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The impact of loneliness on healthcare costs and service utilisation and the cost-effectiveness of loneliness interventions: systematic review

Sharon Eager, Helen Baldwin, David McDaid, Paul McCrone, Phoebe Barnett, Theodora Stefanidou, Prisha Shah, Stephen Jeffreys, Antonio Rojas-García, Ruby Jarvis, Beverley Chipp, Brynmor Lloyd-Evans, Alexandra Pitman, Maria Ana Matias, Nikita Jacob and Sonia Johnson

Background

Loneliness is associated with several physical and mental health problems, yet its costs to the healthcare system remain unclear.

Aims

The current study aimed to review literature on the health and social care impacts of loneliness, and review economic evaluations of loneliness interventions.

Method

We conducted a systematic review of studies published from 2008 to April 2025 by searching five bibliographic databases, grey literature and reference lists of systematic reviews. Studies estimating health and social care cost/expenditure, and on health resource utilisation, were included to assess the impact of loneliness on the health system. Return on investment, social return on investment and cost-effectiveness evaluations were included to assess the economic impact of loneliness interventions. We conducted quality appraisal and narrative synthesis of results.

Results

We included 53 studies. Eight estimated the healthcare cost/expenditure of loneliness, 33 reported healthcare resource use and 19 were economic evaluations of interventions. Findings relating to the cost/expenditure of loneliness and service use were inconsistent: some studies reported excess costs/expenditure and service use, whereas others found lower costs/expenditure and service use. Economic evaluation studies indicated that loneliness interventions can be cost-effective, but were not consistently cost-saving or effective in reducing loneliness.

Conclusions

Findings on the impact of loneliness on the healthcare system and economic evaluations of loneliness interventions were varied. Therefore, we cannot derive confident conclusions from this review. To address evidence gaps, future research relating to social care, younger populations, direct healthcare costs of loneliness and randomised controlled trials with long-term follow-ups should be prioritised.

Keywords

loneliness; healthcare; expenditure; service use; cost-effectiveness.

Loneliness is an unpleasant, personal experience that arises when someone feels their social relationships are deficient in terms of quality and/or quantity.[1,2] Loneliness is closely related to social isolation, which refers to someone's objective number of social contacts and interactions.[3] Although these concepts are related, the subjective nature of loneliness distinguishes it from objective social isolation.[4] Loneliness has previously been thought of as an issue primarily affecting older adults, but recent studies have demonstrated a U-shaped distribution of loneliness, with its prevalence particularly pronounced in late adolescence/early adulthood.[5–7]

Loneliness is associated with a variety of physical and mental health problems.[8,9] Among mental health outcomes, the most consistent evidence supports an association with depression.[10,11] Formal synthesis of the evidence demonstrates that lonely people have around double the odds of developing depression compared with non-lonely people.[12] Loneliness is also a predictor of the subsequent development of anxiety disorders,[13] and is associated with more severe depression and anxiety symptoms among people with existing mental health problems.[14] It also predicts suicidal ideation, suicide attempts and suicide.[15,16] In terms of physical health, loneliness has been linked to cardiovascular problems, including higher blood pressure, lower cardiac output and cardiovascular disease.[17–19] Chronic loneliness has been linked with higher stroke risk.[20] An association has been demonstrated between loneliness and risk of dementia, characterised by more rapid cognitive decline in older age.[21,22] Loneliness is also associated with an elevated risk of premature mortality.[23,24]

The growing impact of mental health challenges means that social determinants of health, including loneliness, represent increasingly key modifiable targets for intervention to promote mental health and well-being.[25] Accordingly, over the past decade, there has been increased policy interest in addressing loneliness. For instance, in 2018 the UK Prime Minister launched a cross-sectoral strategy to tackle the issue in England.[26] The negative health outcomes associated with loneliness and the increase in loneliness and isolation reported during the COVID-19 pandemic[27] have accelerated a rapid increase in research and public interest in loneliness and its societal impact.[28] Thus, a case has been made that loneliness should be considered a pressing public health issue.[23,29] An important aspect of understanding the consequences of loneliness is to assess its economic impact. Because of the adverse associations between loneliness and mental and physical health

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outcomes, an association might be anticipated between loneliness and variations in patterns of health and social care service use.[30]

There have been recent efforts to summarise evidence on the healthcare use and costs associated with loneliness. They include a systematic review of the economic costs of loneliness and the cost-effectiveness of loneliness interventions,[30] and a systematic review regarding the association between loneliness and health and social care use in older adults.[31] The first review, by Mihalopoulos and colleagues,[30] identified 12 studies of samples across all age ranges, including cost-of-illness studies, economic evaluations, return on investment (ROI) studies, and social return on investment (SROI) studies. The authors found some indications that loneliness may be associated with additional costs and that loneliness interventions may be cost-effective, but they noted inconsistency in the included studies and concluded that comparability across studies was limited. Meanwhile, the review conducted by Smith and Victor[31] focused exclusively on the association between loneliness and health service use in older adult populations. They identified 32 heterogeneous studies and concluded that their findings were insufficient to determine whether loneliness was associated with changes in health and social care use among older people. Both reviews highlighted a paucity of evidence on this topic, especially in relation to general adult and younger populations.

An important limitation of these reviews was that they either only examined changes in the utilisation of services, or summarised evidence on health and social care costs, but did not consider these together. There was also very limited evidence in the review by Mihalopoulos et al[30] relating to population groups across the life course, such as young people and working age populations, with evidence at the time predominantly relating to older adults. Additionally, the review by Smith and Victor[31] only included studies relating to older adults in the general population. Because of the timing of when they were conducted, neither review considered evidence on loneliness published since the onset of the COVID-19 pandemic. Given these limitations and the need for an updated and comprehensive summary of this literature, we undertook a systematic review of the health and social care costs and expenditure of loneliness, the association between loneliness and health and social care use, and the economic value of interventions aiming to ameliorate loneliness in both the general population and specific at-risk groups. To ensure the review would be feasible and to keep the focus on direct health and social care costs, we did not include broader economic costs such as productivity losses, informal care and mortality. Our aims were as follows: (a) to review available literature on the healthcare impact of loneliness, including studies estimating the health and social care cost and expenditure of loneliness, as well as studies looking at the association between loneliness and health and social care resource use; and (b) to review available economic evaluations of interventions to address loneliness.

Method

Study design

We designed our review strategy as a team composed of academics, researchers with lived experience and clinical academics. Three lived experience researchers (experts by personal experience of mental health challenges) were involved throughout the project, including reviewing the systematic review protocol, attending monthly meetings, screening, data extraction, contributing to data synthesis, writing the lived experience commentary and reviewing paper drafts. We pre-registered the protocol for this systematic review (PROSPERO Protocol Registration Number: CRD42023 402725) and adhered to the principles of the Preferred Reporting Items for Systematic Reviews (PRISMA) guidelines,[32] including a completed PRISMA checklist (see Supplementary File 1 available at https://doi.org/10.1192/bjo.2025.10862).

Search strategy

We conducted systematic database searches in Medline, EMBASE, PsycINFO (using Ovid), CINAHL and EconLit (using EBSCOhost), using relevant keyword and subject heading searches (see Supplementary File 2) for studies published between January 2008 and March 2023. Before publication, we repeated the search to identify studies published between March 2023 and April 2025. We conducted grey literature searches via Google Scholar search and EThOS. We also hand searched the reference lists of any relevant systematic reviews identified for potentially relevant studies. Additionally, experts within the research team highlighted potentially relevant sources of grey literature that they were aware of based on their research networks, which we screened at the full-text stage.

Screening

We de-duplicated all database search results by using Endnote version X9 for Windows (Clarivate, Philidelphia, USA; see https://support.clarivate.com/Endnote/s/?language=en_US), and imported these into Rayyan (web version; rayyan, Cambridge, MA, USA; https://www.rayyan.ai/)[33] for screening. We conducted title and abstract screening independently, involving seven researchers in this task for the initial search (S.E., T.S., P.M., D.M., P.S., S. Jeffreys and A.R.-G.) and four for the updated search (P.B., S.E., D.M. and N.J.). Each record was independently double-screened by two researchers for consistency. All full texts were screened in the same way. Any discrepancies between researchers' decisions were resolved through discussion with the wider research team.

Inclusion and exclusion criteria

We included studies primarily reporting the impact of loneliness on health and social care. These included studies estimating the health and social care cost and/or expenditure associated with loneliness, and studies on health and social care service utilisation (including primary care use, visits to secondary care specialists and in-patient care, with and without costs reported). We also included economic evaluations of intervention studies on the prevention or alleviation of loneliness, including ROI, SROI and cost-effectiveness evaluations. Studies where loneliness was not the primary outcome were eligible if the intervention explicitly mentioned loneliness reduction as an aim. Studies reporting either partial or full economic evaluations were eligible.

We included peer-reviewed scientific papers, published reports and theses that related to either mental and/or physical health outcomes. There were no limitations placed upon included populations, age groups or language of publication. We included studies published since 2008 to reflect the review conducted by Mihalopoulos et al[30] and to capture the increased quantity of loneliness research published in the past 15 years.[28] We excluded non-systematic narrative reviews, qualitative studies and book chapters.

Data extraction and quality appraisal

Eight researchers simultaneously conducted data extraction and quality appraisal (S.E., H.B., T.S., R.J., P.S., D.M., P.M. and A.R.-G.) for the initial search, and three for the updated search (S.E., D.M. and N.J.). Data extraction and quality appraisal were first piloted by these researchers to check for accuracy and consistency across the group. Data extraction and quality appraisal initially took place between 7 September 2023 and 3 November 2023; data extraction and quality appraisal for the updated search occurred between 28

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May 2025 and 12 July 2025. All extractions and quality appraisals were cross-checked for accuracy by one researcher from a sub-set of the team (S.E., H.B., D.M. and P.M.). Missing data were requested from study authors.

