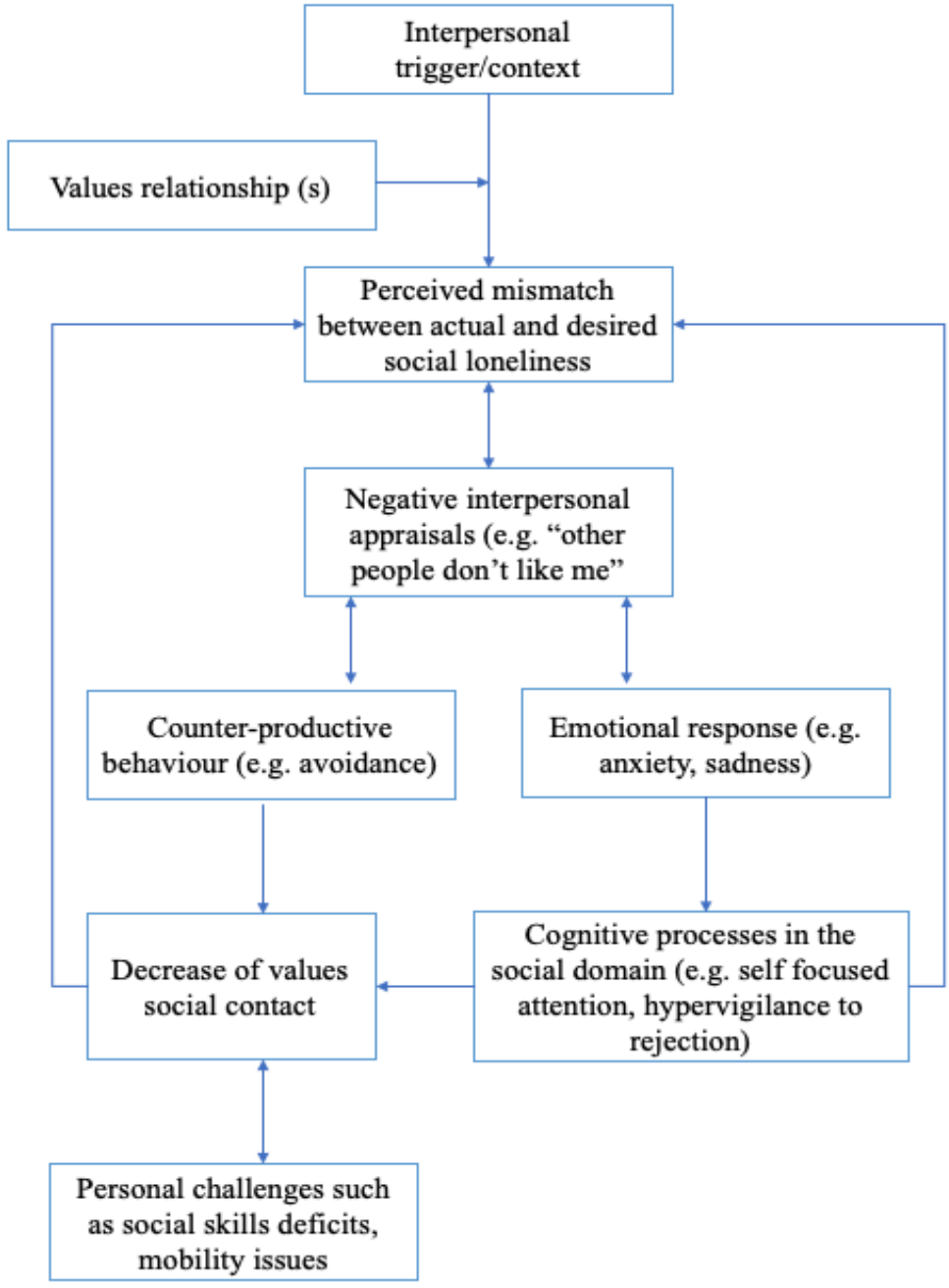


A key distinguishing feature of this model is its modularity, which could facilitate a tailored approach to loneliness treatment. The model acknowledges that the 'starting point' in

a cycle of loneliness maintenance is specific to an individual (Victor et al., 2018). For example, loneliness in a person with an autism spectrum disorder may be maintained by social skills deficits, whereas loneliness in someone with social anxiety symptoms may be maintained by self-focused attention and avoidance (Clark & Wells, 1995).

Figure 3

A Cognitive Behavioural Analysis of the Maintenance of Chronic Loneliness (Replicated from Käll, Shafran & Lindegaard et al., 2020)



1.6 Interventions for Loneliness

Despite the significant consequences of loneliness on both physical and mental health – and advances in the understanding of loneliness maintenance – the development and dissemination of evidence-based interventions for loneliness is still in its infancy compared with interventions for specific disorders (Mann et al., 2017).

A number of systematic reviews have attempted to synthesise the results of loneliness interventions but with significant limitations in several areas. Firstly, nearly all have focused exclusively on interventions for older adults (Cattan et al., 2005; Cohen-Mansfield & Perach, 2015; Dickens et al., 2011; Findlay, 2003; Hagan et al, 2014) rather than on interventions for individuals who have been assessed to be lonely or self-reported as such across the life span (Dickens et al., 2011). This limitation is important as loneliness is present and problematic across the lifespan. Secondly, the majority of reviews have not focused on loneliness, but instead included studies targeting social isolation. This is problematic as loneliness and social isolation are weakly correlated (Coyle & Dugan, 2012); increasing social contact does not necessarily address the perceptual and cognitive components of loneliness. Thirdly, the reviews have been unable to provide conclusive results or robust recommendations due to the heterogeneity of their inclusion criteria and therefore of the types of studies they have included. Taking these various limitations into account, there is a need for additional research that can assess the effectiveness of interventions for loneliness across the lifespan, focus on interventions primarily intended for loneliness, and do this in spite of heterogeneity.

Meta-analysis has the key benefit of providing clearer answers where individual studies are heterogeneous and inconsistent (Haidich, 2010). The first meta-analysis of loneliness interventions was conducted by Masi and colleagues (2011) who evaluated interventions across the lifespan based on four strategies for reducing loneliness: (a) enhancing social skills; (b) providing social support; (c) increasing opportunities for social

interaction; and (d) addressing maladaptive social cognition (biases in attention and cognition towards negative aspects of the social context). Masi and colleagues (2011) were able to establish a key finding: interventions that target maladaptive social cognitions have the greatest average effectiveness. However, because the finding was based on only four RCTs of social-cognitive interventions, the researchers concluded that it should be independently replicated in order to be considered empirically supported (Masi et al., 2011).

Recently, the first meta-analysis evaluating the effectiveness of interventions to reduce loneliness in children and adolescents was conducted (Eccles & Qualter, 2020). Of the studies included, 25 were RCTs and 14 were single group. Overall, it was found that youth loneliness could be reduced by interventions. Moderator analyses for type of intervention were conducted but not found to be significant. However, effect sizes revealed that interventions with the most promise were psychological interventions and social and emotional skills training.

Other systematic reviews and meta-analyses have investigated which characteristics make interventions for reducing loneliness effective. Results, however, have been mixed and inconclusive. Various moderating factors have been examined, including: (a) study quality (Cattan et al., 2005; Cohen-Mansfield & Perach, 2015; Eccles & Qualter, 2020); (b) group or individual delivery (Cattan et al., 2005; Eccles & Qualter, 2020; Findlay et al., 2003; Masi et al., 2011); (c) use of technology in interventions (Chen & Schulz, 2016; Choi et al., 2012; Cohen-Mansfield & Perach, 2015; Eccles & Qualter, 2020; Poscia et al., 2018; Shah et al., 2019); and (d) type of intervention (Cohen-Mansfield & Perach, 2015; Eccles & Qualter, 2020; Gardiner et al., 2018; Jarvis et al., 2020; Masi et al., 2011; Perese & Wolf, 2005). Two consistent findings from moderator analyses are that technological interventions and interventions with a focus on social cognition display the most potential in reducing loneliness.

Overall, psychological interventions show considerable promise for alleviating loneliness. In spite of this, there has been no systematic review or meta-analysis of the effectiveness of psychological interventions for loneliness across the lifespan. Consequently, a synthesis of this type is now needed. In response to this need, the present study analyses a range of psychological interventions for loneliness based on a variety of models, including cognitive behavioural therapy (CBT: Käll et al., 2019), mindfulness (Zhang et al., 2018) and interpersonal therapy (IPT: Ransom et al., 2008) across the lifespan.

1.7 The Present Study

The systematic review and meta-analysis in this thesis advance previous research in multiple distinct ways. Firstly, the review includes only studies that employed randomised controlled trial designs, these being the gold standard due to their potential to eliminate bias in assigning treatments and minimise confounding variables (e.g. Simon, 2001). Secondly, it includes only psychological interventions on the basis that published reviews indicate their strong theoretical grounding and promising efficacy. Psychological treatments for loneliness may also have the added benefit of reducing mental health problems, which often co-occur with loneliness. Thirdly, it extends the literature search by a further ten years – the original search carried out by Masi et al. (2011) in 2009 – and into a period of increased research activity with larger and higher quality studies testing interventions for loneliness. And fourthly, via moderation and sub-group analysis, it establishes key criteria for intervention success which were not conclusively established in previous reviews. These criteria include: whether an intervention is delivered on an individual or a group basis, the age of participants, the risk of bias rating, the percentage of female participants and the type of psychological intervention.

Taken together, the literature on the effectiveness of psychological interventions for loneliness is still in its infancy. Therefore, the aims of the review are threefold:

1. to summarise and synthesise the findings of RCTs to address psychological interventions for loneliness across the lifespan
2. to ascertain the overall effectiveness of psychological interventions compared to control conditions and
3. to explore the heterogeneity of the interventions and assess whether there were significant moderators of change.

2. Methods

The conduct and reporting of the systematic review and meta-analysis follows the guidance of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher et al., 2009). The protocol for the review was registered on the 10th of June 2019 with the PROSPERO database (www.crd.york.ac.uk/prospero/), an international prospective register of systematic reviews. Its registration ID is PROSPERO 2019 CRD42019153376.

2.1 Systematic Literature Search

Search terms were developed in order to identify studies which assessed the effectiveness of psychological interventions in reducing loneliness. These terms were searched in the Ovid Embase, Ovid Medline, PsycINFO, Web of Science and CINAHL databases in November 2019. The key search terms used to identify articles are listed in Table 1. Ovid Embase, Ovid Medline and PsycINFO also allowed the search to include Medical (MeSH) terms which could be 'exploded', meaning that the search retrieved all references indexed to that term as well as all references indexed to any narrower term. Additionally, randomised controlled trial filters were added (See Appendix A).

Table 1

Search Terms

Concept	Search terms
Loneliness	Lonel* or social isolat*
Psychological Interventions	Psychological intervention* or CBT or Cognitive Behavioral Therap* or therap* or

	IPT or interpersonal therapy or psychotherap* or psychodynamic* or intervention*

2.2 Eligibility Criteria

The review identified studies reporting quantitative data from randomised controlled trials comparing the effectiveness of psychological interventions to control groups for alleviating loneliness. The search included all published articles up to November 2019.

The inclusion criteria were: (a) peer-reviewed as identified by the journal; (b) a quantitative methodology; (c) an RCT design; (d) loneliness as a primary outcome or part of the primary construct; (e) a psychological intervention based on a psychological theory; (f) available in the English language; (g) published from the year 2000 onwards.

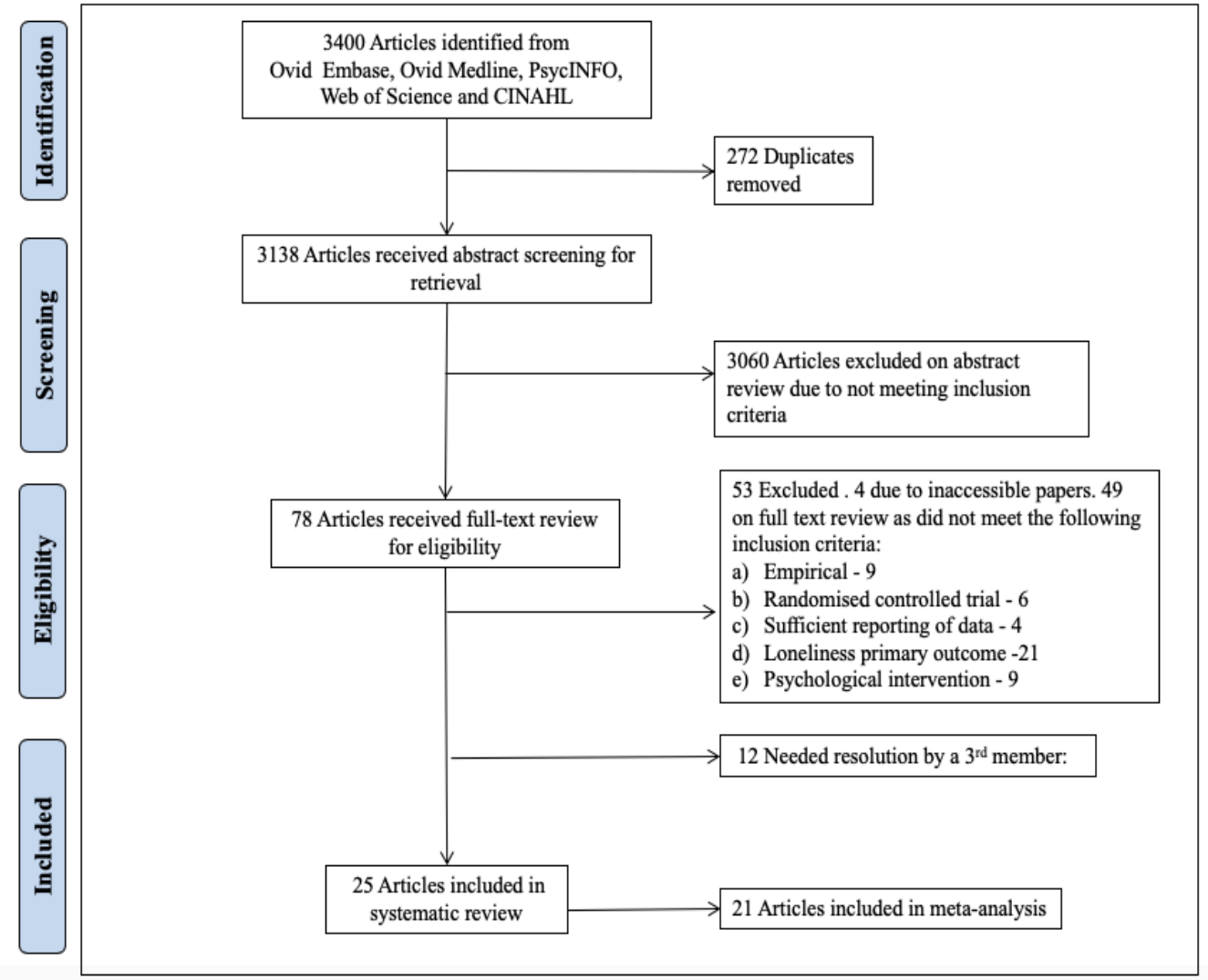
The rationale for including studies published from the year 2000 onwards was that this would reduce overlap with systematic reviews carried out earlier. The additional criterion for inclusion in the meta-analysis was that studies: h) reported standard quantitative information (mean, standard deviation and sample size) or their authors could provide it when contacted.

2.3 Data Collection

Articles were identified, screened and assessed following PRISMA's guidelines (Moher et al., 2009). (See Figure 4 for flowchart.) Repeat listings of papers across the databases were deleted by the primary researcher. Two independent reviewers (the primary researcher and a PhD Clinical Psychology student with expertise in loneliness) each examined the abstracts of all 3,138 obtained publications. The inter-rater agreement was 97.2% at the abstract screening stage. Conflicts of opinion regarding the eligibility of studies were debated until consensus was reached.

Figure 4

PRISMA Flowchart for the Selection Process of Studies in the Systematic Review and Meta-Analysis



Following the screening stage, which aired on the side of inclusion, 78 papers appeared to meet the eligibility criteria. Four could not be accessed, and because their authors failed to respond to an email request for a copy to be supplied, were excluded on the basis that they could not receive a full text screening.

Of the 74 papers that had their full text reviewed, the inter-rater agreement was 77%. Any conflicts of opinion regarding inclusion of articles were discussed, with a referral to a

third reviewer (the primary researcher's supervisor) if necessary, until consensus was reached. Following full text screening, it was decided that 25 papers met the eligibility criteria and would be included in the systematic review. The decision regarding inclusion in the meta-analysis was made following data extraction.

2.4 Data Extraction

A headed table was used to guide the extraction of information from the texts. Extraction was initially conducted by the primary researcher. In order to minimise the probability of errors, an independent second coder repeated the data extraction of all quantitative data (Horton et al., 2010).

Several socio-demographic and clinical characteristics were extracted from the eligible studies including: (a) mean participant age; (b) gender composition; (c) country; (d) population; (e) sample size; and (f) measure of loneliness. Further information was extracted in relation to the psychological intervention: (a) intervention format; (b) type of control group; (c) theoretical model underpinning the intervention; and (d) reported effectiveness of the intervention at reducing loneliness.

The mean, standard deviation and number of participants in the control and intervention group at pre, post and follow up were extracted in order to enable a meta-analysis of the effectiveness of psychological interventions. Authors of the five papers that did not include the necessary statistics for meta-analysis were requested via email to provide these. One author did and their paper was included. The other four failed to respond and their studies were excluded from the meta-analysis, though not from the systematic review.

2.5 Assessment of Risk of Bias

The risk of bias tool (RoB tool: Higgins & Altman, 2008) was used to appraise the included studies' quality and potential bias. This was administered in accordance with the Cochrane Handbook (Higgins et al., 2019). The following five domains were considered in relation to each paper: (a) sequence generation; (b) allocation concealment; (c) blinding of participants, personnel and outcome assessors for each outcome; (d) incomplete outcome data; and I selective outcome reporting.

Assessing each domain involved the application of several criteria. The ratings produced by the criteria informed an algorithm which led to a risk of bias judgement for each domain at one of three levels:

1. Low risk of bias
2. Some concerns
3. High risk of bias.

The domain ratings were then used to inform the overall risk rating for each paper. The primary researcher assessed all articles independently while a second rater assessed nine articles (30%) independently. Ratings were compared and any disagreements resolved by discussion to reach a consensus.

2.6 Data Synthesis and Analysis

All studies included in the systematic review were synthesised and summarised narratively. The meta-analysis was conducted using the software R and the Metafor package (Viechtbauer, 2010). Standardised mean differences (SMD) were calculated to transform the outcome data into a common metric, thereby enabling the inclusion of other outcome measures within the same synthesis. The SMD were calculated for pre- and post-intervention loneliness scores in the control and intervention groups. The difference between the SMD pre

to post intervention was calculated in order to account for any baseline difference in loneliness between the groups. The meta-analysis was conducted to ascertain whether the difference from pre to post loneliness in the experimental group was larger than the difference from pre to post in the control group.

Heterogeneity was anticipated due to the range of psychological therapy approaches and study designs used across the eligible studies. Consequently, a random-effects as opposed to a fixed-effect model was used, the former yielding a more conservative estimate and wider confidence interval when there is heterogeneity amongst effect sizes (Borenstein et al., 2010).

Cochran's Q test and the I^2 statistic were used to assess for heterogeneity in treatment effects. A significant Q statistic indicates varying effect sizes across studies as well as sample or methodological differences that might be causing variance. The I^2 statistic assesses the percentage of variability due to heterogeneity rather than to random error. The I^2 statistic is interpreted as a small (25%), moderate (50%) or high (75%) level of heterogeneity (Higgins et al., 2003).

To explore possible sources of heterogeneity, meta-regressions were conducted to evaluate potential moderators, including age of participant, type of psychological intervention and risk of bias rating. Additionally, forest plots were created to visually illustrate effect sizes, confidence intervals and outliers. Sensitivity analyses assessed for publication bias through assessing funnel plots of standardised mean differences against standard error.

3. Results

3.1 Study Characteristics

Twenty-five studies were identified for inclusion in the review. Table 2 provides an overview of the studies' characteristics and main findings. All were published between 2003 and 2019. Eleven were carried out in the USA, three in Iran, two in China and the Netherlands and one in each of the following countries: Sweden, South Africa, Australia, Japan, Palestine, Israel and Taiwan. Most of the studies did not report participants ethnicity.

All studies were randomised controlled trials (RCTs) although some were pilot RCTs. The total number of participants across all studies was 3,532. Sample sizes at baseline ranged from 17 to 1,138 (Mdn = 79). However, there was often significant attrition of participants. The drop-out percentage from baseline to post intervention ranged from 0% to 52.14% (*M* = 14.85%). Fourteen studies also collected follow-up data, the follow ups taking place between 1.5 months to 6 months post intervention (*M* = 4.18).

The average age of participants ranged from eight years to 78 years (M = *46.17*). Three studies were with children, four with young adults (below 26), nine with middle age adults (26–64), four with old adults (65–74) and three with older adults (75+). Five of the studies had samples that were all female and one was conducted with men only. The average percentage of females across all studies was 62.54%. When the studies with single sex samples were removed, the average percentage of females was 55.98%.

The interventions drew on a range of theoretical models: nine used cognitive behavioural therapy techniques, six were integrative, three were mindfulness-based, three were social skills training programmes, one was an interpersonal therapy programme, one was a gratitude intervention, one was a social identity intervention and one was based on reminiscence therapy.

Fifteen of the interventions were group-based, six were individual and four were a combination of group and individual. Twenty of the interventions were face-to-face and five were delivered over the phone or via the internet. Most studies (N = 12) used a waitlist control group and participants allocated to this group received the intervention once the intervention group had completed treatment. Seven studies had active control groups and six offered no treatment to the control group.

Psychological treatments lasted between five days and 52 weeks (M = 9.91 weeks) and sessions were mostly delivered weekly. The mean number of sessions delivered was 10.12, with sessions typically lasting one to two hours, with group treatment sessions on average lasting longer than individual sessions.

The measure used by seventeen studies was either the 20-item, ten-item or eight-item version of the UCLA loneliness scale (Russell, 1996). Two used the De Jong-Gierveld Loneliness Scale (De Jong-Gierveld & Kamphulus, 1985), one used the Illinois Loneliness Questionnaire (ILQ: Asher et al., 1984), one used the Chinese College Student Loneliness Scale (Li et al, 2006), and one used the Social and Emotional Loneliness Scale for Adults (SELSA: DiTommaso & Spinner, 1993).

