Clinical Psychology Review

The Effectiveness of Psychological Interventions for Loneliness: A Systematic Review and Meta-Analysis

--Manuscript Draft--

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Abstract:	Abstract Chronic loneliness is associated with a range of mental health difficulties. Previous theory and research indicate that psychological interventions show promise for reducing loneliness, however, there have been no systematic reviews or meta-analyses to ascertain the efficacy of these interventions across the lifespan. The aim of this study was to synthesise, meta-analyse and explore the heterogeneity in RCTs of psychological interventions for loneliness in order to establish their efficacy. 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 3,973 studies and 103 full texts, finding 31 studies that met inclusion criteria, 28 of which contained sufficient statistical information to be included in the meta-analysis. The quality of included studies was assessed using the Cochrane Risk of Bias Tool. The 31 studies (N = 3,959) that were included in the systematic review were conducted with 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 Cognitive Behavioural Therapy (CBT). 28 studies (N = 3,039) were included in a meta-analysis which found that psychological interventions significantly reduced loneliness compared to control groups, yielding a small to medium effect size (g = 0.43). Subgroup analysis and meta-regressions were conducted in order to explore heterogeneity and found that type of psychological intervention was approaching significance as a moderator of the effectiveness of psychological interventions for loneliness. In conclusion, psychological interventions for loneliness across the lifespan are effective. This finding should inform policy makers, researchers and clinicians going forward, especially in the context of increased loneliness due to the COVID-19 pandemic. There was considerable heterogeneity in the effectiveness of the interventions, suggesting that future research should also explore what works for whom and consider personalising psychological treatment.
Suggested Reviewers:	Louise Hawkley University of Chicago Laboratory Schools hawkley-louise@norc.org Louise Hawkley is an expert on loneliness and has written a number of influential papers both theoretical and empirical.

	Pamela Qualter University of Manchester Institute of Science and Technology Department of Optometry and Neuroscience: The University of Manchester Faculty of Biology Medicine and Health pqualter@uclac.ac.uk Pamela Qualter is an expert in loneliness across the lifespan and has been involved in a number of large scale studies on loneliness in the UK
	Sonia Johnson UCL: University College London s.johnson@ucl.ac.uk Sonia Johnson leads on the UCL Network for loneliness and mental health and publishes frequently in this field.
	Jingyi Wang UCL: University College London j.wang@ucl.ac.uk Jingyi has recently conducted research into loneliness and considered in particular the impact of COVID-19
Opposed Reviewers:	
Response to Reviewers:	

Cover letter

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7th December 2020

Dear Editors,

I wish to submit an original research article entitled "The Effectiveness of Psychological Interventions for Loneliness: A Systematic Review and Meta-Analysis" for consideration by the Clinical Psychology Review.

I can confirm that this work is original and has not been published elsewhere, nor is it currently under consideration for publication elsewhere.

In this paper, the first systematic review and meta-analysis of psychological interventions for loneliness across the lifespan is detailed. It is well established that loneliness is a significant risk factor for mental health difficulties. Despite the high prevalence of loneliness and the severity of the impacts of chronic loneliness, research on the interventions for loneliness across the lifespan is relatively understudied.

Previous reviews (Masi et al., 2011) have found that out of varying types of interventions for loneliness (e.g. befriending, community interventions), psychological interventions have shown the most efficacy based on small numbers of studies. In addition, this is a particularly apt time to be studying and publishing research on loneliness as one consequence of the COVID-19 pandemic has been an increase in rates of loneliness.

We believe that this manuscript is appropriate for publication by the Clinical Psychology Review because it considers the strong link between loneliness and mental health difficulties and considers specifically how psychological interventions and clinical psychologists can play a vital role in reducing loneliness through the provision of evidence-based interventions.

This research has been conducted with methodological rigour, in that in only includes RCTs, involves multiple coders when ascertaining the inclusion of studies and quality of studies was assessed using the Cochrane Risk of Bias Tool.

I think that your wide readership would be interested in the contents of this paper as the systematic review and meta-analysis ascertain the effectiveness of psychological interventions for loneliness, a novel finding. In addition, moderator analyses were conducted to ascertain what type of intervention is most effective. From this it was found that the type of psychological intervention is influential in informing how effective the therapy is in alleviating loneliness. This finding can therefore directly inform the practice of clinical psychologists, policy and recommendations on a wider scale.

We have no conflicts of interest to disclose.

Please address all correspondence concerning this manuscript to me at nisha.hickin@gmail.com

Thank you for your consideration of this manuscript, it is greatly appreciated.

Sincerely,

Dr Nisha Hickin

The Effectiveness of Psychological Interventions for Loneliness: A Systematic Review and Meta-Analysis

Nisha Hickin, Roz Shafran, Anton Käll, Sebastian Sutcliffe, Dean Langdon

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Thank you very much for the opportunity to revise our manuscript. We have made the following changes to the manuscript in response to the Review's comments as follows.

Reviewer Comments	Author Responses
Reviewer #1	
Introduction	
1. I was concerned about the potential for misinterpretation of some findings reviewed and the conclusions that the authors draw from these in the Introduction. These need to be toned down or better contextualized. There are several issues here in particular: - The importance of social skill deficiencies (p. 4) and its intervention (p.5) is highlighted, but the evidence in the wider literature is more mixed on this point and should be contextualized as such. For instance, there was no support for social skill intervention in the Masi et al. 2011 review.	Thank you for highlighting the more mixed wider literature regarding social skills. We have toned down the conclusions throughout the manuscript and removed mention of social skills deficits from page 4.
- The authors argue that social isolation and loneliness are only weakly correlated, citing a 2012 paper (p.5), and emphasising that loneliness is more problematic for health. I am in general agreement with these points, but there are some mixed findings in the literature around the second point in particular, that the authors need to recognise in their review (see Ge et al., 2017 [https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0182145], Steptoe et al., 2013 [www.pnas.org/cgi/doi/10.1073/pnas.1219686110] Tanskanen & Anttila, 2016, [https://www.ncbi.nlm.nih.gov/pmc/articl	Thank you for the helpful references. We have changed the text around loneliness, social isolation and health so that it is more balanced and we include the references provided. Specifically we state (p.3) "Loneliness is often thought of as being synonymous with social isolation – an objective lack of social contact – although research suggests that in fact these related concepts can have an independent relationship with mental health difficulties, such as depression (Ge et al., 2017). Loneliness is influenced by both the quantity of social contact and the perceived quality and

es/PMC5055788/]), that the authors should recognize in their review.	features of social relations, such as intimacy and trust (Yanguas et al., 2018, Schwarzbach et al., 2014). Furthermore, research has shown that loneliness and social isolation have distinct impacts on health and mortality (Tanskanen & Anttila, 2016, Steptoe et al., 2013)."
- It wasn't clear what moderators of change were explored from the Introduction, nor was there engagement with justification for analysis of particular moderators. This sounds somewhat post-hoc rather than being driven by evidence or theory.	Thank you we have now stated this explicitly and information around moderators has been added to the introduction. Specifically we state (p.8). "And lastly, via moderation and sub-group analysis, it establishes key criteria for intervention success which were not conclusively established in previous research. The moderators investigated were: the type of psychological intervention, the age of participants, the risk of bias rating and the percentage of female participants. Type of psychological intervention will be included in moderator analysis so that the most effective interventions can be identified and applied in clinical practice. With this being the first systematic review or meta-analysis of psychological interventions for loneliness across the lifespan, it provides the opportunity to establish if age will be a moderator of intervention effectiveness. Due to psychological interventions for loneliness being a relatively novel area it is likely that the studies will vary in quality. Therefore, subgroup analysis will consider if studies with high, medium or low risk of bias are more effective. Additionally, previous research has been conflicted regarding the link between gender and loneliness (Solmi et al., 2020, Barreto

	et al., 2020), therefore this will also be examined.”
2. A minor point relates to introducing the COVID context form the start. This is not particularly central to the present research question, so I suggest moving it to Discussion where implications of findings are explored.	We have shortened this section within the introduction and only continued to include the Covid context within this section to highlight the current prevalence of loneliness (p.3). “Loneliness is prevalent and the recent widespread implementation of disease control measures such as social distancing, lockdown and quarantine measures to tackle the recent coronavirus (COVID-19) pandemic have been found to increase rates of loneliness (Patel & Clark-Ginsberg, 2020; Banerjee and Rai, 2020; Hwang et al., 2020). A large-scale and nationally representative study by Li and Wang (2020) found an elevated prevalence of loneliness (35.86%) during the COVID-19 pandemic. This finding is similar to those of longitudinal data from 2,221 adults in the UK, which indicate that the prevalence of loneliness in the UK has more than doubled during the COVID-19 lockdown (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 first UK lockdown period and nearly half reporting concerns about those feelings.”
Method	
1a. It was good to see the focus on theoretically-derived interventions, but the authors should clarify that the theoretical grounding is in itself broad	We have now clarified this by removing the element about strong theoretical grounding (p 8) with an emphasis instead on breadth:

with a number of approaches not specific to understanding social disconnection and loneliness.	“Secondly, it includes only psychological interventions on the basis that published reviews indicate their promising efficacy for reducing levels of loneliness.” Additionally, we have addressed this point in the discussion (p.3) “Whilst one of the eligibility criteria was that interventions needed to be psychological and based on psychological theory, the theoretical grounding underpinning these interventions is broad. Furthermore, whilst the psychological theory behind an intervention may be applied to loneliness, this was not the origin of these approaches. Therefore, the interventions were not all designed with loneliness in mind.”
1b. I would also like to see further information on how the interventions were judged to have "promising efficacy for reducing clinical levels of loneliness" if they were not informed by theory relevant to the underlying social processes underpinning loneliness.	We have now added (p.7) the below paragraph to provide further information on how they were judged to have promising efficacy and explain how interventions were judged to have promising efficacy for reducing loneliness. Together, the findings of Masi et al. (2011) and Eccles and Qualter (2020) provide evidence that psychological interventions have promising efficacy for reducing levels of loneliness. This is despite psychological interventions being guided by a broad array of theoretical underpinnings, some of which are not specific to understanding the processes underpinning loneliness but instead target transdiagnostic processes, such as avoidance and cognitive biases. The effectiveness of

	psychological interventions for loneliness can be understood then by considering the overlap in maintaining mechanisms between loneliness and the mental health difficulties that interventions such as CBT were designed to treat (Mann et al., 2017).
2. Was a systematic review tool used to aid in decisions about study inclusion and analysis (e.g. Covidence, Rayyan)?	Endnote was used as the systematic review tool. Criteria for inclusion were applied by two authors with any disagreements discussed collaboratively. We have now stated this on p.11. “Endnote was used as the systematic review tool. Criteria for inclusion were applied by two independent reviewers (the primary researcher and a PhD Clinical Psychology student with expertise in loneliness) who each examined the abstracts of all 3,973 obtained publications. The inter-rater agreement was 97.2% at the abstract screening stage. Conflicts of opinion regarding the eligibility of studies were discussed until consensus was reached.”
3. Given there are a number of risk of bias tools available, it would help to justify the appropriateness of the tool adopted by the authors for this particular review.	The tool used was decided on after research of the tools available and consulting literature that indicated this was a worthy tool to apply for RCTs due to its comprehensiveness (Higgins et al., 2011, Farrah et al., 2019). Further justification of the appropriateness of the tool has been added to the paper as below (p.14) “The RoB tool was chosen based on literature indicating it to be a comprehensive and widely used tool for

	evaluating RCTs (Higgins et al., 2011, Farrah et al., 2019).”
Results	
1. It was not clear what the post assessment data were used to calculate pre-post differences if studies included immediately post and follow-up measurement.	The post data was the post measurement in studies, not the follow up data. This was because some studies did not collect or report follow up data. Additionally, the post treatment measurement is often the best estimate of the impact of the intervention, as the follow-up results may be more prone to be affected by other non-intervention factors and statistical artifacts such as regression to the means. We have now specified this as follows (p.15). “The post measurement was taken from the end of the intervention and not from follow up data collection”
2. Good to see further analysis to explore heterogeneity, but I wondered about contributing factors other than age and gender - intervention length, group vs individual delivery, which are known to influence treatment outcome. Were these considered and excluded? If so, what was the rationale?	Other moderators, such as intervention length and group vs individual delivery, were also considered but we needed to restrict the number of moderators examined due to time constraints. We have added to the discussion that these other contributing factors are important and should be considered in future research (p.41). “Moderators such as intervention length, group vs individual delivery, face to face vs online format should all be investigated further.”
Discussion	
The Discussion was underwhelming, largely because it didn't really engage with implications of findings, focusing instead on just repeating the key findings, and listing strengths and limitations. It is good to see that	We have now added more details around mechanisms and why psychological interventions have an impact on loneliness (p.38)

psychological interventions have an impact on loneliness, but why is this the case?	“Therefore, a key question is what are the mechanisms which lead psychological interventions to be successful in reducing loneliness? It is postulated that psychological interventions are successful at reducing loneliness due to the subjective and perceptual nature of loneliness. It is recognised that increasing the amount of social contact alone does not necessarily address the negative interpersonal thoughts or emotional responses, which can maintain loneliness (Käll et al., 2020). As psychological interventions are designed for reducing mental health difficulties such as anxiety or depression, which involve mental processes that can overlap with the cognitive changes linked with loneliness, it is proposed that changing a person’s mental processes can lead to a change in social behaviour, and reduced loneliness over time (Mann et al., 2017). The transdiagnostic model of chronic loneliness proposed by Käll, Shafran and colleagues (2020) can also add light to which mechanisms are likely to be addressed in some psychological interventions for loneliness. This model suggests 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 overall

