



The economic costs of loneliness: a review of cost-of-illness and economic evaluation studies

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Abstract

Purpose Loneliness and social isolation can occur at all stages of the life course and are recognized as a global health priority. The aim of this study was to review existing literature on the economic costs associated with loneliness and social isolation as well as evidence on the cost-effectiveness of interventions to prevent or address loneliness and social isolation.

Methods A bibliographic database search was undertaken in Medline, PsycINFO, CINAHL, and Embase, supplemented by a grey literature search and a reference list search. Papers were included that were published in English language in peer-reviewed literature in the past 10 years, reporting costs of loneliness and/or social isolation or economic evaluations of interventions whose primary purpose is to reduce loneliness and/or social isolation, including return on investment (ROI) or social return on investment (SROI) studies.

Results In total, 12 papers were included in this review, consisting of four cost-of-illness studies, seven economic evaluations and five ROI or SROI studies. Most studies were conducted in the UK and focused on older adults. Due to the inconsistent use of the terms loneliness and social isolation, as well as their measurement, the true economic burden can only be estimated to a certain extent and the comparability across economic evaluations and ROI studies is limited.

Conclusions The paucity of evidence that is available primarily evaluating the economic costs of loneliness indicates that more research is needed to assess the economic burden and identify cost-effective interventions to prevent or address loneliness and social isolation.

Keywords Loneliness · Social isolation · Cost–benefit analysis · Cost of illness · Costs and cost analysis · Return on investment

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Background

The problem of loneliness and social isolation is of growing global concern. Loneliness refers to the subjective state of negative feelings resulting from a discrepancy between an individual's desired and achieved levels of social relation [1]. In contrast, social isolation is defined as a state of having minimal physical contact with other people [2]. While individuals who lack social connections are more likely to feel lonely, previous research has shown that some people who have many social connections can still experience loneliness, whereas others who lack social connections may not feel lonely, indicating that loneliness is more related to the quality than the number of relationships [3, 4]. While loneliness can be experienced at all life stages, there are some groups who appear to be at higher risk, such as the elderly [5].

The health effects of loneliness and social isolation have been documented in the literature for various health conditions, including depression [6], impaired cognitive health [7], cardiovascular disease [8], increased blood pressure [9] and dementia [10]. Both social isolation and loneliness are associated with increased mortality and there is no significant differences between the two [4]. Moreover, some studies suggest that lacking social connections may have similar health consequences as smoking 15 cigarettes a day [11] and loneliness and social isolation may have worse health outcomes than risk factors such as obesity and physical inactivity [11].

Despite the clear health implications of loneliness and social isolation, relatively little attention has been paid to the economic implications. As a result of the negative health implications, social isolation and loneliness may bring significant costs to health, social care services and the economy more generally (e.g., productivity). Some research suggests links between loneliness and health care utilization, where socially isolated persons are more likely to seek medical assistance to satisfy their need for interaction [12, 13].

The economic burden of health problems is often documented in the form of cost-of-illness (COI) studies. COI studies provide a comprehensive assessment of the costs of various illnesses and include costs categories such as health care costs, broader societal costs (such as criminal justice, welfare, social sector costs, etc.) and losses in economic productivity related to morbidity and mortality (often called indirect costs) [14]. Partial COI are also common, which may not include all relevant cost components of an illness but provide some cost estimates attributable to an illness.

Developing strategies to tackle loneliness and social isolation should also be guided by economic evidence. Recently, new interventions have been developed to reduce loneliness and/or social isolation [15, 16]. The aim of such interventions is to correct deficits in social skills, social support, opportunities for social interaction and/or maladaptive social cognition. While interventions that address maladaptive cognition appear to be most effective [16], little is known whether such interventions are good value-for-money.

Economic evaluation can provide important information to decision makers regarding the value-for-money credentials of alternative uses of resources when an economic evaluation compares two or more interventions in terms of both costs and benefits [17]. Different forms of full economic evaluation exist including: cost-effectiveness analysis (CEA); cost-utility analysis (CUA); and cost–benefit analysis (CBA). The unit for measuring the benefits is the key distinguishing feature of each [17] (i.e., quality-adjusted life years (QALYs) in CUA, clinical meaningful health outcomes in CEA and outcomes expressed in monetary terms in CBA). The main outcome of full economic evaluations is the incremental cost-effectiveness ratio (ICER) for both CEA

and CUA and a net monetary benefit for CBA. In recent years, return on investment (ROI) studies or social return on investment (SROI) studies have become more popular. These studies can be viewed as a form of cost–benefit analysis that measure the costs of a programme (i.e., the investment) versus the financial return realized by that programme. Such studies generally focus on stakeholders' views in collecting data and sometimes use financial proxies (particularly in SROI studies) to estimate monetary value of benefits that cannot be easily monetized (e.g., cost of friendship). Another type is a cost–consequence analysis, which provides a multi-dimensional listing of costs and benefits of two or more interventions in a disaggregated form.