Table 2

Characteristics of Studies

Author, Year and Country	Participants	Sample Size	Control Group	Format of Intervention	Measure of Loneliness	Psychological Theory	Effectiveness Results
Alaviani et al. (2015) Iran	Older women Mean age = 67 100% female	150 (I = 75, C = 75) 6.7% dropout	No treatment	Group Face to face 4 x 60 min sessions, twice per week No follow up	UCLA Loneliness Scale – version 3 (20 items)	CBT Encourage empowerment in relationships; effective interpersonal interaction; psychoeducation on loneliness. Informed by Social Cognitive Theory	Intervention led to a significant decrease in loneliness and perceived barriers and increase in perceived social self-efficacy and perceived benefits compared to control
Bartlett & Arpin (2019) US	Older adults Mean age = 73 80% female 85% Caucasian	42 (I = 23, C = 19) 14.3% dropout	No treatment	Individual Face to face 21 x daily sessions over three weeks No follow up	Taken from the PANAS (Crawford & Henry, 2004): daily loneliness was assessed with the single negative mood item	Gratitude Gratitude writing exercise	Abstract draws a conclusion about improvement which is not evidenced in mean difference

Cacioppo et al. (2015) US	US Army service personnel Mean age = 24 3% female	1138 (I = 688, C = 450) 49.0% dropout	Active control: Afghanistan cultural awareness training	Group Face to face 5 x 2 hr daily sessions No follow up	UCLA Loneliness Scale – short version (8 items)	CBT Social resilience training: modifying maladaptive social cognitions; practising new perspectives	Significant decrease in perceived social isolation in intervention group compared to control
Chiang et al. (2010) Taiwan	Older men living in a nursing home Mean age = 77 0% female 55% illiterate 58% unmarried	92 (I = 47, C = 45) 58.7% dropout	Waitlist control	Group Face to face 8 x 90 min weekly sessions 3-month follow up	UCLA Loneliness Scale – version 3 (20 items)	Reminiscence Focusing on positive memories	Reduction in loneliness in comparison to control. However, results not significant
Cohen-Mansfield et al. (2018) Israel	Older adults Mean age = 77 81% female	89 (I = 45, C = 44) 16.9% dropout	No treatment	Group and/or individual Face to face Up to 10 individual meetings Up to 7 group sessions 3-month follow up	UCLA Loneliness scale – short version (8 items) Also asked about the severity and frequency of loneliness	CBT Addressing psychosocial barriers Based on the Cohen-Mansfield and Parpura Gill (2007) model of depression and loneliness	Significant difference in loneliness at the end of the intervention and at 3-month follow-up compared to control

Creswell et al. (2012) US	Older Adults Mean age = 65 80% female 64% Caucasian	40 (I = 20, C = 20) 15.0% dropout	Waitlist control	Group and individual Face to face 8 x 120 min weekly group sessions; 1x day-long retreat and 56 x daily 30 min individual practice No follow up	UCLA Loneliness Scale – version 3 (20 items)	Mindfulness Distance from cognitions relating to social threat/distress and negative affect	Significant decrease in loneliness compared to control
Diab et al. (2014) Palestine	Children Mean age = 11 49% female Study carried out in the aftermath of the Gaza-Palestine War (2008–2009)	482 (I = 242, C = 240) 0.0% dropout	Waitlist control	Group Face to face 15 participants per group 8 x weekly sessions 6-month follow up	A questionnaire combining seven items of the Children's Loneliness Scale (Asher & Wheeler, 1985) and eight items of Friendship Qualities Scale (Bukowski et al., 1994)	Integrative The intervention involved a manualised evidence-based approach which aimed to develop coping skills, emotion regulation and empowerment using psycho-educational techniques narrative, imagery and psycho-educational techniques	The intervention effect was gender-specific as boys' not girls' loneliness in peer relations decreased in the intervention group but not among controls
Frankel et al. (2010)	Children with ASD	76 (I = 46, C = 30)	Waitlist control	Group (concurrent parent and child)	The Illinois Loneliness	Social Skills	Children in the intervention condition reported

US	Mean age = 9 14% female 45% Caucasian IQ above 60	10.5% dropout		Face to face 12 x weekly 60 min sessions 3-month follow up	Questionnaire (20 items)	Contains modules that teach social etiquette and specific rules of behaviour which are used by the peer group.	significantly reduced loneliness compared with control
Fukui et al. (2003) Japan	Women with primary breast cancer Mean age = 53 100% female	47 (I = 23, C = 24) 0.0% dropout	Waitlist control	Group Face to face 6 x 1.5 hours weekly sessions 6-month follow up	UCLA Loneliness Scale – version 3 (20 items)	Integrative Social comparison; reciprocal exchange of support; health education; coping skills; stress management; peer support and social learning Based on Fawzy and Fawzy (1994) structured psychoeducational group intervention model for patients with cancer	No group-by-time interaction was found because the baseline scores of the control and experimental groups were adjusted and the experimental group showed consistently lower scores at all subsequent time points
Gantman et al. (2012) US	Young adults with high functioning ASD Mean age = 20 29% female	17 (I = 9, C = 8) 0.0% dropout	Waitlist control	Group Face to face 14 x weekly 90 min sessions, caregivers	Social and Emotional Loneliness Scale for Adults (SELSA: DiTommaso	Social Skills UCLA PEERS for Young Adults Programme (Laugeson et al., 2012): Evidence-based manualised instruction and	Self-reported loneliness decreased for the intervention group compared to control. This group also reported increased participation in

	58% Caucasian IQ above 70			attending concurrently No follow up	and Spinner 1993)	rehearsal of social skills related to building close relationships	social activities, reduced romantic loneliness and the development of friendships compared to control
Haslam et al. (2019) Australia	Adults with social isolation and a mental health diagnosis or symptoms of depression Mean age = 31 64% female 74% Caucasian	120 (I = 66, C = 54) 29.2% dropout	Waitlist control	Group Face to face 4 x weekly 60–90 min sessions No follow up	UCLA Loneliness Scale – short version (8 items)	Social Identity Approach Manualised workbook Social identity approach to health	The intervention produced a greater reduction in loneliness and social anxiety, fewer general practitioner visits at follow-up and a stronger sense of belonging to multiple groups compared to control
Heckman et al. (2006) US	Older adults living with HIV/AIDS Mean age = 54 32% female 50% Caucasian 85% unemployed 49% gay 15% bisexual	90 (I = 44, C = 46) 11.1% dropout	Waitlist control	Group Teleconferencing 6–8 participants per group (separated by sexuality) 12 x 90 min sessions 3-month follow up	UCLA Loneliness Scale (10 Item version)	CBT Improvement of adaptive emotion-focused coping strategies Based on the Transactional Model of Stress of Coping (Folkman & Lazarus, 1984)	No effects on loneliness compared to control. Control group reported significant post-intervention reduction in loneliness

	36% heterosexual						
Jarvis et al. (2019) South Africa	Older adults Mean age = 75 81% female Ethnicity principally Asian Indian Largely widowed	32 (I = 15, C = 17) 9.3% dropout	Active control (routine care): a generic wellness programme for residents	Group and individual Face to face (individual), Online (group) 40 x twice-weekly 90 min sessions over 5 months No follow up	De Jong Gierveld Loneliness scale (6 items)	CBT Psychoeducation on maladaptive cognition linked to loneliness; reflection on cognitive distortion; training in use of technology for increasing social interaction	The intervention reduced loneliness compared to control and this reduction was maintained at follow up.
Jing et al. (2018) China	Housebound older adults Mean age = 75 70% female	80 (I = 40, C = 40) 1.3% dropout	Active control: Baduanjin qigong	Individual Online/Phone 4 x weekly phone check-ins in first month 6 x bi-monthly sessions over 3 months, followed by 9 x monthly sessions over 9 months 3 and 6-month follow ups	A self-evaluation of their participants' degree of loneliness based on a 3-point Likert-type scale	CBT Challenging negative cognitions	Significant improvement for both control and intervention groups, as well as at follow up. Intervention group showed more improvement than control
Käll et al.	General	79	Waitlist	Individual	Swedish	CBT	Intervention group

(2020) Sweden	population Mean age = 47 71% female	(I = 40, C = 39) 12.7% dropout	control	Online 8 week programme No follow up	translation of UCLA Loneliness Scale – version 3 (20 items)	Cognitions and behaviours associated with loneliness	felt significantly less lonely post-intervention compared to control
Kremers et al. (2006) The Netherlands	Older women Mean age = 63 100% female	142 (I = 63, C = 79) 16.2% dropout	No treatment	Group Face to face 8–12 participants per group 6 x 2.5 hr weekly sessions 6-month follow up	De Jong Gierveld Loneliness scale (11 items)	CBT Self-management ability: challenging negative thoughts; goal setting Based on Self-Management of Wellbeing Theory (Steverink et al., 2005)	No difference in loneliness reduction compared to control
Lindsay et al. (2019) US	Community adults Mean age = 32 67% female 53% Caucasian	94 (I = 57, C = 37) 1.1% dropout	Active control: guidance in free reflection, analytic thinking and problem solving with no explicit mindfulness content	Individual Smartphone app 14 sessions No follow up	UCLA Loneliness Scale – version 3 (20 items)	Mindfulness Acceptance toward present-moment experiences	The intervention reduced loneliness significantly more than control
Mascaro et al. (2016)	Medical students	32 (I = 21,	Waitlist control	Group and Individual	UCLA Loneliness	Compassion-based CBT	Participants in the intervention group

US	Mean age = 25 75% female	C = 11) 45.8% dropout		Face to face Group: 10 x 1.5 hr weekly sessions Individual: daily 20 min meditation No follow up	Scale – version 3 (20 items)	Meditation; compassion-focused attention training; analytic approach to challenging automatic thoughts	reported decreased depression and loneliness and an increase in compassion compared to control
Matthews et al. (2018) US	Adolescents with a diagnosis of ASD Mean age = 15 25% female	24 (I = 12, C = 13) 12.5% dropout	Waitlist control	Group Face to face 14 x 90 min weekly sessions 4-month follow up	UCLA Loneliness Scale – version 3 (20 items)	Social Skills The PEERS curriculum: manualised intervention teaching personal and friendship skills	There was a medium reduction in reported loneliness which approached significance as compared with no significant reduction in the control group. This reduction was maintained at follow up
Ransom et al. (2008) US	Adults with a diagnosis of HIV and with depressive symptoms Mean age = 44 34% female 61% Caucasian	79 (I = 41, C = 38) 16.5% dropout	Active control (routine care): access to services provided by the AIDS Service	Individual Telephone 6 x 50 min sessions No follow up	UCLA Loneliness Scale (10 item version)	IPT Psychoeducation and exploration of interpersonal relationships and conflict	No significant change in loneliness in the intervention group or control

Tabrizi et al. (2016) Iran	Breast cancer survivors Mean age = 48 67% unemployed	81 (I = 41, C = 40) 0.0% dropout	Active control (routine care): a brochure regarding self-care.	Group Face to face 6–8 participants per group 12 x 90 min weekly sessions 8-week follow up	UCLA Loneliness Scale – version 3 (20 items)	Integrative Unstructured supportive expressive discussion groups	Significant reduction in loneliness scores compared to control
Theeke et al. (2016) US	Chronically ill older adults Mean age = 75 89% female 70% lived alone	27 (I = 15, C = 12) 27.0% dropout	Attention control: 5 x 2 hr weekly sessions of educational information on ageing	Group Face to face 3–5 participants per group 5 x 2 hr sessions No follow up	UCLA Loneliness Scale – version 3 (20 items)	Integrative LISTEN (Theeke & Mallow, 2015): Rethinking the experience of loneliness to enhance meaning Integrates the key concepts of narrative therapy and CBT	Reduced loneliness compared to control group
van Gestel-Timmermans et al. (2012) The Netherlands	Adults with a history of severe mental illness Mean age = 44 66% female	327 (I = 166, C = 161) 20.5% dropout	Waitlist control	Group Face to face 7 per group 12 x 2 hr weekly sessions 3 and 6-month follow ups	De Jong Gierveld Loneliness scale (11 items)	Integrative A standardised manual: a recovery-enhancing peer support programme	The intervention had no significant effect on loneliness

Zare et al. (2017) Iran	Mothers of children with cerebral palsy Mean age = 28	72 (I = 36, C = 36) 0.0% dropout	No treatment	Individual and group Face to face 5 x group sessions 2 x 1:1 sessions 1.5 month-follow up	UCLA Loneliness Scale (10 item version)	Integrative Education through skills training, self-management empowerment and knowledge improvement	Greater significant improvement for intervention group than control
Zhang et al. (2018) China	University students Mean age = 20 58% female	50 (I = 34, C = 16) 14.0% dropout	No treatment	Group Face to face 8 x 2 hr weekly sessions 3-month follow up	Chinese College Student Loneliness Scale	Mindfulness based Cognitive Therapy Maladaptive cognitive patterns/ de-identify with perceived social threat	Reduction in loneliness compared to control group

3.2 Quality Appraisal

Eight studies were rated as having a low risk of bias, eight as having some concerns and nine as having a high risk of bias. The most common causes of bias were a lack of blinding personnel and selective reporting of outcomes (See Figure 5). However, the ratings for selective reporting of outcomes should be interpreted with caution, as study protocols were not available for many studies. These studies were therefore rated as having no information, thus lowering their selective reporting scores. Table 3 presents the quality checklist for studies included in the review.

Figure 5

Risk of Bias Bar Chart

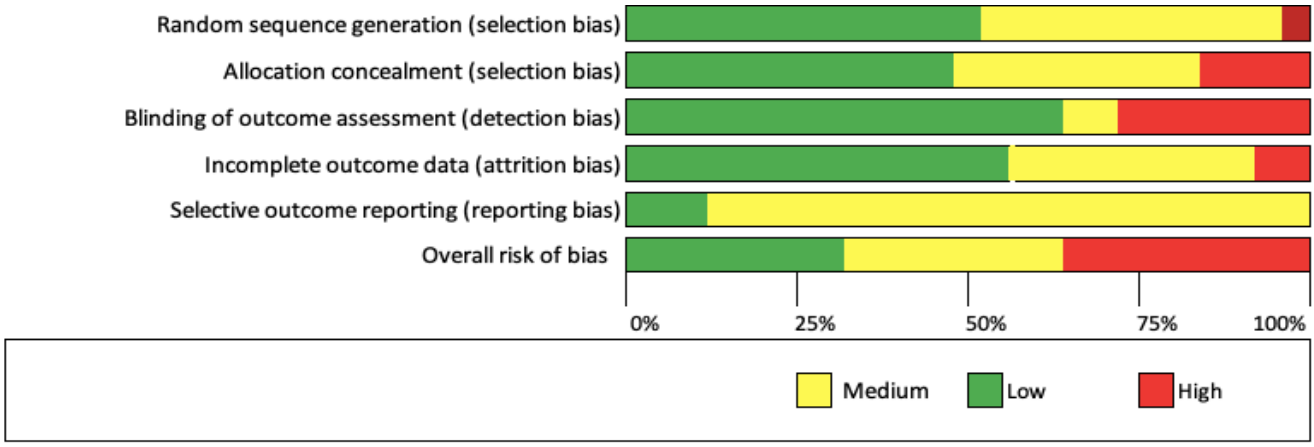
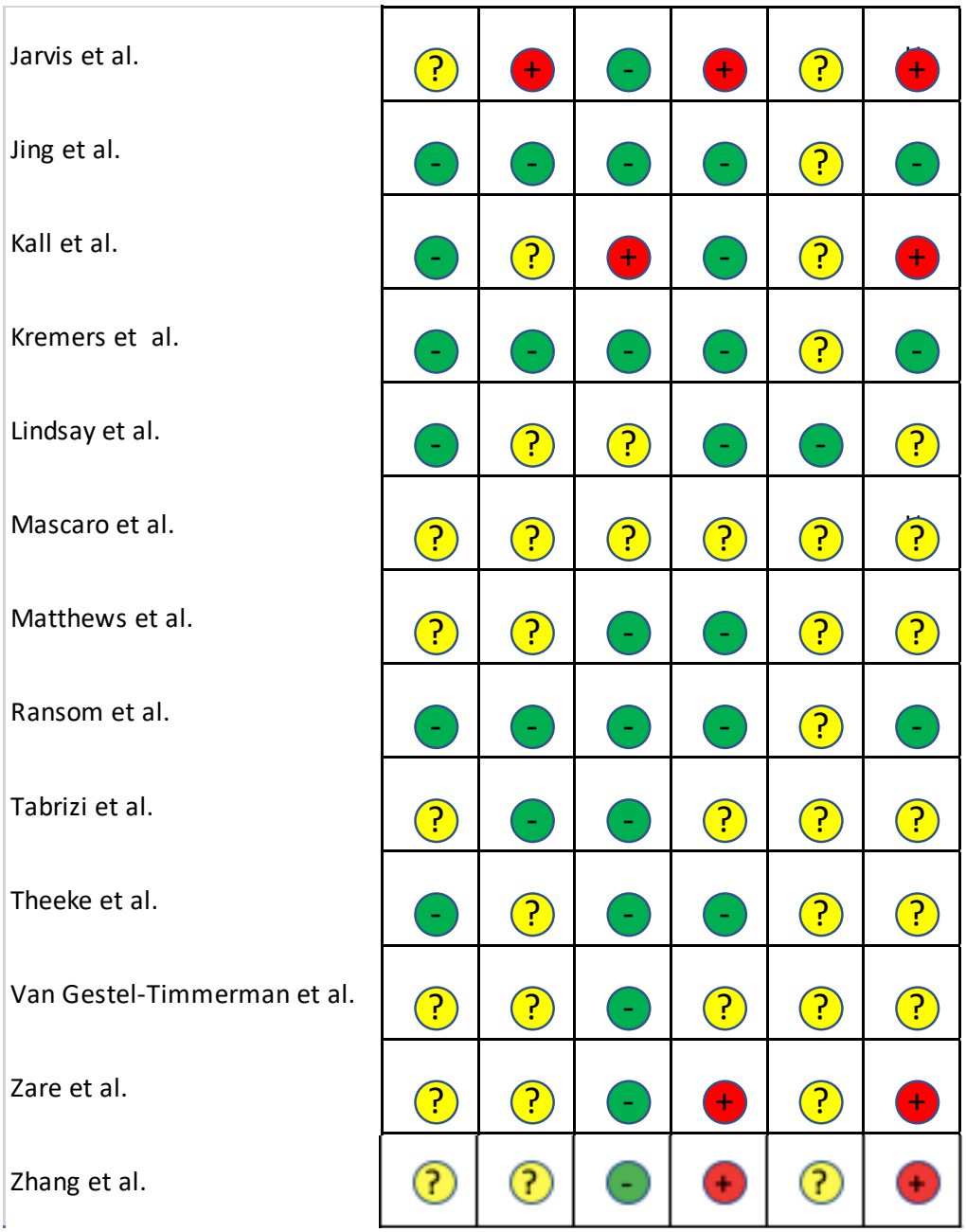


Table 3

Risk of Bias Ratings

Study	Random Sequence Generation	Allocation Concealment	Blinding of outcome assessment	Incomplete outcome data	Selective outcome reporting	Overall
Alaviani et al.	+	+	+	?	?	+
Bartlett et al.	-	-	+	-	?	+
Cacciopo et al.	?	+	+	?	?	+
Chiang et al.	-	+	+	?	?	+
Cohen-Mansfield et al.	?	?	-	-	?	?
Creswell et al.	-	-	-	-	?	-
Diab et al.	-	-	-	-	-	-
Frankel et al.	-	-	+	?	?	+
Fukui et al.	?	-	-	?	?	?
Gantman et al.	-	-	-	-	?	-
Haslam et al.	-	-	-	-	?	-
Heckman et al.	?	-	-	-	-	-



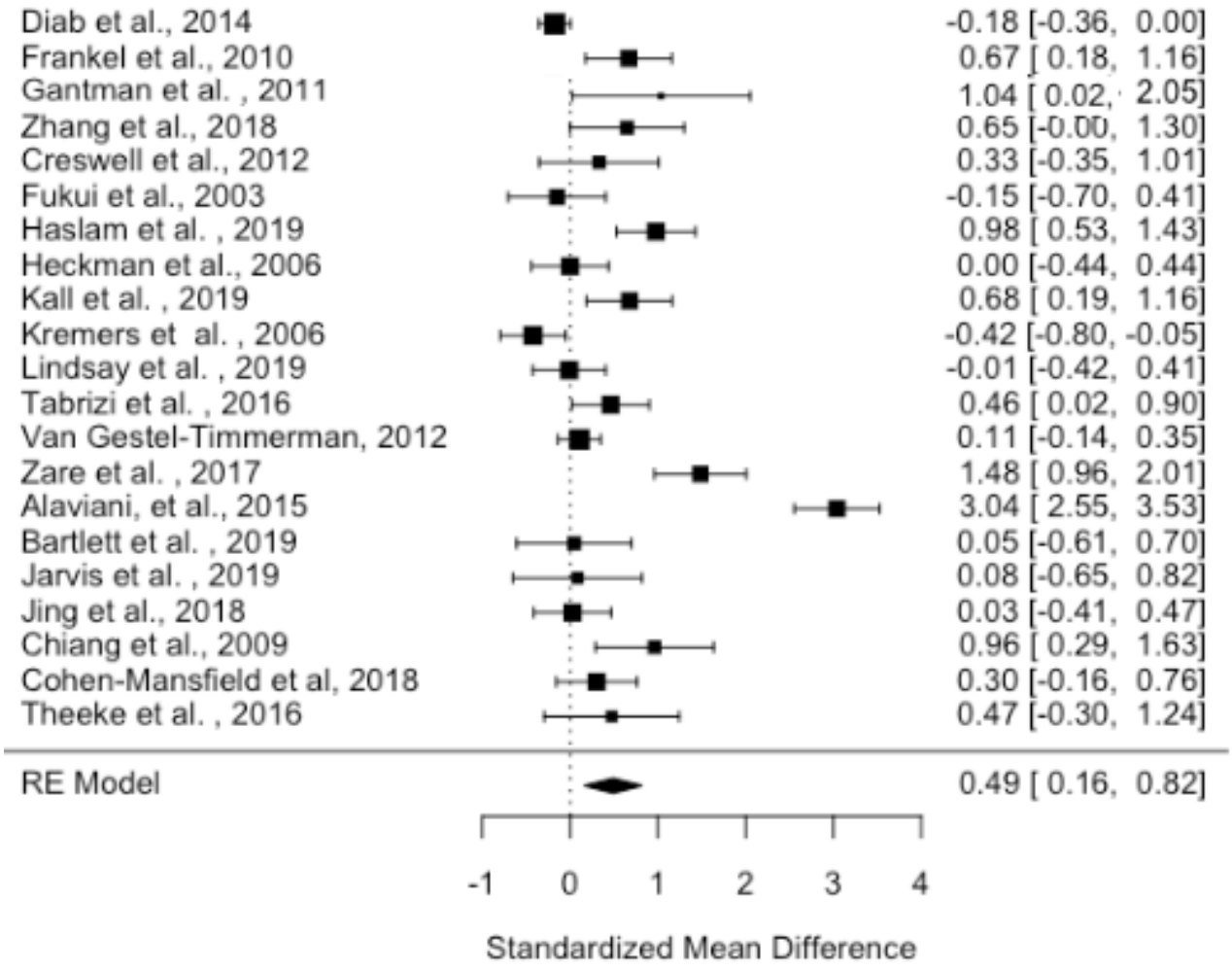
3.3 Meta-Analysis

21 studies (N = 2,232) were included in a meta-analysis of pre- to post-treatment ESs. Psychological interventions significantly reduced loneliness scores compared to control groups (p = 0.002). The meta-analysis yielded a medium effect (overall ES g = 0.49, 95% CI: 0.16–0.82). ESs for individual studies ranged from -0.42 to 3.04 and

substantial significant heterogeneity was observed ($T^2 = 0.491$, $Q = 215.138$, $p < .001$, $I^2 = 91.31\%$). See Figure 6 for the forest plot.

Figure 6

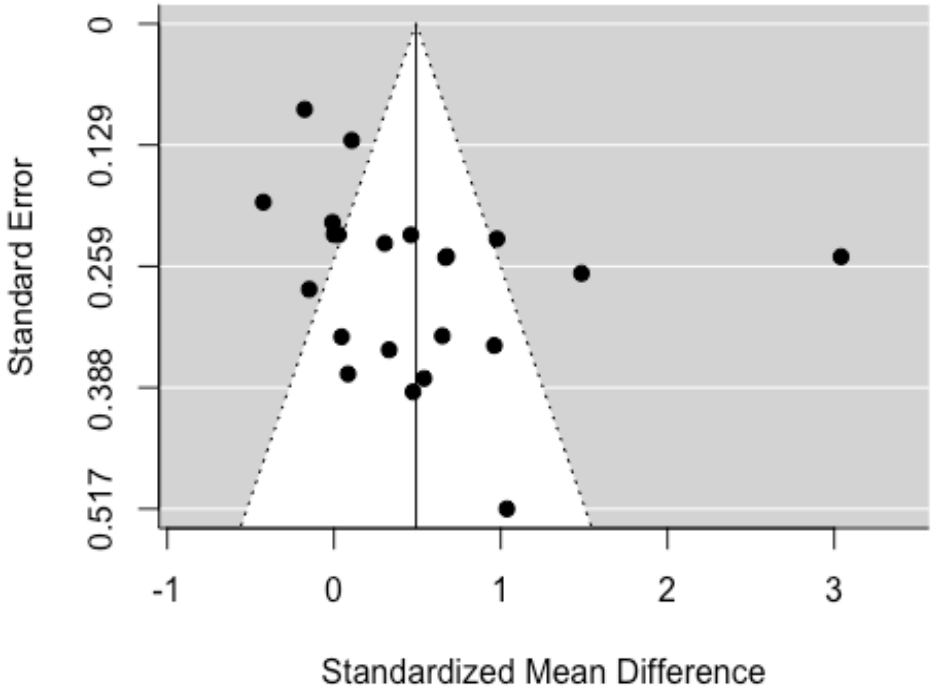
A Forest Plot of Effect Sizes for Pre to Post Treatment



A funnel plot (see Figure 7) was created to identify potential publication bias. The funnel plot showed some asymmetry. However, there were four data points outside of the 95% confidence intervals on both negative and positive sides of the plot, indicating the results would not have been skewed. The Egger test (Egger et al., 1997) remained non-significant ($p = 0.292$ two-tailed), indicating that there was no significant evidence of publication bias.

Figure 7

Funnel Plot of Meta-Analysis



3.4 Subgroup Analysis

To explore possible sources of heterogeneity, a sub-group analysis was performed. Sub-group analysis splits studies into groups and performs a meta-analysis on each group separately using a random effects model. To test if there is a significant difference between the subgroups, the pooled results from each sub-group meta-analysis are treated as if they are a single study. The results of these subgroups are then combined into a separate meta-analysis.

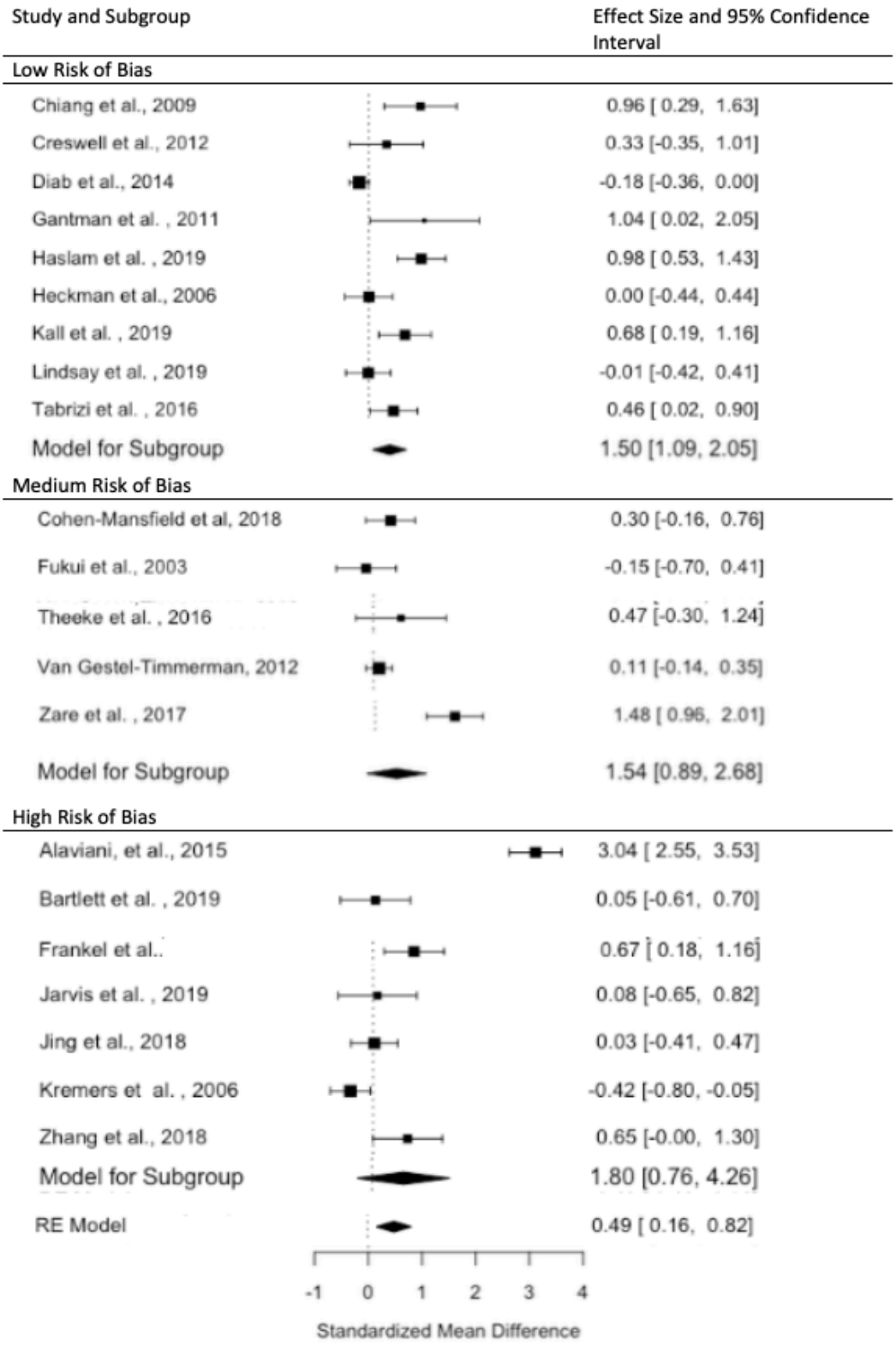
Risk of Bias

A subgroup analysis was conducted (see Figure 8 for forest plot) to ascertain if there was significant variation in effect sizes between studies of low, medium or high risk of bias. Nine studies had a low risk of bias, five had a medium risk and seven had a high risk. A pooled standardised mean difference across the low risk of bias studies was 1.50 (95% CI: 1.09, 2.05). For medium risk of bias the standardised mean difference was 1.54 (95% CI:

0.89, 2.68) and for high risk of bias it was 1.80 (95% CI: 0.76, 4.26). The heterogeneity between the subgroups was non-significant (p = .93) and I^2 = 0%.

