Rapid systematic review: the impact of social isolation and loneliness on the mental health of children and adolescents in the context of COVID-19

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Rapid Systematic Review: The impact of social isolation and loneliness on the mental health of children and adolescents in the context of COVID-19

Running Head
Loneliness mental health rapid review

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No conflicts of interest to declare.

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Clinical Guidance

- This systematic review showed that children and adolescents who self-identify as being lonely have an increased risk of depression and probably anxiety when they are lonely and years later.
- There was also evidence that experiencing disease containment measures in a pandemic was associated with subsequent mental health problems in one retrospective study.
- Clinicians, and those providing care, should consider how to support children and adolescents during and after the COVID-19 pandemic to treat the expected increase in mental health problems.

Abstract

Objective: Disease containment of COVID-19 has necessitated widespread social isolation. We aimed to establish what is known about how loneliness and disease containment measures impact on the mental health in children and adolescents.

Method: For this rapid review, we searched MEDLINE, PSYCHINFO, and Web of Science for articles published between 01/01/1946 and 03/29/2020. 20% of articles were double screened using pre-defined criteria and 20% of data was double extracted for quality assurance.

Results: 83 articles (80 studies) met inclusion criteria. Of these, 63 studies reported on the impact of social isolation and loneliness on the mental health of previously healthy children and adolescents (n=51,576; mean age 15.3) 61 studies were observational; 18 were longitudinal and 43 cross sectional studies assessing self-reported loneliness in healthy children and adolescents. One of these studies was a retrospective investigation after a pandemic. Two studies evaluated interventions. Studies had a high risk of bias although longitudinal studies were of better methodological quality. Social isolation and loneliness increased the risk of depression, and possibly anxiety at the time loneliness was measured and between 0.25 to 9 years later. Duration of loneliness was more strongly correlated with mental health symptoms than intensity of loneliness.

Conclusions: Children and adolescents are probably more likely to experience high rates of depression and probably anxiety during and after enforced isolation ends. This may increase as enforced isolation continues. Clinical services should offer preventative support and early intervention where possible and be prepared for an increase in mental health problems.

Introduction

The COVID-19 pandemic has resulted in governments implementing disease containment measures such as school closures, social distancing and home quarantine. Children and adolescents are experiencing a prolonged state of physical isolation from their peers, teachers, extended family and community networks. Quarantine in adults generally has negative psychological effects including confusion, anger, and post-traumatic distress.[1,2] Duration of quarantine, infection fears, boredom, frustration, lack of necessary supplies, lack of information, financial loss, and stigma appear to increase the risk of negative psychological outcomes. [1] Social distancing and school closures may therefore increase mental health problems in children and adolescents, already at higher risk of developing mental health problems compared to adults [3] at a time when they are also experiencing anxiety over a health threat and threats to family employment/income.

Social distancing and school closures are likely to result in increased loneliness in children and adolescents whose usual social contacts are curtailed by the disease containment measures. Loneliness is the painful emotional experience of a discrepancy between actual and desired social contact[4] Although social isolation is not necessarily synonymous with loneliness, early indications in the COVID-19 context indicate that more than one third of adolescents report high levels of loneliness[5,6] and almost half of 18-24-year olds are lonely during lockdown.[7] There are well established links between loneliness and mental health.[8] The purpose of this review was to establish what is known about the relationship between loneliness and mental health problems in healthy children and adolescents and to establish whether disease containment measures including quarantine and social isolation are predictive of future mental health problems. We included cross sectional, observational, retrospective and case control studies if studies included mainly children and adolescents, who had experienced loneliness or had used validated measures of social isolation and mental health problems. To capture the possible effects of social isolation and the expected mediator (loneliness) on mental health problems, we included search terms to capture these two areas.

Method

We conducted a rapid review to provide timely evidence synthesis to inform urgent healthcare policy decision-making.[9] A rapid review adheres to the essential principles of systematic reviews, including scientific rigour, transparency, and reproducibility. [9,10] It uses “abbreviated” systemic review methodology including: limiting search criteria, faster data extraction, and using narrative synthesis methods.[11,12]

Search strategy and selection criteria [see online supplementary materials table S1.-S3. for full search strategy]

We searched MEDLINE, PSYCHINFO, Web of Science and the Cochrane Library. Our search terms were informed by recent rapid reviews in the COVID-19 context[1] and included definitions of loneliness and social isolation to capture the impact of social distancing and school closures. Terms captured ‘children’ or ‘adolescents’ AND ‘quarantine’ or ‘social isolation’ or ‘loneliness’ AND ‘mental health’ with a focus on the most common mental health problems in this age group: depression and anxiety.

Peer reviewed studies were selected if they were published (1946 to 03/29/2020); reporting primary research; included predominantly children/adolescents (mean age < 21)[13]; published in English (web of science only); participants had experienced either social isolation or loneliness; valid assessment of depression, anxiety, trauma, OCD, mental health, or mental wellbeing.

Study selection and data collection

We checked 20% of all study eligibility results (both included and excluded) to ensure adherence to the eligibility criteria. Data were extracted into a purpose-designed database: A random 20% of the data was double entered to ensure accuracy.

A truncated quality assessment was conducted by one author (SR) using criteria adapted from the NIH[14] (see table 1).

[insert table 1 here]

Data Synthesis
We conducted a narrative synthesis within the following categories: (1) the impact of loneliness on mental health in healthy populations (further divided into cross-sectional and longitudinal evidence), (2) pandemic-specific findings, and (3) intervention studies.

Results

We located 4531 articles (see Figure 1) of which 83 articles (80 studies) met the inclusion criteria. Of these, 18 articles (17 studies) reported on the impact of loneliness in those with a variety of health conditions including mental health problems (12 studies), physical health problems (1 study) and neurodevelopmental conditions (4 studies). The remaining 65 articles reported on 63 studies which examined the impact of loneliness or disease containment measures on healthy children and adolescents. For the purposes of this rapid review, we will focus our analyses on these 63 studies.

[insert figure 1 here]
Figure 1. Flow diagram showing search results.[15]

The 63 studies were mainly from the USA, China, Europe and Australia. Included studies were also conducted in India, Malaysia, Korea, Thailand, Israel, Iran, and Russia. 61 studies were observational and 2 studies reported on interventions. Of the 61 observational studies, 43 studies were cross-sectional only, 6 longitudinal only and 12 reported both cross sectional and longitudinal findings. 1 study was a retrospective study after a pandemic. In cross sectional studies, likely confounders (e.g. adversity, SES) were rarely controlled, meaning that the association between loneliness and mental health outcomes in these studies is very likely to be inflated[16]. Four longitudinal studies used multi-informant approaches including self-report and parent and/or teacher report to assess mental health outcomes. Importantly, they typically assessed and controlled for confounds and could assess the most plausible direction of causality between loneliness/social isolation and mental health.

The impact of loneliness on mental health
Tables 2 and 3 describe the 60 studies which examined the impact of loneliness on mental health. 53 studies stated that they measured the impact of loneliness on mental health. 7 studies stated that they measured the impact of social isolation [17-23] on mental health, but the social isolation measures used were either subscales or questions from loneliness scales, or strongly overlapped with the construct of loneliness. Therefore, we have considered them together with studies that measured loneliness. Participants were mainly school or university students or taking part in longitudinal cohort studies.