The aim of the current study was to review existing scientific literature on: i) the economic burden associated with loneliness and/or social isolation; and ii) economic evaluations of interventions whose primary purpose was to reduce loneliness and/or social isolation.

Methods

The current review conformed to the evidence-based guidelines in the Preferred Reporting Items for Systematic Reviews [18]. It was registered with the prospective register of systematic reviews, PROSPERO (CRD42018114749).

Publication search

Eligible COI studies, economic evaluations and ROI/SROI were identified through searching in Medline, CINAHL, PsycInfo (using Ebscohost platform) and Embase (using Elsevier) for articles published from 1st Jan 2008 to 2nd August 2018. Search terms are reported in Supplementary Material 1. All publications were imported into Endnote reference software where duplicates were removed and then uploaded into Rayyan [19]. The screening of titles and abstracts was split into two groups (LKDL, MLC one group and LE, JB the other). Each reviewer examined the titles and abstracts based on the pre-defined inclusion and exclusion criteria (Fig. 1. PRISMA flow diagram [18] Table 1). Any variation in decisions was resolved by a third reviewer. The articles accepted for full text screening were also assessed by two reviewers (LKDL, JB) and any variations screened by a third reviewer (MLC, CM). Grey literature was identified using Google Advanced Search. Terms used were loneliness, social isolation, economic evaluation and cost; language set as English; and site set as.gov or.org. Only websites and reports of high-income countries were looked into further. Hand searching was performed by checking the reference lists of the included publications and the Scopus database

Fig. 1 PRISMA flow diagram identification

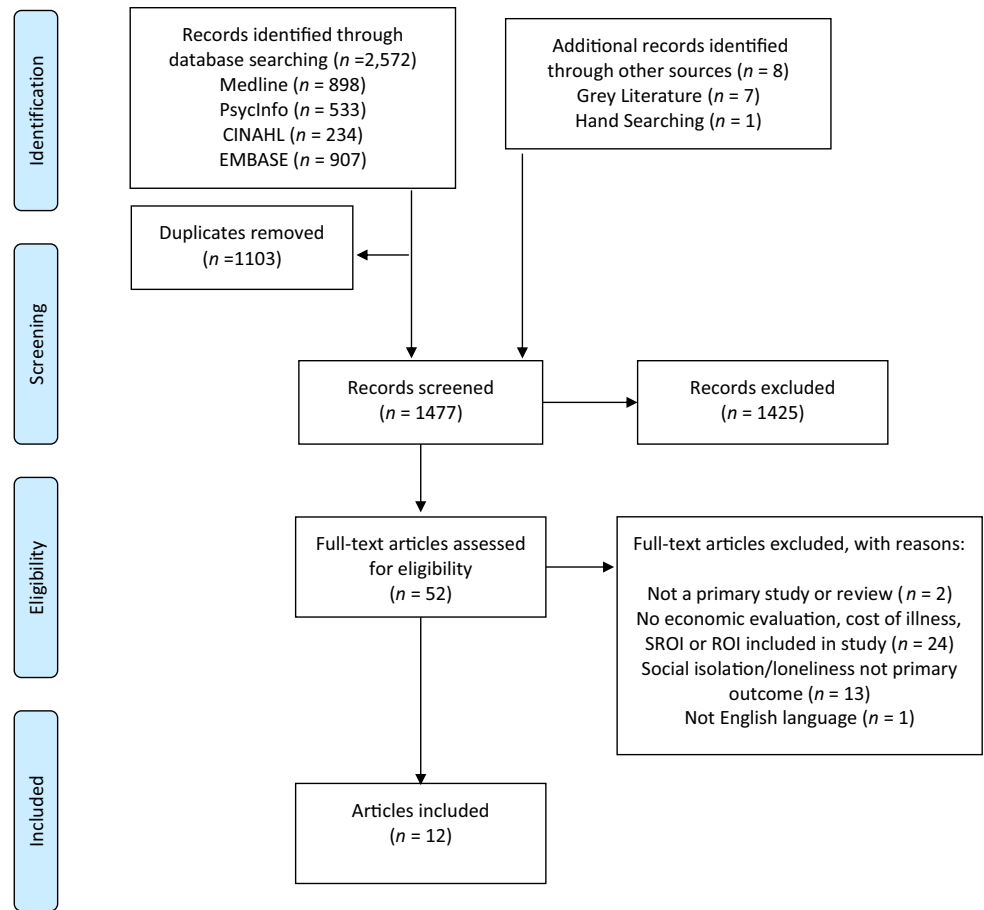


Table 1 Inclusion criteria and exclusion criteria

	Inclusion criteria	Exclusion criteria
Population	All population and age groups, including clinical groups (e.g., cancer patients)	
Design	Economic evaluation Cost analysis (cost of illness) Return on investment	Health utilization only (without reporting costs)
Intervention	Prevention and treatment of loneliness/social isolation No intervention (in case of a cost analysis)	
Outcome	Primary outcome: Loneliness Social isolation Social exclusion	Mental health outcomes (e.g., depression, anxiety) Social relationships Loneliness or social isolation as a secondary outcome
Country	All countries	
Method	Primary studies Reviews	Narrative reviews Expert opinions and editorials Qualitative studies
Publication type	Published in peer-reviewed or grey literature	Conference papers Dissertation Book (chapters)
Year of publication	01/2008–08/2018	Published before 2008
Language	English language	Other languages

was used to identify publications that had cited included publications.