Figure 8

Forest Plot of a Subgroup Analysis by Overall Risk of Bias Rating



3.5 Meta-Regressions

Another approach to explaining heterogeneity is through meta-regression. This method allows for both categorical and numeric variables and can be used to assess the relationship between a study's characteristics and the outcome (Thompson & Higgins, 2002). Meta-regression differs from standard regressions as each data point represents a whole study rather than an individual in a single study. Weights are assigned to each study so that larger, more precise studies have more influence on results.

As it was assumed in this case that study variables accounted for some heterogeneity but that there was residual heterogeneity which needed to be accounted for, random effects meta-regression was undertaken. This was used to investigate whether age of participants, percentage female, type of psychological intervention and intervention format (group, individual or both) were associated with the effectiveness of psychological interventions for loneliness.

The meta-regression model for age was insignificant ($Qb = 0.03$, $df = 1$, $p = 0.85$), indicating that age was not significantly associated with loneliness scores. Sex of participants, measured by the percentage of female participants in each study, was also a non-significant moderator of loneliness ($Qb = 0.064$, $df = 1$, $p = 0.79$), $p = 0.25$).

Type of intervention was categorised as CBT-based or not CBT-based. Whether interventions were CBT-based significantly influenced the loneliness outcome ($Qb = 3.949$, $df = 1$, $p = 0.0469$), explaining R2 = 14.71% of the heterogeneity in the data: interventions associated with higher effect sizes were not CBT-based.

Whether the intervention was group-based or individual did not significantly influence its effectiveness in reducing loneliness ($Qb = 1.967$, $df = 1$, $p = 1607$) although it did explain R2 = 4.22% of the heterogeneity in the data.

4. Discussion

The aims of the systematic review and meta-analysis were to: (a) summarise and synthesise the findings of RCTs to address psychological interventions for loneliness across the lifespan; (b) ascertain the overall effectiveness of psychological interventions compared to control conditions; and (c) explore the heterogeneity of the interventions and assess whether there were significant moderators. A total of 25 studies (N = 3,532) were included in the systematic review, of which 21 articles (N = 2,229) were assimilated to meta-analysis.

4.1 Summary and Interpretation of Findings

Synthesis of Included Studies

The systematic review included studies from 12 countries. There was substantial variation in sample sizes, some of the studies being small pilot or feasibility RCTs, others large trials. Unlike many previous reviews, the review carried out for this thesis included studies across the lifespan: seven studies involved people younger than 25, nine involved middle aged adults and seven involved older adults (65+).

The studies looked at a wide variety of psychological interventions. Many were cognitive behavioural, whilst others were based on interpersonal therapy, mindfulness, social skills training, reminiscence, gratitude or integrative approaches. Most were group-based and delivered face to face. Only five interventions were delivered using technological means.

Eight studies were rated as having a low risk of bias, eight as having some concerns and nine as having a high risk of bias. The most common reason for bias was that interventions did not attempt to blind research personnel or participants. Also, as most studies did not publish protocols, it was difficult to ascertain whether or not reporting bias had occurred due to selective outcome reporting.

Effectiveness of Psychological Interventions

The meta-analysis found that psychological interventions were significantly more effective at reducing loneliness than control conditions, with a medium effect size. Individual studies' effect sizes ranged from -0.42 to 3.04, and substantial significant heterogeneity was observed. These findings build on previous research which also found that psychological interventions were effective (Barreto et al., 2020; Jarvis et al., 2019; Masi et al., 2011).

Heterogeneity in the Data

Considerable heterogeneity was found in the data. To explore this, subgroup analysis and meta-regressions were conducted. The subgroup analysis found that study quality did not moderate the effect sizes for psychological interventions. Meta-regressions found that the age of participants, the percentage of female participants and the intervention format were not significant moderators of the effectiveness of the interventions on loneliness. Some of these findings differ from published results which find that group interventions are more successful than individual interventions (Cattan et al., 2005; Findlay et al., 2003; Hagan et al, 2014) and that males are more responsive to interventions than females (Masi et al., 2011).

One finding of interest from the meta-regressions was that the type of intervention (whether CBT-informed or not) significantly moderated its effectiveness on loneliness outcome: interventions with higher effect sizes were non-CBT informed. This finding goes against what is expected from previous research (Jarvis et al., 2019; Masi et al., 2011). However, the result should be interpreted with caution as the classification of interventions in the review as being CBT-informed or not was based on the limited information given in the papers and was not based on objective criteria. Furthermore, many of the interventions incorporated a CBT element whilst not strictly providing a CBT intervention, and this may have affected the results. One study that adhered to CBT principles and techniques for

loneliness did result in a significant improvement in loneliness scores and obtained a medium to large effect size (Käll et al., 2019).

The large amount of heterogeneity between interventions combined with the limited number of interventions from many therapeutic approaches (e.g. only one reminiscence therapy) means that further sub-group analyses need to be conducted in order to investigate the impact of type of psychological intervention on loneliness.

4.2 Strengths and Impact

This systematic review and meta-analysis is novel as it is the first to research the effectiveness of psychological interventions for loneliness across the lifespan. The main finding – that psychological interventions are effective at reducing loneliness – had a medium effect size and represents a significant advance in the field of loneliness. This finding is particularly critical given the recent upsurge in loneliness and demand for loneliness interventions caused by the current COVID-19 pandemic (Mental Health Foundation, 2020). Research funded by the UK Academy for Medical Sciences recommends the reduction of chronic feelings of loneliness and the promotion of feelings of belonging as candidate mechanisms for protecting against suicide, self-harm and emotional difficulties during the pandemic (Holmes et al., 2020). The effectiveness of psychological interventions for loneliness is therefore an important finding that should inform policy makers, researchers and clinicians considering the pandemic's broader health implications.

A strength of the systematic review is its methodological rigour, including the use of two independent coders for screening all 3,138 abstracts and 78 full texts, with good inter-rater reliability. This minimised the chance of any relevant studies being missed due to human error. The review also utilised a third reviewer when decisions about whether a study met the review's inclusion criteria were unclear .

A further strength of the review is its evaluation of risk of bias in the studies it included using the gold standard tool for RCTs developed by the Cochrane collaboration (Higgins et al., 2011). To assure the reliability of the risk of bias ratings, 30% of the studies were rated by a second coder. Furthermore, to ensure that key statistical data were extracted reliably, data extraction was conducted independently by two individuals with any errors corrected.

4.3 Limitations

The systematic review has limitations at both the review level and the individual study level. One potential weakness of the review is that it includes only psychological interventions, making impossible to compare their efficacy with other types of intervention for loneliness (e.g. befriending or wider community interventions). There are various types of intervention to alleviate loneliness (White et al., 2005). Whilst some aim to increase opportunities for social interaction, having a large number of contacts is not equivalent to having high quality relationships and does not necessarily result in reduced loneliness (Masi et al., 2011). Other interventions aim to teach social skills, but many lonely individuals have no deficiency in social skills so these interventions are unlikely to be helpful (Cacioppo et al., 2006). Further strategies consider the wider context of an individual's difficulties. For example, it has been argued that addressing individuals' maladaptive cognitions prepares them to 'get involved' in their community, though this may have a limited impact if an individual has a lack of connectedness to their community (Mann et al., 2017). A community approach that may be beneficial is GPs socially prescribing, which involves an individual being prescribed time with a link worker, community group or community-based activity (Mann et al., 2017). One study found that 76% of doctors reported that every day between one and five patients visited them primarily due to loneliness (Jopling, 2015), suggesting that

GPs could be well placed to identify individuals suffering with chronic loneliness. The UK government has proposed that all GPs implement a social prescription model to reduce loneliness by 2021 (Department for Digital, Culture, Media and Sport, 2017). However, an evidence base for social prescribing still needs to be established. Future research should therefore compare the effectiveness of psychological interventions to community interventions or examine whether a combination of a psychological and community based intervention is more effective than either type alone.

Another potential limitation of the review is that it includes only published papers and did not consider research in the 'grey' literature. This may have increased the chance of publication bias and Type I errors. However, the Egger's test (Egger et al., 1997) was insignificant, indicating that there was no significant evidence of publication bias within the meta-analysis and that conclusions can be drawn with confidence.

Limitations of the studies included in the review are small sample sizes and lack of underpinning power calculations in many of them. Additionally, some had very high attrition rates (up to 58.7%) which threatened the validity of their results, especially when the issue of missing data was not analysed further to ascertain if there were differences between those who had completed the intervention and those who had not. In addition, only 44% of studies included a follow up, with the length of follow ups differing, making it difficult to comment on whether the interventions had long-lasting effects.

Furthermore, some studies targeted loneliness directly and ensured that participants self-reported as feeling lonely as part of their eligibility criteria, whereas other studies did not and instead targeted certain populations that were presumed to be more at risk of loneliness, especially older adults. Moreover, the majority of interventions did not distinguish between transient and chronic loneliness. Both are factors that may reduce the generalisability of the review's findings to individuals who are suffering with chronic loneliness.

4.4 Future Research Priorities

Future interventions should be designed specifically with loneliness in mind and incorporate the theoretical understanding of the variety of triggers and maintaining factors that exist for chronic loneliness. Additionally, it is important to recognise that lonely individuals are a heterogeneous group and that interventions need to be tailored to the individual rather than using a 'one-size-fits-all' approach (Perese & Wolf, 2005; Victor, 2018). For example, an adolescent with Autism Spectrum Disorder may benefit from an intervention which incorporates social skills whereas a geographically isolated older adult with health conditions may favour online CBT and a middle-aged individual who has recently divorced may benefit from an interpersonal intervention. This level of heterogeneity points to a flexible modular psychological approach being beneficial (Käll, Shafran, Lindegaard, et al., 2020). Additionally, further research should consider which types of psychological intervention are most effective for whom. One way that this question could be addressed is by considering demographic and clinical predictors and moderators of loneliness treatment outcome.

A key issue that remains to be addressed is how best to reach individuals who feel intensely or chronically lonely with the offer of treatment, rather than continuing with the haphazard strategy of targeting particular population groups. One way forward could be through GPs and mental health services using the UCLA-LS-3 tool to screen for loneliness. If this indicates that the loneliness is distressing then individuals could be directed to an evidence-based treatment.

Another potential method for ensuring that psychological interventions for loneliness are available to those who need them is delivery through technological means, such as internet-based CBT, which has been found to be effective in reducing loneliness (Käll et al., 2019), with benefits persisting two years post intervention (Käll, Backlund & Shafran, et al.,

2020). Using technological innovations such as the online delivery of therapy during the COVID-19 pandemic is likely to be key in helping to prevent the risk of further loneliness (Zubatsky et al., 2020).

Given that loneliness has strong links with mental health difficulties and that psychological interventions have been found to be effective, a necessary development will be establishing how mental health services can meet the needs of those experiencing chronic loneliness whilst ensuring that loneliness does not become further stigmatised or medicalised (McLennan & Ulijaszek, 2018). Options include interventions being delivered via the Improving Access to Psychological Therapies (IAPT: Clark, 2011) programme, which offers evidence-based therapies to those with mental health difficulties on a nation-wide basis, and enabling charities such as Silver Line or the British Red Cross, who are currently targeting loneliness, to offer interventions.

Future research should involve the co-production of interventions with individuals with lived experience of chronic loneliness. A co-produced approach to intervention development and refinement is likely to result in more robust interventions which are a closer fit to recipients' needs. Additionally, it is important to consider cultural differences when designing or modifying interventions for loneliness (Rokach et al., 2000). Finally, future interventions need to ensure that they collect follow-up data in order to assess the long-term benefits of psychological interventions for loneliness and ascertain whether improvements post treatment are maintained.

4.5 Conclusions

It is concluded that psychological interventions are effective for loneliness across the lifespan. Type of psychological intervention has emerged as a significant moderator, although this finding warrants further investigation. Future research should address which types of

psychological intervention for loneliness are most effective, for whom, and compare the effectiveness of psychological interventions to community interventions. Finally, it is important to establish pathways for the delivery and dissemination of psychological interventions for loneliness, potential avenues being through technological innovations, GPs and mental health services.

Part III. Empirical Study

Predictors of treatment outcome in a randomised controlled trial of psychological interventions for chronic loneliness

Abstract

Chronic loneliness involves painful feelings of isolation, disconnection from others and not belonging. It is strongly associated with, and predictive of, mental health problems and increases the risk of all-cause morbidity and mortality. However, there is scarce research examining which loneliness interventions are effective for whom. Therefore, this study aimed to address this gap by identifying predictors of treatment outcome for two novel psychological interventions for loneliness: Internet-delivered Cognitive Behavioural Therapy (CBT) and Internet-delivered Interpersonal Therapy (IIPT).

The data was taken from the SOLUS 2.0 Randomised Controlled Trial (RCT) carried out in Sweden, which compared ICBT and IIPT for loneliness to a waitlist control. 116 chronically lonely participants were recruited, with 46 randomised to each treatment condition and 24 randomised to the waitlist control. The ICBT and IIPT interventions were modular, therapist-guided and nine weeks in duration. The primary outcome measure was the UCLA Loneliness Scale –Version 3. The categories for the 29 potential predictor variables were: (a) social/demographic; (b) clinical; (c) outcome measures; (d) loneliness-specific; and (e) process.

Machine learning statistical approaches – in particular, Least Absolute Shrinkage and Selection Operator (LASSO) regressions, multiple imputation and k-fold cross validation – were used to accurately exclude variables that did not improve the predictive value of the model and which covaried strongly with others. The remaining variables were entered into linear regressions, and several statistically significant predictors emerged (a) across all

conditions; (b) specifically in the ICBT (e.g. depression and anxiety); and (c) specifically in the IIPT condition (e.g. previous therapy).

The difference in predictors of outcome found across conditions begins to address the key question of what works for whom in loneliness. This finding can in turn inform treatment allocation and consequently allow for improvements in individual outcomes. Future research should aim to replicate and expand on these findings across different populations and cultures.

1. Introduction

1.1 What is Loneliness?

Loneliness is a perception that has been defined as a distressing feeling that occurs when there is a discrepancy between desired and achieved social interaction (Peplau and Perlman, 1982) involving painful feelings of isolation, disconnection from others and not belonging (Hawkley & Cacioppo, 2010). It is often thought of as being synonymous with social isolation — an objective lack of social contact —-though these are independent constructs that may occur in the absence of each other. The phrase "alone in a crowd" describes how an individual can experience being surrounded by people and yet still feel lonely. In this way, loneliness is related not only to the quantity of social contact but more importantly, to the perceived quality and features of social relations, such as intimacy and trust (Yanguas et al., 2018).

It is also pertinent to note the difference between chronic and transient loneliness (Qualter et al., 2010). Transient loneliness is commonplace and adaptive, with temporary emotional distress associated with social disconnection motivating the creation and maintenance of social connections (Cacioppo et al., 2006). Chronic loneliness, on the other hand, is a more persistent state related to a lack of satisfying social relationships over an extended period of time.

1.2 Why is it Important to Study Loneliness?

Loneliness is a significant public health issue due to both its prevalence and wide-reaching impact. In the UK, more than a quarter of adults report experiencing bouts of transient loneliness and 6% of adults report chronic loneliness (Victor & Yang, 2012). Loneliness also has a large economic impact, costing UK employers an estimated £2.5 billion

per year (Abdallah et al., 2017), this being the cumulative result of: (a) sickness leave required; (b) productivity loss; (c) staff turnover; and (d) leave taken by members of a lonely individual's support network as they undertake increased caring activities.

On an individual level, the impact of chronic loneliness is high and strongly associated with or predictive of mental health problems (Lauder et al., 2004). For example, a community-based study of 15,010 participants found that loneliness was associated with depression, generalised anxiety and suicidal ideation after controlling for demographic variables and other sources of distress (Beutel et al., 2017). Another study of over 1,000 adults found that loneliness predicted social anxiety, depression and paranoia after controlling for trait levels and prior states (Lim et al., 2016). Additionally, there is a large disparity in the prevalence of loneliness for individuals with psychosis (78%) compared to the general population (35%) (Badcock et al., 2015).

In addition to the serious mental health consequences associated with loneliness, there are also a number of significant physical health implications (Cacioppo, Fowler & Christakis, 2009). Longitudinal research has found that chronic loneliness intensifies the risk of all-cause morbidity (Shiovitz-Ezra & Ayalon, 2010) and is linked to a 26% increase in risk of mortality (Holt-Lunstad et al., 2015). There is a strong association between chronic loneliness and cardiovascular disease, with higher chronic loneliness associated with a greater number of cardiovascular health risks (Caspi et al., 2006). Furthermore, people who experience chronic loneliness have been found to be at increased risk of cognitive impairment and developing Alzheimer's disease (Wilson et al., 2007).

Now is an apt time to be researching loneliness as early studies are finding that a major consequence of the global COVID-19 pandemic has been a surge in social isolation and reported loneliness (Holmes et al., 2020; Mental Health Foundation, 2020), an impact which is predicted to have lasting implications for mental health. Research that focuses on

interventions to alleviate chronic loneliness and establish what works for whom therefore is urgently required (Holmes et al., 2020). The empirical study presented here aims to address this need by establishing the factors that influence how well individuals respond to two novel interventions for chronic loneliness.

1.3 What Factors are Associated with Loneliness?

Whilst there are some inconsistencies in findings between reviews of factors associated with chronic loneliness, those that they identify provide useful avenues for further investigation. A review of 38 studies of older adults (Cohen-Mansfield et al., 2016) found that the following variables were significantly associated with loneliness: non-married status, older age, female gender, low quality of social relationships, living alone, lower income, poor self-reported health, lower educational level and poor functional status. The same review identified psychological attributes associated with loneliness that included negative life events, low self-efficacy beliefs, poor mental health and cognitive deficits. The review did not, however, assess the quality of the studies it had synthesised, so these findings need to be interpreted with caution. Additionally, it is unknown if these predictors generalise across the lifespan.

An umbrella review of 14 systematic reviews and meta-analyses that reported on 18 outcomes, 795 studies and 746,706 participants (Solmi et al., 2020) found a longitudinal association between loneliness and suicidal action as well as an association between loneliness and depressive symptoms. Factors that it found to be cross-sectionally associated with loneliness were socio-economic status, quality of social contacts, female sex and chronic medical conditions.

Additionally, a recent large-scale study with 46,054 participants considered the experience of loneliness, across the adult lifespan in a wide range of countries (Barreto et al.,

2020). Findings showed that loneliness increased with societal individualism and that, contrary to previous research, loneliness was greater in males than in females and decreased with age. It concluded that the group most vulnerable to loneliness was younger men living in individualistic cultures.

1.4 How to Alleviate Chronic Loneliness?

From its considerable prevalence and the severity of its consequences it is clear that chronic loneliness needs effective and efficient interventions in order to alleviate it. Previous attention given to this issue has tended to focus on which category of intervention is the most effective and for whom. Masi and colleagues (2011) conducted a meta-analysis which examined four categories of loneliness intervention: (a) enhancing social skills; (b) providing social support; (c) increasing opportunities for social interaction; and (d) addressing maladaptive social cognition. Their moderation analyses found that the effect size for interventions addressing maladaptive social cognitions was significantly larger than the effect sizes for interventions in the other three categories. However, a limitation of this finding is that it was based on only four RCTs of interventions focusing on maladaptive social cognitions. The meta-analysis carried out for this thesis strengthens the evidence base for psychological interventions for loneliness by examining 21 RCTs and concluding that psychological interventions were effective at alleviating loneliness.

1.5 What Psychological Interventions Exist for Loneliness?

There are various psychological interventions for loneliness. (See the systematic review section of the thesis for details.) The most commonly used psychological intervention for loneliness is Cognitive Behavioural Therapy (CBT). This approach is theory driven, as it targets the perceptual and cognitive biases that result in hypervigilance to negative social

information (Cacioppo et al., 2006; 2009). Accordingly, CBT helps individuals to look for disconfirming evidence to reframe perceptions of loneliness and self-efficacy with the aim of changing behaviours, increasing social connections and decreasing loneliness (Kall et al., 2019).

There has been some promising research supporting CBT for loneliness, though findings have often been limited to specific population groups, such as older adults (e.g. Cohen-Mansfield et al., 2018; Theeke et al., 2016). A novel Internet-delivered CBT intervention (ICBT) for individuals across the lifespan was found to significantly improve loneliness scores and quality of life whilst lowering social anxiety (Käll et al., 2019). Additionally, a two-year follow up of this study found that improvements were maintained (Käll, Backlund & Shafran, et al., 2020).

Interpersonal Therapy (IPT), a brief therapeutic approach created initially to treat adults with depression (Law, 2013), also has the potential to reduce loneliness. IPT is based on the principle that helping individuals to improve problematic relationships will result in symptom reduction. IPT focuses on specific interpersonal problem areas: role transition, role dispute, grief and interpersonal deficits (Law, 2013; Moreau et al., 1991). IPT aims to bridge the gap between inter- and intrapersonal processes by improving social skills, increasing social support and focusing on how problems in interpersonal relationships predispose, precipitate and perpetuate an individual's distress (Weissman et al., 2000). As a result of it targeting areas which are recognised as being important factors in loneliness (Heinrich & Gullone, 2006), IPT may be particularly suited to use as a loneliness intervention.

IPT has a strong evidence base for reducing mental health difficulties, including a meta-analysis based on 90 studies, with 11,434 participants, which confirmed its effectiveness in this respect (Cuijpers et al., 2016). The majority of trials in the meta-analysis were aimed at depression, for which IPT had a moderate-to-large effect size compared with

control groups and no significant difference from other therapies. Additionally, IPT significantly prevented the onset of major depression for individuals with subclinical depression and significantly reduced depression relapse in those with previous major depression (Cuijpers et al., 2016). A separate RCT has shown that Internet-delivered IPT (IIPT) can significantly reduce depressive symptoms (Donker Bennett & Bennett et al., 2013).

Given IPT's strong evidence base for reducing depression, as well as loneliness being a predictor for depression (Cacioppo et al., 2010), it is logical to infer that IPT may alleviate loneliness. One study of IPT for loneliness examined an intervention for individuals with human immunodeficiency virus (HIV) (Ransom et al., 2008). Whilst the intervention did not significantly reduce loneliness compared to the control group, the study sample used was small and provided enough power to detect only a large effect size. As a result, the study concluded that further research should be conducted to assess the efficacy of IPT for loneliness.

CBT and IPT are two of the most empirically-validated interventions for depression (Cuijpers et al., 2011). These interventions have significant potential for reducing loneliness given the well-established bidirectional relationship between loneliness and depression as well as the initial promise of CBT and IPT for loneliness. Despite this, there has been no previous research comparing CBT and IPT to establish which of the two interventions is the most effective for treating loneliness and, in relation to individuals with loneliness, what works best for whom.

1.6 What Works Best for Whom?

A key consideration in psychological therapy for loneliness is recognising the heterogeneity of lonely individuals. Those suffering with chronic loneliness will have a

variety of risk/vulnerability factors and triggers linked to loneliness onset as well as a variable likelihood of recovering from loneliness (Victor & Yang, 2012). It has been established that a "one size fits all" approach is unlikely to be successful in treating chronic loneliness (Perese & Wolf, 2005; Victor et al., 2018). As a result, further research is needed to answer the question, "What works best for whom?".

In order to build an understanding of who benefits from which interventions, predictors of treatment outcome need to be considered. A predictor of treatment outcome is a variable which has a presence or magnitude that influences the likelihood of a particular outcome (Papakostas & Fava, 2008). In clinical research, establishing predictors of treatment outcome that are both specific to intervention modality and irrespective of modality can help clinicians identify the type of therapy which is most (or least) likely to be effective for a particular person (e.g. Carter et al., 2011). The practical goal of predictive models is to enhance the efficient allocation of scarce or costly resources, as well as to limit unnecessary exposure to treatments that require substantial time commitments (Hingorani et al., 2013).

Predictor variables fall into eight broad categories: demographic variables, symptom characteristics (e.g. severity), comorbidity, cognitive variables, motivational factors (e.g. treatment expectations), treatment process factors (e.g. therapeutic alliance, engagement in therapy), biological factors and other factors (e.g. social variables, personality factors) (Kyrios et al., 2015). There is still considerable debate regarding which predictors are most important in influencing outcome (Carter et al., 2015).