Forty-five studies examined the cross-sectional relationship between depressive symptoms and loneliness and/or social isolation. [17,20,21,23-66] The majority were conducted in adolescent (N = 23) and young adult (N = 16) samples, although six studies included children under the age of 10. Most reported moderate to large correlations ($0.12 \leq r \leq 0.81$) and most included a measure of depressive symptoms. Two studies reported odds ratios, with those who were lonely 5.8[45] to 40 times[49] more

likely to score above clinical cut-offs for depression. The associations were stronger in older participants[37] and in female participants.[46] However, the strength and direction of the associations did not differ by age of the sample. Fewer studies (N = 23) examined symptoms of anxiety. Those that did found small to moderate associations between anxiety and loneliness/social isolation ($0.18 \leq r \leq 0.54$). The duration of loneliness was more strongly associated with anxiety than intensity of loneliness.[42,67] Social anxiety was moderately to strongly associated with loneliness/social isolation ($0.33 \leq r \leq 0.72$) and there were moderate associations between generalized anxiety and loneliness/social isolation ($r = 0.37, 0.40$).[21,34] One study found a small association between panic and loneliness ($r = 0{\cdot}13$).[61,62] In the single study which reported odds ratios, being lonely was associated with increased odds of being anxious by 1·63 to 5·49 times.[49] Positive associations were also reported between social isolation/loneliness and suicidal ideation, [24,27,28] self-harm,[24] and eating disorder risk behaviour.[24] Negative associations were reported between social isolation/loneliness and wellbeing[68,69] and mental health.[22]

Eighteen studies followed participants over time (see table 3).[17-19,55-58,60-63,65,70-75] Several of these were conducted in childhood (N = 6), or adolescence (N = 8), although three were in university students. Most (N = 12) had only one follow up time point usually between 1 and 3 years.

12 of the 15 studies found that loneliness is associated with depression and explained a significant amount of the variance in severity of depression symptoms several months to several years later.[55,57-63,71,73,74] Two studies found that loneliness in childhood at age 5 was not associated with depression several years later [59,60] although other studies which assessed loneliness during childhood found evidence that it is associated with subsequent depression[55,72] One large study of adolescents (n=3088) found that loneliness was not associated with depression one year later.[56] There were mixed findings in another large study of adolescents (n = 541) which found a significant association between loneliness and subsequent depression, although this did not hold in a cross-lagged model[17] suggesting a possible bidirectional relationships between the variables. A study of university students found evidence of a gender difference, with loneliness being associated with later depression in female participants but not in male participants.[18] In a large longitudinal cohort of vulnerable young people, aged 11 to 17, after controlling for caregiver neglect and other relevant covariates, a substantial increase in self-reported peer isolation (1 S.D.) was associated with an increase in depression symptoms (0.49 S.D.).[71] Duration of peer loneliness rather than the intensity of peer loneliness is associated with depression 8 years later (i.e. from age 5 to age 13); in contrast family related loneliness was not independently associated with subsequent depression.[59]

Three of the four studies which examined the longitudinal effect of loneliness on anxiety found that loneliness was associated with later anxiety.[56,64,75] Two of these studies assessed social anxiety, and one measured anxiety as a broad construct. One study did not find that loneliness/social isolation at age 5 was associated with anxiety at age 12.[19] One study of young adolescents found differences by gender, with loneliness being associated with later social anxiety in male participants but not female participants.[75] None of these studies measured loneliness during childhood.

Other mental health outcomes reported over time included internalizing symptoms which were associated with prior loneliness in primary school age children,[72] and suicidal ideation during adolescence, which was not associated with prior loneliness during childhood.[60]

The impact of social isolation in an infectious disease context

One study[76] reported on mental health and social isolation in the context of different infections including H1N1, SARS, and avian flu (see table 2). This retrospective study included 398 parents of exposed children from the USA, Canada and Mexico, of whom 20·9% experienced social isolation and a further 3.8% had been quarantined. Parents of children reported on their child's experience of

trauma and on their current mental health. One third of parents whose children had been subject to disease containment measures said their child had needed mental health service input because of their pandemic related experiences. The most reported diagnoses were acute stress disorder (16.7%), adjustment disorder (16.7%), grief (16.7%), and PTSD (6.2%). Two different parent-reported measures of PTSD symptoms found that those children exposed to disease containment measures scored significantly higher for PTSD symptoms post-pandemic. On the PTSD Checklist Civilian Version, 28% of children who had experienced isolation/quarantine scored about the cut-off for PTSD, compared to 5.8% of those who had not experienced isolation/quarantine. Similarly, on the UCLA PTSD Reaction Index, 30% of children who experienced isolation/quarantine scored about the cut-off for PTSD, compared to 1.1% of those who had not experienced isolation/quarantine (effect size: Cramer's V = 0.449). Mean scores were 4 times higher in the isolated/quarantined group than in those who had not been isolated/quarantined. The most common trauma symptoms in the quarantined/isolated group were avoidance/numbing (57.8%), re-experiencing (57.8%), and arousal (62.5%).

Interventions

Two randomised control trials measured loneliness and mental health outcomes following an intervention aimed at the general population (peer mentoring[77] and classroom based,[78] see table 4). In both instances the comparator was no intervention/with follow-up and education as usual. A relatively intensive peer mentor program, with an adult mentor, 4-6 hours per month for 4 months on average, reduced loneliness and mental health problems (small to medium effects) for victims of bullying and victimization. However, a brief (two session) universal classroom-based program delivered in schools including psychosocial support through peer mentors and a staff mental health support team did not reduce loneliness. Neither intervention specifically addressed mental health problems which had developed in the context of loneliness; therefore we are unable to answer our second review question which was what interventions are effective for those who have developed mental health problems as a result of social isolation or loneliness.

[insert tables 2 – 4 here]

Discussion

This rapid systematic review of 63 studies of 51, 576 participants found a clear association between loneliness and mental health problems in children and adolescents. Loneliness was associated with future mental health problems up to 9 years later. The strongest association was with depression. These findings were consistent across studies of children, adolescents, and young adults. There may also be gender differences with some research indicating that loneliness was more strongly associated with elevated depression symptoms in girls and with elevated social anxiety in boys.[18,75] The length of loneliness appears to be a predictor of future mental health problems[59]. This is of particular relevance in the COVID-19 context as politicians in different countries consider the length of time that schools should remain closed, and the implementation of social distancing within schools.

Furthermore, in the one study that examined mental health problems after enforced isolation and quarantine in previous pandemics, children who had experienced enforced isolation or quarantine were five times more likely to require mental health service input and experienced higher levels of post-traumatic stress. This suggests that the current social distancing measures enforced on children because of COVID-19 could lead to an increase in mental health problems, as well as possible post-traumatic stress. These results are consistent with preliminary, unpublished data emerging from China during the COVID-19 pandemic where children aged 3 to 18 are commonly displaying behavioural manifestations of anxiety including: clinginess, distraction, fear of asking questions about the pandemic, and irritability [79] Furthermore, a large survey of young adult students in China

has reported that around one in four are experiencing at least mild anxiety symptoms[80] In the UK, early results from the Co-SPACE (COVID-19 Supporting Parents, Adolescents and Children in Epidemics) online survey of over 1500 parents suggest high levels of COVID-19-related worries and fears, with younger children (age four to 10) significantly more worried than older children (age 11 to 16).[81,82]

