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Review: Alleviating loneliness in young people – a meta-analysis of interventions

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Background: Loneliness is common among youth and is associated with poor physical and mental health, and poor educational outcomes. To date, there have been no meta-analyses of interventions aimed at reducing loneliness among young people. **Methods:** We conducted meta-analyses of single group and randomised control trials (RCTs) of studies published between 1980 and 2019, which measured loneliness as an outcome in youth ages 25 years or younger. Moderators, including sample demographics and intervention characteristics, that might affect intervention success, were examined. **Results:** A total of 39 studies (14 single group and 25 RCTs) were included, and we found evidence that youth loneliness could be reduced via intervention. Moderator analysis – including intervention characteristics, study quality and sample demographics – was also examined. **Conclusions:** While interventions were shown to reduce loneliness among youth, the interventions included in the meta-analyses often targeted youth viewed to be at risk – for example those with health concerns – and rarely did the interventions target youth who reported loneliness. There is also no indication of whether youth experienced chronic or transient loneliness. In future work, interventions should be designed specifically for loneliness, with universal programmes helping youth manage their transient feelings of loneliness, and targeted interventions for those suffering from chronic loneliness. There is also a need to look at socioeconomic and other risk factors outside the individual for targeted interventions.

Key Practitioner Message

- There have been no meta-analyses that have evaluated the effect of interventions for reducing loneliness among children and adolescents.
- We found intervention programmes targeted at youth are successful at reducing loneliness.
- Future interventions should be designed specially with loneliness in mind, with (a) universal programmes to help youth manage their experiences of transient loneliness, and (b) targeted interventions for youth reporting chronic loneliness. They should also examine the longer-term outcomes of the interventions.
- Future interventions should be designed, evaluated and then documented using guidelines on how to write up an intervention evaluation.

Keywords: Loneliness; interventions; adolescents; children; review; meta-analysis; adolescents

Introduction

Loneliness is experienced when we have fewer social relationships or fewer relationships of sufficient quality than we wish to have (Peplau & Perlman, 1982). Loneliness is viewed as an adaptive and necessary aspect of human life because the associated negative feelings ensure reconnection, which strengthen our social connections to keep us safe from the dangers of living on the social perimeter (Cacioppo & Hawkley, 2009; Qualter et al., 2015). The beneficial aspects of loneliness diminish when it is intense and prolonged. When that happens, loneliness leads to a variety of short- and long-term negative health effects (Holt-Lunstad et al., 2015); loneliness contributes to poor mental health (Beutel et al., 2017; Schinka et al., 2013) and poor sleep across the life span (Harris, Qualter, & Robinson, 2013; Hawkley, Preacher, & Cacioppo, 2010; Matthews et al., 2017). Given those negative effects, there has been increased demand to introduce interventions that mitigate

loneliness, or increase successful management of transitory loneliness, so that individuals are not propelled into chronic, prolonged loneliness. Given, too, that loneliness is a common experience for young people (BBC Loneliness Experiment, 2018; ONS, 2018), there is an increasing need to explore the efficacy of interventions to reduce loneliness among youth. To date, there are a number of reviews that explore the effects of interventions designed to reduce loneliness for adults, but there are no reviews that deal specifically with interventions for youth. The current review is the first to focus on whether interventions aimed at youth reduce loneliness.

Interventions to reduce loneliness

There have been several influential reviews focusing on interventions aimed at reducing loneliness, social isolation or both. With the exception of one review (Masi et al., 2011), all reviews focus entirely on loneliness among adults, particularly those in oldest old age (Cattan, White, Bond, & Learchmouth, 2005; Cohen-Mansfield &

Perach, 2015; Findlay, 2003; Gardiner et al., 2016; Hagan et al., 2014; Victor, 2018). Such reviews examined various moderating factors related to study design: study quality (Cattan et al., 2005; Cohen-Mansfield & Perach, 2015), design methodology, such as randomised controlled trials and single-group comparisons (Masi et al., 2011; Victor, 2018), and the choice of loneliness measurement tool (Masi et al., 2011; McWhirter, 1990; Victor, 2018). Other potential moderators focused on the delivery of the intervention and included (1) groups or individual delivery (Cattan et al., 2005; Findlay, 2003; Masi et al., 2011; McWhirter, 1990; Rook, 1984), the use of technology (Findlay, 2003; Hagan et al., 2014; Masi et al., 2011; Victor, 2018) and the main focus of the intervention whether it be social skills training, social support and/or social cognition among others (Gardiner et al., 2016; Masi et al., 2011; McWhirter, 1990; Perese & Wolf, 2005; Rook, 1984). Those previous reviews report mixed findings in relation to moderators: there is no consensus on what makes a successful intervention in terms of the underlying characteristics, although often reviews report group-based interventions with an educational or social cognition focus demonstrate the most potential in reducing loneliness. Previous reviews call for continued evaluation of interventions and examination of study quality, design and evaluation measures (Table 1).

Current study

The purpose of the current meta-analyses was to provide a rigorous examination of the interventions previously used to reduce loneliness in young people ages 3–25 years. Effect sizes were compared to examine the general effect of loneliness interventions among young people for ‘single-group pre-post’ and ‘group comparison RCTs’ trials separately. Moderator analysis also examined how the characteristics of the intervention, the outcome measure used and sample composition affected intervention success.

Method

Searches

Searches were completed in the following databases: PubMed, Web of Science, ERIC and PsycArticles. The searches included a combination of the following search phrases: Lonel*, “Social Isolation”, “Perceived Social Isolation” Child*, Adoles*, Youth, Young, “Emerging Adulthood”, “Early Adulthood” and Intervent*. Searches were completed in January 2018 and updated in January 2020 (further information regarding searches protocol can be seen in Appendix S1). The results of the searches were extracted and stored in EndNote.

Selection. A total of 8238 reports were identified (5831 duplicates). A total of 2407 studies were doubled screened for relevance based on the Abstract. Eligible studies were doubled screened against the following criteria: (1) published in English between 1980 and March 2019, (2) published in a peer-reviewed journal and (3) targeted a population of ≤25 years old (as indicated by both sample age range and mean reported below 25 years of age). Further inclusion criteria required each study to have (1) measured loneliness as an outcome (through the use of standardised measure), (2) reported original data (to avoid representing the same sample twice) and (3) involved treatment groups, rather than individual or case studies (See Figure 1 for flow diagram). As a result of the double screening, there was 86% agreement on inclusion between authors and all

disagreements were resolved. In the final sample of 39 studies, 14 studies utilised a single-group comparison design and 25 utilised a randomised control trial (RCT) group design.

Data coding. The following information was coded for each study: study characteristics (author, date, study design, loneliness measure), population characteristics (sample size, percentage males, mean age), intervention focus (categorisation was double coded with an agreement rate of 75%; disagreements were discussed between the two authors) and intervention characteristics (type of intervention, delivery format, use of technology; see Appendix S2). Study quality was assessed using two tools created by the National Heart, Lung, and Blood Institute and Research Triangle Institute International (see Appendix S3). The criteria were designed in line with recommendations from the Agency of Healthcare Research and Quality, the Cochrane Collaboration and the National Health Service Centre for Reviews and Dissemination. The criteria included assessment of research aims, study protocols (including randomisation processes) and attrition rates (see Appendix S3). An overall quality agreement rate of 87% was achieved and discrepancies discussed until agreement was reached.

Overall study characteristics

The present data set included 39 effect sizes (*k*) one for each study published between 1993 and 2019. Sample sizes varied from 4 to 2966 participants. A total of 6750 individuals were included in the present meta-analysis, 55% were males and all participants age fell within the 3 to 25 years age range. Study and sample characteristics, together with the effect sizes, for each included study can be found in Tables 2 and 3.