In depression research, a meta-analytic review of 137 studies with 11,374 participants found that CBT and IPT were equally effective (Whiston et al., 2019). However, the results showed that CBT's efficacy declined as participants' ages increased and that the intervention was more effective in treating severe initial depression than moderate or mild depression. It was also more effective when delivered via an individual rather than a group format (Whiston

et al., 2019). By contrast, analyses of IPT did not identify any of the preselected demographic, clinical or therapeutic variables as significant predictors of outcome.

Limited research has also considered whether certain variables produce better outcomes in one or other of the two interventions, IPT or CBT. Studies on depression have indicated that higher socio-economic status (Falconnier, 2009) and being married (Frank et al., 2011) are associated with better outcomes in IPT, and more severe depression predicts better outcomes in CBT (Luty et al., 2007). Additionally, a RCT of Internet-delivered CBT (ICBT) and IPT (IIPT) found that older participants had larger reductions in depression in the ICBT group than in the IIPT group, whereas younger participants (16–24 years) had larger reductions in depression scores in the IIPT condition than in the ICBT conditions (Donker Batterham & Warmerdam et al., 2013). Given the association between depression and loneliness (Heikkinen & Kauppinen, 2011; O'Luanaigh & Lawlor, 2008; Routasalo & Pitkala, 2003), it can reasonably be assumed that there will be a number of other differential predictors of outcome for CBT and IPT for loneliness.

Predictive models in psychology are the subject of growing interest (Dwyer et al., 2018). However, no predictor variables have yet been well-established for the outcomes of loneliness interventions. Limited research in this area has found that baseline loneliness scores, as well as the number of group sessions attended, can be significant predictors of final loneliness scores (Cohen-Mansfield et al., 2018). However, research to date has not been designed to examine loneliness predictors systematically and those predictors that have emerged have been based on post hoc analyses of a small number of variables with important predictive associations likely to have been overlooked.

Therefore, a key challenge is identifying the variables which may be important predictors of outcome in loneliness treatment. A common solution to this type of problem is a stepwise feature selection procedure (Draper et al., 1998). However, this approach is lengthy

and susceptible to over-fitting (Berk, 2004). An alternative way to overcome this challenge is to use machine-learning statistical approaches to examine a large number of variables in an unbiased, generalisable manner to establish predictors of loneliness outcome (Hastie et al., 2009; Kuhn & Johnson, 2013).

Machine learning is a computational strategy that is used to determine methods and parameters for reaching optimal solutions (Dwyer et al., 2018). The techniques of machine learning are designed for multivariate analysis, including the analysis of data sets with variables that are highly correlated or where the ratio of participants to variables is limited (Cortes & Vapnik,1995). These techniques discover which variables are the most important predictors through feature selection, which is when machine learning algorithms employ statistical regularisation terms in order to shrink the contribution of less important variables (e.g., Least Absolute Selection Shrinkage Operator regression), effectively removing their influence whilst leaving their predictive and nonredundant features in place (Dwyer et al., 2018). Furthermore, machine learning approaches can simulate the gold-standard process of building a statistical model in one sample and testing it in another by using simulations to resample data (e.g. k-fold cross validation) (Chekroud et al. 2016), thereby resulting in higher generalisability.

As "What works for whom?" is a question seldom researched in the field of loneliness, machine learning statistical approaches are used in this study to assess a large number of potential predictor variables. The selection of these variables is guided by existing research into the risk factors for chronic loneliness, predictors of treatment outcome in depression and the limited previous research into predictors of outcome in loneliness interventions.

1.7 The Present Study

People experiencing chronic loneliness are known to be a heterogeneous group, with the key triggers and maintaining mechanisms for their loneliness being specific to their individual circumstances (Käll, Shafran, Lindegaard, et al., 2020). For example, an isolated older person grieving the loss of a partner and a young adult who has recently moved to a new city may both be experiencing chronic loneliness but may need different interventions to respond to their differing circumstances. To guide treatment allocation, it is therefore important that established predictors of outcome are available.

Two interventions which are hypothesised in this study to be successful in alleviating chronic loneliness are CBT and IPT in their therapist-guided, internet-delivered forms. A meta-analysis has already demonstrated that Internet-delivered CBT (ICBT) is as effective as face-to-face treatment for social anxiety disorder, depressive symptoms and other psychological disorders (Andersson et al., 2014). Other meta-analyses have demonstrated that online interventions offer a practical way of making treatment accessible for hard-to-reach groups who may previously have found significant barriers to accessing services (Andersson & Titov, 2014; Cuijpers et al., 2008; Firth et al., 2017). In addition, given that the number of individuals in the UK experiencing loneliness has doubled as a result of the COVID-19 pandemic (Mental Health Foundation, 2020), evidence-based interventions which can be disseminated widely through technological means are needed more than ever.

In order to establish predictors of loneliness outcome, the study looks at a range of variables across five categories: (a) social/demographic; (b) clinical; (c) outcome measures; (d) loneliness-specific; and (e) process. It examines these variables using data collected by the SOLUS 2.0 research group led by Professor Gerhard Andersson and Anton Käll in Sweden. The SOLUS 2.0 trial is a randomised controlled trial that compares the efficacy of

CBT, IPT and a waitlist control on reducing chronic loneliness [1]. It is hypothesised that there will be different predictors for the IPT and CBT group.

The study aims to build on the existing evidence by establishing predictors of loneliness outcome:

1. across all three conditions (ICPT, IIPT and waitlist control)
2. for individuals in the ICBT group
3. for individuals in the IIPT group.

[1] The primary analysis comparing the effectiveness of the two interventions will be conducted by the SOLUS research group and published elsewhere. The analyses contained within the thesis are preliminary and conducted by the student (Nisha Hickin) for the purposes of providing context for the analyses of predictors of treatment outcome.

2. Methods

2.1 Design and Setting

The data used for the empirical study were drawn from the SOLUS 2.0 randomised controlled trial conducted by collaborators at Linkoping University in Sweden. The SOLUS 2.0 trial aimed to investigate the efficacy of two different internet-based treatment programmes against a waitlist control group. The two treatment conditions were internet-based cognitive behavioral therapy (ICBT) and internet-based interpersonal psychotherapy (IIPT). The present study is an analysis of these data to establish predictors and moderators of loneliness outcomes.

2.2 Participants

Recruitment

Recruitment began in January 2019 and lasted for three weeks. Information about the study was disseminated through social media (Facebook and Twitter), newspapers and posters. Two paid-for advertisements in addition to two news stories were published in Swedish newspapers. Details published included a web address at which a prospective participant could receive in-depth information about the study and register an interest. Connected to this website was a secure, encrypted online interface which the study used for the administration of the screening questionnaires, delivery of the interventions and for communication between the therapists and participants.

Screening

Those who applied to participate provided informed consent and were asked to complete an online screening process which consisted of a series of questionnaires and socio-demographic questions. In addition, all prospective participants received a telephone call

during which a structured assessment using the Mini-International Neuropsychiatric Interview (MINI) 7.0 (Sheehan et al., 1998) was administered. The MINI 7.0 is a concise, structured interview used in diagnostic assessment based on the Diagnostic and Statistical Manual of Mental Diagnostic System Disorders (DSM-5: American Psychiatric Association, 2013). The phone call also assessed suicidality and risk.

Inclusion and Exclusion Criteria

To be included in the study prospective participants needed to: (a) have reported experiencing chronic loneliness and consequent suffering; (b) be at least 18 years old; (c) be able to write, speak and read Swedish; (d) have access to the internet and a computer/smartphone; (e) if applicable, be on a stable regime of psychiatric medication with no changes to this planned during the study; and (f) be willing to participate in the study regardless of their randomisation condition.

Prospective participants were excluded if they: (a) were currently undergoing another psychological intervention; (b) reported severe mental illness which required a more comprehensive treatment response; and (c) presented with a psychiatric comorbidity that the prospective participant reported as their primary concern rather than chronic loneliness.

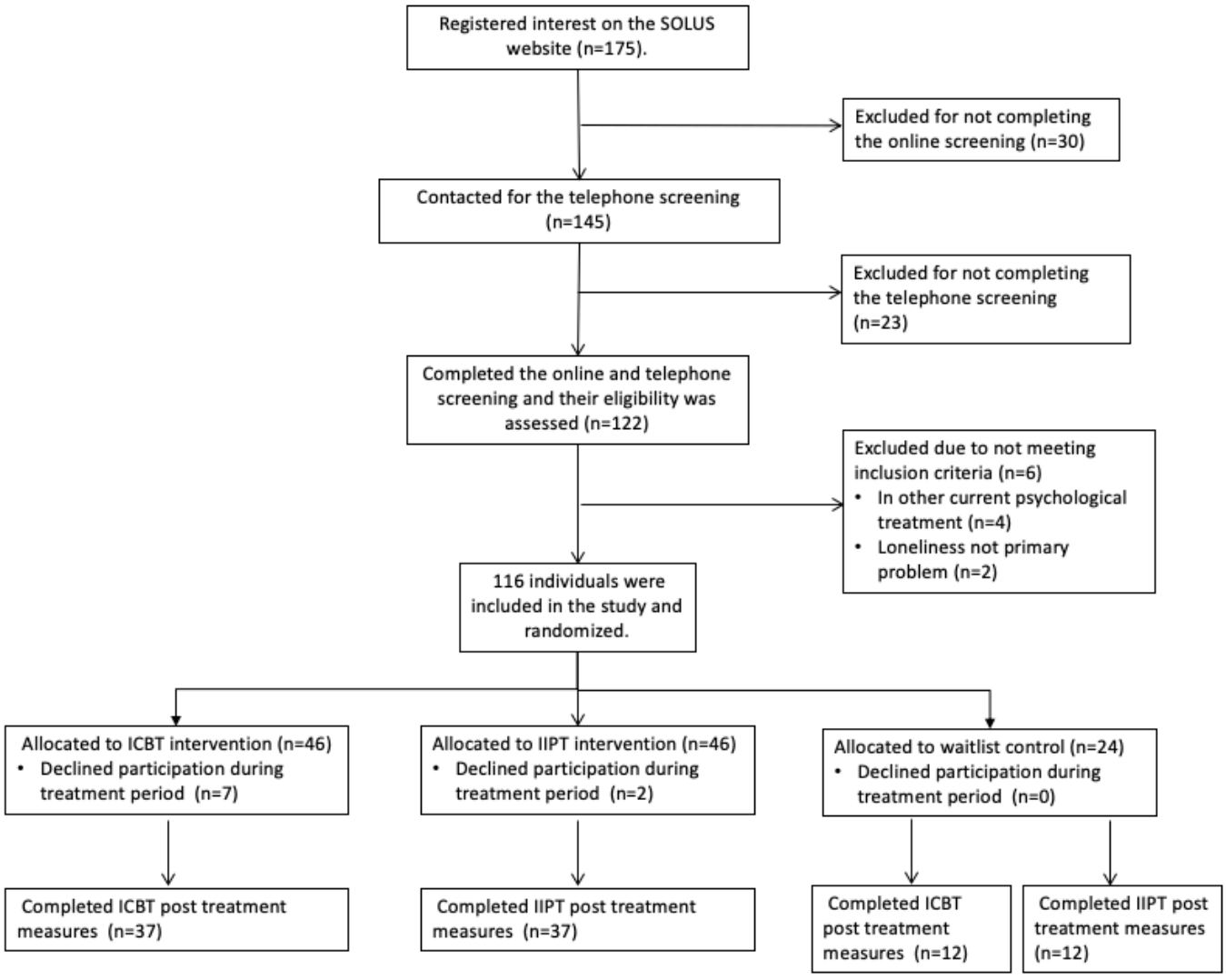
Decisions to exclude unsuitable prospective participants were taken in meetings facilitated by two clinical psychologists. In these meetings, the results from the questionnaires and the structured interviews and the clinical evaluations of the interviewers were discussed. Excluded individuals were signposted to services which could support them with their reported mental health difficulties.

Sample

A total of 175 individuals registered an interest on the SOLUS website, of whom 145 completed the initial screening and were subsequently contacted to arrange a telephone interview. Out of this group, 122 completed the telephone screening. Six prospective participants were excluded: four due to their participation in another, on-going psychological treatment and two due to their primary problem not being loneliness. The final sample size was 116 participants, with 46 randomised to each treatment condition and 24 randomised to the waitlist control condition. (See Figure 1 for CONSORT diagram.) Once the study had ended, the 24 waitlist control participants completed either the IICBT or IIPT interventions.

Figure 1

CONSORT Diagram of Participants in the Study



Randomisation

The 116 participants who were included in the study were randomised at a 2: 2: 1 ratio, meaning that 40% of the participants were randomised to ICBT treatment and 40% to IIPT treatment, with 20% randomised to the waitlist control group. The randomisation was carried out by two independent researchers at Linköping University using the website www.randomization.org. The benefits of randomisation include elimination of selection bias so that the conditions being investigated are balanced with respect to many known and unknown confounding or prognostic variables.

To reduce the risk of participants having a negative response to randomisation, the process of them being allocated randomly to one of two different forms of treatment or to the waitlist condition was described to them both during registration and in the telephone interviews. Participants who were randomised to the waitlist were told that they would be accessing treatment but at a later start date and that they could contact the trial therapists at any point during the waiting period. However, very few made contact with the therapists and, when they did, this was often in relation to the questionnaires which had been administered.

2.3 Measures

Primary Outcome Variable

Loneliness. Participants completed the UCLA Loneliness Scale - Version 3 (UCLA LS3: Russell, 1996), which is a 20-item scale designed to measure subjective feelings of loneliness (See Appendix E). The instrument was translated into Swedish in accordance with Gudmundsson's guidelines (2009), which included a translation/reverse translation procedure. Each item is a statement on a four-point scale which respondents score according to how much they think it is descriptive of them, with the options being 'never', 'rarely', 'sometimes' and 'often'. The UCLA LS-3 has been used extensively in research, including in

treatment studies (e.g., Hopps et al., 2003). Its properties include good test-retest reliability (.73 over a one-year period: Russell, 1996) and high internal consistency (Cronbach's α ranging from .89 to .94). A stringent discriminant validity test demonstrated that loneliness was independent of the influence of other mood and personality variables (Russell, 1996).

Predictor Variables

Demographic. Participants reported their (a) sex; (b) age; (c) civil status; (d) employment status; (e) level of education; and (f) if they had children. All individuals were also asked about their living arrangements including (a) where they lived (large city, small city, town, rural); (b) with whom they lived; and (c) the number of people in their household.

Loneliness specific. All participants were asked to state the duration of their loneliness, if they considered that their loneliness was attributable to a specific event and how old they were when their loneliness started to become a problem.

Past and present mental health difficulties. Individuals were also asked if (a) they had a psychiatric diagnosis; (b) they were currently or previously on medication for their mental health; and (c) they previously received psychological treatment for their mental health.

Specific outcome measures were were translated to Swedish and used to assess for mental health difficulties. All measures were administered at baseline and after the initial treatment period to investigate changes within and between the groups. Measurements will also take place after three months and again after one year to track long-term outcomes.

Depression. Symptoms were measured using the Patient Health Questionnaire-9 (PHQ-9: Kroenke & Spitzer, 2002), in which individuals are asked to rate on a four-point Likert scale from 0 (not at all) to 3 (nearly every day) how often they have experienced particular symptoms over the previous two weeks (See Appendix F). Scores range from 0–27,

with higher scores indicating increased severity symptoms. The PHQ-9 is a validated and psychometrically sound instrument (Kroenke et al., 2001) for measuring the symptoms of major depressive disorder and one that is routinely used in mental health services across the UK. It is reported to be a valid measure of depression severity (Kroenke et al., 2001). It also has adequate specificity (88%) and sensitivity (88%) for detecting major depressive disorder using a cut-off score of ≥ 10 (Kroenke et al., 2001). The PHQ-9 is reported to have good test-retest reliability (r = .84: Kroenke et al. 2001) and internal consistency (α = .89: Kroenke et al., 2001). Additionally, it is sensitive to change (Cameron et al., 2010).

Social Interaction Anxiety. The Social Interaction Anxiety Questionnaire (SIAS: Mattick & Clarke, 1998) was used to assess participants' fear of interacting in social situations. The measure consists of 20 questions relating to distress when initiating and maintaining conversations (See Appendix G). Questions are on a five-point scale where 0 corresponds to "Not at all characteristic of me" and 4 to "Extremely characteristic of me". The instrument has been validated and has good psychometric properties, including high levels of internal consistency (Cronbach's α = .93) and high test-retest reliability (r = .92 over a 12-week period) and good discriminative validity (Heimberg et al.,1992; Mattick & Clarke, 1998). A score above 36 indicates probable social anxiety disorder. Additionally, the SIAS has been shown to respond to change due to treatment (Mattick & Clarke, 1998).

Worry. Symptoms of generalised anxiety and worry were assessed with the Generalised Anxiety Disorder 7-item scale (Spitzer et al., 2006). Participants are asked to rate on a four-point Likert scale from 0 (not at all) to 3 (nearly every day) how often they have experienced particular symptoms over the past two weeks (See Appendix H). Severity ratings are reported at 0–4 (minimal), 5–9 (mild), 10–14 (moderate) and 15–21 (severe). Psychometric properties include good internal consistency of Cronbach's α = .92, a test-retest reliability of .82, along with good specificity and sensitivity (Spitzer et al., 2006).

Additionally, it has good criterion, construct, factorial and procedural validity (Löwe et al., 2008)

Quality of life. This was measured using the Brunnsviken Brief Quality of Life Inventory (BBQ: Lindner et al., 2016). The instrument consists of 12 questions statements describing satisfaction with six areas of life (See Appendix I). Each statement is paired with a follow-up statement describing the importance of the area to quality of life. Respondents indicate the extent to which these statements apply to them on a scale of 0 (Do not agree at all) to 4 (Agree Completely). The convergent validity with the BBQ is satisfactory (Lindner et al., 2016). It also has an internal consistency of Cronbach's $\alpha = .76$ and a high test-retest reliability (ICC = .86).

Behavioural Activation for Depression Scale. The Behavioural Activation for Depression Scale (BADS: Kanter et al., 2007) was used to measure changes in activation and avoidance over the course of behavioural activation (See Appendix J). The BADS consists of 25 items across four subscales: avoidance/rumination, activation, social impairment and work/school impairment. Research on the BADS with an undergraduate sample (Kanter et al., 2007) and a community sample with depressive symptoms (Kanter et al., 2009) found that the BADS demonstrated acceptable psychometric properties, including convergent and discriminant validity as well as internal consistency ($\alpha = .819$).

Interpersonal Competence Questionnaire (ICQ-15). The questionnaire is a self-rating of perceived competence interpersonally. The Interpersonal Competence Questionnaire (ICQ-15: Buhrmester et al. 1988), a 15-item self-report instrument, was used to measure self-rating of perceived competence (See Appendix K). Buhrmester et al. (1988) found that the internal consistency of the ICQ-15 ranged from 0.77 to 0.87, and a series of factor analyses (e.g. Giromini et al., 2016) have confirmed the hypothesised five-factor structure.

Process Measures. The Working Alliance Inventory (WAI-S: Hovarth & Greenberg, 1989) 12 item short form was used to measure therapeutic alliance (See Appendix L). The WAI-S was designed to equally assess: (a) agreement on the goals of therapy; (b) agreement on the tasks of therapy; and (c) development of an affective bond in order to obtain scale scores and a total WAI score (Horvath, 1989). A study evaluating the psychometric properties of the WAI-S in individuals with mental health difficulties in inpatient or outpatient settings found that in both samples reliability ($\alpha > 0.80$) and convergent validity with the Helping Alliance Questionnaire were good ($r > 0.64$) (Munder et al., 2010). A question from The Clinical Global Impressions Scale (CGIS: Guy, 1976) regarding global improvement was asked to assess for participants subjective rating of change in mood and wellbeing. Participants rated on a scale from -3 (very much deteriorated) to 3 (very much improved).

2.4 Procedure

Therapists and Supervision

Four final-year students on the Linkoping University clinical psychology Masters course were the interviewers during the screening phase and the therapists during the treatment phase of the study. The students were trained in the assessment and treatment of mental health difficulties, including cognitive behavioral therapy (CBT) and the MINI-interview. Additionally, they had experience of delivering therapy in clinical practice. The therapists all received additional interpersonal therapy (IPT) training before the start of the study. All of the therapists in the study received supervision fortnightly. The CBT supervision was provided by a clinical psychologist who was one of the authors of the CBT treatment used in the trial. The IPT supervisor was a psychotherapist with a high level of training in IPT and extensive experience of working in a clinical setting. Therapists also had the option of contacting their supervisor between supervision sessions if required.

Interventions

The SOLUS trial interventions were Internet-delivered cognitive behavioural therapy (ICBT) and Internet-delivered interpersonal therapy (IIPT). Each intervention consisted of nine modules. Modules contained text, pictures and interactive assignments related to loneliness and based on the treatment principles of the respective therapeutic approach.

ICBT condition. The content of the ICBT treatment was developed for the earlier SOLUS pilot trial (Kall et al., 2019). The ICBT treatment aims to reduce the distress of loneliness by altering maladaptive social cognitions and avoidant social behaviours and by developing social and communication skills. The key techniques used include psychoeducation, social behaviour activation, exposure to social situations, the challenging of negative automatic thoughts and behavioural experiments (see Appendix C). Participants were assigned a new module each week whether they had completed previous modules or not.

IIPT condition. This treatment was created specifically for the SOLUS 2.0 trial. The treatment was based on the Lipsitz and Markowitz (2013) IPT model for the emergence and maintenance of mental health difficulties through interpersonal problems. There were no existing IPT-based treatments for loneliness and so the IIPT treatment was designed from scratch by experts and clinicians in the fields of loneliness and IPT. IIPT aims to reduce the experience of loneliness by targeting four key interpersonal issues (Law, 2013; Moreau et al., 1991): (a) increasing social support; (b) reducing interpersonal stress; (c) enabling the processing of emotions; and (d) developing interpersonal skills.

The treatment consisted of an introductory phase (Modules One to Three), a middle phase (Modules Four to Eight) and an ending phase (Module Nine). In the initial phase, participants received psychoeducation in IPT principles and loneliness. During the middle phase, participants chose from four focus areas: conflict (selected by 14% of participants),

role change (23%), grief (3%) and interpersonal vulnerability (60%). The ending phase was designed to consolidate knowledge gained over the course of the treatment. See Appendix D for a detailed description of the modules.

Up to and including Module Three, participants were assigned a new weekly module regardless of whether they had completed the previous one. Subsequent modules, which were specifically designed for a focus area, were assigned only after the participant had completed either Module Three or another selected focus area.

3. Results

3.1 Statistical Analyses

The statistical analyses were conducted using IBM SPSS Statistics 25. Descriptive statistics were calculated for all variables. Then the normality of the data and outliers were assessed. An ANCOVA was conducted to test for the effectiveness of the interventions, controlling for baseline scores. This was followed up with t-tests to see if there were significant differences between the intervention conditions.

Following this, missing data were imputed using an expectation-maximisation algorithm. Then, *Least Absolute Shrinkage and Selection Operator* (LASSO: Tibshirani, 1996) regressions were conducted to shrink the number of potential predictors of post loneliness scores to aid variable selection across all conditions, as well as separately for IIPT and ICBT. Multiple linear regressions were then conducted to find a parsimonious model of significant predictors of post loneliness scores.

3.2 Baseline Characteristics

Descriptive statistics were produced for the demographic and clinical variables overall and by condition (See Table 1). Descriptive statistics were also generated for the loneliness-specific measures (See Table 2), psychological outcome measures (See Table 3) and process measures.

3.3 Demographic and Social Variables

The majority of the participants were female (74.1%) and the mean age was 47.1 (*SD* = 17.3). The majority of participants lived alone, were single, did not have children and lived in a big city. Participants were primarily employed (58%) with a university degree (65.5%).

3.4 Clinical Variables

Over half of participants had received psychological therapy in the past. Of those who had received previous therapy the most common type was CBT (41%), followed by counselling (33%) and psychodynamic therapy (19%).

54.3% of participants reported current or previous psychiatric medication use. Based on the Mini-International Neuropsychiatric Interview (MINI) 7.0 (Sheehan et al., 1998) a number of participants would meet the diagnostic criteria for depression (29.3%), social anxiety (22.4%) and generalised anxiety (13.8%).

