VOLUME I - EMPIRICAL RESEARCH PROJECT AND SYSTEMATIC LITERATURE REVIEW

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VOLUME I

EMPIRICAL RESEARCH PROJECT AND SYSTEMATIC LITERATURE REVIEW

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Table of Contents

PART I: EMPIRICAL PROJECT

COVID-19 related loneliness trajectories in young people: Risk factors and coping strategies

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Supervisors:

Professor Jennifer Lau Yun Fai and Dr. Delia Fuhrmann

Abstract

Background: Loneliness is common in young people, and research also suggests that more persistent forms of loneliness may be especially impacting. Yet, we know little about young people's loneliness patterns across time. Enforced social isolation during COVID-19 may present a unique opportunity to: explore a) individual differences in young people's loneliness responses when social interactions are under threat, b) identify the risk and protective factors that may be informative for clinical practice and c) whether more persistent forms of loneliness impact well-being to a greater degree.

Methods: This study analysed data from a multi-wave study which surveyed young people (aged 12-25) during the COVID-19 pandemic in the UK. Demographics, loneliness (UCLA), wellbeing (SWEMWBS), and coping strategies were collected using an online survey. 1,624 participants were included in the analysis. Coping strategies were derived from qualitative responses using thematic analysis guidelines. Latent growth curve modelling (LGCM) and latent class growth analysis (LCGA) were used to identify the overall and distinct loneliness trajectories in young people , explore if demographic factors and coping strategies predicted the trajectory classes, and compare their effects on well-being. The LGCM was carried out in R and the LCGA and regressions (R3STEP and BCH) were carried out in MPlus.

Results: The LGCM indicated that the overall mean loneliness decreased over time. Five loneliness trajectory classes were identified using LCGA: high stable (11%), moderate decreasing (15%), low increasing (16%), moderate stable (23%), low stable (35%). Entry into the high stable loneliness group was predicted by being female. Approach coping strategies were the only coping strategies recommended by young people that predicted lower likelihood of high stable loneliness. The high stable loneliness class was associated with significantly lower wellbeing compared to the low stable, moderate stable, and moderate decreasing loneliness classes.

Conclusions: This study highlighted that just over 1 in 10 young people were at-risk of more persistent forms of loneliness and lower well-being after the isolating period of the COVID-19 pandemic. Furthermore, this risk was associated with being female and decreased with the recommendation of approach coping strategies such as starting a new hobby or engaging with explicit learning or mastery of a skill. Future research and clinical work should consider loneliness as a potential target for interventions and explore the utility of coping strategies to manage loneliness.

Table of Contents

List of Tables

List of Figures

1. **Introduction**

1.1 Loneliness and Young People

Loneliness is defined as the distressing emotional state resulting from a discrepancy between a person's desired and perceived quantity and quality of social relationships (Peplau & Perlman, 1982). Loneliness is a public health concern which has been associated with increased physical and mental health difficulties, increased substance use, poorer quality of relationships, and stigma and perceived ill treatment by others (Heinrich & Gullone, 2006; Ingram et al., 2020; Wang et al., 2017). Mean levels of loneliness change throughout the lifespan although evidence over the direction of these age differences is mixed: some studies suggest heightened and more frequent experiences of loneliness in early adolescence and younger people (Heinrich & Gullone, 2006; Office for National Statistics, 2018a) while others show increasing loneliness with age (Cohen-Mansfield et al., 2016), and still some show a U-shaped pattern, with loneliness decreasing from adolescence to adulthood and then increasing in older adulthood (Victor & Yang, 2012). Regardless of these age trends, loneliness is prevalent in youth, with 40% of 16- to 24-year-olds reporting feeling lonely often or very often (BBC Loneliness Experiment, 2018) and 11% of 10- to 15-year-olds reporting feeling lonely often (Office for National Statistics, 2018a). Loneliness in youth may reflect age-normative transitions, such as changes in education, employment, and leaving home, which can result in uncertain social networks but also in self-identity and autonomy (Laursen & Hartl, 2013; Qualter et al., 2015).

It is likely that levels and persistence of loneliness in youth do not follow a uniform pattern and that different individuals show distinct trajectories both in the intensity, duration and frequency of loneliness (Benner, 2011; Ladd & Ettekal, 2013; Qualter et al., 2013; Vanhalst et al., 2013). Across seven studies investigating changes in loneliness over time in young people (ranging from 7 to 20 years old), between 2 and 5 distinct trajectories were identified (Harris et al., 2013; Ladd & Ettekal, 2013; Qualter et al., 2013; Schinka et al., 2013; Vanhalst et al., 2013; Benner, 2011; Jobe-Shields et al., 2011; Hosozawa et al., 2022). In each of the studies, the largest group consisted of young people who experienced low levels of loneliness that was stable over time and at least one group who experienced changing loneliness over time (e.g., increase, decrease). While the majority of young people across the studies fell into low or moderate levels of loneliness groups, data also highlighted a group (1-22%) who experienced prolonged or increasing loneliness (Benner, 2011; Hosozawa et al.,

2022; Ladd & Ettekal, 2013; Qualter et al., 2013; Schinka et al., 2013; Vanhalst et al., 2013). As these studies tended to concentrate on different age groups with narrow ranges in their samples, there is little understanding about loneliness trajectories across a wider age span in youth (10-24 years) that covers the period of heightened loneliness.

The COVID-19 pandemic, with social distancing measures to contain the spread of the virus, may present a unique opportunity to explore individual differences and trajectories in loneliness responses, because it presents a similar experience where social exchanges and access to social support may be more restricted. Indeed, this period was associated with increases in self-reported social isolation and loneliness, which in turn were associated with higher self-reported depression and suicidal ideation (Holmes et al., 2020; Jia et al., 2020; Killgore et al., 2020; Loades et al., 2020). During the early lockdown period, the prevalence of loneliness in young adults (18-24 years old) was 41% (Groarke et al., 2020). Several studies have found that younger adults (18-30 years old) were at higher risk of experiencing loneliness compared to older adults (above 30 years old) during the pandemic (Jia et al., 2020; Li & Wang, 2020; Losada-Baltar et al., 2021). However, almost all of these studies were cross-sectional and did not assess changes in loneliness over time or loneliness trajectories during these periods of social restriction. A study investigating individual difference in loneliness in adults during the pandemic found four classes of loneliness trajectory, which were high, medium-high, medium-low, and low (Bu et al., 2020b). They found that that the trajectory classes were relatively stable throughout the strict lockdown period, with their high loneliness class consisting of 14% of the sample. While high levels of loneliness were prevalent in younger people during COVID, there have been few longitudinal studies in this population especially ones that cover periods after the first few months of the pandemic. As loneliness tends to increase with prolonged social isolation (Kato et al., 2020), it is possible that there are changes in loneliness after the initial onset of the pandemic and lockdown. It is therefore important to investigate loneliness longitudinally during this period, and whether there were individual differences in both intensity and duration of loneliness.

1.2 Loneliness and Demographic Characteristics

Understanding demographic factors of loneliness in general and trajectories in particular in young people is important to identify risk factors especially for more chronic forms of loneliness. During the pandemic, Bu and colleagues' (2020b) study on loneliness trajectories in adults found that demographic factors such as being younger, female or being

of a lower socioeconomic status (SES) increased the likelihood of being in the chronic loneliness group. Similarly, cross-sectional studies in adults found that age, gender and SES predicted loneliness during COVID-19 in the same direction (Bu et al., 2020a; Lee et al., 2020; Li & Wang, 2020). As these studies focused on adults, their generalisability to younger populations is limited. Research on demographic predictors of loneliness in young people have mostly been cross-sectional. The evidence for gender differences in loneliness in young people has been mixed, with some studies reporting gender differences and others do not (Heinrich & Gullone, 2006; Weeks & Asher, 2012). In terms of ethnicity, some studies have found that ethnic minority status has been associated with higher levels of loneliness perhaps in part due to the role of marginalisation and discrimination in society which may increase the risk of loneliness (Lasgaard et al., 2016; van Bergen et al., 2008). In children and adolescents, only one trajectory study prior to the pandemic explored demographic prediction of loneliness trajectories and found that family income, but not sex and ethnicity, differentiated groups: children and adolescents of lower income families were more likely to be in the chronic loneliness group compared to the stable low loneliness trajectory group (Schinka et al., 2013). All in all, there is a notable gap in investigating demographic predictors for loneliness, especially trajectories, in young people.

1.3 Loneliness and Coping Strategies

With increased loneliness and social isolation during COVID-19, it is not only important to investigate demographic predictors of loneliness trajectories but also modifiable predictors of loneliness, such as an individual's response or behaviour. Young people's experiences with coping (or not) with loneliness during COVID-19 may shed some light on ways to prevent or manage loneliness. Coping can be generally understood as an individual's cognitive and behavioural efforts to manage internal and external demands (Ray et al., 1982). Many different categories of coping strategies have been suggested, making evaluation difficult due to a lack of consensus on coping typologies and categories (Besevegis & Galanaki, 2010). Few studies have examined how coping strategies are linked to loneliness, and findings are, in part, contradictory. In Deckx and colleagues' (2018) review of coping strategy studies in adults problem-focused coping (dealing with the source of loneliness in practical ways) was linked to lower levels of loneliness compared to emotion-focused coping (dealing with the negative emotional response to loneliness). This suggests that coping strategies may be useful in informing interventions. However, this review only looked at broader categories of coping

and re-categorised many different coping strategies which did not allow for subtle differences in coping strategies to be investigated. This is consistent with another study showing that avoidant coping strategies, such as rumination, were associated with higher levels of loneliness in adolescents and young adults (Seepersad, 2004). While some groups of coping strategies are associated with increased loneliness, over-reliance on any type of coping strategy may be maladaptive and flexibility in using different coping strategies when faced with various stressful situations may be linked to better psychological wellbeing (Cheng & Cheung, 2005). Understanding the types and number of coping strategies used by young people during the pandemic could shed light on individual resources that could buffer against loneliness, which has been a priority in mental health research since the pandemic (Holmes et al., 2020). Beyond understanding strategies used by young people during the pandemic, investigating the associations between different coping strategies and number of strategies used with trajectory subgroups could highlight what strategies may be adaptive or may be risk factors for chronic loneliness. This could also inform interventions to prevent or reduce loneliness in young people, which has so far only focused on populations where loneliness is typically a side effect of a chronic health condition or learning disability, and have not differentiated between chronic and transient loneliness (Eccles & Qualter, 2021).

1.4 Loneliness and Mental Wellbeing

The mental health and wellbeing of many people have been affected by the pandemic and its associated lockdowns, with increased loneliness and depression, and decreased wellbeing (Gray et al., 2020). There are clear links between loneliness and poor mental health in young people (Heinrich & Gullone, 2006; Loades et al., 2020). This pattern also holds across time: in young people, loneliness is associated with an increased risk of mental health difficulties, such as depression and anxiety, which can still be observed up to 9 years later (Loades et al., 2020). Loneliness predicts depressive symptoms over one-year intervals in a study spanning five years, but depressive symptoms did not predict loneliness (Cacioppo et al., 2010). Furthermore, in studies of loneliness trajectories, the chronic loneliness group was associated with greater depressive symptoms, greater risk for self-harm and suicidal ideation, poorer functioning and physical health, social skills deficit, and use of services offered by doctor's surgeries (Hosozawa et al., 2022; Qualter et al., 2013; Schinka et al., 2013; Vanhalst et al., 2013). Different loneliness trajectories in adolescence are associated with different depression trajectories; of importance, the chronically lonely

had chronic or increasing depressive symptoms (Ladd & Ettekal, 2013). Even in trajectories where high loneliness reduce to normal levels over time, young people reported higher levels of depressive symptoms, poorer general health, and sleep difficulties compared to those in the low, stable loneliness group (Harris et al., 2013).

Despite many studies linking loneliness with poor mental health, there are far fewer studies investigating the link between loneliness and mental wellbeing. Mental wellbeing, which is more than the absence of mental health difficulties, encompasses concepts such as positive affect and functioning (Barry, 2009; Eriksson et al., 2019; Stewart-Brown et al., 2009). Mental wellbeing has emerged as an important target for research due to its role in healthy maturation, potential to reduce risk of mental health difficulties and use of health services, therefore, decreasing healthcare burden (Keyes et al., 2010). Some studies have reported that loneliness was associated with reduced mental wellbeing, although the studies were often cross-sectional and it is unclear whether the loneliness reported was transient or chronic (Lyyra et al., 2021; Moksnes et al., 2022). Considering the reports of reduced mental wellbeing during the pandemic and its potential relationship with loneliness, investigating whether loneliness trajectories (e.g., low/moderate, transient, chronic) predict mental wellbeing in young people would fill a gap in the literature.

1.5 Current study

The pandemic, albeit unprecedented, was a naturally occurring stressor that impacted the majority of the population, providing an opportunity to assess individual differences in loneliness trajectories and their predictors in the general population. There is a scarcity of studies exploring loneliness trajectories in young people generally and especially after the initial months of the onset of the pandemic. Even fewer studies explored the associations between loneliness trajectories with demographic factors, coping strategies, and wellbeing during this period. The importance of filling this gap is increasingly evident, with the extended nature of the pandemic which may have adverse long-term effects on young people. Given the association between chronic loneliness and adverse mental health outcomes, further exploration into the chronic loneliness group is also warranted if identified in this study's sample. Being able to explore the different aspects together in one study would allow for a richer and more complex understanding of the impact of the isolating experience of the pandemic on young people.

Using data from a large longitudinal study in the UK, we carried out a mixed method study with the following research questions (RQ):

RQ1. Identify the overall fluctuations in loneliness across time in young people (12-25 years old) and different loneliness trajectories during COVID-19;

RQ2. Explore whether different sub-populations of loneliness trajectories are related to demographic factors (e.g., sex, ethnicity, age, SES);

RQ3. Explore the range of self-reported coping strategies endorsed to manage social isolation during lockdown qualitatively and compare endorsement of these across different loneliness trajectories; and

RQ4. Investigate the relationship between the different loneliness trajectories and wellbeing.

2. Methods

2.1 Participants and Procedure

We analysed data from a multi-wave study investigating the impact of the COVID-19 pandemic on young people's emotional wellbeing. Participants aged 12-25 years old completed an online survey about their loneliness and wellbeing during COVID-19 and what advice they would give to others over managing social distancing and isolation situations. Participants were surveyed fortnightly until they completed 8 surveys in total. This study started collecting data on 12th May 2020 which was after the easing of the first strict lockdown period in the UK (23rd March to 10th May 2020). The final follow-up survey was carried out on 26th April 2021. A second lockdown (2nd December 2020) and third lockdown (6th January) took place within the study period. In-between the lockdown periods there were different levels of social restrictions and easing that took place. The participants could participate in the study at any point in the data collection. As participants' starting dates and length of participation varied due to the study's rolling start date, and participants had a week to complete each assessment, baseline survey date and total study duration will be accounted for in the analysis.

The study received ethical approval from the Psychiatry, Nursing and Midwifery Research Ethics Committee at Kings College London (Ref: HR-19/20-18250). The eligibility criteria included being between 12-25 years old, being able to read the questionnaire in English, and residing in the UK at the time of the data collection for the first timepoint. Participants were recruited using advertising within schools, colleges and universities in the UK, research advertisement websites, social media, and charities. Participants were reimbursed with a £10 Amazon voucher for completion of the first 4 surveys and another £10 for the completion of the final 4 surveys. Informed consent was provided by participants above the age of 16 and parents or guardians of participants under the age of 16 provided informed consent while the young person provided assent themselves.

Qualtrics, an online questionnaire platform, was used to administer the survey. Upon clicking on the survey link, participants were presented with the study information (see Appendix A and B) and were asked to provide consent or were instructed on how to obtain parental consent, depending on their age at the time of the survey (see Appendix C). After providing consent, participants were asked about demographic factors such as age, sex,

ethnicity, and highest parental education qualifications. They were then asked about the impact of the COVID-19 pandemic and various psychological questionnaires (see Appendix D). Of interest to our study, they were given questionnaires regarding loneliness and mental wellbeing, and an open-ended question about managing with the isolating impact of the pandemic.

4,872 responses were collected initially at baseline. Data was cleaned according to a protocol with responses removed according to the following criteria: duplicate responses, not responding to any survey questions, not meeting inclusion criteria (e.g., outside of age range), and careless or inauthentic responses (e.g., finishing the survey under the minimum survey duration time of less than five minutes). Participants were included in the current analyses if they had loneliness data at three or more time points. The final sample for the analysis consists of 1,624 participants. Details of the sample size at each assessment are in Appendix E, including time between each assessment timepoint. Participants who were included (had loneliness data at three or more time points) were significantly older than those who were excluded (had data at less than three timepoints) (MD = 0.91, $t(2600)$ = -6.285, $p < .001$, d = 3.57). Females were more likely to be included than males ($\chi^2(1) = 43.56$, $p < .001$).

2.2 Measures

Demographics

Age (calculated using month and year of birth), sex assigned at birth, country currently living in, and ethnicity of participants were collected. Ethnicity data was collected as a multiple choice option from a list according to the Office of National Statistics' recommendations (Office of National Statistics, 2017). There were no missing demographic data, besides ethnicity, after excluding participants with loneliness data at fewer than three time points. Highest academic qualification obtained by either of their parents were collected as a proxy SES. Young people's reports of parental education levels have been found to be a less biased indicator of SES compared to proxies based on young people's reports of other indicators, such as parental occupation (Diemer et al., 2013).

Loneliness

To measure loneliness, participants completed the short three-item University of California Los Angeles (UCLA) Loneliness Scale (Russell, 1996). The three-item UCLA scale was recommended by the Office of National Statistics after exploring qualitatively with young

people aged 10-15 years on its ease of use and interpretation (Office for National Statistics, 2018b). The scale asks in the last two weeks, how often 1. Have you felt that you have no one to talk to? 2. Have you felt left out? 3. Have you felt alone? The questions are rated on a three-point scale (1 = Hardly ever or never, 2 = Some of the time, 3 = Often). The total score ranges from 3 to 9, with higher scores indicating more loneliness.

The original 20-item UCLA scale has shown high internal consistency (alpha between 0.71 and 0.96) with children and adolescents but the shorter UCLA scale has had less reliability and validity testing in younger populations (see Cole et al., 2021). In the present sample, the internal consistency of the UCLA at each assessment point was good (α = 0.80-0.84).

Mental Well-being

The survey used the short version of the Warwick-Edinburgh Mental Well-being scale (SWEMWBS; Tennant et al., 2007). This scale consists of 7 items and focuses on the positive aspects of mental health and has questions like “I’ve been feeling useful” and “I’ve been feeling relaxed”. The scale is rated on a five-point scale (1 = None of the time, 2 = Rarely, 3 = Some of the time, 4 = Often, 5 = All the time) with a minimum summed score of 7 and maximum score of 35. Higher scores on the scale indicate better mental well-being. The scale has a Cronbach’s alpha of 0.89 (Tennant et al., 2007). It has high correlations with other mental health and well-being scales and is responsive to changes in interventions for both clinical and non-clinical populations (Böhnke & Croudace, 2016; Melendez-Torres et al., 2019; Shah et al., 2018; Tennant et al., 2007; Vaingankar et al., 2017). There is extensive evidence for the use of this scale in measuring mental well-being in adults above the age of 16 (Bartram et al., 2013; Ng Fat et al., 2017; Stewart-Brown et al., 2009) and in adolescence (Hunter et al., 2015; Melendez-Torres et al., 2019). The reliability of the SWEMWBS at the initial and final assessment was good (α = 0.78-0.86).

Coping Strategies

To investigate self-reported coping strategies that young people recommended to others to manage loneliness during COVID-19, participants were asked, “Based on your experiences, what advice would you give to other young people on managing the isolating experiences of social distancing?”, with a free text response. Participants’ responses ranged from short one-word answers to long paragraphs. The development of a coding scheme of coping strategy categories for this data was informed by several factors. When looking at the

data, no one previous coping strategy taxonomy captured all the different strategies recommended. Thus, the categories were informed by the general emotion regulation and coping strategy literature (without reliance on one sole framework) and the range of therapeutic techniques used in psychological treatments for affective conditions, along with the themes that emerged from the participants' responses using thematic analysis guidelines (Braun & Clarke, 2006). The coping strategy categories were developed through various stages. Firstly, several independent researchers (JL, AJ, MM, KS, KD) reviewed a subset of the responses and identified potential coping strategy categories. These identified strategies were then discussed and were mapped onto theoretical frameworks or therapeutic techniques to create a draft coding scheme (by JL, AJ, MM, KS, KD). Next, an iterative process of coding subsets of the data, and discussing and resolving any discrepancies in the coding and further reviewing and refining the coding scheme occurred until a finalised coding categories scheme was created with all the data coded. At the end, three independent raters (AJ, LR, MM) checked all the data to ensure coding was consistent with the final coding categories scheme. Any discrepancies which required review were resolved by discussing with a fourth researcher (JL).

The final coding scheme consists of 7 categories: contact-seeking, distraction, approach, self-care, self-talk, self-compassion, and gratitude. The categories, description and examples of the coping strategies are shown in Table 1. Participants' responses could encompass more than one coping strategy category so the presence or absence of a type of coping strategy was coded. For example, a response of "*Creating routines for the day and the week - eg movement that gets your heart pumping on Wednesdays and Sundays, checking in with a close friend at least once a week … writing three things in a gratitude journal each morning can also really help.*" was coded as contact seeking, self-care and gratitude. Responses that were vague, unclear, or expressed not knowing what to recommend were coded "None / Vague". The total number of different coping strategy categories recommended was considered a measure of coping flexibility due to the ability to suggest multiple different strategies, instead of reliance on just one (Cheng & Cheung, 2005).

Table 1

Themes and examples of coping strategies recommended by young people.

Coping strategy	Description and themes	Examples
Contact Seeking	- Reach out to people like friends and family - Seek new contacts for social support or sense of closeness	- "Call your family or friends" - "Keep in touch with others using technology" - "Stay connected" - "Connect online and try to meet people face to face"
Distraction	- Keeping yourself busy with (existing, routine, "default") activities or hobbies - Not necessarily for the purpose of achieving a sense of closeness or achievement - Avoidance of boredom	- "Watch TV" - "Do what you enjoy" - "Keep busy" - "Play videogames as a distraction" - "Try to distract yourself"
Approach	- Explicit learning - Mastering a new hobby or skill - Restart an old hobby or skill that previously didn't have time for - Explicitly setting goals to improve at something previously taken on	- "Find a new hobby" - Volunteering - "Learn a new language" - "Try to be creative" - "Educate yourself" - "Do something meaningful"

Coping strategy	Description and themes	Examples
Self-care	- Making/maintaining healthier *lifestyle choices* (diet, exercise, walking, sleep, routines) - Creating a schedule to provide structure - Abstaining from negative habits (that are generally known to have a negative effect on health)	- "Plan your days" - "Take breaks" - "Get outside and exercise" - "Be productive" - "Don't spend too much time on screens" - "Not listening to news"
Self-talk or self-assurance	- An attitude or mindset that takes the edge off the current situation or to get through it - A sense that what you're going through helps yourself or others get through the situation - A sense of acceptance and reminder that everyone is in the same situation	- "It will be okay" - "Things will get better soon" - "Be positive" - "Don't worry" - "We're all in this together"
Self-compassion	- Being kind to yourself, cutting yourself some slack / accepting yourself - Avoiding activities that make you feel bad/worse about yourself	- "You're trying your best" - "Focus on yourself" - "Just take time to adjust to things slowly" - "Do things to make yourself feel better about yourself" - "Be yourself" - "Avoid contact with people who aren't good for you"

Coping strategy	Description and themes	Examples
Gratitude or re-appraisal	- Appreciating what you currently have and the positive aspects offered by the present situation - Re-appraising the situation to have a more balanced outlook (has to be specific, not generic "look at the positives")	- "This is an opportunity to relax" - "You'll never have so much time again to do the things you love" - "Quality time with family" - "Taking this time to learn to enjoy one's own company/thrive in isolation"
None or vague	- Indicates uncertainty or lack of coping strategy	- "I don't know" - "Can't give any"

2.3 Statistical analyses

To investigate the overall change in loneliness over time (RQ1), we used latent growth curve modelling (LGCM) using the Lavaan package (Rosseel, 2012) for R Version 4.2.0 (R Core Team, 2022). LGCM estimates the initial level of loneliness (intercept) and the change in loneliness over time (slope). To examine whether there were individual differences in the loneliness trajectory, the variance in the intercept and slope were estimated. Fixed growth factor loadings of 0, 1, 2, 3, 4, 5, 6, 7 using maximum likelihood estimation with robust Huber-White standard errors and a scaled test statistic were used to fit a linear model. According to Schermelleh-Engel et al. (2003), a comparative fit index (CFI) > 0.97 and a Standardised Root Mean Square Residual (SRMR) < 0.05 is considered a good model fit while a CFI = 0.95-0.97 and SRMR = 0.05-0.10 is considered an acceptable fit. To illustrate the trajectory by demographic groups, graphs are plotted based on sex, age, ethnicity, and SES. For illustrative purposes only in the graphs, age groups are divided into groups based on percentile, 12-16 years olds (34%), 17-20 years olds (36%), 21-25 years old (30%); age is used as a continuous variable in all other analyses. For ethnicity groups, participants who identified as White/White British were grouped into “Majority” and participants who identified as all other ethnicity were grouped into “Minoritised” due to the small group sizes. For highest parental academic qualification, which was used as a proxy for SES, participants were grouped into participants’ whose parents had received an undergraduate qualification or above, and those who did not.