	consequence is that a negative self-image is established, along with a desire to avoid social contact, results in chronic feelings of loneliness. Therefore, the most commonly used psychological intervention for loneliness in this meta-analysis, Cognitive Behavioural Therapy (CBT), 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 (Käll., Shafran and Lindegaard, 2020).
There was a marginal effect (p=.06) of intervention type, with some suggestion of difference between effects sizes. Given the interventions were selected for being theoretically derived, this begs some exploration of the role of the theory guiding these interventions and their predictions about potential mechanisms supporting improvement. This would be particularly important in light of Masi's review whose findings are opposite to those reported here, with CBT being found to have the largest effect size (and substantially larger than that reported in the present study) and social skill development having no effect.	We thank the reviewer for this important point which we have incorporated into the discussion. We have also thanked the reviewers for their anonymous comments given we have included this point almost in its entirety. We discuss our findings in light of Masi's review, and the need for replication. In our view, the interventions show some overlap despite different theoretical orientations which has implications for testing distinct interventions. (p.39) "Another key finding was that the effectiveness of psychological interventions varied based on which therapeutic approach was used. Whilst this difference did not reach statistical significance, it indicates that some psychological interventions are better able to alleviate loneliness than others. The reminiscence intervention had the highest effect size, followed by social

	identity approach interventions and then CBT. However, results should be interpreted with some caution, given that the reminiscence study included was found to have a high risk of bias. Furthermore, due to only having a limited number of studies in most therapy modalities, for example, only one reminiscence based study, further sub-group analyses will need to be conducted as more data and interventions are published. Interestingly, our subgroup analysis found CBT and social skills had similar effect sizes, differing to Masi and colleagues (2011) who found cognitive interventions as having the largest effect size and social skills development having no effect. Our finding can be explained by both of these interventions having some overlap despite different theoretical orientations. For example, CBT is often focused on supporting behavioural change such as increased socialising, which will also be a component of social skills interventions.”
In elaborating on the question of mechanism, the authors should provide clearer direction for future research given they focused only on theory driven interventions which have make predictions about how interventions produce change.	We have now expanded the question of mechanisms to include approaches other than theory-driven, for example potential mechanisms identified by people with lived experience (p.39) “It would be beneficial to also consider mechanisms for change through qualitative research with individuals with lived experience of chronic loneliness, who have undertaken psychological interventions for loneliness, or with mental health practitioners working with lonely individuals (e.g. Stefanidou, Wang & Morant et al. 2021) ”

Reviewer #2: Review for Clinical Psychology.	
Introduction	
Page 3, paragraph 2. Authors note that rates of loneliness appear to be rising. Is that the case? References needs. Also, in all age groups and before the COVID-19 pandemic?	We have re-examined literature around rates of loneliness rising and further examined this regarding loneliness across the lifespan and before the COVID-19 pandemic. We have removed the term “loneliness is rising” and focussed on the well-researched increase due to COVID-19 and we have added in literature around the particularly striking increase in youth loneliness (p.3): “Loneliness is prevalent and the recent widespread implementation of disease control measures such as social distancing, lockdown and quarantine measures to tackle coronavirus (COVID-19) have been found to increase rates of loneliness (Patel & Clark-Ginsberg, 2020; Banerjee and Rai, 2020; Hwang et al., 2020). A large-scale and nationally representative study by Li and Wang (2020) found an elevated prevalence of loneliness (35.86%) during the COVID-19 pandemic. This finding is similar to those of longitudinal data from 2,221 adults in the UK, which indicates that the prevalence of loneliness in the UK has more than doubled during the COVID-19 lockdown (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.”
Page 4, paragraph 2. The authors note loneliness as a public health crisis, but make reference only to work that	We have now added in further literature and health implications for lonely youth. (p.4)

highlights health issues for adults. There is work suggesting well-being and health implications for lonely youth too, and reference to that work is important.	"There are also significant health implications for loneliness on young people. Qualter et al., 2013 found that young people with moderate but rising levels or high levels of loneliness had lower perceived general health at age 17 and a higher frequency of visits to their doctor. "
Page 12. Risk of bias. Why did the authors decide that this aspect of the work include assessment of all manuscripts independently by two authors? Why the new approach?	Cochrane guidance suggests that two authors should complete risk of bias assessments, however, due to time constraints and our focus on ensuring two coders completed all screening, it was felt that 29% of the papers being independently by two authors would ensure that this was done consistently.
Page 15. The authors note that some studies were pilot RCTs. Can the authors provide some more information about what makes such a study a pilot rather than a full RCT?	The studies were identified as being pilot rather than a full RCT based on how the original paper described the study in the methods. One of the studies (Kall et al., 2020) stated that a pilot approach was used due to only one previous internet-administered intervention being tested against loneliness." We have now added this to the manuscript. (p.16) "Studies were identified as pilot RCTs based on the explicit description of the RCT being a 'pilot' study within the original paper's methods section."
In the same section of the results (page 15, paragraph 2), the authors write that 19 studies collected follow-up date. I know that the authors mean beyond the RCT time frame, but that may not be clear to all readers; it is worth thinking how the sentence might be rephrased so there is no confusion.	This has now been rephrased and reads: (p.17) "Nineteen studies also collected follow-up data beyond the RCT timeframe"

Page 16. How did the information on loneliness measurement feed into the quality check? Or, was this information simply used in the moderator analyses? Also, aren't the ILQ and the LSDQ the same measure?	The risk of bias tool has a module on risk of bias in the measure of the outcome. The loneliness measure would feed into the quality check through ratings such as “was the method of measuring the outcome was inappropriate.” Thank you for noticing the ILQ and LSDQ are the same measure, this has been updated in the paper (p.18)
Page 17. I wondered how bias was represented across age group or type of intervention? That information would be useful for the reader and could be included as supplementary material if the authors did not want to disrupt the flow of the manuscript.	We have now included risk of bias rating in Table 2 so that it can easily be seen alongside the interventions other characteristics. (p.20)
Page 37, paragraph 2. The authors note that several studies included in the analysis had high attrition rates. Was that not taken into account here by using the risk of bias as a moderator?	Whilst the risk of bias includes high attrition, it is also informed by other domains such as blinding of participants, meaning that attrition alone may not be fully accounted for.
Page 37, paragraph 3. It is worth referencing the Eccles and Qualter (2020) publication again here because their meta-analyses found the same issue for the youth interventions. Combined, those findings suggest that we need to ask more about 'loneliness' rather than make assumptions about who experiences it.	Thank you for this suggestion, we have now included Eccles and Qualter (2020) again: (p.41) “These findings were also apparent in Eccles and Qualter’s (2020) meta-analysis of interventions for loneliness in young people. Combined, these findings suggest that we need to ask more about loneliness rather than make assumptions about who experiences it.”

Highlights

- Loneliness is prevalent, distressing and associated with adverse mental health outcomes
- A systematic review and meta-analysis were conducted on randomised controlled trials (RCTs) of psychological interventions for loneliness
- It was found that psychological interventions are effective at reducing loneliness compared to control groups

Abstract

Chronic loneliness is associated with a range of mental health difficulties. Previous theory and research indicate that psychological interventions show promise for reducing loneliness, however, there have been no systematic reviews or meta-analyses to ascertain the efficacy of these interventions across the lifespan. The aim of this study was to synthesise, meta-analyse and explore the heterogeneity in RCTs of psychological interventions for loneliness in order to establish their efficacy.

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 3,973 studies and 103 full texts, finding 31 studies that met inclusion criteria, 28 of which contained sufficient statistical information to be included in the meta-analysis. The quality of included studies was assessed using the Cochrane Risk of Bias Tool.

The 31 studies (N = 3,959) that were included in the systematic review were conducted with 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 Cognitive Behavioural Therapy (CBT).

28 studies (N = 3,039) were included in a meta-analysis which found that psychological interventions significantly reduced loneliness compared to control groups, yielding a small to medium effect size (g = 0.43). Subgroup analysis and meta-regressions were conducted in order to explore heterogeneity and found that type of psychological intervention was approaching significance as a moderator of the effectiveness of psychological interventions for loneliness.

In conclusion, psychological interventions for loneliness across the lifespan are effective. This finding should inform policy makers, researchers and clinicians going forward, especially in the context of increased loneliness due to the COVID-19 pandemic. There was considerable heterogeneity in the effectiveness of the interventions, suggesting that future research should also explore what works for whom and consider personalising psychological treatment.

Author Biography

Dr Nisha Hickin has completed a Doctorate in Clinical Psychology at Royal Holloway, University of London. She conducted her thesis on psychological interventions for loneliness, considering the effectiveness of interventions in addition to considering what works for whom. Dr Nisha Hickin is a member of University College London's Loneliness and Mental Health Network, conducting research in collaboration with Professor Roz Shafran. Dr Nisha Hickin now works clinically in the NHS, providing evidence-based interventions to children and adolescents. She had a strong interest in working collaboratively with young people to optimise recovery from mental health difficulties.

Role of funding sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Contributors

NH and RS conceived the idea of this review. NH and GM conducted the literature search; AK was a second reviewer and quality rater. SS assisted with data extraction, coding, checking and referencing. RS was the third reviewer. DL and NH conducted the statistical analysis. NH summarised the findings of previous research studies and wrote the first draft of the manuscript. All authors contributed to, revised and approved the final version.

Declaration of Competing Interest

The authors declare that they have no conflicts of interest.

Acknowledgements

Dr. Hickin's research was supported by Barry Sutcliffe who proof-read this research and Dr Gary Brown also provided supervisory guidance to this research.

The Effectiveness of Psychological Interventions for Loneliness: A Systematic Review and Meta-Analysis

Dr Nisha Hickin, Professor Roz Shafran, Anton Käll, Sebastian Sutcliffe, Dr Dean Langan and Grazia Manzotti

1. Introduction

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 – although research suggests that in fact these related concepts can have an independent relationship with mental health difficulties, such as depression (Ge et al., 2017). Loneliness is influenced by both the quantity of social contact and the perceived quality and features of social relations, such as intimacy and trust (Yanguas et al., 2018, Schwarzbach et al., 2014). Furthermore, research has shown that loneliness and social isolation have distinct impacts on physical health and mortality (Tanskanen & Anttila, 2016, Steptoe et al., 2013).

Loneliness is prevalent and the recent widespread implementation of disease control measures such as social distancing, lockdown and quarantine measures to tackle the recent coronavirus (COVID-19) pandemic have been found to increase rates of loneliness (Patel & Clark-Ginsberg, 2020; Banerjee & Rai, 2020; Hwang et al., 2020). A large-scale and nationally representative study by Li and Wang (2020) found an elevated prevalence of loneliness (35.86%) during the COVID-19 pandemic. This finding is similar to those of longitudinal data from 2,221 adults in the UK, which indicate that the prevalence of loneliness in the UK has more than doubled during the COVID-19 lockdown (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 first UK lockdown period and nearly half reporting concerns about those feelings.

Whilst transient loneliness can result in emotional distress associated with social disconnection, it is commonplace and adaptive, as it motivates the creation and maintenance of social connections (Cacioppo et al., 2006). However, when loneliness becomes a chronic and more persistent state, related to a lack of satisfying social relationships over an extended period of time, this triggers neurobiological and behavioural mechanisms that contribute to adverse health consequences (Cacioppo & Hawkley, 2009; McDade et al., 2006).

Cacioppo and Hawkley (2009) theorise a self-reinforcing loop to explain the formation and maintenance of chronic loneliness. They propose that loneliness can increase hypervigilance and cognitive biases towards social threat, leading lonely individuals to anticipate negative social interactions and remember more 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. Käll, Shafran and colleagues (2020) state that the challenge of social interaction may also be compounded by individual difficulties such as mental 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.

Chronic loneliness is emerging as a serious global health concern, as it 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). There are also significant health implications for loneliness on young people. Qualter et al. (2013) found that young people with moderate and rising levels or high levels of loneliness had lower perceived general health at age 17 and a higher frequency of visits to their doctor. Furthermore, decreased employee health caused by loneliness has major economic consequences, costing UK employers alone an estimated £2.5 billion per year (Abdallah et al., 2017).

Importantly, loneliness can be viewed as a transdiagnostic construct (Käll, Shafran, Lindegaard, et al., 2020) that can occur alongside, as well as predict and exacerbate, a range of 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 study of 7,461 adults by Meltzer and colleagues (2013) found that the likelihood of being lonely is eight times greater in individuals with a diagnosed mental health difficulty. Additionally, these odds are increased 20-fold for those with two or three mental health diagnoses (Meltzer et al., 2013). Furthermore, 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.

A sample of 594 primary care patients showed that loneliness, when left untreated, can independently predict worse anxiety and depression symptoms after one year (van Beljouw et al., 2010). When in treatment, a longitudinal analysis of older adults has found that higher loneliness scores are associated with poorer mental health treatment outcomes (Holvast et al., 2015). In addition, a rapid review of 63 studies and 51,576 children with good

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

The picture presented by existing research into chronic loneliness highlights that it not only precipitates and exacerbates other serious conditions but is also a distressing psychological phenomenon in its own right that necessitates intervention. Despite this, the development and dissemination of evidence-based interventions for loneliness is still in its infancy compared with interventions for specific mental health 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 lifespan (Dickens et al., 2011). This limitation is important as loneliness is present and problematic across age groups. Secondly, the majority of reviews have not focused primarily on loneliness, but instead have included studies targeting social isolation. This is problematic as loneliness and social isolation are distinct and only 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 when 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 a range 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, although many of the studies did not target youth for whom loneliness was a clinical or chronic problem and moderator analyses did not ascertain which type of intervention was most effective. However, effect sizes revealed that the type of interventions with the most promise were psychological interventions, as well as social and emotional skills training.