Data extraction and quality assessment

Data were extracted in standardized tables depending on the type of study (Tables 2, 3, 4). Quality assessment was performed by a researcher who did not do the data extraction (Supplement 2). If discrepancies occurred between reviewers who did the data extraction and quality assessment, a third researcher adjudicated. A different quality assessment tool was used for each of the different types of economic assessment. Quality criteria for each study type were used including the Larg and Moss's checklist [14] for COI; the Drummond et al. checklist [17] for economic evaluation; and, the 12-point quality assessment framework for social return on investment studies by Krlev et al. [20].

Results

The PRISMA flowchart is provided in Fig. 1. In total, 12 references were considered in this review. Four COI studies were identified, seven economic evaluations (of which four were published in the same report) and five ROI or SROI studies. All studies were conducted in the UK, except for four undertaken in the Netherlands, Finland, Portugal, and USA. All studies focused on older adults who are lonely and/or socially isolated or are at risk of becoming so.

Quality of studies

Overall, only 50% of the quality criteria were met for the COI studies (Supplement 2, Table 1). Studies with the lowest quality tended to be published in the grey literature and did not report any sensitivity analyses or discuss study limitations. The seven economic evaluations met 55–100% of the criteria (Supplement 2, Table 2) [17]. Reasons for deductions resulted from the lack of establishing the effectiveness of the programmes, the absence of providing an incremental analysis of costs and effects of alternatives, failure to undertake uncertainty analysis and inappropriate presentation of results and discussion. The remaining evaluations met at least 60% of the quality checklist criteria. The quality criteria for ROI/SROI studies were generally high (> 70%), with the majority of the studies accounting for dead-weight or counter-factual situation (i.e., what would have happened without the intervention), attribution (i.e., how much of the outcome was caused by the contribution of other organizations or people), displacement (i.e., what activities or services are displaced by the activities) and drop-off (i.e., the

decline in the outcome over time) (Supplement 2, Table 3) [20]. Deductions in the quality of the included studies resulted from the missing limitation sections and the exploration of the robustness of the results in sensitivity analyses. The moderate quality of the two ROI studies was mainly due to the lack of information provided in the summary report.

Summary of the results

The following three sections summarize the results of the included studies by the type of study.

Cost of illness studies

Cost of illness studies (COI) are reported in Table 2. Of the four COI studies, two examined the economic burden of loneliness [21, 22], one focused on social isolation [23] and the last study on both [24]. All studies evaluated the impacts of loneliness/social isolation on older adults aged 65+ although Landeiro et al. reported the cost of social isolation in the elderly aged 75+ with hip fractures [23]. Both Shaw et al. [24] and Landeiro et al. [23] used a 'bottom up' costing methodology approach based on individual patient data, while Fulton and Jupp [21] and McDaid et al. [12] used modelling. In terms of the measuring tools, Shaw et al. used the 3-items loneliness measure and a range of survey questions included in the Health and Retirement Study Psychosocial and Lifestyle Questionnaire to capture objective isolation [24], whereas Landeiro et al. used the Lubben social network scale of 10 items as a measure for social isolation [23].

Both Fulton and Jupp [21] and Shaw et al. [24] compared states of being lonely/socially isolated with not being lonely/socially isolated. Landeiro et al. [23] compared across levels of risk of social isolation (i.e., low, moderate and high risk) and McDaid et al. [22] across levels of loneliness (not lonely, always lonely and sometimes lonely). Inpatient costs were reported in all four studies and outpatient cost were reported in three [21, 22, 24]. Both Fulton and Jupp [21] and Landeiro et al. [23] included non-medical costs (e.g., costs of residential care) and McDaid et al. also considered informal care [22]. Only Landeiro et al. separately reported medication costs related to hospital admission [23], although these may have been included in the overall hospitalization costs in the others.