As participants’ survey start date and length of participation varied due the study’s rolling start date and number of surveys completed, the loneliness scores were adjusted for baseline survey date and total study duration. This was done by regressing both variables out of the loneliness scores at each assessment timepoint; the residuals were then used in the LCGA models.

We used latent class growth analysis (LCGA) to investigate the individual differences in loneliness trajectories, identifying different classes of loneliness trajectories (RQ2). LCGA was implemented in Version 8.8 Mplus (Muthén & Muthén, 1998). Missing data in the LGCM and LCGA models were modelled using full information maximum likelihood estimation (Schafer & Graham, 2002). A series of models with different number of classes were fit to the loneliness data to determine the best number of classes. The 2-, 3-, 4-, 5- and 6-class trajectory models were compared. To inform our decision of the number of optimal

classes, we used similar criteria with overlapping data in another paper (Riddleston et al., 2022):

- Model convergence
- Comparing K-class and K-1 class model fit statistics, using the Akaike information criterion (AIC), Bayesian information criterion (BIC) and sample size adjusted BIC (aBIC). Lower values indicate better model fit.
- Bootstrapped Lo, Mendell, Rubin likelihood ratio test (LRT), comparing K-class and K-1 class models. A significant p-value indicates model fit was significantly improved by the addition of an extra class.
- Entropy. A measure of subgroup classification quality, higher is preferrable. Acceptable > .07-.08.
- Minimum subgroup n. E.g., more than 5% of total sample.
- Qualitatively different subgroup trajectories.
- Model parsimony and the theoretical meaning and relevance of classes.

In the chosen model, if a high, stable loneliness class is identified, the high, stable loneliness class will be compared to the other loneliness classes. Alternatively, loneliness classes that indicate loneliness trajectories that are high or increasing will be compared to the other loneliness classes.

After the optimal model was chosen and the latent loneliness classes were identified, covariates including demographic factors (sex, age, ethnicity, highest level of parental education as a proxy for SES) and coping strategy variables were added to the model (RQ3) using MPlus' R3STEP (Asparouhov & Muthén, 2014a). This method regresses the loneliness classes on the covariates while preventing the inclusion of the covariates from changing the latent class structure and measurement error. Another separate model using R3STEP was carried out using demographic factors and coping flexibility (number of coping strategies endorsed). Lastly, the relationship between loneliness class membership and wellbeing outcome at the final timepoint was examined while controlling for covariates (sex, age, SES, ethnicity, and initial wellbeing scores) (RQ4). The manual Bolck, Croons, and Hagenaars (BCH) method (Asparouhov & Muthén, 2014b; Bolck et al., 2004) was carried out (see section 3.2 of Asparouhov & Muthén (2014b)). The manual BCH method estimates a distal outcome model (final wellbeing) with an arbitrary secondary model (controlling for

covariates in addition to the latent classes). This occurred in two steps: the first step involved estimating the latent class model and saving the BCH weights (measurement error in the latent class variable), and the second step used the BCH weights to estimate the auxiliary model which involved both simultaneously regressing the loneliness classes on the covariates (age, sex, SES, ethnicity, and initial wellbeing) and regressing final wellbeing outcome on the covariates conditional on the loneliness classes. The BCH model produces final wellbeing mean intercepts specific to each loneliness class, which indicate the loneliness classes' influence on the final wellbeing scores while controlling for covariates. An omnibus test was carried out to detect differences between the loneliness trajectory groups. If the omnibus test was significant, pairwise comparisons were carried out with the mean intercepts across the loneliness classes using the "MODEL CONSTRAINT" function in Mplus. The BCH method protected the formation of latent classes from the influence of other variables in the model while also accounting for classification uncertainty when generating parameter estimates (Bolck et al., 2004). The BCH has been suggested to produce the least biased estimates and is more robust and flexible compared to other latent class modelling with continuous distal outcomes (Bakk & Vermunt, 2016). The creation of the latent classes are not influenced by the distal variable and ensures the stability of the model between generating and comparing the latent groups, while controlling for covariates (Asparouhov & Muthén, 2014b).

Exact p-values are reported for all tests. For interpreting results, Benjamini-Hochberg adjustment with a false discovery rate of 0.05 were carried out to control for multiple comparisons.

3. Results

3.1 Descriptive Statistics

Table 2 shows the descriptive statistics of the participants' demographics and initial outcome scores. The mean age of the participants was 18.2 years (*SD* = 3.55). 75% of participants were female and 63% were White. More than half of the participants reported that their parents were university educated (66%), with a quarter of parents obtaining a post-graduate degree.

Table 1 details the seven coping categories (contact seeking, distraction, approach, self-care, self-talk, self-compassion, gratitude) that were derived from the free-text responses to the question "Based on your experiences, what advice would you give to other young people who are managing the isolating experiences of social distancing?". Figure 1 displays the percentages of participants endorsing each coping strategy. Of the categories, the three most frequently recommended are contact seeking (51.7%), self-care (35.8%) and distraction (23.2%). The least recommended strategy was gratitude (9.0%). 5.8% of participants did not recommend a coping strategy. As for coping flexibility, young people recommended between one and six coping strategies (*M* = 1.72, SD = 0.99) with one being the most frequently recommended number of coping strategies (41.6%) and the percentage of participants decreasing as number of coping strategies increased. More detailed analyses of the strategies and its associations with demographic factors are reported in a separate paper (Jong et al., 2023). For the purposes of this study, we will report how the coping strategies relate to the aims of this study.

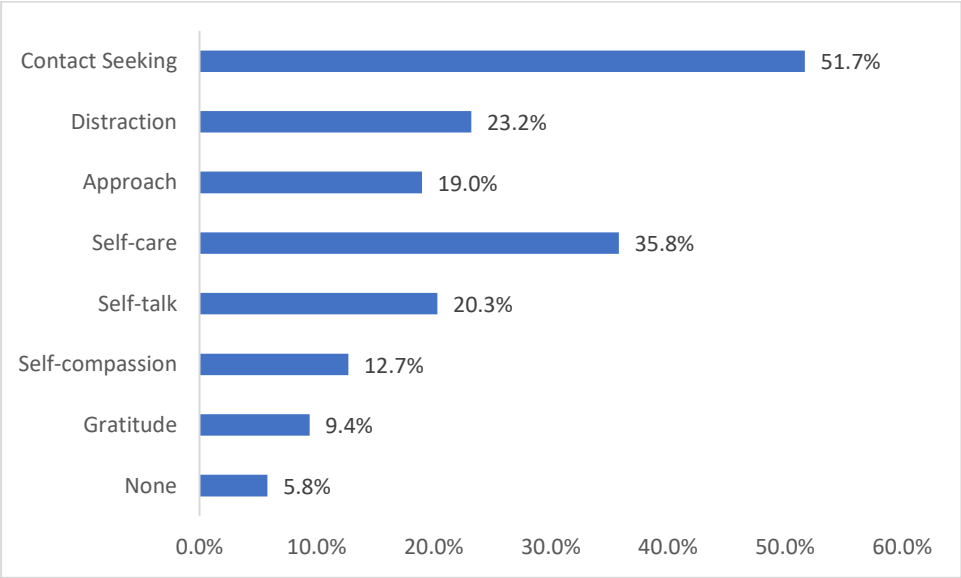
Table 2

Sample characteristics and mean responses at the initial timepoint

Variables	Participants at Timepoint 1 (*N* = 1624)	
	Mean (*SD*) or %	*n*
Age	18.2 (3.55)	1,624
Sex		
Male	25	414
Female	75	1210
Ethnicity		
White / White British	63	1019
Asian / Asian British	20	326
Black / Black British	4	60
Mixed or Other	11	170
Prefer Not to Say	3	49
Highest Parent Education		
Primary	2	40
GCSE	13	205
A-level	19	300
Undergraduate	41	664
Master	19	314
PhD	6	102
Loneliness (UCLA)	5.31 (1.84)	1,624
Mental Wellbeing (SWEMWBS)	21.9 (4.42)	1,624

Figure 1

Percentage of coping strategies endorsed by participants



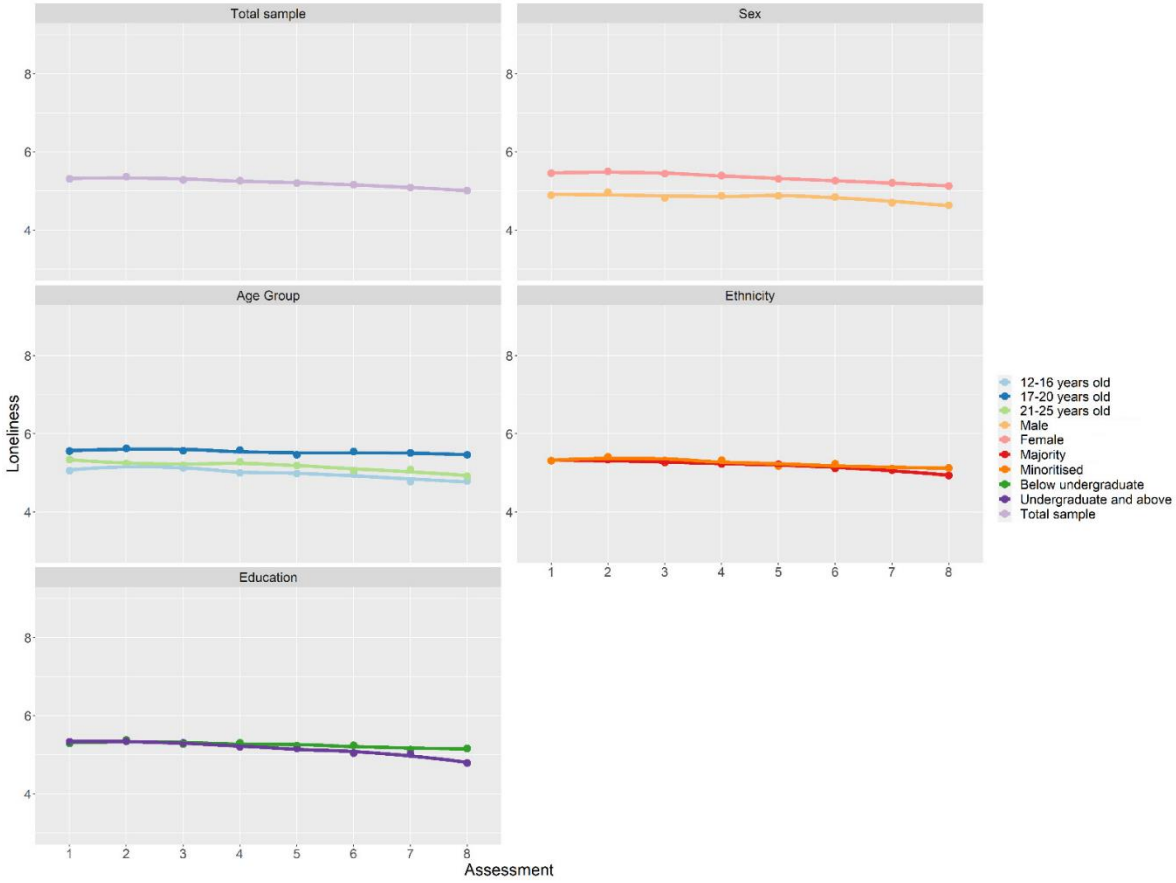
3.2 Latent Growth Curve Model

The LGCM fit the data well, $\chi^2(31) = 168.15$, $p < .001$, CFI = 0.98, SRMR = 0.04. The intercept (*standardised estimate* = 3.48, *unstandardised* = 5.36, $p < .001$) and slope (*standardised estimate* = -0.18, *unstandardised* = -0.04, $p < .001$) were significant, indicating that the mean loneliness scores decreased over time. There were significant variances in both the intercept (*standardised* = 1.00, *unstandardised* = 2.38, $p < .001$) and slope (*standardised* = 1.00, *unstandardised* = 0.04, $p < .001$), which supported further analyses of distinct trajectories. Overall mean and standard deviation of loneliness scores at each time point can be found in Appendix F.

Figure 2 shows the overall loneliness trajectory across the eight assessments grouped by age, sex, parental education level and ethnicity. It should be noted that the demographic trends displayed in Figure 2 are descriptive rather than based on statistical comparisons.

Figure 2

Mean loneliness score trajectory between Assessment 1 and 8 grouped by demographic categories



Spaghetti plots showing individual trajectories in addition to mean loneliness trajectory are included in the Appendices (see Appendix G).

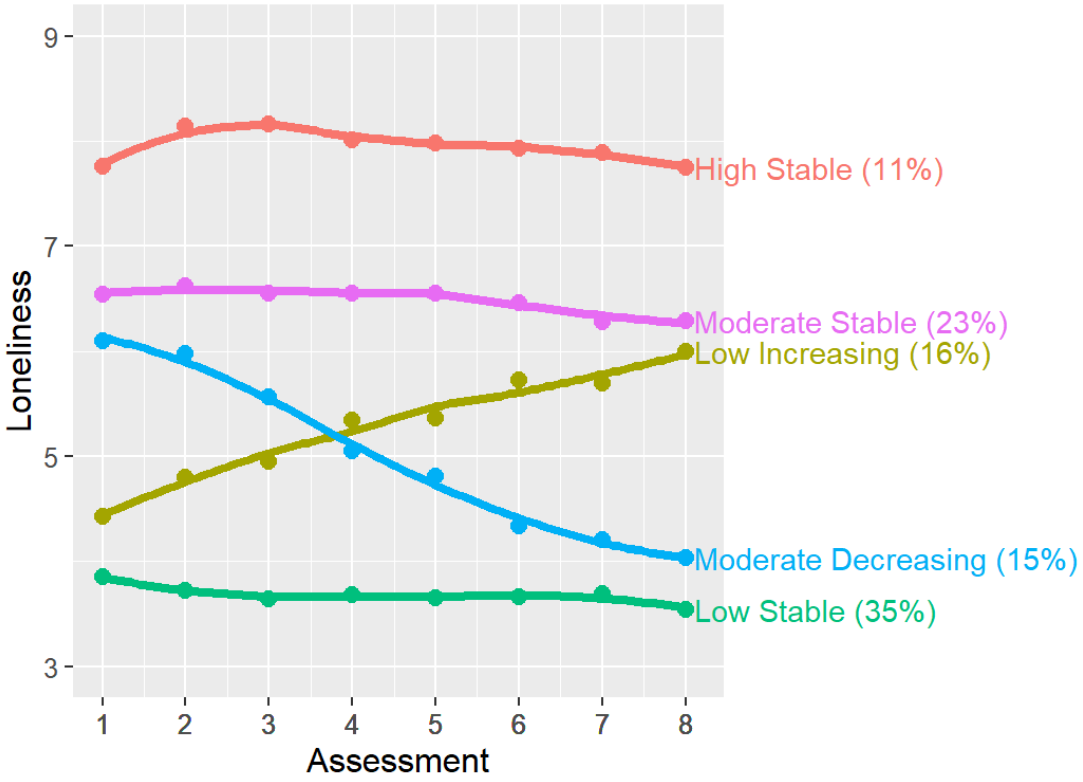
3.3 Latent Class Growth Analysis

The LCGA was carried out to identify different loneliness trajectory classes. Table 3 shows the fit statistics for the 2 through to 6-class models using residuals loneliness scores after controlling for first survey start date and length of study participation. All classes' bootstrapped LRT were significant. Considering the fit indices, entropy, minimum number of participants in each class, and the substantive meaning of the classes, the 5-class model was chosen. In the 5-class model, the largest class consisted of 35% of the sample and shows a low, stable loneliness trajectory ($M_{intercept}$ = -1.60, p < .001; M_{slope} = 0.02, p = .064). There were classes that showed: a moderate stable loneliness trajectory (23%; $M_{intercept}$ = 1.26, p < .001; M_{slope} = -0.002, p = .946), low increasing loneliness trajectory (16%; $M_{intercept}$ = -0.76, p < .001; M_{slope} = 0.24, p < .001) and a moderate decreasing loneliness trajectory (15%; $M_{intercept}$ = 0.69, p < .001; M_{slope} = -0.25, p = < .001). Lastly, the smallest class (11%) shows a high, stable loneliness trajectory ($M_{intercept}$ = 2.59, p < .001; M_{slope} = 0.03, p = .354).

The loneliness trajectories of the 5 classes are shown in Figure 3, which depicts the trajectories using the raw loneliness scores.

Figure 3

Mean trajectory of loneliness scores in different classes from Assessment 1 to 8



Note. The sample proportion of each class is shown in brackets.

Table 3

Model fit indices for the latent class growth analysis

Classes	Parameters	Convergence	Trajectories	Entropy	AIC	BIC	aBIC		Group *n* (%)	BLR	*df* (BLR)	*p* (BLR)
2	13	Yes	Distinct	0.875	38,529.157	38,599.261	38,557.962	1	940 (58)	-21,522.188	3	<.001
								2	684 (42)			
3	16	Yes	Distinct	0.856	37,306.356	37,392.638	37,341.809	1	310 (19)	-19,251.578	3	<.001
								2	658 (41)			
								3	654 (40)			
4	19	Yes	Distinct	0.792	37,020.717	37,123.178	37,062.818	1	482 (30)	-18,637.178	3	<.001
								2	559 (34)			
								3	177 (11)			
								4	406 (25)			
5	22	Yes	Distinct	0.770	36,778.285	36,896.923	36,827.033	1	264 (16)	-18,491.359	3	<.001
								2	574 (35)			
								3	172 (11)			
								4	243 (15)			
								5	371 (23)			
6	25	Yes	Distinct	0.756	36,658.305	36,793.121	36,713.701	1	100 (6)	-18,367.142	3	<.001
								2	565 (35)			
								3	289 (18)			
								4	238 (15)			
								5	264 (16)			
								6	168 (10)			

Note. Loneliness scores are adjusted for baseline survey date and total study duration.

AIC = Akaike information criterion; BIC = Bayesian information criterion; aBIC = Sample size adjusted Bayesian information criterion; BLR = Bootstrapped likelihood ratio test.

3.4 Predictors of loneliness class membership

Table 4 presents the results from the LCGA with predictors, showing the associations between both demographic factors and coping strategies and the likelihood of membership in the loneliness trajectory classes. Compared to the low stable loneliness class, participants in the high stable loneliness class were more likely to be females compared to males, *OR* = 0.28, 95% CI [0.16, 0.52], $p < .001$. Participants in the high stable loneliness class were also more likely to be female, compared to male, than those in the moderate decreasing class, *OR* = 0.33, 95% CI [0.17, 0.66], $p = .002$. There were no significant differences between males and females in the likelihood of class membership between those in the high stable loneliness class compared to those in the moderate stable class nor the low increasing class. Age, ethnicity, and parental education were not significant predictors of loneliness class membership. For coping strategy, participants who recommended approach coping strategies were less likely to be in the high stable loneliness class compared to the moderate decreasing loneliness class, *OR* = 0.37, 95% CI [0.20, 0.71], $p = .003$. While not significant after Benjamini-Hochberg corrections, self-care as a coping strategy approached significance: participants who recommended self-care as a coping strategy were also less likely to be in the high stable loneliness class compared to the moderate decreasing loneliness class, *OR* = 0.46, 95% CI [0.26, 0.81], $p = .007$. Endorsement of the other coping strategies did not significantly predict loneliness class membership.

Another regression model with the latent classes and demographics as covariates in addition to coping flexibility (number of coping strategies endorsed) was ran. Coping flexibility did not significantly predict loneliness class membership above and beyond the other predictors (see Appendix H).

Table 4

Latent class growth analysis of loneliness predicted by demographic factors and coping strategy variables

	High stable vs. Low stable loneliness			High stable vs. Moderate stable loneliness			High stable vs. Low increasing loneliness			High stable vs. Moderate decreasing loneliness		
Variable	*B (SE)*	*OR* [95% CI]	*p*	*B (SE)*	*OR* [95% CI]	*p*	*B (SE)*	*OR* [95% CI]	*p*	*B (SE)*	*OR* [95% CI]	*p*
Age	-0.03	0.97	.240	-0.04	0.96	.250	-0.03	0.97	.419	0.01	1.01	.764
	(0.03)	[0.92, 1.02]		(0.03)	[0.91, 1.03]		(0.03)	[0.91, 1.04]		(0.04)	[0.94, 1.07]	
Sex	-1.23	0.28	**<.001*** **	-0.68	0.51	.058	-0.67	0.51	.059	-1.09	0.33	**.002****
	(0.30)	[0.16, 0.52]		(0.36)	[0.25, 1.02]		(0.36)	[0.26, 1.03]		(0.35)	[0.17, 0.66]	
Ethnicity	0.03	1.03	.880	0.05	1.04	.860	-0.21	0.81	.414	0.28	1.32	.283
	(0.21)	[0.68, 1.56]		(0.26)	[0.64, 1.72]		(0.26)	[0.48, 1.35]		(0.26)	[0.77, 2.09]	
Parental	-0.24	0.79	.253	0.07	1.07	.792	-0.05	0.95	.847	-0.08	0.92	.766
Education	(0.21)	[0.52, 1.19]		(0.25)	[0.65, 1.76]		(0.26)	[0.57, 1.58]		(0.27)	[0.54, 1.51]	
Coping Strategy												
Contact	0.05	1.05	.819	0.22	1.24	.400	0.06	1.06	.813	0.02	1.02	.934
Seeking	(0.21)	[0.69, 1.59]		(0.26)	[0.75, 2.06]		(0.26)	[0.64, 1.77]		(0.27)	[0.60, 1.74]	
Distraction	0.01	1.01	.964	-0.05	0.95	.845	0.32	1.38	.280	0.34	1.40	.273
	(0.23)	[0.64, 1.59]		(0.28)	[0.55, 1.63]		(0.30)	[0.77, 2.46]		(0.31)	[0.77, 2.57]	
Approach	-0.39	0.68	.178	-0.57	0.57	.084	0.06	1.06	.879	-0.99	0.37	**.003****
	(0.29)	[0.38, 1.20]		(0.33)	[0.30, 1.08]		(0.39)	[0.50, 2.27]		(0.33)	[0.20, 0.71]	
Self-care	-0.41	0.66	.079	-0.53	0.59	.054	-0.31	0.74	.275	-0.78	0.46	.007**
	(0.24)	[0.41, 1.05]		(0.28)	[0.34, 1.01]		(0.28)	[0.42, 1.28]		(0.29)	[0.26, 0.81]	
Self-talk	0.28	1.31	.235	0.41	1.51	.166	0.52	1.68	.096	0.25	1.28	.445
	(0.23)	[0.83, 2.08]		(0.30)	[0.84, 2.69]		(0.31)	[0.91, 3.09]		(0.32)	[0.68, 2.41]	

Table 4 Continued

	High stable vs. Low stable loneliness			High stable vs. Moderate stable loneliness			High stable vs. Low increasing loneliness			High stable vs. Moderate decreasing loneliness		
Variable	*B* (SE)	*OR* [95% CI]	*p*	*B* (*SE*)	*OR* [95% CI]	*p*	*B* (*SE*)	*OR* [95% CI]	*p*	*B* (*SE*)	OR [95% CI]	*p*
Self-compassion	0.16 (0.29)	1.17 [0.66, 2.06]	.586	-0.35 (0.33)	0.71 [0.37, 1.33]	.282	0.33 (0.39)	1.40 [0.65, 3.01]	.395	0.61 (0.47)	1.84 [0.73, 4.65]	.199
Gratitude	0.04 (0.32)	1.04 [0.56, 1.95]	.901	0.84 (0.45)	2.32 [0.96, 5.59]	.061	0.06 (0.43)	1.06 [0.46, 2.44]	.897	-0.04 (0.43)	0.96 [0.42, 2.23]	.931

*Note***.** Loneliness scores are adjusted for baseline survey date and study participation duration. *SE* = Standard Error; *OR* = Odds Ratio; CI = Confidence Intervals. Sex: female = 0, male = 1; ethnicity: marginalised = 0; majority = 1; parental education level: below undergraduate = 0, undergraduate and above = 1.