In addition to the more direct effects of enforced isolation and quarantine, loneliness as an unintended consequence of disease containment measures seems to be particularly problematic for young people[5,7]. This may be because of the particular importance of the peer group for identity and support during this developmental stage.[83,84] This propensity to experience loneliness may make young people particularly vulnerable to loneliness in the COVID-19 context, which, based on our findings, may further exacerbate the mental health impacts of the disease containment measures. More studies have examined the relationship between loneliness and depression than loneliness and anxiety. Losing links to other people and feeling excluded can result in an affective response of depression.[85] Social anxiety was more strongly associated with loneliness than other anxiety subtypes. This may be because social anxiety is triggered by a perceived threat to social relationships or status.[86]

It is difficult to predict the effect COVID-19 will have on the mental health of children and young people. The subjective social isolation experienced by participants did not mirror the current features of social isolation experienced by many children and adolescents worldwide. Social isolation was not enforced upon the participants, nor was social isolation almost ubiquitous across their peer groups and across the communities in which they live. As loneliness involves social comparison, [87] it is possible that the shared experience of social isolation imposed by disease containment measures may mitigate the negative effects. The studies were also not in the context of an uncertain but dangerous threat to health. These features limit the extent to which we can extrapolate from existing evidence to the current context. In order to make evidence based decisions on how to mitigate the impact of a second wave, we need further research on the mental health impacts of social isolation in the disease containment context of a global pandemic. In this context, to more specifically understand the impacts of loneliness, measures such as the Loneliness and Aloneness Scale for Children and Adolescents (LACA) that assess the duration and the intensity of loneliness, and that separate peer-related loneliness from parent-related loneliness could be elucidating.

This rapid systematic review was conducted rapidly, in 3 weeks, to inform our response to COVID-19. We double screened 20% of all articles and data extracted. In line with Cochrane rapid review guidance,[10] grey literature, and trial registry databases were not searched, hand-search strategies were not employed, and only English language publications were included, meaning that some relevant studies may have been missed. During the rapid data extraction phase, there was no scope to contact authors to request any missing information. The main limitation from this review is the lack of high-quality studies investigating mental health problems after enforced isolation. All but one study investigated social isolation that was not enforced on young people and was not common across a peer group. The effect of widespread social distancing could mitigate against the social isolation described with increased use of internet mediated relationships which can be beneficial to adolescents.[88]. Most studies were cross-sectional, and therefore the direction of the association cannot be inferred. Few studies used independent (i.e. not self-report) measures of mental health or social isolation/loneliness, increasing the risk of bias. Furthermore, the studies were mainly observational and did not consistently control for potential confounders. The majority of studies focused on depression and anxiety, and other mental health problems are important to measure in future research.

However, we used all available evidence on social isolation and loneliness to inform the likely outcome for healthy children and adolescents subjected to social isolation. The results were consistent across all study methodology for depression, (but less so for anxiety) suggesting these results are reliable. The results are also consistent with one study investigating mental health problems in children[76] after pandemics improving our confidence in the results. However, the post pandemic study has several limitations in that the sample was self-selecting, and the demographics of the children and the time elapsed since the experience were not reported. There is little evidence pertaining to interventions. We have focused on healthy populations in this review and will report on those with pre-existing conditions including mental health problems elsewhere.

Implications for Policy and Practice

The review indicates that felt loneliness is associated with adverse mental health in children and adolescents. There is limited evidence that indicates specific interventions to prevent loneliness or to reduce its effects on mental health and well-being. However, there are well-established practical and psychological strategies that may help promote child and adolescent mental health in the context of involuntary social isolation e.g. during the COVID-19 pandemic. Reducing the impact of enforced physical distancing by maintaining the structure, quality, and quantity of social networks, and helping children and adolescents to experience social rewards, feel part of a group, and know that there are others they can look to for support is likely to be important.[8] Finding ways to give children and adolescents a sense of belonging within the family and to feel that they are part of a wider community should be a priority. Therefore, providing accurate information about the relative risks and benefits of social media and networking to parents who overestimate the dangers of allowing their children too much screen time may help young people access the benefits of virtual social contact.

However, simply increasing the frequency of contact may not address young people's subjective experience of loneliness.[20] Helping young people to identify valued alternative activities and build structure and purpose into periods of involuntary social isolation may help to provide a wider range of rewards.[89] Addressing negative thoughts about social encounters (e.g. self-blame, self-devaluation) may also be effective.[34,90] During periods of prolonged social isolation digital technology that provides evidence-based interventions to help young people to reappraise their thoughts and change their behaviour within the confines of the home setting may be particularly welcome.

Whilst this review did not provide evidence on interventions to improve social isolation or loneliness in healthy children and adolescents, given social distancing, digital interventions may be appropriate. Computerized Cognitive Behaviour Therapy (CBT) based self-help program, BRAVE-TA, was shown to be effective for anxiety following the Christchurch earthquake in New Zealand.[91] Furthermore, computerized CBT, such as MoodGym, SPARX, and 'Think, Feel, Do' generally have small but positive effects on mental health.[92,93] Although mobile applications for mental health have been found to be generally acceptable to children and adolescents, there is a lack of convincing evidence of effectiveness on intended mental health outcomes[94] and few mobile health apps have been thoroughly tested.[93] Self-help interventions including bibliotherapy[95] and computerized therapy[96] have shown a moderate positive effect size when compared to control groups although they are generally less effective than face to face therapies.[97] Importantly, reviews have tended to conclude that effects are better if there is some therapist input[93,97] and if parents are involved especially for younger children.[92,93]

The rapid review suggests that loneliness that may result from disease containment measures in the COVID-19 context could be associated with subsequent mental health problems in young people. Strategies to prevent the development of such problems should be an international priority.

Table 1. Quality assessment tool adapted from NIH.[16]

Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Yes 1 No 0
Was the exposure measure objective (i.e. not self-report)	Yes 1 No 0
Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Yes 1 No 0
Was the outcome assessed objectively?	Yes or by blinded assessors 2 By another individual e.g. parent 1 No I.e. self-report 0
Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	No or unclear 0 Some attempt, e.g. SES, demographics 1 Reasonable or comprehensive, e.g. baseline depression for longitudinal studies, other exposure to stress or adversity, negative affectivity 2
Is a longitudinal design with exposure measured before outcome?	Yes 1 No 0
Longitudinal only	
Was loss to follow up after base line 20% or less?	Yes 1 No 0
Was the exposure(s) assessed more than once over time?	Yes 1 No 0

Note: Exposure measures = independent variables

Table 2. Cross sectional studies examining social isolation/loneliness.

Author (year), Country	Sample	Total N (% male participants)	Child (≤11)/ Adolescent (12-18)/ Young adult (≥19)	Age range at baseline (years)	Mean age (S.D.)	Social isolation/Loneliness measure	Mental Health Measure(s)	Associations between social isolation/loneliness (lon) and mental health - r (p) unless otherwise stated		
								Depression (dep)	Anxiety (anx)	Other mental health
Social isolation/loneliness and concurrent mental health symptoms										
Alpaslan et al (2016),[25] Turkey	School students	487 (41·7)	Adolescent	14 to 19	16·07 (1·05)	UCLA Loneliness Scale	CDI, SDQ	Male participants: OR 1·21 Female participants: OR 1·05		
Arslan (2020),[98] Turkey	School students	244 (47·5)	Adolescent	14 to 18	16·27 (1·02)	8-item UCLA Loneliness Scale-Short Form	Youth Internalizing and Externalizing Behavior Screeners			Lon - mental health problems 0·41 (< ·001), β = ·22 (< ·01).
Baskin et al (2010),[26] USA	School students	294 (n.s)	Adolescent	n.s. Estimated 13-14	13·11 (0·469)	Children's Loneliness Scale (CLS)	BDI-Y	R^2 = ·28 (< ·001). Moderated by Belongingness		
Brage et al (1993),[28] Brage et al (1995),[27] USA	School students	156 (39·7)	Adolescent	11 to 18	14 (1·56)	Loneliness Inventory Short Form	CES-D (child version)	0·646, (<·001).		