Fulton and Jupp estimated a total cost of being chronically lonely of £11,725 per person over the medium term (15 years) compared to those who are not lonely [21]. Approximately 40% of the cost occurred within 5 years of being lonely and around 20% was associated with residential care. People with loneliness reported a 1.3–1.8 times higher rate of accessing healthcare services and also had a greater likelihood of developing certain health conditions

Table 2 Cost of illness (COI) studies

Lead author (year), country	Sample description (n), target risk factor (social isolation or loneliness)	Study design, study perspective, reference year, time horizon	Costs categories					Results		Quality score ^a
			Inpatient	Outpatient	Medication	Non-medical	Indirect	Direct costs	Indirect costs	
Fulton (2015), UK [21]	Older lonely adults, loneliness	Modelling study, UK public sector, no reference year identified, 15 years	+	+	-	+ ^b	-	£12,000 per person over 15 years		Grey lit. QS = 38%
Landeiro (2015), Portugal [23]	Older adults aged > 75 admitted to hospital with hip fracture, social isolation	Prospective cohort study, societal perspective, 2013, duration of hospital stay (average 13.1 days)	+	-	+	+ ^c	-	The additional costs per patient are €532 for the moderate risk group and €905 for the high-risk/socially isolated group		Peer-reviewed QS = 69%
McDaid (2016), UK [22]	Older adults > 65 years (general population cohort), loneliness	Modelling study (incidence-based costing approach), UK societal perspective, 2015, 10 years	+	+	+ (indirectly included)	+ (social services)	+ (informal care)	If effective action could be taken to avoid loneliness in a general population cohort, some of whom will already be lonely, net present value costs of more than £1700 per person over 10 years might be averted or £6000 over 10 years in those who are lonely most of the time.		Grey lit QS = 34%
Shaw (2017), USA [24]	Older adults 65+ (5270), social isolation and loneliness	Cross-sectional study, Health Care system perspective-US federal health insurance, Medicare 2006–2012, 1 month	+	+	-	-	-	Loneliness reduces spending- minus US\$64/month \$764 annually Isolation increased spending- US\$137/month \$1643 annually	-	Peer-reviewed QS = 66%

^aQuality assessment was undertaken using the checklist by Larg and Moss [14] for the critical evaluation of cost-of-illness studies^bResidential care costs^cCosts of administrative sections, costs of auxiliary sections rendering general support and costs of auxiliary services rendering clinical support

Table 3 Included economic evaluations

Lead author (year), country	Targeted population/sample description	Intervention(s) and Comparator	Evaluation type	Study design	Perspective, time horizon	Year of pricing, discount rates	Costs	Outcomes	Measure of loneliness/social isolation	Results	Quality score ^a
<i>Targeting lonely and/or socially isolated people</i>											
Knapp (2011), UK [26]	Lonely and isolated individuals aged over 50	Befriending versus do nothing	CUA	Modelling	Health care, 1 year	2009, 3.5% discount rate	Mental health services, primary care, hospital, medication, home helps	Reduction in depression and associated health service use; QALYs	Not reported	CUA: ICER = £2900 per QALY	Grey lit. QS = 70%
Onrust (2008), Netherlands [28]	Widows and Widowers reporting loneliness	Visiting service (the Widow-to-widow programme) versus care as usual	CUA	RCT	Societal, 1 year	2003 No discount	Intervention costs, direct health care costs, indirect costs (informal caregivers costs)	QALYs	de Jong Gierveld Loneliness Scale	€6827 per QALY	Peer-reviewed QS = 100%
Pitkala (2009), Finland [25]	Older adults with subjective feelings of loneliness	Psychosocial group rehabilitation versus usual community care	CEA	RCT	Health sector, 1 year	2001, No discount	Health care professional visits and hospitalization costs	Mortality, Subjective health	Based on 1 question in the survey (Do you suffer from loneliness?)	Cost-saving Intervention group had lower mortality rates and better subjective health but associated with lower health care costs (-943Euro/person)	Peer-reviewed QS = 55%
<i>Targeting other population groups</i>											
Mallender (2015), UK (1) [27]	Older adults	Internet and computer training intervention versus 'no training' (waitlist)	CCA CUA	Modelling	Public sector, 5 years	2013, 1.5% discount rate	Intervention cost and other financial consequences (potential savings to the health service)	CCA: Loneliness/life satisfaction, computer use CUA: QALYs	The UCLA loneliness Scale (20 questions)	CCA: Cost of intervention: £27,060 but no impact on loneliness; CUA: ICER = £15,962 per QALY gained, thus cost-effective	Grey lit. QS = 80%

Table 3 (continued)