**p* < .05, ***p* < .01, ****p* < .001, bold values represent statistical significance based on Benjamini-Hochberg adjustment (false discovery rate of 0.05)

3.5 Final wellbeing as a function of loneliness class membership

Table 5 displays the initial and final wellbeing of participants according to the five trajectory classes. In this model, we included loneliness class membership as a predictor for final wellbeing outcome, controlling for initial wellbeing score and demographic factors (sex, age, SES, and ethnicity) to investigate whether final wellbeing differed across loneliness classes. Table 6 presents results from the BCH method investigating loneliness class differences in predicting final wellbeing outcome. The omnibus Wald χ^2 test indicated that overall, there were significant differences in the wellbeing mean intercept between the loneliness classes at the final assessment timepoint ($p < .001$). We ran further pairwise comparisons between the high stable loneliness class and the other four classes. After Benjamini-Hochberg adjustment (false discovery rate of 0.05), participants in the high stable loneliness class reported significantly lower final wellbeing scores compared to the low stable class ($z = -4.43$, $p < .001$), moderate stable class ($z = -1.74$, $p = .001$) and the moderate decreasing class ($z = -4.87$, $p < .001$). There were no significant differences in the final wellbeing scores between high stable loneliness class and low increasing loneliness class ($z = -0.59$, $p = .290$).

In summary, the mean loneliness of the participants decreased over the period of the study and five loneliness trajectories were identified: high stable, moderate stable, low stable, low increasing, and moderate decreasing loneliness. In terms of demographics, only being female predicted membership of the high stable loneliness trajectory. Recommending approach coping strategies predicted lower likelihood of high stable loneliness class membership. Lastly, young people in the high stable loneliness trajectory reported significantly lower wellbeing at the last timepoint compared to all other loneliness trajectories except for the low increasing loneliness trajectory.

Table 5

Mean wellbeing and standard error by loneliness class

Outcome	Loneliness class				
	High stable (*n* = 172)	Low stable (*n* = 574)	Moderate stable (*n* = 371)	Moderate decreasing (*n* = 243)	Low Increasing (*n* = 264)
	M (SE)	*M (SE)*	*M (SE)*	*M (SE)*	*M (SE)*
Initial Wellbeing	17.15 (0.31)	24.27 (0.16)	19.97 (0.17)	20.80 (0.24)	23.15 (0.20)
Final Wellbeing	17.08 (0.41)	24.68 (0.20)	20.06 (0.25)	23.61 (0.34)	20.32 (0.35)

Note. M = Estimated Means, *SE* = Standard Error.

Table 6

Final wellbeing estimated means by loneliness class

Outcome	Loneliness class						
	High stable (*n* = 172)	Low stable (*n* = 574)	Moderate stable (*n* = 371)	Moderate decreasing (*n* = 243)	Low Increasing (*n* = 264)	Latent subgroup comparison omnibus test	
	M[1] *(SE)*	*M*[1] *(SE)*	*M*[1] *(SE)*	*M*[1] *(SE)*	*M*[1] *(SE)*	Wald χ^2	*p-value*
Final Wellbeing	10.12 (0.96)	14.56 (1.16)	11.94 (1.02)	14.99 (1.02)	10.73 (1.13)	178.32	<.001

Note. *SE* = Standard Error. Loneliness scores are adjusted for baseline survey date and study participation duration.

[1]Means estimated from class-specific intercepts (BCH-generated) for the final wellbeing in a latent class auxiliary regression model, which represents the influence of the latent loneliness class on final wellbeing.

4. Discussion

The COVID-19 pandemic and its associated lockdown and social distancing measures impacted many young people's lives, including their education, professional life, finances, personal and professional relationships, daily routines, and their emotional wellbeing. We investigated the overall loneliness trajectory in young people (aged 12 to 25 years old) in the UK during the COVID-19 pandemic and whether there were any distinct loneliness trajectories amongst young people. We next explored the association between demographic factors and coping strategies for managing social isolation with the different loneliness trajectories. Lastly, we looked at whether the loneliness trajectories predicted wellbeing. We found that loneliness decreased slightly over the eight time points in our study and identified five distinct loneliness trajectories in the sample: low stable, moderate stable, low increasing, moderate decreasing, and high stable. We found that sex was the only demographic factor that predicted membership of the high stable loneliness class. Endorsing approach as a coping strategy also predicted membership of the high stable loneliness class (compared to the moderate decreasing class). Lastly, we demonstrated that loneliness trajectory class predicted wellbeing - high stable loneliness was associated with significantly lower wellbeing (compared to the low stable, moderate stable, and moderate decreasing loneliness classes).

4.1 Overall loneliness trajectory

Our study found that during the pandemic, the overall loneliness level experienced by young people was moderate and decreased slightly over time. Overall, our findings are in line with much of the previous literature: A longitudinal study early in the pandemic (March to May 2020) found decreasing loneliness in young adults (Ray, 2021) while a trajectory study which overlapped with the earlier half of our study (between June and November 2020) found a U-shaped trend in loneliness (Hu & Gutman, 2021). Fewer adolescents reported recent feelings of loneliness during August-October compared to May-June 2020, suggesting a general decrease in loneliness (Generation Scotland, 2021). However, some studies on loneliness changes during the earlier months of the pandemic have found increased loneliness prevalence in young adults (Lee et al., 2020) and adults (McGinty et al., 2020), while others have found no change in overall loneliness in adults (Luchetti et al., 2020; O'Connor et al., 2021). Some of these differences in findings could be attributable to factors such as the period in which the study took place, the different social distancing measures implemented during the time span and the different age ranges included. Thus, it is difficult to make direct

comparisons. The emotional loneliness in adults was also found to increase while social loneliness remained the same according to (Lampraki et al., 2022). It is possible that some of the inconsistent finding could also be due to the lack of distinguishing the different dimensions of loneliness.

4.2 Loneliness trajectory groups

Along with the finding that there was a significant, albeit small, decrease in overall mean-level change in loneliness over time across the study sample, there was also significant variance within the overall loneliness trajectory in our study. We identified five separate loneliness trajectory groups (low stable, moderate stable, low increasing, moderate decreasing, and high stable). While the most common loneliness trajectory was the low stable loneliness group, making up around a third of the sample (35%), it should be highlighted that half of the sample experienced stable high (11%), stable moderate (23%) and low increasing (16%) loneliness trajectories. This indicates that most of the sample had loneliness trajectories that were at least moderate in level or increasing. This is in line with the previous literature. A trajectory study in adults during the pandemic also found some similar trajectories with a chronic high loneliness class (smallest group) and stable low loneliness class (largest group), and two moderate loneliness classes (Bu et al., 2020b). Their moderate loneliness trajectories classes were stable, in contrast to those found in this study which had both increasing, decreasing, and stable moderate trajectories. Our finding of five loneliness trajectories echo pre-COVID loneliness trajectory papers in young people that identified four to five distinct trajectories (Hosozawa et al., 2022; Ladd & Ettekal, 2013; Qualter et al., 2013; Schinka et al., 2013; Vanhalst et al., 2013), with the stable low loneliness representing the most common largest group. The percentage of our stable high loneliness (11%) was within the range of those reported previously (1-22%). It is interesting to note that some of the groups show little change over time, perhaps implying that there was little adaptation to loneliness or impact of changing circumstances (the study period encompassed both periods of easing and tightening of social measures). To our knowledge, this is the only study investigating different loneliness trajectories in young people during the pandemic and our findings suggest that the loneliness changes during COVID-19 mirror, to some extent, loneliness outside of the pandemic; there is a small group of chronically lonely young people and although the largest group tend to be made up of individuals who report low loneliness, they made up less than half the young people sampled.

4.3 Predictors of loneliness trajectory class

When investigating demographic predictors of loneliness trajectory class, sex predicted loneliness class membership above and beyond other demographic predictors, such as age, ethnicity, and SES. Females were more likely than males to experience chronic high loneliness compared to low stable or moderate decreasing loneliness. Similar to a trajectory study in adults during COVID, females were more likely to be in the highest loneliness class relative to the lowest loneliness class (Bu et al., 2020b). This pattern of higher risk for loneliness in females has also been found in cross-sectional studies during COVID in young people (Cooper et al., 2021; Generation Scotland, 2021; Geulayov et al., 2022; Li & Wang, 2020) and adults (Golemis et al., 2022; Lee et al., 2020), although some have reported no gender differences in changes in perceived social isolation (Houghton et al., 2022; Hu & Gutman, 2021). While one previous study found no gender differences, a moderating effect of gender on the association between self-reported emotional support (from individuals outside of the household) and loneliness was found; increased emotional support was linked to lower loneliness in males but not in females (Hu & Gutman, 2021). Additionally, despite both males and females showing a negative relationship between perceived levels of support (from friends and family) and loneliness, females were impacted more by perceived lower levels of support (Lee & Goldstein, 2016). It is possible, therefore, that females are more at risk than males of being in the chronic high loneliness class rather than the low stable loneliness class because more social support was required to mitigate loneliness in females. Adolescent females, compared to males, usually have greater friendship quality that is characterised by greater intimacy and emotional support (Houghton et al., 2014) and this may have been difficult to sustain with social distancing, thus, having a larger impact on loneliness (Rose & Rudolph, 2006). It should also be noted that females have been found to be more willing to express emotions, which may lead to a higher reporting of self-reported loneliness than males (Tamres et al., 2002). The source of social support and its quality, as opposed to just amount, should also be considered because friendship quality has been found to account for more variance in loneliness levels than parent relationship quality in college-aged individuals (Calderon Leon et al., 2022).

The finding that there is a consistently lonely group of young people during the pandemic highlights the need to consider how to manage loneliness in this population. Besides demographics, we also investigated coping strategies as predictors of stable high

loneliness trajectories in young people. It is notable that contact seeking, which was the most frequently recommended coping strategy in our study, and perhaps most direct form of increasing social support, was not associated with loneliness. This is consistent with reports that increased social contact, such as over the phone or texting, during the pandemic was not associated with lower loneliness in adolescents (Cooper et al., 2021). As loneliness is a subjective feeling, resulting from the discrepancy between desired and perceived quantity and quality of social relationships rather than the actual amount of social relationships (Peplau & Perlman, 1982), it may be that increased contact seeking is insufficient by itself to alleviate loneliness. Rather, more in-depth understanding is required in managing loneliness beyond increasing contact with others and focus is needed on other areas, such as the subjective feeling of loneliness (Matthews et al., 2015). Furthermore, other factors such as living arrangements, relationships status and the different sources of support differentially predict loneliness levels (Calderon Leon et al., 2022; Ray, 2021). Those who both endorsed contact-seeking and lived with other people/were in relationships would perhaps be more successful in reaching out to others around them and have different loneliness levels than those who endorsed contact seeking but lived alone and are single. It may have been difficult to achieve contact seeking to the level desired by young people due to the many social restrictions in place so recommending contact seeking may not have been as effective as it might have been previously. An aspect that may have been obscured in our contact seeking category is the different sources or types of social support sought. As some studies suggest that friends and family support may differentially impact loneliness levels (Calderon Leon et al., 2022; van Roekel et al., 2015), future studies should take this into account.

One potential way of addressing the subjective feelings of loneliness, as suggested by the young people in our study, is identifying and engaging in alternative activities that provide a sense of achievement, purpose, or mastery. Young people who recommended approach coping strategies (e.g., picking up a new hobby and learning something new) to manage loneliness were more likely to have a moderate decreasing loneliness trajectory compared to a high stable trajectory. This supports findings from a meta-analysis, where interventions that focused on learning a new hobby yielded the largest effect size among randomised controlled trials of loneliness interventions in young people (Eccles & Qualter, 2021). It is interesting that the approach coping strategy, which was associated with reduced risk of chronic loneliness in our study, is also related to providing a wider range of rewarding activities, similar to the view

taken by behavioural activation for depression (Cuijpers et al., 2007; Pass et al., 2018). Furthermore, as problem-focused engaged coping (active behaviour or cognition to solve the problem) and higher self-efficacy is protective against adverse symptomology during the pandemic (Hussong et al., 2021), engaging in approach activities which include proactive, explicit plans to manage loneliness may have buffered against chronic loneliness. Besides recommending approach as a coping strategy, our findings tentatively suggest that recommending self-care (e.g., scheduling, exercise, productive work) may be predictive of decreasing loneliness, although caution should be used when interpreting this pattern as it only approached significance following correction for multiple comparisons. The use of planning, which is an example of adaptive coping in a study of adults in the early periods of the pandemic, was a protective factor against loneliness (Sampogna et al., 2021). Maintaining a daily routine and coping in an active manner, such as doing school work and exercising has been similarly reported to help individuals cope during lockdown (Dewa et al., 2021). Our findings that some coping strategies such as approach and self-care may buffer against chronic high loneliness is especially pertinent because coping strategies can be modified and learnt through interventions such as coping skills training (Pincus & Friedman, 2004) and as most loneliness interventions have not specifically investigated chronic loneliness (Eccles & Qualter, 2021). Our study has demonstrated that young people are aware of and presumably engaging with many different coping strategies. This can be used to inform the development and implementation of future interventions and coping guidelines that are likely to be acceptable and easily adoptable by young people.

4.4 Association between loneliness trajectory classes and wellbeing

In the literature, the link between loneliness and adverse psychological impacts has been well documented prior to COVID-19 (Lyyra et al., 2021; Schinka et al., 2013). Our study found that loneliness trajectories during the pandemic predicted young people's wellbeing at the final timepoint, after controlling for initial wellbeing and demographic factors. Young people in the low stable, moderate stable and moderate decreasing loneliness classes reported significantly higher wellbeing compared to the high stable loneliness class. Similarly, a review of young people below the age of 20 identified that higher loneliness was significantly associated with both lower overall wellbeing and increased mental health difficulties (anxiety and depression symptoms) in cross sectional studies (Farrell et al., 2023). They also found that in longitudinal studies, loneliness predicted lower concurrent and future

wellbeing and poorer mental health. The relationship between loneliness and lower wellbeing has also been demonstrated in adolescents prior to the pandemic (Lyyra et al., 2021). Our finding is consistent with the idea that loneliness is itself a stressor which contributes to negative affect (Cacioppo et al., 2002). Another possible explanation linking loneliness and poor wellbeing could be that lonelier individuals use more negative strategies to cope with stress, which may be more ineffective (Matthews et al., 2019). It should be noted that negative coping strategies were rarely reported in our study, so we were unable to test for the association between negative coping and loneliness. Interestingly, loneliness, but not compliance with social distancing measures, has also been reported to predict increased depression during the pandemic (Rosa et al., 2022). This included loneliness at the start of the pandemic and the loneliness trajectory throughout the pandemic. Taken together, this points to loneliness being a key indicator of individuals who may be more susceptible to lower wellbeing and mental health. Loneliness, as opposed to just social contact, could be useful as an additional dimension to monitor to understand young people's wellbeing.

4.5 Limitations

There are some limitations to this study. First, the trajectory classes found in this study were statistically derived using LGCM and LCGA and are not directly measured in self-reports so some caution should be taken when interpreting the findings (Peugh & Fan, 2012). Secondly, this study's sample was not chosen randomly and has a larger representation of females, individuals of higher SES and individuals of minoritized ethnic groups than the general UK population so there are limits to the generalisability of our findings to other young people in the country. The higher representation of minoritized ethnic groups in this study can also be seen as a strength as it allows for a better understanding of groups that are less represented. Furthermore, the sample may be skewed towards those who were both motivated and able to access the survey repeatedly.

It is important to consider how SES was measured in this study, which used parents' highest level of education attainment as a proxy. While the use of parental education as an indicator of SES is not uncommon especially in research involving young people (Galobardes, 2006), the measurement of SES is complex and inconsistent in the literature (Quon & McGrath, 2014; Svedberg et al., 2016) so this study's findings in relation to SES should be interpreted with caution. Given that the participants consisted of young people of varying ages (who may have difficulty accurately reporting parental income levels, assets and

occupation), the choice of parental education level as a proxy for SES was chosen to balance between the validity of the measure, accuracy of the response, and response rate of the participants (Galobardes, 2006; Svedberg et al., 2016). There is no one ideal indicator of SES, so further research should carefully consider the choice of SES indicator, the source of the information, and to relate it to the phenomenon explored, in addition to taking into account the ease and accuracy of participants' response (Diemer et al., 2013).

It should be noted that there were some limitations that may have impacted the coping strategies identified. While some studies found that avoidant and maladaptive coping strategies were associated with higher loneliness and symptomology during the early months of the pandemic (Hussong et al., 2021; Sampogna et al., 2021), this was not found in our study. Our sample reported much fewer maladaptive strategies potentially due to how the question was worded (recommendations to others about how to manage the isolation, rather than what the participants used to cope themselves). This makes comparisons with existing research less straightforward and determining whether strategies recommended to others is an adequate proxy for strategies that people carry out is unclear. Some studies have suggested that people who give advice come to believe the advice they give and that generating advice may encourage the advisor to plan and implement ways of carrying out the advised behaviour in their own lives (Eskreis-Winkler et al., 2018, 2019). This implies that there may be some associations between people's recommendations and their behaviours, with recommendations possibly increasing confidence and motivation to carry out the behaviours (Eskreis-Winkler et al., 2019). It should also be noted that self-reported behaviour or perception of behaviour has also been found not to be entirely consistent – there is some disconnect between people's perception of their behaviour compared to independent observations and measures of their behaviour (Affuso et al., 2011; Allom et al., 2016; Ebert-May et al., 2011). For example, the validity of self-report of health-risk behaviours in adolescents are affected by many factors but the effect on the validity varies depending on the specific behaviour reported (Brener et al., 2003). Thus, future studies may benefit from not only exploring what coping strategies young people employed to manage loneliness, but perhaps also more detailed exploration around how effective were they in implementing the strategies and how effective the strategies were for managing loneliness.

Furthermore, due to the open-text nature of the coping strategies question, the participants had to be able to notice and self-generate the coping strategies, rather than

picking from a list, which may have limited the types of coping strategies recommended in this study. Due to the prolonged nature of the pandemic and the social distancing measures, young people's experiences of the pandemic and coping strategies to manage loneliness may have changed over time, potentially accounting for the differences in findings between studies. There are other important factors that were not included that may have been able to further contextualise and shed light on some of our findings, for example, young people's perceived social support.

4.6 Clinical Implications

This study identified a considerable minority of young people who report prolonged high levels of loneliness, along with the negative impact of chronic loneliness on wellbeing. It is crucial to introduce targeted interventions and strategies that prevent or reduce loneliness. These findings speak to the potential for utilising young people's psychological resources and coping strategies to manage difficult events that are out of their control such as the pandemic. This is crucial given the well-documented negative outcomes associated with chronic loneliness (Heinrich & Gullone, 2006; Ingram et al., 2020; Wang et al., 2017) and the few effective targeted interventions for those who are lonely (Eccles & Qualter, 2021). One focus of mental health provision could be on supporting young people with coping strategies to manage loneliness and develop functional coping strategies. For example, improving awareness as to what activities may be more helpful for coping with loneliness such as those that have elements of achievement or explicit learning or those that encourage scheduling one's day and maintaining healthier lifestyle choices. It may be important to emphasize that these activities, although not explicitly related to increasing one's social contact, may alleviate young people's feelings of loneliness in addition to improving their wellbeing. Indeed, a recent review incorporating qualitative and quantitative studies, along with stakeholder views identified potential mechanisms to target in interventions for loneliness such as in the intrapersonal (e.g., cognitive, and behavioural interventions), interpersonal (e.g., social skills training), and social domain (e.g., increasing social contact) (Pearce et al., 2021). This comprehensive review is informative in guiding future loneliness studies as it conceptualises what factors may impact individual differences in loneliness intervention effectiveness and the mechanism of change behind the effectiveness of certain loneliness interventions. Interestingly, evidence around intrapersonal strategies like changing thoughts and behaviours were found to be most

promising. In line with that finding, recent loneliness interventions in adults have shown positive effects with a modular, CBT approach which involved modules on behavioural activation, behavioural experiments, and cognitive restructuring (Käll et al., 2020, 2021, 2021). This suggests that loneliness reduction may be linked to maladaptive cognitive processes, behavioural avoidance, and social skills difficulties, rather than just a lack of social contact. Furthermore, these studies indicate the potential utility of both strategies around behavioural interventions (e.g., behavioural activation) and cognitive (e.g., restructuring) for lonely populations. The efficacy, feasibility, and acceptability of this modular CBT for loneliness intervention in young people is still being evaluated (Cawthorne et al., 2022). The outcome would be informative for loneliness interventions moving forward. Furthermore, it is also crucial for loneliness interventions to be co-developed and informed by the experiences of young people, some of whom have expressed that activities that build self-esteem, confidence, social skills and provide a sense of purpose are crucial for alleviating loneliness (Pearce et al., 2021). It is likely that those who struggle with loneliness are not a homogenous group, thus loneliness interventions should also be personalised to the young people taking part in the intervention (Pearce et al., 2021).

4.7 Areas for Future Research

As elaborated above, the lack of association between contact seeking as a coping strategy and loneliness trajectories suggests that more research is required to understand how loneliness is impacted. Future research on loneliness in young people should take into account other factors such as the young person's different sources of support, including a more in-depth understanding of how the young person views and uses their different types of social support (Calderon Leon et al., 2022). Research focusing on the underlying mechanism of loneliness, including what factors maintain high levels of loneliness could also inform intervention designs. Additionally, loneliness has been theorised to be multifaceted, with at least two basic types often suggested to be social and emotional loneliness (Weiss & Bowlby, 1980). This was not explored here. In brief, while both social and emotional loneliness can be impacted by reduced social activities, social loneliness relates to a lack of a desired wider network while emotional loneliness stems from a lack of desired close relationships (Aartsen & Jylhä, 2011; Weiss & Bowlby, 1980). It is possible that our study, which treated loneliness as a unidimensional concept, may have obscured some of the relationships between the specific loneliness dimensions and the different variables. As other studies have suggested

that there may be distinct developmental trajectories for emotional and social loneliness in adolescents and young adults (von Soest et al., 2020), it would be informative to consider the different dimensions of loneliness in future research.

4.8 Conclusion

The findings from this mixed method study highlight young people's experience of loneliness during the COVID-19 pandemic and lockdown, a challenging and isolating period for many. As many published studies on the pandemic were conducted during the earlier periods and there is a lack of trajectory studies on young people, this study fills a much-needed gap in the literature. While most of our sample experienced low or moderate loneliness that was stable or decreasing, a sizeable minority experienced high levels of loneliness. This study also highlights possible risk factors for chronic loneliness, along with potential targets for interventions in terms of coping strategies used by young people. This includes the possible use of approach and self-care coping strategies to manage loneliness. Overall, considering the predictive role of loneliness trajectories for wellbeing, it is crucial to prioritise better understanding, assessment and management of loneliness and its associated factors in clinical practice.

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6. Appendices

6.1 Appendix A

Survey welcome pages

Survey Welcome Page

Managing emotions during COVID-19: The experiences of 12-25 year olds
We are conducting a study to measure the impact of the coronavirus disease 2019 (COVID-19) pandemic on young peoples' lives around the world. We are particularly interested in the ways that young people are managing their emotions during these uncertain times. We would like to take this opportunity to hear more about the strategies you are using to help manage these emotions. We hope that these data can be shared with young people all over the world to help them through challenging situations.

Participation is open to anyone aged between 12 and 25 years old.

If you normally spend all or most of your time living in the UK (at least 8 months per year), we will give you a £10 Amazon gift voucher after you have fully completed four surveys and then a second £10 Amazon gift voucher once you have fully completed the final four surveys (£20 Amazon gift vouchers in total). This is funded by Rosetrees Trust.

For anyone under 16 years, we will require consent from a parent or guardian before you can take part.

Do you wish to continue?

Follow-up survey welcome page

Managing emotions during COVID-19: The experiences of 12-25 year olds
Welcome back to our survey, where we are looking at how young people are managing their emotions during the coronavirus (COVID-19) pandemic.

You will receive a similar survey approximately every two weeks until you have completed 8 surveys in total (unless you choose to opt-out before this).

You may be asked the same or similar questions to the previous surveys, but it is important that you answer them all anyway, so that we can track answers over time.

Just a reminder, if you normally spend all or most of your time living in the UK (at least 8 months per year), we will give you a £10 Amazon gift voucher after you have fully completed four surveys and then a second £10 Amazon gift voucher once you have fully completed the final four surveys (£20 Amazon gift vouchers in total). This is funded by Rosetrees Trust.

Thank you in advance for completing this survey!

6.2 Appendix B

Survey information sheets

INFORMATION SHEET FOR PARTICIPANTS UNDER 16
This project has been reviewed and approved by the Psychiatry, Nursing & Midwifery Research Ethics Sub-Committee (REF: HR-19/20-18250).