We extracted relevant data into a proforma including fields pre-agreed by the team. Data extraction for all studies included bibliographic details, country, study aims, sample size, sample health status, sample demographics, study design, loneliness measures used, lived experience involvement, cost perspective, costing/pricing year and currency, time horizon of study and author summary/conclusions. For studies estimating the cost/expenditure of loneliness and reporting health resource use, we additionally extracted direct and indirect costs/resource use outcomes and direct and indirect costs/resource use results. For economic evaluation studies, we additionally extracted information on the intervention and comparator, type of economic evaluation, main economic outcome measure, discount rate, types of costs measured, main outcomes, costs reported and economic evaluation results. We also documented if studies reported including lived experience and/or public or patient involvement (PPI) input, given the potential PPI input has to enhance the quality, impact and relevance of health service research outcomes and the importance of giving those affected by research a say in how it is conducted.[34]

We used the Schnitzler et al[35] quality appraisal checklist to assess the quality of evidence for studies estimating the cost/expenditure of loneliness and healthcare use. We used the Evers et al[36] checklist to appraise the quality of economic evaluation studies. For quality appraisal, each item within the corresponding checklist was weighted equally and we reported scores as a percentage of the total number of applicable items for each study. We had initially planned to use different checklists to assess quality, as reported in our protocol: namely, the Larg and Moss checklist,[37] Drummond et al checklist,[38] and Krlev et al checklist.[39] However, during the course of our study, Schnitzler and colleagues[35] published a checklist for the appraisal of cost-of-illness studies, which we found to be more appropriate for the studies retrieved in our search. We also identified that the Evers et al[36] checklist for economic evaluation studies was more consistent with the newly published Schnitzler et al checklist,[35] and therefore elected to use this for the appraisal of economic evaluation and ROI studies, rather than the checklists described in our protocol.

Evidence synthesis

We carried out a narrative synthesis of eligible studies.[40] This included developing a preliminary synthesis of findings from included studies, exploring potential relationships in the data, including comparisons of study quality, design, costing approach, population group and setting, as well as finally assessing the overall robustness of the synthesis. To facilitate comparisons, all monetary values have been adjusted for purchasing power parity (PPP) using the CCEMG–EPPI Centre Cost Converter website version 1.7.[41] The reference year for PPP adjustments was 2023 and our standard currency was USD. All PPP values are reported in brackets after originally reported figures.

Results

Study selection

Our searches identified 2595 records, which were reduced to 1700 studies after de-duplication. On screening these titles and abstracts and searching the reference lists of relevant reviews found through the search, we identified 266 for full-text review. From these, 53 studies were eligible for inclusion. These comprised eight studies estimating the healthcare cost or expenditure of loneliness, 33 healthcare resource use studies and 19 economic evaluations (six studies included more than one type of analysis). All eligible studies were published in English or had an English language version available. Full details of the search and screening process are provided in the PRISMA flowchart in Fig. 1. See Supplementary File 3 for a list of all papers excluded at full text screening, including exclusion reasons.

Quality of included studies

The quality of included studies was judged to be generally moderate to high. Of the 38 studies estimating the healthcare cost of loneliness and studies examining the association between loneliness and healthcare use that were assessed for quality with the Schnitzler et al checklist,[35] 23 met between 63.2 and 82.6% of quality criteria. The remaining 15 studies met between 57.9 and 44.4% of quality criteria. The criteria that were most often missed across studies related to whether sensitivity analyses were conducted, whether the time horizon of the study was justified and whether ethical issues were discussed. Of the 19 economic evaluations that were assessed for quality with the Evers et al checklist,[36] six of these met between 84.2 and 94.7% of quality criteria. Eleven studies met between 68.4 and 78.9% of quality criteria, with the remaining two studies meeting 55.6 and 44.4% of criteria, respectively. The quality criteria these studies were rated lowest on most consistently related to whether they discussed ethical and distributional issues and whether they discussed the generalisability of findings (see Supplementary File 4 for full quality appraisal ratings for each study).

Studies estimating the healthcare cost and expenditure of loneliness

Eight studies examined the healthcare costs or expenditure associated with loneliness, of which two also examined aspects of social care (Supplementary Table 1). Of the eight studies in this category, six employed cross-sectional analyses, one had a longitudinal design and one was a modelling study. Three studies looked at the healthcare cost of loneliness and the remaining studies examined expenditure. We distinguished between costs and expenditure based on both the terminology used by the original study authors and the conceptual difference between the two. Expenditure is defined as actual financial outlays, such as money spent on services or interventions. In contrast, costs refer to monetary estimates of resource use attributable to loneliness, such as increased use of healthcare services, even if not directly tied to spending. Five studies investigated the cost or expenditure of loneliness in older adults (65 years and older), and the others examined healthcare expenditure in the general adult population. Three studies were from the USA, two were from Spain and one each was from the UK, The Netherlands and Japan. Four measured loneliness with the three-item UCLA Loneliness Scale, two used the 11-item De Jong Gierveld Scale and one used a single-item question. Two studies used the same secondary data-set for their analyses and one modelling study used one source of input data from another study included in the current review (see Supplementary File 5 for details of data sources used in each study). None reported any PPI or lived experience input in design, delivery or interpretation.

The study with the second highest quality score was conducted in the USA.[42] This was a longitudinal assessment of annual Medicare (the main federal insurance scheme for older Americans) health and social care spending for 5270 individuals aged 65 years and older. Mean monthly health spending was $1024 (PPP = $1350.68). Spending covered in-patient acute care, hospice

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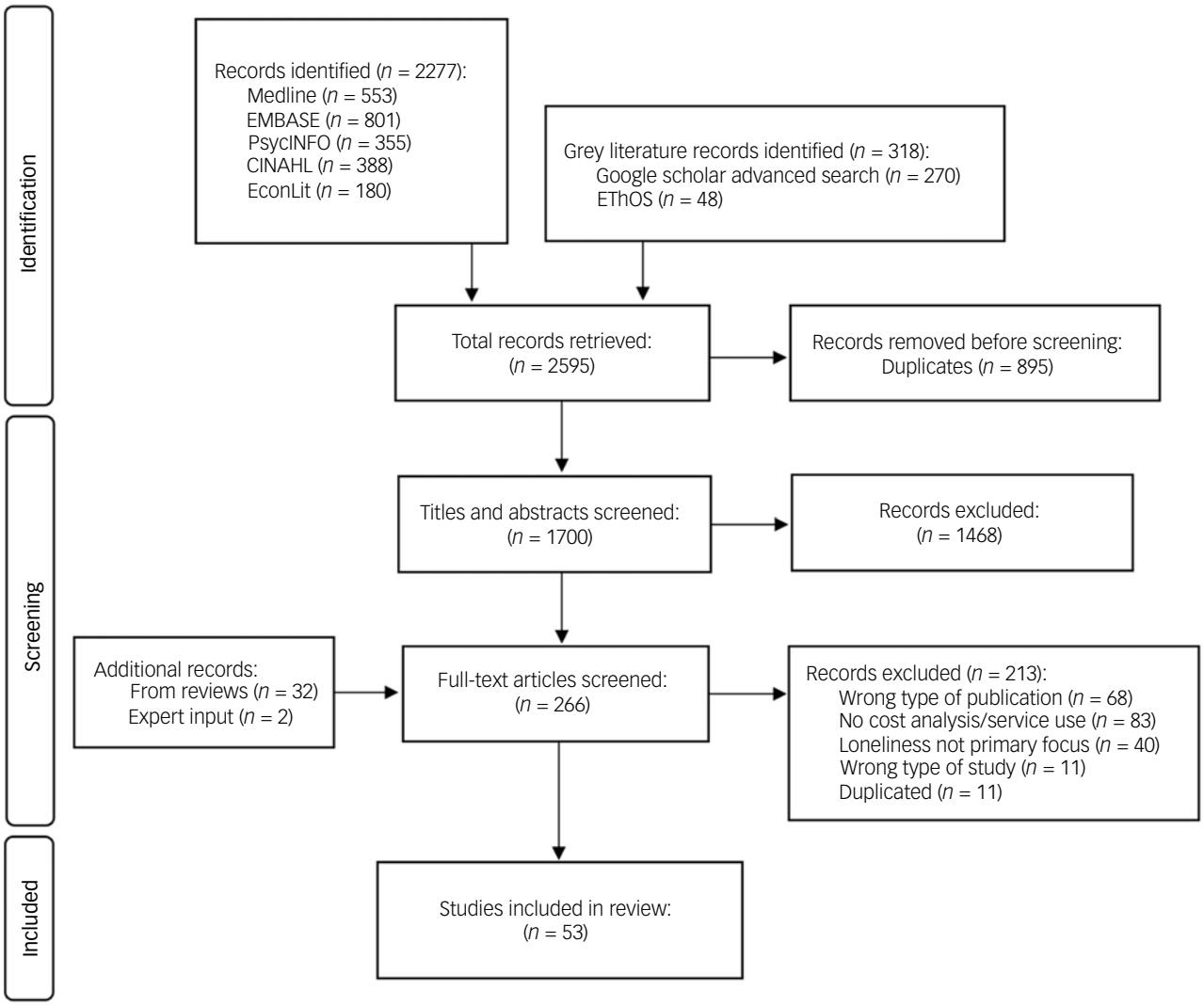

Fig. 1 PRISMA flow diagram summarising the search.

care, post-hospital stay nursing home care, out-patient services and medical providers' fees, including primary care, specialist care, occupational/physical therapies and some home health services. Compared with non-lonely participants, those who were lonely represented significantly lower expenditure, at $64 (PPP = $84.42) per month ($P < 0.001$), or $768 (PPP = $1013.01) per year. Overall mean monthly in-patient spending was $396 (PPP = $522.33), with lonely participants having $54 (PPP = $71.23) lower monthly in-patient spending ($P < 0.05$) than non-lonely participants. Loneliness did not explain differences in expenditure for out-patient care or skilled nursing facility care (i.e. post-hospital stay nursing home care).