Lead author (year), country	Targeted population/sample description	Intervention(s) and Comparator	Evaluation type	Study design	Perspective, time horizon	Year of pricing, discount rates	Costs	Outcomes	Measure of loneliness/social isolation	Results	Quality score ^a
Mallender (2015), UK (2) [27]	Older women	Friendship enrichment programme (lessons focused on topics related to friendship) versus no programme	CCA CUA	Modelling	Public sector, 5 years	2013, 1.5% discount rate	Intervention cost and other financial consequences (potential savings to the health service)	CCA: Friendships, self-esteem, wellbeing, loneliness, self-management in friendship CUA: QALYs	de Jong Gierveld Loneliness Scale	CCA: cost of programme £7190 and an increase in friendships and lower loneliness; CUA: The programme was considered dominant over its comparator (no programme)	Grey lit. QS = 85%
Mallender (2015) UK (3) [27]	Older adults	Arts-based interventions: Singing versus usual activities	CCA	Modelling	Perspective not stated, 12 months follow-up	2014, No discounting	Intervention cost and other financial consequences (potential savings to the health service)	5 physical health outcomes, 2 physical activity, and 3 mental health outcomes, including loneliness	UCLA Loneliness Scale (Version 3)	CCA: The cost of the programme was estimated at £7740 but no differences in loneliness	Grey lit. QS = 56%
Mallender (2015) UK (4) [27]	Older adult volunteers	School-based intergenerational and volunteering intervention (senior volunteers engaged in reading picture books to children) vs no programme	CCA	Modelling	Perspective not stated, 5 months	2014, No discounting	Intervention cost and value of volunteering	Social network, receiving social support, providing social support, social activity, self-rated health	Social network was assessed by to the amount of daily contact	The cost of the intervention was estimated at £691 but no differences in loneliness	Grey lit. QS = 56%

^aQuality assessment was undertaken using the Drummond et al. [17] checklist for the critical assessment of economic evaluation

Table 4 Included return on investment (ROI) or social return on investment (SROI) studies

Lead author (year), Country ROI/SROI	Intervention	Targeted population of the intervention; target risk factor (social isolation or loneliness)	Stakeholders considered	Data source	Inputs	Outcomes	Year of pricing, time horizon, Discount rate	SROI ratio obtained	Quality score ^a
Kimberlee (2015), UK, SROI [30]	Whitehall and St. George Link-Age hub (e.g., walking groups, coffee morning, computer course)	Older adults (55 + years old); Social isolation and loneliness	Beneficiaries, volunteers, befrienders and local advisory, Anchor Society, Guinness Trust, Bristol City Council Adult Social Care Services, Bristol PCT and community members	Interviews, surveys	Cost of running the LinkAge hub (year of operation: Sep 2011 to Aug 2012)	Facilitated friendship, improved wellbeing, improved physical health	2011/2012, 1 year, no discounting	For every £1 invested in the intervention, there is a SROI of £1.20	Grey lit. QS = 73%
Knapp (2011), UK, ROI [26]	Befriending (a person visits the older person at home—intervention usually not structured)	Lonely and isolated individuals aged over 50; social isolation and loneliness	NHS	Secondary quantitative data	12 h of befriending contact estimated at £85	Reduction in depressive symptoms and the consequent decline in the use of health services	2009, 1 year, no discounting	ROI: £.44 for every £ of investment over one year	Grey lit. QS = 45%
McDaid (2017), UK, ROI [22]	Signposting service + participate in local social activities	Older adults aged 65 and older who are not in paid work; social isolation and loneliness	NHS, beneficiaries	Secondary quantitative data	Cost of signposting service (borne by the participants or the activity deliverer)	Impact on GP and GP nurse contacts, risk of hospital presenting self-harm, and avoidance of psychological therapy to treat depression	2015, 5 years, 3.5% for costs, 1.5% for health benefits	ROI: £1.26 for every £ of investment over five years	Grey lit. QS = 55%

Table 4 (continued)

Lead author (year), Country ROI/SROI	Intervention	Targeted population of the intervention; target risk factor (social isolation or loneliness)	Stakeholders considered	Data source	Inputs	Outcomes	Year of pricing, time horizon, Discount rate	SROI ratio obtained	Quality score ^a
Social Value Lab (2011), UK, SROI [31]	Craft Café programme offers a safe, social and creative environment where older people can learn new skills, renew social networks and reconnect with their communities	Older adults; Social isolation and loneliness	Beneficiaries, family members, partner housing associations, the National Health Service	Interviews, surveys	Wider Role Fund, in-kind contributions by Housing associations and Impact Arts, and older people's time and effort	Impacts on older people that participate, member of participants, partner housing associations, and National Health Service	2010/2011, 5 years, 3.5% discounting	SROI ratio of £8.27 for every £ of investment. Sensitivity results showed the ratio varied between of £4.86 : £1 to £9.57: £1	Grey lit. QS = 91%
Willis (2018), UK, SROI [32]	Three peer support groups in South London (provision of a facilitated environment for people to meet and socialise, with a variety of dementia appropriate activities to engage group members)	People with dementia and carers; Social isolation and loneliness	Beneficiaries, carers, volunteers	Focus groups, interviews	Cost of peer support groups (grants, staff, refreshments, in-kind contributions and use of venue)	Impact on people with dementia, carers, and volunteers	2014/2015, 4 years, 3.5% discounting	£1.17 to £5.18 for every £ of investment, dependent on the design and structure of the group	Peer-reviewed QS = 82%