We are conducting a study, to measure the impact of the coronavirus disease 2019 (COVID-19) pandemic on young peoples' lives around the world. This study is part of PhD project at King's College London. We are particularly interested in the ways that young people are managing their emotions during these uncertain times. We know that although difficult, young people can show strength to such challenges and we would like to take this opportunity to hear more about how you are responding. If you chose to take part, we hope that the data you provide can be shared with young people all over the world to help them manage challenging situations. Participation is open to anyone aged between 12 and 25 years old. For anyone under 16 years, we will require consent from a parent or guardian before you can take part.

What will happen if I take part? Taking part involves answering some short questionnaires for around 20 minutes every two weeks for 16 weeks. These questions will be about your feelings (good and bad), how you are managing your feelings and how you are staying close to other people while at home. As you are under 16 years old, your parent/ carer will need to read the information on the next page. Once they have read this, you will both be asked to complete an agreement form. We will also ask for your parent/carers email address so we can further check they are happy for you to take part. We will also ask for your email address so we can contact you every two weeks. Once you and your parent/carer have agreed for you to take part, you will be able to complete the questionnaires. You can choose to leave the study at any point or to remove the information you have already given us without giving any reason. Just simply email the researchers to let us know. If you choose to remove your data, you must email the researchers to let us know before 1st January 2021.

Are there any benefits? You will help us to understand ways that young people deal with their feelings during hard times. These findings will be shared with you and more widely to other young people around the world. These findings may also help with treatments for depression and anxiety in adolescents. To say thank you for the time and effort you have spent answering our questions, we will give you a £10 Amazon gift voucher after you have fully completed four surveys and then a second £10 Amazon gift voucher once you have fully completed the final four surveys (£20 Amazon gift vouchers in total).

Are there any risks? We do not expect that there will be any risks to you when completing the surveys, but sometimes when we ask young people questions about their feelings, this can be upsetting. Together with the survey questions, we have also provided links to websites where you can learn more about your feelings, if you are interested.

Will my information be kept private? Your information will be looked after in agreement with the General Data Protection Regulation 2016 (GDPR). To ensure privacy and anonymity (that no one knows your information is from you), you will be randomly given a unique ID.

This information will be saved on a secure online computer system maintained by King's College London. Your information (in it's anonymised form) may be shared with other research scientists or non-governmental and governmental organisations for the purposes of research and knowledge. Your information will be saved for up to 10 years. During the study, the research team will have access to your email address so we can easily contact you every two weeks. The email address will not be shared with any third party. Once the study is finished and we have shared the findings with you, we will delete your email address unless we have your agreement to contact you about other studies. Participants who choose to remove their data will have their data destroyed/deleted including their email addresses.

Data Protection Statement: King's College London will act as controller for the information that you provide. The University will use your personal information for the purpose of the research as we have described above and is legally defined as a 'task in the public interest'. By completing the agreement forms, you and your parent/carer are giving your agreement for the use of your personal data in this study. You have the right to see the information held about you and this can be done in agreement with the General Data Protection Regulation. You also have other rights such as asking us to correct or remove your data. Questions, comments and requests about your personal information can also be sent to the King's College London Data Protection Officer **Mr Albert Chan info-compliance@kcl.ac.uk.** If you wish to send a complaint with the Information Commissioner's Office, please visit **www.ico.org.uk**.

What will happen to the results of the study? The results will be written up as part of a University student work, but will also be written up for scientific journals. However, no information that would identify you would be included in this. If you wish to receive a copy of the scientific article, please let the researcher know.

Who should I contact for further information? If you have any questions or want more information about this study, please contact me using these contact details: **Taryn Hutchinson**, Mental Health Research UK Doctoral Researcher, Department of Psychology, Kings College London, Denmark Hill, London, SE5 8AF. **Email: taryn.hutchinson@kcl.ac.uk**

What if I have further questions, or if something goes wrong? If this study has harmed you in any way or if you wish to make a complaint about the study you can contact King's College London using the details below for further advice and information:
Dr Jennifer Lau, Institute of Psychiatry, Psychology and Neuroscience; Kings College London, Department of Psychology, Denmark Hill, London, SE5 8AF
Email: jennifer.lau@kcl.ac.uk; Tel: 0207 848 0678

Do you wish to continue to the parent information sheet and consent forms?

INFORMATION SHEET FOR PARENTS/ CARERS

This project has been reviewed and approved by the Psychiatry, Nursing & Midwifery Research Ethics Sub-Committee (REF: HR-19/20-18250).

We would like to invite your child to take part in a study. Please read the following information carefully. At the end of this information sheet, we will ask for your consent so your child can take part.

We are conducting a study to measure the impact of the coronavirus disease 2019 (COVID-19) pandemic on young peoples' lives around the world. This study is part of PhD project at King's College London. We are particularly interested in the ways that young people are managing their emotions during these uncertain times. We know that although difficult, young people can show strength to such challenges and we would like to take this opportunity to hear more about how you are responding. If you chose for your child to take part, we hope that the data they provide can be shared with young people all over the world to help them through challenging situations. Participation is open to anyone aged between 12 and 25 years old. For anyone under 16 years, we will require consent from a parent or guardian before you can take part.

What will happen if my child takes part? Taking part involves answering some short questionnaires for around 20 minutes every two weeks for 16 weeks. These questions will be about your child's emotions (positive and negative) and how they are managing these emotions including how they are continuing to feel connected with other people. At the end of this page, you will be asked if you are happy for your child to take part. If you select "yes", you and your child will be asked to complete an agreement form. It will also ask for your and your childs' email address, before giving further instructions around completing the survey. We will then email you again to further verify that you are the parent. We will use your childs' email address to contact them for subsequent data collection. Your child can choose to leave the study at any point or to withdraw the data they have already given us without giving any reason. Your child just simply needs to email the researchers to let us know. If your child chooses to remove their data, they must email the researchers to let us know before 1st January 2021.

Are there any benefits? Your child's participation will help us to understand ways that young people manage their emotions during challenging times. These findings will be shared with your child and more widely to other young people around the world. These findings may also help inform treatments for depression and anxiety in adolescents. To say thank you for the time and effort your child has spent answering our questions, we will give them a £10 Amazon gift voucher after they have fully completed four surveys and then a second £10 Amazon gift voucher once they have fully completed the final four surveys (£20 Amazon gift vouchers in total).

Are there any risks? We do not expect that there will be any risks to your child when completing the surveys, but sometimes when we ask young people questions about their feelings particularly around COVID-19, this can be upsetting. Together with the survey questions, we have also prepared some resources that your child can access to learn more about their emotions, should they be interested.

Will my information be kept private? Your child's data will be processed in accordance with the General Data Protection Regulation 2016 (GDPR). To ensure anonymity and confidentiality, your child will be randomly given an unique ID. These data will be saved on a secure server maintained by King's College London. These data (in their anonymised form) may be shared with other research scientists or non-governmental and governmental organisations for the purposes of research and knowledge. The data will be saved for up to 10 years. During the study, the research team will have access to your child's email address so we can easily contact them every two weeks. Neither your nor your childs' email address will be shared with any third party. Once the study is finished and we have shared the findings with your child, we will delete their email address unless we have their agreement to contact them about other studies. Participants who choose to remove their data will have their data destroyed/deleted including their email addresses.

Data Protection Statement: The data controller for this project will be KCL. The University will process your child's personal data for the purpose of the research outlined above. The legal basis for processing your child's personal data for research purposes under GDPR is a 'task in the public interest'. You can provide your consent for the use of your child's personal data in this study by completing the consent form that has been provided to you. Your child has the right to access information held about them. Your child's right of access can be exercised in accordance with the General Data Protection Regulation. Your child also has other rights including rights of correction, erasure, objection, and data portability. Questions, comments and requests about your personal data can also be sent to the King's College London Data Protection Officer **Mr Albert Chan info-compliance@kcl.ac.uk.** If your child wishes to lodge a complaint with the Information Commissioner's Office, please visit **www.ico.org.uk**.

What will happen to the results of the study? The results will be written up as part of doctoral theses as well as for scientific journals but no information that would identify your child would be included in this. If you wish to receive a copy of the scientific article, please let the researcher know.

Who should I contact for further information? If you or your child have any questions or require more information about this study, please contact me using the following contact details: **Taryn Hutchinson**, Mental Health Research UK Doctoral Researcher, Department of Psychology, Kings College London, Denmark Hill, London, SE5 8AF. **Email: taryn.hutchinson@kcl.ac.uk**

What if I have further questions, or if something goes wrong? If this study has harmed your child in any way or if you or your child wish to make a complaint about the conduct of the study you can contact King's College London using the details below for further advice and information: **Dr Jennifer Lau**, Institute of Psychiatry, Psychology and Neuroscience; Kings College London, Department of Psychology, Denmark Hill, London, SE5 8AF **Email: jennifer.lau@kcl.ac.uk; Tel: 0207 848 0678**

Are you happy for you child to take part?

INFORMATION SHEET FOR PARTICIPANTS OVER 16

This project has been reviewed and approved by the Psychiatry, Nursing & Midwifery Research Ethics Sub-Committee (REF: HR-19/20-18250).

We are conducting a study, to measure the impact of the coronavirus disease 2019 (COVID-19) pandemic on young peoples' lives around the world. This study is part of PhD project at King's College London. We are particularly interested in the ways that young people are managing their emotions during these uncertain times. We know that although difficult, young people can show strength to such challenges and we would like to take this opportunity to hear more about how you are responding. If you chose to take part, we hope that the data you provide can be shared with young people all over the world to help them manage any challenging situations. Participation is open to anyone aged between 12 and 25 years old. For anyone under 16 years, we will require consent from a parent or guardian before you can take part.

What will happen if I take part? Taking part involves answering some short questionnaires for around 20 minutes every two weeks for 16 weeks. These questions will be about your emotions (positive and negative) and how you are managing these emotions including how you are continuing to feel connected with other people. To take part, please click "yes" at the bottom of this page to complete the consent form. We will also ask for you to submit your email address to us so we can contact you every two weeks. Once you have consented you will be able to complete the questionnaires on a web-browser. You can choose to leave the study at any point or to withdraw the data you have already given us without giving any reason. Just simply email the researchers to let us know. If you choose to withdraw your data, you must email the researchers to let us know before 1st January 2021.

Are there any benefits? You will help us to understand ways that young people manage their emotions during challenging times. These findings will be shared with you and more widely to other young people around the world. These findings may also help inform treatments for depression and anxiety in adolescents. To say thank you for the time and effort you have spent answering our questions, we will give you a £10 Amazon gift voucher after you have fully completed four surveys and then a second £10 Amazon gift voucher once you have completed the final four surveys (£20 Amazon gift vouchers in total).

Are there any risks? We do not expect that there will be any risks to you when completing the surveys, but sometimes when we ask young people questions about their feelings, this can be upsetting. Together with the survey questions, we have also prepared some resources you can access to learn more about your emotions, should you be interested.

Will my information be kept private? Your data will be processed in accordance with the General Data Protection Regulation 2016 (GDPR). To ensure anonymity and confidentiality, you will be randomly given a unique ID. These data will be saved on a secure server maintained by King's College London. These data (in their anonymised form) may be shared with other research scientists or non-governmental and governmental organisations for the purposes of research and knowledge. The data will be saved for up to 10 years. During the study, the research team will have access to your email address so we can easily contact you every two weeks. The email address will not be shared with any third party. Once the study

is finished and we have shared the findings with you, we will delete your email address unless we have your permission to contact you about further studies. Participants who choose to remove their data will have their data destroyed/deleted including their email addresses.

Data Protection Statement: The data controller for this project will be KCL. The University will process your personal data for the purpose of the research outlined above. The legal basis for processing your personal data for research purposes under GDPR is a 'task in the public interest'. You can provide your consent for the use of your personal data in this study by completing the consent form that has been provided to you. You have the right to access information held about you. Your right of access can be exercised in accordance with the General Data Protection Regulation. You also have other rights including rights of correction, erasure, objection, and data portability. Questions, comments and requests about your personal data can also be sent to the King's College London Data Protection Officer **Mr Albert Chan info-compliance@kcl.ac.uk.** If you wish to lodge a complaint with the Information Commissioner's Office, please visit **www.ico.org.uk**.

What will happen to the results of the study? The results will also be written up as part of doctoral work but also for scientific journals. However, no information that would identify you would be included in this. If you wish to receive a copy of the scientific article, please let the researcher know.

Who should I contact for further information? If you have any questions or require more information about this study, please contact me using the following contact details: **Taryn Hutchinson,** Mental Health Research UK Doctoral Researcher, Department of Psychology, Kings College London, Denmark Hill, London, SE5 8AF. **Email: taryn.hutchinson@kcl.ac.uk**

What if I have further questions, or if something goes wrong? If this study has harmed you in any way or if you wish to make a complaint about the conduct of the study you can contact King's College London using the details below for further advice and information: **Dr Jennifer Lau**, Institute of Psychiatry, Psychology and Neuroscience; Kings College London, Department of Psychology, Denmark Hill, London, SE5 8AF
Email: jennifer.lau@kcl.ac.uk; Tel: 0207 848 0678

Do you wish to take part?

6.3 Appendix C

Survey consent forms

CONSENT FORM FOR PARTICIPANTS OVER 16
Please complete this form after you have read the Information Sheet.

Consent

- I understand that my participation is completely voluntary.
- I understand that I will need to provide an email address so that I can be sent the future surveys to answer. I understand that this email address will not be passed on to any third parties and will be removed from my answers before any data analysis takes place, meaning the information I provide will be anonymised.
- I understand that I can withdraw from the study at any point by not completing any further surveys. Should I wish to remove myself from the study, I understand that I will have to email the researcher by 1st January 2021 in order to delete any completed surveys,
- The data gathered in this study will be stored securely and it will not be possible to identify me in any outputs from this research.

I confirm I am at least 16 years old, I have read the information about the study, I am voluntarily agreeing to take part in this study and I understand my data will be stored in the UK, that subsets of my data will be anonymously shared with the broader international research team and that my data will be processed in accordance with GDPR

Name

Date

By taking part, you are agreeing that you have read and understood the information about the study

CONSENT FORMS FOR PARENTS AND PARTICIPANTS UNDER 16
Please complete this form after you have read the Information Sheet.

Parental Consent

- I understand that my child's participation is completely voluntary.
- I understand that I will need to provide an email address or mobile phone number in order to verify that I am a parent/carer. I understand that this email address will not be passed on to any third parties and will be removed once data collection is completed
- I understand that my child will be providing their email address so that they can be sent the future surveys to answer. I understand that this email address will not be passed on to any third parties and will be removed from their answers before any data analysis takes place, meaning the information they provide will be anonymised.
- I understand that my child can withdraw from the study at any point by not completing any further surveys. Should my child wish to be removed from the study, I understand that they will have to email the researcher by 1st January 2021 in order to delete any completed surveys.
- The data gathered in this study will be stored securely and it will not be possible to identify my child in any outputs from this research.

I confirm that my child is at least 12 years old, I have read the information about the study, I agree for my child to take part in this study voluntarily and I understand their data will be stored in the UK, that subsets of their data will be anonymously shared with the broader international research team and that their data will be processed in accordance with GDPR

Name

Date

Email

By your child taking part, you are agreeing that you have read and understood the information about the study

Young Persons Consent

- I understand that my participation is completely voluntary.
- I understand that I will need to provide an email address so that I can be sent the future surveys to answer. I understand that this email address will not be passed on to any third parties and will be removed from my answers before any data analysis takes place, meaning the information I provide will be anonymised.
- I understand that I can withdraw from the study at any point by not completing any further surveys. Should I wish to remove myself from the study, I understand that I will have to email the researcher by 1st January 2021 in order to delete any completed surveys,
- The data gathered in this study will be stored securely and it will not be possible to identify me in any outputs from this research.

I confirm I am at least 12 years old, I have read the information about the study, I am voluntarily agreeing to take part in this study and I understand my data will be stored in the UK, that subsets of my data will be anonymously shared with the broader international research team and that my data will be processed in accordance with GDPR

Name

Date

Email

By taking part, you are agreeing that you have read and understood the information about the study

6.4 Appendix D

Survey questions and measures used in this study

1. Demographic Information

Information about you

- Please enter the year of your birth: GIVE OPTIONS TO SELECT (GIVEN THE POSSIBLE RANGE)
- Please enter the month of your birth: GIVE OPTIONS TO SELECT (GIVEN THE POSSIBLE RANGE)
- Which gender were you assigned at birth? MALE / FEMALE
- Please state the country you are currently living in: FREE TEXT
- Please state the city you are currently living in: FREE TEXT
- Please state what country you were born in: FREE TEXT
- What is your ethnic group? GIVE OPTIONS TO SELECT (harmonised with ONS question)
- What is the highest academic qualification obtained by either one of your parents? PRIMARY SCHOOL LEVEL / GCSE OR EQUIVALENT /A LEVEL OR EQUIVALENT / HIGHER LEVEL DEGREE OR EQUIVALENT / MASTERS / PHD

2. Adapted 3-item version of the UCLA loneliness scale (Hughes et al., 2004; Russell, 1996)

Information about your social life

1. In the last two weeks, how often have you felt that you have no one to talk to? [HARDLY EVER/NEVER, SOME OF THE TIME / OFTEN]
2. In the last two weeks, how often have you felt left out? [HARDLY EVER/NEVER, SOME OF THE TIME / OFTEN]
3. In the last two weeks, how often have you felt alone? [HARDLY EVER/NEVER, SOME OF THE TIME / OFTEN]
4. In the last two weeks, how often do you feel lonely? [OFTEN/ALWAYS, SOME OF THE TIME, HARDLY EVER, NEVER]

3. **Warwick-Edinburgh Mental Wellbeing Scale (Short Version)** (Stewart-Brown et al., 2009; Tennant et al., 2007)

Information about your emotional health

1. For each statement below, please circle the answer that best describes your experience over the last 2 weeks

STATEMENTS	None of the time	Rarely	Some of the time	Often	All of the time
I've been feeling optimistic about the future	**1**	**2**	**3**	**4**	**5**
I've been feeling useful	**1**	**2**	**3**	**4**	**5**
I've been feeling relaxed	**1**	**2**	**3**	**4**	**5**
I've been dealing with problems well	**1**	**2**	**3**	**4**	**5**
I've been thinking clearly	**1**	**2**	**3**	**4**	**5**
I've been feeling close to other people	**1**	**2**	**3**	**4**	**5**
I've been able to make up my own mind about things	**1**	**2**	**3**	**4**	**5**

4. **Recommended coping strategies for loneliness**

Based on your experiences, what advice would you give to other young people on managing the isolating experiences of social distancing? FREE TEXT

6.5 Appendix E

Summary of dates and number of participants at each timepoint.

Assessment	Earliest-Latest date	Range (days)	Mean range between *n* and *n*+1 (days)	Sample size
1	01/06/2020-01/12/2020	183	18.7	1624
2	14/06/2020-24/01/2021	224	17.5	1624
3	28/06/2020-08/02/2021	225	16.3	1624
4	11/07/2020-21/02/2021	225	17.8	1469
5	25/07/2020-12/03/2021	230	16.8	1280
6	08/08/2020-25/03/2021	229	15.6	1140
7	22/08/2020-25/03/2021	215	15.7	1018
8	05/09/2020-26/04/2021	233	18.7	887

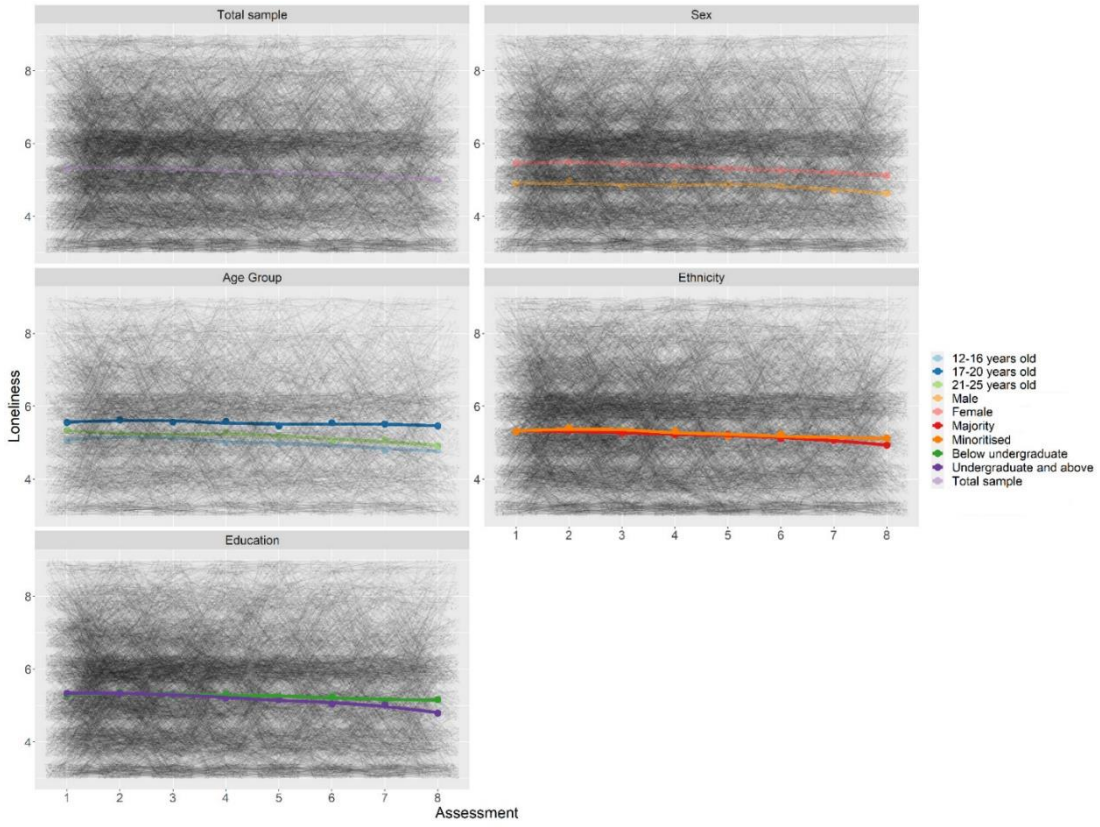
6.6 Appendix F

Loneliness scores at each assessment

Assessment	Loneliness *M* (*SD*)
1	5.31 (1.84)
2	5.37 (1.81)
3	5.29 (1.83)
4	5.26 (1.83)
5	5.21 (1.87)
6	5.16 (1.84)
7	5.09 (1.83)
8	5.01 (1.83)

6.7 Appendix G

Spaghetti plot of mean loneliness trajectory between Assessment 1 and 8 grouped by demographics



Age was categorised into 2 age groups for illustration purposes only; all analyses involving age were performed with age as a continuous variable.

6. Appendix H

Latent class growth analysis of loneliness predicted by demographics factor and coping flexibility

	Loneliness class comparison											
	High stable vs. Low stable loneliness			High stable vs. Moderate stable loneliness			High stable vs. Low increasing loneliness			High stable vs. Moderate decreasing loneliness		
Variable	*B (SE)*	*OR* [95% CI]	*p*	*B (SE)*	*OR* [95% CI]	*p*	*B (SE)*	*OR* [95% CI]	*p*	*B (SE)*	*OR* [95% CI]	*p*
Age	-0.04 (0.03)	0.96 [0.91, 1.01]	.137	-0.05 (0.03)	0.96 [0.90, 1.01]	.115	-0.04 (0.03)	0.96 [0.90, 1.02]	.204	0.00 (0.03)	1.00 [0.94, 1.07]	.995
Sex	-1.23 (0.30)	0.29 [0.16, 0.52]	**.000***	-0.65 (0.35)	0.52 [0.26, 1.04]	**.066**	-0.65 (0.35)	0.52 [0.26, 1.03]	**.062**	-1.06 (0.34)	0.35 [0.18, 0.68]	**.002****
Ethnicity	0.03 (0.21)	1.03 [0.69, 1.56]	.872	0.04 (0.25)	1.04 [0.64, 1.70]	.861	-0.22 (0.26)	0.80 [0.49, 1.33]	.398	0.31 (0.26)	1.36 [0.82, 2.24]	.231
Parental Education	-0.26 (0.21)	0.77 [0.51, 1.16]	.211	0.02 (0.24)	1.02 [0.63, 1.65]	.930	-0.08 (0.25)	0.92 [0.56, 1.52]	.748	-0.12 (0.26)	0.85 [0.66, 1.09]	.639
Coping Strategy												
Coping Flexibility	-0.06 (0.10)	0.94 [0.77, 1.16]	.569	-0.07 (0.13)	0.93 [0.73, 1.20]	.589	0.13 (0.12)	1.13 [0.89, 1.45]	.313	-0.17 (0.13)	0.85 [0.66, 1.09]	.201

Note. Loneliness scores are adjusted for baseline survey date and total study duration. *SE* = Standard Error; *OR* = Odds Ratio; CI = Confidence Intervals. Sex: female = 0, male = 1; ethnicity: marginalised = 0; majority = 1; parental education level: below undergraduate = 0, undergraduate and above = 1.