In a study judged to be of moderate quality, data from prior studies sourced from within and external to the UK examining the cost of loneliness were used to model the cost of loneliness over 15 years among older adults in the UK.[43] In contrast to the findings of the above USA study,[42] the UK authors[43] estimated the additional costs for an older person experiencing chronic loneliness as £12 000 (PPP = $23 032.63) higher than a non-lonely person over a 15-year period. Their model included estimates of the annual cost per person of increased primary care visits (£150; PPP = $286.53), emergency room visits (£27; PPP = $51.57) and unplanned admissions (£56; PPP = $106.97) for those reporting loneliness compared with non-lonely individuals. They also accounted for costs associated with an increased likelihood of lonely individuals entering local authority-funded residential care and experiencing health conditions (including depression, dementia and physical inactivity). They estimated that 40% of these costs occurred within 5 years of an older person experiencing chronic loneliness.

The six remaining studies in this category presented cross-sectional analyses. The study with the highest quality score, conducted by Casal and colleagues,[44] looked at the cost of loneliness in the Spanish general population, using a representative sample of 400 lonely participants and matched controls from two national health surveys. It was found that the case sample of lonely participants had significantly higher frequentation of healthcare services and consumption of medicines and significantly lower quality of life than controls. The authors then calculated the population cost of loneliness in Spain, using existing estimates of Spanish healthcare costs. They estimated the overall costs associated with loneliness to be €14 141 million (PPP = $24 287 million) or 1.17% of the Spanish Gross Domestic Product (GDP) in 2021. Of these costs, direct costs were estimated to amount to €6101 million (PPP = $10 478 million) or 0.51% of overall GDP and 4.71% of total health expenditure. They estimated 91.9% of these costs to come from health service use, with the highest estimated costs for specialist medical consultations (€3880 million; PPP = $6664 million), followed by family doctor consultations

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(€1018 million; PPP = $1748 million), urgent consultations (€596 million; PPP = $1024 million) and hospital stays (€110 million; PPP = $189 million). The remaining direct costs were associated with consumption of medicines, with the highest costs associated with anti-depressants and stimulants (€298 million; PPP = $512 million), followed by tranquillisers and relaxants (€158 million; PPP = $271 million), then heart medicines (€39 million; PPP = $67 million).

In a similar Dutch study judged to be of moderate quality, multiple databases were combined to achieve a large ($N = 341\,376$), nationally representative sample of adults in The Netherlands.[45] The authors calculated expenditure figures based on health insurance spending in their sample, and then extrapolated this figure to the entire Dutch population. They found that when compared with non-lonely individuals, those who were rated as somewhat lonely represented a slightly lower total expenditure (incident rate ratio (IRR) 0.96, 95% CI 0.93–0.99, $P < 0.05$), which translated to €435.4 million (95% CI −€494.8 to −€376.1; PPP = $672.62 million) reduced total population spending, or 1% of total health expenditure. They also found lower specialised care expenditure for people who self-rated as somewhat lonely (IRR = 0.94, 95% CI 0.90–0.98, $P < 0.05$) or as very severely lonely (IRR = 0.88, 95% CI 0.80–0.97, $P < 0.05$). This corresponded to €449.8 million (95% CI −€474.3 to −€425.2 million; PPP = $694.86 million) lower spending on specialised care, corresponding to 2% of total population specialised care spending. In contrast, there was an association between higher expenditure on general practitioner (GP) visits and self-rating as somewhat (IRR = 1.02, 95% CI 1.01–1.04, $P < 0.05$), severely (IRR = 1.07, 95% CI 1.04–1.10, $P < 0.05$) and very severely (IRR = 1.08, 95% CI 1.04–1.13, $P < 0.05$) lonely. This translated to €5.8 million (95% CI €4.5–€7.1; PPP = $8.96 million) additional spending on GP visits, or 0.8% of total annual primary care expenditure. The authors also found an association between increased mental healthcare expenditure and self-rating as somewhat lonely (IRR = 1.17, 95% CI 1.04–1.33, $P < 0.05$) or as very severely lonely (IRR = 1.31, 95% CI 1.08–1.58, $P < 0.05$), corresponding to €340.2 million (95% CI €314.7–€365.8; PPP = $525.55 million) extra mental healthcare spending, or 10.3% of annual mental healthcare expenditure. The authors did not observe a significant association between loneliness and pharmaceutical expenditure.

A Spanish study of moderate quality[46] sought to examine the association between loneliness and healthcare facility use and costs among older adult (65 years and older) healthcare centre patients, in a cross-sectional analysis using retrospective healthcare data. They included participants that demonstrated loneliness and compared their healthcare utilisation against annual averages for their peers of the same age. They found that lonely patients spent an estimated annual average of €806.19 (PPP = $1216.49) more on healthcare use than their non-lonely peers. This was based on excess family practice visits (€221.16; PPP = $333.72), primary care nurse visits (€106.66; PPP = $160.94), home visits (€258.20; PPP = $389.61), emergency care visits (€206.97; PPP = $312.30) and mental health visits (€13.20; PPP = $19.92).

In another cross-sectional study from the USA, rated as moderate quality, the authors investigated how loneliness affected healthcare expenditure patterns according to level of physical activity in a sample of 6652 older adults (65 years and older).[47] Participants who had moderate physical activity levels and who were rated as severely lonely had a mean annual healthcare expenditure of $12 338 (PPP = $14 489.28), whereas those who were rated as having low/no loneliness had significantly lower mean annual expenditure of $9154 (PPP = $10 750.11; $P = 0.002$). For participants with either high or low physical activity levels there were no significant differences in their healthcare expenditure according to whether they reported loneliness or not.

Finally, two cross-sectional studies rated low–moderate quality found no significant association between loneliness and increased medical costs or healthcare spending in general population groups. The first of these, based in Japan, included 2546 adults aged 50 years and older, and did not identify any significant association between loneliness and healthcare spending.[48] The second was a USA-based study involving almost 7000 older adults (65 years and older) and found no significant association between loneliness and total medical costs.[49]

In summary, two studies looking at expenditure reported a significant association between loneliness and lower healthcare expenditure, two estimated higher healthcare expenditure associated with loneliness, and one study did not report any significant association between loneliness and healthcare expenditure. In terms of costs, two studies estimated excess healthcare cost associated with loneliness, and the remaining study did not report significant association between loneliness and healthcare costs.

Healthcare resource use studies

The 33 studies evaluating the association between loneliness and health and social care use are summarised in Supplementary Table 2. Where authors presented estimates as unadjusted, partially adjusted and/or fully adjusted associations taking into account specified confounders, we report estimates from the final model only.

All 33 of the studies we identified focused on healthcare use, five of which also included some measures of social care use. Of these, 11 studies focused exclusively on older adult populations (aged 60 to ≥80 years), nine studies sampled middle-aged to older adults (aged 40 to ≥56 years), five focused on young adults (aged 18–29 years) and/or university students, one included only adolescents and young adults (aged 13–18 years), three sampled across the general population (aged ≥15 to ≥18 years), one studied military veterans (of all ages), one focused on people with psychotic disorders (of all ages), one was with adults with chronic respiratory disease and one was with adult informal carers. The 33 studies in this category included 22 cross-sectional analyses and 12 longitudinal analyses (one study reported both). Seventeen studies used a version of the UCLA Loneliness Scale to measure loneliness (ranging from the three-item version to the full 20-item version), thirteen used a single-item question, and the remaining three studies used the De Jong Gierveld loneliness scale, a loneliness subscale from the National Institute for Health Toolbox Adult Social Relationship scale, and a three-item measure taken from a ten-item scale to measure social support, respectively. Twelve of the studies were conducted in Northern and Western Europe (UK, Ireland, Switzerland, Denmark, Sweden and Germany), one in South-Eastern Europe (Bosnia and Herzegovina), 15 in North America (Canada and the USA), three in Asia (Singapore, China and Japan) and two in Australia. Four studies used overlapping secondary data-sets; two used the same Irish data-set and two used the same USA data-set. One study used a data-set also used in an economic evaluation included in the current review (see Supplementary File 5).

Only one study described PPI input in their study, conducted by Savage and colleagues.[50] This involved including members of a retired teachers organisation on their study advisory committee and conducting interviews with members on priorities for ageing to shape their research questions and feedback on results. One additional study, Wang et al,[51] mentioned PPI in their paper, acknowledging that PPI was not commonplace at the time of establishing the cohort study from which the data they analysed

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were drawn (early 1980s). Results are synthesised narratively below according to healthcare outcomes and service use.

Loneliness and GP/physician visits

Seventeen studies in this category investigated the association between loneliness and GP or other physician visits. Three longitudinal studies judged to be of high methodological quality represented mixed findings: Newall et al[52] found no significant evidence of an association between loneliness and having made one or more physician visits in adults (aged 45 years and older) over 2.5 years in a Canadian sample, and Gao et al[53] found no association between trajectories of loneliness over 8 years and physician visits in a USA sample (aged 50 years and older). Wang et al,[51] considering a population of older adults in the UK (80 years and older), showed that participants who reported feeling slightly lonely at baseline had a significantly shorter time (in months) since their last GP visit when followed up 7 years later, compared with people who were not lonely at baseline ($\beta = -0.5$, 95% CI −0.8 to −0.2, $P < 0.05$). They found no significant evidence of a shorter time interval since their last GP visit for participants who reported feeling lonely often.