Table 1

Baseline Demographic and Clinical Variables

		Number of participants			
		IIPT	ICBT	Control	Total
Sex (%)	Woman	37 (80.4)	32 (69.6)	12 (29.2)	86 (74.1)
	Man	9 (19.6)	14 (30.4)	7 (70.8)	30 (25.9)
Mean Age (*SD*)		48.9 (17.8)	46.8 (16.9)	44.1 (17.3)	47.1 (17.3)
Age range		27–80	19–83	21–75	19–83
Location of residence (%)	Large city	25 (54.3)	28 (60.9)	10 (41.7)	63 (54.3)
	Other city	11 (23.9)	6 (13.0)	7 (29.2)	24 (20.7)
	Town	4 (8.7)	4 (8.7)	6 (24.9)	14 (12.1)
	Rural	6 (13.1)	8 (17.4)	1 (4.2)	15 (12.9)
Civil Status (%)	Single	19 (41.3)	21 (45.7)	18 (75)	58 (50.8)
	Married	7 (15.2)	7 (15.2)	1 (4.2)	15 (12.9)
	In a relationship living together	4 (8.7)	3 (6.5)	1 (4.2)	8 (6.9)

	In a relationship not living together	1 (2.2)	4 (8.7)	0 (0)	5 (4.3)
	Other	12 (26.1)	10 (21.7)	3 (12.5)	25 (21.6)
	Widower	3 (6.5)	1 (2.2)	1 (4.2)	5 (4.3)
Residential Status (%)	Alone	34 (73.9)	28 (60.9)	18 (74.9)	80 (68.9)
	With family	5 (10.9)	13 (28.3)	3 (12.5)	21 (18.1)
	With friends	0 (0.0)	0 (0.0)	1 (4.2)	1 (0.9)
	With partner	6 (13.0)	4 (8.7)	1 (4.2)	11 (9.5)
	Other	1 (2.2)	1 (2.2)	1 (4.2)	3 (2.6)
Quantity of people in household	Mean	1.3	1 .9	1.7	1.6
	Min – max	1–4	0–6	0–12	0–12
Has children (%)	Yes, but they don't live at home	16 (34.8)	8 (17.4)	7 (29.2)	31 (26.7)
	Yes, living with me full time	3 (6.5)	7 (15.2)	2 (12.5)	13 (11.2)
	Yes, living with me part time	2 (4.3)	7 (15.2)	0 (0.0)	9 (7.8)
	No	25 (54.3)	24 (52.2)	14 (58.3)	63 (54.3)
Employment (%)	Student	3 (6.5)	5 (10.9)	3 (12.5)	11 (9.5)
	Employed	27 (58.7)	27 (58.7)	14 (58.3)	68 (58.6)
	Unemployed	3 (6.5)	4 (8.7)	1 (4.2)	8 (6.9)
	Internship	1 (2.2)	0 (0.0)	0 (0.0)	1 (0.9)
	Retired	7 (15.2)	10 (21.7)	4 (16.7)	21 (18.1)
	Short-term sick leave	2 (4.3)	0 (0.0)	0 (0.0)	2 (1.7)
	Long term sick leave	2 (4.3)	0 (0.0)	2 (8.3)	4 (3.4)

	Other	1 (2.2)	0 (0.0)	0 (0.0)	1 (0.9)
Highest level of education (%)	No finished education	0 (0.0)	1 (2.2)	0 (0.0)	1 (0.9)
	Primary School	1 (2.2)	0 (0.0)	0 (0.0)	1 (0.9)
	High School Education	7 (15.2)	9 (19.6)	3 (12.5)	19 (16.4)
	University/Higher Education	31 (67.4)	26 (56.5)	19 (79.2)	76 (65.5)
	Other training?	5 (10.9)	7 (15.2)	0 (0.0)	12 (10.3)
	PhD	2 (4.3)	3 (6.5)	2 (8.3)	7 (6.0)
Earlier treatment for a mental illness (%)	No	18 (39.1)	24 (52.2)	15 (62.5)	57 (49.1)
	Yes	28 (60.9)	22 (47.8)	9 (37.5)	59 (50.9)
Previous or current psychiatric medication (%)	Yes	20 (43.5)	28 (60.9)	15 (62.5)	63 (54.3)
	No	26 (56.5)	18 (39.1)	9 (37.5)	53 (45.7)
Presence of psychiatric diagnosis (%)	Depression	16 (34.8)	11 (23.9)	7 (29.2)	34 (29.3)
	Social Anxiety	7 (15.2)	9 (19.6)	7 (29.2)	26 (22.4)
	Generalised Anxiety	7 (15.2)	6 (13.0)	3 (12.5)	16 (13.8)

3.5 Loneliness Variables

Loneliness-specific measures were also assessed. The mean number of years participants reported being lonely prior to the intervention was 10.58 years. There was considerable variation with how long individuals had felt lonely ranging from 0 months to 66 years. Participants were also asked how old they were when loneliness started to become a problem, for which the mean age was 27.22 (*SD*, 20.78). There was also a large variation in response to this question, with individuals reporting loneliness becoming a problem from three years to 83 years old.

Participants were asked if their loneliness was attributed to a specific event. Out of the 116 participants, 52 (44.8%) stated *yes*. When participants said *yes*, they were given a free text box to describe the event or multiple events. This free text response was coded by two independent raters into 14 categories and each response was allocated to at least one category, resulting in 68 responses. There was 100% agreement on the coding. Table 2 below shows the most common events which participants felt resulted in loneliness: divorce or separation from a partner was cited by 20 individuals, with bereavements, personal illness and relocation also common events which led participants to feel lonely.

Table 2

Events that Led to Loneliness

Events that led to loneliness	Number of Participants	Percentage (%)
Divorced or separated	20	29
Relocated	8	12
Bereavement	7	10
Personal illness	6	9
Lost friendships	5	7
Family member moved out	5	7
Difficulty making friends	4	6
Interpersonal difficulties	3	4
Illness in a relative	3	4
Had children	2	3
Retirement	2	3
Seasonal	1	1
Domestic violence	1	1
Not having time	1	7
Total	68	100

3.6 Outcome Measures

The mean and standard deviations for each outcome measure, both pre and post, are shown in Table 3. The means indicate reductions in loneliness, social anxiety, generalised anxiety and depression. They also indicate improvements in quality of life, interpersonal competence and behavioural activation. However, the differences vary by condition and warrant statistical investigation.

Table 3

Mean Values for the Outcome Measures at Pre and Post Intervention

	Pre	Post	Pre	Post	Pre	Post
Outcome Measure	ICBT Mean (*SD*)		IIPT Mean (*SD*)		Control group Mean (*SD*)	
UCLA-LS-3	57.43 (7.34)	50.93 (10.73)	58.59 (7.84)	53.52 (7.75)	60.38 (7.76)	56.90 (8.25)
SIAS	32.76 (16.26)	27.82 (14.81)	35.59 (18.87)	28.78 (16.22)	35.29 (15.84)	32.71 (17.69)
GAD-7	5.89 (4.72)	5.21 (4.24)	7.61 (5.64)	6.82 (4.99)	7.17 (4.91)	7.05 (5.04)
PHQ-9	9.28 (5.32)	6.72 (5.35)	12.13 (6.17)	8.30 (5.23)	12.29 (6.83)	9.03 (6.08)
BBQ	31.59 (17.27)	39.12 (20.11)	32.52 (17.03)	37.49 (17.85)	32.25 (14.04)	29.33 (17.05)
ICQ-15	41.30 (9.55)	44.75 (9.96)	43.26 (8.07)	45.93 (7.24)	42.92 (10.99)	44.75 (10.74)
BADS-12	39.12 (12.15)	20.97 (5.59)	36.33 (10.41)	29.02 (8.20)	36.71 (9.51)	18.72 (6.67)
BADS-A	20.30 (8.98)	25.49 (9.11)	19.50 (7.43)	24.05 (5.90)	19.63 (8.75)	19.31 (8.62)
BADS-SI	18.87 (6.68)	20.97 (5.59)	16.83 (6.91)	21.60 (5.77)	17.08 (6.60)	18.72 (6.67)

Note. SD = the standard deviation. UCLA-LS-3 = UCLA Loneliness Scale–Version 3; SIAS = Social Interaction Anxiety Scale; BBQ = Brunnsviken Brief Quality of Life Scale; PHQ-9 = Patient Health Questionnaire 9- item scale; GAD-7 = Generalised Anxiety Disorder 7-item scale; BADS-12 = Behavioural Activation Depression Scale, BADS-A = Behaviour Activation Subscale, BADS-SI- Social Isolation Subscale

3.7 Process Measures

Working Alliance Inventory scores at week three of the intervention had a mean of 4.80 (*SD* = 1.25) in the IPT condition and 4.69 (*SD* = 1.36) in the CBT condition. The subjective rating of change to mood and wellbeing during the study, measured by one question of the Clinical Global Impression Scale (CGIS), was had a mean of .91 (*SD* = 1.03) in the IPT condition, 1.07 (*SD* = 1.02) in the CBT condition and 0.63 (*SD* = .76) in the control condition.

3.8 Distribution of Data

To assess the normality of the continuous variables distribution, histograms were consulted, in addition to z scores for skew and kurtosis. It was found that there was a non-significant skew for all continuous variables, indicating a normal distribution ($z < 2.58$, $p < .01$) and kurtosis was within acceptable bounds ($z < 2.58$, $p < .01$) .

The continuous variables were also examined for outliers. Boxplots indicated that data points did not deviate more than three standard deviations from the mean of each variable and therefore did not need to be winsorized.

3.9 Attrition and Treatment Adherence

During treatment, seven individuals dropped out of the IIPT condition and two from the ICBT group due to time constraints. The post-treatment outcome measures were sent to all participants and completed by 37 participants (80%) in the IIPT condition and 32

participants (70%) in the ICBT condition. All participants who completed the intervention were contacted after 15 weeks, receiving an email, two reminders and a phone call if they did not respond to the second reminder. This resulted in 57 follow up responses, which was 58.6% of those who completed the interventions.

Participants' treatment adherence was defined as the number of modules complete during the treatment period. A module was categorised as complete when the exercises had been completed and deemed sufficient by the therapist. On average, participants completed 4.6 modules.

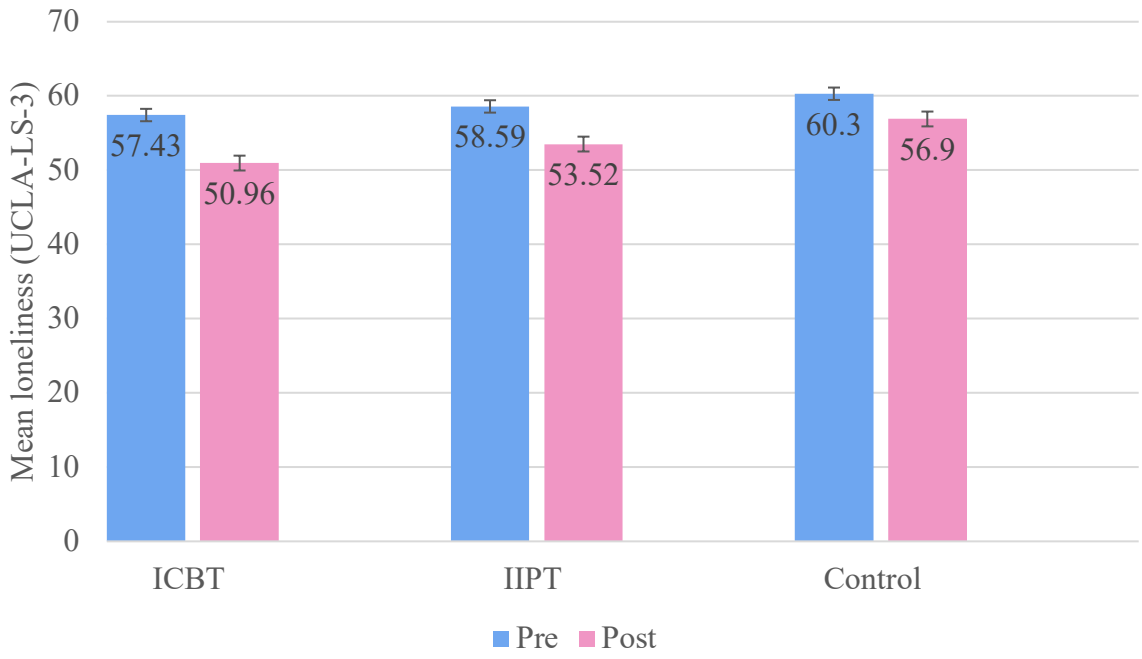
3.10 Effectiveness of the Interventions

A one way independent ANCOVA was conducted to compare the primary measure – loneliness score – across the IIPT, ICBT and control groups, whilst controlling for the influence of baseline loneliness scores.

The ANCOVA found a significant difference between the groups post loneliness scores ($F(2, 86) = 4.22$, $p < .018$), whilst adjusting for baseline loneliness scores. Post hoc pairwise comparisons showed that the ICBT group significantly improved over the control group ($p = .018$). No significant differences were found between the ICBT group and the IIPT group ($p = .718$) or between the IIPT group and control group ($p = .151$).

Figure 2

Mean Loneliness Scores from the Outcome Measure UCLA-LS-3 for Each Condition Pre and Post the Intervention



3.11 Missing Data

A missing value analysis was conducted to see the patterns of missing data. For all of the baseline measures there were no data missing. For post-outcome measures there was between 22.4% and 23.3% of data missing. For the 15 weeks follow up there was 41.4% of data missing for the outcome measures. Little's *Missing Completely At Random* (MCAR: Little, 1988) test was conducted to assess the missingness mechanism. If data were MCAR then this would mean that there were no systematic differences between the missing values and the observed values.

This test was non-significant, indicating that the data were missing completely at random ($\chi 2(51) = 31.06$, $p = 0.99$). Therefore, a sophisticated method for dealing with missing data – multiple random imputation – could be conducted, as the assumption that data were missing at random was met. The incomplete data were then imputed using the

expectation-maximisation method (Schafer & Olsden, 1998). The expectation-maximisation algorithm is a technique for performing maximum likelihood estimation in the presence of missing variables. It first estimates the values for the missing variables and then optimises the model, repeating these two steps until convergence. This method produces unbiased estimates of parameters and standard errors. This resulted in a complete data set with no missing values.

3.12 Predictors of Post Loneliness

In order to explore the predictors of post loneliness score a number of variables were entered into a regression model. As multicollinearity between variables was expected, a Least Absolute Shrinkage and Selection Operator (LASSO) regression (Tibshirani, 1996) was performed in order to exclude variables that did not improve the predictive value and covaried strongly with others.

The LASSO imposes a penalty term that shrinks coefficients towards zero, penalising the sum of the squared regression coefficients. This yields more generalisable prediction equations compared to conventional regression models which are susceptible to overfitting and are less reliable in the presence of multicollinearity. Additionally, the LASSO procedure was combined with optimal scaling (Gifi, 1990), which rescales each predictor using splines in order to model non-linear relationships with the dependent variable.

A k-fold cross-validation approach with ten folds was applied in order to determine the model with minimal expected prediction error. This was applied in combination with the 1 standard error rule (Rodriguez et al., 2009). Cross validation involves randomly dividing the set of observations into k groups (or folds) of an equivalent size. The first fold is treated as a validation set, with the method fit on the remaining k−1 folds (James et al., 2013).

The predictors entered into LASSO models included outcome measures (baseline loneliness (UCLA-LS-3), social anxiety (SIAS), generalised anxiety (GAD-7), depression (PHQ-9), quality of life (BBQ), interpersonal competence (ICQ-15) and behavioural activation (BADS), demographic (sex, age, civil status, employment rate, level of education, where they live (large city, small city, town, rural), whom they live with and if they have children), clinical (probable diagnosis of depression, generalised anxiety disorder or social anxiety, they were currently or previously on medication for their mental health and if they had previous psychological treatment for their mental health), process (subjective rating of change in mood and wellbeing as measured using an item on the CGIS and working alliance questionnaire – WAI) and loneliness specific (duration of loneliness, if loneliness is attributable to a specific event and how old they were when their loneliness started to become problematic).

Whole Sample Predictors

The adjusted R^2 calculated for all 29 predictors was .649, indicating that these variables explained 64.9% of the variance in post loneliness scores. The adjusted R^2 for this model only increases if variables improve the model above what would be obtained by chance.

It was found that the selected optimal model, which incurred a penalty of .140 had shrunk the number of potential predictor variables from 29 to 16 (See Figure 3), aiding variable selection. The demographic predictors that remained were: who participants were living with, occupation and level of education. The psychological outcome measure predictors that remained were: pre loneliness, pre worry, pre avoidance on the behavioural activation for depression scale and pre social interaction anxiety. The loneliness-specific measures that remained were: onset of loneliness and duration of loneliness. Clinical variables based on the MINI that remained were: depression diagnosis, social anxiety

diagnosis and generalised anxiety diagnosis. Process variables that remained were working alliance at week three and subjective positive rating of change in mood and wellbeing during the study.

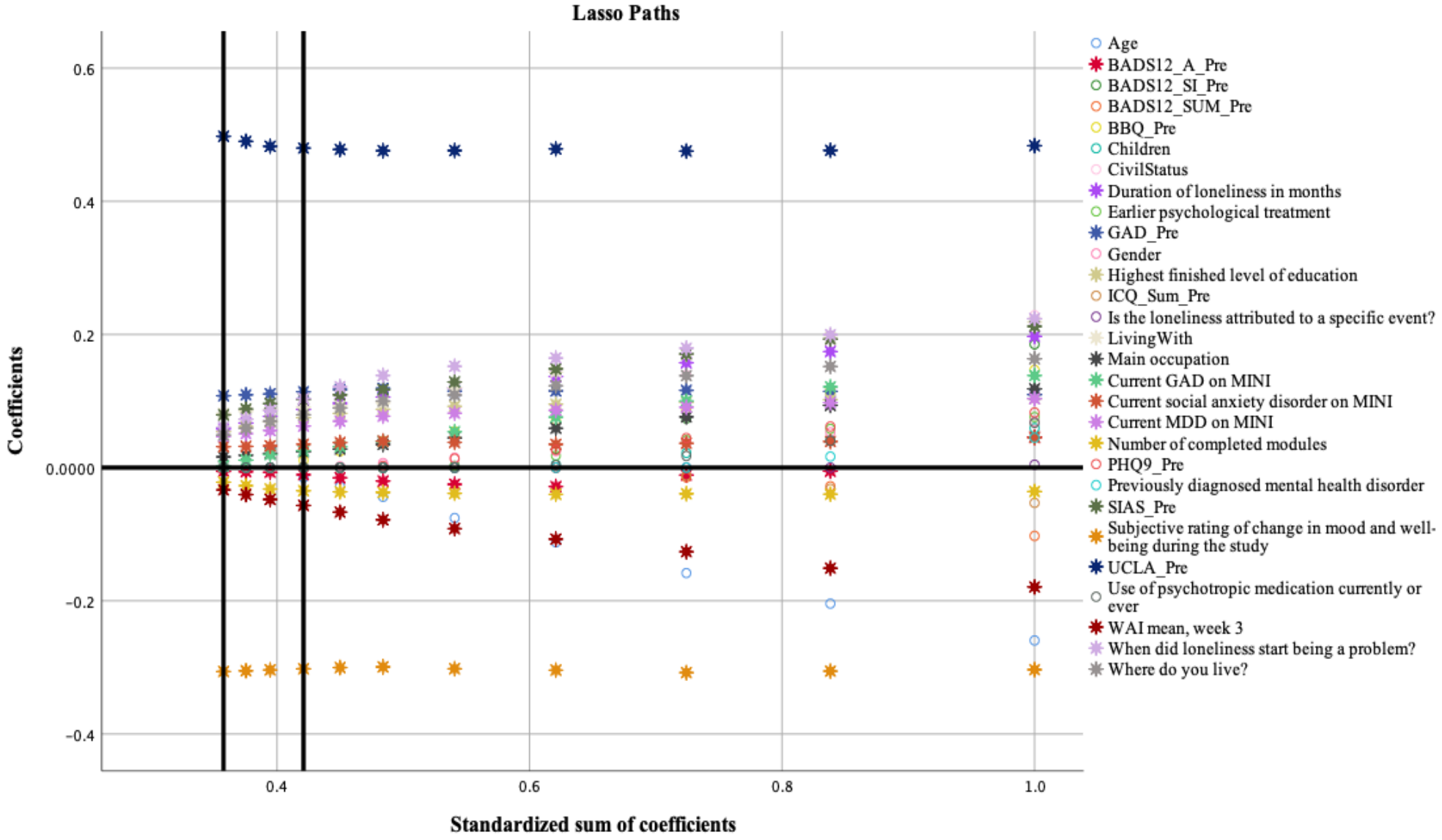
Following the LASSO regression, aiding variable selection by reducing the number of predictors from 29 to 16, the 16 remaining predictors were entered into a multiple linear regression with the aim of finding a set of parsimonious significant predictors of post loneliness scores. The final model found that pre loneliness, pre worry and subjective rating of change in mood and wellbeing accounted for a significant amount of the variance in post loneliness (Adjusted $R^2 = .689$; $F(3,112) = 85.74$, $p < .001$).

The partial regression coefficients show that pre loneliness had a significant positive relationship to post loneliness (B = .74, β = .60, $t(112) = 10.97$, $p < .001$). Pre worry scores were also independently positively associated with post loneliness (B = .36, Beta = .10, $t(112) = 3.62$, $p < .001$) and subjective positive rating of change in mood and wellbeing had a negative significant independent association with post loneliness (B = -4.71, β = .563, $t(112) = -8363$, $p < .001$). This indicates that higher pre loneliness or pre worry predicted higher post loneliness and that if participants subjectively thought there was a positive change in their mood and wellbeing this predicted lower post loneliness scores across all conditions.

Figure 3

LASSO Regression Graph for the Overall Sample

Note. Stars indicate selected predictors, circles indicate predictors shrunk to 0.



CBT Predictors

The initial adjusted R^2 for all predictors was .782, indicating that these variables explained 78.2% of the variance in post loneliness scores in the CBT condition.

It was found that the selected optimal model, which incurred a penalty of .100 had shrunk the number of potential predictor variables from 29 to 16 (See Figure 4), aiding variable selection. The demographic predictors that remained were: gender, where participants lived, civil status, who participants were living with, whether they had children, occupation and level of education. The psychological outcome measure predictors that remained were baseline levels of: loneliness, worry, avoidance on the behavioural activation for depression and social interaction anxiety. Clinical variables remaining were: depression diagnosis, social anxiety diagnosis, generalised anxiety diagnosis and psychiatric medication. Process variables remaining were: working alliance at week three and subjective rating of change in mood and wellbeing.

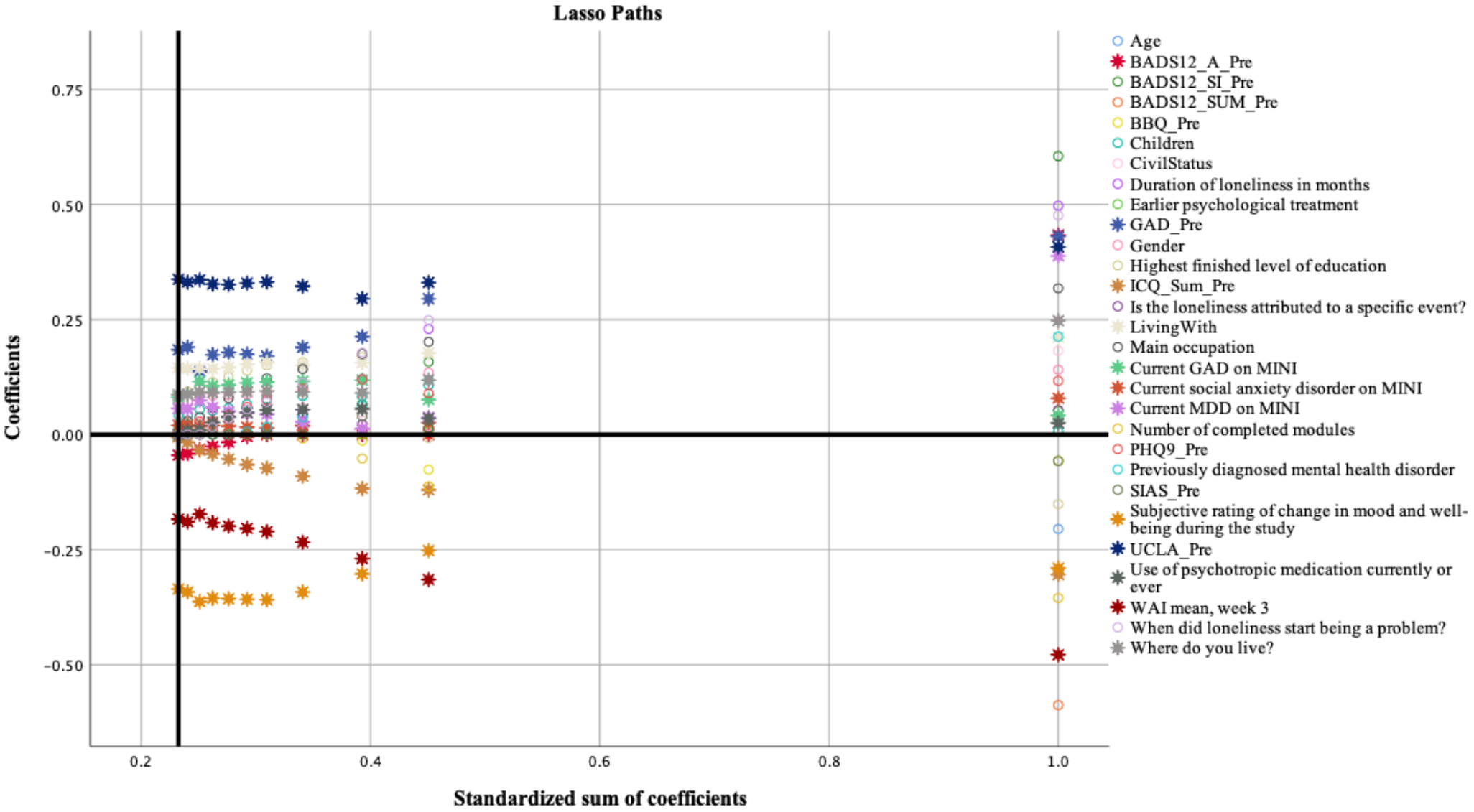
A multiple linear regression was conducted on the 16 predictors selected by the LASSO regression. It was found that the optimal model of significant predictors included pre loneliness, depression diagnosis, generalised anxiety disorder diagnosis, subjective rating of change in mood and wellbeing, gender and whether participants had children. These variables accounted for a significant amount of variance in post loneliness scores (Adjusted $R^2 = .85$; $F(6,39) = 41.85$, $p < .001$).

The partial regression coefficients showed that pre loneliness (B = .67, β = .46, $t(113) = 7.19$, $p < .001$), depression diagnosis (B = 7.18, β = .29, $t(113) = 4.52$, $p < .001$), generalised anxiety diagnosis (B = 4.19, β =.14, $t(113) = 2.24$, $p = .031$) and gender (B = 4.02, β = .17, $t(113) = 2.81$, $p = .008$) all had positive, significant, independent associations with post loneliness. Therefore, having higher baseline loneliness, a depression or generalised anxiety diagnosis or being male predicted higher loneliness scores post CBT intervention.

Figure 4

LASSO Regression Graph for the CBT Condition

Note. Stars indicate selected predictors, circles indicate predictors shrunk to 0



Subjective rating of positive change in mood and wellbeing [B = -6.52, β = .71, $t(113) = -9.17$, $p < .001$] and whether participants had children [B = -1.33, β = .57, $t(113)$, $p < .023$] both had negative, significant, independent associations with post loneliness. This indicates that individuals with children and who had rated a positive change were predicted to have lower loneliness scores post CBT intervention.

IPT Predictors

The initial adjusted R^2 for all variables was .690, indicating that these variables explained 69.0% of the variance in post loneliness scores in the IPT condition. It was found that the selected optimal model, which incurred a penalty of .100 had shrunk the number of potential predictor variables from 29 to 16 (See Figure 5), aiding variable selection.