*p < .05, **p < .01, ***p < .001, bold values represent statistical significance after Benjamini-Hochberg adjustment (false discovery rate of 0.05).

PART II: SYSTEMATIC REVIEW

Loneliness in young people with ADHD: A systematic review and meta-analysis

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Supervisors:

Dr. Matthew Hollocks and Professor Jennifer Lau Yun Fai

Second Reviewer:

Clarissa Odoi

Abstract

Background: There are often significant difficulties in social interactions and peer functioning in young people with Attention-Deficit/Hyperactivity Disorder (ADHD). Most studies focus on problematic peer functioning when assessing socio-emotional functioning in ADHD but loneliness, the subjective experience of social isolation or disconnection has been studied less. While some studies suggest higher levels of loneliness in individuals with ADHD, others suggest a similar or lower level with those without ADHD. A clearer understanding of the levels of loneliness in individuals with ADHD compared to those without would be informative because loneliness has been linked with increased mental health difficulties, both externalising and internalising symptoms. A better understanding of whether loneliness is elevated in individuals with ADHD and associated with mental health may shed light on whether loneliness should be targeted in future ADHD interventions. This systematic review and meta-analysis examined 1. the differences in loneliness levels between young people (below 25 years old) with ADHD and those without ADHD, and 2. the association between loneliness and mental health difficulties in young people with ADHD.

Methods: Six electronic databases were searched for relevant studies that met the inclusion criteria. Studies were appraised for quality using the QualSyst appraisal tool. A random effects meta-analysis was carried out to answer the first research question, while a narrative synthesis summarised the findings for the second review question.

Results: A total of 20 studies were included. The meta-analysis (n = 15) found that young people with ADHD reported significantly higher loneliness than young people without ADHD, with a small to medium weighted pool effect (Hedges' g = 0.41). For the second review question, the systematic review investigated the association between loneliness and mental health (n = 8) and found an association between loneliness and mental health difficulties in young people with ADHD; these ranged from *r* = 0.05 to 0.68. However as there were different mental health measures and a small number of studies, it was difficult to compare between studies.

Discussion: Across studies, there is evidence of higher loneliness in young people with ADHD compared to their peers without ADHD. Additionally, loneliness is associated with mental health difficulties, including externalising and internalising symptoms, depression, anxiety, and internet addiction scores. However, there were only eight studies exploring loneliness and mental health in ADHD, with different mental health domains. Given the

elevated level of loneliness in young people with ADHD compared to their peers without ADHD, and the potential association with mental health difficulties, further targeted research and interventions on loneliness in young people with ADHD is needed.

Table of Contents

List of Tables

List of Figures

1. Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a common neurodevelopmental disorder, with an estimated prevalence of between 5% to 13% in children and adolescence (Polanczyk et al., 2007; Thomas et al., 2015; Willcutt, 2012). It is typically characterised by inattention and/or hyperactivity-impulsivity, with the diagnostic criteria according to the Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-V) requiring six or more symptoms from the inattention and/or hyperactivity-impulsivity groups in two or more settings (American Psychiatric Association, 2013). The symptoms must be present before the age of 12 years old and interfere with functioning in school, work, or social life. As for the International Classification of Diseases 10th Revision (ICD-10), diagnosis (termed hyperkinetic disorder) requires presence of several symptoms from the three areas of attention deficit, hyperactivity and impulsivity (World Health Organization, 2019). ADHD has been consistently associated with numerous impairments in emotional, social, and academic functioning (Harpin, 2005; Paul, 2016; Wehmeier et al., 2010).

Young people with ADHD tend to experience difficulties in their social functioning and peer relationships (Hoza et al., 2005; McQuade & Hoza, 2008). They are rejected and victimised more by their peers compared to same-aged peers according to self-reports and reports from both parents and teachers (Bagwell et al., 2001; Hoza et al., 2005; Smit et al., 2020; Wehmeier et al., 2010). Young people with ADHD are also ranked lower on social preference and are less well-liked compared to their non-ADHD peers (Hoza et al., 2005; McQuade et al., 2018). These experiences have been attributed partly to the core symptoms of ADHD (hyperactivity/impulsivity and inattention) in addition to social skills deficits in some young people with ADHD such as negative/aggressive interactions, inattention, impatience when playing games, interrupting others, and potentially poor judgement of their own social behaviour (Capodieci et al., 2019; Cervantes et al., 2013; Hoza et al., 2005). They are, therefore, at higher risk of social isolation concurrently and in the future (Matthews et al., 2015).

1.1 Loneliness in ADHD

Many studies looking at social-emotional functioning in ADHD focus on social networks and peer functioning problems, with fewer research on young people's experience of and satisfaction with their relationships. This is an important distinction as loneliness, or perceived social isolation, is the subjective feeling of distress due to a perceived deficit in

the quantity and quality of one's social relationships (Peplau & Perlman, 1982). An individual may be objectively socially isolated but may not have a negative perception of their relationships and equally, someone may find their social relationships lacking despite having a large social network (Hawkley & Cacioppo, 2010). Thus, loneliness captures the individual's internal emotional state and is often a negative and distressing experience, possibly as a signal to avoid threats to social relationships and to motivate social repair. While loneliness is not an uncommon experience in young people, it has the potential to become a prolonged, debilitating condition (Hall-Lande et al., 2007; Heinrich & Gullone, 2006). As loneliness and social isolation (e.g., number of friends or size of social network) have been found to be weakly correlated (Coyle & Dugan, 2012), it is important to capture the loneliness experience of the young person rather than relying on just the objective measures of social isolation.

Loneliness is a public health concern with well-documented adverse effects on mental health (Cacioppo et al., 2002; Cacioppo & Cacioppo, 2018; Christiansen et al., 2021; Eccles et al., 2020), in addition to worsened physical health (Hawkley & Cacioppo, 2010; Holt-Lunstad et al., 2015). A systematic overview found associations between loneliness and poorer mental health outcomes, such as increased risk of depression, anxiety and suicidal ideation (Leigh-Hunt et al., 2017). In young people in the general population, increasing and chronic loneliness trajectories predict increases in depression, anxiety, self-harm and suicidal ideation (Heinrich & Gullone, 2006; Ladd & Ettekal, 2013; Qualter et al., 2013; Vanhalst et al., 2013). Given that both loneliness and ADHD are associated with many negative outcomes, it is important to better understand loneliness levels in young people with ADHD in order to inform future research and clinical directions in this area. This is especially pertinent in this population given that existing psychosocial interventions for ADHD often primarily focus on improving peer networks and relationships by targeting functional aspects such as social skills despite the limited efficacy (Morris et al., 2021), while overlooking the individual's loneliness. Furthermore, as loneliness and social isolation are distinct, strategies that target social isolation by increasing social participation and support have limited impact on loneliness (Meltzer et al., 2013).

While it is evident that young people with ADHD may have difficulties with social functioning and peer relationships, what is still unclear is whether they experience greater loneliness compared to their peers without ADHD. Langher and colleagues (2009) found that

children with ADHD reported higher levels of loneliness compared to gender- and age-matched peers without special needs, and similar levels of loneliness compared to peers with special needs. On the other hand, some studies have found that young people with ADHD did not report higher levels of loneliness compared to their peers. In Heiman's (2005) study, the loneliness levels between children with and without an ADHD diagnosis were found not to significantly differ, although their parents and teachers perceived children with ADHD to have higher levels of loneliness compared to parents and teachers of children without ADHD. Houghton (2015) corroborated the lack of association between ADHD diagnosis and self-reported loneliness in a gender- and age-matched sample of children with ADHD and without: in their sample, children and adolescents with ADHD did not report any significant difference compared to adolescents without ADHD in the four loneliness domains investigated (friendship loneliness, isolation loneliness, and positive and negative attitude towards solitude). Given both the many social-emotional difficulties consistently found in ADHD populations (Hoza et al., 2005) and research suggesting that loneliness is prevalent in populations with developmental conditions that substantially impact social difficulties in young people, such as in Autism Spectrum Disorder (Bauminger et al., 2003; Hymas et al., 2022; Lasgaard et al., 2010), these ambiguous findings are surprising. It is possible that some of these may arise from methodological differences between the studies. Therefore, it would be informative to systematically investigate whether loneliness is elevated in young people with ADHD.

There are factors that may impact the levels of loneliness reported in these studies and contribute to why some studies find differences in loneliness levels in young people with ADHD compared to those without ADHD and others do not, thus it would be important to examine potential moderators of loneliness. The demographic makeup of the studies' samples such as age, ethnicity and gender may be impacting the loneliness rates. Loneliness changes throughout the lifespan (Cohen-Mansfield et al., 2016; Heinrich & Gullone, 2006) and without taking into account age, loneliness patterns may be obscured. For example, Houghton (2015) measured loneliness in children and adolescence with ADHD but did not account for age differences. Both levels of loneliness (Mund et al., 2020; Shovestul et al., 2020) and ADHD symptoms tend to change with age (De Rossi et al., 2023), thus it is important to consider age. Furthermore, gender may influence loneliness experience in young people with ADHD as males and females with ADHD often present, and are

responded to differently; for example, despite displaying more behaviours that are less tolerable compared to females (e.g. hyperactivity and aggression), males with ADHD are tolerated more by their peers (Diamantopoulou et al., 2005). Additionally, studies involving young people with ADHD tend also to comprise predominantly of males (Heiman, 2005; Houghton et al., 2015; Langher et al., 2009) which may skew the loneliness findings. Referral sources may also impact reported loneliness levels as there may be important differences between clinical and community referred samples, such as the degree of impairment in ADHD, presence of comorbidities and representation of age groups (Bauermeister et al., 2007). Previous research suggested that the choice of loneliness measure may also impact on the reported loneliness levels: Houghton and colleagues (2020) recommended the use of multidimensional measures of loneliness that consider different elements of loneliness, such as friendship loneliness and isolation loneliness in the PALS, while some other studies employed unidimensional measures of loneliness (e.g. Heiman (2005)). Taken together, this suggests that having a clearer understanding of the loneliness levels in young people with ADHD and their possible moderators may be informative.

1.2 Loneliness and mental health in ADHD

The high comorbidity with mental health difficulties in ADHD has been well documented: comorbidities can be categorised into both internalising disorders/behaviours (e.g. anxiety, depression) and externalising disorders/behaviours (e.g. oppositional defiant disorder, conduct, aggression) (Elia et al., 2008; Jarrett & Ollendick, 2008; Lee et al., 2011; Ollendick et al., 2008; Pliszka, 2000; Tung et al., 2016). In both males and females, individuals with ADHD have higher odds for externalising than internalising comorbidities (Angold et al., 1999; Tung et al., 2016). As comorbidities are common in ADHD and can increase the long-term risk of elevated mental health symptoms (Newcorn et al., 2004) it is important to identify the association between loneliness and mental health difficulties in this population. One study demonstrated that not only are loneliness and depression elevated in adolescents with ADHD compared to their non-ADHD peers, but also that loneliness fully mediates the relationship between ADHD diagnosis and depression (Houghton et al., 2020). This suggests that loneliness plays a crucial part in the development of depression in ADHD. As loneliness and mental health difficulties have also been demonstrated to have bidirectional relationships in the general population, it is possible that similar associations are present in young people with ADHD (Lim et al., 2016; McDowell

et al., 2021). Given the negative impact of both loneliness and mental health difficulties, and the potential bidirectional effects which may contribute to further deterioration of mental health and loneliness, the relationship between loneliness and mental health difficulties in young people with ADHD is an important aspect to explore.

Currently, there does not seem to be a clear understanding of loneliness in children and adolescents with ADHD despite the increased risk of loneliness conferred by both the age group (Hawthorne, 2008; Ladd & Ettekal, 2013) and the prevalence of social difficulties (Becker et al., 2012; Elmose & Lasgaard, 2017). Given that the degree of loneliness experienced by young people with ADHD compared to young people without ADHD has not been, to date, reviewed systematically, it is essential to do so to synthesize findings across different studies and establish whether young people with ADHD are lonelier than their peers. In doing so, this review would also be able to identify the extent of the current research on loneliness in young people with ADHD, understand what studies there are in this area and highlight any gaps. A better understanding of the level of loneliness in young people with ADHD is crucial in informing future research in this field. Secondly, as loneliness has been linked with increased mental health difficulties in the general population (Cacioppo et al., 2006; Hawkley & Cacioppo, 2010; Loades et al., 2020), a better understanding of if, and how, loneliness is associated with mental health in ADHD may shed light on whether loneliness in this population should be targeted in future interventions.

1.3 This Review

To the best of our knowledge, there has been no systematic reviews focused on loneliness in young people with ADHD. The definition of young person in this review encompasses a mean age of up to 24 years old, in line with the World Health Organisation's definition of young people as between the ages of 10 and 24 (World Health Organization, 2019). Additionally, this age range corresponds more closely to the current conception of adolescent growth and the transition period from childhood to adulthood now occupies a larger range (Sawyer et al., 2018) and this study would be the first systematic review covering this topic. This review aims to synthesize findings from studies that explore loneliness in young people with ADHD.

1. Do young people with ADHD experience greater loneliness compared to young people without ADHD?

2. What is the association between loneliness and mental health difficulties (e.g. depression, anxiety, conduct disorder) in young people with ADHD?

If appropriate, meta-analyses will be conducted to address these questions. Further moderator analyses and meta-regressions will also be run, if there are enough studies, to assess the impact of gender, age, loneliness measure, study quality, and recruitment setting on the heterogeneity in the effect sizes.

2. Methods

2.1 Search Strategy

A protocol of this review was registered on PROSPERO on 2nd February 2022 and adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidance (Page et al., 2021). At the time of registration, there were no other similar systematic reviews or meta-analysis on PROSPERO and the Cochrane library.

The search terms were developed in discussion with researchers knowledgeable in the area of loneliness and neurodevelopmental disorders (JL and MH), and through scoping searches of other ADHD-related and loneliness-related systematic reviews. To identify relevant studies, combinations of the following terms were used: (("attention deficit hyperactivity disorder") OR ("attention deficit disorder with hyperactivity") OR ("attention deficit/hyperactivity") OR ("attention-deficit/hyperactivity disorder") OR (ADHD) OR (ADD) OR (ADDH) OR (ADHS) OR ("attention deficit disorder") OR (TDAH) OR (hyperkine*) OR ("hyperkinetic syndrome")) AND (("soc* isolation*") OR ("subject* isolation*") OR ("feeling* isolat*") OR ("lonel*")). Due to the high frequency of the term "social isolation" in research around peer rejection and exclusion in ADHD or more generally during the COVID pandemic lockdowns, it was decided that the search terms would be limited to specifically perceived social isolation or loneliness in the title, keyword or abstract. The following databases were searched: PubMed, SCOPUS, PsychINFO APA, Embase, Medline and Web of Science. The initial search was carried out on 7th February 2022. An updated search was carried out on 14th July 2023. To reduce the risk of missing relevant research, references of included papers and relevant reviews were also manually screened for relevant literature. Results were collated using EndNote library and duplicates were removed before exporting the references (including title and abstract) to Excel for screening. Titles and abstracts were screened according to relevance, with 20% of titles and abstracts also screened by an independent rater (CO). Full-text review of studies likely to meet the inclusion criteria were carried out and 20% of the full-text review was carried out by an independent rater (CO). Any discrepancies in the full-text review were discussed.

2.2 Eligibility Criteria

The inclusion and exclusion criteria for the first research question are listed in Table 1. The inclusion and exclusion criteria for the second research question are similar except that a non-ADHD control group is not required, and a measure of mental health difficulties

is required. The definition of intellectual disabilities used in this review follows that of DSM-V, which defines intellectual disabilities as neurodevelopmental disorders that begin in childhood and are characterised by deficits in intellectual functioning and adaptive functioning (American Psychiatric Association, 2013). Participants with learning disorders or difficulties, defined as having difficulties in learning and using specific academic skills than expected for age, schooling and IQ (American Psychiatric Association, 2013), are not excluded in this review. For this review, a broad definition of mental health outcomes is used and included any diagnosed psychopathology or symptoms of psychopathology. This includes disorder-specific measures that look at symptoms or presence of diagnosis (e.g., depression), and mental health measures that look at general externalising or internalising behaviours symptoms or behaviours.

2.3 Data Extraction

A data extraction table was created in Excel prior to extraction. The following information was extracted from the studies when available: authors, date, country, objectives, sample size, age and predominant ethnic group of the participants, IQ measure, ADHD measure, loneliness measure, mental health measure, key findings, and results. For multidimensional measures of loneliness, only factors and subscales directly related to loneliness will be extracted; factors and subscales related to other aspects such as aloneness (e.g. positive and negative feelings towards aloneness in the The Perth A-loneness Scale (Houghton et al., 2014) will not be extracted. When relevant results or statistics were not reported (such as the mean and standard deviation in comparison studies), authors of the studies were contacted to obtain the analysis. Given the number of studies for each research question, we performed a meta-analysis only for Research Question 1. For the meta-analysis, the means and standard deviations for loneliness in the ADHD groups and non-ADHD comparison groups were extracted from the studies.

Table 1

Inclusion and exclusion criteria for the primary review question

Inclusion	Exclusion
1. Published in English regardless of date and country 2. Published in peer-reviewed journals 3. Cross sectional or longitudinal quantitative studies 4. Reported participants with a categorical diagnosis of ADHD in accordance with DSM-III, DSM-III-R, DSM-IV, DSM-IV-TR, DSM-5, a categorical diagnosis of hyperkinetic disorder in accordance with ICD-9 or ICD-10 or symptomatic presentation of ADHD (scoring above threshold on ADHD symptom questionnaires with known psychometric properties e.g. ASRS) 5. Reported participants with mean age between 0-24 years old 6. Reported at least one self-reported or parent/teacher-reported measure (or subscale) of loneliness (or related concepts such as perceived social isolation e.g. UCLA Loneliness Scale (D. Russell et al., 1980) and Loneliness and Aloneness Scale for Children and Adolescents (Marcoen et al., 1987)	1. Qualitative studies or case studies 2. Participants in the ADHD group or the non-ADHD group had intellectual disabilities and/or other neurodevelopmental conditions such as Autism Spectrum Disorder 3. Studies did not include a non-ADHD control group

2.4 Quality Assessment

The quality of the eligible studies was evaluated using the QualSyst appraisal tool (Kmet et al., 2004). The QualSyst tool provides guidelines for assessing both quantitative and qualitative research papers and we used the quantitative scale for this review. The Qualsyst checklist consists of 14 questions covering different aspects such as the appropriateness of the study design, sample size, analytic methods and so on. Each study is

scored from 0 to 2 (0 = Not met, 1 = Partially met, 2 = Fully met and N/A = Not relevant). N/As are excluded from the total possible sum calculation. A summary score is then calculated for each study by calculating the total sum dividing it by the total possible sum. The possible summary scores range from 0 to 1, with higher scores indicating higher quality. The developers recommended a score of 0.75 on the QualSyst as a conservative cut-off for inclusion of studies, while a score of 0.55 being liberal. For this review, we chose a priori not to exclude any papers but to assess the quality and include it in the meta-regression. All eligible studies were rated by two raters and any discrepancies were discussed until consensus was reach.

2.5 Data Analysis

The meta-analysis will only be carried out on the first research question which is to compare loneliness levels in groups of young people with ADHD compared to young people without ADHD. The meta-analysis was conducted using RStudio (R Core Team, 2022) with the "metafor" package (Viechtbauer, 2010). Hedges *g* was chosen as the effect size for the standardised mean difference in this meta-analysis due to its higher accuracy with smaller sample sizes (less than 20). Hedges *g* of 0.2, 0.5 and 0.8 were considered small, medium and large effect sizes, respectively (Cohen, 1992). To account for differences between the studies (e.g., participant demographics and different loneliness measures), a random-effects model was applied.

For the meta-analysis, if papers report overlapping samples, the paper with the most relevant information will be included in the meta-analysis. For papers reporting separate groups, such as age or ADHD sub-types, they will be combined if possible. If this is not possible, the most relevant or largest group will be included. When studies report multiple loneliness scales or sub-scales, measures the capture peer or perceived social isolation (rather than familial or friendship) will be chosen to increase the validity of the effect size estimates.

For the second research question (association between loneliness and mental health difficulties in young people with ADHD), a meta-analysis was not conducted due to the broad nature and small number of studies included. Instead, a narrative synthesis summarising the findings of the studies will be conducted. The results will be presented in a table and discussed.

2.6 Heterogeneity

Cochran's *Q* and I^2 test statistics were carried out to assess heterogeneity and the percentage of variability of effect size due to heterogeneity, respectively. As a smaller number of studies in the meta-analysis can cause Cochran's *Q* test to have low power, an adjusted alpha level of 0.10 is used. For the I^2 test, the following rough guide will be used: 25% = low heterogeneity, 50% = moderate heterogeneity, 75% = high heterogeneity (Higgins et al., 2003).

2.7 Moderator Analysis

To assess sources of heterogeneity in the meta-analysis, moderator analyses were carried out including subgroup analysis and meta-regression for categorical and continuous variables respectively (Borenstein et al., 2010). Sub-group analysis was carried out when each category had at least five studies. The following characteristics were explored: age and age category, gender (percentage of males), study quality, loneliness measure used, and recruitment setting.

3. Results

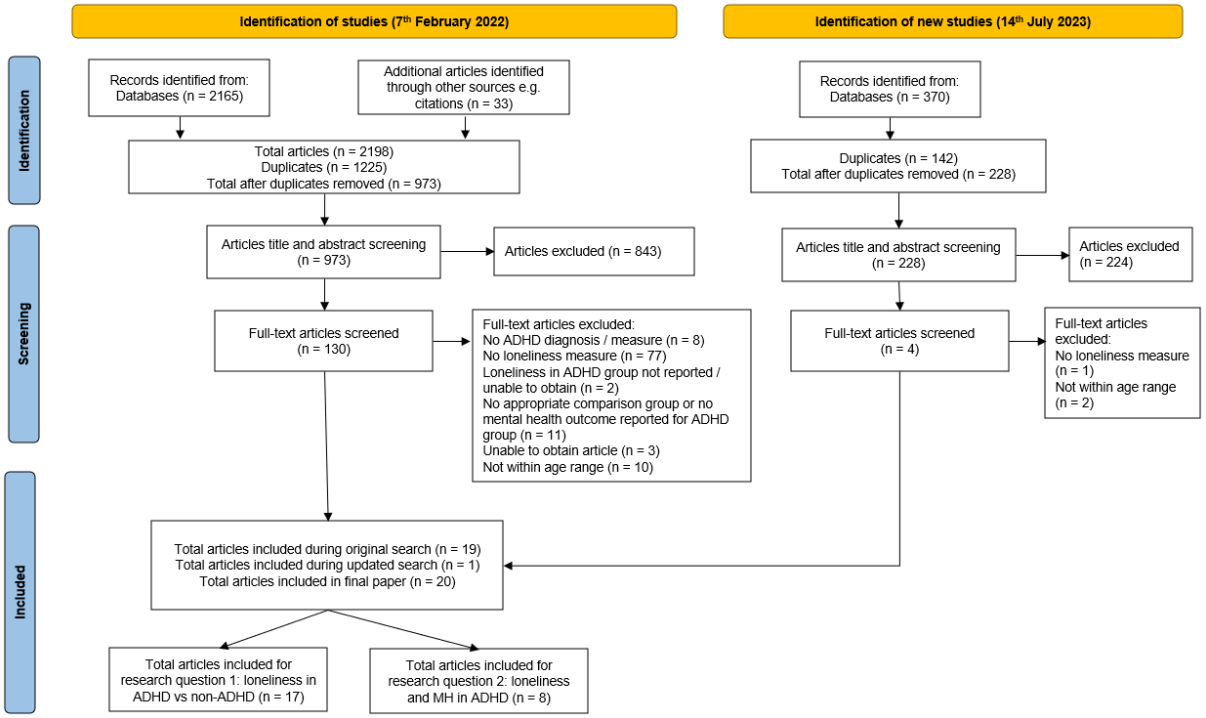
3.1 Study Methodology and Quality

Results from the initial database search on 7th February 2022 (*n* = 2165) were exported into EndNote Web and duplicates were removed, before exporting the references to Microsoft Excel for title and abstract screening. All titles and abstracts (*n* = 973) were screened according to relevance and 20% of the titles and abstracts were screened by an independent rater, with substantial agreement (*n* = 195, κ = .78). Full-text review of studies likely to meet the inclusion criteria were carried out (*n* = 130) by the first author and 20% of the full-text review was replicated by the independent rater (*n* = 27, κ = 0.88). Any discrepancies in the full-text review were discussed, resulting in 19 studies included. An updated search was carried out on 14th July 2023 and the results were exported into EndNote Web (n = 370) and after duplicates were removed, the titles and abstracts of the remaining were screened (n = 228) which resulted in the addition of 1 study. The overall literature search process is summarised in the Figure 1 (Moher et al., 2009; Page et al., 2021).