The remaining five longitudinal studies, which we found to be of moderate methodological quality, also reported a mixture of findings. When investigating the general adult Danish population, Christiansen et al[54] found that loneliness was associated with a slight increase in the number of GP contacts (IRR = 1.03, 95% CI 1.02−1.04, $P < 0.05$) after 6-year follow-up. In a study on informal carers in Australia over 8 years,[55] being lonely was found to be significantly associated with a higher number of GP visits compared to those who were not lonely (IRR = 1.18, 95% CI 1.04−1.36, $P = 0.011$); however, being lonely was not significantly associated with a dichotomous measure of whether participants had or had not visited a GP or family doctor. In contrast, in a study on Finnish adolescents, Kekkonen et al[56] found that non-lonely male participants had a higher number of primary health care visits ($\beta = 0.48$, 95% CI 0.12−0.84, $P = 0.008$) after 5 years, compared to lonely participants. Female participants showed no significant differences in primary healthcare visits. A study investigating adults in Germany (aged 40 years and older) did not find a significant association between loneliness and GP visits,[57] and a study investigating military veterans in the USA did not observe a significant association between loneliness and primary care visits after 1 year.[58]

Ten other studies in this category employed cross-sectional analyses and were judged to be of low–moderate to high quality. In a high-quality study, Gao et al[53] identified a significant cross-sectional association between loneliness and increased number of physician visits in the past 2 years in a USA sample aged 50+ ($\beta = 0.06$, s.e. = 0.03, $P < 0.05$), compared with those who were not lonely. However, they also found a significant cross-sectional association between loneliness and a lower likelihood of having visited a physician versus not in the past two years ($\beta = -0.15$, s.e. = 0.08, $P < 0.05$). Among older German adults (aged 60+), Denkinger et al[59] identified a modest positive association between loneliness score and number of physician contacts in the past year ($\beta = 0.03$, rooted $\chi^2 = 2.19$, $P = 0.029$). Zhang et al[60] found a significant association between loneliness and increased odds of reporting a physician visit in the previous 2 weeks among older adults in China (odds ratio 1.26, 95% CI 1.079−1.472, $P = 0.003$), whereas Gerst-Emerson and Jayawardhana[61] observed a modest positive association between chronic loneliness (loneliness at two time points) and number of doctor visits in the previous 2 years in the USA ($\beta = 0.075$, s.e. = 0.034, $P = 0.029$). In a Northern Irish sample, Burns et al[62] found a significant association between loneliness score and higher number of GP visits in middle aged to older adults (50 years and older), although the magnitude of this effect estimate was small (IRR = 1.03, 95% CI 1.01−1.05, $P = 0.013$). Burns et al[63] found positive associations of a small magnitude between loneliness (IRR = 1.03, 95% CI 1.01−1.05, $P = 0.004$) chronic loneliness (IRR = 1.1, 95% CI 1.01−1.19, $P = 0.028$) and number of GP visits in middle aged to older adults in Ireland (aged 50 years and older). They also found that women in their sample who reported loneliness at one time point and chronic loneliness (participants reporting loneliness at all three waves) had a slightly increased number of GP visits (one time point: IRR = 1.05, 95% CI 1.02−1.07, $P < 0.001$; chronic: IRR = 1.11, 95% CI 1.01−1.23, $P = 0.03$), whereas this did not apply to men. In a Swiss general population sample (aged 15 years and above), Richard et al[64] found that loneliness was associated with increased odds of reporting a physician visit in the previous year (odds ratio 1.29, 95% CI 1.17−1.42, $P < 0.05$). When stratified by age, this association was non-significant for 15- to 30-year-olds but was significant for those aged 30–60 years (odds ratio 1.32, 95% CI 1.16−1.51, $P < 0.05$) and those aged 60 years and older (odds ratio 1.80, 95% CI 1.40−2.31, $P < 0.05$). Stančić et al[65] also found a significant association between loneliness and increased number of GP visits (IRR = 1.12, 95% CI 0.99−1.24, $P = 0.04$) in a study conducted in the general population in one region of Bosnia and Herzegovina.

In contrast to most other results reported in this category, Lim and Chan[66] found that older Singaporean adults (aged 60 years and older) who became lonely over time (odds ratio 0.71, s.e. = 0.08, $P = 0.004$) and those who reported chronic loneliness (i.e. lonely at two time points) (odds ratio 0.75, s.e. = 0.09, $P = 0.014$) had lower odds of utilising a physician in the previous month, compared with those who were never lonely. Neither chronic loneliness nor recent loneliness were significantly associated with number physician visits in this sample. Finally, there was no significant association between loneliness and GP visits in those with a psychotic disorder in an Australian study.[67]

Considered together, the findings from these studies provide little convincing evidence that loneliness is associated with an increase in number of GP visits or physician contacts, given that most of the studies that identified an association employed cross-sectional analyses and the majority of significant findings only showed minor changes in number of GP visits/physician contacts.

Loneliness and hospital use/in-patient admissions

Sixteen studies in this category considered the association between loneliness and hospital stay/in-patient admissions. The four highest quality longitudinal studies considered several aspects of hospital stay. Newall et al[52] found that loneliness was not associated with risk of being admitted to hospital and was not associated with average length of stay in hospital, among Canadian adults (aged 45 years and older). However, they did find that loneliness was associated with higher odds of re-admission over a period of 2.5 years (odds ratio 1.74, 95% CI 1.01−3, $P < 0.05$). Wang et al[51] did not observe a significant association between loneliness and number of hospital visits over 7 years in adults in the UK aged over 80 years. In contrast, Shaw et al[42] found that older adults in the USA (aged 65 years and older) who reported loneliness reported slightly less frequent in-patient care admission (IRR = 0.96, $P < 0.05$) over a 6-year period. Gao et al[53] did not find a significant association between longitudinal trajectories of loneliness and trajectories of hospital stays or readmissions over 8 years in a USA sample of adults aged over 50 years, nor did they find a cross-sectional association between loneliness and hospital stays or readmissions.

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Four longitudinal studies of moderate quality also examined the association between loneliness and hospital stay. Christiansen et al[54] observed a small but significant positive association between loneliness and number of days in hospital among Danish adults (IRR = 1.05, 95% CI 1.00–1.11, $P < 0.05$), but not between loneliness and number of planned in-patient admissions. In an 8-year Australian study of informal carers, Majmudar et al[55] identified a significant association between being lonely and higher odds of having visited a hospital doctor (odds ratio 1.42, 95% CI 1.07–1.87, $P = 0.013$) compared with those who were not lonely. They did not find a significant association, however, between being lonely and number of hospital admissions. Dahlberg et al[68] in a Swedish sample and Bock et al[57] in a German sample found no significant association between loneliness and hospital stay in older adults (aged 76 years and older) and adults (aged 40 years and older), respectively.

Two high-quality cross-sectional studies conducted with data on older populations found some evidence that loneliness was associated with hospital stay. In a Chinese sample, Zhang et al[60] identified an association between loneliness and higher odds of hospital stay, reported annually (odds ratio 1.26, 95% CI 1.079–1.472, $P = 0.003$). In a sample from the USA, Gerst-Emerson and Jayawardhana[61] observed a modest association between loneliness and higher number of hospital stays in the previous 2 years ($\beta = 0.218$, s.e. = 0.101, $P = 0.031$). However, they only observed a significant association for people who were lonely in one specific point in time and not for chronic loneliness or loneliness at a different time points.

The remaining six studies in this category were cross-sectional and judged as moderate quality. These presented mixed evidence. In an Australian sample of people with psychotic disorders, Badcock et al[67] observed evidence of a positive association with loneliness and being a frequent hospital user, which included all health service use in the past 12 months (odds ratio 1.8, $P = 0.03$) and did not observe an association between loneliness and number of inpatient admissions. In the USA, loneliness was significantly associated with greater odds of hospital stay in the past 12 months among adults with asthma (odds ratio 2.81, 95% CI 1.13–7.02, $P = 0.027$) and also in adults with chronic obstructive pulmonary disease (odds ratio 3.46, 95% CI 1.65–7.24, $P = 0.001$).[69]

In older populations (aged 65 years and older), Denkinger et al[59] found no significant association between loneliness and length of stay in hospital (in a German sample), and Molloy et al[69] did not find a significant association between loneliness and planned in-patient admissions (in an Irish sample). Barnes et al[49] found that loneliness was not significantly associated with in-patient admissions among older adults in the USA, and Yüksel et al[48] did not find an association between loneliness and likelihood of in-patient visits in adults over 50 years of age in Japan.

In summary, we found little consistent evidence that loneliness is associated with an increase in hospital and/or in-patient admissions in both longitudinal and cross-sectional studies.

Loneliness and emergency department visits

Of the ten studies in this category that considered the association between loneliness and emergency department visits, only one was longitudinal. In this longitudinal study rated as moderate quality, Christiansen et al[54] observed a significant association between loneliness and increased number of emergency room treatments/visits (IRR = 1.06, 95% CI 1.03–1.10, $P < 0.05$) and number of emergency admissions (IRR = 1.06, 95% CI 1.03 –1.10, $P < 0.05$) in the Danish general adult population over a 6-year follow-up.