Together, the findings of Masi et al. (2011) and Eccles and Qualter (2020) provide evidence that psychological interventions have promising efficacy for reducing levels of loneliness. This is despite psychological interventions being guided by a broad array of theoretical underpinnings, some of which are not specific to understanding the processes underpinning loneliness but instead target transdiagnostic processes, such as avoidance and cognitive biases. The effectiveness of psychological interventions for loneliness can be understood then by considering the overlap in maintaining mechanisms between loneliness

and mental health difficulties that interventions such as CBT were designed to treat (Mann et al., 2017).

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, 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 chronic loneliness. In spite of this promise, 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. This systematic review and meta-analysis advances 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 promising efficacy for reducing clinical levels of loneliness. Furthermore, psychological treatments for loneliness may also have the added benefit of reducing mental health problems, which often co-occur with loneliness. Thirdly, it

only includes studies in which loneliness is the primary or part of the primary target of the intervention. Fourthly it extends the literature search by a further eleven 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 lastly, via moderation and sub-group analysis, it establishes key criteria for intervention success which were not conclusively established in previous research. The moderators investigated are: the type of psychological intervention, the age of participants, the risk of bias rating and the percentage of female participants.

Type of psychological intervention will be included in moderator analysis so that the most effective interventions can be identified and applied in clinical practice. With this being the first systematic review or meta-analysis of psychological interventions for loneliness across the lifespan, it provides the opportunity to establish if age will be a moderator of intervention effectiveness. Due to psychological interventions for loneliness being a relatively novel area it is likely that the studies will vary in quality. Therefore, subgroup analysis will consider if studies with high, medium or low risk of bias are more effective. Additionally, previous research has been conflicted regarding the link between gender and loneliness (Solmi et al., 2020, Barreto et al., 2020), therefore this will also be examined.

Therefore, the aims of the review are to:

1. Summarise and synthesise the findings of RCTs to address psychological interventions for loneliness across the lifespan
2. Ascertain the overall effectiveness of psychological interventions compared to control conditions and
3. 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) and the Cochrane Handbook (Higgins, Thomas & Chandler, 2020). 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 and updated in November 2020. 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.

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 until the end of November 2020.

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.

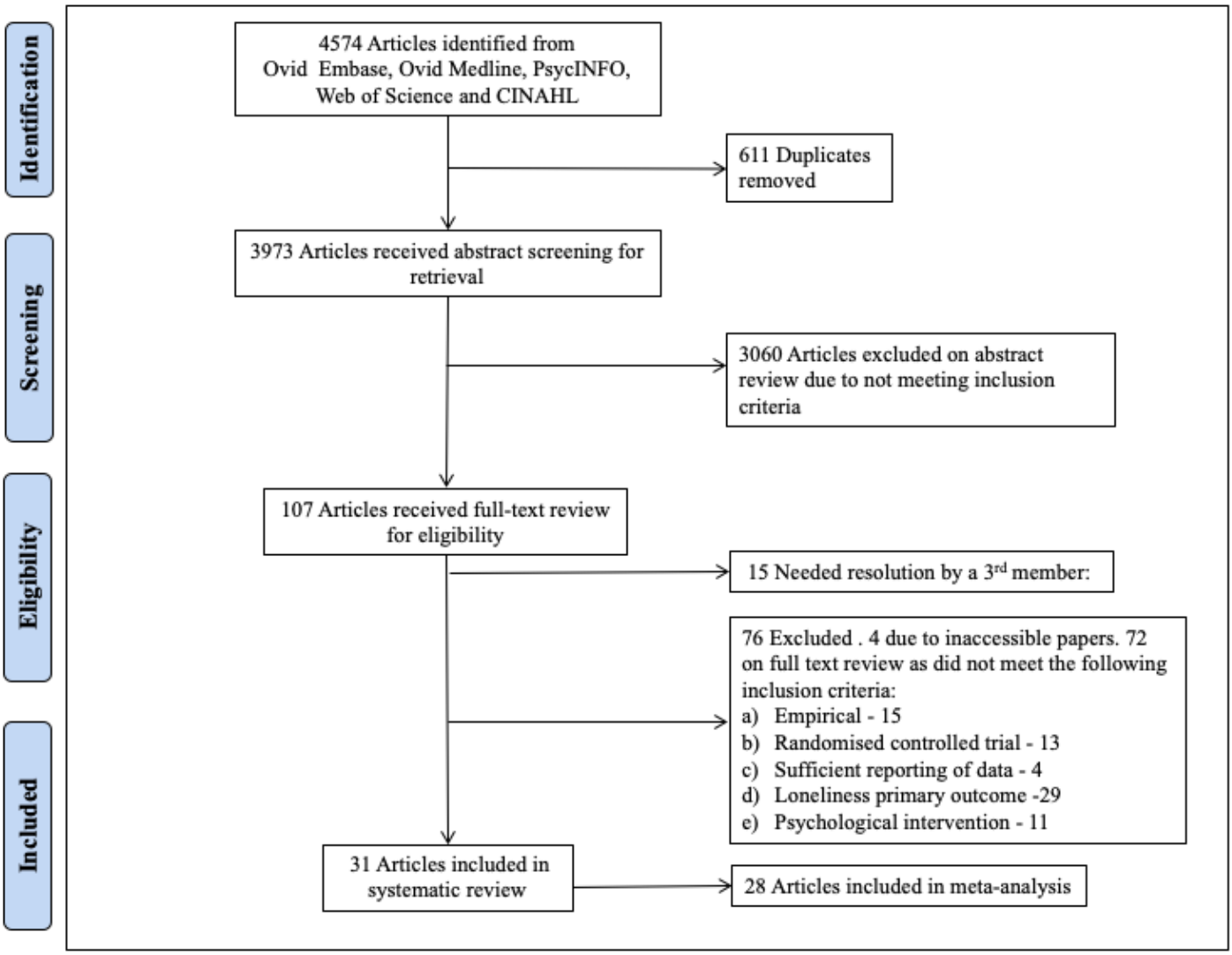
2.3 Data Collection

Articles were identified, screened and assessed following PRISMA's guidelines (Moher et al., 2009). (See Figure 1 for flowchart.) Repeat listings of papers across the databases were deleted by the primary researcher. Endnote was used as the systematic review tool. Criteria for inclusion were applied by two independent reviewers (the primary researcher and a PhD Clinical Psychology student with expertise in loneliness) who each examined the abstracts of all 3,973 obtained publications. The inter-rater agreement was

97.2% at the abstract screening stage. Conflicts of opinion regarding the eligibility of studies were discussed until consensus was reached.

Figure 1

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



Following the screening stage, which err on the side of inclusion, 107 papers appeared to meet the eligibility criteria. Four could not be accessed and, because their authors did not 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 103 papers that had their full text reviewed, the inter-rater agreement was 81.55%. Any conflicts of opinion regarding inclusion of articles were discussed, with a referral to a third reviewer (RS) if necessary, until consensus was reached. Following full text screening, it was decided that 31 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. Two authors did and their papers were included. The other three did not 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. The RoB tool was chosen based on literature indicating it to be a comprehensive and widely used tool for evaluating RCTs (Higgins et al., 2011, Farrah et al., 2019). 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 (e) 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 25 articles, the second rater (AK) independently assessed 15 articles, nine of which were coded by both authors (29%) independently. Of those nine, 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 post measurement was taken from the end of the intervention and not from follow up data collection. 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). REML was used as the method for estimating the heterogeneity variance due to its favourable statistical properties (Langan et al., 2019).

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 and subgroup analyses were conducted to evaluate potential moderators, including age of participant, type of psychological intervention and risk of bias rating. 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.

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

Thirty-one 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 2020. Thirteen were carried out in the USA, three in Iran, two in China, Taiwan and the Netherlands, and one in each of the following countries: Sweden, South Africa, Australia, Japan, Palestine, Israel, United Kingdom, Canada and Italy. Most of the studies did not report participants' ethnicity.

All studies were randomised controlled trials (RCTs) although some were pilot RCTs. Studies were identified as pilot RCTs based on the explicit description of the RCT being a 'pilot' study within the original paper's methods section. The total number of participants across all studies was 3,959. Sample sizes at baseline ranged from 17 to 817 (M = 127.71). However, there was often significant attrition of participants. The drop-out percentage based on missing data at post-treatment from baseline to post intervention ranged from 0% to 45.4% (M = 10.45%). Nineteen studies also collected follow-up data beyond the RCT time frame, the follow ups taking place between 1.5 months and 6 months post intervention (M = 3.92).

The average age of participants ranged from eight years to 81 years (M = 45.20). Four studies were with children, six with young adults (below 25), ten with middle age adults (26–64), five with old adults (65–74) and four 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 62.47%. When the studies with single sex samples were removed, the average percentage of females was 57.47%.

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.

Sixteen of the interventions were group-based, eight were individual and seven were a combination of group and individual. Twenty-four of the interventions were face-to-face and seven were delivered over the phone or via the internet. Fourteen studies used a waitlist control group and participants allocated to this group received the intervention once the intervention group had completed treatment. Eleven studies had active control groups and six offered no treatment to the control group.

Psychological treatments lasted between five days and 52 weeks (M = 10.11 weeks) and sessions were mostly delivered weekly. The mean number of sessions delivered was 9.94, with sessions typically lasting one to two hours, with group treatment sessions on average lasting longer than individual sessions.

The measure used by nineteen studies was either the 20-item, ten-item or eight-item version of the UCLA loneliness scale (Russell, 1996). Four used the De Jong-Gierveld Loneliness Scale (De Jong-Gierveld & Kamphulus, 1985), two used the Illinois Loneliness Questionnaire (ILQ: Asher et al., 1984), one used the Chinese College Student Loneliness Scale (Li et al, 2006), one used the Social and Emotional Loneliness Scale for Adults (SELSA: DiTommaso & Spinner, 1993), and one used the Patient-reported Outcomes Measurement Information System (PROMIS: Hahn et al., 2010).

3.2 Quality Appraisal

Nine studies were rated as having a low risk of bias, twelve as having some concerns and ten 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 2). 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. Appendix 1 presents the quality checklist ratings for all studies included in the review.

Figure 2

Risk of Bias Bar Chart

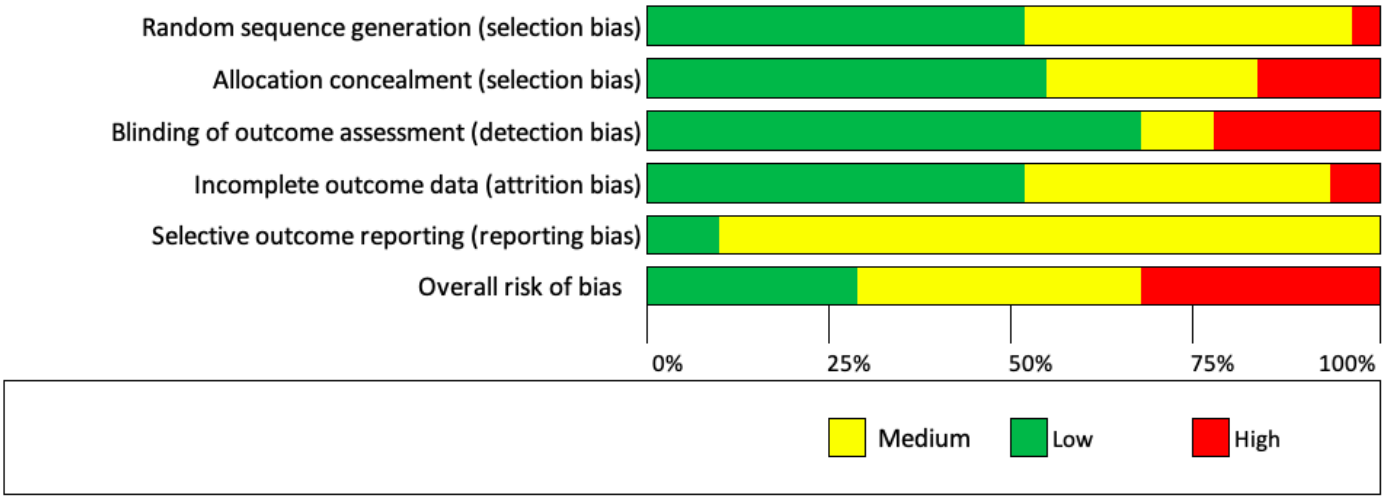


Table 2

Characteristics of Studies

Author, Year, Country, Risk of Bias (ROB)	**Participants**	**Sample Size**	**Control Group**	**Format of Intervention**	**Measure of Loneliness**	**Psychological Theory**	**Effectiveness Results**
Alaviani et al. (2015) **Iran** ROB: High	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** ROB: High	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
Bruehlman-Senecal et al.	University students	221 (I = 100,	Waitlist control	Individual	UCLA Loneliness	CBT	No significant condition