Chang et al (2017),[29] USA	University students	228 (23·7)	Young adult	18 to 28	19·69 (1·38)	Revised UCLA Loneliness scale	BDI, Frequency of Suicidal Ideation Inventory.	0·69 (< ·001). Regressions: 47% shared variance.		Lon - suicidal ideation 0·52 (<·001). Lon R^2 = 26·9% variance in suicidal ideation
Doman and Le Roux (2012),[30] South Africa	University students	275 (42·3)	Young adult	19 to 34	20·92 (n.s.)	Le Roux Loneliness Questionnaire	Psychological General Well-Being Index: anxiety + depressed mood	0·517 (<·01). 26·7% shared variance.	Anx: 0·365, (<·01)	
Erdur-Baker and Bugay (2011),[31] Turkey	School students	144 (54·2)	Adolescent	11 to 15	12·5 (1·61)	LSDQ	CDI	0·51 (n.s.).		
Ginter et al (1996),[67] Israel	School students	144 (45·1)	Adolescent	11 to 16	13·90 (1·5)	The Loneliness Rating Scale (subscales for Frequency, Intensity, Duration) + additional 2 questions	Revised Children's Manifest Anxiety Scale (RCMAS)		Not lonely group: Frequency of lon – anx 0·33 (<·001), Intensity of lon – anx 0·18 (< ·05). Lonely group > anx t=3·81, (<·001),	
Heredia et al (2017),[68] USA	School students	394 (50·2)	Adolescent	12 to 15	13·52 (0·63)	LSDQ	Wellbeing - World Health Organisation Well-being Index (WHO-5)			Lon - wellbeing 0·111, (<·05). Hierarchical linear regression - loneliness

										accounted for 1·3% of variance in wellbeing
Houghton et al (2016),[69] Australia	School students	1143 (46·3)	Adolescent	10·1 to 16	13·20 (1·2)	Perth Aloneness Scale (includes (friendship-related loneliness subscale)	Warwick-Edinburgh Mental Well Being Scale (WEMWBS)			Friendship related lon-wellbeing 0·36 (< ·001).
Hudson et al (2000),[32] USA	Adolescent mothers post-partum recruited from primary health care practices	21 (0)	Adolescent	16 to 19	18 (1·14)	Revised UCLA Loneliness Scale	CES-D (child version)	0·53 (<·05).		
Hutcherson and Epkins (2009),[33] USA	Female school students (and their mothers)	100 (0)	Child	9 to 12	10·52 (1·04)	Loneliness Scale (LS)	Social Anxiety Scale for Children-Revised (SASC-R), CDI.	0·62 (< ·001). Controlling for soc anx 0·36 (< ·001).	Social anx: 0·65 (< ·001). Controlling for dep 0·49 (< ·001).	
Jackson and Cochran (1991),[34] USA	University students	293 (49·8)	Young adult	17 to 26	Median 19	Revised UCLA Loneliness Scale	Symptom Checklist-90 (SCL-90)	0·54 (< ·001). Controlling for overall symptoms 0·23 (<·01).	General anx: 0·37 (< ·001).	Obsessive Compulsivenes s 0·40 (< ·001).
Johnson et al (2001),[9997] USA	University students	124 (43·5)	Young adult	17 to 21	Male participant s 19·41 (n.s.) Female participant s 19·69 (n.s.)	UCLA Loneliness Scale (Revised)	Franke and Hymel Social Anxiety and Social Avoidance Scale		Soc anx: $F(6, 115) = 4·23$ (< ·05). $\beta = ·24$, $p < ·01$, $R^2 = ·31$, $p < ·01$.	

Kim (2001),[35] Korea	University students	452 (44·7)	Young adult	18 to 25	20·9 (2·0)	Revised UCLA Loneliness Scale	BDI	Male participants: β = ·49 (< ·01). 24% shared variance.		
Koenig et al (1994),[36] USA	School students	397 (38·3)	Adolescent	14 to 18	n.s.	Revised UCLA Loneliness Scale	BDI	Male participants: 0·55 (<·001). Female participants: 0·49 (<·001).		
Lasgaard, Goosens et al (2011),[24] Denmark	School students	1009 (43)	Adolescent	n.s.	17·11 (1·11)	SELSA– SF (3 subscales: social lon, family-related lon, romantic lon)	BAI-Y, BDI-Y, Social Interaction Anxiety Scale (SIAS), Suicide Ideation subscale from the Suicide Probability Scale, Deliberate self-harm (DSH), Risk Behavior related to Eating Disorders (RiBED-8)	23% of the variance. Peer-related lon – dep β= 0·26, r^2 = 0·076; family-related lon – dep β = 0·29, r^2 = 0·089.	Anx: 14% shared variance. Peer-related lon β = ·21, r^2 = ·045. Family-related lon β = ·21, r^2 = ·045 Social anx: 21% shared variance. Peer-related lon β = ·33, r^2 = ·109. Romantic lon β = ·19, r^2 = ·040.	Suicidal ideation (SI): 14% shared variance. Peer-related lon – SI β = ·17, r^2 = ·027. Family-related lon – SI β = ·26, r^2 = ·061. Self-harm: 10% shared variance. Family-related lon β = ·31, r^2 = ·081. Eating Disorder (ED): risk behaviour: 6% shared variance. Family related lon – ED β = ·22, r^2 = ·041.

Lau et al (1999),[37] Hong Kong	School students	6,356 (n.s. estimated 48)	Child/ adolescent	9 to 14	n.s.	Marcoen and Brumagne's Loneliness Scale (3 subscales: Peer-Related Lon, Parent-Related Lon, and Aloneness)	CDI, RCADS	Primary school students: 0·71 (<·001). Peer-related lon 0·67 (<·001), parent-related lon 0·49 (<·001), aloneness – 0·65 (<·001). 46% shared variance. Secondary school students: 0·81 (<·001). Peer-related lon 0·77, (<·001), parent-related lon 0·56 (<·001), aloneness – dep 0·72 (<·001). 65% shared variance.		
Majd Ara et al (2017),[39] Iran	Female school students	301 (0)	Adolescent	15 to 18	16·6 (1·1)	Children's Loneliness Scale	DASS-21	0·66 (n.s.).		
Mahon et al (2001),[38] USA	School students	127 (43·3)	Adolescent	12 to 14	12·9 (0·63)	Revised UCLA Loneliness Scale	Profile of Mood States - Depression-	0·57 (< ·001).		