A total of 20 studies are included in this paper: 17 studies included comparisons of levels of loneliness in ADHD versus non-ADHD (Research Question 1). For research question 1, a meta-analysis was carried out and 15 of the 17 studies were included in the meta-analysis. As Houghton et al. (2022) and Houghton et al. (2020) had overlapping samples, only Houghton et al. (2020) was included in the meta-analysis because it contained more relevant information (e.g. number of males in the groups). One study was excluded from the meta-analysis as it did not report relevant necessary information (e.g. mean and standard deviation of the groups) to be included in the meta-analysis (Heiman, 2005). For Research Question 2, eight studies measured the association between loneliness in young people with ADHD and mental health difficulties. Due to the small number of studies investigating different mental health difficulties, a systematic review will be carried out to explore Research Question 2.

Figure 1

PRISMA flow diagram



In terms of the quality assessment, scores of the papers in this review ranged from 0.64 to 0.91 (see Appendix A). Many of the studies recruited from schools or clinics. All studies included in this review was assessed independently by two raters. Any discrepancies in quality appraisal scores were discussed. The intra-class correlation coefficient showed good agreement between the raters (κ = 0.88; 95% *CI* [0.68, 0.95]). The studies were generally rated highly on clearly reporting their aims, analysis, and results, and had appropriate study designs and analyses for the studies' aims. Most studies appeared to have appropriate sample sizes although some were underpowered to detect small effect sizes. Three studies had less than 30 participants per group when comparing ADHD and non-ADHD samples (Capodieci et al., 2019; Elmose & Lasgaard, 2017; Heiman, 2005). The majority of the studies sampled from a limited number of schools or clinical services. Due to the non-randomised nature of the studies, they did not score highly for controlling for confounds but most studies did account for some amount of confounding, such as using age- and gender-matched samples.

3.2 Systematic Review for Research Question 1: Do young people with ADHD experience greater loneliness?

Research question 1: Study Characteristics

Table 2 summarises the study and sample characteristics of the studies comparing loneliness in ADHD and non-ADHD samples. All studies except for Heiman (2005) provided means and standard deviations for loneliness in both ADHD and non-ADHD groups. Studies were conducted across eight countries, predominantly in Western countries and Israel. Seven studies provided information on intellectual or cognitive functioning. Besides three studies that were longitudinal (Houghton et al., 2022; Matthews et al., 2019; Meinzer et al., 2013), all other studies were cross-sectional in nature.

Overall, the sample size for participants with ADHD was 1253 participants, and for the non-ADHD control group was 5028 participants. Included in the count are two studies with overlapping samples (42 ADHD participants and 42 non-ADHD participants, Houghton et al. (2020); 76 ADHD participants 238 and non-ADHD participants, Houghton et al. (2022)). In terms of age, the range of the means in the overall samples of the studies (as some studies did not report age broken down by groups) was between 9.72 to 22.5 years old. Six studies included predominantly children (mean age < 12 years old), nine with predominantly adolescents and young adults (mean age >= 12 years old) and two including both children and adolescents. There was a much higher representation of males in the ADHD sample in 10 studies, a higher representation of females in one study and the gender distribution for the ADHD sample was not reported in three studies. Few studies reported ethnicity (n = 4), with two reporting predominantly White/Caucasian samples, one reported all Greek, one predominantly Black and one with predominantly no ethnic affiliation. The ADHD participants in Al-Yagon's (2009; 2016) studies were diagnosed with learning disabilities according to DSM-IV-TR and had average IQ and lower achievements on standardised testing than expected for age, schooling and level of intelligence (American Psychiatric Association, 2000).

Research question 1: Outcomes

Table 2 details the measures and outcomes for the studies comparing loneliness levels in ADHD and non-ADHD samples (see Appendix B for information about the loneliness scales). Of the 17 studies, participants in the ADHD group either had previous formal diagnoses of ADHD or were diagnosed using clinician or self-/parent-reported DSM or ICD

diagnostic codes or interviews in all but two studies (Capodieci et al., 2019; Koutra & Kokaliari, 2022). Capodieci et al. (2019) used informal interviews with teachers and parents, and a cut-off point on at least one of the two inattention and hyperactivity subscales of the teacher-report SDAI (Marzocchi & Cornoldi, 2000) to inform their ADHD grouping but the participants were not formally diagnosed with ADHD. Koutra and Kokaliari (2022) used a cut-off point of above 4 points on the ASRS, although some of their participants had a formal diagnosis of ADHD. For loneliness measures, the most commonly used measure of the 17 studies that compared loneliness rates were both the Children's Loneliness and Social Dissatisfaction Scale (CLSD; Asher et al. (1984)), including the different variations and adaptations, and the University of California, Los Angeles Loneliness Scale (UCLA; Russell et al. (1978)), including its different variations and adaptations, with five studies each. All studies used self-report questionnaires to measure loneliness in young people except for one which only measured parent-reported loneliness (Laslo-Roth et al., 2021). Heiman (2005) reported both self-reported loneliness in young people, and parent- and teacher-reported loneliness of the young people.

Of the 17 studies, nine studies reported significantly higher loneliness levels in the ADHD group compared to the non-ADHD group, four reported no significant difference between the groups, three studies did not test for significance, and one study (Deckers et al., 2017) reported significantly lower levels of loneliness in the ADHD group compared to the non-ADHD group in their adolescence group but no significant difference in their child group. Two of the studies that reported significantly higher loneliness levels in the ADHD group shared overlapping samples (Houghton et al., 2020; Houghton et al., 2022) and only the former was included in the meta-analysis as it reported more relevant information, such as age and gender breakdown of the groups. All studies that included parent-reported and teacher reported loneliness reported significantly higher loneliness scores compared to reports from parents and teachers of non-ADHD young people.

Table 2

Summary of studies comparing loneliness in ADHD and non-ADHD group (Research Question 1)

Authors (Year); Country	Sample size *n* (male)	Age *M* (*SD*)	Ethnicity	IQ	Study Quality	ADHD Measure	Loneliness Measure	ADHD loneliness score *M* (*SD*)	n-ADHD loneliness score *M* (*SD*)	Key Findings
Al-Yagon (2009); Israel	ADHD-LD: 59 (42) TD: 59 (40)	ADHD-LD: nr TD: nr Overall: 10.05 (1.05)	nr	Average IQ	0.77	Previously diagnosed with both LD and ADHD through psychoeducational and neurological/psychiatric evaluations, according to DSM-IV-TR.	CLSD (Hebrew adaptation)	37.00 (15.16)	26.64 (10.00)	Children with comorbid LD and ADHD reported higher loneliness than children without LD and ADHD, $F(1,114) = 16.90$, $p < 0.001$.
Al-Yagon (2016); Israel	ADHD-LD: 91 (41) LD: 90 (40) TD: 98 (45)	ADHD-LD: nr LD: nr TD: nr	nr	Normal level, according to WISC-IV	0.82	Previous ADHD diagnosis based on DSM-IV-TR using clinical	PNDLS	Peer-network loneliness: 15.09 (5.50) Peer-	LD; Peer-network loneliness: 14.09 (4.34) Peer-dyadic	Peer network loneliness: ADHD-LD group reported higher loneliness compared to TD, $F(2, 277) = 5.67$, $p < 0.01$, $\eta^2 = .04$. No sig. difference

Authors (Year); Country	Sample size *n* (male)	Age *M* (*SD*)	Ethnicity	IQ	Study Quality	ADHD Measure	Loneliness Measure	ADHD loneliness score *M* (*SD*)	n-ADHD loneliness score *M* (*SD*)	Key Findings
		Overall: 15.94 (0.70) no sig. diff between the groups				interview, computerised tests and widely used measures of ADHD symptom. Diagnosis validated by document check.		dyadic loneliness: 13.33 (4.92)	loneliness: 13.48 (5.45) TD; Peer-network loneliness: 12.87 (3.70) Peer-dyadic loneliness: 11.43 (3.42)	between ADHD-LD and LD, and LD and TD. Peer dyadic loneliness: Comparing all 3 groups, $F(2, 277) = 5.67$, $p < 0.01$, $\eta^2 = .04$. ADHD-LD = LD > TD
Capodieci et al. (2019); Italy	ADHD: 21 (13) N-ADHD-Low-social skills: 21 (13)	ADHD: 9.72 (1.34) N-ADHD-Low-social skills: 9.72 (1.34)	nr	nr	0.68	Informal interviews with teachers and parents; >= 14 on SDAI Controls were matched for control items on the SDAI	CLSD (Italian adaptation)	83 (10)	Control with weak social skills: 81 (10) Control with normal social skills: nr	There is no difference in loneliness between the ADHD group and the control group with weak social abilities, $F = 0.15$ $p = .698$, $\eta^2 = .004$. No differences were found in loneliness levels between ADHD, N-ADHD with low social skills, and N-ADHD with normal

Authors (Year); Country	Sample size *n* (male)	Age *M* (*SD*)	Ethnicity	IQ	Study Quality	ADHD Measure	Loneliness Measure	ADHD loneliness score *M* (*SD*)	n-ADHD loneliness score *M* (*SD*)	Key Findings
						scale, and sociability on the COM scale				social skills. All children showed a high level of perceived loneliness.
Deckers et al. (2017); Netherlands	ADHD: 76 (54) n-ADHD: 106 (62)	ADHD: Combined = 11.79 (2.48) Child = 9.61 (1.13) Adolescent = 13.75 (1.55) n-ADHD: Combined = 11.61 (2.63) Child = 9.31 (1.26) Adolescent = 14.00 (1.10)	Predominant Caucasian	Excluded if Severe cognitive (i.e., estimated IQ <70) or language impairments.	0.82	Diagnosed by a multidisciplinary team (interview, psychiatric examination, psychological assessment, observations)	LACA (only relationships with peer subscale was used in the study)	Child: 19.54 (7.98) Adolescent: 15.48 (3.35) Combined: 17.403 (6.302)	Child: 20.32 (6.14) Adolescent: 18.12 (4.58) Combined: 19.241 (5.517)	In the Child group, no sig diff between ADHD or control. In adolescents, sig diff: control > ADHD In ADHD and control group, children reported sig higher levels of loneliness than adolescents.

Authors (Year); Country	Sample size *n* (male)	Age *M* (*SD*)	Ethnicity	IQ	Study Quality	ADHD Measure	Loneliness Measure	ADHD loneliness score *M* (*SD*)	n-ADHD loneliness score *M* (*SD*)	Key Findings
Elmose & Lasgaard (2017); Denmark	ADHD: 25 (25) n-ADHD: 199 (199)	ADHD: 14.6 (1.04) n-ADHD: 14.1 (0.43)	nr	IQ > 70	0.72	Diagnosis based on ICD-10 criteria for F90 Hyperkinetic disorder and to be without intellectual disability	UCLA (Danish version)	37.6 (7.94)	37.69 (10.23)	No group difference was found in loneliness between adolescents with ADHD and adolescents from regular schools, *p* = ns.
Heiman (2005); Israel	ADHD: 39 (31) n-ADHD: 17 (12)	ADHD: 11.2 (2.05) n-ADHD: 10.2 (1.10)	nr	88 - 120; no profound develop mental or psychiatr ic disorder	0.64	Diagnosed between the age of 5.5 to 10 using: WISC-III, parent interview based on DSM-IV; above 15 on teacher-rating on CRS	CLSD (Hebrew version)	nr	nr	ADHD group not significantly lonelier than n-ADHD group, *p* = ns. Parents and teachers of children with ADHD rated children significantly lonelier than parents, $F(1, 56) = 16.43$, $p < 0.001$, and teachers, $F(1, 56) = 20.21$; $p < 0.001$, of children without ADHD.

Authors (Year); Country	Sample size *n* (male)	Age *M* (*SD*)	Ethnicity	IQ	Study Quality	ADHD Measure	Loneliness Measure	ADHD loneliness score *M* (*SD*)	n-ADHD loneliness score *M* (*SD*)	Key Findings
Houghton et al. (2015); Australia	ADHD: 84 (74) n-ADHD: 84 (73)	ADHD: 15.2 (2.43) n-ADHD: 15.3 (2.49)	63% none 26% Anglo Saxon/European 4% Asian 5% Other	nr	0.82	Previous diagnosis meeting DSM-IV-TR criteria.	PALs	Isolation loneliness: 1.77 (0.12) Friendship loneliness: 4.53 (0.16)	Isolation loneliness: 1.69 (0.11) Friendship loneliness: 4.52 (0.15)	No difference between groups on isolation loneliness, $F(1, 166) = 1.41$, $p = .236$, partial $\eta^2 = 0.009$, and friendship loneliness, $F(1, 166) = 0.012$, $p = .914$, partial $\eta^2 = 0.001$.
[1]Houghton et al. (2020); Australia	ADHD: 42 (32) Control: 42 (32)	ADHD: 13.01 (2.0) Control was age-matched	nr	nr	0.73	Previously diagnosed by a paediatrician / child psychiatrist as meeting DSM-IV-TR or DSM-5 criteria for ADHD.	PALs	Isolation loneliness: 13.45 (6.71) Friendship loneliness: 23.76 (7.76)	Isolation loneliness: 10.33 (4.26) Friendship loneliness: 28.17 (5.84)	Adolescents with ADHD had lower quality of friendships, $F(1, 78) = 8.43$, $p = .005$, $\eta 2 = 0.10$, and greater feelings of isolation, $F(1, 78) = 8.99$, $p = .003$, $\eta^2 = 0.10$.
[1]Houghton et al.	ADHD: 76 (nr)	ADHD: nr	nr	nr	0.77	Previously diagnosed by a	PALs	*Isolation loneliness:	*Isolation loneliness: 10.55 (4.93)	Adolescents with ADHD compared to controls, reported

Authors (Year); Country	Sample size *n* (male)	Age *M* (*SD*)	Ethnicity	IQ	Study Quality	ADHD Measure	Loneliness Measure	ADHD loneliness score *M* (*SD*)	n-ADHD loneliness score *M* (*SD*)	Key Findings
(2022); Australia	n-ADHD: 238 (131)	n-ADHD: 13.52 (1.44)				paediatrician or child psychiatrist as meeting DSM-IV-TR or DSM-5 criteria for ADHD.		11.89 (6.20)		higher isolation loneliness (B = 2.14, p = .009) and lower friendship quality (B = 3.03, p = .002).
Koutra & Kokaliari (2022); Greece	ADHD: 67 n-ADHD: 295	Overall: 22.5 (5.5)	Overall: 352, 100% Greek	nr	0.77	>4 on ASRS	UCLA	28.7 (15.7)	20.2 (13.4)	The ADHD group reported significantly higher loneliness scores than the n-ADHD group (U =6760, z = –4.01, p < .001)
Langher et al. (2009); Italy	ADHD: 31 (25) No special needs: 31 (25)	ADHD: Primary = 23 Low Secondary = 8 No special needs: Primary = 23	nr	nr	0.68	Diagnosed by local health department. All hyperactive form.	CLSD	38.52 (14.56)	31.94 (9.71)	Children with ADHD reported greater loneliness than children with no special needs, F(1,90) = 4.75, p = .03.

Authors (Year); Country	Sample size *n* (male)	Age *M* (*SD*)	Ethnicity	IQ	Study Quality	ADHD Measure	Loneliness Measure	ADHD loneliness score *M* (*SD*)	n-ADHD loneliness score *M* (*SD*)	Key Findings
		Low Secondary = 8								
Laslo-Roth et al. (2020); Israel	*Under 24: ADHD: 34 (6) n-ADHD: 146 (15)	*Under 24: ADHD: nr N-ADHD: nr Overall: 22.01 (1.20)	nr	nr	0.82	Previously diagnosed (psychiatrist / psychologist). Documentation confirmed.	UCLA (short version)	*1.98 (1.28)	*2.03 (0.99)	*There were no significant differences found between the loneliness scores of YP with ADHD vs without ADHD, $t(178) = -0.27$, $p = .78$.
Laslo-Roth et al. (2021); Israel	ADHD: 166 (118) n-ADHD: 114 (65)	ADHD: 9.89 (2.20) n-ADHD: 9.33 (2.45)	nr	nr	0.82	Previously diagnosed (psychiatrist /psychologist).	Parent-reported loneliness: "How often does your child seem lonely to you?"	2.93 (1.35)	2.39 (1.09)	Parents of children with ADHD (compared to without) reported their children to have higher levels of loneliness, $F(3, 276) = 9.07$, $p < .01$, Partial $\eta^2 = .032$.

Authors (Year); Country	Sample size *n* (male)	Age *M* (*SD*)	Ethnicity	IQ	Study Quality	ADHD Measure	Loneliness Measure	ADHD loneliness score *M* (*SD*)	n-ADHD loneliness score *M* (*SD*)	Key Findings
Martin et al. (2019); USA	ADHD: 199 (199) n-ADHD: 74 (74)	ADHD: 9.8 (1.3) n-ADHD: 10.0 (1.3)	ADHD, n-ADHD: Caucasian 83, 65% African American 12, 24% Other/mixed 5, 11 %	nr	0.77	Formally diagnosed: DSM-III-R; parent and teacher versions of the DBD and the parent DBD structured interview	CLSD	2.09 (0.83)	1.87 (0.64)	Tests of difference and significance not reported.
Matthews et al. (2019); UK	At age 18, ADHD: 162 (nr) n-ADHD: 1904 (nr)	At age 18, ADHD: nr n-ADHD: nr Overall: 18.4 (0.36)	nr	Overall: Age 5 on WPPSI-R: 100 (15)	0.86	Past-year diagnosis: DSM-IV or DSM-V criteria	UCLA (Version 3)	2.71 (2.28)	1.47 (1.88)	Tests of difference and significance not reported.
Meinzer et al. (2013); USA	T1: *ADHD: 40 (nr) NT: 1467 (nr)	T1: ADHD: nr NT: nr	T1: 62% Black, 36% White,	nr	0.91	K-SADS-PL at Time 1	UCLA (8-item version)	*17.62 (5.28)	*14.98 (4.22)	Tests of difference and significance not reported.

Authors (Year); Country	Sample size *n* (male)	Age *M* (*SD*)	Ethnicity	IQ	Study Quality	ADHD Measure	Loneliness Measure	ADHD loneliness score *M* (*SD*)	n-ADHD loneliness score *M* (*SD*)	Key Findings
	Overall: 1709 (803)	Overall: 16.6 (1.2)	1% Hispanic, 1% 'other'							
Tracey & Gleeson (1998); Australia	ADHD-PI: 22 (18) ADHD-PHI: 19 (17) n-ADHD: 43 (21)	ADHDPI: 14.04 (2.14) ADHDPHI: 13.07 (2.66) n-ADHD: 14.29 (2.66)	nr	Score >70 on PPVT-R	0.68	Previous diagnosis based on DSM-III	LACAYAS (study only used Peer-related loneliness subscale)	ADHD-PI: 33.9 (10.6) ADHD-PHI: 34.1 (9.2)	28.6 (7.5)	ADHD-PI and ADHD-PHI reported significantly more peer-related loneliness than non-ADHD, $p < 0.05$.

Note. [1]Studies shared overlapping sample. *Relevant sub-sample obtained from author(s) as not reported in the original paper.

Abbreviations: ADHD = Attention-Deficit/Hyperactivity Disorder; ADHD-PI = Attention-Deficit/Hyperactivity Disorder-Predominantly Inattentive; ADHD-PHI = Attention-Deficit/Hyperactivity Disorder-Predominantly Hyperactive; ASD = Autism Spectrum Disorder; IQ = Intelligence Quotient; LD = Learning Disability; n-ADHD = non-Attention-Deficit/Hyperactivity Disorder; NDD = Neurodevelopmental Disorder; nr = not reported; ns = not significant; T1 = Time 1; TD = Typical Development.

Measures: ASRS = Adult ADHD Self-Report Scale (Kessler et al., 2005); CLSD = Children's Loneliness and Dissatisfaction Scale (Asher & Wheeler, 1985); CLSD Hebrew adaptation (Margalit, 1991); CLSD Italian adaptation (Casiglia et al., 1998); COM = Comorbidity teacher's report scale (Marzocchi et al., 2010); CRS = Conners Rating Scale (Conners, 1997); DBD = Disruptive Behavior Disorders Rating Scale (Pelham et al., 1992); Parent DBD structured interview (Pelham, 1994); DSM-5 = The Diagnostic and Statistical Manual of Mental Disorders - Fifth Edition (American Psychiatric Association, 2013); DSM-IV = Diagnostic and Statistical Manual of Mental Disorders - Fourth Edition (American Psychiatric Association, 1994); DSM-IV-TR = Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition Text Revision (American Psychiatric Association, 2000); ICD-10 = 10th revision of the International Statistical Classification of Diseases and Related Health Problems (World Health Organization, 2016); K-SADS = Schedule for Affective Disorders and Schizophrenia for School-Age Children (Kaufman et al., 1997); LACA = Loneliness and Aloneness Scale for Children and Adolescents (Marcoen et al., 1987); LACAYAS = The Loneliness Among Children and Young Adolescents Scale (Marcoen & Brumagne, 1985); PALs = The Perth A-loneness Scale (Houghton et al., 2014); PNDLS = Peer Network and Dyadic Loneliness Scale (Hoza et al., 2000); PPVT-R = Peabody Picture Vocabulary Test – Revised (Dunn & Dunn, 1981); SDAI = ADHD Rating Scale for Teachers (Marzocchi & Cornoldi, 2000); UCLA Loneliness Scale (Russell et al., 1978); UCLA Loneliness Scale Danish Version (Lasgaard, 2007); UCLA short version (Russell et al., 1980); UCLA Version 3 (Russell, 1996); UCLA Version 8-item version (Roberts et al., 1993); WISC-IV = Wechsler Intelligence Scale for Children – Fourth Edition (Wechsler, 2003); WPPSI-R = Wechsler Preschool and Primary Scale of Intelligence-Revised (Wechsler, 1990);

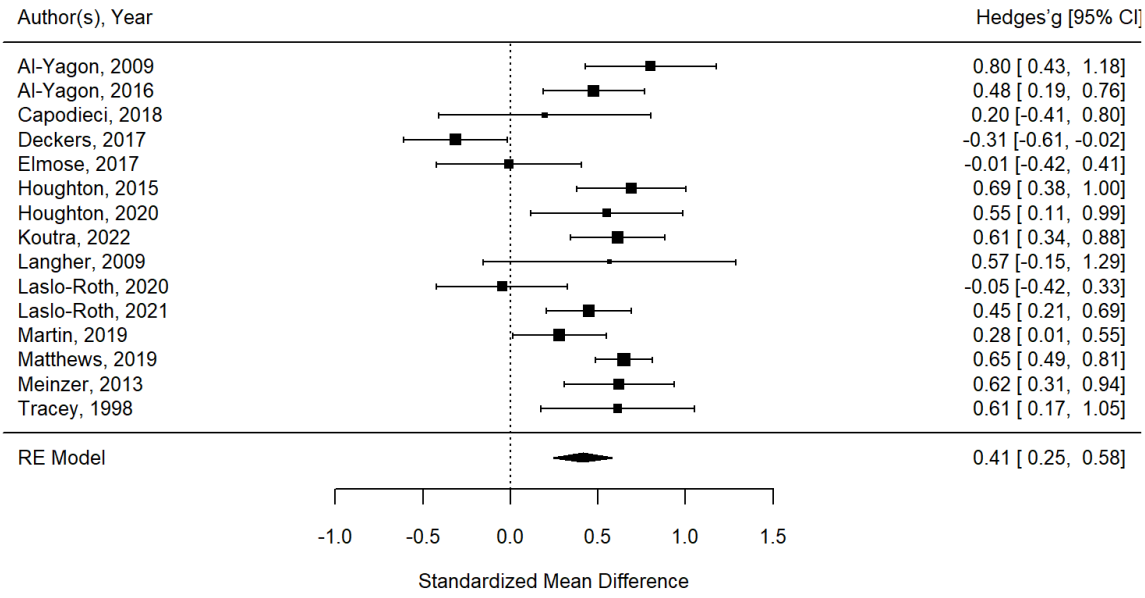
3.3 Meta-Analysis for Research Question 1: Do young people with ADHD experience greater loneliness?