(2020) **US** ROB: Medium	Mean age = 19 59% female	C = 121) 5.43% dropout		Phone app Open access to app over four weeks. Survey at weeks two and four 8 week follow up	Scale – short version (8 items)	Nod app incorporates positive psychology, mindfulness-based self-compassion and cognitive behavioural skill-building	differences in loneliness at week 4. However, significant condition-by-baseline depression interaction to predict week-4 loneliness
Cacioppo et al. (2015) **US** ROB: High	US Army service personnel Mean age = 24 3% female	817 (I = 489, C = 328) 28.89% 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
Caputi et al. (2020) **Italy** ROB: Medium	Children Mean age = 10 48% female	210 (I = 105, C = 105) 0%	Active control: physical stories	Individual & group Face to face 5 x weekly sessions 2-month follow up	Illinois Loneliness Questionnaire (ILQ: Asher et al., 1984)	Social skills training Participants read and discussed mentalistic stories, which contain a discrepancy in beliefs/knowledge/points of view between characters and so tap into the concepts of persuasion, misunderstanding, white lie, irony/sarcasm and contrary emotions in order to develop theory of mind	Significant decrease in loneliness in intervention group. However, no significant difference between groups at follow up
Chiang et al.	Older men	92	Waitlist	Group	UCLA	Reminiscence	Reduction in

(2010) **Taiwan** ROB: High	living in a nursing home Mean age = 77 0% female 55% illiterate 58% unmarried	(I = 47, C = 45) 29.4% dropout	control	Face to face 8 x 90 min weekly sessions 3-month follow up	Loneliness Scale – version 3 (20 items)	Focusing on positive memories	loneliness in comparison to control. However, results not significant
Choi et al. (2020) **US** ROB: Medium	Older adults Mean age = 74 62% female	89 (I = 43, C = 46) 9% dropout	Active control: videoconference friendly visit	Individual Teleconferencing x5 sessions 12-week follow up	8-item PROMIS Social Isolation Scale (PROMIS-L)	CBT Behavioural activation is a brief, structured behavioural approach that aims to increase and reinforce wellness-promoting behaviours	Compared with control, intervention group had greater increase in social interaction and satisfaction with social support and decrease in loneliness
Cohen-Mansfield et al. (2018) **Israel** ROB: Medium	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	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

				3-month follow up			
Creswell et al. (2012) **US** ROB: Low	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** ROB: Low	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 narrative, imagery and psycho-educational techniques	The intervention effect was gender-specific as boys' but not girls' loneliness in peer relations decreased in the intervention group and not among controls

Frankel et al. (2010) **US** ROB: High	Children with ASD Mean age = 9 14% female 45% Caucasian IQ above 60	76 (I = 46, C = 30) 10.5% dropout	Waitlist control	Group (concurrent parent and child) Face to face 12 x weekly 60 min sessions 3-month follow up	The Illinois Loneliness Questionnaire (20 items)	Social Skills Contains modules that teach social etiquette and specific rules of behaviour which are used by the peer group	Children in the intervention condition reported significantly reduced loneliness compared with control
Fukui et al. (2003) **Japan** ROB: Medium	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** ROB: Low	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 attending concurrently	Social and Emotional Loneliness Scale for Adults (SELSA: DiTommaso and Spinner 1993)	Social Skills UCLA PEERS for Young Adults Programme (Laugeson et al., 2012): Evidence-based manualised instruction and rehearsal of social skills related to	Self-reported loneliness decreased for the intervention group compared to control. This group also reported increased

	58% Caucasian IQ above 70			No follow up		building close relationships	participation in social activities, reduced romantic loneliness and the development of friendships compared to control
Haslam et al. (2019) **Australia** ROB: Low	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** ROB: Low	Older adults living with HIV/AIDS Mean age = 54 32% female 50% Caucasian	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	UCLA Loneliness Scale (10 Item version)	CBT Improvement of adaptive emotion-focused coping strategies Based on the Transactional Model of Stress of Coping	No effects on loneliness compared to control. Control group reported significant post-intervention reduction in loneliness

	85% unemployed 49% gay; 15% bisexual; 36% heterosexual			3-month follow up		(Folkman & Lazarus, 1984)	
Jarvis et al. (2019) **South Africa** ROB: High	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	Individual and group 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 controls and this was maintained at follow up
Jing et al. (2018) **China** ROB: High	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	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

				sessions over 9 months 3 and 6-month follow ups			
Käll et al. (2020) **Sweden** ROB: Low	General population Mean age = 47 71% female	73 (I = 36, C = 37) 10% dropout	Waitlist control	Individual Online 8-week programme No follow up	Swedish translation of UCLA Loneliness Scale – version 3 (20 items)	CBT Cognitions and behaviours associated with loneliness	Intervention group felt significantly less lonely post-intervention compared to control
Kremers et al. (2006) **The Netherlands** ROB: High	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
Lai et al. (2020) **Canada** ROB: Medium	Older adults Immigrant members of the Chinese community	60 (I = 30, C = 30) 0% dropout	Active control: brief telephone calls from the programme coordinator	Individual and group Face to face Weekly, over 5 months	De Jong Gierveld Loneliness scale (11 items)	Social identity approach Peer-based social programme based on Dynamic Social Impact Theory	The intervention group showed a statistically significant decrease in loneliness compared to control

	Mean age = 81 63% female			No follow up			
Lindsay et al. (2019) **US** ROB: Low	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 compared with control
Lloyd-Evans et al. (2020) **UK** ROB: High	Adults with complex depression or anxiety Mean age = 43 73% female	40 (I = 30, C = 10) 12.5% dropout	Active control: standard NHS care, involving monthly meetings with a care coordinator and psychological/psychiatric support on referral	Individual and group Face to face Up to x10 hour-long individual sessions and x3 group sessions over 6 months 6-month follow up	De Jong Gierveld Loneliness scale (11 items)	Social identity approach The Community Navigator programme is a socially-focused approach, focusing on creating social goals and planning towards increasing social involvement in line with personal values	Reduction in loneliness in intervention group compared with control
Loucks et al. (2020) **US** ROB: Low	University students Mean age = 20 68% female 37% BAME	96 (I = 47, C = 49) 13.5% dropout	Waitlist control	Group Face to face Weekly group, plus daily 45-minute meditation for 6 days per week	UCLA Loneliness Scale – version 3 (20 items)	Mindfulness Mindfulness Based Stressed Reduction (MBSR) for college aged students (MB-College) incorporates a traditional MBSR programme with	Impact on loneliness pre to post was pronounced in the intervention group

				3-month follow up		psychoeducation on wellbeing prioritities for this demographic	
Mascaro et al. (2016) **US** ROB: Medium	Medical students Mean age = 25 75% female	32 (I = 21, C = 11) 45.8% dropout	Waitlist control	Group and Individual Face to face Group: 10 x 1.5 hr weekly sessions Individual: daily 20 min meditation No follow up	UCLA Loneliness Scale – version 3 (20 items)	Cognitive Based Compassion Training Meditation; compassion-focused attention training; analytic approach to challenging automatic thoughts	Participants in the intervention group reported decreased depression and loneliness and an increase in compassion compared to control
Matthews et al. (2018) **US** ROB: Medium	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	79 (I = 41, C = 38)	Active control (routine care): access to services provided by the AIDS Service	Individual Telephone 6 x 50 min	UCLA Loneliness Scale (10 item version)	IPT Psychoeducation and exploration of interpersonal	No significant change in loneliness in the intervention group or control

ROB: Medium	Mean age = 44 34% female 61% Caucasian	16.5% dropout		sessions No follow up		relationships and conflict	
Tabrizi et al. (2016) **Iran** ROB: Low	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** ROB: Medium	Chronically ill older adults Mean age = 75 89% female 70% lived alone	27 (I = 15, C = 12) 27.0% dropout	Active 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** ROB: Medium	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** ROB: Medium	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** ROB: High	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

3.3 Meta-Analysis

28 studies (N = 3,039) were included in a meta-analysis of pre- to post-treatment effect sizes (ESs). Psychological interventions significantly reduced loneliness scores compared to control groups ($p < 0.001$). The meta-analysis yielded a small to medium effect favouring the intervention group (overall ES g = 0.43, 95% CI = 0.18 – 0.68). ESs for individual studies ranged from -0.42 to 3.04 and substantial significant heterogeneity was observed ($T^2 = 0.49$, $Q = 228.60$, $p < 0.001$, $I^2 = 89.55\%$). See Figure 3 for the forest plot.

A funnel plot (see Figure 4) was created to identify potential publication bias. The funnel plot showed some asymmetry with larger studies having effect sizes closer to zero. However, Egger test (Egger et al., 1997) indicated that there was no significant evidence of funnel plot asymmetry or publication bias ($p = 0.19$).

Subgroup Analysis

To explore possible sources of heterogeneity, sub-group analyses were performed considering type of psychological intervention and risk of bias.

Types of psychological intervention

Type of intervention was categorised as CBT-based or not CBT-based. This categorisation was decided by three independent coders, one of whom an expert on CBT (RS), who considered the content of the interventions and the theory behind them. Whether interventions were CBT-based did not significantly influence the loneliness outcome ($I^2 = 0$, $p = 0.60$).

A further analysis grouped interventions into seven therapy categories: CBT (10 studies), gratitude (1) , reminiscence (1) , mindfulness (4), integrative (6), social skills (3) and social identity approach (3). This coding was decided by two independent raters. The interventions

therapy had varying effect sizes (see Figure 5), and the difference between effects was borderline significant (Qb = 11.99, df = 6, p = 0.06). The reminiscence intervention had the highest effect size, followed by social identity approach interventions then CBT.

Figure 3

A Forest Plot of Effect Sizes for Pre to Post Treatment

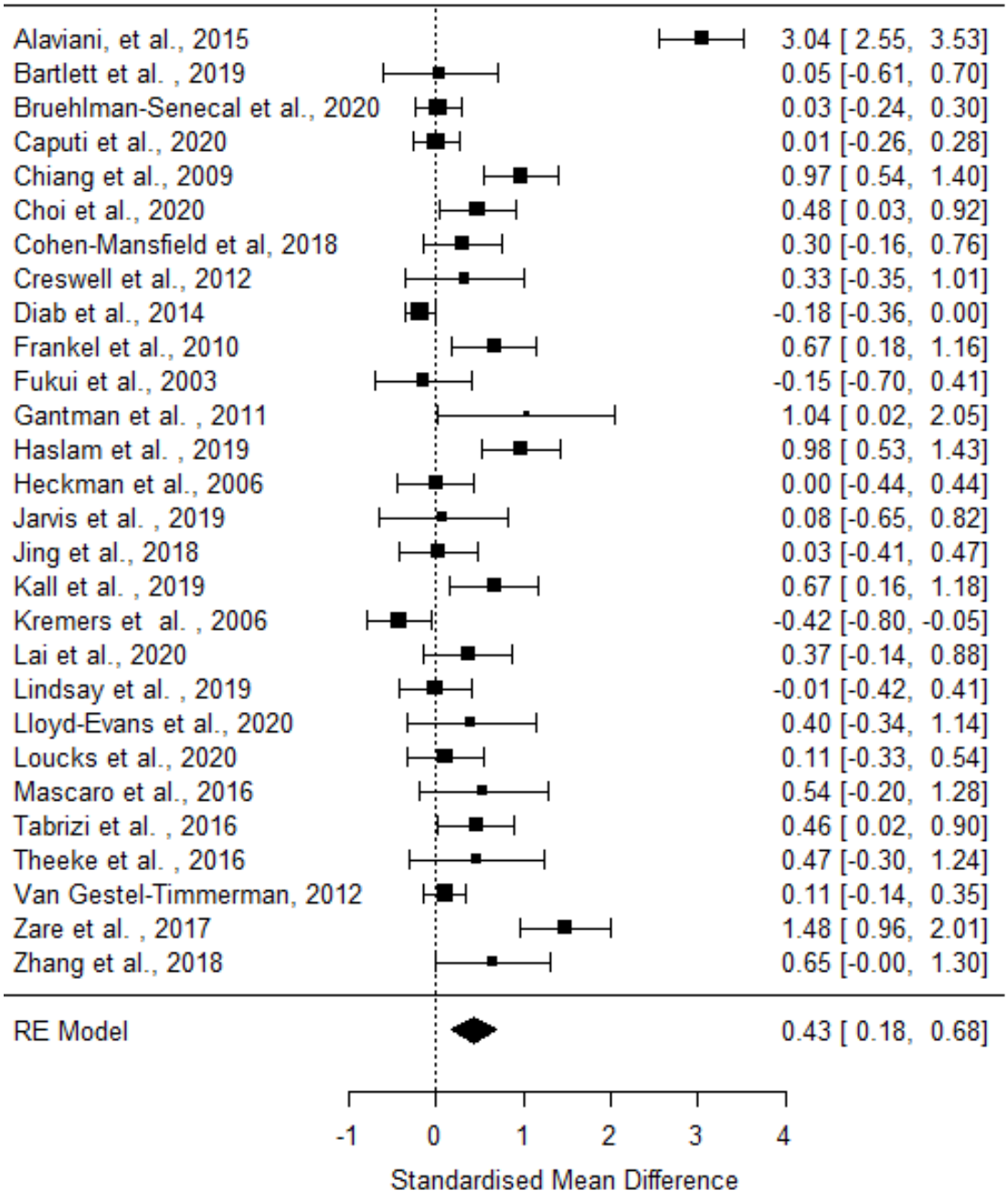
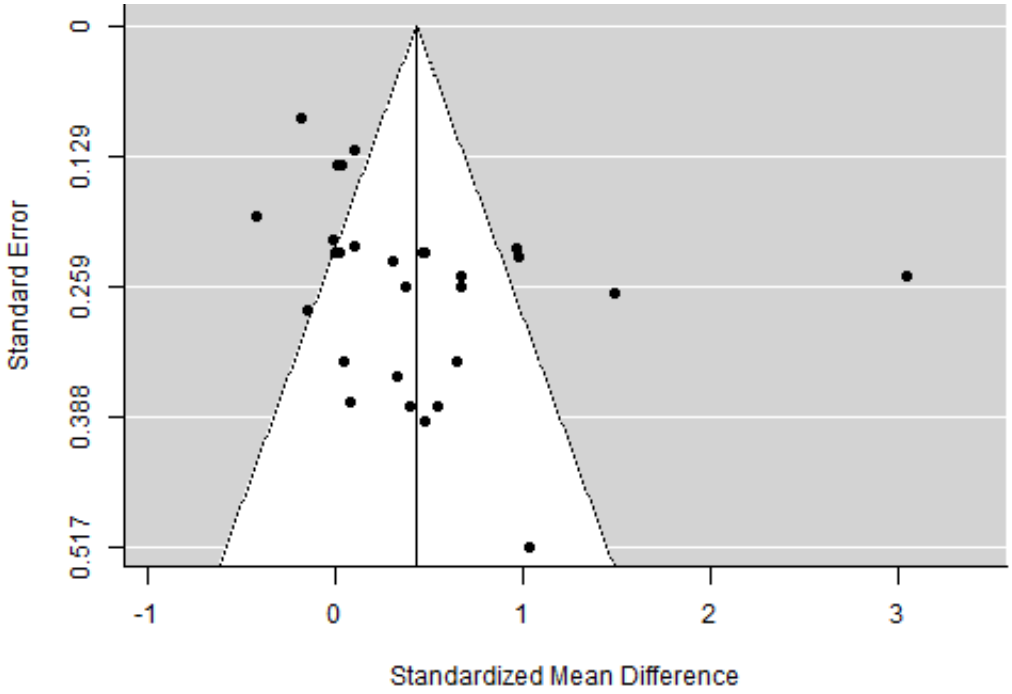