Effect size calculation

The Comprehensive Meta-Analysis software was utilised to calculate the effect size for each study (CMA, Borenstein, Hedges, Higgins, & Rothstein, 2013). Because studies utilised different outcome measurement tools, the raw difference was calculated to create the standardised mean difference (SMD) with the recommended correction known as Hedges *g* (Hedges, 1981). For RCT studies, if studies reported significant differences in pre-intervention baseline loneliness scores, the effect size was calculated as the difference between the change scores of the treatment group and the control group (Cross et al., 2018; Deckers, Muris, Roelofs, & Arntz, 2016; Klingman & Hochdorf, 1993). If no such information was provided, 95% CI interval graphs were generated and assessed (Beidel, Turner, & Morris, 2000; Diab et al., 2014; Larsen et al., 2019; Leff et al., 2009; Quayle et al., 2001; Rohde et al., 2004; Stice et al., 2010). If scores for the control and intervention groups did not overlap, indicative of a significant difference, then change scores were calculated (Craig, Brown, Upright, & DeRosier, 2016). Primary effect sizes were calculated for each study. For each study, the first reported post-treatment time point was included (time frame ranged from immediately postinterventions to 7 months later; see Tables 2 and 3). For those with multiple interventions/controls, the most theoretically distinct was chosen (Larsen et al., 2019; Matthews et al., 2018; Regev & Guttman, 2005; Rohde et al., 2004; Stice et al., 2010). For those that reported subscales of loneliness, an average effect size was calculated (Klingman & Hochdorf, 1993; Kopelman-Rubin et al., 2012).

Analysis

Using CMA, the random effects model was selected (Field, 2003; Field & Gillert, 2010; Hunter & Schmidt, 2004). To quantify heterogeneity in a random effects model, the following statistics were included: *Q*-statistic and *p*-value (to test the assumption of homogeneity), *T*² (to examine between-study variance) and *I*² (the ratio of true heterogeneity with 25%, 50% and 75% represent low, moderate and high proportion of the observed variations (Higgins et al., 2003). Following guidance from Borenstein, Hedges, Higgins and Rothstein (2009), moderation analyses would be completed using both subgroup analysis (for

Table 1. Overview of previous meta-analytic and systematic reviews evaluating interventions aimed at reducing loneliness and social isolation

Authors	Type	Lifetime focus (where reported)	N of studies included	Moderators discussed	Key conclusions
Rook (1984)	Systematic Review	Adulthood	Not reported	-Intervention focus -Delivery format -Target population (particularly at-risk populations) -Intervention focus	-Evaluations of the effectiveness of interventions are needed -Greater need for evaluation of loneliness as a specific outcome -Long-term effect of interventions may be significantly different from the short-term effects -Focus needs to move away from the idea of completely removing loneliness to providing individuals with skills and options so they can seek to improve their current social relations -Highlights the importance of intervention focus – including social skills, social cognition and social support – as an important consideration when designing interventions
McWhirter (1990)	Systematic Review	Adulthood	Not reported		-Psychologists and practitioners need to be aware of the prevalence, characteristics and severity of loneliness within a wide variety of populations -Concludes there is a need for continued research and the need to ensure effective evaluation of interventions
Findlay (2003)	Systematic Review	Older adulthood	17	-Delivery format -Technology use	-One of the most important factors underpinning the successful interventions was the use of well trained, and supported, facilitators -Secondly, the review concludes those interventions which involved the individuals in various stages of the intervention were seen to be more successful. -Third, the review concludes those interventions which utilise pre-existing resources and focus upon community had a greater chance of success. -Clear evidence for interventions aimed at groups and which included some element of education (e.g. training) and social activities. -Highlights the importance of involving the individuals in the planning, developing and delivering the interventions -Effective -Effectiveness depends on the needs of individual -Good fit is needed between intervention focus and the persons current need (e.g. disabilities, social situation) -Sample characteristics are important in success -Type of intervention (e.g. social cognition most effective in RCT) is also important -Outcome measure important in pre-post design -In non-RCTs, effect size moderated by age and gender of sample and loneliness measure used
Cattan et al. (2005)	Systematic Review	Older adulthood (51–93 years)	30	-Delivery format -Intervention focus -Sample characteristics (including targeting specific groups such as women, care-givers, widows) -Intervention focus	
Perese and Wolf (2005)	Systematic Review	Adulthood	36		
Masi et al. (2011)	Meta-Analysis	Life span (7–93 years)	50	-Loneliness measure -Intervention duration, length and frequency -Sample characteristics (including age and gender) -Delivery format -Intervention focus	

(continued)

Table 1. (continued)

Authors	Type	Lifetime focus (where reported)	N of studies included	Moderators discussed	Key conclusions
Hagan et al. (2014)	Systematic Review	Older adulthood (52+)	17	-Groups vs Individual -Use of new technology	-For effective interventions, they were all distinct from one another and supports the use of innovative interventions, including new technologies, in the future. -Reviews highlight the lack of validated loneliness scales
Cohen-Mansfield and Perach (2015)	Systematic Review	Older adulthood (55+)	34	-Group vs Individual -Intervention focus -Assessed quality -Intervention type -Sample (institutional vs community) -Study quality	-Concludes there is limited evidence of the effectiveness of one-to-one interventions. -Group interventions were somewhat more effective than one to one but highlights the need design refinements to help increase the effectiveness of group interventions -The use of the technology was supported in both group and one-to-one interventions -Those interventions which included educational elements – such as guided social group participation, self-management and training – demonstrate potential. -Found support for the use of therapy-based interventions in alleviating loneliness -Concludes there is a need for more research into beneficial interventions before such interventions can be recommended
Gardiner et al. (2016)	Systematic Review	Older adulthood	39	-Intervention focus	-Concludes the scope of interventions available varies widely, in both scope and purpose -The review highlights commonalities between effectiveness interventions including the adaptability of intervention, adopting a community development approach and focusing on productive engagement.
Victor (2018)	A review of Systematic Review	Adulthood (+55)	14	-Target population (including community-dwelling samples) -Intervention Focus -Use of technology	-Review did not find group interventions to be more effective than one to one but solitary pet or technology one-to-one interventions were successfully in reducing the experience of loneliness. -Concludes there is limited evidence to support the effectiveness of loneliness within the published literature -Highlights the need for a clear definition of loneliness when evaluating interventions as terms such as social isolation, social support and social networks are often used interchangeably. -Concludes there is a large range of interventions and agrees with other reviews by suggesting tailored or targeted interventions to combat loneliness could be more effective -Warns that some technology-based interventions could re-enforce feelings of isolation among those who are unable to engage with the equipment.

categorical moderators: intervention type, use of technology, delivery format, study quality, and target sample) and meta-regression (for continuous moderators; age and gender).

Results

Studies with a single-group comparison

All 14 studies that reported a single-group design were included in the first set of analysis (summarised in Table 2). The studies included young people aged between 6 and 25 years. Seven studies reported a higher percentage of male participants, two reported an all-male sample, and five reported a higher percentage of female participants. Nine studies delivered the intervention in a group format; the remaining five reported an individual delivery format. As for intervention type, 3 studies focused on social skills, 1 on social and emotional skills, 3 on increased social interaction, 4 on enhancing social support, 2 included psychological therapies and 1 was classified as 'other' (focused on social identity and acceptance). Four studies utilised a technology-based delivery system, and 10 used an in-person approach. Of the 14 studies, nine studies used variations of the Loneliness and Social Dissatisfaction Questionnaire (LSDQ), 3 studies measured loneliness using variations of the UCLA scale, one study used the Peer Network and Dyadic Loneliness Scale and one used a 16-item peer scale. The majority were rated good ($n = 5$) or fair ($n = 6$ for each) and 3 studies as poor. For the single-group design studies, 10 studies included 'at-risk clinical' samples and four studies included 'at-risk non-clinical' samples.

