



## SYSTEMATIC REVIEW

# Rapid systematic review of systematic reviews: what befriending, social support and low intensity psychosocial interventions, delivered remotely, are effective in reducing social isolation and loneliness among older adults? How do they work? [version 1; peer review: awaiting peer review]

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## Abstract

**Background:** During the 2020 COVID-19 pandemic, millions of older adults are advised to avoid contact with those outside their household. 'Social distancing' has highlighted the need to minimise loneliness and isolation through the provision of remotely delivered befriending, social support and low intensity psychosocial interventions. We wanted to know what interventions are effective and how they work to help inform decisions about different approaches.

**Methods:** We followed a systematic 'review of reviews' approach and included systematic reviews focussed on the effectiveness or implementation of remote interventions to reduce levels of social isolation or loneliness in adults aged 50+. Searches of 11 databases were undertaken during April 2020 and eligible reviews were critically appraised using AMSTAR2. Narrative synthesis was used at a review

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and study level to develop a typology of intervention types and their effectiveness. Intervention Component Analysis (ICA) and Qualitative Comparative Analysis (QCA) were used at a study level to explore the characteristics of successful interventions.

**Results:** We synthesised evidence from five systematic reviews and 18 primary studies. Remote befriending, social support and low intensity psychosocial interventions took the form of: (i) supported video-communication; (ii) online discussion groups and forums; (iii) telephone befriending; (iv) social networking sites; and (v) multi-tool interventions. The majority of studies utilised the first two approaches, and were generally regarded positively by older adults, although with mixed quantitative evidence around effectiveness. Focussing on processes and mechanisms, using ICA and QCA, we found that the interventions that were most effective in improving social support: (i) enabled participants to speak freely and to form close relationships; (ii) ensured participants have shared experiences/characteristics; (iii) included some form of pastoral guidance.

**Conclusions:** The findings highlight a set of intervention processes that should be incorporated into interventions, although they do not lead us to recommend particular modes of remote support.

### Keywords

social isolation, loneliness, remote interventions, review of reviews

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## Introduction

During the 2020 coronavirus (COVID-19) crisis, millions of older adults over 70 years old have been advised to be particularly stringent about social distancing, and to avoid contact with those outside their household<sup>1</sup>. Older adults are more likely to have long-term illness or disability, to live alone and to be widowed, all of which are risk factors for loneliness<sup>2</sup>. Social isolation and loneliness adversely affect quality of life, wellbeing and mental health, and are associated with physical ill health and mortality<sup>3</sup>. Social distancing and restrictions on face-to-face contact increase the risk of social isolation and loneliness. The requirement for older adults to restrict their activities during the COVID-19 pandemic puts a spotlight on the need to understand how to minimise the impact of loneliness and isolation using remotely-delivered approaches.

In the voluntary and community sector, many existing services are shifting to providing remote support, often via the telephone. In England, the call during March 2020 for NHS Volunteer Responders included roles to make 'regular phone calls to check on people isolating at home'<sup>4</sup>. Fulfilment of such roles requires that:

- (i) the programmes and interventions staffed by these volunteers are effective and have minimal adverse consequences for older people; and
- (ii) the volunteers making phone calls and providing other forms of support are adequately trained and supported to fulfil these roles, with training based on evidence of how the intervention should be delivered and the key processes that generate successful interventions.

This review focusses on interventions that seek to ameliorate loneliness or social isolation, or both. We conceptualise loneliness as an emotional response by individuals when there is a 'deficit between their desired and actual quality and quantity of social engagement and relationships'<sup>5, p647</sup>. We define social isolation as 'having minimal quantity and quality of structural and functional support' which can involve having social networks of low density that are not maintained through frequent engagement<sup>6, p15</sup>. Structural support reflects the number and diversity of social contacts and social roles; functional support reflects the meaningful functions that these social relationships play. Both loneliness and social isolation are conceptually distinct from living alone, the latter having limited utility as a proxy for either social isolation or loneliness<sup>7</sup>.