							Dejection subscale			
Markovic and Bowker (2015),[40] USA	School students	157 (45)	Adolescent	n.s.	13·84 (·75)	LSDQ	YSR	0·39 (< ·001)	Anx: 0·35, (<·001)	
Matthews et al (2016),[20] UK	Twin birth cohort	2066 (49)	Young adult	18	18·4 (0·36)	Multidimensional Scale of Perceived Social Support (MSPSS)	Diagnostic Interview Schedule	0·21 (< ·001)		
McIntyre et al (2018),[41] UK	University students	1135	Young adult	n.s.	20·78 (4·35)	UCLA Loneliness Scale	PHQ-9, GAD=-7, Self-harm (4 items)	0·58 (<·001) β = 0·52 (<·001)	Anx: 0·54 (<·001) β = 0·50 (<·001)	
Moore and Schultz (1983),[42] USA	School students	99 (45)	Adolescent	14 to 19	17 (0·98)	UCLA Loneliness Scale (ULS) + frequency, duration, characteristics and perceived causes of loneliness	SDS, STAI	0·66 (<·001). Lon duration 0·46, (<·001). Lon frequency - dep 0·70 (<·001).	State anx: 0·48 (<·001), Lon duration 0·37 (<·001) Lon Frequency 0·48 (<·001)	
Mounts et al (2006),[43] USA	University students – ethnically diverse sample	350 (36)	Young adult	18 to 19	n.s.	Revised UCLA Loneliness Scale	BDI, BAI	β =·51, (<·001).	Anx: β = ·30 (<·001)	
Neto and Barros (2000),[100] Portugal	School students	487 (39·3)	Adolescent	n.s. (estimated 15 to 18)	Cape Verde 17·5 (1·2): Portugal 17·8 (1·0).	Revised UCLA Loneliness Scale	Social Anxiety subscale		Soc anx: 0·33-0·35 (<·001)	
Purwono and French (2016),[44] Indonesia	Muslim school students	453 (45·9)	Adolescent	13 to 16	7th grade: 13·57 (0·44)	10 items from UCLA Loneliness Scale - modified	CES-D	0·59 (< ·01).		

					10th grade: 16·47 (0·43)					
Richardson et al (2019),[21] Australia	Community	528 (51)	Child/ adolescent	10 - 12	11·18 (0·56)	3 items from School Belonging and Isolation Scale	SCAS-C– subscales generalized anx, social anx and separation anx 3 item SMFQ	0·46 (< ·001).	Social anx: 0·50 (< ·001). Generalized anx: 0·42 (< ·001). Separation anx: 0·41 (< ·001).	
Roberts and Chen (1995),[45] USA	School students	2614 (n.s)	Adolescent	11 to 14	n.s. (n.s.)	8 item UCLA Loneliness Scale	CES-D, 4 suicide items from Oregan Adolescent Depression Project.	OR = 5·8 (< ·001).		Suicidal ideation: OR 5·0
Singhvi et al (2011),[46] India	School students	300 (50)	Adolescent	15 to 17	n.s.	Revised UCLA Loneliness Scale	SDS, Cohen's Perceived Stress Scale	Male participants: 0·461(< ·001) Female participants: 0·683 (<·001). Male participants: lon associated with dep [t=6·32, p<0·005, β=·461]. Female participants:	Male participants: lon associated with perceived stress [t=1·50, p<·01, β=-·108]	

								lon associated with dep [t=11·38, p<·005, β=·683].		
Spithoven et al (2017),[47] Belgium and Netherlands	n.s.	Sample 1: 417 (48·4) Sample 2: 1140 (48·7)	Adolescent	n.s.	Sample 1: 12·47 (1·89) Sample 2: 12·81 (0·42).	LACA – peer-related loneliness subscale	Sample 1: CDI. Sample 2: Iowa short form of CES-D.	Sample 1: 0·48 (< ·001). Sample 2: 0·54 (< ·001).		
Stednitz and Epkins (2006),[48] USA	Community sample	102 (0)	Child	9 to 12	10·46 (1)	LSDQ	CDI, Social Anxiety Scale for Children – Revised (child and parent versions)	0·63 (< ·001)	Social anx: self-rated 0·72 (< ·001)· mother rated 0·36 (<·001).	
Stacciarini et al (2015),[22] USA	Church and community (Latina/o immigrants)	31 (42)	Adolescent	11 to 18	13·0 (2·0)	Short version of PROMIS Health Organisation Social Isolation	SF12 Health survey			Mental health (r = -·38, p < ·05)
Stickley et al (2016),[49] Czech, Russia and USA	School students	Sample 1: 2205 (n.s.) Sample 2: 1995 (n.s.) Sample 3: 2050 (n.s.)	Adolescent	13 to 15	n.s.	Lon item from CES-D	CES-D (minus lon item), 12 statement anxiety scale	ORs: 8·04-40·13.	Anx: ORs: 1·63 - 5·49.	
Swami et al (2007),[50] Malaysia	University students	172 (41·8)	Young adult	18 to 24	20·3 (1·25)	Revised UCLA Loneliness Scale	BDI	0·38 (< 0·01).		
Thomas and Bowker (2015),[51]	School students	103 (51·4)	Child/ Adolescent	n.s. (estimated 10-13)	13·73 (0·82)	LSDQ	YSR	0·42 (<0·1)		

USA										
Tu and Zhang (2014),[52] China	University students	444 (38·4)	Young adult	n.s.	19·02 (1·26)	Revised UCLA Loneliness Scale	CES-D (7 item version), Perceived Stress Scale	γ = ·517, (<·001). β = ·833 (<·001).	Stress: γ = ·381, (<·001), β = ·297 (<·001)	
Uba et al (2012),[66] Malaysia	School students	242 (49·2)	Adolescent	13 to 16	14·67 (1·27)	Revised UCLA Loneliness Scale	CDI	0·493 (<·01).		
Vanhalst, Luyckx, Raes (2012),[53] Belgium	University students	370 (16·5)	Young adult	n.s.	18·22 (1·21)	LACA	CES-D	Peer-related lon 0·58 (·001). Parent-related lon 0·23 (< ·001).		
Wang and Yao (2020),[101] China	Schools (left behind children in rural China)	442 (54)	Child/ Adolescent	8 to 16	11·5 (2·098)	UCLA Loneliness Scale	Social Anxiety Subscale		Soc anx: 0·332 (< ·001)	
Xu and Chen (2019),[54] China	School students	724 (59·5)	Child/ Adolescent	6 to 14	9·15 (1·79)	LSDQ	CES-D	0·492 (< 0·01).		
Yadegarfard et al (2014),[2325] Thailand	Transgender association and university (male Transgender and cis gender)	260 (100)	Adolescent / Young adult	15 to 25	20 (n.s.)	SSA	DASS-21 (short version), Positive and Negative Suicide Inventory	Transgender: Soc support-dep. (B = -0·01) Lower soc support associated with higher negative risk factors related to suicidal behaviour (B = ·13).		

								Cisgender: Soc support-dep. (B = ·23). Lower soc support associated with higher negative risk factors related to suicidal behaviour (B = ·15).		
	Social isolation/quarantine in the context of infectious disease									
Sprang and Silman (2013),[76] USA, Canada and Mexico	Parents of children (who experienced H1N1/SARS/avian flu pandemics)	398 (n.s.)	Child	n.s.	n.s.	Children experienced pandemic – 20·9% social isolation and 3·8% quarantine	UCLA Posttraumatic Stress Disorder Reaction Index (PTSD-RI); PTSD Checklist Civilian Version (PCL-C)	PTSD-RI: Children who experienced isolation/quarantine were more likely to meet cut-off score for PTSD (30%) than those who had not been in isolation or quarantine (1·1%; X^2 =49·56, P < ·001, Cramer V = ·449). Mean scores in isolated/quarantined group (22·3) were 4 x general group (5·5), (t = 6·59, P=·000). PCL-CL: Children who experienced isolation/quarantine were more likely to meet cut-off score for PTSD (28%) (X_2 = 31·44, P<·001)		