The remaining nine studies in this category were all cross-sectional and of moderate quality. Molloy et al[69] found that loneliness was associated with significantly increased odds of past-year emergency department attendance in older Irish adults (odds ratio 1.3, 95% CI 1.09–1.56) and Chamberlain et al[70] found that risk of unplanned emergency department visits was higher for those reporting loneliness compared to those that did not report loneliness, in a sample of older Canadian adults in supported living (hazard ratio 1.10, 95% CI 1.04–1.15). In a general population sample in Bosnia and Herzegovina,[65] there was a significant association between loneliness and increased number of emergency department visits in the past month (IRR = 1.26, 95% CI 1.05–1.51, $P = 0.005$). Chamberlain et al[71] identified an association between loneliness and a higher odds of an emergency department visit in the previous 12 months in Canadian adults aged over 45 years (odds ratio 1.13, 95% CI 1.05–1.21). They also found that loneliness was only significantly associated with increased odds of an emergency department visit among women (odds ratio 1.15, 95% CI 1.05–1.25), not men, in the previous 12 months. Burns and colleagues[63] did not find a significant association between loneliness and emergency department visits in Irish adults (aged 50 years and older). When stratified by gender, they found that women who reported loneliness had higher odds of an emergency department visit (odds ratio 1.08, 95% CI 1.0–1.16, $P = 0.028$), but not men. Burns et al,[62] Badcock et al,[67] Barnes et al[49] and Leukel et al[72] did not observe any significant associations between loneliness and emergency department visits in Northern Irish adults aged 50 years and older, Australian people with psychotic disorders, USA adults aged 65 and older, and USA adults with chronic respiratory disease, respectively.

In summary, we noted evidence from one longitudinal study that loneliness may be associated with increased emergency department visits; however, findings from a range of cross-sectional studies were contradictory and therefore inconclusive.

Loneliness and out-patient/specialist visits

Seven studies examined the association between loneliness and out-patient care or specialist visits. Of these, four were longitudinal. In a high-quality longitudinal study of older adults in the USA,[42] there was no significant association between loneliness and frequency of out-patient visits. The other three longitudinal studies were of moderate quality. Majmudar et al[55] identified a significant association between being lonely and higher odds of having visited a specialist (odds ratio 1.31, 95% CI 1.02–1.71, $P = 0.046$) in an 8-year Australian sample of informal carers. However, Christiansen et al[54] did not find a significant association between loneliness and planned out-patient treatments in the Danish adult population, and Bock et al[57] found no significant association between loneliness and specialist out-patient visits in adults (aged 40 years and older) in Germany.

Two cross-sectional studies judged to be of moderate quality[48,67] found no significant association between loneliness and out-patient visits in people with psychotic disorders in Australia and Japanese adults over 50 years old, respectively. One cross-sectional study on adults in Bosnia and Herzegovina,[65] rated low–moderate quality, identified a significant association between loneliness and number of specialist healthcare service visits (IRR = 1.15, 95% CI 1.01–1.32, $P = 0.029$).

In summary, there was modest evidence from only two studies that loneliness was associated with out-patient visits, which was not replicated across the other five studies that examined this.

Loneliness and general mental health service use

Eight studies considered mental health service use and its association with loneliness, of which two were longitudinal. Both of these studies were judged to be of moderate quality. Chen et al[58] examined the

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association between loneliness and mental health service use longitudinally (over 1 year) in veterans in the USA, finding no significant association. In an 8-year study of Australian adult carers, Majmudar et al[55] also did not identify a significant association between being lonely and odds of using mental health services.

The remaining studies, all cross-sectional, were judged to be of low–moderate to high quality. Two studies conducted with young adults (aged 18–29 years) in the USA did not identify any significant association between loneliness and mental health service use, which respectively encompassed whether participants had received treatment and medication for their mental health[73] and use of community or university mental health services.[74] Three additional studies conducted in USA, specifically in university students, found contrasting results. In two studies rated low–moderate quality, Russell et al[75] found a significant association between loneliness reported at the peak of the COVID-19 pandemic and greater odds of reporting mental health service use in the previous 12 months (odds ratio 1.17, 95% CI 1.14−1.19, $P < 0.001$), whereas Varughese and colleagues[76] identified an association between being lonely and reported lifetime therapy use in both domestic (odds ratio 2.38, 95% CI 2.29−2.47, $P < 0.01$) and international students (odds ratio 1.97, 95% CI 1.69−2.30, $P < 0.01$), compared with those who were not lonely. In contrast, Litt et al[77] did not identify a significant association between loneliness and international college students' professional help-seeking for mental health. Finally, Badcock et al[67] investigated the association between loneliness and home visits by a mental health professional in Australia, also finding no significant association.

Overall, there was little high-quality evidence of an association between loneliness and mental health service use.

Loneliness and other measures of health and social care service use

Several studies considered other aspects of health and social care service use, including long-term residential care. In a Canadian longitudinal study with older adults (65 years and older) rated as high quality, Savage and colleagues[50] examined transition rates between different healthcare settings, specifically transitions from community, in-patient, long-stay home care and long-term care. They did not find any significant association between loneliness and transition between these different healthcare states.

Hanratty et al[78] investigated the longitudinal association between loneliness and care home admission in English adults (aged 50 years and older) in a 13-year study judged to be of moderate quality. They found that loneliness was significantly associated with increased odds of being admitted into a care home, based on two different measures of loneliness: the UCLA Loneliness Scale (odds ratio 1.80, 95% CI 1.01−3.27, $P = 0.049$) and a single-item measure (odds ratio 2.13, 95% CI 1.43−3.17, $P = 0.0002$). In contrast, in a USA study with adults (also aged 50 years and older) and rated as high quality, Gao and colleagues[53] did not find a cross-sectional or longitudinal association between being lonely and nursing home care.

Wang and colleagues[51] examined the longitudinal association between loneliness and different aspects of social care service use over 7 years in a high-quality study of older adults (aged 80 years and older) in the UK. They did not find an association between loneliness and day centre visits, meals on wheels, community nurse input or home help when measuring loneliness at one time point. However, when measuring loneliness across three time points as a time-varying exposure, they identified an association between loneliness and increased community nurse visits (IRR = 3.4, 95% CI 1.4−8.7, $P < 0.05$) and meals on wheels use (IRR = 2.5, 95% CI 1.1−5.6, $P < 0.05$).

In another high-quality longitudinal study, Shaw et al[42] found that loneliness did not predict changes in skilled nursing facility care (i.e. post-hospital stay nursing home care) in older adults (aged 65 years and older) in the USA. In a moderate-quality longitudinal study of Australian carers, Majmudar et al[55] did not identify significant associations between loneliness and dental, chiropractor, physiotherapist, optometrist, community nurse or other health service visits.

In relation to pharmacy use and drug prescriptions, in a low–moderate quality cross-sectional study of Irish adults (aged 56 years and older) Murry et al[79] did identify a significant association between loneliness reported some of the time and higher likelihood of using pharmacy services (odds ratio 1.28, 95% CI 1.06−1.56) compared to not being lonely, although not for loneliness reported a moderate amount of the time or all of the time. Being lonely some of the time (odds ratio 1.38, 95% CI 1.12−1.72) and all of the time (odds ratio 1.86, 95% CI 1.13−3.07) were both significantly associated with requesting advice about medications (but not being lonely a moderate amount of the time). Denkinger et al[59] found no association between loneliness and number of drugs prescribed in German older adults (aged 65 years and older).

In summary, there is some longitudinal evidence that loneliness may be associated with aspects of social care use, specifically care home admission, community nurse visits and meals-on-wheels use, and pharmacy service use. However, outcomes were varied and some findings were inconsistent across studies.

Economic evaluations of interventions to reduce loneliness

Economic evaluations compare an intervention to alternatives and assess the options in terms of their respective costs and benefits.[80] In total, we identified 19 economic evaluations from 15 publications, summarised in Supplementary Table 3. Eight of the economic evaluations were cost-utility analyses (CUA), four were cost-consequence analyses (CCA), three were cost-effectiveness analyses (CEA), five were ROI analyses and five were SROI analyses (several studies included more than one evaluation type). These studies were designed as follows: nine modelling studies, five impact evaluations of an intervention using pre–post study design, four randomised controlled trials (RCTs) and one service evaluation. Most studies used a validated measure to assess loneliness; seven used a version of the UCLA Loneliness Scale (ranging from the revised three-item to the full 20-item version), seven used a version of the De Jong Gierveld loneliness scale (including the full 11-item version and the revised six-item version) and two used the three-item Campaign to End Loneliness scale[81] (one study used two different measures). Of the remaining four studies, three identified loneliness through participant interviews and one was a modelling study that did not report a loneliness measure.

The majority of studies examined populations aged 50 years and older. Seven studies specified older adult populations (three studies with participants aged 65 years and older and four studies without a specified age range) and seven evaluations were with middle-aged and older adult participants (aged ≥50 to ≥57 years). Of the remaining evaluations, one analysed data from a general adult population, one was for adults at risk of loneliness or social isolation, one for people with a mental illness diagnosis, one for adults who reported mental and/or physical health problems and low socioeconomic status, and one for people with dementia. A total of 16 studies were conducted or modelled in the UK, two

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were set in Australia and one in The Netherlands. Two modelling studies each included findings from one other economic evaluation included in this review as one of their sources of input data. One study identified matched controls using a dataset also used by a healthcare resource use study in the current review (see Supplementary File 5).

A total of 12 out of the 19 evaluations did not mention any PPI or lived experience involvement. Only one study mentioned having consulted one individual with lived experience to review their study protocol and supporting documents.[82] As part of their SROI analyses, Willis and colleagues,[83] the Social Value Lab,[84] Foster et al[85] and Jones et al[86] consulted a range of stakeholders, including participants of each respective intervention. Band et al[87] described having PPI input on their trial steering committee, which included attending meetings, opportunities to comment on the content of participant materials, offering informal advice on project management and interpretation of study findings. The study by McDaid and colleagues[88] also included perspectives from participants in the study intervention when reporting their CEA. However, none of these analyses reported co-producing with individuals with lived experience in the design or running of their studies.