The results demonstrate the mean effect size of the studies was $g = .411$ ($g = .966$ to $.027$; 95% CI: 0.25, 0.57, $p < .001$; see Figure 2 for distribution). The between-study variance was $T^2 = .06$. A significant Q statistic (47.49, $p < .001$) indicated a heterogeneous distribution of effect sizes. The I^2 showed that 72.62% of the variance could be attributed to between-study variations. Sensitivity analysis, following the one study removed procedure (Borenstein et al., 2009), suggests none of the included studies demonstrated a disproportional impact on the overall effect size ($r = .352$ to $.493$, $ps < .001$). Therefore, all studies remained in the meta-analysis for the subsequent analysis ($n = 14$). Results from the main analysis suggested that the interventions included in the meta-analysis were moderately successful in reducing loneliness scores in young people ($g = .411$). Visual inspection of funnel plots (see Figure S1) and an Orwin's fail-safe $N = 532$ (Orwin, 1983) demonstrate no evidence of publication bias.

Moderator analyses demonstrated no significant differences in mean effect size among the different intervention types ($Q_b = .472$, $df = 5$, $p = .449$). The mean effect sizes are as follows for the different intervention types: social skills $g = .207$ ($n = 3$, 95% CI: -0.16 – 0.57 ; $p = .277$), social and emotional skills $g = .724$ ($n = 1$, 95% CI: 0.15 – 1.30 ; $p = .013$), increased social interaction $g = .571$ ($n = 3$, 95% CI: 0.17 – 0.97 ; $p = .005$), enhanced social support $g = .334$ ($n = 4$, 95% CI: -0.01 – 0.66 ; $p = .042$), psychological therapy $g = .601$ ($n = 2$, 95% CI: 0.19 – 1.01 $p = .004$) and other $g = .161$ ($n = 1$, 95% CI: -0.42 – 0.75 $p = .584$). Although there was no significant difference, interventions that focused on social and emotional skills or included a

psychological therapy demonstrated the biggest effect on reducing loneliness in young people.

Subgroup analysis demonstrated no significant difference in mean effect size depending on the use of the technology ($Q_b = .28$, $df = 1$, $p = .595$). The mean effect size for those using technology was $g = .360$ ($n = 6$, 95% CI: 0.11 – 0.61 ; $p = .005$); for those interventions that did not use technology, the mean effect size was $g = .450$ ($n = 8$, 95% CI: 0.23 – 0.67 , $p < .001$). Thus, although the difference was nonsignificant, those interventions not using technology demonstrated the bigger effect size on reducing loneliness in young people.

Upon examination of the type of loneliness measure used, whether LSDQ or other, subgroup analysis demonstrated no significant differences between the two measures ($Q_b = 1.19$, $df = 1$, $p = .276$). Sample demographics did not significantly explain variance for both age ($Z = -.84$, $p = .399$)¹ and gender ($Z = -.56$, $p = .575$).² In addition, whether the intervention focused on an at-risk clinical or an at-risk nonclinical sample did not significantly explain variance ($Q_b = 1.79$, $df = 1$, $p = .181$).

Moderation analysis based on quality assessment suggests there were no significant differences among the different quality assessments ($Q_b = .719$, $df = 2$, $p = .698$). The mean effects for the interventions based on quality were as follows: good – $g = .405$ ($n = 6$, 95% CI: 0.17 – 0.65 ; $p < .001$), fair – $g = .354$ ($n = 5$, 95% CI: 0.07 – 0.64 ; $p = .015$) and poor – $g = .583$ ($n = 3$, 95% CI: 0.13 – 1.03 ; $p = .011$). The quality-based analysis suggests the poor-quality studies did not have a disproportional impact on the results of a meta-analysis.

Studies with a randomised control trial (RCT) design

Twenty-five RCT studies were included in the second set of analyses and included interventions aimed at reducing loneliness in young people ages 3–25 years (summarised in Table 3). Fourteen studies reported a higher percentage of male participants, 1 reported an all-male sample, 6 reported a higher percentage of female participants, 2 reported an all-female sample, 1 reported an equal gender split, and 1 study did not comment upon gender split of the sample. For intervention type, 5 studies focused on social skills, 7 focused on social and emotional support, 4 focused on enhancing social support, 8 focused on psychological therapy, and 2 focused on Learning New Hobby. For delivery format, 21 utilised a group design and 4 used an individual delivery format. Only 3 studies utilised a technology-based delivery, and 22 studies delivered the intervention in person. Of the 25 studies, 15 studies measured loneliness using the LSDQ and 10 used alternative measures (LACA $n = 1$; Social and Emotional Loneliness Scale for Adults $n = 1$; Social Stress scale $n = 1$; UCLA $n = 5$; Chinese College Loneliness Scale $n = 1$; Norway Loneliness Scale $n = 1$). As for quality, 11 studies were rated as poor, 7 as fair and 7 as good. For the RCTs, 13 studies included 'at-risk clinical' samples, 5 studies included 'at-risk nonclinical' samples, and 7 studies focused on 'general' samples.

The mean effect size for the interventions was $g = .316$ ($r = .030$ to 1.74 ; 95% CI: 0.19 , 0.44 ; $p < .001$; see Figure 3). The between-study variance in the group was $T^2 = .05$. The Q statistic was 73.50, $df = 24$, $p < .001$, rejecting the null hypothesis of homogeneity and

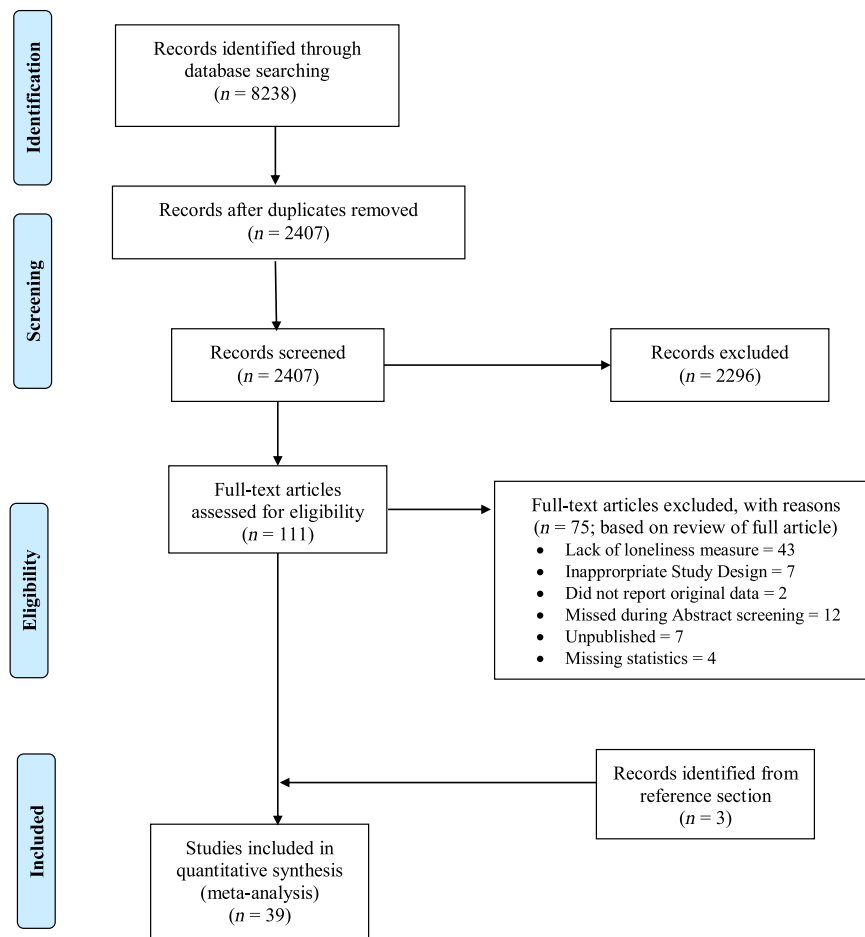


Figure 1. PRISMA flow diagram outlining the inclusion process of articles in the final meta-analysis