A number of evidence reviews have highlighted the diverse range of interventions to alleviate loneliness amongst older adults in a variety of settings<sup>8,9</sup>. In the main, these have been face-to-face interventions, either in groups or between individuals. During the height of the COVID-19 pandemic these interventions were of limited utility as lockdown regulations in many countries confined the vast majority of the population to their homes, except for essential outings. In this period all opportunities for face-to-face social contact outside the home were curtailed, and visiting friends and family for social contact prohibited. Even

as these regulations were eased social distancing has restricted opportunities for social interaction, by restricting face-to-face connections and physical contact. During this period there has been considerable growth in the use of remote communication tools including telephones, videoconferencing, or other internet 'chat' facilities.

This rapid review examines evidence on whether befriending, social support, and low intensity psychosocial interventions delivered remotely can reduce social isolation or loneliness among older adults. Specifically, the aims are to:

- (i) Identify existing systematic reviews on befriending, social support, and low intensity psychosocial interventions delivered remotely for older adults.
- (ii) Synthesise review-level findings on the nature and effectiveness of these interventions.
- (iii) Generate new understandings on how interventions work and which core components and processes are associated with successful interventions.
- (iv) Map the review-level and study-level evidence to better understand evidence gaps.

This paper is an abridged summary of a full report, available elsewhere, containing further details<sup>10</sup>. The rapid review was conducted in a short timescale (four weeks for the main body of work), and adopted a review of reviews approach to meet these timescales.

## Methods

We followed a systematic 'review of reviews' methodology to synthesise evidence from related (but differing) interventions for social isolation and loneliness, to help inform decisions about different approaches<sup>11</sup>.

The review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) checklist for the reporting of systematic reviews<sup>12</sup>. A protocol was agreed before data extraction and published on the [EPPI-Centre website](#).

## Search strategy

Searches of 11 bibliographic databases and online resources across the fields of health, social care, psychology and social science were carried out on 23<sup>rd</sup>-24<sup>th</sup> April 2020. We searched: Applied Social Sciences Index and Abstracts (ASSIA)(Proquest), Emerging Sources Citation Index (Web of Science), Database of Promoting Health Effectiveness Reviews (DoPHER), Epistemonikos, Medline (OVID), NHS Evidence, PsycInfo (OVID), Social Policy and Practice (OVID), Social Sciences Citation Index (Web of Science), Social Systems Evidence and Sociological Abstracts (Proquest).

The search terms reflected four concepts that needed to be present in each of the study citations:

- 1) **Population:** older and middle-aged populations aged 50+ years.

- 2) **Interventions** that enable remote delivery: technology, remote communication, telephone, helplines, self-help, bibliotherapy.
- 3) **Outcomes:** loneliness, social isolation (or close proxy measures e.g. social contact).
- 4) **Study design:** systematic reviews.

An example search history for Medline is presented in the full report<sup>10</sup> and as *Extended data*<sup>13</sup>.

### Inclusion and exclusion criteria

Inclusion and exclusion criteria were also based on the Population, Intervention, Comparator, Outcome and Study Design (PICOS) framework:

**Population:** We included reviews on ‘older’ adults age 50+ (see protocol for further details<sup>14</sup>). Participants could be located in a

variety of settings in the community or residential care, although reviews of interventions delivered to older adults in hospital settings were excluded. Studies included older people who were socially isolated, lonely, or who were otherwise at risk of loneliness or isolation.

While we identified all reviews on older people, we only synthesised evidence from reviews focussed on diverse populations of older people. We did not synthesise evidence from reviews focussed exclusively on particular groups of older people, specifically older caregivers (see 10), although interventions including caregivers are well represented in the evidence presented. The decision to synthesise evidence from a subset of reviews was inline with the rapid timescales of the review (see Figure 1).