Note: Anx – Anxiety, BAI – Beck Anxiety Inventory; BAI-Y - Beck Anxiety Inventory for Youth; BDI – Beck Depression Inventory, BDI-Y - Beck Depression Inventory for Youth; CBCL - Child Behaviour Checklist; CDI - Children's Depression Inventory, CES-D - Center for Epidemiologic Studies Depression Scale, DASS-21 Depression, Anxiety, and Stress Scale, Dep – depression, GAD-7 – Generalized Anxiety Disorder - 7, Lon – Loneliness, LSDQ - Loneliness and Social Dissatisfaction Questionnaire, LACA - Loneliness and Aloneness Scale for Children and Adolescents, OR – Odds Ratio, PHQ-9 - Patient Health Questionnaire, RCADS - Revised Children's Anxiety and Depression Scale, SAS-A - Social Anxiety Scale for Adolescents, SCAS-C Spence Children's Anxiety Scale- Child, SDS - Zung Self-rating Depression Scale, SDQ - Strengths and Difficulties Questionnaire, SELSA - Social and Emotional Loneliness Scale for Adults , SMFQ - Short Mood and Feelings Questionnaire-Child, SSA - Social Support Appraisals scale, STAI -State Trait Anxiety Inventory, TRF – Teacher Rating Form, YSR - Youth Self-Report Form

Table 3. Longitudinal studies examining social isolation/loneliness and subsequent mental health outcomes.

Author (year), Country	Sample (selection criteria)	Total N (% male participants)	Child (≤11)/ Adolescent (12-18)/ Young adult (≥19)	Age range (years)	Mean age (S.D.) at T1	Social isolation/loneliness measure	Mental Health Measures	Cross-sectional associations r (p)	Length of follow-up (years)	Is social isolation/loneliness associated with later mental health?	
										Depression	Anxiety
Boivin et al (1995),[55] Canada	School students	774 (51·8)	Child	9 to 12	10·8 (n.s.)	LSDQ	CDI	Lon-dep 0·53 (<·001)	1	T1 Lon – T2 Dep: r = 0·36 (p < ·01) T1 Lon accounted for 8·3% of the variance in T2 Dep.	
Christ et al (2017),[71] USA	National Survey of Child and Adolescent Well-being (child welfare cohort)	2776 (47)	Adolescent	11 to 17	13·5 (n.s.)	LDSQ 7 peer isolation items	4 items from YSR	n.s.	7	Controlling for caregiver neglect and covariates, a 1 S.D. increase in peer Isolation was associated with a 0·49 S.D. increase in depression	
Danneel et al (2019),[56] Belgium	Longitudinal cohorts	Sample 1: 1116 (51·1), Sample 2: 1423 (47·6), Sample 3: 549 (37·33)	Adolescent	Sample 1: 11 to 17 Sample 2: 11 to 18 Sample 3: 12 to 17	Sample 1: 13.79 (0.94) Sample 2: 13.59 (0.98) Sample 3: 14.82 (0.79)	LACA peer-related loneliness subscale	Samples 1 and 3 – SAS-A; CES-D. Sample 2 - CDI	Lon-Social anxiety 0.58 ≤ r ≤ 0.67. Lon-Dep 0.48 ≤ r ≤ 0.56, (all <.01).	1	Not significant	Lon --> Social Anxiety (β = 0.10, p < 0.001).

Fontaine et al (2009),[72] USA	School students (longitudinal cohort)	n.s. (52)	Child	n.s. Estimated 5 to 9	n.s.	LSDQ (T2)	Internalizing items from: CBCL (mother T1 and T3); TRF (teacher T1 and T2); YSR (self T2 and T3)	n.s.	2-3	T2 Lon --> Anx/Dep symptoms at T3 (γ2 = ·18, z = 2·60, p < ·01).	
Jones et al (2011),[73] USA	Longitudinal cohort	889 (50)	Child	6	n.s.	LSDQ	CDI short form	n.s.	9	Indirect effects T1 Lon --> T2 Suicidal Thoughts through Dep (β = ·06, p < ·001)	
Ladd and Ettekal (2013),[57] USA	School students (longitudinal cohort)	478 (50)	Adolescent	12 to 18	12·0 (n.s)	LSDQ – revised - 3 items	Depression items CBCL (parent); TRF (teacher); YSR (self)	Lon-Dep 0·19 (< ·01) (parent), 0·38 (< ·001) (teacher) 0·62 (<·001) (self)	7	Changes in Lon associated with changes in dep reported by teachers (r = 0·63, p < ·001) and adolescents (r = 0·65, p < ·001), but not parents (r = 0·18, p = 0·13)	
Lalayants and Prince (2015),[74] 83 countries	National Survey of Child and Adolescent Wellbeing (child welfare cohort)	356 (0)	Adolescent	11 to 12	n.s.	LSDQ	CDI	n.s.	1·5	T1 Lon --> T2 Dep AOR=2·93, CI=1·74-4·91, p < ·001. T1 lonely female participants were 5·09 times more likely (CI 2·24-11·56, p < ·001) to be depressed at T2.	
Lapierre et al (2019),[58] USA	College Students	346 (33·6)	Young adult	17 to 20	19·11 (0·75)	UCLA Loneliness Scale	10 item CES-D	Lon-Dep 0·628 (T1), 0·666 (T2) (<·001)	0·25	T1 Lon – T2 Dep r = 0·524, p < ·001	

										T1 Lon --> T2 Dep (b= ·21, SE= ·05, p < ·001),	
Lasgaard et al (2011b),[17] Denmark	School students	T1: 1009 (43) T2: 541 (40)	Adolescent/ Young adult	15 to 26	17·11 (1·11)	SELSA-short form; MSPSS	BAI-Y, BDI-Y	Lon-Dep 0·61 (<·0005) Lon-Anx 0·51 (<·0005). Soc support - dep r = -0·12, -0·18, -0·28 (all p < ·0005)	1	T1 Lon--> T2 Dep r = 0·37, p < ·0005. Cross lagged structural equation modelling found T1 Lon did not predict dep at T2.	
Liu et al (2020),[18] China	College students	741 (28·3)	Young adult	n.s. (estimated 18-20)	18·47 (0·87)	6 item index of social isolation based on only child status, number of friends, frequency of contact with friends and family; UCLA Loneliness Scale	SDS	n.s.	3	Female participants: T1 isolation associated with increased dep (β = 0·22, p < 0·001). Lon associated with increased dep. (β = 0·23, p < 0·001). Male participants: T1 isolation associated with increased dep. (β = 0·25, p < 0·01). Lon did not predict dep. (β = 0·14, p > 0·05)	
Mak et al (2018),[75] USA	School students (Randomised trial)	687 (47·7)	Adolescent	n.s. (estimated 11 to 14)	11·27 (0·49)	LSDQ	SAS-A	Lon-social anxiety 0·41-0·45 (< ·01).	1·5 (T2), 3 (T3)		T1 Lon --> T2 Social Anxiety (β = ·09, p < ·05).