suggesting a heterogeneous distribution of effect sizes. The I^2 showed that 67.35% of the variance could be attributed to between-study variations. Results of the one study removed sensitivity analysis demonstrated the overall effect sizes ranged from $g = .262$ to $.350$, $ps < .001$. Those results, therefore, suggest that no individual study had a disproportional impact on the overall effect size. As a result, all 25 studies were included in the moderator analysis. Visual inspection of funnel plots (see Figure S2) and an Orwin's fail-safe $N = 321$ demonstrate no evidence of publication bias.

The first moderator analysis, focused on intervention type, revealed mean effect sizes for the intervention types as follows: social skills training $g = .441$ ($n = 5$, 95% CI: 0.10–0.79; $p = .013$), social and emotional skills $g = .269$ ($n = 7$, 95% CI: -0.01 –0.53; $p = .042$), enhanced social support $g = .212$ ($n = 3$, 95% CI: -0.16 –0.59; $p = .265$), psychological intervention $g = .359$ ($n = 8$, 95% CI: 0.12–0.60; $p = .003$) and those focusing on learning a hobby or skill $g = .471$ ($n = 2$, 95% CI: -0.05 –0.99; $p = .076$). However, the overall subgroup analysis demonstrated no significant difference between the intervention types ($Q_b = 1.33$, $df = 4$, $p = .857$). Therefore, it can be concluded the type of intervention type did not affect the success of an intervention that used a group comparison design. However, those interventions utilising social skills training or psychological intervention may offer the most promising effect sizes.

Choice of loneliness measure, categorised as utilising the LSDQ measure or an alternative measure, did not significantly explain the observed variance between studies ($Q_b = .63$, $df = 1$, $p = .428$). Further moderation analysis, examining sample demographics, also demonstrated nonsignificant results in terms of age ($Z = .06$, $p = .951$) and gender ($Z = .16$, $p = .871$). In addition, the target sample of the intervention also yielded nonsignificant results ($Q_b = .57$, $df = 2$, $p = .753$).

As for quality assessment, the mean effects for the interventions based on quality were as follows: poor – $g = .421$ ($n = 11$, 95% CI: 0.22–0.63; $p < .001$), fair – $g = .255$ ($n = 7$, 95% CI: 0.06–0.45; $p = .010$) and good – $g = .260$ ($n = 7$, 95% CI: 0.04–0.48; $p = .020$). The overall subgroup analysis result was $Q_b = 1.64$, $df = 2$, $p = .440$. Those results suggest there were no significant differences among the quality assessments. Although the subgroup analysis suggests no significant differences, poor-quality studies inflated the effect size and may be driving the significant results of the main analysis. Therefore, the remaining conclusions relating to the RCT interventions need to be interpreted with caution.

Discussion

The current meta-analyses examined interventions aimed at alleviating loneliness in young people up to 25 years of age. Using meta-analytical techniques, we were able to examine the potential moderating factors

Table 2. Single group intervention study information (*n* = 14)

Authors (date)	Intervention type	Delivery format	Technology use	Intervention length	Measurement points	Age range (mean, sd)	Brief sample description	Type of sample	N in analytical sample (n male, %)	Loneliness measure	Quality Rating	Outcome (impact on loneliness)	Effect size (CI 95%)
Barry et al. (2003)	Social Skills	Group	Nontech	8 × 2 hr session (8 weeks)	2; baseline and post (immediate)	6–9 (8.21, 1.18) ¹	High functioning ASD children	At-risk clinical	4 (3, 75%)	LSDQ (24-item)	Poor	N.Sig	.341 (–0.24, 0.92)
Battles and Wiener (2002)	Social Interaction	Group	Technology ^b	8 × 30-min sessions (over treatment period)	2; baseline and post (immediate)	8–19 (13.5)	Young patients with potentially life-threatening illnesses (including HIV)	At-risk clinical	32 (17, 53%)	UCLA (8-item)	Fair	Sig	.419 (0.15, 0.69)
Bostick and Anderson (2009)	Social Skill and Emotional Skills	Group	Nontech	10 sessions (10 weeks over 3 years)	2; baseline and post (immediate)	8–9 ² (not reported)	Student identified as needing counselling according to screening instruments (including loneliness & social anxiety)	At-risk nonclinical	49 (24, 49%)	LSDQ (8-item)	Good	Sig	.724 (0.48, 0.96)
Bradley (2016)	Enhanced Social Support	Group	Nontech	1 session every fortnight (6 months)	2; baseline and post (immediate)	11–12 (11.67, 0.49) ³	ASD children	At-risk clinical	12 (8, 67%)	LSDQ (16-item)	Fair	Sig	.966 (0.46, 1.47)
Brouzos, Vassilopoulos, and Moschou (2016)	Psychological Intervention	Group	Nontech	6 session × 90 min (6 weeks)	2; baseline and post (immediate)	9–12 (10.02, 0.91)	School children wearing glasses	At-risk nonclinical	48 (18, 38%)	LSDQ (24-item)	Good	Sig	.951 (0.69, 1.21)
Grace, Raghavendra, Newman, Wood, and Connell (2014)	Social Interaction	Individual	Technology ^b	13 × 25 min (7 months; on average)	2; baseline and post (immediate)	10–15 (13.23, 1.73) ⁴	Young people with complex communication needs as a result of physical disability, condition or acquired brain injury	At-risk clinical	5 (3, 60%)	LSDQ (16-item)	Poor	N.Sig	.649 (0.02, 1.28)
King et al. (1997)	Social Skills	Group	Nontech	2 × 90 mins weekly 10 weeks	3; baseline, post (immediate) & follow-up (24 weeks)	8.6–14.6 (12.00)	Children with a diagnosis of cerebral palsy or spina bifida. Problems with peer relations.	At-risk clinical	11 (3, 27%)	LSDQ (24-item)	Fair	N-sig	.161 (–0.27, 0.59)
Kneer, Eldik, Jansz, Eischeid, and Usta (2019)	Enhanced Social Support Other	Individual	Nontech	14 weeks long	2; baseline and post (immediate)	13–18 (14.09, 1.65)	Refugees adolescents	At-risk nonclinical	16 (7, 38%) ¹¹	Peer Loneliness (16-item)	Fair	N.Sig	.027 (–0.36–0.41)
Kopelman-Rubin et al. (2012)		Individual	Nontech	13 session + 6 booster sessions (3 months then within 18 months)	2; baseline and post (immediate)	11–15 (12.60, 0.87) ⁸	Young adolescents with learning disorders	At-risk clinical	37 (28, 70%) ⁸	PNDLS (2 subscale)	Good	N.Sig	.161 (–0.09, 0.41)
Lim et al. (2019)	Social Interaction	Individual	Technology ^a	5 min blocks over 6 weeks	3; baseline, post (immediate) and follow-up (3 months)	18–24 (21.00)	Adolescent with a Social Anxiety Disorder	At-risk clinical	9 (5, 55%)	UCLA (20 item)	Poor	Decreased ¹⁰	.748 (0.22–1.29)
Margalit (1995b)	Social Skills	Group	Technology ^b	1 × fortnightly meeting (4 months)		11–15 (12.38, 1.23) ⁷	Students with special needs including learning disabilities and behavioural disorders	At-risk clinical	83 (83, 100%)	LSDQ Hebrew Adaptation (24-item)	Good	Sig	.264 (0.01, 0.43)