ROI studies

ROI studies value the financial return of an intervention minus the cost of its delivery.[80] The five ROI analyses were all from high-quality modelling studies. Engel et al[89] conducted two ROI analyses; one was an assessment of a friendship enrichment programme and one was an assessment of a computer and internet training programme, both intended to reduce loneliness and depression in older adults in Australia. The friendship enrichment programme was modelled in a large sample of women ($N = 163\,299$) aged over 55 years, and when compared with usual care had an ROI ratio of $2.87 for every $1 invested (AUD; uncertainty interval −15.43 to 28.92; PPP = $2.53 per $0.88) after 5 years. In related analyses, the intervention was found to have cost savings of $72.4 million (AUD; uncertainty interval −731 to 396; PPP=$63.84 million) after 5 years because of reductions in healthcare treatment costs and productivity gains, with 7889 quality-adjusted life-years (QALYs) gained (uncertainty interval −77 904 to 117 568) and a dominant incremental cost-effectiveness ratio (ICER). However, strength of evidence of the effectiveness of the intervention in reducing loneliness was poor. Similarly, the computer and internet training programme was modelled in a sample of adults aged over 65 years ($N = 4791$), and, when compared with usual care, had an ROI ratio of $2.14 for every $1 invested (AUD; uncertainty interval = −4.49 to 17.88; PPP = $1.89 per $0.88) after 5 years. Further analyses demonstrated cost savings of $4.7 million (AUD; uncertainty interval −38 M to 9.9M; PPP = $4.14 million), 1072 QALYs gained (uncertainty interval −3939 to 8569) and a dominant ICER; however, there was also uncertainty over the effectiveness of this intervention in reducing loneliness.

Bauer and colleagues[90] examined the cost-effectiveness of a one-on-one befriending intervention for adults in the UK aged over 50 years, compared with no intervention. They found an ROI of 44p per £1 (PPP = $0.88 per $2.01) invested in the intervention, from an NHS perspective. Thus, the intervention did not appear to be cost-saving from a public expenditure perspective, though when potential quality of life benefits were included, the intervention was estimated to be cost-effective with an ICER of £2900 (PPP = $5822.99) and potential improvements per person of £270 (PPP = $542.14). McDaid et al[91] modelled the impact of a signposting service for people over 65 years not in paid work on a sample of 100 000 people, also in the UK. Over 5 years, taking a societal perspective, they found that the intervention had an ROI of £1.26 from every £1 (PPP = $2.31 per $1.83) invested and resulted in 1313 additional loneliness-free years. McDaid et al[88] also modelled the impact of a personalised support and community response programme for loneliness in UK adults over 50 ($N = 500$) over 5 years. They observed an ROI of £1.11 for every £1 (PPP = $1.89 per $1.70) invested in the intervention and an extra 486 loneliness-free years gained.

In summary, this evidence demonstrates a positive ROI value for several loneliness interventions, although their effectiveness in reducing loneliness was not consistently established.

SROI studies

All five SROI studies were carried out within the UK. Unlike ROI studies, which compare the value of monetary costs averted with the additional costs of intervention, SROI studies additionally place a monetary value on benefits that are difficult to value monetarily. This might be done after consultation with relevant stakeholders on why and how they believe an action will work, as well as on the magnitude of these effects.[92] The SROI study that was rated as the highest quality was conducted by Willis et al.[83] This examined the social value of three peer support groups for people with dementia and their carers. The three groups were estimated to create social values ranging from £1.17 to £5.18 (PPP = $2.14 to $9.49) for every £1 (PPP = $1.83) invested. The social value generated depended on the design and structure of each group, and key outcomes included a reduction in loneliness, reported qualitatively. The group that had an SROI of £5.18 (PPP = $9.49) was conducted weekly, included carers in the group, had approximately 23 participants in each session, focused on a variety of group activities, and had ten volunteer staff involved as well as paid staff and a group facilitator. The other two groups, which had SROI values of £1.71 (PPP = $3.13) and £1.17 (PPP = $2.14), respectively, occurred less frequently (fortnightly and monthly, respectively), had fewer participants (five and nine, respectively), fewer volunteers (zero and two, respectively) and were focused on group activities related to memory and reminiscence. The other high-quality SROI study was conducted by Foster and colleagues[85] and assessed the social value of a link worker scheme to reduce loneliness in adult service users of a social prescribing service ($N = 4010$). They found an estimated SROI value of £3.42 per £1 (PPP = $5.49 per $1.61) invested in the service and the intervention significantly reduced mean loneliness score on the three-item UCLA Loneliness Scale by 1.8 (95% CI −1.91 to −1.77, $P \leq 0.001$). The authors concluded that the service was effective in reducing loneliness and that the social value returned exceeded the investment.

In a moderate-quality study, the Social Value Lab[84] conducted SROI analysis of a Craft Café in a small sample of older adults aged 50-90 years ($N = 72$). The intervention was designed to enable skills acquisition and improve social and community connections. There was an estimated SROI value of £8.27 for every £1 (PPP = $16.03 per $1.94) invested. Sensitivity analyses produced estimates ranging from £4.86 to £9.57 (PPP = $9.42 to $18.55) and participants discussed feeling that their loneliness had reduced in qualitative interviews. Two further SROI analyses in this category were of moderate quality. Jones et al[86] assessed the SROI of a social prescribing physical activity programme for a small group of adults over 55 years ($N = 66$). They observed an SROI value of £5.07 generated for every £1 (PPP = $8.81 per $1.74) invested in the programme, with sensitivity analyses identifying estimates ranging from £2.60 to £5.16 (PPP = $4.52 to $8.96), suggesting that the intervention outweighed the input costs. Finally, Jones et al[93] conducted a SROI of an intervention supporting volunteers to help people aged 57 years and older

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access and use the internet ($N = 144$). The intervention resulted in a significant reduction in mean De Jong Gierveld loneliness score of 0.58 ($P = 0.004$). The cost of the intervention was £708 (PPP = $1306.97) per person with a SROI value estimated at £1000 to £1300 (PPP = $1846.01 to $2399.81) per person. Therefore, the authors concluded that the invention would theoretically pay for itself in under a year.

In summary, the loneliness interventions evaluated in this category demonstrated positive SROI values, suggesting that they can generate social value.

Cost consequence, cost-utility and cost-effectiveness analyses

The eight evaluations in this category were either a CCA, CUA, or CEA, or a combination of these approaches. Four of these evaluations were incorporated into RCTs. The highest quality study was a pilot RCT conducted in the UK by Simpson and colleagues[94] to examine the effect of peer support for a small sample of adults recently discharged from in-patient care, with care as usual as the comparator ($N = 46$). Their CEA and CUA found no significant mean difference between costs for the two groups and no significant difference between groups on loneliness outcomes at 3 months post-discharge. Mountain et al[82] conducted a high-quality RCT in the UK to examine an occupation-based lifestyle intervention for older adults aged 65 years and older, compared with usual care ($N = 262$), also incorporating a CUA. They found loneliness, measured using the 11-item De Jong Gierveld scale, to be significantly lower in the intervention group at 24 months post-intervention (mean difference −0.7, 95% CI −1.4 to −0.1, $P = 0.026$) but not at 6 months. The ICER was £7621 (PPP = $14 068.44). They concluded that the probability of the intervention being cost-effective was 30%, and that there was little convincing evidence of clinical or cost-effectiveness of the intervention.

The remaining two RCTs were both rated as high quality. Band et al[87] conducted a cluster RCT and CUA in England to examine an online intervention, called GENIE (Generating Engagement in Network Involvement), designed for adults at risk of loneliness ($N = 469$) to map their social network and connect them to local community activities. They did not find any evidence of a meaningful treatment effect of the intervention on loneliness in either the 3- or 6-month follow-ups. The intervention was found to be inexpensive to deliver, with an estimated total cost of £12 688.65 for all participants (PPP = $20375.16) or a mean of £52.65 (PPP = $84.54) per participant. However, there were also no significant differences in QALYs, costs or net monetary benefits compared with usual care. The probability that the intervention was cost-effective was 34.5% at a threshold of £20 000 (PPP = $32 115.57) and 39.85% at a threshold of £30 000 (PPP = $48 173.35) per QALY gained. The final RCT in this category was conducted by Weiss and colleagues[95] in The Netherlands, to compare a positive psychology intervention for adults experiencing loneliness, experiencing mental and/or physical ill health, and with low socioeconomic status ($N = 108$) to an active control of customised care from counsellors. Both groups significantly improved on loneliness, but with no statistically significant difference between them. Although the intervention group gained 0.07 less QALYs on average than the control group (95% CI 0.05–0.11), the intervention cost was €1090 higher in the control group (PPP = $1705.08; 95% CI −€1336 to €3516) and the cost saved per lost QALY was €161 953 (PPP = $253 341.64). The authors concluded that the intervention had an 84% chance of being cost-effective but may not be considered a good investment by some policy makers as it also accrued less QALYs than the control group.

McDaid et al[88] conducted an impact evaluation and CEA of a personalised support and community response to loneliness, named Reconnections, which had been delivered to older adults in the UK. In an analysis judged to be high quality, using data from a sample of 121 participants they found that loneliness scores on the four-item UCLA Loneliness Scale improved significantly in the intervention group (mean difference 1.75, $P < 0.0001$), and that this was maintained at the 18-month follow-up. The intervention had a mean cost of £752 (PPP = $1388.20) per person, and there was no significant difference between health service costs pre- and post-intervention. Out-patient costs were found to be significantly lower in the intervention group ($P = 0.034$) and the improvement in loneliness score was associated with 32% lower emergency department costs ($P = 0.02$).