Figure 4

Funnel Plot of Meta-Analysis



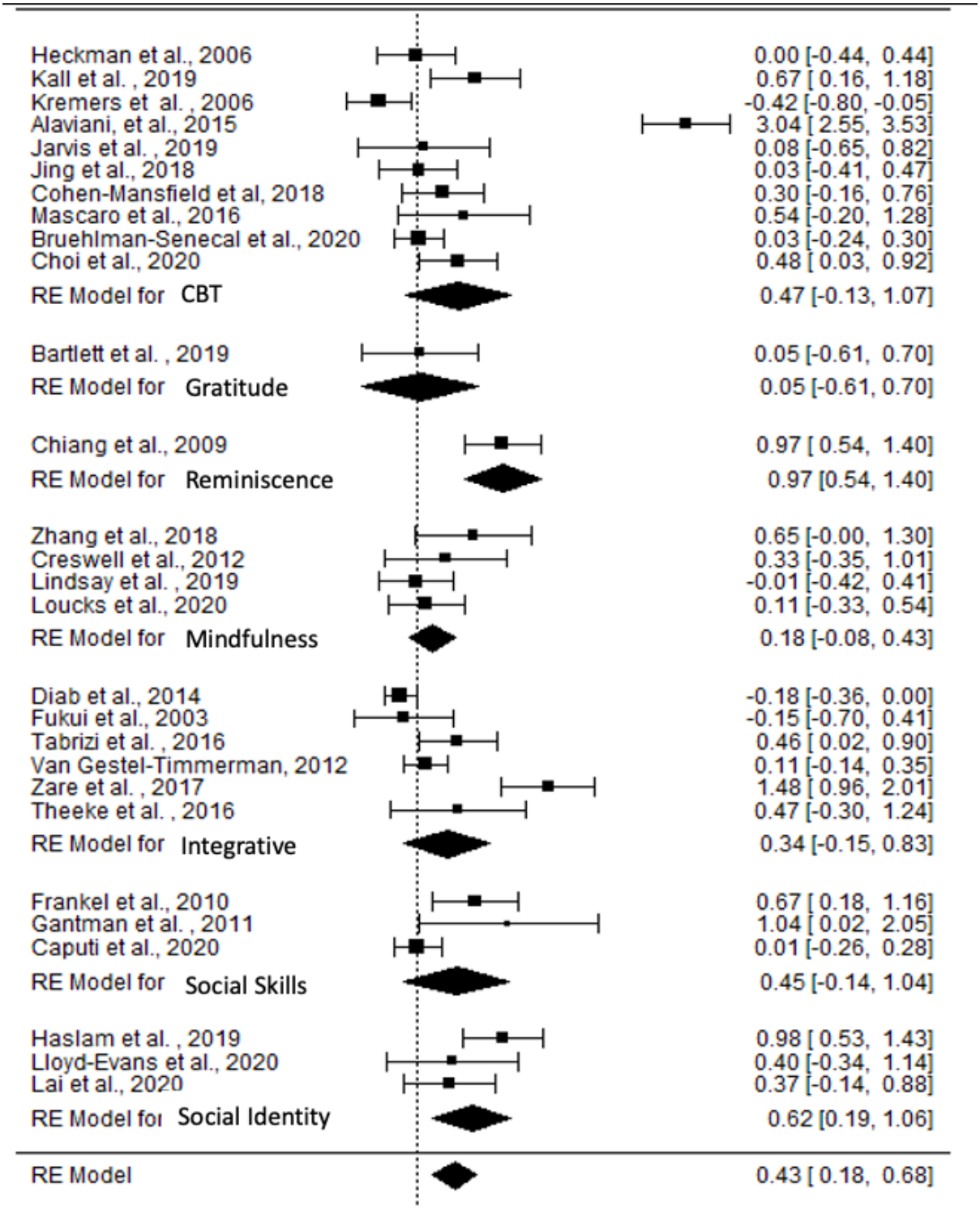
3.4

Risk of Bias

A subgroup analysis was conducted to ascertain if there was significant variation in effect sizes between studies of low, medium or high risk of bias. Ten studies had a low risk of bias, ten had a medium risk and eight had a high risk. The heterogeneity between the subgroups was non-significant (p = 0.84) and I^2 = 0%. Therefore, risk of bias rating was not a moderator of reduction in loneliness. Effect sizes and confidence intervals for each of the different risks were 0.38 (95% CI: 0.09, 0.67) across the low risk of bias studies, 0.33 (95% CI: 0.05, 0.60) and for the high risk of bias it was 0.56 (95% CI: - 0.18, 1.32).

Figure 5

A Forest Plot of Effect Sizes for different Types of Psychological Interventions



3.5 Meta-Regressions

Meta-regressions were conducted to investigate whether numeric study-level variables including ‘age of participants’ and ‘percentage female’ were associated with the effectiveness of psychological interventions for loneliness.

The meta-regression model for age was insignificant ($Qb = 0.02$, $df = 1$, $p = 0.74$), indicating that age was not significantly associated with interventions loneliness scores. Sex of participants, measured by the percentage of female participants in each study, was also a non-significant moderator of reduction in loneliness ($Qb = 0.17$, $df = 1$, $p = 0.68$).

4. Discussion

This systematic review and meta-analysis are 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 compared to control groups – represents a significant advance in loneliness research, building on the limited previous evidence (Barreto et al., 2020; Jarvis et al., 2019; Masi et al., 2011).

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). 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.

Whilst one of the eligibility criteria was that interventions needed to be psychological and based on psychological theory, the theoretical grounding underpinning these interventions is broad. Furthermore, whilst the psychological theory behind an intervention may be applied to loneliness, this was not the origin of these approaches. Therefore, the interventions were not all designed with loneliness in mind. Therefore, a key question is what

are the mechanisms which lead psychological interventions to be successful in reducing loneliness?

It is postulated that psychological interventions are successful at reducing loneliness due to the subjective and perceptual nature of loneliness. It is recognised that increasing the amount of social contact alone does not necessarily address the negative interpersonal thoughts or emotional responses, which can maintain loneliness (Käll, Shafran et al., 2020). As psychological interventions are designed for reducing mental health difficulties such as anxiety or depression, which involve mental processes that can overlap with the cognitive changes linked with loneliness, it is proposed that changing a person's mental processes can lead to a change in social behaviour, and reduced loneliness over time (Mann et al., 2017).

The transdiagnostic model of chronic loneliness proposed by Käll, Shafran and colleagues (2020) can also add light to which mechanisms are likely to be addressed in some psychological interventions for loneliness. This model suggests 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 overall consequence is that a negative self-image is established, along with a desire to avoid social contact, results in chronic feelings of loneliness. Therefore, the most commonly used psychological intervention for loneliness in this meta-analysis, Cognitive Behavioural Therapy (CBT), 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 (Käll, Jägholm et al., 2020). It would

be beneficial to also consider mechanisms for change through qualitative research with individuals with lived experience of chronic loneliness, who have undertaken psychological interventions for loneliness, or with mental health practitioners working with lonely individuals (e.g. Stefanidou et al., 2021) Another key finding was that the effectiveness of psychological interventions varied based on which therapeutic approach was used. Whilst this difference did not reach statistical significance, it indicates that some psychological interventions are better able to alleviate loneliness than others. The reminiscence intervention had the highest effect size, followed by social identity approach interventions and then CBT. However, results should be interpreted with some caution, given that the reminiscence study included was found to have a high risk of bias. Furthermore, due to only having a limited number of studies in most therapy modalities, for example, only one reminiscence based study, further sub-group analyses will need to be conducted as more data and interventions are published.

Interestingly, our subgroup analysis found CBT and social skills had similar effect sizes, differing to Masi and colleagues (2011) who found cognitive interventions as having the largest effect size and social skills development having no effect. Our finding can be explained by both of these interventions having some overlap despite different theoretical orientations. For example, CBT is often focused on supporting behavioural change such as increased socialising, which will also be a component of social skills interventions.

Sex of participants and targeted age group were not moderators of how effective interventions were. This demonstrates that psychological interventions aimed at all age groups can play an important role in alleviating loneliness for both men and women.

The present systematic review benefits from its methodological rigour, including the use of two independent coders for screening all 3,973 abstracts and 103 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.

However, the findings need to be interpreted with an awareness of some limitations. The review only included psychological interventions, making it not possible to compare their efficacy with other types of intervention for loneliness that focus on the wider context of individual's difficulties (e.g. wider community interventions). It has been argued that addressing individuals' maladaptive cognitions prepares them to 'get involved' in their community, although this may have a limited impact if an individual has a lack of connectedness to their community (Mann et al., 2017). 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.

Limitations of some specific studies included in the review include their small sample sizes and lack of underpinning power calculations. Additionally, several studies had very high attrition rates (up to 45.4%) 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 61% 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.

Whilst some studies targeted loneliness directly and ensured that participants self-reported as feeling lonely as part of their eligibility criteria, other studies did not, instead targeting certain populations that were presumed to be more at risk of loneliness. Moreover, the majority of interventions did not distinguish between transient and chronic loneliness. These findings were also apparent in Eccles and Qualter's (2020) meta-analysis of

interventions for lonely young people. Combined, these findings suggest that we need to ask more about loneliness rather than make assumptions about who experiences it.

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 will need to be tailored to individuals rather than using a 'one-size-fits-all' approach (Perese & Wolf, 2005; Victor, 2018). This level of heterogeneity points to a flexible modular psychological approach being beneficial (Käll, Shafran, 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. Moderators such as intervention length, group vs individual delivery, face to face vs online format should all be investigated further. Finally, future research should assess the long-term benefits of psychological interventions for loneliness and ascertain whether improvements are maintained post-treatment.

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The Effectiveness of Psychological Interventions for Loneliness: A Systematic Review and Meta-Analysis

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1. Introduction

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 – although research suggests that in fact these related concepts can have an independent relationship with mental health difficulties, such as depression (Ge et al., 2017). Loneliness is influenced by both the quantity of social contact and the perceived quality and features of social relations, such as intimacy and trust (Yanguas et al., 2018, Schwarzbach et al., 2014). Furthermore, research has shown that loneliness and social isolation have distinct impacts on physical health and mortality (Tanskanen & Anttila, 2016, Steptoe et al., 2013).

Loneliness is prevalent and the recent widespread implementation of disease control measures such as social distancing, lockdown and quarantine measures to tackle the recent coronavirus (COVID-19) pandemic have been found to increase rates of loneliness (Patel & Clark-Ginsberg, 2020; Banerjee & Rai, 2020; Hwang et al., 2020). A large-scale and nationally representative study by Li and Wang (2020) found an elevated prevalence of loneliness (35.86%) during the COVID-19 pandemic. This finding is similar to those of longitudinal data from 2,221 adults in the UK, which indicate that the prevalence of loneliness in the UK has more than doubled during the COVID-19 lockdown (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 first UK lockdown period and nearly half reporting concerns about those feelings.

Whilst transient loneliness can result in emotional distress associated with social disconnection, it is commonplace and adaptive, as it motivates the creation and maintenance of social connections (Cacioppo et al., 2006). However, when loneliness becomes a chronic and more persistent state, related to a lack of satisfying social relationships over an extended period of time, this triggers neurobiological and behavioural mechanisms that contribute to adverse health consequences (Cacioppo & Hawkley, 2009; McDade et al., 2006).