^aQuality assessment was undertaken using the 12-point quality assessment framework for social return on investment studies by Krlev et al. [20]. A score of > 70% is considered good quality

including depression and dementia compared to those without loneliness. Similar findings were reported by McDaid et al. where a net present value cost of more than £1700 per person over 10 years (or £6000 if only considering people who reported being lonely most of the time) could be avoided, for example, by reduced GP consultations [22]. In contrast, Shaw et al. found that loneliness was associated with lower annual health care expenditure of US \$768 per year per person (when compared to non-lonely people). The study suggested that loneliness might act as a barrier to accessing health care. However, Shaw et al. also found that socially isolated people incurred higher annual healthcare costs of US \$1643 compared to people with greater social connections [24]. Importantly, these costs increased to US \$3276 for women who were dually widowed and isolated compared to widowed women who were not isolated. In older adults with hip fracture, moderate and high risk of social isolation was associated with both delayed hospital discharge compared to low risk of social isolation. People with moderate and high risk of social isolation, respectively, accounted for an additional 1.5 and 2.6 days to discharge, which was associated with an additional cost per patient of €532 for the moderate-risk group and €905 for the high-risk group compared to the low-risk group.

Economic evaluations

We identified one publication reporting a partial economic evaluation [25] and three publications reporting a total of six full economic evaluations [26–28], which are summarized in Table 3. The partial economic evaluation collected data on health care service use, which was used to provide costs from a randomised controlled trial of group activities provided within day care centres in Finland [25]. The 235 study participants were home dwelling, over 74 years old and reported subjective feelings of loneliness. Participants were asked to express a preference for one activity on offer: (1) art and inspiring activities, (2) exercise and health-related discussions or (3) therapeutic writing and group psychotherapy. Participants were randomised to the intervention or a control group consisting of usual community care. The intervention groups met at a local rehabilitation or group psychotherapy center once a week for 3 months. The use of doctor's office visits and hospital services was measured in detail from baseline to 1-year follow-up. The results found that participants receiving an intervention had significantly lower healthcare costs compared to controls. This difference was greater than the 881 €/person intervention cost resulting in cost-saving.

One full economic evaluation was a cost–utility analysis conducted with data collected in a randomised clinical trial of a visiting service for widowed people over 55 years old versus usual care [28]. The widow-to-widow programme

consisted of 10–12 home visits by a trained volunteer. The perspective of the economic evaluation was societal and, therefore, included health care costs (direct medical), and direct non-medical such as transportation, parking and time lost from domestic tasks. Outcomes were measured using the EuroQol (EQ-5D). The total costs and QALYs were greater for the intervention group, but were not statistically significantly different. However, the study went on to calculate a non-significant cost-utility ratio of €6827.

The remaining full economic evaluations incorporated efficacy/effectiveness data from the literature into economic models to evaluate costs and outcomes. A published economic evaluation of befriending, as part of a broader analysis evaluating the costs and outcomes of several mental health prevention and promotion activities, was undertaken to support the UK National Health Service decision making [26]. The befriending intervention targeted lonely and isolated individuals aged over 50 and consisted of a home visitor for an hour per week (12 h of contact in total) compared to usual care. The costs included the use of hospital, primary care and mental health services, in addition to medications and other support in the home. This model estimated cost savings and quality of life benefits associated with befriending based on the reduction in depressive symptoms reported in a systematic review. The befriending intervention was not cost saving over a 1-year time frame, but was potentially good value-for-money with an incremental cost effectiveness ratio (ICER) of £2900.

The final group of economic analyses, reported by Optimity Matrix, was commissioned by the National Institute for Health and Care Excellence [27]. Four interventions, identified through a systematic review targeting independence and mental wellbeing for older people included the following: (1) arts-based interventions: singing, (2) internet and computer training, (3) school-based intergenerational activities and (4) friendship programmes. All interventions were evaluated through cost–consequences analysis. The cost of the interventions and comparators were calculated by the authors for a United Kingdom setting. The effects reported by the intervention publications were the outcome measures. A cost–utility analysis was also undertaken for two of the interventions where a significant effect on loneliness was reported. The model estimated the relative cost and QALY benefits of being ‘not lonely’ versus ‘lonely’ based on literature showing effects on depression, dementia and physical activity outcomes which has effects on diabetes, stroke and cardiovascular disease. The arts-based intervention was a 30-week chorale singing programme evaluated in the United States. The programme was estimated to deliver cost savings since the health system savings of £92/person was greater than the running costs of £86/person. The internet and computer training intervention for older people consisted of the use of email and an introduction to the web. The intervention

costs were estimated at £564 per person and did not lead to a statistically significant direct impact on participants' loneliness and depression although it did increase computer use. The resulting ICER of £15,962 per QALY gained falls below the generally accepted cost/QALY threshold in the United Kingdom (£20,000/QALY) making this intervention good value-for-money. The school-based intergeneration and volunteering intervention was a Japanese-based programme where senior volunteers read picture books to children. The programme cost was relatively low at £10/participant while the calculated value of volunteering was estimated at £81 per session.