The four remaining studies in this category were modelling studies, all using UK data. Mallender and colleagues[96] conducted three of these studies, whereas McDaid and Park[97] carried out the fourth. The highest quality of these was by McDaid and Park,[97] who assessed a local signposting service to help older people aged 65 years and older who reported moderate or severe loneliness to make new social connections in their community, compared with usual care ($N = 1200$). This CEA identified a mean additional 0.45 loneliness-free years gained from the intervention over 5 years. The cost per participant in the intervention group was £7131 (PPP = $12 132.24) compared with £6783 (PPP = $11 540.18) in the usual care group. The incremental cost per loneliness-free year gained over 5 years was £768 (PPP = $1306.63), and the intervention was cost-saving in 3.5% of iterations. The cost-effectiveness acceptability curve (CEAC) indicated that the intervention had a higher probability of being cost effective than no action, if the willingness to pay reached £836 (PPP = $1422.32). It was concluded that the intervention was likely to be cost-effective, but unlikely to be cost-saving.

In a modelling study also judged to be high quality, Mallender et al[96] assessed the cost-effectiveness of a friendship programme for older female adults, compared with a group receiving no intervention ($N = 115$). Although the economic analyses were modelled in a UK population, the original intervention was conducted in The Netherlands. The CCA revealed that loneliness significantly improved in the intervention group over 9 months, but that there were not significantly differences to the control group. The intervention was estimated to cost £77 (PPP = $142.14) per person. In a CUA, 0.035 QALYs were gained per person based on reductions in disutility across a range of adverse health conditions associated with loneliness. It was concluded that the cost-savings associated with reducing loneliness and associated health outcomes were £391 (PPP = $721.79) per person, or savings of £5.10 per £1 (PPP = $9.41 per $1.85) spent and a net saving of £314 (PPP = $579.65) per person. Therefore, the intervention was dominant over the control – i.e. both more effective and with lower costs.

Mallender et al[96] also modelled the cost-effectiveness of a group internet and computer training intervention for older adults in a high-quality study, with no intervention as the comparator ($N = 93$). The study was modelled on a UK population, whereas the original intervention was from the USA. The CCA showed no significant impact on loneliness in the intervention group, after a 5-month follow-up. The intervention was estimated to cost £564 (PPP = $1054.46) per person. Their CUA revealed 0.021 QALYs gained in the intervention group. The incremental cost per QALY gained was £15 962 (PPP = $29 842.59), so the intervention was deemed cost-effective. Cost-savings associated with reduced loneliness were £224 (PPP = $418.79) per person, or savings of 40p per £1 (PPP = $0.75 per $1.87) spent on the intervention.

Another modelling study, also by Mallender et al[96] was a moderate-to-high quality analysis of the cost-effectiveness of

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a group choir singing intervention in older adults, compared with no intervention ($N = 166$) and followed up after 12 months. This analysis was modelled in a UK population. A CCA was conducted and showed no significant difference between groups on loneliness score at the 12-month follow-up. The cost of the intervention was £86 (PPP = $158.76) per participant. Costs averted per participant were £92.13 (PPP = $170.07) for 2.49 fewer doctor visits and £2.40 (PPP = $4.43) averted for fewer medications in the intervention group. Total savings therefore outweighed intervention costs.

Overall, findings demonstrated that several different types of loneliness interventions had the potential to be cost-effective, although general effectiveness in reducing loneliness was limited.

Discussion

Summary of findings

Our review synthesised evidence from 53 studies that examined the healthcare impact of loneliness, and the cost-effectiveness of interventions to address loneliness. We identified eight studies that estimated either the healthcare cost or expenditure associated with loneliness. Two of these studies identified a significant association between loneliness and lower healthcare expenditure, two studies estimated higher expenditure for lonely individuals and one did not report any difference in expenditure. In terms of cost, one study modelling the healthcare cost of loneliness for the public sector reported excess healthcare costs associated with being lonely in the medium term, whereas another study reported excess healthcare costs associated with being lonely over a 1-year period in a cross-sectional analysis. One other study found no statistically significant difference in direct healthcare costs between lonely and non-lonely individuals. The inconsistency of this evidence, represented by a small number of studies from a variety of contexts and using differing methods, presents a challenge to drawing robust conclusions about the impact of loneliness on healthcare costs and expenditure. Furthermore, only three studies directly assessed healthcare costs associated with loneliness, whereas the remainder focused on healthcare expenditure. This highlights a clear lack of research on the true cost of loneliness, posing a considerable challenge for assessing its economic impact. It is also important to note that five of these studies focused on older adult populations, and the sample of adults in two of the remaining studies had mean ages over 50 years old. These studies also primarily focused on healthcare costs and expenditure, and generally did not consider wider social care costs, which may have particular and increasing relevance for older adult populations.[98]

Across the 33 studies examining the association between loneliness and healthcare use, there was little consistent evidence that loneliness was associated with GP/physician contacts, hospital/in-patient admissions, emergency department visits, out-patient visits or mental health service use. The majority of research into loneliness and healthcare use specifically considered GP/physician visits and in-patient/hospital admissions, with less evidence examining emergency department visits, out-patient visits, mental health service use and social care use. Relatedly, most of the high-quality longitudinal evidence related to GP/physician visits and in-patient/hospital admissions. Even so, much of the high-quality longitudinal evidence within different types of healthcare use is inconsistent, and in some instances, findings were contradictory. Therefore, an overall robust conclusion cannot be drawn about the association between loneliness and healthcare use from the findings identified in this study.

We identified 19 economic evaluations from 15 studies in this review. The findings from these studies suggest that loneliness interventions can be cost-effective, can generate social value, and that reducing loneliness may improve health-related quality of life. However, few interventions were identified as potentially cost-saving, and their effectiveness in reducing loneliness was not robustly established. Although many of the studies identified were rated as high quality, only four studies were RCTs. Further, only one of these studies concluded that their intervention, a positive psychology programme, was likely to be cost-effective, also noting that it may not be considered a good investment by policy makers as it also accrued fewer QALYs than the control condition.[82] This highlights the importance of conducting high-quality evaluations of interventions alongside thorough economic evaluations, before robust conclusions can be drawn about intervention efficacy and cost-effectiveness. The lack of such studies is a notable limitation of research on this topic.

It should also be noted that the economic evaluations we identified related to a wide range of different intervention types, including several befriending interventions, peer support interventions, computer training programmes, signposting, social prescribing and others. The studies also employed a variety of evaluation methodologies. This makes comparisons across different interventions and studies difficult. Furthermore, many of the sample sizes were small, so results should be interpreted with caution. All of the interventions were aimed at adult populations, and the majority focused on older adults. Therefore, findings are likely to be most relevant for this group and may not be applicable to younger populations. It is also important to note that 16 of the 19 economic evaluations were conducted or modelled in UK populations, so findings are likely to be most relevant to a UK context.

Strengths and limitations

A notable strength of the current review is our inclusion of studies that measure the healthcare cost/expenditure of loneliness, the impact of loneliness on healthcare use as well as studies that examine the cost-effectiveness of loneliness interventions. As such, this review considers the healthcare impact of loneliness from several key perspectives, representing a thorough evaluation of existing research and building on previous reviews on this important topic.

We addressed important limitations of the review conducted by Mihalopoulos et al,[30] by including intervention studies that included loneliness as a secondary outcome (provided that loneliness reduction was an explicit aim of the intervention). We also addressed important limitations of the review conducted by Smith et al,[31] by including studies with any population, including those who were not older adults and those beyond the general population. We also did not limit our search to studies published in English, addressing a limitation of both previous reviews.

It is also important to note several limitations and evidence gaps highlighted by the current review. Our focus in this review was on studies relating to health and social care use. This means that it is likely we have missed studies that consider economic impacts beyond health and social care, such as economic productivity in workplaces, informal care and volunteering. These are important considerations on this topic and should be examined in future research. The general focus on academic literature may also mean that we missed loneliness interventions offered by charities and voluntary sector organisations, as these sources may have fewer resources to undertake economic evaluations. However, we attempted to mitigate this through thoroughly searching two sources of grey literature and backward citation searching of relevant reviews.

As evidence was generally mixed and imprecise, we opted to grade the overall certainty of evidence as low and to weight the

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strength of our recommendations accordingly, instead of using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) guidelines.[99] This represents a deviation from our study protocol and is a limitation of this review. Further, because of the varied and numerous studies included in this review, we were not able to highlight all potentially key sources of variation across studies. Although data extraction and quality assessment were independently checked by two researchers, we did not conduct dual and independent data extraction and quality appraisal. This is also a limitation. Finally, we only included studies that examined loneliness and did not consider related concepts such as social isolation, social exclusion and perceived social support. Future studies should aim to assess the health and social care impact of these related domains and whether they differ to the impact of loneliness.

In terms of evidence gaps highlighted by this review, the studies included in this review are predominantly focused on older populations. We only identified one study that examined health and social care outcomes in adolescents.[56] We found five studies that that were focused on young adults; however, these were all cross-sectional and examined mental health service use only, and all but one were conducted in university populations. This is despite loneliness being at least as common among adolescents/young adults as in older adults.[5–7] For instance, research in the UK has previously found that young people aged 16–24 years report a higher prevalence of frequent loneliness than any other age group in the population.[100] This highlights a key research gap, as the economic impact of loneliness in groups other than older adults has not been well examined. This is especially true for economic evaluations of loneliness interventions, none of which were conducted with younger populations. Furthermore, this focus on older populations poses a challenge to making inferences relating to the economic impact of loneliness across the life course, as it is likely that estimates of lifetime cost-effectiveness will vary considerably between younger and older populations. Given this, the findings in this review are likely to be most relevant for older age groups.