For the purposes of the meta-analysis, the two ages groups in Deckers et al. (2017) were combined. Two studies (Houghton et al., 2015, 2020) used the PALs, which included more than one subscale for loneliness, so the isolation loneliness subscale was chosen. Similarly, the peer-network loneliness subscale of the PNDLS in Al-Yagon (2016) was included in the meta-analysis. Additionally, Al-Yagon's (2016) study compared the ADHD (with LD) group with a group without ADHD but with LD, and a TD group. The meta-analysis included the comparison between the ADHD-LD group and the TD group. The two ADHD subtype groups (ADHD-PI and ADHD-PHI) in Tracey & Gleeson (1998) were combined into an overall ADHD group for the meta-analysis.

Figure 2 displays the standardized mean difference for the individual studies in the meta-analysis. Young people with ADHD reported significantly higher loneliness than young people without ADHD, with a small to medium weighted pool effect, Hedges' g = 0.41, 95% CI [0.25, 0.58]; z = 4.83, p < .001.

Figure 2

Forest plot for meta-analysis on comparison of loneliness levels between ADHD and non-ADHD group



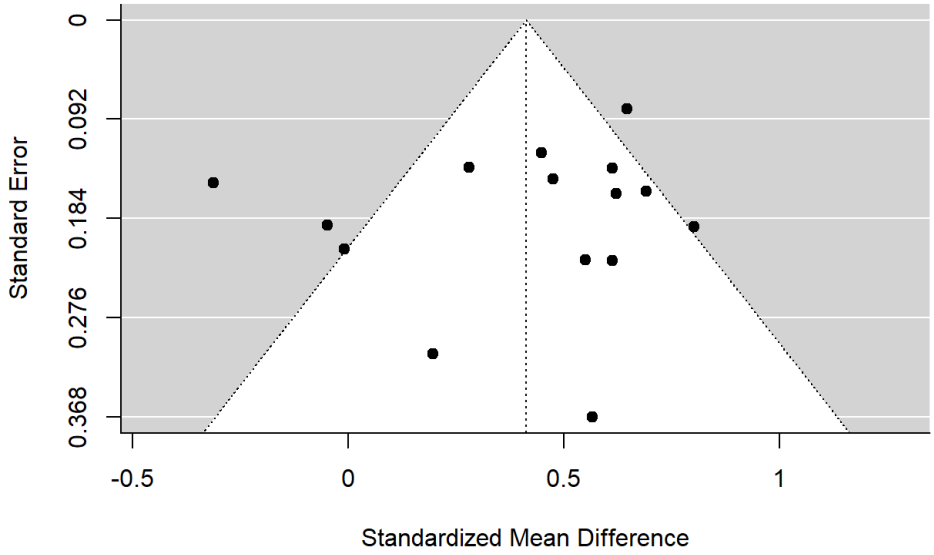
In the meta-analysis, significant heterogeneity was found: $Q(14) = 52.5$, $p < .001$. The I^2 suggested high heterogeneity, $I^2 = 75.1\%$, 95% CI [50.1%; 89.8%]. The influence of the studies included were assessed using "leave-one-out" analysis to demonstrate the heterogeneity contributed by the studies included. One study (Deckers et al., 2017) was identified as an outlier and contributed around 20% of the heterogeneity found between studies (see Appendix C for leave-one-out analysis). A sensitivity analysis was run, excluding the study, which produced a larger weighted pool effect (Hedges' $g = 0.48$, 95% CI [0.35, 0.61]; $z = 7.37$, $p < .001$) and moderate heterogeneity, $I^2 = 52.64\%$, 95% CI [15.40%, 81.13%]; $Q(13) = 26.43$, $p = .015$.

Moderator analyses were also carried out to explore heterogeneity. Across the studies included in the meta-analysis, there were different loneliness measures used, none of which were used in enough studies to warrant a sub-group analysis; the most frequently used measure was the UCLA ($n = 5$)followed by the CLSD (n = 4). The following subgroup analyses were found to be non-significant: age group (child, adolescent), $Q(1) = 0.00$, $p = 982$; and, setting (community, clinical), $Q(1) = 2.12$, $p = .146$. For the age subgroup analysis, the category "both child and adolescent" was excluded as it had less than five studies. Additionally, meta-regression analyses indicated that the following were not significant moderators of effect-size: study quality, $Q(1) = 2.12$, $p = .146$; percentage of males in the ADHD group, $Q(1) = 0.43$, $p = .511$; and the mean age of the ADHD group, $Q(1) = 0.002$, $p = .967$. 12 studies provided information on participant's gender by group, and all but two studies provided the mean and standard deviations of the participants' ages in the ADHD group.

The funnel plot (Figure 3) indicates potential asymmetry in the effect sizes of the studies, with four studies falling outside of the 95% confidence intervals, however, neither Egger's regression test ($p = .726$) nor the Rank Correlation Test ($p = .697$) were significant, indicating that the likelihood of publication bias was low.

Figure 3

Funnel plot for meta-analysis on comparison of loneliness levels between ADHD and non-ADHD group



3.4 Systematic Review for Research Question 2: What is the association between loneliness and mental health difficulties in young people with ADHD?

Research Question 2: Study Characteristics

Table 3 summarises the studies exploring the associations between loneliness and mental health difficulties in young people with ADHD. All studies were cross-sectional except for three which were longitudinal (Houghton et al., 2022; Meinzer et al., 2013; Sciberras et al., 2022). There were 781 participants overall, including two overlapping studies (Houghton et al., 2020; Houghton et al., 2022). The mean age of the young people ranged from 8.58 to 22.56 years old, although some studies did not specifically report the ages of the ADHD participants (Al-Yagon, 2016; Houghton, Kyron, Lawrence, et al., 2022; Meinzer et al., 2013). Two studies had an approximately equal distribution of genders (Al-Yagon, 2016; Li et al., 2016), four studies had a larger proportion of male participants (Deckers et al., 2017; Houghton et al., 2020; Sciberras et al., 2022; Smit et al., 2020), and two studies did not report gender specifically for the ADHD sample (Houghton, Kyron, Lawrence, et al., 2022; Meinzer et al., 2013). Three studies reported ethnicity for the overall

sample, with two having predominantly White participants (Deckers et al., 2017; Smit et al., 2020) and one with predominantly Black participants (Meinzer et al., 2013). Of the eight studies, ADHD was previously formally diagnosed or was diagnosed using clinician or self-/parent-reported DSM or ICD diagnostic codes or interviews in all but one study which classified their ADHD participants using the Adult ADHD Self-Report Scale Chinese version (Gau et al., 1997; Kessler et al., 2005) if they scored higher than 17 on either of the subscales (Li et al., 2016). Six different loneliness measures were used across the eight studies included, with the The Perth A-loneness Scale (PALS; (Houghton et al., 2014) and UCLA Loneliness Scale (UCLA; Russell et al., 1978) being the most frequently used loneliness measures with two studies each. As for measures of mental health, all the studies employed different measures except two studies who had overlapping samples (Houghton et al., 2020; Houghton et al., 2022). Measures including both internalising and externalising disorders or symptoms were included in three studies (Al-Yagon, 2016; Houghton et al., 2022; Smit et al., 2020), depression measures were included in four studies (Houghton et al., 2020; Houghton et al., 2022; Meinzer et al., 2013; Sciberras et al., 2022), anxiety measures were included in two studies (Deckers et al., 2017; Sciberras et al., 2022), and internet addiction was included in one study (Li et al., 2016).

Research Question 2: Outcomes

Externalising. Houghton et al. (2022) found significant correlations between loneliness and externalising symptoms (e.g. conduct difficulties) on the SDQ. In a sample of clinically diagnosed children with ADHD aged 6-11 years old, Smit et al. (2020) found significant correlations between loneliness and externalising disorder (parent-endorsed ODD or CD on the K-SADS) in males but not in females. After controlling for gender, age, and internalising disorders, externalising disorders were not associated with loneliness. In Al-Yagon's (2016) study, neither peer-network loneliness nor peer-dyadic loneliness were significantly associated with externalising behaviour (e.g. delinquency and aggressiveness) on the YSR.

General Internalising. Two studies found significant correlations between loneliness and internalising behaviours or symptoms (Houghton et al., 2022; Smit et al., 2020). Smit et al.'s (2020) study found that internalising disorders on the K-SADS, which covered endorsement of any anxiety or depressive disorder, had significant positive correlations with loneliness after controlling for gender, age and externalising disorders. Houghton et al

(2022) used the internalising scale on the SDQ, which covered emotional and peer problems, and found that internalising behaviours had significant positive correlations with isolation loneliness and friendship loneliness. One study found that internalising symptoms (e.g. withdrawal and anxiety/depression) on the YSR was only significantly associated with peer-network loneliness but not peer-dyadic loneliness (Al-Yagon, 2016).

Depression. Three studies explored the association between loneliness and depression (Houghton et al., 2020; Houghton et al., 2022; Meinzer et al., 2013). Houghton et al. (2020)'s study explored to what extent loneliness explained the relationship between ADHD diagnosis and depressive symptoms. They found, in adolescents with ADHD, significant positive correlations between isolation loneliness and depression, and negative correlations between friendship loneliness (having reliable, supportive friends) and depression. Furthermore, after controlling for age and gender, friendship and isolation related loneliness fully mediated the association between depression and ADHD symptoms. Houghton et al. (2022), which shared an overlapping sample with Houghton et al. (2020), also found significant positive correlations between isolation loneliness and depression. One study reported small-to-medium correlations (significance unreported) between loneliness and sad/depressed symptoms before COVID and an increased effect size during COVID (May 2020) in children and adolescents (Sciberras et al., 2022). Meinzer et al. (2013) found that loneliness levels in mid-adolescence predicted the onset of Major Depressive Disorder in early adulthood in ADHD. This study also looked at whether ADHD status, loneliness and other predictors were significantly associated with MDD onset in adolescents and found that ADHD diagnosis remained as a significant predictor for MDD onset after controlling for loneliness, gender, other psychiatric disorders, life stress, coping skills and academic impairment.

Anxiety. Deckers and colleagues (2017) found significant partial correlations (corrected for gender) between loneliness and social anxiety in children and adolescents with ADHD. They did not find similar associations between loneliness and social anxiety in children and adolescents with ASD, nor in the typical development control group. Another study examined the impact of COVID-19 social restrictions on young people aged 5-17 years old and measured symptoms before and during COVID (Sciberras et al., 2022). They reported small-to-medium correlations between loneliness and worried/anxious symptoms in young people before COVID and an increased effect size of the correlation between

loneliness and worried/anxious symptoms during COVID (May 2020), but the significance of the correlations was unreported.

Addiction. Higher levels of loneliness in adolescents and young adults have been found to be correlated with higher internet addiction scores, but this pattern was also seen in the non-ADHD group (Li et al., 2016). Loneliness, impulsivity, and behavioural inhibition were all significant predictors of internet addiction in ADHD in a hierarchical linear regression (Li et al., 2016).

Table 3

Summary of studies examining the association between loneliness and mental health difficulties in ADHD (Research question 2)

Authors (Year); Country	ADHD Sample *n* (male)	ADHD Age *M* (*SD*)	Study Ethnicity	Study IQ	Study Quality	ADHD Measure	Loneliness Measure	Mental Health Measure	Key Findings
Al-Yagon (2016); Israel	91 (41)	nr Overall sample: 15.94 (0.70) No sig. diff between ages of groups	nr	Normal level: WISC-IV	0.82	Previous ADHD diagnosis DSM-IV-TR using clinical interview, computerised tests. Diagnosis validated by document check.	PNDLS	YSR (Hebrew adaptation; Externalizing/ Internalizing Syndrome scales)	Peer-network loneliness in the LD-ADHD group is significantly correlated with internalising behaviours (r = .57, p < .001) but not externalising behaviours (r = .15, p = nr). Peer-dyadic loneliness in the LD-ADHD group is not significantly correlated with internalising behaviours nor externalising behaviours (p = nr).
Deckers et al. (2017); Netherlands	76 (54)	11.79 (2.48)	Predominant Caucasian	Severe cognitive (IQ <70) or language impairments excluded.	0.82	Previous diagnosis by a multidisciplinary team using multiple sources (i.e., interviews, observations, assessments)	LACA (only relationships with peer subscale was used in the study)	SCARED-71 (parent-reported)	In ADHD, children-reported loneliness is partially correlated (corrected for gender) with parent-reported social anxiety (r = 0.35, p < 0.001). In ASD and control group, loneliness not correlated with social anxiety.

Authors (Year); Country	ADHD Sample *n* (male)	ADHD Age *M* (*SD*)	Study Ethnicity	Study IQ	Study Quality	ADHD Measure	Loneliness Measure	Mental Health Measure	Key Findings
[1]Houghton et al. (2020); Australia	42 (31)	13.01 (2.0)	nr	nr	0.73	Previously diagnosed by a paediatrician or child psychiatrist as meeting DSM-IV-TR or DSM-5 criteria.	PALs	CDI:SR	Isolation loneliness is correlated with depression in ADHD (r = 0.67, p < .001). Friendship loneliness is correlated with depression in ADHD (r = -0.68, p < .001). Together, friendship and isolation related loneliness fully mediated the relationship between ADHD and depressive symptoms. The total indirect effect of an ADHD diagnosis on depressive symptoms, through friendship related loneliness and isolation, was statistically significant (B = 2.29, β = 0.24, p < .001).

Authors (Year); Country	ADHD Sample *n* (male)	ADHD Age *M* (*SD*)	Study Ethnicity	Study IQ	Study Quality	ADHD Measure	Loneliness Measure	Mental Health Measure	Key Findings
[1]Houghton et al. (2022); Australia	76 (nr)	nr Total NDD: 13.52 (1.44)	nr	nr	0.77	Previous diagnosis as meeting DSM-IV-TR / DSM-5 criteria for ADHD.	PALs	CDI:SR; SDQ	*At baseline, correlations between isolation loneliness and: CDI:SR Depression (r = 0.53, p < .001) SDQ Internalising (r = 0.67, p < .001) SDQ Externalising (r = 0.38, p < .001)
Li et al. (2016); China	73 (39)	22.56 (3.19)	nr	nr	0.77	ASRS (Chinese version), >17 on either subscale classified as ADHD group	UCLA (version 3)	CIAS-R: >=64 was classified as the Internet addiction group	Both loneliness in ADHD scores (r = 0.54, p < 0.01) and non-ADHD (r = 0.52, p < 0.01) is correlated with higher internet addiction. In a hierarchical linear regression, loneliness, impulsiveness and behavioural inhibition were significant predictors of internet addiction in ADHD.
Meinzer et al. (2013); USA	T1: *40 (nr) Overall: 1709 (803)	T1: nr Overall: 16.6 (1.2)	T1: nr Overall:	nr	0.91	K-SADS-PL; DSM-III-R	UCLA (8-item version)	SCID-NP; LIFE	*In a univariate regression, T1 loneliness significantly predicted MDD onset in ADHD (r = .49, p < .01).

Authors (Year); Country	ADHD Sample *n* (male)	ADHD Age *M* (*SD*)	Study Ethnicity	Study IQ	Study Quality	ADHD Measure	Loneliness Measure	Mental Health Measure	Key Findings
			62% Black, 36% white, 1% Hispanic, 1% 'other'						In the multivariate regression, ADHD remained a significant predictor of MDD onset even after loneliness (*p* = ns), coping skills, new onset psychiatric disorders, psychiatric disorders, gender, life stress, academic impairment were added as predictors.
Sciberras et al. (2022); Australia	212 (162)	10.59 (3.1)	nr	nr	0.90	Prior diagnosis of ADHD	CRISIS (Parent-reported loneliness subscale)	CRISIS (Sad/depressed/unhappy and anxious/nervous subscales)	*2 months before COVID: loneliness and sad/depressed (*r* = 0.39) loneliness and worried/anxious (*r* = 0.35). May 2020 / COVID: loneliness and sad/depressed (*r* = 0.56) loneliness and worried/anxious (*r* = 0.47).

Authors (Year); Country	ADHD Sample *n* (male)	ADHD Age *M* (*SD*)	Study Ethnicity	Study IQ	Study Quality	ADHD Measure	Loneliness Measure	Mental Health Measure	Key Findings
Smit et al. (2020); Canada	213 (147)	8.58 (1.55)	70% White, 5% Pacific Islander/ Asian, 1% Latino/ Hispanic, 1% Afro-Canadian/ Black, 16% multi-racial, 6% Not reported	IQ below 75 on WASI / short form WISC-IV excluded	0.90	Prior diagnosis of ADHD; parent-rated Child Symptom Inventory (at least 4 hyperactivity and inattention), parent K-SADS-PL Exclusion: ID, ASD, severe MH e.g., suicidality	CLSD	Parent endorsement of child meeting DSM-IV-TR criteria for a relevant disorder (internalising or externalising) on the K-SADS, in addition to second informant (child or teacher).	*Loneliness is associated with child internalising comorbidities (r = .32, p <.001) but not child externalising comorbidities (r = .05, p = .468). Bivariate correlations: Loneliness was associated with more internalizing comorbidities for boys (r = .28, p < 0.01) and girls (r = .40, p < 0.01). However, externalizing comorbidities was associated with more loneliness in boys (r = .17, p < 0.05), but not girls. After controlling for gender and age, loneliness was associated with more internalising disorders (β = .31, p < .01) but not externalising disorders (β = .03, p = ns).

Note. [1]Studies shared overlapping sample; *Relevant sub-sample obtained from author(s) as not reported in the original paper.

Abbreviations: ADHD = Attention Deficit/Hyperactivity Disorder; ASD = Autism Spectrum Disorder; LD = Learning Disability; MDD = Major Depressive Disorder; NDD = Neurodevelopmental Disability; nr = not reported; ns = not significant; T1 = Time 1; TD = Typical Development;

Measures: ASRS = Adult ADHD Self-Report Scale (Kessler et al., 2005); ASRS Chinese version (Gau et al., 1997); CBCL = Child Behaviour Checklist (Achenbach, 1999); CDI:SR = The Children's Depression Inventory Short Version (Kovacs, 2004); CIAS-R = The Revised Chen Internet Addiction Scale (S.-H. Chen et al., 2016); CLSD = Children's Loneliness Scale (Asher et al., 1984); CRISIS = CoRonavIruS Health Impact Survey (Nikolaidis et al., 2021); DSM-III-R = Diagnostic and Statistical Manual of Mental Disorders – Third Edition Revised (American Psychiatric Association, 1987); DSM-IV-TR = Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition Text Revision (American Psychiatric Association, 2000); DSM-5 = Diagnostic and Statistical Manual of Mental Disorders – Fifth Edition (American Psychiatric Association, 2013); K-SADS-PL = Kiddie-Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version (Kaufman et al., 1997); LACA = Loneliness and Aloneness Scale for Children and Adolescents (Marcoen et al., 1987); LIFE = Longitudinal Interval Follow-Up Evaluation (Keller, 1987); PALs = The Perth A-loneness Scale (Houghton et al., 2014); PNDLS = Peer Network and Dyadic Loneliness Scale (Hoza et al., 2000); SCID-NP = Structured Clinical Interview for Axis I DSM-IV Disorders (Gorgens, 2011); SDQ = The Strengths and Difficulties Questionnaire (Goodman, 1997); TRF = Teacher's Report Form (Achenbach & Rescorla, 2001); UCLA Loneliness Scale-Version (Russell, 1996); UCLA Version 8-item version (Roberts et al., 1993); WASI = Wechsler Abbreviated Scale of Intelligence (Wechsler, 2011); WISC-IV = Wechsler Intelligence Scale for Children – Fourth Edition (Wechsler, 2003); YSR = Youth Self-Report 11-18 (Achenbach, 1991); YSR Hebrew adaptation (Zilber et al., 1994).

4. Discussion

This review carried out the first meta-analysis and systematic review to explore whether young people with ADHD experienced greater loneliness compared to young people without ADHD. The combined effect size for the significant increased loneliness in the ADHD group was small-to-medium (Hedges' *g* = 0.41). There was a high level of heterogeneity between the studies and non-significant effects of age and gender of the ADHD group, study quality, and recruitment setting. For the second research question, which reviewed the association between loneliness and mental health difficulties in young people with ADHD, most studies reported an association between loneliness and mental health difficulties including general internalising behaviours and symptoms, anxiety, depression, externalising behaviours and symptoms, and addiction.

4.1 Loneliness levels in young people with ADHD

The findings for the systematic review and meta-analysis for the first question provides an important contribution to our understanding of loneliness in young people with ADHD. The current state of the literature shows that young people with ADHD report significantly higher levels of loneliness compared to those without ADHD. This is consistent with findings of individuals with ADHD perceiving their friendships as having fewer positive and more negative features (Normand et al., 2011) and being less satisfied with their social networks (Grygiel et al., 2018), suggesting that there is an awareness of a gap in their social relationships. One possible factor that might explain the increased loneliness in young people with ADHD compared to their peers could be the greater peer rejection and social difficulties experienced (Hoza et al., 2005; McQuade & Hoza, 2008). Indeed, other research shows that loneliness follows peer rejection and peer difficulties (Ladd & Troop-Gordon, 2003; Pedersen et al., 2007). It is also possible that the loneliness experience in ADHD encompasses more than social and peer difficulties and may also relate to feeling different. In a qualitative study, adults with ADHD expressed feeling loneliness in suffering in relation to their disability, illness and care and feeling different, which persisted from childhood (Björk et al., 2017).

While the meta-analysis found overall increased loneliness levels in young people with ADHD compared to their peers without ADHD, there were some studies included that found no difference or decreased levels of loneliness in the ADHD group. This is interesting in light of some theories positing that people with ADHD may have lower loneliness levels

due to a self-perceptual bias which protects them from feeling lonely, and thus masking associations between ADHD and loneliness (Hoza et al., 2005; Martin et al., 2019). For example, when children with ADHD were compared with those without ADHD, but had similar social skills difficulties, children with ADHD viewed themselves as more popular and interpersonally competent compared to teacher reports while children without ADHD had similar ratings to the teacher reports (Capodieci et al., 2019). Martin and colleagues (2019) reported that ADHD diagnosis was associated more strongly with loneliness when social self-perceptual bias was controlled for. It is possible that a self-perceptual bias may affect loneliness reports and that this review's findings are an underestimation. More research is required to examine to loneliness in young people with ADHD as there were some limitations (expanded below) of the studies included that could have impacted the results.

The meta-analysis found a high level of heterogeneity, which warranted further moderator and meta-regression analyses. However, there was a lack of significant findings in the analyses. Despite excluding studies that had samples with both mixed children and adolescents, there was still overlaps between ages in the child and adolescent groups which may have contributed to the lack of significant differences in the moderator analysis on age groups. Similarly, the meta-regression on the age of the ADHD group could have been affected by the limited variability, with many of the samples comprising individuals in their late childhood and early adolescence, rather than an even distribution throughout the age range. The lack of significance when comparing the research setting (clinical vs community) could perhaps partly be due to some of the community settings being special educational or inclusive schools which may have obscured some of the difference in severity of ADHD symptoms and lessened the difference between young people with ADHD in the clinical and community studies. The proportion of males in the ADHD sample in the studies were much larger compared to females, potentially impacting the meta-regression. For example, two studies consisted of only males (Elmose & Lasgaard, 2017; Martin et al., 2019). A recent meta-analysis found that in samples with at least 100 males and females in the general population, there were no significant differences in loneliness between males and females (Maes et al., 2019). It is possible that perhaps there is no gender difference in loneliness in young people with ADHD although this is difficult to ascertain due to the skewed sample of many of the studies included. The quality of the studies did not significantly explain the between-study heterogeneity in the meta-analysis, though many of the studies had similar

quality scores of around 0.73 to 0.82. Other factors that were not analysed as a moderator may have contributed to the heterogeneity, such as, the type of loneliness measure or the ADHD subtype.