The final intervention was a friendship programme targeting older women (> 55 years old) with 12 weekly lessons focused on topics related to friendship (i.e., expectations, self-esteem, conflict solving). The intervention costs totaled £77 per participant and resulted in significant benefits to increased friendships, contact with friends, number of friends, negative affect, self-esteem, life satisfaction, loneliness and self-efficacy. The CUA estimated a savings of £391 per person and a gain of .035 QALYs per person, making the friendship programme dominant over a waitlist control.

With regard to the measurements within the seven economic evaluations, one identified lonely and socially isolated people using the de Jong Gierveld Loneliness Scale [28], whereas another [27] used one question "Do you suffer from loneliness" (1 = seldom or never, 2 = sometimes, and 3 = often or always). Another modelling study did not include a measure of loneliness but rather inferred it [26]. Two of the four analyses by Mallender utilized the UCLA Loneliness Scale, one the de Jong Gierveld Loneliness Scale and one study assessed social networks via the amount of daily social contact [27].

Return on investment (ROI) and social return on investment (SROI) studies

Table 4 provides details of the two ROI studies [26, 29] and three SROI studies [30–32]. Using modelling techniques, the two ROI studies synthesized evidence from multiple sources on effects and costs for two interventions targeting loneliness and social isolation. Knapp et al. modelled a befriending intervention (i.e., home visits) targeting lonely and isolated individuals aged over 50 [26]. The intervention was modelled in terms of reduction in depressive symptoms and the corresponding decrease in health service use compared with doing nothing. Considering the costs and cost savings for the National Health Service (NHS), a ROI ratio was estimated of £1.20: £1.00 over 1 year. A similar ratio was estimated by McDaid et al. for signposting services for people aged 65 and older who are not in paid work (£1.26: £1.00) [29]. The impacts of subsequent participation in regular group

activities over 5 years were considered and the associated GP contacts, risk of hospital presenting self-harm and avoidance psychological therapy to treat depression. The ROI of £1.26: £1.00 was judged by the authors to be highly conservative, as it did not take account of additional health benefits.

The three SROI studies identified in this review [30–32] were conducted by having discussions first with relevant stakeholders in order to identify the resources used (inputs) and the resulting outputs for stakeholders [33]. All three SROI studies involved qualitative methods to establish which outcomes (themes) were of most importance and had an impact on stakeholders' lives. Once outcome indicators were developed, surveys were conducted to collect evidence on the outcomes that occurred. In the next step, a monetary representation of these outcomes and their value was established through the use of financial proxies. Kimberlee et al. evaluated the social and economic impact of one LinkAge hub in Whitehall and St. George, Bristol, which involved a range of activities, such as walking groups, coffee mornings, computer courses, etc., targeting older people (55+ years old) [30]. The study found that for every £1 invested in the intervention, there was a SROI of £1.20 over 1 year, with three broad areas of impact areas that included improvements in (i) friendship, (ii) wellbeing and (iii) physical health. Another study evaluated a Craft Café. A greater SROI ratio was obtained for the evaluation of the Craft Café that offers a safe, social and creative environment where older people can learn new skills, renew social networks and reconnect with their communities [31]. A number of positive outcomes were identified for older people that participated in the Craft Café, their family members, the housing associations, and the NHS and a high SROI ratio was reported (£8.27:£1:00). Finally, Willis et al. evaluated three peer support groups in South London that consist of providing a facilitated environment for people with dementia and carers to meet, socialize and engage in a variety of activities [32]. The SROI ratio ranged from £1.17 to £5.18 for every £1 of investment, depending on the design and structure of the group. The key outcomes for people with dementia included mental stimulation and a reduction in loneliness and isolation, whereas carers reported a reduction in stress and burden of care, and volunteers described an increased knowledge of dementia. It is, however, important to note that these studies were not trials but rather qualitative studies informed by stakeholder opinion, the outcomes should be observed as such.

Discussion

Key findings

This review identified 12 studies that were primarily focused on loneliness and or social isolation that can be used to inform economic questions around loneliness and social isolation. Four of these studies were descriptive in terms of the economic (or cost) burden associated with loneliness; a further four studies, evaluating seven interventions, reported the cost-effectiveness credentials of various loneliness interventions and five more were ROI/SROI studies. Most COI studies reported excess healthcare costs associated with loneliness/social isolation, although one US study found less costs associated with loneliness but higher costs associated with social isolation [24]. However, all these cost estimates are likely to be under-estimated given the lack of evidence of the impact of loneliness/social isolation on important cost categories, such as productivity losses. Even if the focus is on older population, it is important to consider categories of productivity, such as unpaid productivity (home duties or caring). Furthermore, there is no evidence evaluating the economic costs of loneliness/social isolation in younger populations. This is clearly an urgent research priority.

There is only one other UK review which has considered the economic case of tackling loneliness [34]. However, this is an unpublished report with only interim findings available. Furthermore, as the report is brief it is not possible to make comparisons with our review as there was insufficient detail regarding search terms, strategies, etc. The report did conclude that there have been very few attempts to assess the economic credentials of addressing loneliness.