**Intervention:** Included reviews examined interventions that sought to reduce levels of social isolation or loneliness, through

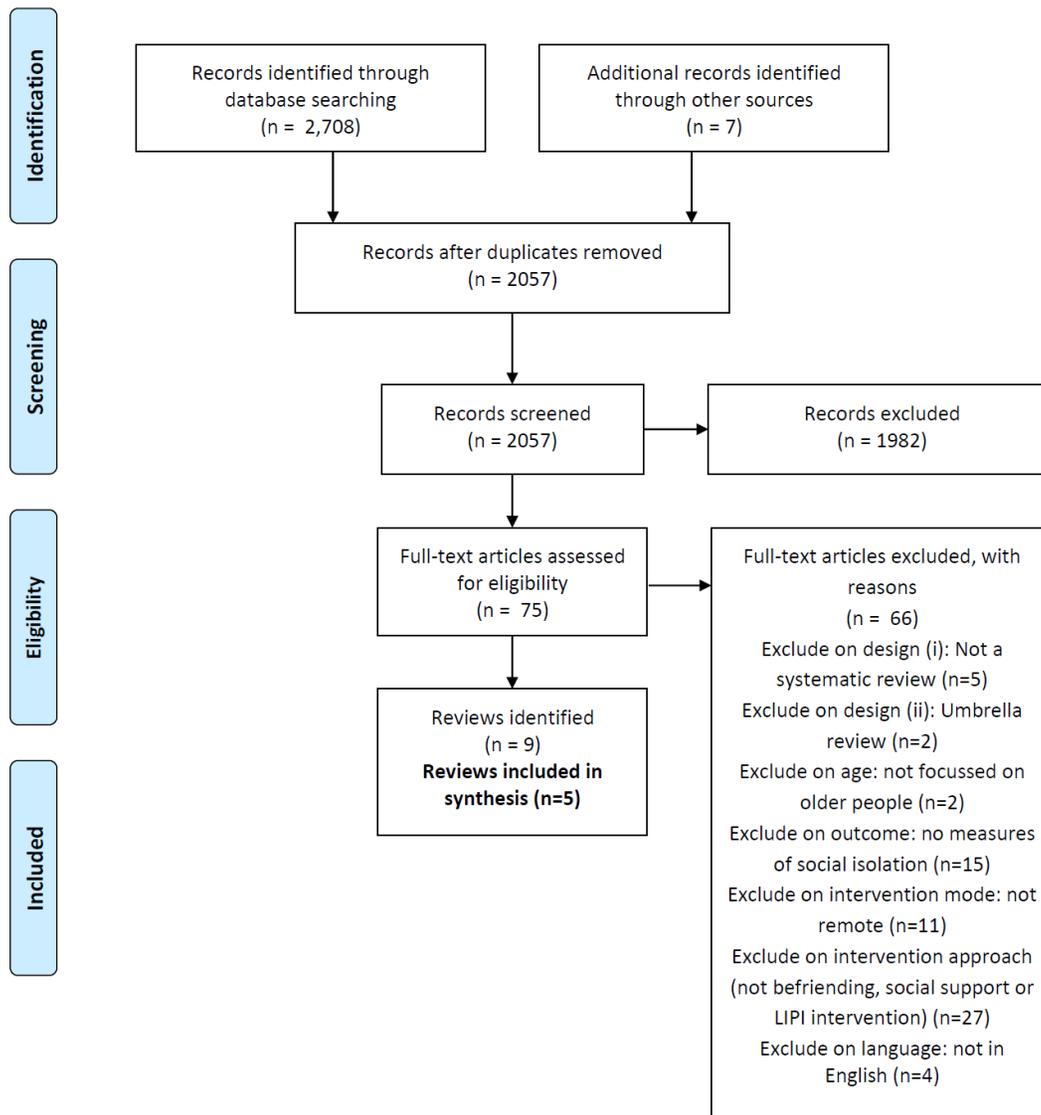


Figure 1. Flow of studies through the review.

strengthening individuals' social contacts and social relationships (e.g. befriending and social support), or through low intensity psychosocial interventions (e.g. internet-delivered CBT - iCBT), using remote methods and technologies. Interventions were delivered on a one-to-one basis (e.g. befriending), or as remote group-based interventions (e.g. discussion groups). We did not include interventions that examined the use of social robots, pets or virtual pets, or reviews solely focused on the use of technology for educational or training purposes.