(continued)

Table 2. (continued)

Authors (date)	Intervention type	Delivery format	Technology use	Intervention length	Measurement points	Age range (mean, sd)	Brief sample description	Type of sample	N in analytical sample (n male, % male)	Loneliness measure	Quality Rating	Outcome (impact on loneliness)	Effect size (CI 95%)
Smith et al. (2017)	Psychological Intervention	Group	Nontech	8 sessions, 2.5 hr, twice weekly	3; baseline, post (immediate) and follow-up (3 months)	18–25 (21.91, 2.15)	Gay and bisexual young men	At-risk nonclinical	33 (33, 100%)	UCLA (20 item)	Good	Sig	.250 (–0.01–0.51)
Stewart, Barnfather, Magill-Evans, Ray, and Letourneau (2011)	Enhanced Social Support	Group	Technology ^a	25 × 60–90-min sessions (6 months)	3; baseline, post (immediate) and follow-up (3 months)	12–18 (14.6, 1.6)	Children with physical disabilities including cerebral palsy and spinal bifida.	At-risk clinical	22 (12, 55%)	LSDQ (24-item)	Fair	N.Sig	.128 (–0.19, 0.44)
Stewart, Letourneau, Masuda, Anderson, and McGhan (2013)	Enhanced Social Support	Group	Technology ^a	1–5 hr a week (8 weeks)	2; baseline and post (within one month)	7–11 (9.26)	Children with either allergies, asthma or both.	At-risk clinical	27 (12, 44%)	LSDQ (24-item)	Fair	N.Sig	.242 (–0.05, 0.53)

LSDQ, Loneliness and Social Dissatisfaction Questionnaire; PNDLS, Peer Network and Dyadic Loneliness Scale; UCLA, UCLA Loneliness Scale.

^{1,3,4}Means and standard deviations not reported, but calculated from raw ages of participants.

²Age range was not provided, but authors reported '49 3rd-grade students'. 3rd Graders are typically aged between 8 and 9 years.

⁶The gender split was reported for the initial qualifying sample of 81 students. However, statistics suggest there were no gender differences between those who completed the intervention and those who were lost (noncompleters). The gender split was calculated for the 54 intervention completers based on the initial percentage provided.

⁷Means and SD were given for two groups of students. However, results suggest there is no significant difference between the two groups on age. Therefore, the average of the two was calculated.

⁸Gender and/or age based on total sample recruited. Specific information regarding the final analytical sample was not included.

⁹Calculated from the two subgroups.

¹⁰No significance testing, but included quantitative data (means and SDs) and commented upon trends.

¹¹Based on whole sample enrolled ($N = 44$).

^a100% technology based.

^bMajority/novel aspect of intervention technology based.

Table 3. Randomised control trial (RCT) intervention study information (*N* = 25)

Authors (date)	Intervention type	Delivery format	Technology use	Intervention length	Measurement points	Age range (mean, sd)	Brief sample description	Type of sample	N in analytical sample (n male, % male)	Loneliness measure	Quality rating	Outcome (impact on loneliness)	Effect size (CI 95%)	
Beidel et al. (2000)	Social Skills	Group	Nontech	2 × 60 mins weekly (12 weeks)	2; Baseline and post (immediately)	8–12 (10.5, 1.5)	School-aged children with social phobia	At-risk clinical	50 (20, 40%)	LSDQ (24-item)	Poor	N.Sig	.534 (–0.03, 1.10)	
Christian and D'Auria (2006)	Social Skills	Group ^b	Nontech	2 sessions (2 weeks apart)	4; Baseline, post (3 months), follow-up 1 (6 months) and follow-up 2 (9 months)	8–12 (9.27, 1.26)	School-aged children with cystic fibrosis	At-risk clinical	116 (59, 51%)	LSDQ (16-item)	Good	N.Sig	.078 (–0.28, 0.44)	
Craig et al. (2016)	Social and Emotional Skills	Individual	Tech ^a	2 weeks to complete 6 'scenes'/sessions	2; Baseline and post (immediate)	7–11 (9.65, 1.27)	School-aged children with access to Internet	General	47 (28, 59%)	LSDQ (19-item)	Poor	Sig	1.74 (1.08–2.41)	
Cross et al. (2018)	Social and Emotional Skills	Group	Nontech	12 hourly long training sessions throughout school	3; baseline, post (same year) and follow-up (following year)	12–14 ⁸ (13)	Adolescents enrolled in Grade 7 and 8.	General	2966 (1483, 50%)	LSDQ (15-item)	Fair	Sig	.053 (–0.02–0.13)	
Deckers Muris Roelofs and Arntz (2016)	Social and Emotional Skills	Group	Nontech	12 weekly × 1 hr (12 weeks) and 3 × 1 hr parent sessions	3; baseline, post (immediately) and follow-up (3 months)	8–12 (10.1, 1.27)	Children with a formal diagnosis of Pervasive Developmental Disorder Not otherwise Specified, Asperger's or Autistic Disorder	At-risk clinical	52 (47, 90%)	LACA (12-item)	Poor	N.Sig	.106 (–0.43–0.64)	
Diab Punamäki Palosaari and Qouta (2014)	Psychological Intervention	Group	Nontech	Multiple sessions over 2 months	3; baseline, post (immediate) and follow-up (6 months)	10–13 (11.29, 0.68) ⁶	War affected children	At-risk nonclinical	404 (244, 51%) ⁶	LSDQ (7-item)	Fair	N.Sig	.192 (–0.01–0.39)	
Frankel et al. (2010)	Social Skills	Group	Nontech	12 × 60 min (12 weeks)	3; baseline, post (immediate) and follow-up (6 months)	7–11 ¹ (8.53, 1.26) ²	Children who satisfied the ASD criteria	At-risk clinical	65 (58, 85%) ⁶	LSDQ (16-item)	Good	Sig	.666 (0.17–1.16)	
Gantman, Kapp, Orenski, and Laugeson (2012)	Social Skills	Group	Nontech	14 × 90 min (14 weeks)	2; Baseline and post (immediate)	18–23 (20.4, 1.62)	Young adults with ASD	At-risk clinical	17 (12, 71%)	SELSA (37-item)	Poor	Sig	1.04 (0.07–2.01)	
Kjøbli and Ogden (2014)	Social and Emotional Skills	Individual	Nontech	1 × 60 min (8–10 weeks)	3; Baseline, post (immediate) and follow-up (6 months)	3–12 (7.64, 2.19) ⁶	Children who displayed problem behaviours (such as aggression and delinquency) at day care or school reported)	At-risk nonclinical	121 (159, 80%) ⁶	LSDQ (24-item)	Good	N.Sig	.119 (–0.18–0.42)	
Klingman and Hochdorf (1993)	Psychological Intervention	Group	Nontech	12 × 50 min (12 weeks)	2; Baseline and post (within 2 weeks)	12.5–13.5 (not reported)	School-aged children	School-aged children	General	237 (112, 47%)	UCLA (20-item)	Poor	N.Sig	
.096 (–0.26–0.46)														
Larsen et al. (2019)	Enhanced Social Support	Group	Nontech		2; Baseline and post (7 months)	15–19 (16.82)	Adolescent enrolled in upper secondary school	General	1128 (669, 51%) ⁶	Norway Loneliness Scale (6-item)	Fair	N.Sig	.049 (–0.07–0.17)	