											T2 Lon --> T3 Social Anxiety (β = ·12, p < ·01) By gender: T2 Lon --> T3 Soc Anxiety: Boys (β = ·22, p < ·001). Girls (β = ·01, p = ·79)
Matthews et al (2015),[19] UK	Twin birth cohort	2232 (n.s.)	Child	5	n.s.	6 items from CBCL (parent) and TRF (teacher)	MASC	n.s.	7		T1 social isolation failed to predict T2 anx, controlling for T1 anx.
Qualter et al (2010),[59] UK	School students	296 (49·3)	Child	5	n.s.	T1 and T2: Peer and Parent subscales LACA	T1: T-CARS T2 and T3: DDPCA	T1 Peer Lon-internalizing symptoms 0·32 (< ·01) Parent Lon-Internalizing Symptoms 0·09. T2 Peer Lon-Dep 0·13 (< ·05) Parent Lon-Dep 0·12 (<·05)	8	T1 Peer Lon-T2 Dep r = 0·07. T1 Peer Lon-T3 Dep r = 0·06. T2 Peer Lon – T3 Dep r = 0·12, p < ·05 T1 Parent Lon – T2 Dep r = 0·19, p < ·01 T1 Parent Lon-T3 Dep r = 0·13, p < ·05 T2 Parent Lon-T3 Dep r = 0·08 Structural model: Duration of Peer Lon --> T3 dep. T1 and T2 Peer Lon, Parent Lon (T1,	

										T2, and duration), did not independently predict T3 Dep.	
Schinka et al (2013),[60] USA	Longitudinal cohort study	832 (53)	Child	9	n.s.	LDSQ	T1: CBCL (mother) T3: CDI -Short form; Suicide items from CBCL and YSR	T3 Lon- Dep - 0·10 (< ·01) Lon- Suicidal Ideation r = 0·02 Lon- Suicidal Attempt r = 0·4	2 (T2), 6 (T3)	T1 Lon-T3 Dep r = 0·01 T2 Lon-T3 Dep r = -0·01 T1 Lon- T3 Suicidal Ideation r = 0·00 T2 Lon-T3 Suicidal Ideation r = 0·03 T1 Lon- T3 Suicidal Attempt r = 0·02 T2 Lon-T3 Suicidal Attempt r = -0·01	
Vanhalst, Goosens et al (2013)[61] and Vanhalst, Klimstra et al (2012),[62] Netherlands	Community sample via municipality registers	389 (53)	Adolescents	15	15·22 (0·60)	LACA Peer-related loneliness subscale	6 item depression questionnaire; SCARED generalized anxiety, panic and social anxiety subscales.	Lon- Dep - 0·34 -0·50 (<·001). Lon-Perceived Stress 0·23, (< ·001). Lon-Generalized Anx 0·40 (< ·001), Lon-Panic 0·13 (p < ·05), Lon- Social Phobia 0·47 (< ·001).	5	T1 Lon --> T2 Dep Symptoms (B = ·13, p < ·001)	

Vanhalst, Luyckx et al (2012),[63] Belgium	University students	Sample 1: 514 (10·9) Sample 2: 437 (17)	Young adults	Sample: 19·62 (0·62) Sample 2: 18·22 (1·21)	n.s.	Sample 1: 8-item revised UCLA Loneliness Scale. Sample 2: LACA Peer-related loneliness subscale	Sample 1: 12-item CES-D Sample 2: 20-item CES-D	Sample 1: Lon – dep 0·49-0·52 (< ·001). Sample 2: Lon – dep r= 0·40-0·60 (< ·001).	2	Sample 1: T1 lon – T2 dep r= 0·35, p < ·001. T1 lon – T3 dep r= 0·36, p < ·001. Lon --> associated with dep across both time intervals. Sample 2: cross-lagged path from lon --> associated with dep (b = ·12, p< ·05)	
Wang et al (2020),[64] China	School students	921 (48·3)	Adolescents	12 to 15	12·98 (0·66)	Revised UCLA Loneliness Scale (T1 and T2)	SCARED; DSRSC (T1 and T3)	T1 Lon- Anx 0·40 p<·001, Lon-Dep 0·57, p<·001,	1	T1 Lon-T3 Dep 0·36, p<·001. T2 Lon-T3 Dep 0·46, p<·001.	T1 Lon-T3 Anx 0·29, p<·001. T2 Lon-T3 Anx 0·36, p<·001.
Zhou et al (2020),[65] China	School students	866 (49)	Adolescents	11 to 15	12·98 (0·67)	UCLA Loneliness Scale (T1 and T2)	DSRSC (T3)	T1 Lon-Dep r = 0·56, p < ·001	2	T1 Lon-T3 Dep r = 0·38, p < ·001 Controlling for age, gender and SES, T2 Lon - T3 Dep adj. b= 0·34 p <·001.	

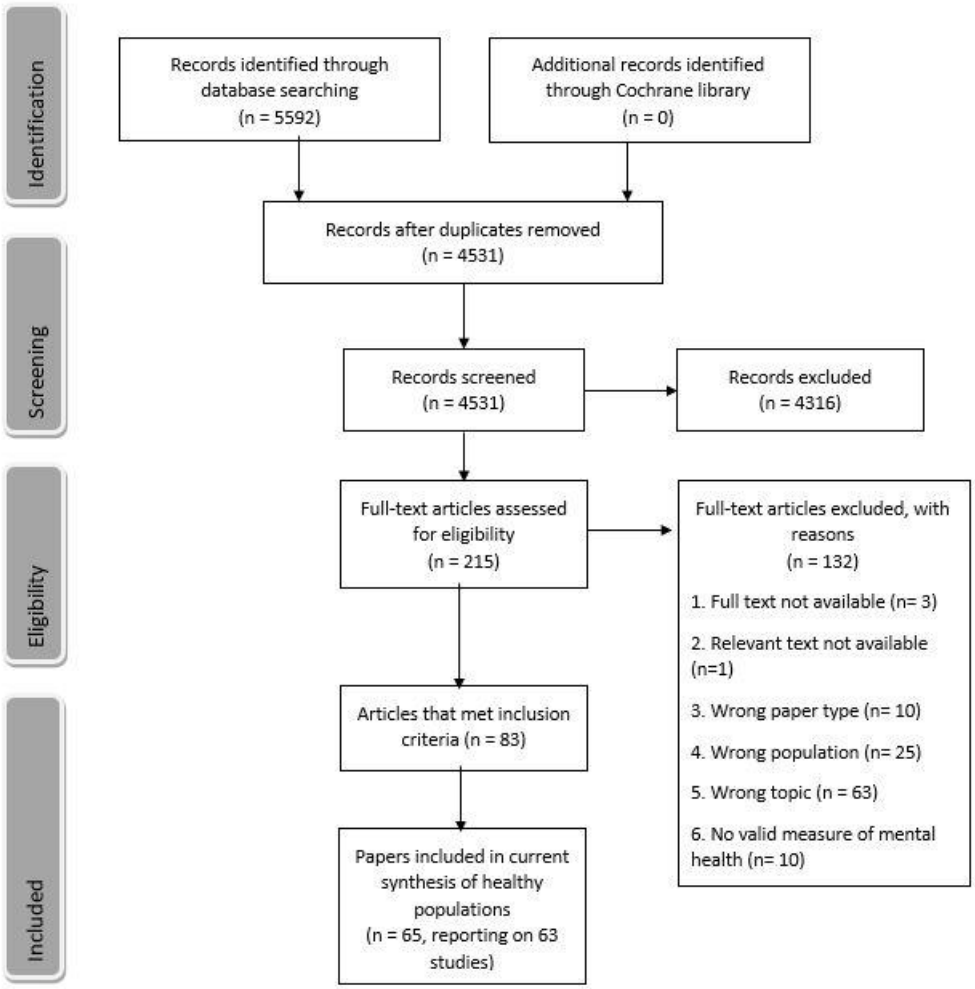
Note: Anx – Anxiety, BAI-Y - Beck Anxiety Inventory for Youth; BDI-Y - Beck Depression Inventory for Youth; CBCL - Child Behaviour Checklist; CDI - Children's Depression Inventory, CES-D - Center for Epidemiologic Studies Depression Scale, DDPCA - Depression profile for children and adolescents, Dep – depression, DSRSC - Birleson Depression Self-Rating Scale for Children, Lon – Loneliness, LSDQ - Loneliness and Social Dissatisfaction Questionnaire, LACA - Loneliness and Aloneness Scale for Children and Adolescents, MASC - Multidimensional Anxiety Scale for Children, MSPSS - Multidimensional Scale of Perceived Social Support, SAS-A - Social Anxiety Scale for Adolescents, SCARED - Scale for Child Anxiety Related Emotional Disorders, SDS - Zung Self-rating Depression Scale, SELSA - Social and Emotional Loneliness Scale for Adults, T-CARS - Teacher-Classroom Adjustment Rating Scale, T1 – Time 1, T2 – Time 2, T3 – Time 3, TRF – Teacher Rating Form, YSR - Youth Self-Report Form
n.s. = not specified

Table 4. Study description and relevant findings: Intervention studies.