Cacioppo and Hawkley (2009) theorise a self-reinforcing loop to explain the formation and maintenance of chronic loneliness. They propose that loneliness can increase hypervigilance and cognitive biases towards social threat, leading lonely individuals to anticipate negative social interactions and remember more 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. Käll, Shafran and colleagues (2020) state that the challenge of social interaction may also be compounded by individual difficulties such as ~~social skills deficits~~, mental 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.

Chronic loneliness is emerging as a serious global health concern, as it 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). There are also significant health implications for loneliness on young people. Qualter et al. (2013) found that young people with moderate and rising levels or high levels of loneliness had lower perceived general health at age 17 and a higher frequency of visits to their doctor. Furthermore, decreased employee health caused by loneliness has major economic consequences, costing UK employers alone an estimated £2.5 billion per year (Abdallah et al., 2017).

Importantly, loneliness can be viewed as a transdiagnostic construct (Käll, Shafran, Lindegaard, et al., 2020) that can occur alongside, as well as predict and exacerbate, a range of 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 study of 7,461 adults by Meltzer and colleagues (2013) found that the likelihood of being lonely is eight times greater in individuals with a diagnosed mental health difficulty. Additionally, these odds are increased 20-fold for those with two or three mental health diagnoses (Meltzer et al., 2013). Furthermore, 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.

A sample of 594 primary care patients showed that loneliness, when left untreated, can independently predict worse anxiety and depression symptoms after one year (van Beljouw et al., 2010). When in treatment, a longitudinal analysis of older adults has found that higher loneliness scores are associated with poorer mental health treatment outcomes (Holvast et al., 2015). In addition, a rapid review of 63 studies and 51,576 children with good

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

The picture presented by existing research into chronic loneliness highlights that it not only precipitates and exacerbates other serious conditions but is also a distressing psychological phenomenon in its own right that necessitates intervention. Despite this, the development and dissemination of evidence-based interventions for loneliness is still in its infancy compared with interventions for specific mental health 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 lifespan (Dickens et al., 2011). This limitation is important as loneliness is present and problematic across age groups. Secondly, the majority of reviews have not focused primarily on loneliness, but instead have included studies targeting social isolation. This is problematic as loneliness and social isolation are distinct and only 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 when 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 a range 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, although many of the studies did not target youth for whom loneliness was a clinical or chronic problem and moderator analyses did not ascertain which type of intervention was most effective. However, effect sizes revealed that the type of interventions with the most promise were psychological interventions, as well as social and emotional skills training.

Together, the findings of Masi et al. (2011) and Eccles and Qualter (2020) provide evidence that psychological interventions have promising efficacy for reducing levels of loneliness. This is despite psychological interventions being guided by a broad array of theoretical underpinnings, some of which are not specific to understanding the processes underpinning loneliness but instead target transdiagnostic processes, such as avoidance and cognitive biases. The effectiveness of psychological interventions for loneliness can be understood then by considering the overlap in maintaining mechanisms between loneliness

and mental health difficulties that interventions such as CBT were designed to treat (Mann et al., 2017).

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, 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 chronic loneliness. In spite of this promise, 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. This systematic review and meta-analysis advances 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 promising efficacy for reducing clinical levels of loneliness. Furthermore, psychological treatments for loneliness may also have the added benefit of reducing mental health problems, which often co-occur with loneliness. Thirdly, it

only includes studies in which loneliness is the primary or part of the primary target of the intervention. Fourthly it extends the literature search by a further eleven 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 lastly, via moderation and sub-group analysis, it establishes key criteria for intervention success which were not conclusively established in previous research. The moderators investigated are: the type of psychological intervention, the age of participants, the risk of bias rating and the percentage of female participants.

Type of psychological intervention will be included in moderator analysis so that the most effective interventions can be identified and applied in clinical practice. With this being the first systematic review or meta-analysis of psychological interventions for loneliness across the lifespan, it provides the opportunity to establish if age will be a moderator of intervention effectiveness. Due to psychological interventions for loneliness being a relatively novel area it is likely that the studies will vary in quality. Therefore, subgroup analysis will consider if studies with high, medium or low risk of bias are more effective. Additionally, previous research has been conflicted regarding the link between gender and loneliness (Solmi et al., 2020, Barreto et al., 2020), therefore this will also be examined.

Therefore, the aims of the review are to:

1. Summarise and synthesise the findings of RCTs to address psychological interventions for loneliness across the lifespan

2. Ascertain the overall effectiveness of psychological interventions compared to control conditions and

3. 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) and the Cochrane Handbook (Higgins, Thomas & Chandler, 2020). 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 and updated in November 2020. 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.

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 until the end of November 2020.

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.

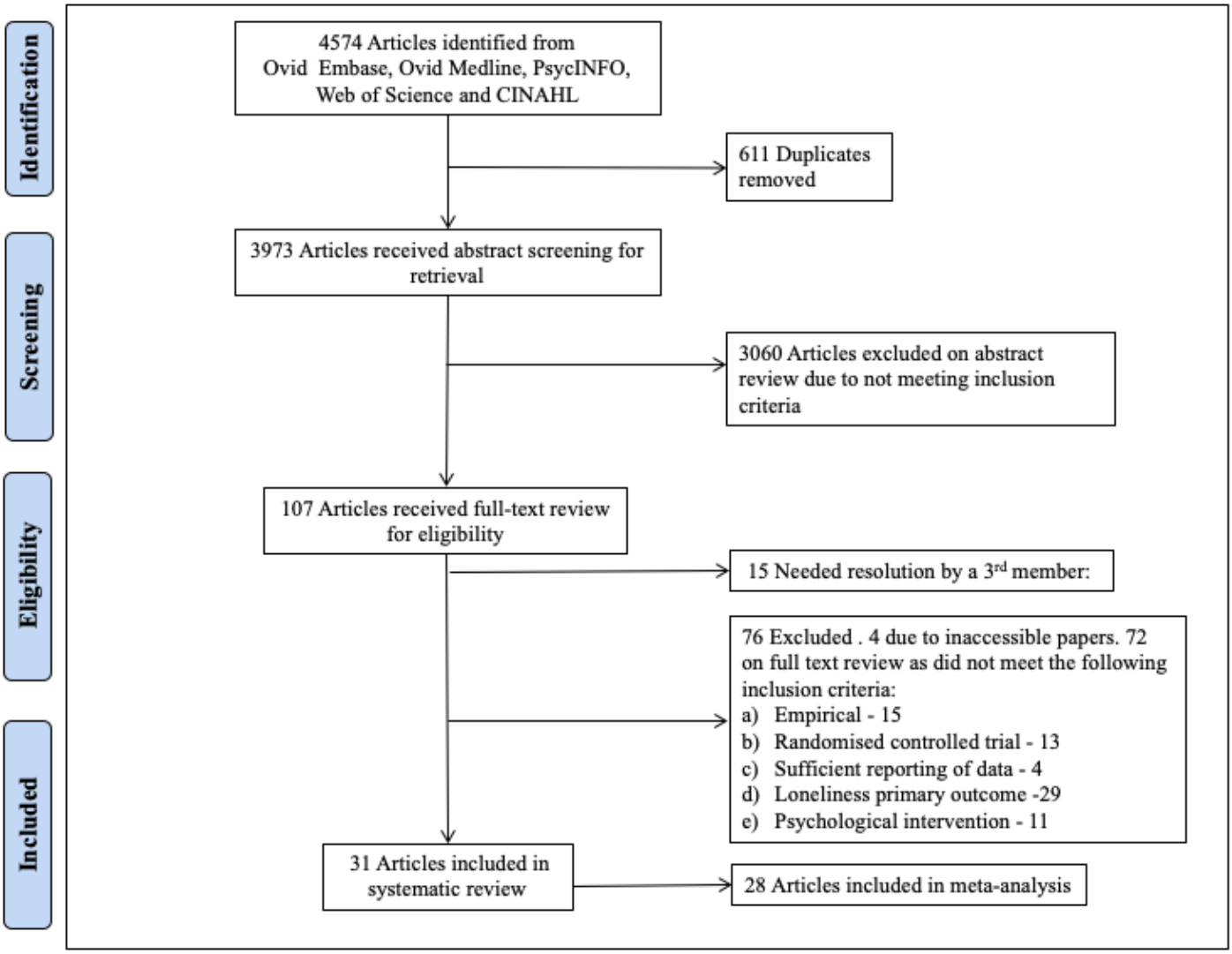
2.3 Data Collection

Articles were identified, screened and assessed following PRISMA's guidelines (Moher et al., 2009). (See Figure 1 for flowchart.) Repeat listings of papers across the databases were deleted by the primary researcher. Endnote was used as the systematic review tool. Criteria for inclusion were applied by two independent reviewers (the primary researcher and a PhD Clinical Psychology student with expertise in loneliness) who each examined the abstracts of all 3,973 obtained publications. The inter-rater agreement was

97.2% at the abstract screening stage. Conflicts of opinion regarding the eligibility of studies were discussed until consensus was reached.

Figure 1

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



Following the screening stage, which err on the side of inclusion, 107 papers appeared to meet the eligibility criteria. Four could not be accessed and, because their authors did not

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 103 papers that had their full text reviewed, the inter-rater agreement was 81.55%. Any conflicts of opinion regarding inclusion of articles were discussed, with a referral to a third reviewer (RS) if necessary, until consensus was reached. Following full text screening, it was decided that 31 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. Two authors did and their papers were included. The other three did not 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. The RoB tool was chosen based on literature indicating it to be a comprehensive and widely used tool for evaluating RCTs (Higgins et al., 2011, Farrah et al., 2019). 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 (e) 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 25 articles, the second rater (AK) independently assessed 15 articles, nine of which were coded by both authors (29%) independently. Of those nine, 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 post measurement was taken from the end of the intervention and not from follow up data collection. 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). REML was used as the method for estimating the heterogeneity variance due to its favourable statistical properties (Langan et al., 2019).

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 and subgroup analyses were conducted to evaluate potential moderators, including age of participant, type of

psychological intervention and risk of bias rating. 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.

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

Thirty-one 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 2020. Thirteen were carried out in the USA, three in Iran, two in China, Taiwan and the Netherlands, and one in each of the following countries: Sweden, South Africa, Australia, Japan, Palestine, Israel, United Kingdom, Canada and Italy. Most of the studies did not report participants' ethnicity.

All studies were randomised controlled trials (RCTs) although some were pilot RCTs. Studies were identified as pilot RCTs based on the explicit description of the RCT being a 'pilot' study within the original paper's methods section. The total number of participants across all studies was 3,959. Sample sizes at baseline ranged from 17 to 817 (M = 127.71). However, there was often significant attrition of participants. The drop-out percentage based on missing data at post-treatment from baseline to post intervention ranged from 0% to 45.4% (*M* = 10.45%). Nineteen studies also collected follow-up data beyond the RCT time frame, the follow ups taking place between 1.5 months and 6 months post intervention (*M* = 3.92).

The average age of participants ranged from eight years to 81 years (M = 45.20). Four studies were with children, six with young adults (below 25), ten with middle age adults (26–64), five with old adults (65–74) and four 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 62.47%. When the studies with single sex samples were removed, the average percentage of females was 57.47%.

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.

Sixteen of the interventions were group-based, eight were individual and seven were a combination of group and individual. Twenty-four of the interventions were face-to-face and seven were delivered over the phone or via the internet. Fourteen studies used a waitlist control group and participants allocated to this group received the intervention once the intervention group had completed treatment. Eleven studies had active control groups and six offered no treatment to the control group.

Psychological treatments lasted between five days and 52 weeks (M = 10.11 weeks) and sessions were mostly delivered weekly. The mean number of sessions delivered was 9.94, with sessions typically lasting one to two hours, with group treatment sessions on average lasting longer than individual sessions.

The measure used by nineteen studies was either the 20-item, ten-item or eight-item version of the UCLA loneliness scale (Russell, 1996). Four used the De Jong-Gierveld Loneliness Scale (De Jong-Gierveld & Kamphulus, 1985), two used the Illinois Loneliness Questionnaire (ILQ: Asher et al., 1984), one used the Chinese College Student Loneliness

Scale (Li et al, 2006), one used the Social and Emotional Loneliness Scale for Adults (SELSA: DiTommaso & Spinner, 1993), and one used the Patient-reported Outcomes Measurement Information System (PROMIS: Hahn et al., 2010).

3.2 Quality Appraisal

Nine studies were rated as having a low risk of bias, twelve as having some concerns and ten 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 2). 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. Appendix 1 presents the quality checklist ratings for all studies included in the review.