The demographic predictors that remained were: where participants lived, civil status, who participants were living with, occupation and level of education. The psychological outcome measure predictors that remained were: baseline levels of loneliness, total behavioural activation for depression scale score, avoidance subscale on the behavioural activation for depression scale and previous psychological treatment. Loneliness specific variables remaining were: duration of loneliness and if loneliness was attributed to a specific event. Clinical variables remaining were: social anxiety diagnosis and generalised anxiety diagnosis. Process variables remaining were: working alliance at week three, number of modules completed and subjective rating of change in mood and wellbeing during the study.

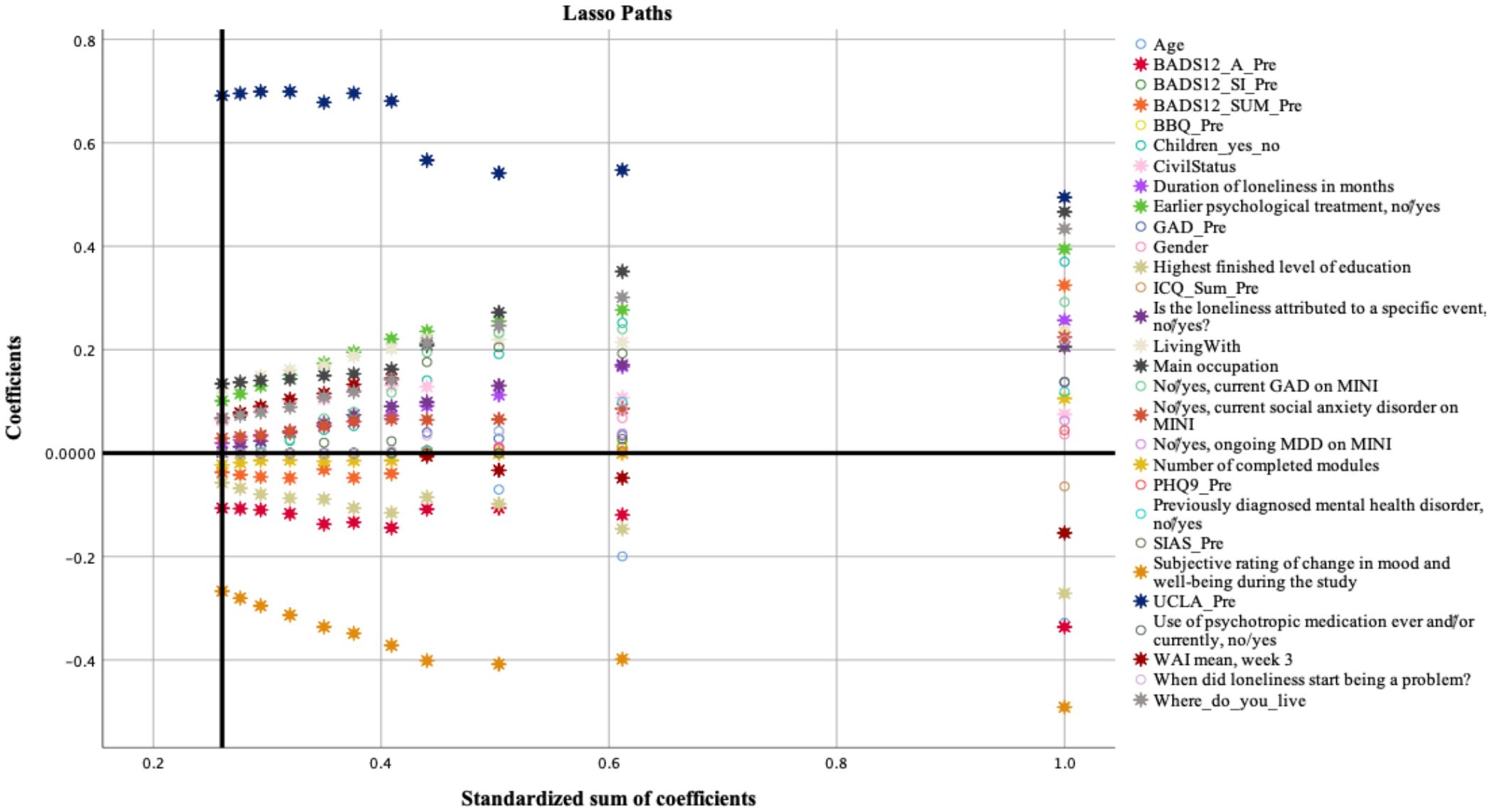
A multiple regression was conducted on the 15 predictors selected by the LASSO regression. It was found that the optimal model of significant predictors included pre loneliness, previous psychological treatment and subjective rating of change to mood and wellbeing. These variables accounted for a significant amount of variance in post loneliness scores (Adjusted $R^2 = .76$; $F(3,42) = 48.38$, $p < .001$).

The partial regression coefficients showed that pre loneliness (B = .801, β = .073, $t(113) = 10.97$, $p < .001$) had a positive, significant, independent association with post loneliness. This means that higher loneliness scores at baseline predict higher loneliness scores post IPT intervention. Subjective rating of positive change to mood and wellbeing (B = -2.89, β = -.334, $t(113) = -4.50$, $p < .001$) and whether participants had previous psychological therapy (B = -2.57, β = -.163, t(113), $p < .034$) both had negative, significant, independent associations with post loneliness. Therefore, individuals who had previous psychological therapy and those who subjectively rated a positive change in their mood and wellbeing were predicted to have lower post IPT loneliness scores.

Figure 5

LASSO Regression Graph for the IPT Condition

Note. Stars indicate selected predictors, circles indicate predictors shrunk to zero



4. Discussion

4.1 Summary and Interpretation of Results

This study is the first in the field of loneliness to comprehensively examine a range of potential outcome predictors for internet-based psychological treatment for loneliness across social/demographic, clinical, outcome measure, loneliness-specific and process domains. It does so by investigating data from the SOLUS 2.0 RCT: (a) across all conditions; (b) specifically in the ICBT condition; and (c) specifically in the IIPT condition. Preliminary analyses were conducted to assess the effectiveness of the two interventions.

Effectiveness Results

The effectiveness analyses found that loneliness scores in the ICBT group were significantly improved compared to the control group. However, there were no significant differences between the ICBT and IIPT groups or between the IIPT group and the control group. This indicates that ICBT was effective at reducing loneliness. The IIPT condition, despite being more effective than the control condition, was not significantly so.

The effectiveness of ICBT found in the SOLUS 2.0 trial adds to previous findings from the SOLUS pilot trial (Käll et al., 2019) that ICBT significantly reduces loneliness, with this reduction maintained at two-year follow up (Käll, Backlund & Shafran, et al., 2020). Taken together, the RCTs provide confidence in the effectiveness of Internet-delivered CBT for reducing chronic loneliness.

Predictors of Loneliness Outcome Across all Conditions

In relation to its primary aim of establishing predictors of loneliness outcome across all conditions, this study found that higher baselines of loneliness and anxiety significantly

predicted higher post loneliness scores. In addition, participants' subjective rating of change in mood and wellbeing over the course of the intervention significantly predicted lower post loneliness scores.

Baseline loneliness levels predicting higher loneliness post intervention is in line with previous research on loneliness (Cohen-Mansfield et al., 2018) and depression (Warmerdam et al., 2013). Individuals' subjective rating of positive change to their mood and wellbeing predicting lower post loneliness demonstrates that being part of a loneliness intervention results not only in reduced loneliness but also in improved mood more generally. Loneliness interventions having secondary benefits is supported by previous research that has found associations between psychological interventions for loneliness and (a) reduced social anxiety (Käll, et al., 2019); (b) fewer GP visits (Haslam et al., 2019); (c) improved feelings of belonging to multiple groups (Haslam et al., 2019); (d) perceived increases in social self-efficacy (Alaviani et al., 2015); (e) reduced depression (Mascaro et al., 2018); (f) increased compassion (Mascaro et al., 2018); and (g) improved quality of life (Käll, et al., 2019).

The study's finding that higher anxiety, as measured using the GAD-7 questionnaire (Spitzer et al., 2006), predicted higher post loneliness indicates that overcoming loneliness may be particularly challenging for individuals suffering with anxiety. An explanation for this could be the commonality in the core maintaining intrapersonal and interpersonal processes of anxiety and chronic loneliness. Existing literature suggests that individuals with high anxiety and loneliness are more likely to process social information as threatening and engage in avoidant, self-protective safety behaviours (Cacioppo & Hawkley, 2009; Clark & Wells, 1995) which maintain pre-existing negatively-biased beliefs about the self and others, as well as feelings of anxiety and loneliness (Cacioppo et al., 2009; McManus et al., 2008).

4.2 Predictors of Loneliness Outcome in the ICBT Condition

It was found that having higher baseline loneliness, a depression or a generalised anxiety diagnosis, or being male, significantly predicted higher loneliness scores post ICBT intervention. Factors that significantly predicted lower loneliness scores post ICBT intervention were having children and subjective ratings of positive change in mood and wellbeing.

The bidirectional nature of the relationships between chronic loneliness, depression and anxiety (Cacioppo, Hawkley & Thisted, 2010; Lim et al., 2016) may result in significant barriers for people experiencing loneliness when they attempt to break out of a chronic loneliness cycle. In the SOLUS 2.0 study, those barriers may have been more problematic in the ICBT condition as participants had lower belief in the rationale for ICBT than they did in the rationale for IIPT. Lower belief in treatment rationale is linked to negative therapy outcome (Carter et al., 2006). It is plausible that participants had a lower belief in ICBT as many of them reported that they had previously received CBT and it may not have resulted in desired improvements. By contrast, no participants stated that they had received IPT in the past. As a result, those in the IIPT condition may have been more optimistic about the "new" approach and its strategies and therefore more engaged, resulting in improvements in their loneliness outcome. This is supported by the finding that those in the IIPT group who had previously received CBT had better outcomes.

Being male was another predictor of worse loneliness outcome in the ICBT condition. This finding may be explained by recent research by Barreto and colleagues (2020) which found that loneliness was more prevalent, intense and long standing in men, especially younger men living in individualistic cultures. A possible explanation for men’s higher loneliness could be that men feel more stigma related to loneliness and so are more reluctant than women to disclose such experiences and access support (Borys & Perlman, 1985;

Pinquart and Sörensen, 2001a). This may be linked to the male gender role norms of 'toughness', lack of emotional expression and self-reliance that are incompatible with expressions of emotional distress (e.g., Addis & Mahalik, 2003; Michniewicz et al. 2015). The hypothesis that men are less likely to seek support for loneliness is supported across this thesis: 74.1% of participants in the SOLUS 2.0 trial were female as were 62.54% of all participants across the 25 studies included in the systematic review.

Why men fared less well in the ICBT condition but not in the IIPT condition warrants further exploration as the result is inconsistent with previous research. A large meta-analysis of RCTs found that gender did not moderate differential responses to CBT in comparison to medication for depression, whilst a study comparing ICBT and IIPT for depression found that female gender predicted better outcome regardless of condition (Donker Batterham & Warmerdam et al., 2013). A possible explanation for why men responded well to IIPT is that men often have smaller and less active social networks (Pinquart and Sörensen, 2001b). IPT techniques which specifically aim to increase contact with social networks and improve relationships may be more advantageous for men than CBT techniques focusing on perceptions and cognitions. Future research needs to include consultation with lonely men to consider with them how to reduce stigma, increase access to treatment and establish what they would value in a loneliness intervention.

Lastly, having children was found to be a predictor of lower loneliness specific to the ICBT condition. There has been a limited amount of research on the impact of having children on adult loneliness (Stack, 1998). One finding of interest is that, whilst the amount of contact between older adults and their children is unrelated to loneliness, poor quality relationships between older adults and their children is positively correlated (De Jong-Gierveld et al., 1987). If lonely individuals have poor quality relationships with their children then CBT strategies, such as behavioural activation to encourage individuals to overcome

avoidance, may result in lonely parents reconnecting with their children and fostering better relationships, resulting in lower loneliness post intervention. It may also have been, that parents had more opportunities to implement the CBT strategies for reducing loneliness and complete the homework tasks as they had children with whom they could practise the strategies.

4.3 Predictors of Loneliness Outcome in the IIPT Condition

It was found that higher loneliness scores at baseline predicted higher loneliness scores post IIPT intervention. Additionally, individuals who had received previous psychological therapy, as well as those who subjectively rated a positive change in their mood and wellbeing, were predicted to have lower post IIPT loneliness scores.

The key finding here is that previous psychological treatment was a predictor of lower post loneliness in the IIPT group. As already noted, many participants in the SOLUS 2.0 trial had previously received CBT, but none reported having received IPT. Since IPT was novel to them, participants may have had more belief in it as a treatment rationale, this being linked to positive therapeutic outcome (Carter et al., 2006). Additionally, the previous therapy may have given participants CBT strategies and insight into their difficulties, which could be supplemented by IPT strategies which addressed different maintaining mechanisms, this combination resulting in a reduction in loneliness.

A potential strength of IPT for individuals who have had previous therapy is that, of its four focal areas – interpersonal role dispute, role transition, grief and interpersonal deficits (Law, 2013; Moreau et al., 1991) – one is targeted based on an individual's need. This means that the intervention can be more personalised to an individual's specific experience, which is in line with research suggesting that intervention focus alone is unlikely to influence the

effectiveness of a loneliness intervention for adults unless that focus is tailored to the needs of the individual (Victor et al., 2018).

Overall, there are different predictors of loneliness outcome for CBT and IPT, as found in research on depression (Donker Batterham & Warmerdam et al., 2013). In the SOLUS 2.0 trial, ICBT was significantly effective in reducing loneliness whereas IIPT's reduction of loneliness did not meet statistical significance, although it was more helpful for individuals who had received previous therapy. Additionally, CBT was particularly helpful for those with children but less effective for men and individuals with co-occurring depression or anxiety. Applying these findings in clinical settings should be useful in informing treatment allocation to optimise outcomes. Future research should consider how CBT for loneliness can be adapted to be more effective for men and those with mental health difficulties.

4.4 Strengths and Impact

A key strength of this study is that it is the first to examine a range of social/demographic, clinical, outcome measure, loneliness-specific and process variables as potential predictors of loneliness treatment outcome in internet-based psychological interventions. It used state-of-the-art machine learning approaches to optimise variable selection and improve the accuracy and generalisability of findings (Yang et al., 2019). Its results represent a significant advance in the field of loneliness treatment as previously very little was known about which factors predict who will benefit most, or least, from any given intervention. This information is the starting-point for a unifying framework that can begin to answer the question of what works for whom in loneliness.

Additionally, the findings can help to inform loneliness treatment allocation and consequently lead to improvements in individuals' outcomes. For example, it was found that

individuals with anxiety and depression are likely to respond less well to CBT, valuable information which highlights a need for a modular approach to loneliness interventions and cautions against a one-size-fits-all model. Käll, Shafran and colleagues (2020) have developed a modular CBT approach with multiple treatment pathways for chronic loneliness and its associated mental health disorders. This modularity could be particularly beneficial given the heterogeneity of lonely individuals and the changes in loneliness that occur across the lifespan (Victor, 2018). Future research on predictors could further help to inform which pathway and modules individuals should take to target the key mechanisms that are maintaining their specific experience of loneliness.

Another strength of the research is that the data analysed came from a high quality RCT. Methodological strengths of RCTs include the elimination of bias in treatment assignment and minimisation of confounding variables. An important factor that differentiates this RCT from other studies of interventions for loneliness is that it specified in its inclusion criteria that individuals needed to be experiencing chronic and distressing loneliness. Furthermore, the sample included participants across the adult lifespan and individuals with mental health difficulties. The findings of this study are, therefore, more likely to generalise to adults who are suffering with chronic loneliness in the population. Much of the existing work on loneliness has been conducted with older adults without chronic loneliness being an assessed feature.

The interventions considered in the study are innovative. They were created for the purpose of the SOLUS trial by experts in the fields of CBT, IPT, loneliness and online interventions. Additionally, the RCT not only compared ICBT with a control but with a novel psychological intervention which had promise for alleviating loneliness (IIPT). The result – that ICBT was more effective than IIPT – provides further confidence in CBT as an evidence-based treatment for loneliness.

The internet-based delivery of the psychological interventions in the SOLUS 2.0 trial is an additional strength as computer and mobile technology have become popular formats for the implementation of interventions (Chandrashekar, 2018). By providing these treatments online, a large number of lonely individuals can be treated, including those in hard-to-reach groups who may have significant barriers to accessing services (Andersson & Titov, 2014; Cuijpers et al., 2008).

The finding that ICBT is effective at alleviating loneliness is of particular relevance given that the number of individuals in the UK now experiencing loneliness has doubled due to the COVID-19 pandemic (Mental Health Foundation, 2020). Evidence-based interventions that can be disseminated widely through technological means are needed in these unprecedented times when conventional treatment delivery is vulnerable to disruption.

4.5 Limitations

Certain limitations of the predictor analyses and of the SOLUS 2.0 trial need to be taken into consideration. The choice of variables selected as potential predictors was based on existing available research on predictors of loneliness and treatment outcome that emerge when CBT and IPT are used for depression. However, this analysis could be improved by including a wider range of clinical or demographic variables known to be associated with outcomes for CBT and IPT for other disorders (Chekroud et al., 2016).

An element of an intervention's success is that it is able to engage participants so that they are motivated to complete the treatment. A limitation of the SOLUS 2.0 trial is that there were differences in attrition rate by condition, with the highest rate in the CBT condition. Previous research has shown that common reasons for dropout include early gains, dissatisfaction with the treatment or the therapist and changes in circumstances (Bados et al., 2007). Whilst drop-out in the ICBT condition was around 30%, which is lower than the

median attrition of 56% found in a review of ICBT studies (Waller & Gilbody, 2009), it remains important to understand the levels of attrition encountered by the trial so that adaptations can be made for the future. This could done through consultation with both with participants who completed their intervention and those who did not in order to establish which aspects they found helpful and which in their view needed improvement.

A further weakness of the SOLUS 2.0 trial was that the loneliness scores of the control group reduced from pre to post measurement despite individuals choosing to have minimal contact with the therapists whilst they were waiting. This finding means that positive changes in the loneliness scores of the intervention groups cannot be fully attributed to the active interventions. Potential explanations for positive changes in the control group's mean loneliness scores could be that the administered questionnaires and interviews were perceived as normalising and validating participants' experiences of loneliness or that these led participants to reflect on their loneliness and as a result make changes to their interpersonal interactions. A natural reduction in loneliness in the control group during the pilot SOLUS trial (Käll et al., 2019) also took place, supporting this hypothesis. The pattern of change in the control group may also be a function of regression to the mean (Barnett et al., 2005), a statistical phenomenon which occurs when unusually small or large scores are followed by scores that are closer to the mean, making natural variation in repeated data look like change caused by another variable.

Additionally, there are limitations to the tool used to measure loneliness used in the trial, the UCLA Loneliness Scale–Version 3 (UCLA-LS-3: Russell, 1996). Although this established tool for measuring loneliness gathers data on how frequently loneliness is felt, it fails to capture the intensity, duration and impact of loneliness. This is a significant weakness as a latent class analysis of loneliness experiences found duration and intensity to be important factors in understanding individuals' experience of loneliness (Qualter et al., 2020).

In response to this, Barreto, Qualter and colleagues (2020) supplemented the UCLA-LS-3 with additional questions regarding the intensity and duration of loneliness. The information they collected in this way was insightful as it indicated that young men living in individualistic cultures were more vulnerable to frequent loneliness and also to more intense and persistent loneliness. Future research should consider the intensity and duration of loneliness in order to establish trajectories.

4.6 Future Research

One issue with the existing literature on predictors is that it focuses mainly on the effect of individual predictors of treatment outcome. By using machine learning statistical procedures, future research will be able to analyse large multivariable datasets in order to establish multiple predictors and moderators and make more robust and powerful predictions regarding which treatment is most likely to result in positive outcomes for a given patient (Cohen & DeRubeis, 2018; Delgadillo & Gonzalez Salas Duhne, 2020; Wallace et al., 2013).

An innovative approach to doing this is the Personalized Advantage Index (PAI), proposed by DeRubeis and colleagues (2014), which uses algorithms to predict the treatment likely to produce a better outcome for a given patient. PAI provides an estimate of the magnitude by which a treatment is predicted to outperform another for an individual patient (DeRubeis et al., 2014). In a randomised controlled trial, one way of testing the utility of this approach is to compare the outcomes of those who have been randomly assigned to their optimal treatment with the outcomes of those assigned to a non-optimal treatment. The PAI approach has already shown promise as a way of predicting differential outcomes to interventions in studies comparing CBT and IPT for depression (Cohen & DeRubeius, 2018). A PAI approach for loneliness would be a logical next step for future research in this area.

For this to happen, though, there will need to be more large-scale RCTs of empirically validated interventions.

Given that the SOLUS 2.0 RCT was conducted in Sweden, future research should seek to replicate the predictors for loneliness treatment outcome identified in this study in different cultural contexts. Recent research shows that certain predictors are common across cultures whereas others appear to be culturally-bound (e.g., in terms of gender: Barreto et al., 2020). When replicating intervention studies in different cultures, it is key to ensure that the content and format of the intervention are culturally responsive, with one meta-analysis finding that mental health interventions delivered to specific cultural groups were four times more effective than interventions provided to groups consisting of individuals from a number of cultural backgrounds (Griner & Smith, 2006).

Future research should also compare CBT for loneliness with a wider range of other active treatments, both social and psychological, which have shown promise as interventions for loneliness. Additionally, it would be useful to incorporate a qualitative focus to examine (a) the acceptability of the interventions; (b) which factors participants understand to be most important in predicting therapeutic outcomes; and (c) which elements of interventions are found to be most helpful.

A key goal for future research would be to adapt the ICBT intervention designed by the SOLUS team for young people. The majority of interventions for loneliness target adult participants even though loneliness has the same negative consequences for the mental health of children. (Hawkley & Capitanio, 2015.) The first meta-analysis for interventions for loneliness in young people found that interventions were shown to reduce loneliness though these often targeted young people viewed to be at risk – for example children with physical health concerns or a learning disability – and rarely young people who reported loneliness

(Barreto et al., 2020). Future work should be designed specifically for young people suffering from chronic loneliness.

4.7 Conclusion

This study has examined the predictors of treatment outcome for loneliness in an internet-based RCT. Across all conditions, higher baseline loneliness and anxiety predicted higher post intervention loneliness, and subjective ratings of positive change in mood and wellbeing predicted lower loneliness. In the ICBT condition, existing diagnoses of anxiety and depression, as well as being male, predicted worse outcomes whilst having children predicted better outcomes. In the IIPT condition, having previously received psychological treatment predicted better outcomes. It was also found that ICBT was significantly more effective at reducing loneliness than IIPT or the control condition.

Taken together, these findings advance understanding of what works for whom in the field of loneliness treatment and research. Future research should develop the current work further by using a PAI approach, gaining qualitative insights from those with lived experience of chronic loneliness, and adapting interventions to make them culturally fitting and suitable for those under 18.

Part IV. Integration, Impact and Dissemination

1. Integration

There are two interrelated parts to the research: (a) a systematic review and meta-analysis and (b) an empirical study. The review was designed to address the question, 'Are psychological interventions effective in alleviating loneliness?' while the empirical study explores, 'What are the predictors of treatment outcome in psychological therapy for loneliness?'. Each is distinct, but both share a common aim: to examine what works for whom in the area of psychological interventions for loneliness.

The systematic review synthesised 25 randomised controlled trials (RCTs), of which 21 were included in the meta-analysis. It found that a range of psychological interventions were effective in reducing loneliness. However, the moderator analyses explained only a limited amount of the heterogeneity in the effectiveness and found differences between types of psychological interventions that warranted further investigation. This supported the rationale for establishing a more in-depth understanding of what characteristics influence how well an individual responds to psychological interventions. The empirical study addresses this gap by analysing data from a RCT which directly compared two psychological interventions for loneliness with a control group and explored heterogeneity in outcomes by examining a range of potential predictors. A range of significant predictors were found, including differential predictors for the two psychological interventions, thereby explaining some of the heterogeneity in outcomes. Additionally, the empirical study built on the meta-analysis by finding that Internet-delivered cognitive behavioural therapy was significantly more effective at alleviating chronic loneliness than a control condition.

A conceptual link between the review and the empirical study is found in the relationship between loneliness and mental health difficulties. The systematic review included a number of studies that targeted individuals with mental health difficulties (Fukui

et al., 2003; Haslam et al., 2019; Jarvis et al., 2019; Ransom et al., 2008). Many referenced the strong bidirectional relationship between mental health difficulties and chronic loneliness as the rationale for their intervention. In the empirical study, examination of predictors found that across all conditions higher baseline anxiety was associated with higher loneliness post intervention. Furthermore, in the CBT condition, but not in the IPT condition, anxiety and depression diagnoses at baseline predicted a worse outcome for individuals. So not only do the systematic review and empirical study highlight the complex relationship between mental health and loneliness, they also underline the need to consider co-occurring mental health problems when offering a loneliness intervention, in line with the transdiagnostic model of loneliness and associated modular approach for the treatment of chronic loneliness (Käll, Shafran & Lindegaard, et al., 2020).

An avenue for future research, which may help to consolidate the links between the meta-analysis and the empirical study in the thesis, would be a further meta-analysis with expanded inclusion criteria to bring in RCTs of psychological interventions with loneliness as a secondary measure. Such an expansion would capture more studies and may allow for subgroup analysis by type of intervention as well as providing further insight into links between mental health difficulties and their impact on loneliness treatment outcome.

Challenges and Dilemmas

Systematic Review. An initial obstacle encountered was the discovery from a search of PROSPERO that another research team was planning on conducting a systematic review in the same area. In response, and to ensure novel research, I considered alternative topics, such as a review of predictors of loneliness outcome with psychological interventions, which would have had a high degree of synergy with my empirical study. However, early searches found little research in this area, leading to the conclusion that it would not be a fruitful topic

to synthesise. The issue of originality later resolved itself when I learnt that the other research team was planning its systematic review with a range of alternative inclusion criteria, such as: only including other reviews rather than individual studies, using different search terms, searching different databases in relation to a different time frame and not meta-analysing the data.