The economic evaluations found that interventions targeting loneliness or social isolation are generally, likely to provide good value-for-money—if they are effective. While the quality of these studies was generally quite good, the lack of economic evaluations undertaken alongside high-quality intervention evaluation designs (e.g., randomised controlled trials) is a notable limitation. We identified only one full economic evaluation undertaken within a trial context. The modelling studies that reported costs/QALYs tended to find that the interventions were good value-for-money at commonly accepted value-for-money thresholds (such as the UK's £20,000–30,000/QALY) although the effects on health-related quality of life were based on changes in depression, dementia and physical activity associated with loneliness. Another limitation of the existing economic evaluations is that they tend to use varying costing perspectives (e.g., only one included a type of productivity cost—volunteer time) [27]. Measurements of both resource use/cost and utility data from trials would provide more robust information for any subsequent modelled analyses. Therefore, while the

economic evaluations tended to generally demonstrate that loneliness or social isolation interventions may provide good value-for-money, the differences in the methods and contexts of each study meant that they are not inherently comparable.

We identified five ROI/SROI studies highlighting the popularity of this type of analysis in this research area. However, while ROI studies tend to adopt what are largely partial economic evaluation frameworks (with health benefits sometimes ignored), SROI studies tend to place monetary values on many impacts, which do not have an inherent monetary value (e.g., friendship). Unfortunately, many of the values for such benefits used in SROI studies have not been determined using experimental designs and, therefore, the accuracy of the valuation is unclear.

A more general issue relating to all the studies identified in this review is the focus on older adults. We did not identify any studies which included children, adolescents or younger adults. A recent unpublished UK study found that the prevalence of loneliness was higher in young people than older populations [35]. This finding has been corroborated in the peer-reviewed literature [36]. It is also important to consider how loneliness and interventions designed to target loneliness impact on working-age adults since productivity losses are a significant component of economic burden of many health and mental health conditions. Another finding of this literature was the lack of consistency in the actual measurement of loneliness and social isolation. Many scales in this area have been developed from different theoretical perspectives and may not be comparable [37]. Further research regarding what is the gold standard of measurement needs to occur.

Another finding, particularly of the economic evaluation and ROI/SROI studies, was that the modelled studies sometimes used evaluations undertaken in one context (e.g., Japan) and modelled their impact in another context (e.g., the UK). While this is not uncommon in the modelled health economic evaluation literature, it is important to assess to what extent the components of the intervention are “transferable” to other settings and whether they are likely to result in the same or similar impacts. Last, tackling social isolation and loneliness is likely to require a multi-sector approach and the impacts are likely to fall in many sectors, not just health. As such, the economic evaluation approach needs to reflect these complexities and consider the costs and benefits occurring outside the health care sector. Furthermore, attention to the comparators or the counterfactual also needs to be more carefully considered.

Limitations of the current review

While we are confident we have retrieved the key economic studies in this area there are some limitations to our approach. First, we only included studies where the

primary focus was loneliness and/or social isolation. This resulted in the exclusion of a number of studies that considered loneliness/social isolation as secondary outcome. Second, although we comprehensively examined both the peer-reviewed literature and the grey literature, there may be unpublished grey literature studies that were inadvertently not included. We also only included studies published in English within the previous 10 years (2008–2018). However, given that the impacts of loneliness and social isolation have only recently been clearly articulated, there may be unpublished studies that were advertently not included. Third, given the different types of studies comprising this review, each was assessed with a different set of quality criteria. How comparable the actual ratings are across the criteria is unclear. Fourth, since the aim of the current review was to evaluate the costs associated with loneliness, studies which reported resource utilization but not costs were excluded. We are aware of seven such studies, which still provide important indices of potential resource use since many of these studies reported increased service use associated with loneliness/social isolation [12, 13, 38–42]. Finally, while social isolation and loneliness represent two different concepts, there are even more related but distinct concepts, such as social capital, social network, perceived social support, etc. [43], which were outside the scope of this review. However, it is worth noting that while our search included the term ‘social exclusion’, which is the feeling that one does not belong to the society, we did not identify any papers related to this concept. Due to the inconsistent use of terminology in this area [37], we may have missed some papers in our search that used different terminology but did in fact measure loneliness and social isolation.

Conclusion

In conclusion, we found that loneliness and social isolation are likely to be associated with excess health care costs, although one study did find that loneliness was associated with less costs, while social isolation was associated with greater costs. The economic evaluation and ROI/SROI literature found that of the limited interventions assessed (almost all targeting older populations) many were likely to be cost-effective and possibly even cost-saving. The most promising interventions from a cost-effectiveness perspective were those that included increased social contact (e.g., befriending, peer visiting, etc.). However, the literature is quite small and there are obvious gaps, particularly with respect to burden and interventions targeting younger people as well as methodological issues associated with the measurement of loneliness and social isolation.

Compliance with ethical standards

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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