The studies included in this review were from a small number of countries, predominantly within the UK and the USA. Therefore, findings are most likely to reflect these contexts and may not represent other countries. Additionally, many of the included studies employed cross-sectional designs, limiting understanding of the temporality of identified associations and of the economic impact of loneliness over time. Both the cross-sectional and longitudinal studies may also include participants who were lonely prior to the study period. This may mean that associated costs and/or service use may already have been incurred before the study period, and newer impacts of loneliness may not be reflected. Relatedly, few of the longitudinal or intervention studies had follow-up periods longer than 10 years. It is possible, therefore, that the impact of loneliness on health and social care use, and the outcomes of loneliness interventions, may occur over longer time periods than were captured by these studies.

Implications for future research

This is an important and topical research area, likely to gain further relevance in coming years because of the current economic pressures and an increase in loneliness-related research.[28] As such, continued research into the health and social care impact of loneliness is warranted to determine how best to direct investment to address this problem. Specifically, our review identified a lack of studies looking at the healthcare costs of loneliness, which are essential to understanding its economic impact on the healthcare system. High-quality longitudinal studies should also be a priority, with extended follow-up periods to identify whether there are long-term impacts of loneliness on health and social care use. An additional important consideration is to explore the association between loneliness and help-seeking behaviour and whether this has an impact on healthcare use, and associated costs, over time. Continued focus on identifying loneliness interventions that are both effective and cost-effective is also warranted. More RCTs of loneliness interventions with long follow-up periods, detailed cost analyses and qualitative components to understand participants' experiences could improve understanding of the acceptability, effectiveness and cost-effectiveness of loneliness interventions over time. Barriers to this are likely to include high costs and practical constraints associated with economic evaluations of interventions covering long timelines.

A finding of potential note derives from one longitudinal study that found an association between being lonely and a lower number of primary care visits in men, but not women; and two cross-sectional analyses that showed an association between loneliness and increased emergency department and GP visits in women, but not in men. This highlights a possible future area of research, to examine sex differences in the association between loneliness and healthcare use through high-quality, longitudinal studies. Additionally, the association between loneliness and social care use specifically is an important future research avenue, as this was not well explored in the studies included in this review. As noted in the review by Mihalopoulos et al,[30] evaluating the economic cost of loneliness in younger populations is a clear research gap and should be considered a priority.

There are also potential methodological issues to address. Previously, it has been argued that the EQ-5D and other instruments used in health economic evaluations to measure quality of life may favour physical health outcomes and may not adequately capture the impacts of mental health conditions[101] and loneliness.[102] There is a need for more research on the relationship between quality of life, mental health, and loneliness, as well as comparison of the sensitivity of different measures of quality of life to differing levels of loneliness. There may also be a case for considering adding an additional dimension to quality-of-life questionnaires, when being used in studies related to loneliness. The case for such 'bolt-on' dimensions to the EQ-5D has been explored for the related concept of social isolation.[103]

Future research on this topic should also include input from people with lived experience, as this review highlights that this is lacking from current studies. Future economic evaluations on this topic should consider such input to be necessary, particularly to highlight what outcomes matter most to people with lived experience. Additionally, it is key to incorporate outcome measures that are useful both in health economic evaluation as well as measures of loneliness and related outcomes. This is key to allow for more definitive statements to be made about the relative cost-effectiveness of different interventions, as this may be more subjective in instances where loneliness is the only common outcome measure. Finally, it is important to evaluate interventions to address wider factors like digital exclusion and poverty, to assess the potential economic impact of these in comparison to targeted loneliness interventions.

In conclusion, evidence relating to the cost of loneliness and the cost-effectiveness of loneliness interventions was varied and mixed. Inconsistency across findings made it difficult for any robust conclusions to be drawn about the cost of loneliness and the impacts of loneliness on health and social care use. We identified a range of different types of loneliness interventions, many of which were found to be cost-effective. However, the overall effectiveness of these interventions in reducing loneliness was often not clearly established. This review highlights a clear need for further research

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on this topic. Specifically, this includes conducting longitudinal studies with long follow-up periods and RCTs that include CEAs. The cost of loneliness in younger populations and how loneliness impacts on social care across all age groups are additional important research gaps that should be addressed. There should also be an emphasis on improving the way loneliness is captured within quality-of-life measures used in economic evaluation.

Lived experience commentary by P.S., S. Jeffreys and B.C.

Loneliness is not a unitary concept or experience and has different temporal trajectories, underlying causes and varied pathways to potential resolution. Thus, the inconsistent findings of the review are not surprising, even with the focus on older populations. Although some reviewed papers identified participants' gender and age, considering the impact of loneliness and interventions requires focus on discrete demographic populations, and consideration of predictable gender and age variables in likely health issues and anticipated use of services.

In reviewing the impact of loneliness on healthcare costs and usage, the bidirectional mixed findings may be explained by the issues of differential access to healthcare unique to individuals and different contexts. This might be exacerbated in some populations in the future, because of increasing reliance on health technology to access support. Disabilities and access challenges can contribute to social exclusion so may also lead to loneliness, although disentangling the impact of loneliness from increased need for health services may be challenging.

This systematic review addresses the subjective emotion of loneliness, but not objective measures of social isolation. As there is historic conflation of loneliness and social isolation within studies, tools and cohorts, the data may not adequately distinguish between them. The omission of linked experiences such as social isolation perhaps bypasses consideration of key underlying mechanisms for associated healthcare utilisation and costs. For example, family members may encourage seeking early support with a health concern. The growing number of older people without children, who have no family support at all, is a concern.

Few studies declared lived experience input, so we were unable to discern any accumulated wisdom from this experiential perspective regarding the health economics approaches taken. There is a need for more lived experience involvement in such studies including training offered in the technical aspects.

Loneliness, in its many forms, is unpleasant and isolating. We need ways of ameliorating it (at individual, group and societal levels), whether or not there is a quantifiable economic cost.

Sharon Eager, National Institute for Health and Care Research (NIHR) Policy Research Unit in Mental Health, Division of Psychiatry, University College London, London, UK; **Helen Baldwin**, National Institute for Health and Care Research (NIHR) Policy Research Unit in Mental Health, Division of Psychiatry, University College London, London, UK; **David McDaid**, Care Policy and Evaluation Centre, Department of Health Policy, London School of Economics and Political Science, London, UK; **Paul McCrone**, Institute for Lifecourse Development, University of Greenwich, London, UK; **Phoebe Barnett**, National Institute for Health and Care Research (NIHR) Policy Research Unit in Mental Health, Division of Psychiatry, University College London, London, UK; and Centre for Outcomes Research and Effectiveness, Research Department of Clinical, Educational & Health Psychology, University College London, London, UK; **Theodora Stefanidou**, National Institute for Health and Care Research (NIHR) Policy Research Unit in Mental Health, Division of Psychiatry, University College London, London, UK; **Prisha Shah**, NIHR Policy Research Unit in Mental Health Lived Experience Working Group, Division of Psychiatry, University College London, London, UK; **Stephen Jeffreys**, NIHR Policy Research Unit in Mental Health Lived Experience Working Group, Division of Psychiatry, University College London, London, UK; **Antonio Rojas-García**, National Institute for Health and Care Research (NIHR) Policy Research Unit in Mental Health, Division of Psychiatry, University College London, London, UK; and Department of Behavioural Science Methodology, Faculty of Psychology, University of Granada, Granada, Spain; **Ruby Jarvis**, National Institute for Health and Care Research (NIHR) Policy Research Unit in Mental Health, Division of Psychiatry, University College London, London, UK; **Beverley Chipp**, NIHR Policy Research Unit in Mental Health Lived Experience Working Group, Division of Psychiatry, University College London, London, UK; **Brynmor Lloyd-Evans**, National Institute for Health and Care Research (NIHR) Policy Research Unit in Mental Health, Division of Psychiatry, University College London, London, UK; and NIHR Biomedical Research Centre Loneliness and Social Isolation in Mental Health Research Network, Division of Psychiatry, University College London, London, UK; **Alexandra Pitman**, NIHR Biomedical Research Centre Loneliness and Social Isolation in Mental Health Research Network, Division of Psychiatry, University College London, London, UK; and North London NHS Foundation Trust, London, UK; **Maria Ana Matias**, Centre for Health Economics, University of York, York, UK; **Nikita Jacob**, Centre for Health Economics, University of York, York, UK; **Sonia Johnson**, National Institute for Health and Care Research (NIHR) Policy Research Unit in Mental Health, Division of Psychiatry, University College London, London, UK; NIHR Biomedical Research Centre Loneliness and Social Isolation in Mental Health Research Network, Division of Psychiatry, University College London, London, UK; and North London NHS Foundation Trust, London, UK

Correspondence: Sharon Eager. Email: sharon.eager.20@ucl.ac.uk

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Supplementary material

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Data availability

Data availability is not applicable to this article as no new data were created or analysed in this study.

Author contributions

S. Johnson, B.L.-E. and P.M. developed the original study proposal. S.E. drafted the protocol, with input from P.B. This was reviewed and approved by P.M., B.L.-E., D.M., A.P. and S. Johnson. S.E. led the search. S.E., T.S., P.M., D.M., P.S., S. Jeffreys, A.R.-G. and N.J. conducted screening. S.E., H.B., T.S., R.J., P.S., D.M., P.M., A.R.-G. and N.J. conducted data extraction and quality appraisal. Methodological and subject expertise was offered by P.M., D.M., B.L.-E., P.B., A.P., M.A.M. and S. Johnson. S.E., P.M., D.M., P.S., S. Jeffreys, H.B., T.S., R.J., A.R.-G., B.C., A.P., P.B., B.L.-E., M.A.M., N.J. and S. Johnson contributed to the analysis and interpretation of findings. S.E. drafted the manuscript, which all authors reviewed, revised and approved.

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Declaration of interest

None.

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