Once work was under way, an early challenge was ensuring thoroughness of searches. When I ran the searches on the databases I wanted to be certain that I was not missing any papers of interest. It was an iterative process refining the search terms, incorporating MESH and exploding terms to maximise the likelihood of all relevant papers being retrieved. This led to the subsequent challenge of reviewing, with my second coder, over 3,000 abstracts and 78 full texts in a reliable manner that was consistent and true to the inclusion criteria. One particular criterion — that studies should have loneliness either as a primary outcome or as part of the primary construct — was challenging to implement as many studies included loneliness as one of a number of outcomes and it was not clear which of these were primary and which secondary. Additionally, deciding whether loneliness was part of a primary construct such as recovery felt open to subjective interpretation and therefore problematic. However, introducing a third reviewer provided clarity in areas of uncertainty.

Empirical Study. One of the major challenges to my empirical study was that the project on which it was to be based did not take place as planned. The SOLUS 2.0 trial was due to be held in the UK as a collaborative project between Linkoping University in Sweden, University College London (UCL) and Royal Holloway University. I had been involved in the planning and ethics proposal submitted to UCL and was due to be the trial's UK coordinator, involved in all active stages of the research, including recruiting, screening and working as a therapist on the trial alongside colleagues from UCL and Linkoping University.

My unique contribution was going to be statistical analyses looking at the impact of age and loneliness chronicity on treatment outcome. However, the UCL ethics committee needed revisions which would have delayed the project which would have been problematic as the trial therapists were psychology students who were due to graduate in the summer of 2019. As Linkoping University had already granted ethical approval it was decided that the research would be conducted in Sweden. As I do not speak Swedish, this limited my involvement in the active research processes. It was agreed that I would instead conduct secondary analysis using the SOLUS 2.0 trial data, with a wider research question and more complex methods of analysis. An area that I am particularly interested in is "what works for whom", an issue which has seldom been addressed in loneliness research, so I decided to broaden the original focus of my analysis and increase understanding in this area by looking at predictors of treatment outcome for loneliness interventions.

In order to do this, I needed to learn a complex statistical procedure based on machine learning — Least Absolute Shrinkage Selector Operator (LASSO: Tibshirani, 1996) Regressions. As LASSO regressions have been conducted by relatively few researchers, there has been little published on the practicalities of how these analyses are carried out and how their output is to be interpreted. Additionally, I needed to learn how to execute complex multiple imputation to overcome the issue of missing data, which was stopping the analyses running correctly.

Including qualitative insights into what works for whom with loneliness is something that I am aware would bolster and improve the generalisability of the research. Unfortunately, due to time pressures and the COVID-19 lockdown I was unable to consult with individuals with lived experience of chronic loneliness who were part of the UCL loneliness and mental health network. As part of my dissemination I intend to share my results with those with lived experience and obtain their insights and feedback at that stage.

2. Impact

The thesis has a range of real-world implications and potential for significant clinical impact. Its key messages and main beneficiaries are summarised below. Additionally, the pathways and barriers to its clinical and personal impacts are described.

Key Messages

1) **Psychological interventions are effective at alleviating loneliness.**

   The systematic review and meta-analysis highlight the effectiveness of psychological interventions at alleviating loneliness across age groups, countries and populations. The empirical study shows that Internet-delivered CBT is an effective intervention.

2) **One size does not fit all; there is a need for a modular transdiagnostic approach.**

   The large heterogeneity in the review shows that there is wide variability in the type and format of intervention and in the population targeted. The empirical study shows there are a number of significant treatment outcome predictors. It was found that for some individuals CBT is less likely to be effective, and for others IPT is more likely to be effective. Those with mental health difficulties, in particular anxiety and depression, were found to respond less well to the CBT loneliness intervention, and may therefore need a more intense intervention or, where relevant, an intervention adapted to explore their anxiety and depression. For this reason, a modular transdiagnostic approach (Käll, Shafran & Lindegaard, et al., 2020) is recommended.

3) **Evidence-based interventions for loneliness need to be widely implemented.**

   There is a lack of wide-scale delivery of evidence-based interventions for loneliness, perhaps due to a historical lack of evidence regarding their efficacy. The meta-analysis included in the thesis does, however, provide robust evidence for the efficacy of psychological interventions for loneliness. It also provides a clear rationale for the

need for these interventions to be widely accessible, especially during and in the aftermath of the COVID-19 pandemic, which has led to an increase in social isolation and loneliness. The empirical study shows that psychological interventions can be delivered effectively through the internet and that ICBT is effective at alleviating chronic loneliness.

Key Beneficiaries

Individuals with lived experience of chronic loneliness. Those who have experienced chronic and distressing feelings of loneliness may have also experienced stigma which has prevented them from sharing their experiences and which may in turn have exacerbated their feelings of isolation and loneliness. It is hoped that the research in the thesis normalises and validates the distressing experience of loneliness by discussing its high prevalence and range of adverse impacts. Additionally, by describing the self-perpetuating maintaining mechanisms of chronic loneliness and promoting effective psychological interventions for loneliness, the research aims to gives individuals further insight, hope and ultimately access to new forms of treatment.

Individuals with lived experience of chronic loneliness and mental health difficulties. The empirical research carried out for the thesis has established that high levels of depression and anxiety can predict a worse treatment outcome in interventions for loneliness. This finding should lead to a recognition of the challenges that those with co-occurring mental health difficulties and loneliness face when attempting to overcome factors maintaining their distress. It also supports the recommendation that interventions are provided in a modular way to account for the range of heterogeneity in lonely individuals.

Hopefully, dissemination of this research will result in mental health services playing a key role in reducing loneliness.

Individuals experiencing loneliness in relation to COVID-19. A major consequence of the global COVID-19 pandemic has been an upsurge in social isolation and reported loneliness which requires immediate direct intervention and prevention (Holmes et al., 2020). As populations physically and socially isolate, new ways of intervening to tackle the increase in loneliness need to be developed, in particular using digital technologies. Existing and new psychological interventions are being converted to digital delivery (Fairburn & Patel, 2017), in particular CBT interventions (Andersson, 2014), which have been found to be effective at alleviating chronic loneliness in the longer term (Käll, Backlund, Shafran, et al., 2020). It will be important to ensure that these are accessible to individuals experiencing loneliness who are typically marginalised and isolated, including those with disabilities and severe mental health difficulties.

Knowing more about predictors of loneliness is also particularly helpful to informing an understanding of who may be most at risk of developing chronic loneliness during the COVID-19 pandemic and its aftermath. Research from Spain has assessed predictors of higher loneliness during the pandemic (González-Sanguinoa, 2020). It found that being female, younger and more exposed to news about COVID-19, as well as having a higher self-perception of being a burden to others, lower contact with relatives, lower quality of sleep, fewer positive emotions, fewer resources for entertaining oneself and higher expressed emotion, were associated with higher loneliness. The research in this thesis could inform a screening process to identify those with high levels of loneliness and ensure that interventions are made accessible to them.

Mental Health Services. Psychological interventions have been used widely for treating a range of mental health difficulties (Roth & Fonagy 2006). In mental health, there are well-established systems and structures to guide treatment allocation and decision-making regarding which interventions individuals are offered. However, there is no system in place currently for wide-scale delivery of psychological interventions for loneliness.

Conveying to mental health services the findings of this research will be an important first step in helping them play a role in reducing both chronic loneliness and comorbid mental health difficulties. In terms of skills set, mental health therapists are already well positioned, with their knowledge of psychological interventions and formulation, to address chronic loneliness.

Charities. It is hoped that dissemination of the findings and evidence-based recommendations of this research regarding how loneliness can be tackled and which interventions are most effective for specific groups can influence the provision offered by charities and their future campaigns.

The UK Government. Governments have a top-down role in shaping and informing public policy. In 2018, Theresa May launched the first cross-government strategy for loneliness which had three overarching goals:

1. to improve the evidence base to increase understanding of the causes and impacts of loneliness, as well as what works to alleviate it
2. to embed loneliness as an issue to be considered across government policy. (The strategy included policies to benefit wider society alongside more tailored interventions to support people when they are at greater risk of loneliness.)

3. to build a ‘national conversation’ on loneliness in order to raise awareness of its impacts and help tackle stigma.

The research in this thesis directly addresses the first of these aims, adding to the evidence base with regard to what works to alleviate loneliness. It contributes to the second aim through identification of effective tailored interventions for loneliness. If widely disseminated to raise awareness of loneliness and tackle stigma, it can also address the third aim. The-findings of the research will be made available to the government through a briefing report to the UK's Minister of Civil Society, Baroness Diana Barran, who will be in charge of loneliness policy.

Academia. By addressing questions which seldom receive attention, the findings of the systematic review and empirical study make a significant contribution to academic knowledge. Academics are encouraged to build upon the findings and limitations. Firstly there is a need to replicate the empirical research findings within different cultures and age groups, for example young people. Secondly, there is scope to add to the finding that different interventions have differential predictors of outcome through further research into a modular approach to loneliness interventions (Käll, Shafran & Lindegaard, et al., 2020).

Clinical Impact

The thesis has strengthened the evidence base for psychological interventions for loneliness. Unfortunately, the translation of innovative treatments for loneliness from research to practice has been slow, and experience from other fields of clinical psychology show that therapies even with a wealth of research to support their efficacy are often not widely practised in community settings (e.g. Kazdin, 2008). This may be due in part to a tendency of published papers not to detail how research findings could be implemented and how services can be involved in this process.

In order to achieve the broadest clinical impact for this research, the implementation of psychological interventions needs to be part of a wider collaborative multi-agency strategy for reducing loneliness. The Campaign to End Loneliness states that to reduce loneliness we have to address three challenges: (a) understanding the nature of loneliness and developing a personalised response; (b) reaching lonely individuals; and (c) supporting lonely individuals to access appropriate support (Fe rguson, 2011). Recommendations about how to achieve these aims are proposed in relation to the following key stakeholders.

Implementing Recommendations

GPs and Mental health services. Given the strong link between chronic loneliness and mental health problems (e.g. Bekhet et al., 2012; Theeke et al., 2012), a recommended route to having nationwide implementation of psychological interventions for loneliness would involve general practitioners (GPs) and mental health services working collaboratively to screen for and treat loneliness. The government's current proposal is for all GPs to implement a 'social prescription' model to reduce loneliness (Department for Digital, Culture, Media and Sport, 2017) does not systematically and routinely identify individuals with chronic loneliness or offer evidence-based psychological therapies to alleviate symptoms, and taking account of the findings of this research would help to correct this, enabling the response to be more comprehensive.

In the UK, most psychological therapies are offered via the Improving Access to Psychological Therapies (IAPT: Clark, 2011) programme, which offers evidence-based therapies to those with mental health difficulties on a nation-wide scale. Currently, IAPT treats over 560,000 patients per year (Clark, 2018). Most receive psychological therapy following either self-referral or referral by their GP. This referral includes screening questionnaires for anxiety and depression, with this clinical outcome data gathered on 98.5%

of patients (Clark, 2018). One way that lonely individuals could be identified is through screening for loneliness as part of this IAPT referral process, perhaps via the UCLA-LS-3 (Russell, 1996).

Doing this would be particularly valuable if an individual has comorbid mental health difficulties, to allow their therapist to establish what the individual feels is the primary problem. If the individual scored highly on the UCLA-LS-3 they could be offered a loneliness-specific psychological intervention, such as Internet-delivered CBT (ICBT), via IAPT or an evidence-based intervention via a 'social prescription' or involvement with a local charity. If, on the other hand, a mental health difficulty is the primary problem then this could be addressed using the standard IAPT offer. If loneliness remains problematic, a supplementary module could be administered, formulated around loneliness and its maintaining mechanisms and including loneliness-specific psychoeducation.

For maximum impact, the screening and treatment of loneliness should be as widespread as possible, across mental health services for older adults and young people, as well as health services and secondary care mental health services for people with more severe, complex and enduring difficulties.

Charities. Charities may be an important part of the gateway to clinical impact, due to their longstanding involvement in tackling loneliness. In June 2018, the UK Government announced £20 million of funding to tackle loneliness, including the £11.5 million Building Connections Fund to support charitable, voluntary and community organisations in tackling loneliness. A number of charities in the UK are involved in initiatives for tackling loneliness. The Campaign to End Loneliness promotes the importance of loneliness to commissioners and contributes to research and campaigns in the public sphere. The Co-op Foundation has launched the 'Belong' initiative to raise awareness of loneliness among young people and

partnered with a number of other organisations to research effective solutions to combat loneliness. The Silver Line is a helpline which aims to help combat loneliness in the elderly. And the British Red Cross helps people who experience loneliness and social isolation through programmes such as befriending schemes.

Through providing briefing summaries to charities regarding the effectiveness of psychological interventions, the sector may be able to further disseminate and promote findings. Charities may also be able play a pivotal role in screening and delivering psychological interventions for chronic loneliness. A model proposed by the Campaign to End Loneliness suggests how in practice intra- and interpersonal approaches to reducing loneliness could be integrated (see Figure 1).

Other organisations. Collaboration across a range of services is desirable when identifying those suffering with, or at risk of, chronic loneliness. In addition to charities, GPs and mental health services, other organisations active in a wide range of areas – such as care homes, bereavement services, hospitals, substance misuse groups, schools, youth centres and religious institutions – could help identify individuals who might benefit from a loneliness intervention. Future government strategy will therefore need to encourage greater collaboration between agencies and outline how they can work together to identify and refer suitable individuals for a psychological or social evidence-based intervention. A noteworthy model proposed by Mann and colleagues (2017) suggests how responsibilities could be distributed between various levels in society (see Figure 2).

The UK Government. The government has a key role to play in enabling the impacts outlined above to take place. There have been positive government initiatives, such as the Let's Talk Loneliness campaign, which aims to create a culture in which people feel

comfortable to talk about their feelings of loneliness. However, for loneliness screening and treatment programmes to be implemented on a wide scale, further government-level strategy and funding will be needed.

Figure 1

The Campaign to End Loneliness Model

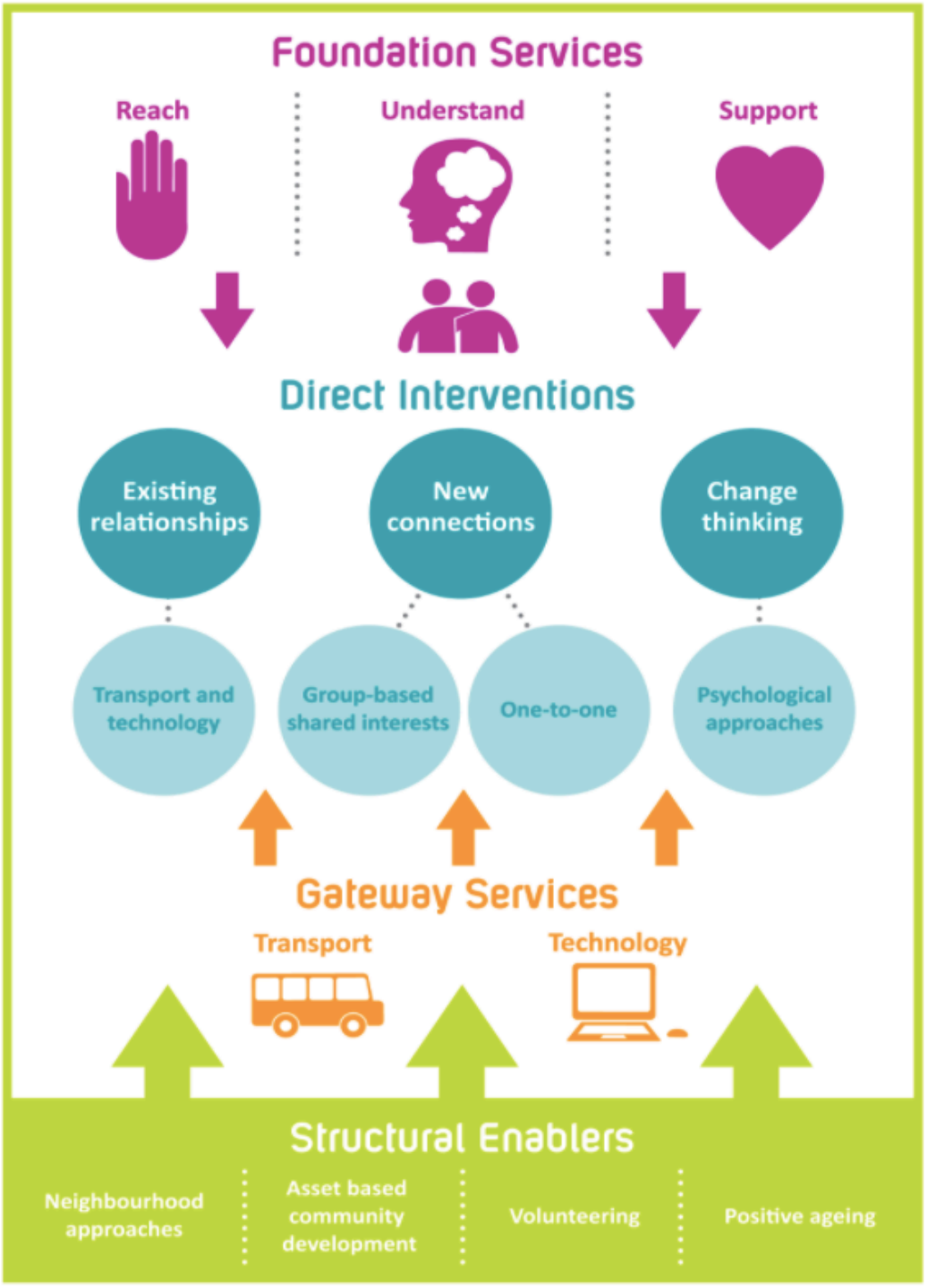
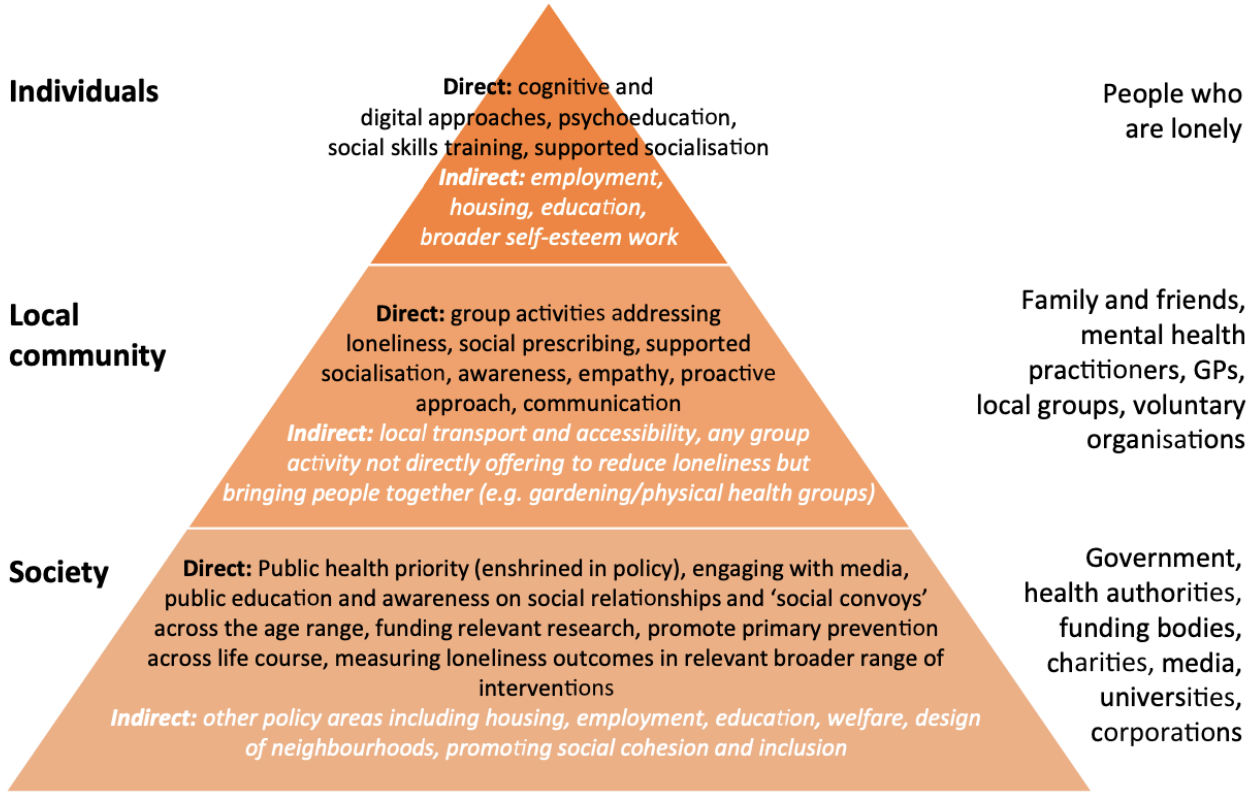


Figure 2

Levels of Responsibility for Interventions for Loneliness (from Mann et al., 2017)



Are the Recommendations Feasible, Acceptable and Cost-effective?

Recommendations for increasing access to psychological interventions for loneliness clearly need to be cost effective, acceptable and feasible. It has been estimated that the total cost of being chronically lonely is £11,725 per person over a 15-year period (Fulton & Jupp, 2015), people with chronic loneliness having a 1.3–1.8 times higher rate of accessing healthcare services and a greater likelihood of developing certain health conditions, such as depression and dementia, compared to those without loneliness (Mihalopoulos et al., 2019).

Research into the cost-effectiveness of psychological interventions for loneliness has been minimal. One RCT by Routasalo and colleagues (2009) in Finland assessed the impact and cost-effectiveness of a psychosocial group which aimed to reduce loneliness in older adults. The intervention was delivered weekly for three months and involved group sessions

of around seven older adults and two professional group leaders. Sessions lasted for five to six hours and meals and transport were provided. In the intervention group, total costs per year for health care services were €1,522 per person compared with €2,465 per person in the control group. The significant difference of €943 per person exceeded in one year the total costs of the intervention, which was €881 per person and included the group programme costs, transportation, meals and the tutoring of group leaders. In 2013, the overall cost of completed treatment in IAPT was £877 (Radhakrishnan et al., 2013), indicating that if IAPT were to offer interventions for loneliness then this would be cost-effective. Despite this promising finding, the cost effectiveness of psychological interventions for loneliness needs further research that takes account particularly of the heterogeneity in type, duration, mode of delivery and format.

The key recommendation of the research – that a programme of psychological interventions for loneliness be implemented – is nevertheless feasible. The structures and organisations are already in place to offer interventions. There is a workforce skilled in delivering therapy which is already widely accessible across the UK via GP and self-referral pathways. The IAPT program alone will have trained and deployed around 10,500 new therapists in England between 2018 and 2021 (Clark, 2018). The IAPT training focuses in particular on CBT but also includes other evidence-based psychological treatments such as IPT. Available to them is a loneliness screening tool (the UCLA-LS-3) which is well established and validated (Russell, 1996). Moreover, many RCTs have shown that psychological interventions for loneliness are indeed feasible and acceptable (e.g. Theeke, Mallow & Barnes, et al., 2015), including interventions for participants with loneliness and severe depression or anxiety (Lloyd-Evans & Johnson, 2019) and for young people (Lim et al., 2019).

Barriers to Impact

Those most isolated and in need of social interaction are often the hardest to access (Age UK, 2008). There is a strong social stigma about loneliness, with 30% of respondents to one survey reporting that they would be embarrassed to say that they felt lonely (Griffin, 2010). Accordingly, organisations providing services to reduce loneliness often have difficulty identifying and recruiting people who are experiencing loneliness (Age UK, 2008; Goodman et al., 2015).

Certain groups, such as some ethnic minority groups and individuals with disabilities, have been found to be particularly at risk of loneliness and may need extra consideration. One study found that older adults from certain ethnic minority groups (those born in China, Africa, the Caribbean, Pakistan and Bangladesh) reported that they were almost twice as lonely as their White British counterparts (Hayanga et al., 2019). Additionally, when surveyed by the Office for National Statistics, 36% of ethnic minority individuals said they would like more companionship or contact with other people compared with 20% of the population generally (cited in British Red Cross, 2019). A survey of 1,004 disabled people found that 45% of those who were of working age said that they always or often felt lonely while 85% of young disabled adults (aged 18 to 34 years old) felt lonely (Scope, 2017). Therefore, it is important that loneliness interventions are suitably developed to meet the needs of individuals from a range of backgrounds.

Unfortunately, the COVID-19 pandemic has increased levels of loneliness and the need for interventions whilst also acting as a potential barrier to impact and implementation. Psychological therapy is being either cancelled or delivered in a more flexible way, through webinars, over the phone or online because of infection-control measures such as social distancing (Royal College of Psychiatry, 2020). Additionally, it is probable that many conferences and meetings to do with loneliness, psychological therapies and mental health

will be postponed or cancelled, reducing opportunities for the dissemination of the research findings.

Finally, innovation and evidence-based treatments come at a cost and in the UK, as in other countries with state-funded healthcare, the budgetary process is subject to economic and political pressures (Layard & Clark, 2014). The financial constraints of the charity sector and NHS may ultimately be a barrier to the implementation of the screening and treatment of chronic loneliness. It is to be hoped that the promising results from research looking at the cost-effectiveness of loneliness treatment and growing political recognition of loneliness and mental health as social issues are persuasive arguments for the provision of extra funding.

Personal Impact

Since starting work on this thesis I have been struck by how often in my clinical work I come across individuals expressing their own experiences of loneliness and describing the central role loneliness plays in maintaining their mental health difficulties. As a result, I have become acutely aware of the importance of loneliness and now feel passionately that it should be part of the training curriculum for mental health professionals. I have also witnessed the impact of COVID-19 on the amount of loneliness in society and the intensity of the loneliness that people can feel and believe that the research is timely and needed. I hope its findings can lead to real-world positive changes in the levels of distressing loneliness experienced.