Figure 2

Risk of Bias Bar Chart

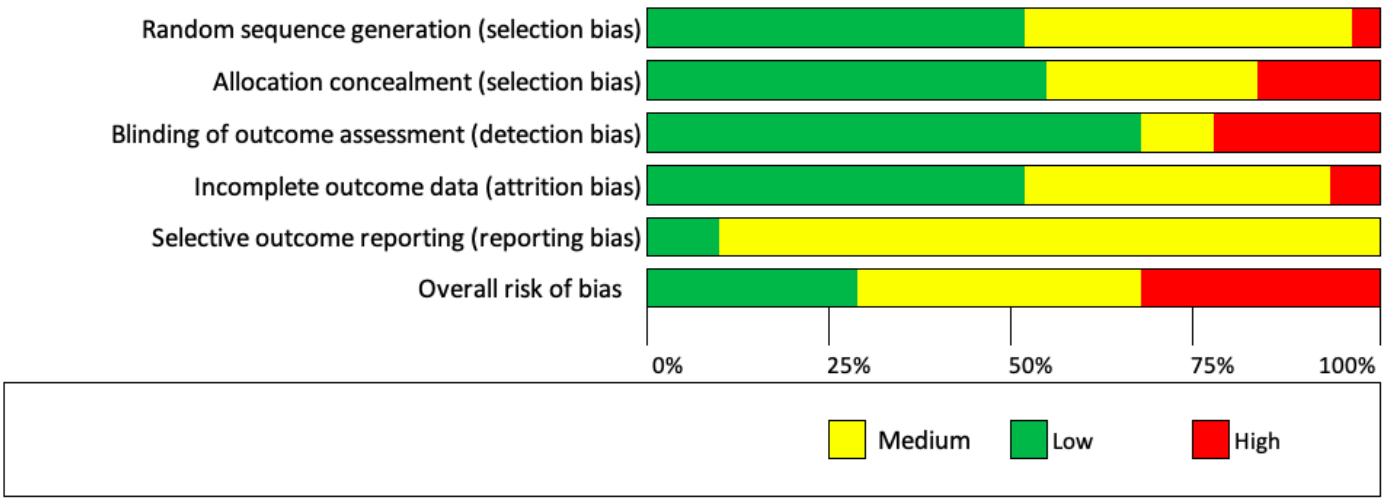


Table 2

Characteristics of Studies

Author, Year, Country, Risk of Bias (ROB)	**Participants**	**Sample Size**	**Control Group**	**Format of Intervention**	**Measure of Loneliness**	**Psychological Theory**	**Effectiveness Results**
Alaviani et al. (2015) **Iran** ROB: High	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** ROB: High	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
Bruehlman-Senecal et al.	University students	221 (I = 100,	Waitlist control	Individual	UCLA Loneliness	CBT	No significant condition

(2020) **US** ROB: Medium	Mean age = 19 59% female	C = 121) 5.43% dropout		Phone app Open access to app over four weeks. Survey at weeks two and four 8 week follow up	Scale – short version (8 items)	Nod app incorporates positive psychology, mindfulness-based self-compassion and cognitive behavioural skill-building	differences in loneliness at week 4. However, significant condition-by-baseline depression interaction to predict week-4 loneliness
Cacioppo et al. (2015) **US** ROB: High	US Army service personnel Mean age = 24 3% female	817 (I = 489, C = 328) 28.89% 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
Caputi et al. (2020) **Italy** ROB: Medium	Children Mean age = 10 48% female	210 (I = 105, C = 105) 0%	Active control: physical stories	Individual & group Face to face 5 x weekly sessions 2-month follow up	Illinois Loneliness Questionnaire (ILQ: Asher et al., 1984)	Social skills training Participants read and discussed mentalistic stories, which contain a discrepancy in beliefs/knowledge/points of view between characters and so tap into the concepts of persuasion, misunderstanding, white lie, irony/sarcasm and contrary emotions in order to develop theory of mind	Significant decrease in loneliness in intervention group. However, no significant difference between groups at follow up
Chiang et al.	Older men	92	Waitlist	Group	UCLA	Reminiscence	Reduction in

(2010) **Taiwan** ROB: High	living in a nursing home Mean age = 77 0% female 55% illiterate 58% unmarried	(I = 47, C = 45) 29.4% dropout	control	Face to face 8 x 90 min weekly sessions 3-month follow up	Loneliness Scale – version 3 (20 items)	Focusing on positive memories	loneliness in comparison to control. However, results not significant
Choi et al. (2020) **US** ROB: Medium	Older adults Mean age = 74 62% female	89 (I = 43, C = 46) 9% dropout	Active control: videoconference friendly visit	Individual Teleconferencing x5 sessions 12-week follow up	8-item PROMIS Social Isolation Scale (PROMIS-L)	CBT Behavioural activation is a brief, structured behavioural approach that aims to increase and reinforce wellness-promoting behaviours	Compared with control, intervention group had greater increase in social interaction and satisfaction with social support and decrease in loneliness
Cohen-Mansfield et al. (2018) **Israel** ROB: Medium	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	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

				3-month follow up			
Creswell et al. (2012) **US** ROB: Low	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** ROB: Low	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 narrative, imagery and psycho-educational techniques	The intervention effect was gender-specific as boys' but not girls' loneliness in peer relations decreased in the intervention group and not among controls

Frankel et al. (2010) **US** ROB: High	Children with ASD Mean age = 9 14% female 45% Caucasian IQ above 60	76 (I = 46, C = 30) 10.5% dropout	Waitlist control	Group (concurrent parent and child) Face to face 12 x weekly 60 min sessions 3-month follow up	The Illinois Loneliness Questionnaire (20 items)	Social Skills Contains modules that teach social etiquette and specific rules of behaviour which are used by the peer group	Children in the intervention condition reported significantly reduced loneliness compared with control
Fukui et al. (2003) **Japan** ROB: Medium	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** ROB: Low	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 attending concurrently	Social and Emotional Loneliness Scale for Adults (SELSA: DiTommaso and Spinner 1993)	Social Skills UCLA PEERS for Young Adults Programme (Laugeson et al., 2012): Evidence-based manualised instruction and rehearsal of social skills related to	Self-reported loneliness decreased for the intervention group compared to control. This group also reported increased

	58% Caucasian IQ above 70			No follow up		building close relationships	participation in social activities, reduced romantic loneliness and the development of friendships compared to control
Haslam et al. (2019) **Australia** ROB: Low	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** ROB: Low	Older adults living with HIV/AIDS Mean age = 54 32% female 50% Caucasian	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	UCLA Loneliness Scale (10 Item version)	CBT Improvement of adaptive emotion-focused coping strategies Based on the Transactional Model of Stress of Coping	No effects on loneliness compared to control. Control group reported significant post-intervention reduction in loneliness

	85% unemployed 49% gay; 15% bisexual; 36% heterosexual			3-month follow up		(Folkman & Lazarus, 1984)	
Jarvis et al. (2019) **South Africa** ROB: High	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	Individual and group 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 controls and this was maintained at follow up
Jing et al. (2018) **China** ROB: High	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	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

				sessions over 9 months 3 and 6-month follow ups			
Käll et al. (2020) **Sweden** ROB: Low	General population Mean age = 47 71% female	73 (I = 36, C = 37) 10% dropout	Waitlist control	Individual Online 8-week programme No follow up	Swedish translation of UCLA Loneliness Scale – version 3 (20 items)	CBT Cognitions and behaviours associated with loneliness	Intervention group felt significantly less lonely post-intervention compared to control
Kremers et al. (2006) **The Netherlands** ROB: High	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
Lai et al. (2020) **Canada** ROB: Medium	Older adults Immigrant members of the Chinese community	60 (I = 30, C = 30) 0% dropout	Active control: brief telephone calls from the programme coordinator	Individual and group Face to face Weekly, over 5 months	De Jong Gierveld Loneliness scale (11 items)	Social identity approach Peer-based social programme based on Dynamic Social Impact Theory	The intervention group showed a statistically significant decrease in loneliness compared to control

	Mean age = 81 63% female			No follow up			
Lindsay et al. (2019) **US** ROB: Low	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 compared with control
Lloyd-Evans et al. (2020) **UK** ROB: High	Adults with complex depression or anxiety Mean age = 43 73% female	40 (I = 30, C = 10) 12.5% dropout	Active control: standard NHS care, involving monthly meetings with a care coordinator and psychological/psychiatric support on referral	Individual and group Face to face Up to x10 hour-long individual sessions and x3 group sessions over 6 months 6-month follow up	De Jong Gierveld Loneliness scale (11 items)	Social identity approach The Community Navigator programme is a socially-focused approach, focusing on creating social goals and planning towards increasing social involvement in line with personal values	Reduction in loneliness in intervention group compared with control
Loucks et al. (2020) **US** ROB: Low	University students Mean age = 20 68% female 37% BAME	96 (I = 47, C = 49) 13.5% dropout	Waitlist control	Group Face to face Weekly group, plus daily 45-minute meditation for 6 days per week	UCLA Loneliness Scale – version 3 (20 items)	Mindfulness Mindfulness Based Stressed Reduction (MBSR) for college aged students (MB-College) incorporates a traditional MBSR programme with	Impact on loneliness pre to post was pronounced in the intervention group

				3-month follow up		psychoeducation on wellbeing prioritities for this demographic	
Mascaro et al. (2016) **US** ROB: Medium	Medical students Mean age = 25 75% female	32 (I = 21, C = 11) 45.8% dropout	Waitlist control	Group and Individual Face to face Group: 10 x 1.5 hr weekly sessions Individual: daily 20 min meditation No follow up	UCLA Loneliness Scale – version 3 (20 items)	Cognitive Based Compassion Training Meditation; compassion-focused attention training; analytic approach to challenging automatic thoughts	Participants in the intervention group reported decreased depression and loneliness and an increase in compassion compared to control
Matthews et al. (2018) **US** ROB: Medium	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	79 (I = 41, C = 38)	Active control (routine care): access to services provided by the AIDS Service	Individual Telephone 6 x 50 min	UCLA Loneliness Scale (10 item version)	IPT Psychoeducation and exploration of interpersonal	No significant change in loneliness in the intervention group or control

ROB: Medium	Mean age = 44 34% female 61% Caucasian	16.5% dropout		sessions No follow up		relationships and conflict	
Tabrizi et al. (2016) **Iran** ROB: Low	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** ROB: Medium	Chronically ill older adults Mean age = 75 89% female 70% lived alone	27 (I = 15, C = 12) 27.0% dropout	Active 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** ROB: Medium	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** ROB: Medium	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** ROB: High	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

3.3 Meta-Analysis

28 studies (N = 3,039) were included in a meta-analysis of pre- to post-treatment effect sizes (ESs). Psychological interventions significantly reduced loneliness scores compared to control groups ($p < 0.001$). The meta-analysis yielded a small to medium effect favouring the intervention group (overall ES g = 0.43, 95% CI = 0.18 – 0.68). ESs for individual studies ranged from -0.42 to 3.04 and substantial significant heterogeneity was observed ($T^2 = 0.49$, $Q = 228.60$, $p < 0.001$, $I^2 = 89.55\%$). See Figure 3 for the forest plot.

A funnel plot (see Figure 4) was created to identify potential publication bias. The funnel plot showed some asymmetry with larger studies having effect sizes closer to zero. However, Egger test (Egger et al., 1997) indicated that there was no significant evidence of funnel plot asymmetry or publication bias ($p = 0.19$).

Subgroup Analysis

To explore possible sources of heterogeneity, sub-group analyses were performed considering type of psychological intervention and risk of bias.

Types of psychological intervention

Type of intervention was categorised as CBT-based or not CBT-based. This categorisation was decided by three independent coders, one of whom an expert on CBT (RS), who considered the content of the interventions and the theory behind them. Whether interventions were CBT-based did not significantly influence the loneliness outcome ($I^2 = 0$, $p = 0.60$).

A further analysis grouped interventions into seven therapy categories: CBT (10 studies), gratitude (1) , reminiscence (1) , mindfulness (4), integrative (6), social skills (3) and social identity approach (3). This coding was decided by two independent raters. The interventions

therapy had varying effect sizes (see Figure 5), and the difference between effects was borderline significant (Qb = 11.99, df = 6, p = 0.06). The reminiscence intervention had the highest effect size, followed by social identity approach interventions then CBT.