**Comparator/control:** We included reviews that included studies with most forms of control group (randomised and non-randomised) and those without a control group (pre-post designs). Reviews on the implementation of interventions, including qualitative evidence syntheses were also included.

**Outcomes:** Included reviews measured social isolation or loneliness as a primary outcome. Based on previous reviews, we expected various measures of loneliness and social isolation to be reported, and we included both bespoke measures and proxies, such as reports of social connectedness.

**Study design:** We defined systematic reviews as those that met at least four of the following criteria<sup>15</sup>:

1. Were inclusion/exclusion criteria reported?
2. Was the search adequate?
3. Were the included studies synthesised?
4. Was the quality of the included studies assessed?
5. Were sufficient details about the individual included studies presented?

We did not include any other reviews of reviews, but used these to identify additional systematic reviews. We included unpublished manuscripts. We did not place any restrictions on date of publication, although only reviews in English were selected.

### Study selection and data extraction

We exported search records to EPPI-Reviewer web<sup>16</sup> and de-duplicated the records. Title and abstract screening was undertaken independently by three reviewers (DK, EB, PH) following joint screening of 204 citations (10%) to ensure consistency. For records included for full-text screening, each record was examined in duplicate, and reviewers met online to reconcile any differences. Reasons for exclusion are reported in [Figure 1](#).

Systematic reviews in this area often include a mix of eligible and ineligible interventions. In line with previous overviews<sup>17</sup>, and in addition to the criteria outlined above, systematic reviews were included if they:

- (i) contained only or a majority of interventions within scope; or
- (ii) contained separate evidence tables, or defined sections of evidence tables, presenting evidence on interventions within scope; or
- (iii) contained separate synthesis sections presenting evidence on interventions within scope.

Interventions in scope were befriending, social support, and low intensity psychosocial interventions, delivered remotely, to reduce social isolation and loneliness among older adults. We did not include reviews where only a single study within the review met our criteria. Individual studies reported within systematic reviews were identified as relevant, using the same inclusion criteria as above (albeit applied at the study, not review level) and after agreement of two reviewers.

Data were extracted by two reviewers and any differences agreed in online reconciliation meetings. We extracted the following data from reviews:

- Lead author and team;
- Year of publication;
- Number of primary studies included in the review;
- Primary study design(s) (e.g., RCT studies, qualitative studies);
- Aims of review and main topic focus; (e.g. if focussed on social isolation/loneliness);
- Target population (e.g., if focussed on particular group e.g. bereaved older people);
- Participant characteristics (e.g., age, gender);
- Intervention approaches in primary studies (e.g., type of remote intervention);
- Synthesised outcomes/key findings relating to social isolation and/or loneliness; secondary outcomes relating to implementation and adverse effects;
- Quality assessment characteristics and rating.

### Critical appraisal

Included systematic reviews were critically appraised using AMSTAR-2<sup>18</sup> by two reviewers (DK/BH and EB/PH). Criteria were summed and categories of quality created based on the AMSTAR-2 assessment (low risk of bias: equivalent to high confidence in AMSTAR-2; unclear: equivalent to moderate confidence; and high risk of bias: equivalent to low or critically low confidence).

## Data synthesis

**Descriptive analysis of reviews and studies.** We produced textual descriptions of the reviews and their findings and presented this in tabular form to develop a preliminary understanding of the evidence. The results also helped to populate an evidence map (see later synthesis).

**Narrative synthesis of the evidence.** A narrative synthesis was conducted to examine review-level and study-level findings. The narrative synthesis focussed on the outcomes of befriending, social support, and low intensity psychosocial interventions delivered remotely. Building on the descriptive analysis, we followed guidance outlined elsewhere<sup>19</sup>.