3. Dissemination

Dissemination, which involves the sharing of information on how an intervention is to be transmitted and interpreted by various stakeholders (Chambers, Ringeisen, & Hickman, 2005), has as its goal promoting evidence-based practice (McHugh & Barlow, 2012).

Deficiencies in dissemination are an issue for research and often undermine the full potential for it to impact on clinical practice and policy (e.g. Shafran, Clark, et al., 2009; Wilson et al., 2010). As chronic loneliness is a severe and distressing condition which is currently surging in prevalence, I am particularly keen for my findings to be disseminated as widely as possible.

Dissemination Strategy

Multicomponent dissemination strategies are significantly more effective in communicating findings and maximising their impact than single strategies (McCormack et al., 2013). The study plans to utilise the multiple strategies and channels described below.

Research Presentations and Conferences

Academic. The dissemination of findings has already begun at Royal Holloway University. I was due to present to students across the three cohorts of the Clinical Psychology Doctorate and to members of its course staff. However, due to the COVID-19 pandemic, I narrated my findings over PowerPoint slides and this presentation was circulated to students and staff.

I will also be disseminating my findings amongst my collaborators at Linkoping University who conducted the SOLUS 2.0 trial and developed the ICTB and IPT interventions for loneliness. It is hoped that information about predictors could lead to further research that builds on modular or stepped-care approaches.

Clinical. I have been approached by a lead member of the IPT UK network, who has asked me to present my findings. The presentation will take place at the IPT Greater London Network meeting to an audience that includes leading IPT therapists. Another avenue for

dissemination will be the British Association for Behavioural and Cognitive Psychotherapies Conference. I will also seek to present the findings to University College London's Loneliness and Social Isolation in Mental Health research network, of which I am an active member.

A further presentation will be made to mental health professionals at The Tavistock and Portman Mental Health NHS Trust on the link between loneliness and mental health and the role that we can play in reducing loneliness.

Peer-Reviewed Publication. I plan to submit the systematic review and meta-analysis together with the empirical study for publication in a peer-reviewed journal by October 2020. Potential journals are *Clinical Psychology Review* or the *Journal of Personality and Social Psychology*. Both have a high impact factor and have previously published papers on loneliness. Reaching a wide audience is important as I feel that my findings regarding the effectiveness of psychological interventions, in particular ICBT, will help inform NHS mental health services, the voluntary sector and policy makers in their response to loneliness at both local and national levels in relation to COVID-19 and in the long term.

Broader dissemination. To facilitate dissemination to the third sector, to commissioners and to policy makers including UK Minister of Civil Society, Baroness Diana Barran, I will create a bullet-point summary of the key messages and findings from the research and an accessible summary that can be shared on social media. A similar summary will be created and shared on social media for individuals with lived experience of chronic loneliness. And crucially, I will seek feedback and insights on the work I have done from people with lived experience of loneliness.

In concluding this section, key features that the thesis can demonstrate are (a) a high degree of integration between its two component parts; (b) a significant amount of potential for real-world impact, with a range of beneficiaries; (c) that the introduction of wide scale screening and psychological interventions for loneliness is feasible, acceptable and likely to be cost-effective; and (d) that a multicomponent strategy is in place to maximise the dissemination and implementation of its recommendations.

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Appendices

Appendix A: Search Strategy

Number	Searches	Results
1	exp Loneliness/	7642
2	Lonel* or social isolat*	32644
3	1 or 2	32644
4	exp Cognitive Behavioural Therapy/	11981
5	exp Psychotherapy/	230776
6	exp Therapeutics/	7834479
7	Exp treatment outcome/	1623249
8	Psychological intervention* or CBT or Cognitive Behavioural Therapy or therapy or IPT or interpersonal therapy or psychotherapy or psychodynamics	7289541
9	4 or 5 or 6 or 7 or 8	10815149
10	3 and 9	10965
11	therap* or psychotherap* or Cognitive Behavioural Therap* or intervention* or psychodynamic*	8848916
12	9 or 11	11871378
13	3 and 12	13955
14	Clinical trial/	960848
15	Randomized controlled trial/	592972
16	Randomization/	86267
17	Single blind procedure/	38349
18	Double blind procedure/	167879
19	Crossover procedure/	62505
20	Placebo/	334252
21	Randomi?ed controlled trial$.tw.	224126
22	Rct.tw	36215
23	Random allocation.tw.	1989
24	Randomly allocated.tw.	34527

25	Allocated randomly.tw.	2515
26	(allocated adj2 random).tw.	811
27	Single blind$.tw.	24275
28	Double blind$.tw.	200281
29	((treble or triple) adj blind$).tw.	1119
30	Placebo$.tw.	298981
31	Prospective study/	588837
32	or/14-31	2157666
33	Case study/	67672
34	Case report.tw.	396046
35	Abstract report/or letter/	10087762
36	or/33-35	1541211
37	32 not 36	2104704
38	13 and 37	1362
39	Limit 38 to (english language and yr=’2000 – 2020’)	1231

Appendix B: SOLUS 2.0 Ethics Application
(Google Translated as was submitted in Swedish)

Supplementary application, no. 2015 / 418-31
Supplementary application for previously approved application for ethics review, no. 2015 / 418-31
The project has previously been ethically tested and approved in this Ethics Committee. It has progressed well and the intervention included in the project has shown good treatment effects for the participants recruited so far . A continuation is planned , with a slightly different arrangement than before.

For the part of the project carried out so far, 73 of the 120 students enrolled, providing additional space to gather data related to the study's problem is . The purpose of the changed arrangement is to create the conditions for drawing conclusions about whether the treatment effects are specific to the intervention in question or if another active condition produces equivalent effects. Therefore, in order to make a more accurate and informative comparison , the treatment developed will be compared with a theoretical one. equal treatment condition based on interpersonal therapy as previously used in a published article (Dagöö et al., 2014) , but here adapted to suit the population in question . Methodologically, therefore, this continuation of the study would consist of three conditions: two active and one waiting list that will have access to treatment after the initial treatment period (participants in this condition randomize to one of the two active conditions). As the added condition n is 9 weeks long, the existing treatment will also be extended by one week. To give reasonable statistical power to the study, an additional 12 0 participants will be recruited , giving a total number of participants of 193 within the study . This means that the participant estimate is increased by 73 participants in order to give the opportunity to find out the difference between both the treatment conditions and the control group. Recruitment takes place, as described in the previous ethics application, nationally through advertising in daily press, dissemination of information via social media and posting in public place. Participants will undergo the same screening procedure and are recruited with the same criteria as the study of origin.

For this admission, therapists will also be students from semester 10 of the psychology program at Linköping University who receive supervision in the respective method . Research heads are still clinically responsible . Guidance for treatment within the added condition will be provided by a legitimate psychotherapist who specializes in the method. The ethical considerations contained in the original application remain and the measures taken to ensure safety for the participants have worked well at the previous intake, so no adjustments are considered necessary at this stage . Furthermore meets Internet platform continued the requirements regarding safety and storage of data , including regarding the newly EU regelverke T (GDPR). The planned changes in the research design of the project affect the content of the research staff information (Appendix 4a). A revised version of this annex a is attached.

Reference :
Dagöö , J., Asplund , R.P. , Bsenko , H.A., Hjerling , S., Holmberg, A., Westh , S., ... & Andersson, G. (2014). Cognitive behavior therapy versus interpersonal psychotherapy for

social anxiety disorder delivered via smartphone and computer: A randomized controlled trial. *Journal of A nxiety D isorders* , *28* , 410-417 .

Linköpings universitet

Karolinska Institutet

25 Sep. 18

I am a Professor of Clinical Psychology at Linköping University and also at the Karolinska Institute, Stockholm. In my research group we have completed a number of controlled studies on guided internet-delivered cognitive behaviour therapy. We have now started a collaboration with professors Roz Shafran and have planned a study on loneliness as part of our collaboration. We will recruit four MSc students from Sweden who will work in the project. A doctoral student from our university (Anton Käll, MSc) will also help with the study. We here at Linköping University will cover the costs of the web portal including web master.

Yours sincerely,

Gerhard Andersson, PhD, professor in clinical psychology
Linköping University and Karoliniska Institute, Sweden
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Appendix C: Content of ICBT Modules

Module	Description
1	In addition to an introduction to the treatment program, the first module contained psychoeducation about loneliness, information about cognitive behavioural therapy and functional analysis (antecedents, behaviours, consequences).
2.	The second module contained goal setting and working with values. The participants were given the task of performing behaviours in accordance with their values.
3.	The third module consisted of psychoeducation about social behaviour activation. Participants also mapped their avoidance and valued behaviours, with the aim of increasing valuable social contact.
4.	In this module, the focus was on overcoming any obstacles to social behavioural activation. Psychoeducation about exposure to anxiety provoking obstacles was introduced.
5.	The fifth module contained psychoeducation about negative automatic thoughts (NATs) and thought traps were given. Exercises involved the identification of thought traps and challenging NAT with alternative thoughts.
6.	This module consisted of a rational for behavioural experiments. Exercises included conducting at least two behavioural experiments to challenge dysfunctional assumptions.
7.	This module was newly added to this version of the treatment program

	and contained psychoeducation around communication and social skills as well as further information on social behavioural activation.
8.	The penultimate module consisted of a repetition of previous strategies, evaluation of what worked well and less well during treatment and continued social activation.
9.	The final module of the treatment included psychoeducation about potential triggers and obstacles and exercises involving the design of an action plan for future to maintain progress.

Appendix D: Content of IIPT Modules

Module	Description
Introductory phase - common to all focus areas.	
1.	The first module consisted of an introduction to the treatment, psychoeducation about loneliness and information about interpersonal psychotherapy. In addition, there were exercises involving identifying other people that could be involved in the treatment and identifying the most prominent current difficulties.
2.	The second module consisted mainly of exercises where participants were allowed to create a timeline for their loneliness and an inventory of their current relationships.
3.	In module three, the participants would choose a focus area for the remainder of the treatment based on their symptoms, their timeline and their current relationships. In addition, they would set goals for their treatment.
Middle phase – Modules 4-8 were specific to each focus area (Role change, Conflict, Grief, Interpersonal Vulnerability)	
Ending phase - common content but tailored to each focus area	
9.	Module nine was the last of the treatment where examples were designed based on respectively focus area but where exercises and text content were the same regardless of focus area. The module contained repetition of the contents of the treatment, an analysis of changes in loneliness symptoms and their interpersonal inventory over time. There was also the designing of an action plan for the future that consisted of potential risk situations, social network inclusion and continued work towards individual's goals.

Appendix E: UCLA Loneliness Scale Version 3

UCLA LONELINESS SCALE VERSION 3

Reference:

Russell, D. (1996). UCLA Loneliness Scale (Version 3): Reliability, validity, and factor structure. *Journal of Personality Assessment, 66*, 20-40.

Description of Measure:

A 20-item scale designed to measure one's subjective feelings of loneliness as well as feelings of social isolation. Participants rate each item on a scale from 1 (Never) to 4 (Often).

This measure is a revised version of both the original UCLA Loneliness Scale and the Revised UCLA Loneliness Scale. The first revision was done to make 10 of the 20 original items reverse scored. The second revision was done to simplify the scale so less educated populations could comprehend it (see other UCLA Loneliness Scale pages on this website).

Abstracts of Selected Related Articles:

Russell, D , Peplau, L. A.. & Ferguson, M. L. (1978). Developing a measure of loneliness. *Journal of Personality Assessment, 42,* 290-294.

Research on loneliness has been hindered by the lack of a simple and reliable assessment technique. The development of the UCLA Loneliness Scale, a short, 20-item general measure of loneliness is reported. The measure has high internal consistency (coefficient alpha = .96) and a test-retest correlation over a two-month period of .73. Concurrent and preliminary construct validity are indicated by correlations with self-reports of current loneliness and related emotional states, and by volunteering for a "loneliness clinic."

Russell, D , Peplau, L. A.., & Cutrona, C. E. (1980). The Revised UCLA Loneliness Scale: Concurrent and discriminate validity evidence. *Journal of Personality and Social Psychology, 39*, 472-480.

The development of an adequate assessment instrument is a necessary prerequisite for social psychological research on loneliness. Two studies provide methodological refinement in the measurement of loneliness. Study 1 presents a revised version of the self-report UCLA (University of California, Los Angeles) Loneliness Scale, designed to counter the possible effects of response bias in the original scale, and reports concurrent validity evidence for the revised measure. Study 2 demonstrates that although loneliness is correlated with measures of negative affect, social risk taking, and affiliative tendencies, it is nonetheless a distinct psychological experience.

McKenna, K. Y. A., Green, A. S., & Gleason, M. E. J. (2002). Relationship formation on the internet: What's the big attraction? *Journal of Social Issues, 58*, 9–31

Appendix E Continued : UCLA Loneliness Scale Version 3

We hypothesized that people who can better disclose their "true" or inner self to others on the Internet than in face-to-face settings will be more likely to form close relationships on-line and will tend to bring those virtual relationships into their "real" lives. Study 1, a survey of randomly selected Internet newsgroup posters, showed that those who better express their true self over the Internet were more likely than others to have formed close on-line relationships and moved these friendships to a face-to-face basis. Study 2 revealed that the majority of these close Internet relationships were still intact 2 years later. Finally, a laboratory experiment found that undergraduates liked each other more following an Internet compared to a face-to-face initial meeting.

Scale:
INSTRUCTIONS: Indicate how often each of the statements below is descriptive of you.

Statement	Never	Rarely	Sometimes	Often
*1. How often do you feel that you are "in tune" with the people around you?	1	2	3	4
2. How often do you feel that you lack companionship?	1	2	3	4
3. How often do you feel that there is no one you can turn to?	1	2	3	4
4 How often do you feel alone?	1	2	3	4
*5. How often do you feel part of a group of friends?	1	2	3	4
*6. How often do you feel that you have a lot in common with the people around you?	1	2	3	4
7. How often do you feel that you are no longer close to anyone?	1	2	3	4
8. How often do you feel that your interests and ideas are not shared by those around you?	1	2	3	4
*9. How often do you feel outgoing and friendly?	1	2	3	4
*10. How often do you feel close to people?	1	2	3	4
11. How often do you feel left out?	1	2	3	4
12. How often do you feel that your relationships with others are not meaningful?	1	2	3	4
13. How often do you feel that no one really knows you we11?	1	2	3	4
14. How often do you feel isolated from others?	1	2	3	4
*15. How often do you fee1 you can find companionship when you want it?	1	2	3	4
*16. How often do you feel that there are people who really understand you?	1	2	3	4
17, How often do you feel shy?	1	2	3	4
18. How often do you feel that people are around you but not with you?	1	2	3	4
*19. How often do you feel that there are people you can talk to?	1	2	3	4
*20. How often do you feel that there are people you can turn to?	1	2	3	4

Scoring:
The items with an asterisk are reverse scored. Keep scoring on a continuous basis.

This scale is provided only for Researchers.

Appendix F: Patient Health Questionnaire

PATIENT HEALTH QUESTIONNAIRE-9 (PHQ-9)

Over the last 2 weeks, how often have you been bothered by any of the following problems? *(Use "✔" to indicate your answer)*	**Not at all**	**Several days**	**More than half the days**	**Nearly every day**
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed. Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

FOR OFFICE CODING 0 + _____ + _____ + _____

=Total Score: _____

If you ticked any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	**Somewhat difficult**	**Very difficult**	**Extremely difficult**
☐	☐	☐	☐

Developed by Drs. Robert L. Spitzer, Janet B.W. Williams, Kurt Kroenke and colleagues, with an educational grant from Pfizer Inc. No permission required to reproduce, translate, display or distribute.

Appendix G: Social Interaction Anxiety Scale

Patient Name: _____ **Date:** _____

Instructions: For each item, please circle the number to indicate the degree to which you feel the statement is characteristic or true for you. The rating scale is as follows:

0 = **Not at all** characteristic or true of me.
1 = **Slightly** characteristic or true of me.
2 = **Moderately** characteristic or true of me.
3 = **Very** characteristic or true of me.
4 = **Extremely** characteristic or true of me.

CHARACTERISTIC	NOT AT ALL	SLIGHTLY	MODERATELY	VERY	EXTREMELY
1. I get nervous if I have to speak with someone in authority (teacher, boss, etc.).	0	1	2	3	4
2. I have difficulty making eye contact with others.	0	1	2	3	4
3. I become tense if I have to talk about myself or my feelings.	0	1	2	3	4
4. I find it difficult to mix comfortably with the people I work with.	0	1	2	3	4
5. I find it easy to make friends my own age.	0	1	2	3	4
6. I tense up if I meet an acquaintance in the street.	0	1	2	3	4
7. When mixing socially, I am uncomfortable.	0	1	2	3	4
8. I feel tense if I am alone with just one other person.	0	1	2	3	4
9. I am at ease meeting people at parties, etc.	0	1	2	3	4
10. I have difficulty talking with other people.	0	1	2	3	4
11. I find it easy to think of things to talk about.	0	1	2	3	4
12. I worry about expressing myself in case I appear awkward.	0	1	2	3	4
13. I find it difficult to disagree with another's point of view.	0	1	2	3	4
14. I have difficulty talking to attractive persons of the opposite sex.	0	1	2	3	4
15. I find myself worrying that I won't know what to say in social situations.	0	1	2	3	4
16. I am nervous mixing with people I don't know well.	0	1	2	3	4
17. I feel I'll say something embarrassing when talking.	0	1	2	3	4
18. When mixing in a group, I find myself worrying I will be ignored.	0	1	2	3	4
19. I am tense mixing in a group.	0	1	2	3	4
20. I am unsure whether to greet someone I know only slightly.	0	1	2	3	4

Appendix H: Generalized Anxiety Disorder Questionnaire

GAD-7

Over the last 2 weeks, how often have you been bothered by the following problems? *(Use "✔" to indicate your answer)*	Not at all	Several days	More than half the days	Nearly every day
1. Feeling nervous, anxious or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid as if something awful might happen	0	1	2	3

(For office coding: Total Score T____ = ____ + ____ + ____)

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Appendix I: The Brunnsviken Brief Quality of Life Inventory

The following 12 questions are about how you experience your quality of life. It covers six areas, how satisfied you are with these, and how important they are to you. Circle the number that best reflects your experience.

		Don't agree at all				Agree completely
1	I am satisfied with my **leisure time.** I have an opportunity to do what I want in order to relax and enjoy myself.	0	1	2	3	4
2	My **leisure time** is important for my quality of life.	0	1	2	3	4
3	I am satisfied with how I **view my life**. I know what means a lot to me, what I believe in, and what I want to do with my life.	0	1	2	3	4
4	How I **view my life** is important for my quality of life.	0	1	2	3	4
5	I am satisfied with opportunities to be **creative** - to get to use my imagination in my everyday life, in a hobby, on the job, or in my studies.	0	1	2	3	4
6	Being able to be **creative** is important for my quality of life	0	1	2	3	4
7	I am satisfied with my **learning.** I have the opportunity and desire to learn new, exciting things and skills that interest me.	0	1	2	3	4
8	**Learning** is important for my quality of life	0	1	2	3	4
9	I am satisfied with **friends and friendship.** I have friends that I associate with and who support me (as many friends as I want and need).	0	1	2	3	4
10	**Friends and friendship** are important for my quality of life	0	1	2	3	4
11	I am satisfied with **myself as a person.** I like and respect myself.	0	1	2	3	4
12	My satisfaction with **myself as a person** is important for my quality of life	0	1	2	3	4

Appendix J: Behavioural Activation for Depression Scale

Behavioral Activation for Depression Scale

Please read each statement carefully and then circle the number which best describes how much the statement was true for you DURING THE PAST WEEK, INCLUDING TODAY.

0 = Not at all 1 2 = A little 3 4 = A lot 5 6 = Completely	0	1	2	3	4	5	6	For Scoring Purposes only				
								AC	AR	WS	SI	T
1. I stayed in bed for too long even though I had things to do.	○	○	○	○	○	○	○			_		R
2. There were certain things I needed to do that I didn't do.	○	○	○	○	○	○	○			_		R
3. I am content with the amount and types of things I did.	○	○	○	○	○	○	○	_				_
4. I engaged in a wide and diverse array of activities.	○	○	○	○	○	○	○	_				_
5. I made good decisions about what type of activities and/or situations I put myself in.	○	○	○	○	○	○	○	_				_
6. I was active, but did not accomplish any of my goals for the day.	○	○	○	○	○	○	○			_		R
7. I was an active person and accomplished the goals I set out to do.	○	○	○	○	○	○	○	_				_
8. Most of what I did was to escape from or avoid something unpleasant.	○	○	○	○	○	○	○		_			R
9. I did things to avoid feeling sadness or other painful emotions.	○	○	○	○	○	○	○		_			R
10. I tried not to think about certain things.	○	○	○	○	○	○	○		_			R
11. I did things even though they were hard because they fit in with my long-term goals for myself.	○	○	○	○	○	○	○	_				_
12. I did something that was hard to do but it was worth it.	○	○	○	○	○	○	○	_				_
13. I spent a long time thinking over and over about my problems.	○	○	○	○	○	○	○		_			R

Appendix J Continued: Behavioural Activation for Depression Scale

0 = Not at all 1 = 2 = little 3 = 4 = A lot 5 = 6 = Completely	0	1	2	3	4	5	6	For Scoring Purposes only				
								AC	AR	WS	SI	T
14. I kept trying to think of ways to solve a problem but never tried any of the solutions.	○	○	○	○	○	○	○		_			R
15. I frequently spent time thinking about my past, people who have hurt me, mistakes I've made, and other bad things in my history.	○	○	○	○	○	○	○		_			R
16. I did not see any of my friends.	○	○	○	○	○	○	○				_	R
17. I was withdrawn and quiet, even around people I know well.	○	○	○	○	○	○	○				_	R
18. I was not social, even though I had opportunities to be.	○	○	○	○	○	○	○				_	R
19. I pushed people away with my negativity.	○	○	○	○	○	○	○				_	R
20. I did things to cut myself off from other people.	○	○	○	○	○	○	○				_	R
21. I took time off of work/school/chores/responsibilities simply because I was too tired or didn't feel like going in.	○	○	○	○	○	○	○			_		R
22. My work/schoolwork/chores/responsibilities suffered because I was not as active as I needed to be.	○	○	○	○	○	○	○			_		R
23. I structured my day's activities.	○	○	○	○	○	○	○	_				_
24. I only engaged in activities that would distract me from feeling bad.	○	○	○	○	○	○	○		_			R
25. I began to feel badly when others around me expressed negative feelings or experiences.	○	○	○	○	○	○	○		_			R

Subscale Totals: __ __ __ __

BAS Total: __

Appendix K: Interpersonal Competence Questionnaire

ICQ-15: For each statement, please indicate your level of competence and comfort in handling the situation.

	I am poor at this; I'd feel so uncomfortable and unable to handle this situation, I'd avoid it if possible				I'm extremely good at this; I'd feel very comfortable and could handle this situation very well)
Introducing yourself to someone you might like to get to know/date.	1	2	3	4	5
Calling (on the phone) a new date/acquaintance to set up a time to get together and do something	1	2	3	4	5
Confronting your close companion when he/she has broken a promise.	1	2	3	4	5
Telling a companion that he/she has done something to hurt your feelings	1	2	3	4	5
Telling a date/acquaintance that he/she has done something that made you angry.	1	2	3	4	5
Helping a close companion get to the heart of the problem he/she is experiencing	1	2	3	4	5
Being able to say and do things to support a close companion when she/he is feeling down	1	2	3	4	5
When a close companion needs help and support, being able to give advice in ways that are well received.	1	2	3	4	5
Confiding in a new friend/date and letting him/her see your softer, more sensitive side.	1	2	3	4	5
Letting a new companion get to know the "real" you.	1	2	3	4	5
Letting down your productive "outer shell" and trusting a close companion.	1	2	3	4	5
Being able to admit that you might be wrong when a disagreement with a close companion begins to build into a serious fight.	1	2	3	4	5
Being able to take a companion's perspective in a fight and really understand his or her point of view.	1	2	3	4	5
Not exploding at a close companion (even when it's justified) in order to avoid a damaging conflict	1	2	3	4	5
Finding and suggesting things to do with new people whom you find interesting and attractive.	1	2	3	4	5

Appendix L: Working Alliance Inventory

Working Alliance Inventory

Short Form (C)

Instructions

On the following pages there are sentences that describe some of the different ways a person might think or feel about his or her therapist (counsellor). As you read the sentences mentally insert the name of your therapist (counsellor) in place of _____in the text.

Below each statement inside there is a seven point scale:

1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Often	Very Often	Always

If the statement describes the way you always feel (or think) circle the number 7; if it never applies to you circle the number 1. Use the numbers in between to describe the variations between these extremes.

This questionnaire is CONFIDENTIAL; neither your therapist nor the agency will see your answers.

Work fast, your first impressions are the ones we would like to see. (PLEASE DON'T FORGET TO RESPOND TO EVERY ITEM.)

Thank you for your cooperation.

Appendix L Continued: Working Alliance Inventory

1. _____ and I agree about the things I will need to do in therapy to help improve my situation.						
1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Often	Very Often	Always
2. What I am doing in therapy gives me new ways of looking at my problem.						
1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Often	Very Often	Always
3. I believe _____ likes me.						
1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Often	Very Often	Always
4. _____ does not understand what I am trying to accomplish in therapy.						
1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Often	Very Often	Always
5. I am confident in _____ 's ability to help me.						
1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Often	Very Often	Always
6. _____ and I are working towards mutually agreed upon goals.						
1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Often	Very Often	Always
7. I feel that _____ appreciates me.						
1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Often	Very Often	Always
8. We agree on what is important for me to work on.						
1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Often	Very Often	Always
9. _____ and I trust one another.						
1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Often	Very Often	Always
10. _____ and I have different ideas on what my problems are.						
1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Often	Very Often	Always
11. We have established a good understanding of the kind of changes that would be good for me.						
1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Often	Very Often	Always
12. I believe the way we are working with my problem is correct.						
1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Often	Very Often	Always