(continued)

Table 3. (continued)

Authors (date)	Intervention type	Delivery format	Technology use	Intervention length	Measurement points	Age range (mean, sd)	Brief sample description	Type sample	N in analytical sample (n male, % male)	Loneliness measure	Quality rating	Outcome (impact on loneliness)	Effect size (CI 95%)
Leff et al. (2009)	Social and Emotional Skills	Group	Nontech	20 × 30 biweekly (at least 10 weeks)	2; Baseline and post (immediate)	8–12 ³ (not reported)	Relationally aggressive girls	At-risk clinical	32 (0, 0%)	LSDQ (24-item)	Poor	Decreased	.158 (–0.55–0.87)
Margalit (1995a)	Social and Emotional Skills	Group	Tech ^a	Twice weekly × 1 hr sessions (3 months)	2; Baseline and post (immediate)	11–15 (13.3, .85)	Children with mild intellectual disability	At-risk clinical	73 (43, 59%)	LSDQ Hebrew Adapt (24-item)	Poor	N.Sig	.030 (–0.42–0.48)
Masia-Warner et al. (2005)	Social Skills	Group	Nontech	12 × 40 min group, 2 × 15 min individual, 4 × 90 min social boosters (3 months)	2; Baseline and post (immediate)	13–17 (14.8, .81)	Adolescents with a specific subtype of social phobia or social anxiety disorder	At-risk clinical	35 (9, 26%)	LSDQ (16-item)	Good	N.Sig	.311 (–0.34–0.96)
Mason, Zaharakis, and Sabo (2016)	Psychological Intervention	Individual	Nontech	20 min session	4; Baseline, post (1 month), follow-up 1 (3 months) and follow-up 2 (6 months)	14–18 (16.4, 1.2)	Adolescents at high risk of substance abuse and presenting a primary care clinics	At-risk clinical	119 (35, 29%)	Social Stress (2-item)	Good	Sig	.170 (–0.19–0.53)
Mattanah et al. (2010)	Enhanced Social Support	Group	Nontech	9 × 90 min (over 2 semesters; over 3 months)	3; Baseline, post (Spring term), follow-up (Summer term)	17–19 ⁴ (17.7, 0.52)	First-year college students	General	142 (51, 30%)	UCLA (20-item)	Fair	Sig	.508 (0.17–0.84)
Matthews et al., (2018)	Enhanced social support	Group	Nontech	14 weeks	3; Baseline, post (immediate) and follow-up (4–5 months later)	13–17 (15.30)	Adolescents diagnosed with ASD	At-risk clinical	24 (20, 83%)	UCLA (20-item)	Fair	N.Sig	.036 (–0.74–0.81)
Purohit, Pradhan, and Nagendra (2016)	Learning new skills	Group	Nontech	4 × 90 min a week (3 months)	2; Baseline and post (immediate)	11–16 (not reported)	Orphan adolescents	At-risk nonclinical	68	LSDQ (24-item)	Poor	N.Sig	.446 (–0.03–.93)
Quayle, Dziurawiec, Roberts, Kane, and Ebsworthy (2001)	Psychological Intervention	Group	Nontech	1 × 80 mins weekly (8 weeks)	3; Baseline, Post (immediate) and follow-up (6 months)	11–12 (not reported)	School-age girls	General	33 (0, 0%)	LSDQ (16-item)	Good	Nonsign	.181 (–0.50–0.86)
Regev and Guttman (2005)	Learning new skills	Group	Nontech	25 × 45 min (25 weeks or more)	2; Baseline and post (1 month)	8.5–13 (10.64)	Primary school children with learning disorders	At-risk clinical	50 (58, 53%) ⁶	LSDQ Hebrew Adapt (24-item)	Poor	N.Sig	.499 (–0.06–1.05)
Rohde, Jorgensen, Seeley, and Mace (2004)	Psychological Intervention	Group	Nontech	Biweekly meetings (8 weeks)	2; Baseline and post (immediate)	12–22 (16.3, 1.9)	Incarnated young males	At-risk nonclinical	76 (76, 100%)	UCLA (8-item)	Fair	N.Sig	.168 (–0.29–0.62)
Sanchez Brown Koher and DeRosier (2017)	Social and Emotional Skills	Individual	Tech ^a	9 × 1 weekly episodes	2; Baseline and post (immediate)	7–11 (8.90) ⁷	School children identified as 'at risk' on the behaviour assessment system for children	At-risk clinical	69 (41, 60%)	LSDQ (19-item)	Poor	Sig	.297 (–0.17–.77)

(continued)

Table 3. (continued)

Authors (date)	Intervention type	Delivery format	Technology use	Intervention length	Measurement points	Age range (mean, sd)	Brief sample description	Type of sample	N in analytical sample (n male, % male)	Loneliness measure	Quality rating	Outcome (impact on loneliness)	Effect size (CI 95%)
Stice, Rohde, Seeley, and Gau (2010)	Psychological Intervention	Group	Nontech	6 week	3; Baseline, during and post (immediate)	14–19 (15.6, 1.2)	At-risk teens with elevated depressive symptoms	At-risk clinical	341 (150, 44%)	UCLA (8-item)	Good	Sig	.395 (0.10–0.70)
Vassilopoulos, Diakogiorgi, Brouzos, Moberly, and Chasioti (2018)	Psychological Intervention	Group	Nontech	90 min per week, 5 weeks	2; Baseline and post (5 weeks)	11–12 (not reported)	Adolescents enrolled in Year 6 of Greek school	General	54 (27, 50%)	LSDQ (24-item)	Fair	Sig	1.52 (0.90–2.15)
Zhang Fan, Huang and Rodriguez (2016)	Psychological Intervention	Group	Nontech	8 × 2 hr (8 weeks)	3; Baseline, post (immediate) and follow-up (3 months)	17–25 (19.79, 1.57) ^c	Chinese college students with elevated loneliness	At-risk nonclinical	43 (30, 61%) ^b	Chinese College Student Loneliness Scale (16-item)	Poor	Sig	.649 (0.01–1.29)

LACA, Loneliness and Aloneness Scale for Children and Adolescence; LSDQ, Loneliness and Social Dissatisfaction Questionnaire; SELSA, Social and Emotional Loneliness Scale for Adults; UCLA, UCLA Loneliness Scale.

¹No figures were provided for age range. Recruitment criteria required participants to be attending 2nd- to 5th-grade school. The age range for Grade 2 is 7–8, and Grade 5 is 10–11.

²No overall mean provided for sample. Calculated based on Control + Intervention/2.

³No statistics relating to age provide. Authors state children were in Grade 3 to Grade 5 (8 years, 12 years, retrospectively).

⁴No age range given, but sample description states 'all traditional-age, first time (no transfer) freshmen at a suburban university'. Typically, freshman are aged 17–19 years.

⁵Gender split statistics not reported, but a preintervention chi-square revealed no significant differences in gender distribution.

⁶Gender and/or age based on total sample recruited. Specific information regarding the final analytical sample was not included.

⁷Calculated based on % of children age reported in years.

⁸Not reported but sample was recruited from Grades 7 and 8.

⁹No significance testing, but comments upon effect sizes.

^a100% technology based.

^bContained both individual and group elements, and focused on the social skills element of the intervention.