4.2 Loneliness and mental health difficulties in young people with ADHD

Most studies reviewed found a significant positive association between loneliness with different mental health difficulties in young people with ADHD, including general internalising behaviours and symptoms, anxiety, depression, and internet addiction. For externalising behaviours and symptoms, one study found significant positive correlations, one study only found significant associations in males and one study did not find any significant associations. It should be noted that there were few studies included in this systematic review and most of the studies did not look at the same mental health difficulties so caution should be used when interpreting the results. The general finding that loneliness is associated with mental health problems is in line with the wealth of studies in the general population, including in adults and young people (Heinrich & Gullone, 2006; Loades et al., 2020), in young people with pre-existing mental health problems (Hards et al., 2022), and also in other neurodevelopmental populations (Hymas et al., 2022; Kwan et al., 2020). Additionally, Al-Yagon (2016) reported that different forms of loneliness were differentially associated with internalising and externalising symptoms, which is consistent with conceptualisations of loneliness as being multi-dimensional (Hoza et al., 2000). For example, Lasgaard and colleagues found that, in adolescents, peer- and family-related loneliness was correlated with depression, anxiety and suicidal ideation while romantic loneliness was associated with social phobia (Lasgaard et al., 2011). Thus, it would be important to measure different types of loneliness and their relationship with mental health difficulties. In the general population, studies have shown that loneliness predicts depressive and anxious symptoms (Lee et al., 2021; Wang et al., 2018), with some showing bidirectional associations (Cacioppo et al., 2006). There was a small number of studies included in this review and they were mostly cross-sectional in nature, so our understanding of the directionality of the association between loneliness and mental health problems in young people with ADHD is still limited. One study found that although loneliness predicted the onset of Major Depressive Disorder, only ADHD diagnosis remained a significant predictor of MDD when other predictors (e.g., gender, psychiatric disorders) were controlled (Meinzer et al., 2013). In contrast, another study found that friendship loneliness and isolation

loneliness fully mediated the relationship between ADHD diagnosis and depression (Houghton et al., 2020). Additionally, adolescents with ADHD who had higher levels of isolation loneliness were more likely to have higher levels of depression even with similar levels of quality friendships (Houghton et al., 2020). Even with the same level of quality friendships as their non-ADHD peers, adolescents with ADHD who feel higher peer isolation may interpret their peer relationships more negatively which may be a maintaining factor for loneliness (Houghton et al., 2020; Qualter et al., 2015). Regardless of temporal precedence, the studies reviewed suggest that loneliness in young people with ADHD may be positively associated to mental health difficulties in a similar way as it does in young people in the general population, although more research is required to replicate the few studies available and to better understand how loneliness may vary with different mental health difficulties. Future longitudinal studies focusing on loneliness in young people with ADHD may be able to further shed light on the relationship and causality between loneliness and mental health difficulties.

4.3 Strengths and Limitations of the Included Studies

There were multiple different aspects of the studies included in this paper that should be taken into consideration when interpreting the findings. The measurement and reporting of the demographics in the studies were sometimes inconsistent. As mentioned previously, there was a much larger proportion of males than females in the studies included. While a larger percentage of males in studies may reflect, to some extent, the current prevalence of ADHD in males and females (Lawrence et al. 2016), future studies should attempt to replicate studies with more diverse samples. Furthermore, some studies only reported the gender and age information for the overall sample, rather than specifically in the breakdown of groups. Only four studies reported ethnicity data, with two of the studies comprising predominantly Caucasians, so generalisation of the findings of this review is limited.

The methodological quality of the studies included in this review was generally good (see Tables 2 and 3). There were, however, aspects of many of the included studies that could have introduced bias and affected the results of this review. For example, while most studies attempted to control for some amount of confounding by using age- and gender-matched samples, there were other factors that could potentially impact loneliness that were not accounted for, such as, ethnicity and socio-economic status (Qualter et al., 2021;

Visser & El Fakiri, 2016). It is possible, therefore, that some of the loneliness differences reported in the studies included may be inflated. It is important to note that the studies' quality was assessed based on the studies' stated primary aims rather than specifically for loneliness in ADHD. Thus, for some studies, they may rank highly in their quality appraisal despite lacking some information for this specific review as the information and analysis for loneliness in ADHD may have been a secondary outcome for some studies.

Some methodological concerns relate to the assessments and measures used across studies. In terms of ADHD categorisation, most of the studies included previous diagnosis of ADHD or diagnosis made during the study but were scarce on information about details of how the diagnosis was made (e.g., type of interview, scores on what measures and what criteria was used). A recommended "gold standard" for ADHD diagnosis includes many aspects including history taking and interviews, rating scales, behavioural observations, and neuropsychological testing which can be prohibitive and resource intensive (Gualtieri & Johnson, 2005). The ADHD diagnoses in the studies included in this review may, to some extent, reflect how ADHD diagnoses are carried out in the real world and may provide important information, despite potentially decreasing the confidence of the ADHD diagnosis of the samples in this review. Future studies would benefit from administering both interviews and rating scales to diagnose or validate prior diagnosis when carrying out research with ADHD samples. There were also inconsistencies regarding ADHD subtype, medication status, and comorbidities reporting. While this review excluded studies with comorbid ASD and ID, some studies did not have detailed documentation about comorbidities. The coexistence of ADHD together with ASD, along with other mental health diagnoses is not uncommon (Gargaro et al., 2011; Tung et al., 2016). This may have confounded some of the results as different ADHD presentations along with different comorbidities (e.g. Oppositional Defiant Disorder) can influence social difficulties differently (de Boo & Prins, 2007). Future studies and reviews may benefit from reporting and considering different ADHD subtypes and comorbidities.

In terms of outcome measures, most loneliness measures used in the studies were unidimensional measures of loneliness that are commonly used with good psychometric properties such as the UCLA and CLSD (see Appendix B for more information about the scales). However, due to the many different types of loneliness measures used across different studies, it is difficult to compare the effects of different measures on the loneliness

reported despite findings from previous reviews that loneliness scores are impacted by the types of measures used (Masi et al., 2011). For example, loneliness measures that directly ask about loneliness may underreport loneliness due to stigma and different loneliness measures may capture different aspects of loneliness (Houghton et al., 2014; Hoza et al., 2000). This inconsistency poses challenges in comparing loneliness levels and prevalence between studies, in addition to interpreting whether the elevated loneliness levels experienced by young people with ADHD in this review are clinically relevant or not (Nicolaisen & Thorsen, 2014; Surkalim et al., 2022). Future studies could benefit from using multiple loneliness measures, including direct and indirect measures, to aid with comparability (Office for National Statistics, 2018). Furthermore, studies on measurement invariance of loneliness measures in ADHD populations have been scarce, making it challenging to ascertain whether the difference in loneliness scores is due to a true difference between loneliness experience between ADHD and non-ADHD populations or due to young people with ADHD interpreting the questions differently. For example, the definition of "best friend" differs in boys with and without ADHD: boys with ADHD saw "best friends" primarily as companions for having fun as opposed to the non-ADHD boys who saw "best friends" as a source of emotional support (Heiman, 2005). Therefore, more research into loneliness in young people with ADHD is required, including norming loneliness measures.

4.4 Strengths and Limitations of this Review

This systematic review's search strategy was based on PRISMA guidelines, was pre-registered on PROSPERO for transparency, excluded papers that were not peer-reviewed, and focused on loneliness/perceived social isolation in young people who were categorised as having ADHD in the studies included. A quarter of the screening was replicated by an independent rater, and the quality assessment for all papers included was carried out by two independent raters, bolstering the reliability of the screening and quality appraisal. The search strategy used for this review was also broad and the search was carried out in multiple databases (including reviewing references of relevant studies), so the likelihood of missing relevant studies was low. The inclusion criteria were chosen, a priori, to be inclusive while maintaining strict criteria around loneliness and ADHD. While this may have increased the heterogeneity of the review, the studies included represent the current state of research of loneliness in young people with ADHD. The differences between the studies

were also analysed in the moderator analysis and meta-regression as opposed to having restrictive inclusion criteria. It should also be noted that the small number of studies included in the moderator and meta-regression analyses decreases the confidence in the interpretation of the results.

Another limitation of this review encompasses what studies were included. As this review focused only on papers in English, papers written in other languages were not captured. Additionally, most of the studies were from Western countries or Israel, and few were from national databases so the conceptualisation of loneliness in young people in ADHD in this review may not be generalisable to other regions of those countries or the rest the world. Reviews of this area in different populations would be informative to ascertain whether loneliness in young people with ADHD differs culturally or by country. This review also only included published studies, so papers that did not find significant results in terms of loneliness differences or associations between loneliness and mental health difficulties may have been missed.

This review only investigated loneliness in ADHD in studies that categorised their participants into ADHD groups and excluded studies that examined how loneliness is associated with ADHD symptoms. Dichotomous categorisation of ADHD can sometimes miss out less severe presentations of ADHD or individuals who present with ADHD symptoms but do not have substantial functional impairment, which may have affected this review. Some have proposed viewing ADHD as a continuum, with clinical cases making up the higher end of the continuum rather than a discrete category (McLennan, 2016). Including studies with ADHD on a continuum may improve reliability of certain comparisons due to how different populations may present with ADHD. For example, females tend to present more inattentively, and less hyperactively compared to males, and may be under-diagnosed and under-represented in clinical studies and studies that categorise ADHD as a discrete diagnosis (Ramtekkar et al., 2010). To reduce potential bias and increase the representativeness, it is recommended that future reviews investigate the association between loneliness and ADHD symptom severity.

4.5 Clinical Implications

This review puts forward evidence that that loneliness is elevated in young people with ADHD compared to their peers without ADHD, and that loneliness is associated with mental health difficulties in young people with ADHD. This highlights that loneliness may be

an important, albeit under-recognised, problem in ADHD and clinicians should be aware of and assess the potential for elevated loneliness in this population. Given the possible mental health problems associated with loneliness in ADHD, reducing loneliness may not only decrease the distress but may also positively impact other aspects of mental health. Currently, individuals with ADHD who experience relationship difficulties are often offered social skills training (Mikami et al., 2014). Not only do these interventions have limited effectiveness on social skills, emotional competencies, and general behaviour (Storebø et al., 2019), they also fail to consider both the wider context which maintains the peer difficulties and the distressing experience of loneliness in the young person (Mikami et al., 2014). Efforts should be made to tailor interventions specific to loneliness in young people with ADHD. There exists interventions that have been found to lower loneliness in young people generally, such as those focusing on picking up a new hobby, and learning social and emotional skills (Eccles & Qualter, 2021). While promising, most studies reviewed in that meta-analysis did not distinguish between transient and prolonged loneliness, did not measure loneliness as the primary outcome and were not ADHD specific. Social skills and emotion management training may be helpful to re-establish connection for transient loneliness but may be insufficient for prolonged loneliness (Qualter et al., 2015), which may be more likely to be experienced by individuals with ADHD both due to their social functioning difficulties which often persists into adolescence and adulthood (Lee et al., 2011; Wehmeier et al., 2010) and the feeling different due to the hardships faced due to their ADHD (Björk et al., 2017). A better understanding of the experience of loneliness in young people with ADHD, including what contributes to their loneliness, may aid in developing loneliness interventions targeted for this population. Additionally, it could be beneficial to focus on improving other aspects, as opposed to peer network and regard, that are that are linked to loneliness such as increasing close friendships. Increasing quality, reciprocated friendships, have been found to reduce loneliness in young people with ADHD (Al-Yagon, 2016; Kingery et al., 2011; Smit et al., 2020). It is clear that more research is needed to inform the development and adaptation of loneliness specific interventions for young people with ADHD.

4.6 Conclusions

This systematic review and meta-analysis is the first to examine levels of loneliness in young people with ADHD, along with its association with mental health difficulties. Given

the well documented adverse consequences of loneliness among the general population (Christiansen et al., 2021; Hawkley & Cacioppo, 2010), this review's finding that young people with ADHD experience heightened loneliness levels compared to their peers highlights the importance of understanding loneliness in this population. In the small number of studies that reported loneliness associations with mental health difficulties in this review, most studies reported positive associations. Despite some of the limitations, this review provides support for considering loneliness as part of the wide-ranging social-emotional difficulties that young people with ADHD are at higher risk of experiencing. As it is recommended that interventions aimed at individuals with ADHD should target the different aspects of their difficulties (National Institute for Health and Clinical Excellence, 2018), more resources should be focused on loneliness as a separate construct from social isolation and peer difficulties. ADHD is a complex neurodevelopmental condition, which is associated with higher risks of comorbidities and adverse outcomes so early identification and treatment of loneliness may be especially important in this population. Further research is needed in order to better understand loneliness in this population, as well as investigate the association between loneliness and different mental health difficulties in ADHD, including the consequences and factors that may exacerbate or maintain loneliness in this population.

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6. Appendices

6.1 Appendix A

Quality Appraisal Ratings according to QualSyst (Kmet et al., 2004)

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Score
Al-Yagon (2009)	1	2	1	2	N/A	N/A	N/A	1	1	2	2	1	2	2	0.77
Al-Yagon (2016)	2	2	1	1	N/A	N/A	N/A	1	2	2	2	1	2	2	0.82
Capodieci et al. (2018)	2	2	1	1	N/A	N/A	N/A	2	1	1	1	1	1	2	0.68
Deckers et al. (2017)	2	2	1	2	N/A	N/A	N/A	1	1	2	2	1	2	2	0.82
Elmose & Lasgaard (2017)	2	1	1	2	N/A	N/A	N/A	1	1	2	2	1	1	2	0.73
Heiman (2005)	1	2	1	2	N/A	N/A	N/A	1	1	1	1	1	1	2	0.64
Houghton et al. (2015)	2	2	1	2	N/A	N/A	N/A	1	1	2	2	2	1	2	0.82
Houghton et al. (2020)	2	2	1	1	N/A	N/A	N/A	1	1	2	1	2	2	1	0.73
Houghton et al. (2022)	2	2	1	1	N/A	N/A	N/A	1	2	2	1	2	1	2	0.77
Koutra & Kokaliari (2022)	2	2	1	1	N/A	N/A	N/A	1	2	2	2	1	1	2	0.77
Langher et al. (2009)	2	2	1	1	N/A	N/A	N/A	1	1	1	1	1	2	2	0.68
Laslo-Roth et al. (2020)	2	2	1	2	N/A	N/A	N/A	1	2	2	2	1	1	2	0.82
Laslo-Roth et al. (2021)	2	2	1	1	N/A	N/A	N/A	1	2	2	2	1	2	2	0.82
Li et al. (2016)	2	1	1	1	N/A	N/A	N/A	2	1	2	2	1	2	2	0.77
Martin et al. (2019)	2	2	1	1	N/A	N/A	N/A	2	2	2	2	1	1	1	0.77
Matthews et al. (2019)	1	2	2	1	N/A	N/A	N/A	2	2	2	2	1	2	2	0.86
Meinzer et al. (2013)	2	2	1	1	N/A	N/A	N/A	2	2	2	2	2	2	2	0.91
Sciberras et al. (2020)	2	2	1	1	N/A	N/A	N/A	2	2	2	2	N/A	2	2	0.90
Smit et al. (2020)	2	2	2	2	N/A	N/A	N/A	1	2	2	1	N/A	2	2	0.90
Tracey & Gleeson (1998)	2	1	1	2	N/A	N/A	N/A	1	1	2	1	1	1	2	0.68

Q1. Question / objective sufficiently described? Q2. Study design evident and appropriate? Q3. Method of subject/comparison group selection or source of information/input variables described and appropriate? Q4. Subject (and comparison group, if applicable) characteristics sufficiently described? Q5. If interventional and random allocation was possible, was it described? Q6. If interventional and blinding of

investigators was possible, was it reported? Q7. If interventional and blinding of subjects was possible, was it reported? Q8. Outcome and (if applicable) exposure measure(s) well defined and robust to measurement / misclassification bias? Means of assessment reported? Q9. Sample size appropriate? Q10. Analytic methods described/justified and appropriate? Q11. Some estimate of variance is reported for the main results? Q12. Controlled for confounding? Q13. Results reported in sufficient detail? Q14. Conclusions supported by the results?

6.2 Appendix B

Descriptions of loneliness measures and measures

Measure	Description
CLSD, Children's Loneliness and Social Dissatisfaction Scale (Asher et al., 1984; Asher & Wheeler, 1985)	Different names are used in the literature to refer to this scale, including the Children's Loneliness Scale, the Children's Loneliness and Social Dissatisfaction Scale, and the Asher Loneliness scale. The measure has been revised and adapted several times since its first publication. Consists of 24 items, with 16 target and 8 "filler" items. Designed to assess children's feelings of loneliness and social dissatisfaction. It consists of items about feelings of loneliness (e.g. "I'm lonely"), perception of social competence (e.g. I get along well with other children) and their perceived status in their peer group (e.g. I have many friends). Rated on a 5-point Likert scale, ranging from 1 = never/not true at all to 5 = always/always true. Higher scores indicate higher levels of loneliness. For use in children ages 6-18 years old. CLS is a valid and reliable instrument for assessing the loneliness levels and has been administered to children with and without special needs and learning disabilities (Asher et al., 1984; Asher & Wheeler, 1985; Heiman, 2002; Tekinarslan & Küçüker, 2015). Cronbach's α was between 0.89 to 0.91 in the studies that reported reliability in this review (Al-Yagon, 2009; Heiman, 2005; Martin et al., 2019; Smit et al., 2020). Hebrew adaptation (Margalit, 1991): Translated into Hebrew. Hebrew adaptation- Child scale: Consists of 16 items and 8 filler items. 5-point Likert scale, ranging from 1 = never to 5 = always. Items include "I am lonely at school" and "I have nobody to talk to in school". Scores range between 16 to 80. Higher scores indicate higher levels of loneliness. Hebrew adaptation- Adult scale: The Hebrew version was adapted for parents and teachers. The 16 items were transformed into third person singular to capture adult's perceptions of the child's loneliness (e.g. "S/he is lonely at school"). Cronbach's α was 0.93 for parents and 0.95 for teachers (Heiman, 2005).

	Italian adaptation (Casiglia et al., 1998): Consists of 18 items on a 5-point scale, from 5 = always true to 1 = never true. Capodieci and colleagues' (2019) study did not report reliability scores but the CLSD has also been used in and validated for different cultures including in Italian samples (internal consistency of .84) (Chen et al., 2004).
CRISIS, CoRonavIruS Health Impact Survey (Nikolaidis et al., 2020)	Measured parent-reported child physical health, mental health and media use. This review only focuses on the loneliness item (i.e., "how lonely was your child?") which was rated on a 5-point Likert scale between 1 = not lonely at all to 5 = extremely lonely. Higher scores indicated higher levels of loneliness. Measure has been shown to be valid and reliable (Nikolaidis et al., 2021). There is an adapted CRISIS for children and adolescents (3- 21 years) with autism and related neurodevelopmental conditions. However, the CRISIS version used in the study included in this review did not specify using the adapted version of CRISIS.
LACA/LACAYAS, Loneliness and Aloneness Scale for Children and Adolescents (Marcoen et al., 1987) / The Loneliness Among Children and Young Adolescents Scale (Marcoen & Brumagne, 1985)	This measure is also known as the Louvain Loneliness Scale for Children and Adolescents. Consists of 48 items and 4 subscales: loneliness in relationships with parents and peers, aversion to aloneness and affinity for aloneness. For use in children and adolescents ages 10-19 years old. The two studies included in the review only used the peer-related loneliness subscale (e.g., "I think I have fewer friends than others") which contained 12 items for the LACA (Marcoen et al., 1987) and 17 for the LACAYAS (Marcoen & Brumagne, 1985). Participants report how often they feel the statement applies to them on a 4-point scale from 1 = never to 4 = often. A total score can be calculated for the subscale ranging between 12 and 48, and 17 to 68 respectively for the LACA and LACAYAS. Higher scores indicate higher levels of loneliness. LACA has high internal consistency and satisfactory validity in samples of school children and adolescents (Maes et al., 2015; Marcoen et al., 1987). The peer related loneliness subscale was found to have a Cronbach's α of 0.88 for both studies (Deckers et al., 2017; Tracey & Gleeson, 1998).

PALs, The Perth A-loneness Scale (Houghton et al., 2014)	Consists of 24 items exploring adolescent loneliness on a 6-point Likert scale ranging from 1 = never to 6 = always. Measures four aspects: friendship-related loneliness, isolation loneliness, negative attitude to solitude and positive attitude to solitude. This review focuses only on friendship related loneliness and isolation loneliness. Higher scores for friendship-related loneliness reflects greater friendship quality while higher scores for isolation loneliness indicate higher levels of isolation. Has strong psychometric properties (Houghton et al. 2014; 2016). In the studies included in this review, the Cronbach's alpha was found to be acceptable (Houghton et al., 2015, 2020; Houghton, Kyron, Lawrence, et al., 2022).
PNDLS, Peer Network and Dyadic Loneliness Scale (Hoza et al., 2000)	Measures loneliness with two subscales looking at 1. a lack of involvement in social network and 2. an absence of close dyadic friendships. Participants are presented with pairs of sentences describing children who differ on specific characteristics and are asked to choose which type of children they are most like and rate how true the description is for them. They are rated on a 4-point Likert scale. The Peer Network Loneliness subscale consist of 8 items (e.g. "Some kids hardly ever feel accepted by others their age—But—other kids feel accepted by others their age most of the time") and the Peer-Dyadic Loneliness subscale also consist of 8 subscales (e.g. "Some kids don't have a friend that they can talk to about important things—But—others kids do have a friend that they can talk to about important things"). Subscales scores range from 1 = very low loneliness to 4 = very high loneliness. The Cronbach's α found in the study included in this review was 0.86 for network loneliness and 0.87 for dyadic loneliness (Al-Yagon, 2016).
UCLA Loneliness Scale (Russell et al., 1978)	Measures subjective feelings of loneliness and feelings of social isolation. There are 20 items and the Items are rated from 0 = I never feel this way to 3 = I often feel this way. Higher scores indicate higher levels of loneliness.

	The measure has been revised and adapted several times since its first publication. UCLA Short version (Russell et al., 1980): Contains 4 items (e.g. "How often do you feel isolated from others?"). Items are rated on a 6-point Likert scale ranging from 1 = never to 6 = always. Cronbach's α of 0.75 (Laslo-Roth et al., 2020). UCLA 8-item Version (Roberts et al., 1993): Contains 8 items with a 4-point Likert scale ranging from 1= never to 4 = always. The study included in this review found a Cronbach's α of 0.78 (Meinzer et al., 2013). UCLA Version 3 (Russell, 1996): Contains 20 items. Items are rated on a scale from 1 = never to 4 = often. This measure is a revised version of both the original UCLA Loneliness Scale and the Revised UCLA Loneliness Scale. It has good psychometric properties with an internal consistency of between 0.89 and 0.94, and a test-retest reliability of 0.73 (Russell, 1996). A study included in this review found a Cronbach's alpha of 0.83 (Matthews et al., 2019). Li et al's (2016) study did not report reliability scores. UCLA Danish Version (Lasgaard, 2007): Adapted UCLA to Danish. Consists of 20 items. Results comparable to original UCLA version. Demonstrated good internal consistency with Cronbach's α of 0.84 for the ADHD sample and 0.91 for non-ADHD sample (Elmose & Lasgaard, 2017).
Parents' perception of child's loneliness	Examined using one item: "How often does your child seem lonely to you?" (Laslo-Roth et al., 2021). Responses were on a five-point Likert scale. Higher scores indicate higher levels of loneliness.

6.3 Appendix C

Leave-one-out analysis for meta-analysis (Research Question 1)

Study	*g* [95% CI]	*SE*	*z*-value	*p*-value	*Cochrane Q*	*Cochrane Q p*-value	tau^2	I^2 (%)
Al-Yagon (2009)	0.39 [0.22, 0.56]	0.09	4.42	< .001	50.5	< .001	0.07	74.8
Al-Yagon (2016)	0.41 [0.23, 0.59]	0.09	4.41	< .001	53.95	< .001	0.08	76.77
Capodieci et al. (2018)	0.42 [0.25, 0.60]	0.09	4.75	< .001	53.28	< .001	0.08	76.93
Deckers et al. (2017)	0.48 [0.35, 0.61]	0.07	7.37	< .001	26.43	0.01	0.03	52.64
Elmose & Lasgaard (2017)	0.44 [0.27, 0.61]	0.09	5.09	< .001	49.07	< .001	0.07	74.65
Houghton et al. (2015)	0.39 [0.22, 0.57]	0.09	4.37	< .001	51.55	< .001	0.08	75.48
Houghton et al. (2020)	0.40 [0.23, 0.58]	0.09	4.46	< .001	53.78	< .001	0.08	77.12
Koutra & Kokaliari (2022)	0.40 [0.22, 0.57]	0.09	4.35	< .001	52.49	< .001	0.08	75.79
Langher et al. (2009)	0.40 [0.23, 0.58]	0.09	4.59	< .001	53.88	< .001	0.08	77.08
Laslo-Roth et al. (2020)	0.45 [0.28, 0.61]	0.09	5.24	< .001	46.76	< .001	0.07	73.37
Laslo-Roth et al. (2021)	0.41 [0.23, 0.59]	0.09	4.4	< .001	53.97	< .001	0.09	76.27
Martin et al. (2019)	0.42 [0.24, 0.60]	0.09	4.6	< .001	52.23	< .001	0.08	76.22
Matthews et al. (2019)	0.39 [0.21, 0.57]	0.09	4.3	< .001	46.66	< .001	0.08	72.47
Meinzer et al. (2013)	0.40 [0.22, 0.57]	0.09	4.37	< .001	52.8	< .001	0.08	76.21
Tracey & Gleeson (1998)	0.40 [0.22, 0.58]	0.09	4.44	< .001	53.45	< .001	0.08	76.87