Figure 3

A Forest Plot of Effect Sizes for Pre to Post Treatment

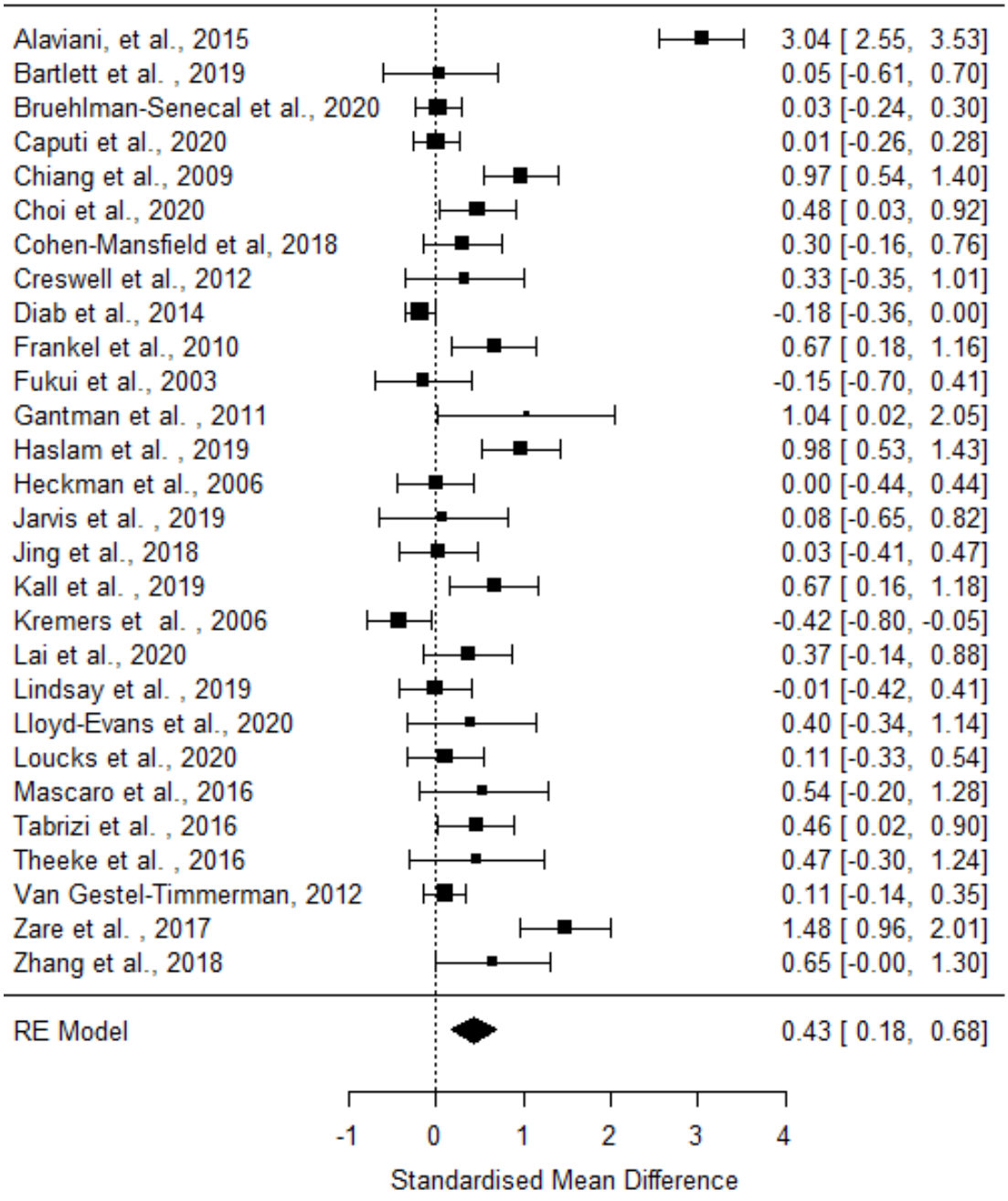
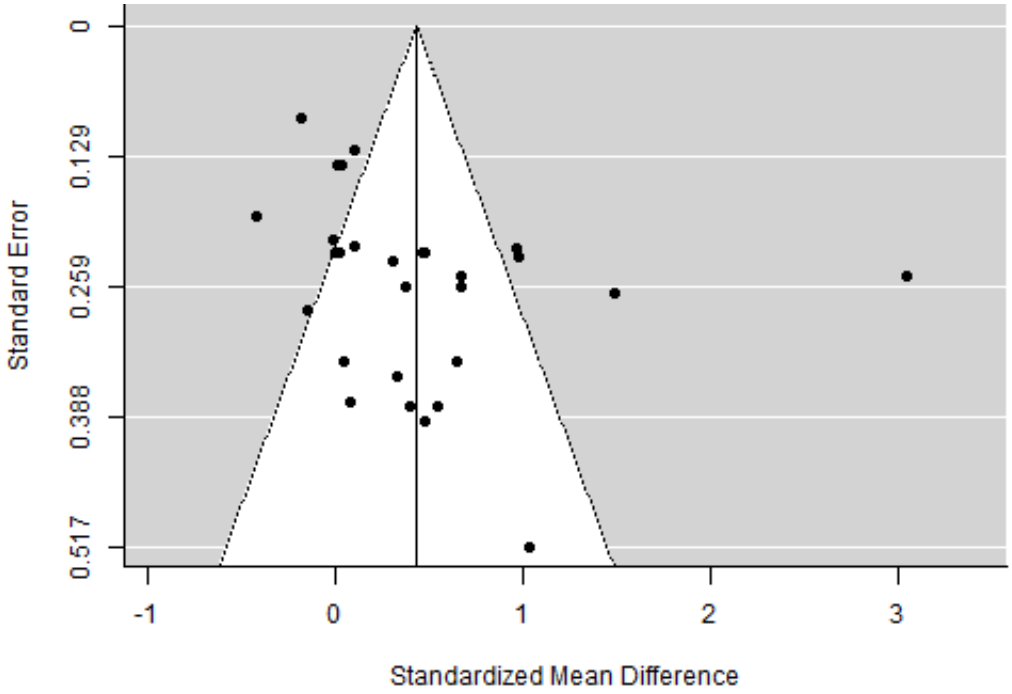


Figure 4

Funnel Plot of Meta-Analysis



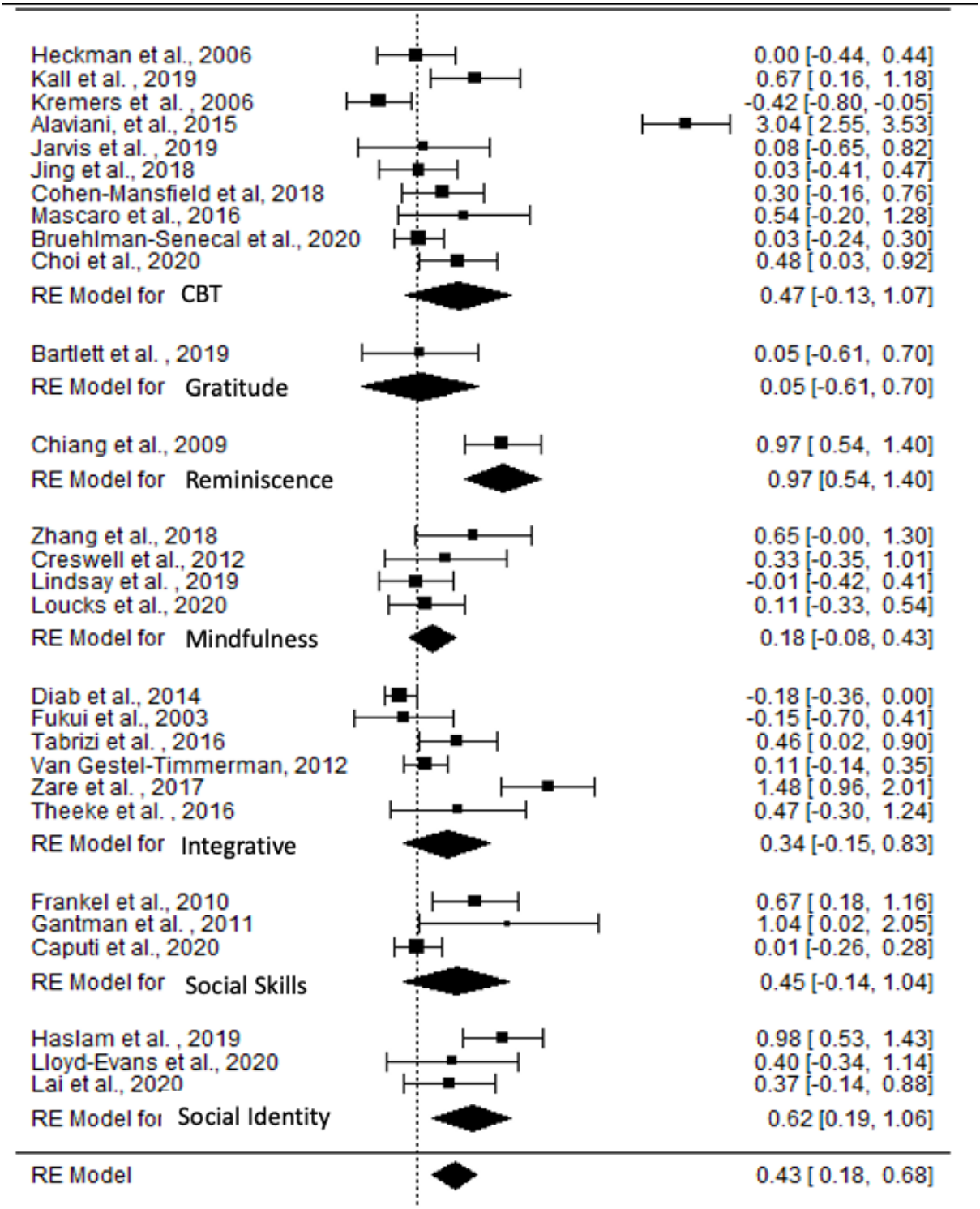
3.4

Risk of Bias

A subgroup analysis was conducted to ascertain if there was significant variation in effect sizes between studies of low, medium or high risk of bias. Ten studies had a low risk of bias, ten had a medium risk and eight had a high risk. The heterogeneity between the subgroups was non-significant (p = 0.84) and I^2 = 0%. Therefore, risk of bias rating was not a moderator of reduction in loneliness. Effect sizes and confidence intervals for each of the different risks were 0.38 (95% CI: 0.09, 0.67) across the low risk of bias studies, 0.33 (95% CI: 0.05, 0.60) and for the high risk of bias it was 0.56 (95% CI: - 0.18, 1.32).

Figure 5

A Forest Plot of Effect Sizes for different Types of Psychological Interventions



3.5 Meta-Regressions

Meta-regressions were conducted to investigate whether numeric study-level variables including 'age of participants' and 'percentage female' were associated with the effectiveness of psychological interventions for loneliness.

The meta-regression model for age was insignificant ($Qb = 0.02$, $df = 1$, $p = 0.74$), indicating that age was not significantly associated with interventions loneliness scores. Sex of participants, measured by the percentage of female participants in each study, was also a non-significant moderator of reduction in loneliness ($Qb = 0.17$, $df = 1$, $p = 0.68$).

4. Discussion

This systematic review and meta-analysis are 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 compared to control groups – represents a significant advance in loneliness research, building on the limited previous evidence (Barreto et al., 2020; Jarvis et al., 2019; Masi et al., 2011).

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). 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.

Whilst one of the eligibility criteria was that interventions needed to be psychological and based on psychological theory, the theoretical grounding underpinning these interventions is broad. Furthermore, whilst the psychological theory behind an intervention may be applied to loneliness, this was not the origin of these approaches. Therefore, the interventions were not all designed with loneliness in mind. Therefore, a key question is what

are the mechanisms which lead psychological interventions to be successful in reducing loneliness?

It is postulated that psychological interventions are successful at reducing loneliness due to the subjective and perceptual nature of loneliness. It is recognised that increasing the amount of social contact alone does not necessarily address the negative interpersonal thoughts or emotional responses, which can maintain loneliness (Käll, Shafran et al., 2020). As psychological interventions are designed for reducing mental health difficulties such as anxiety or depression, which involve mental processes that can overlap with the cognitive changes linked with loneliness, it is proposed that changing a person's mental processes can lead to a change in social behaviour, and reduced loneliness over time (Mann et al., 2017).

The transdiagnostic model of chronic loneliness proposed by Käll, Shafran and colleagues (2020) can also add light to which mechanisms are likely to be addressed in some psychological interventions for loneliness. This model suggests 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 overall consequence is that a negative self-image is established, along with a desire to avoid social contact, results in chronic feelings of loneliness. Therefore, the most commonly used psychological intervention for loneliness in this meta-analysis, Cognitive Behavioural Therapy (CBT), 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 (Käll, Jägholm et al., 2020). It would

be beneficial to also consider mechanisms for change through qualitative research with individuals with lived experience of chronic loneliness, who have undertaken psychological interventions for loneliness, or with mental health practitioners working with lonely individuals (e.g. Stefanidou et al., 2021) Another key finding was that the effectiveness of psychological interventions varied based on which therapeutic approach was used. Whilst this difference did not reach statistical significance, it indicates that some psychological interventions are better able to alleviate loneliness than others. The reminiscence intervention had the highest effect size, followed by social identity approach interventions and then CBT. However, results should be interpreted with some caution, given that the reminiscence study included was found to have a high risk of bias. Furthermore, due to only having a limited number of studies in most therapy modalities, for example, only one reminiscence based study, further sub-group analyses will need to be conducted as more data and interventions are published.

Interestingly, our subgroup analysis found CBT and social skills had similar effect sizes, differing to Masi and colleagues (2011) who found cognitive interventions as having the largest effect size and social skills development having no effect. Our finding can be explained by both of these interventions having some overlap despite different theoretical orientations. For example, CBT is often focused on supporting behavioural change such as increased socialising, which will also be a component of social skills interventions.

Sex of participants and targeted age group were not moderators of how effective interventions were. This demonstrates that psychological interventions aimed at all age groups can play an important role in alleviating loneliness for both men and women.

The present systematic review benefits from its methodological rigour, including the use of two independent coders for screening all 3,973 abstracts and 103 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.

However, the findings need to be interpreted with an awareness of some limitations. The review only included psychological interventions, making it not possible to compare their efficacy with other types of intervention for loneliness that focus on the wider context of individual's difficulties (e.g. wider community interventions). It has been argued that addressing individuals' maladaptive cognitions prepares them to 'get involved' in their community, although this may have a limited impact if an individual has a lack of connectedness to their community (Mann et al., 2017). 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.

Limitations of some specific studies included in the review include their small sample sizes and lack of underpinning power calculations. Additionally, several studies had very high attrition rates (up to 45.4%) 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 61% 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.

Whilst some studies targeted loneliness directly and ensured that participants self-reported as feeling lonely as part of their eligibility criteria, other studies did not, instead targeting certain populations that were presumed to be more at risk of loneliness. Moreover, the majority of interventions did not distinguish between transient and chronic loneliness. These findings were also apparent in Eccles and Qualter's (2020) meta-analysis of

interventions for lonely young people. Combined, these findings suggest that we need to ask more about loneliness rather than make assumptions about who experiences it.

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 will need to be tailored to individuals rather than using a 'one-size-fits-all' approach (Perese & Wolf, 2005; Victor, 2018). This level of heterogeneity points to a flexible modular psychological approach being beneficial (Käll, Shafran, 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. Moderators such as intervention length, group vs individual delivery, face to face vs online format should all be investigated further. Finally, future research should assess the long-term benefits of psychological interventions for loneliness and ascertain whether improvements are maintained post-treatment.

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