Author (year), Country	Sample	Total N (% male participants)	Age range at baseline (years)	Mean age (S.D.)	Loneliness measure	Mental Health Measures	Intervention	Comparison condition	Main findings
King et al (2018),[77] USA	Experienced bullying/ Victimization, recruited via paediatric medical emergency services	218 (33· 5)	12 to 15	13· 50 (1· 1)	Revised UCLA Loneliness Scale	Reynolds Adolescent Depression Scale - 2 short; Columbia Suicide Severity Rating Scale	LET'S CONNECT (LC) mentorship program – strengths-based approach. Mentorship lasted an average of 120· 32 days (SD = 69· 69), 4-6 hours/month.	No treatment	At 6 months, loneliness decreased more in the LC intervention group than to the control group ($p < \cdot 01$), E.S. = · 4.
Larsen et al (2019),[78] [78] Norway	School students	2254 (n.s. estimate 53).	15 to 19	16· 82 (n.s.)	Loneliness Scale (modified)	Symptom Checklist	Dream School Program – aimed to change psychosocial environment of classroom, including through peer mentors and a staff mental health support team. 2 classes over 2 semesters.	Education as usual.	No significant effects on mental health or loneliness for either intervention group.

Note: E.S. = effect size, n.s. = not specified, SD = standard deviation.

Figure 1: PRISMA diagram.



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Appendix. Database searches –03/29/2020

Table S1. Ovid MEDLINE (R)

1	exp Adolescent/ or exp Child/ or exp Child, Preschool/ or exp Infant/ or exp Minors/ or exp Pediatrics/	3533050
2	(adolesc* or preadolesc* or pre-adolesc* or boy* or girl* or child* or infan* or preschool* or pre-school* or juvenil* or minor* or pe?diatri* or pubescen* or pre-pubescen* or prepubescen* or puberty or teen* or young* or youth* or school* or high-school* or highschool* or schoolchild* or school child*).tw,kf.	2951684
3	1 or 2	4748091
4	quarantine*.tw,kf.	4350
5	exp Quarantine/	2093
6	Quarantine.tw,kf.	3975
7	exp social isolation/	17148
8	(isolation and (infect* or SARS or influenza or flu or MERS or ebola or COVID-19)).tw,kf.	34141
9	exp Loneliness/	3552
10	4 or 5 or 6 or 7 or 8 or 9	56227
11	anxiet*/ or anxious*/ or "anxiety disorder*".tw,kf.	29320
12	depress*/ or "internal* disord*"/ or "low mood".tw,kf.	737
13	depressive disorder/	72188
14	exp depression/	115922
15	depress*.tw,kf.	445459
16	exp adjustment disorders/	4197
17	adjustment disorder*.tw,kf.	1642
18	low mood.tw,kf.	737
19	obsessive-compulsive disorder.tw,kf.	12336
20	stress disorders, traumatic/	672
21	stress disorders, post-traumatic/	31840
22	trauma*.tw,kf.	353295
23	(((post-trauma* or posttrauma*) adj stress) or PTSD).tw,kf.	35040
24	11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23	853134
25	3 and 10 and 24	1277

Full references saved as Medline 290320 v1

Table S2. Ovid PsycINFO

1	(adolescent or child or child, preschool or infant or minor or pediatrics).ti,ab,id.	425212
2	(adolesc* or preadolesc* or pre-adolesc* or boy* or girl* or child* or infan* or preschool* or pre-school* or juvenil* or minor* or pe?diatri* or pubescen* or pre-pubescen* or prepubescen* or puberty or teen* or youth* or school* or high-school* or highschool* or schoolchild* or school child*).ti,ab,id.	1227549
3	1 or 2	1227549
4	quarantine.ti,ab,id.	179
5	exp *Social Isolation/	5944
6	(isolation and (infect* or SARS or influenza or flu or MERS or ebola or COVID-19)).ti,ab,id.	437
7	Disease containment*.ti,ab,id.	5
8	Lonel*.ti,ab,id.	10569
9	exp *loneliness/	3642
10	4 or 5 or 6 or 7 or 8 or 9	16688
11	anxiet*/ or anxious*/ or "anxiety disorder*".ti,ab,id.	33786
12	depress*/ or "internal* disord*"/ or "low mood".ti,ab,id.	673
13	exp *depression/	19678
14	depress*.ti,ab,id.	301583
15	exp adjustment disorders/	719
16	adjustment disorder*.ti,ab,id.	1851
17	obsessive-compulsive disorder.ti,ab,id.	15268
18	post-traumatic stress disorder.ti,ab,id.	10195
19	trauma*.ti,ab,id.	107899
20	(((post-trauma* or posttrauma*) adj stress) or PTSD).ti,ab,id.	44403
21	11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20	431601
22	3 and 10 and 21	1303

Full references saved as PsycINFO 290320 v1

Table S3. Web of Science Core Collection

# 22	3,211	#21 AND #10 AND #3
# 21	1,173,555	#20 OR #19 OR #18 OR #17 OR #16 OR #15 OR #14 OR #13 OR #12 OR #11
# 20	64,185	TS=(((post-trauma* or posttrauma*) NEAR stress) or PTSD)
# 19	387,085	TS=trauma*
# 18	15,994	TS=post traumatic stress disorder
# 17	25,733	TS=obsessive compulsive disorder
# 16	22,119	TS=adjustment disorder*
# 15	22,104	TS=adjustment disorders
# 14	627,349	TS=depress*
# 13	494,240	TS=depression
# 12	628,267	TS=(depress* OR " internal* disord* " OR " low mood ")
# 11	283,559	TS=(anxiet* OR anxious* OR " anxiety disorder* ")
# 10	77,296	#9 OR #8 OR #7 OR #6 OR #5 OR #4
# 9	12,570	TS=loneliness
# 8	15,420	TS=Lonel*
# 7	2,586	TS=Disease containment*
# 6	35,721	TS=(isolation and (infect* or SARS or influenza or flu or MERS or ebola or COVID-19))
# 5	17,794	TS=social isolation
# 4	8,759	TS=quarantine
# 3	3,591,598	#2 OR #1
# 2	3,581,837	TS=(adolesc* or preadolesc* or pre-adolesc* or boy* or girl* or child* or infan* or preschool* or pre-school* or juvenil* or minor* or pe?diatri* or pubescen* or pre-pubescen* or prepubescen* or puberty or teen* or youth* or school* or high-school* or highschool* or schoolchild* or school child*)
# 1	2,450,709	TS=(adolescent OR child OR child, preschool OR infant OR minor OR pediatrics)

Applied ‘English language’ limit = 3012