**Intervention Component Analysis and Qualitative Comparative Analysis.** We drew on two complementary synthesis methods – Intervention Component Analysis (ICA) and Qualitative Comparative Analysis (QCA) – and applied these to primary studies contained within the reviews that presented quantitative results, to understand how interventions ‘worked’. The first approach, ICA<sup>20</sup>, is an inductive approach developed in response to the poor reporting of intervention processes. It involves (a) inductively coding the nature of intervention features (i.e. components) and (b) using trialists’ informally-reported experiences of implementing the intervention (i.e. information usually located in introduction and discussion sections of trial reports, which is usually not incorporated into analysis)<sup>20</sup>. This information is then used in conducting the QCA.

The second approach, QCA, is applied to numeric data and is based on set-theory<sup>21</sup>. QCA is employed as a solution to the challenge of analysing data containing a small number of studies (known as cases in QCA terminology), each with an extensive array of factors that may trigger a given outcome<sup>22</sup>. This ‘small N-many variables’ challenge is similar to that faced by systematic reviewers, and Thomas and colleagues provide one of the first examples where QCA was utilised within a systematic review to understand configurations of intervention components that were aligned with ‘successful’ interventions<sup>23</sup>. Studies were eligible for QCA if they reported quantitative findings (see *Results*). We identified studies as belonging to both ‘condition sets’ (i.e. belonging to a distinct set of studies distinguished by the presence or absence of different characteristics or processes) and ‘outcome sets’ (i.e. belonging to a group of studies differentiated by whether they are considered most effective or least effective). Ultimately, we were interested in establishing which condition sets ‘overlapped’ with successful outcome sets. The goal of QCA is to identify the simplest expression of characteristics/processes that lead to effective interventions; to find the simplest expression we drew on Boolean minimisation. We followed standards of good practice that have been laid out elsewhere in conducting the QCA<sup>24</sup>. Further explanation of the approach is provided alongside the results.

## Results

### Review and study characteristics

The literature searches identified 2,715 citations. After duplicates were removed, 2,057 citations were screened at title and

abstract level, identifying 75 possible studies for inclusion. Full texts were obtained for all 75 records, with nine potential reviews identified and five included for synthesis<sup>i</sup> (see [Figure 1](#)). Not all of the primary studies within these five reviews met our inclusion criteria (see *Methods*) and from the 112 primary studies included across the five reviews, we identified 18 studies as eligible for synthesis.

**Review populations.** The reviews covered a range of populations, using different definitions and age thresholds for ‘older adults’, with a combined age range of 50–95. The settings were not always clearly stated, but were primarily older adults’ own homes, nursing homes, or supported living facilities, in North America, Europe and Taiwan. Whilst some reviews contained studies focused on the general older adult population, others included studies of people with multiple chronic conditions, specific conditions (such as Alzheimer’s Disease, or breast cancer), or in a particular geographical area.

**Review study designs.** RCTs, quasi-experimental cohort studies, survey studies, and qualitative (semi-structured interviews and focus groups) were all represented. Three of the five reviews conducted quality appraisals on the included studies<sup>25–27</sup>, one evaluated only the effectiveness of the technologies within the studies, not the quality of the study itself<sup>28</sup>, and one did not report any quality appraisal<sup>29ii</sup>.

The reviews contained studies reporting interventions using various technologies to deliver remote befriending, social support or low intensity psychosocial interventions including those in scope (e.g. video-communication and telephone befriending) and those out of scope (e.g. computer training and internet training). There was a range of different outcome measures within the reviews, although all contained some measure of loneliness or social isolation.

**Risk of bias assessment of included reviews.** All of the reviews were deemed to be of low or critically low quality (displayed as having a high risk of bias in [Table 2](#)). Although all had

<sup>i</sup> Four of the reviews focussed exclusively on interventions to support caregivers: 30. Corry M, Neenan K, Brabyn S, *et al.* Telephone interventions, delivered by healthcare professionals, for providing education and psychosocial support for informal caregivers of adults with diagnosed illnesses. *Cochrane Database of Systematic Reviews* 2019(5); 31. Elvish R, Lever S-J, Johnstone J, *et al.* Psychological interventions for carers of people with dementia: A systematic review of quantitative and qualitative evidence. *Counselling and Psychotherapy Research* 2013;13(2):106-25.; 32. Hopwood J, Walker N, McDonagh L, *et al.* Internet-based interventions aimed at supporting family caregivers of people with dementia: systematic review. *Journal of medical Internet research* 2018;20(6):e216.; and 33. Lins S, Hayder-Beichel D, Ruecker G, *et al.* Efficacy and experiences of telephone counselling for informal carers of people with dementia. *Cochrane database of systematic reviews* 2014(9). In view of the need for rapid evidence synthesis, we excluded these reviews from the synthesis, which only included the reviews focussed on the general older population (this included care givers in some instances).