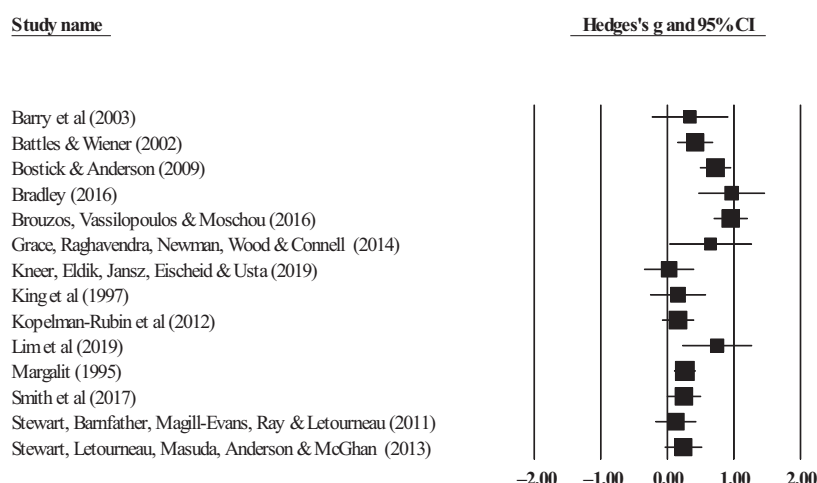


Figure 2. Effect size distribution single group comparison ($N = 14$)

underling the effectiveness of the interventions including sample demographics (including age and gender composition) and intervention characteristics such as intervention focus, delivery mode and choice of loneliness measure. We were also able to examine the influence of study quality and sample categorisation (i.e. clinical vs nonclinical). Overall, we found a significant effect, such that interventions reduced loneliness among youth. There was some limited evidence that intervention success depended on the type of intervention. For single-group designs, those interventions that focused on social and emotional skills yielded the largest effect size followed by those which included a psychological therapy. For RCTs, those interventions that focused on learning a new hobby yielded the largest effect, followed by interventions aimed at social skills training. While there is evidence to suggest the intervention focus may be a promising avenue for future research, it is important to

note the moderating role failed to reach significance. In-person versus technology-based interventions, while not significant, were the more successful for single-group interventions, while the quality of study was important for studies that utilised an RCT design. The measure of loneliness used in the evaluation, the target population and the age and gender of the participants did not appear to affect the success of the intervention.

Our meta-analyses are unique as they are the first to explore interventions that reduce loneliness for youth. As such, the results can only be indirectly compared with previous reviews on loneliness because those included studies most focused on adults. Masi et al. (2011) included studies from across the life span and found a comparable average effect size of .367 for single-group designs and .198 for RCT. Such effect sizes are comparable to the current results for interventions for youth, where single-group design demonstrated a large

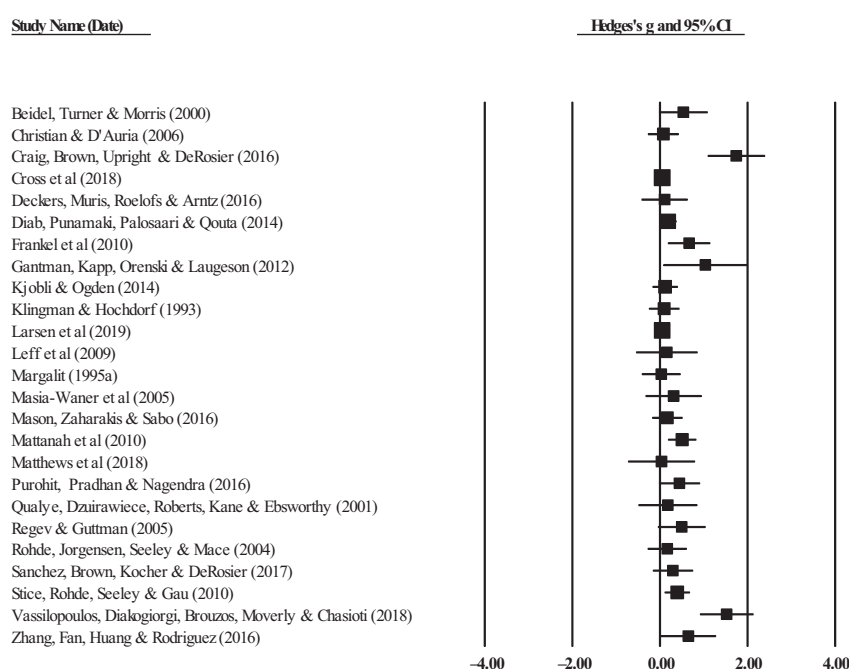


Figure 3. Effect size distribution randomised control trial design ($N = 25$)

and significant effect size ($g = .411$) and RCTs generated a moderate and significant effect size ($g = .316$).

Impact of intervention characteristics

Reviews examining interventions in adulthood suggested intervention focus may play an important role in the effectiveness of the intervention for reducing loneliness (Cattan et al., 2005; McWhirter, 1990; Perese & Wolf, 2005). However, for youth, we did not find that one intervention type was significantly more effective at reducing loneliness than other types. While our analyses showed that, for youth, those interventions that focused on social and emotional training yielded the greatest effect size when evaluated using single-group designs, the overall effect of intervention type was not significant. It was the same for RCT: those interventions that focused on learning a new skill yielded the greatest effect size, but the overall effect of intervention type was also not significant. Those findings support findings from Masi et al. (2011), where intervention type was a non-significant moderator for single-group designs. However, it is important to consider the small number of studies included within the moderator analysis in the current study, suggesting that conclusions regarding type of intervention should be interpreted with caution.

Perese and Wolf (2005) and Victor (2018) suggested intervention focus alone is unlikely to influence the effectiveness of the loneliness interventions for adults, unless that focus is tailored to the needs of an individual. Given our findings, future interventions for youth should take note because combined findings suggest that any intervention should be matched to an individual's current needs: we should not expect a 'one size fits all' intervention. That applies to interventions to reduce loneliness among youth and adults.

The current study also investigated the role of technology and delivery mode (individual or group) in studies that utilised a single-group design. However, results suggest those two characteristics did not play a significant moderating role. That finding is not consistent with previous work with adults, where group interventions were found to be more successful than individual interventions (Cattan et al., 2005; Findlay, 2003; Hagan et al., 2014). Cohen-Mansfield and Perach (2015) and Hagan et al. (2014) highlight technology as an important moderator factor in alleviating loneliness among adults, whereas Victor (2018) warns against the use of technology because it may simply reinforce the experience of loneliness. Because the current review is the first to examine youth interventions, we must consider the possibility that technology does not have the same influence on youth's feelings of loneliness as it does for adults. Technology is often seen as an appropriate and effective delivery format for youth intervention because over 90% of young people use the Internet at least occasionally (Madden et al., 2013), with reductions in mental health problems such as anxiety and depression within young adults (Farrer et al., 2013) and adolescents (Grist, Croker, Denne, & Stallard, 2019). The use of technology in interventions should not be discouraged: our findings suggest they may be an effective alternative to face-to-face interventions for youth. More studies are needed to truly gain an insight into their usefulness in alleviating loneliness across the life span.

We found no significant effect of the loneliness measurement used to evaluate loneliness on the success of

the intervention. At first glance, that finding is not consistent with previous reviews of adult interventions (Hagan et al., 2014; Masi et al., 2011; Victor, 2018). It is possible that the categorisation of measures used in the current study is not capturing the true variation. In the current review, the vast majority of studies utilised a variation of the LSDQ scale, with the remaining studies being categorised as 'other'. Such a categorisation approach may be a potential limitation because the 'other' category may not reflect the true variation of loneliness measurement for youth, overlooking important issues of direct versus indirect measurement of loneliness noted as important in previous reviews (Victor, 2018). However, in the current study, it was not possible to conduct moderator analysis on outcome measures for each individual scale because representation was too small to be statistically meaningful. Considering recent findings on the use of a single, direct, measure of loneliness with youth (Eccles et al., 2020), in future work, it would be beneficial to use it as an evaluation tool alongside more in-direct and composite measures of loneliness. Conducting intervention studies utilising both loneliness assessment techniques will help establish whether loneliness measurement is an important factor in the effectiveness of loneliness intervention.

Sample demographics

We found that gender and age did not impact the effectiveness of loneliness interventions for young people. Masi et al. (2011) found a contrasting result, suggesting males were more responsive to interventions than females in both nonrandomised and RCT designs. Given recent findings that there are no gender differences in the experience of loneliness across including childhood and adolescents (Maes, Qualter, Vanhalst, Van den Noortgate, & Goossens, 2019), future studies aiming to alleviate loneliness may be best to focus on other characteristics – such as general vs nongeneral samples – when considering what type of intervention to employ.

Study quality

Study quality did not demonstrate a moderating role on the effect sizes. However, it should be noted that in the RCT studies, those studies graded as 'poor' demonstrated the largest effect size and, therefore, may still be driving results. In addition, for RCTs, 25% of studies were graded as 'poor'. For single group, 21% studies out of 14 were rated as 'poor'. While the quality may not have influenced the effectiveness in the current analyses, the review clearly highlights a potential issue with the way interventions for youth are evaluated and reported. Particularly for RCT, there were important elements missing from reports, including information on how young people were selected, how they were randomised into groups, and the attrition rates. Thus, our findings raise some interesting concerns relating to the way interventions are conducted and reported. In line with those ratings, we recommend that authors follow published guidelines on what to include in an RCT intervention paper (Montgomery et al., 2018).

Modifying risk

The interventions included in the meta-analysis did not appear to look at-risk factors for loneliness other than special needs of the those in the sample – that is

orphaned (Purohit et al., 2016), incarcerated youth (Rohde et al., 2004), ASD/Autism (Barry et al., 2003) and children with life-threatening illnesses (Battles & Wiener, 2002) – interventions were targeted at youth who were assumed to have higher loneliness rather than those that we know actually did. In addition, interventions did not distinguish between transient and chronic loneliness. Such an approach means that the interventions did not include treatment aimed specifically at preventing and/or alleviating the harmful consequences of those different types of loneliness. Heinrich and Gullone (2006) argued for the need for prospective studies of interventions designed to alleviate loneliness among youth, but, to date, the evaluation of interventions designed to help youth manage their experiences of loneliness and/or to treat chronic loneliness has not been achieved.

We also argue that future intervention work would do well to look at society-level variables that have been shown to influence loneliness among youth. For example, parents' low socioeconomic status has been shown to be associated with loneliness among youth (Madsen et al., 2019); parent-reported loneliness (Junttila & Vauras, 2009) is also an important predictor of youth loneliness. Neither have been used to target youth for intervention, but could prove important for prevention and intervention work.

Limitations of included studies

Consistent with previous findings (Masi et al., 2011), we found a higher mean effect size in single-group studies compared with RCTs. There are several reasons why single-group studies on loneliness reveal larger effect sizes than RCTs, with several concerns related to internal validity. Those include being unclear whether any potential improvements, or a lack of improvements, are actually the result of something outside the intervention (Knapp, 2016). Lipsey and Wilson (1993) note the risk of single-group comparisons in social sciences, highlighting that single-group designs overestimated effect sizes by 61% compared with control group studies. While such designs do have their merit, the field needs to move towards studies with a control group in order to allow reliable and accurate evaluation of interventions designed to reduce loneliness.

The current review included some studies that directly targeted loneliness, but also those that included loneliness as a secondary or additional outcome. Considering the wide array of negative consequences of loneliness for youth, including the detrimental impact it can have on physical health (Eccles et al., 2020; Stickley et al., 2016), sleep (Eccles et al., 2020; Harris, Qualter, & Robinson, 2013; Matthews et al., 2017) and mental health (Beutel et al., 2017; Schinka et al., 2013), it is essential to start targeting loneliness as an independent, and important, issue rather than as a by-product of other conditions or problems (Heinrich & Gullone, 2006). Future interventions should be designed with alleviating loneliness as a primary goal and should look to the literature on loneliness for intervention content, including the underlying mechanisms explaining the negative implications (Hawkey et al., 2010) or the maintenance of loneliness (why do some people feel lonely for longer than others do?). Focusing these potential explanatory factors will help ensure the interventions can be tailored to the

individual and ensure the correct approach is adopted depending on the type of loneliness experienced.

In addition, the review highlighted the need for long-term follow-ups. For the pre-post comparisons, only 28% of studies included a follow-up period, and for RCT, this improved slightly to 44%. Studies do not all provide multiple follow-up assessment, and therefore, it is difficult to comment upon whether the interventions had long-lasting effects.

Strengths and limitations of the current study

The current review is the first review to examine interventions aimed at alleviating loneliness in young people. To date, one review has focused on the life span (Masi et al., 2011), but it only included a small number of interventions specially aimed at children ($n = 5$). The current review addresses that important gap in the literature. The current review is critically important at this point in time because, in the UK, there is growing recognition of loneliness in youth as an issue in light of recent population surveys (ONS, 2018) and large-scale research projects (BBC Loneliness Experiment, 2018), with increased focus from charities (NSPCC/Child Line, 2017), youth projects (The Co-op Foundation, 2018) and government (United Kingdom, Department for Digital, Culture, Media and Sport, 2018).

However, the current meta-analysis is vulnerable to limitations associated with all systematic reviews and meta-analyses. There is always a risk a loneliness intervention aimed at young people was missed during the literature search. The current review followed guidelines published by recognised and recommended literature relating to meta-analysis (including Borenstein et al., 2009; Lipsey & Wilson, 2001) and followed examples set by previous meta-analysis (Masi et al., 2011), but there is still the possibility that we missed a study. However, the publication bias for both types of study design suggests the 'file drawer' issue was not present within the current set of analyses, and, as such, the conclusions drawn can be interpreted with confidence.

Implications

It is clear from the results of the meta-analyses that interventions can reduce loneliness among youth and yield a moderate effect size. Thus, researchers, policy-makers and practitioners should know that interventions can have a positive effect in reducing loneliness for young people. While that is promising, there is also a large amount of between-study variance which was not accounted for by the moderators examined in the current study including sample demographics, intervention characteristics and study design. Moving forward, it is clear there is a need for high-quality interventions aimed specifically at reducing loneliness – rather than a secondary outcome – and those interventions need to be evaluated properly, and extensively, to help identify the best way of helping young people experiencing loneliness. In addition, there is a need to consider the best type of intervention for those experiencing transient versus prolonged loneliness. Based on previous research (Qualter et al., 2015), interventions for transient loneliness will include the teaching of emotion management and social skills that enable appropriate management of the experience for successful reconnection and mitigate falling into prolonged loneliness; interventions for

prolonged loneliness may involve the treatment of anxiety and negative cognitive biases that characterise prolonged loneliness.

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Ethical information

No ethical approval was required for this review.

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Notes

1 Only those studies where a mean age was provided/confidently calculated were included (pre-post: $n = 13$; RCTs: $n = 20$).

2 Only those studies where a gender split was provided/ confidently calculated were included (pre-post comparisons: $n = 14$; RCTs: $n = 24$).

Supporting information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Literature search protocol.

Appendix S2. Coding manual.

Appendix S3. Quality checks for both pre-post and RCTs studies.

Figure S1. Funnel plot of standard error by Hedges's g for pre-post group comparisons.

Figure S2. Funnel plot of standard error by Hedges's g for RCT trials.

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