<sup>ii</sup> Note that while Beneito-Montagut and colleagues’ study (2018) was a self-defined ‘review of the literature’, it was deemed to sufficiently meet the criteria of a systematic review for this review of reviews.

reasonably clearly defined PICO components and had conducted reasonably comprehensive search strategies, the majority had failed to prepare a protocol, and many failed to justify the choice of study selection. This latter concern was particularly problematic where authors had included studies of various designs.

**Primary study characteristics.** Befriending, social support and low intensity psychosocial interventions reported in the 18 primary studies fell into five categories reflecting modes of delivery:

- Supported videoconferencing to alleviate loneliness<sup>34–38</sup>.
- Telephone befriending to reduce social isolation<sup>39,40</sup>.
- Online discussion groups/forums to reduce social isolation and/or loneliness, or to improve/maintain social connectedness<sup>40–47</sup>.
- Supported use of social networking sites for mitigating social isolation and loneliness<sup>48</sup>.
- Multi-tool interventions (PC, training, messaging, chat groups) to reduce loneliness and/or social isolation, or increase social connectedness<sup>44,47,49,50</sup>.

Further primary study characteristics, including their populations, details of implementation, methodological details including how the outcome was measured, and outcomes as found in [Table 1](#).

### Narrative synthesis of findings

**Supported videoconferencing to alleviate loneliness.** Four reviews included a total of three qualitative studies, three quantitative studies, and one mixed-methods study, on supported video-communication interventions. Five studies involved supporting older adults to communicate with family members<sup>35–38,51</sup>, with the other two reporting on the videoconferencing element of the ACTION service in Sweden and Norway<sup>34,46</sup>. The qualitative evidence suggests the interventions were generally regarded positively by older adults, with increased feelings of connection with their family members<sup>35</sup>. The quantitative evidence showed some evidence of decreases in feelings of loneliness and increases in social support scores. Two quantitative studies<sup>37,38</sup> found reduced feelings of loneliness at one week, three months and 12 months, although this achieved statistical significance in only one study<sup>iii37</sup>. Torp *et al.*'s<sup>46</sup> mixed-methods pilot cohort study, employing questionnaires and focus groups, also found that the video phone was important for building and maintaining relationships. It is important to note that all interventions included ongoing support to use the technology. See [Table 1](#) for contextual details of reviews and studies on videoconferencing.

**Telephone befriending to reduce social isolation.** Two reviews included a total of one qualitative and one quantitative study

reporting on forms of telephone contact, one of which was a study of telephone befriending. Cattan *et al.*<sup>39</sup> reported on the *Call in Time* intervention, with qualitative findings from 40 participants. Telephone calls were made to older adults by volunteers, with a project co-ordinator managing the process. Findings included reduced feelings of social isolation, loneliness, depression and anxiety; improved state of mind, contentment with life, confidence level, and physical health (less pain). This study built on an earlier evaluation report that presented data used for the QCA<sup>52</sup>; this evaluation report was not directly included in any of the reviews, but quantitative data presented within this report suggested that participants had lower wellbeing and social support after the intervention, albeit with a number of caveats.

The only other included study to incorporate telephone contact was Gustafson *et al.*<sup>40</sup>, from the Morris *et al.*<sup>27</sup> review, where one element of the intervention was to match up participants with peer advocates, who engaged in weekly phone calls. This was not a telephone befriending service, as the peer advocate had a different role to that of a befriender. Findings showed that, of those who used a peer advocate 77.3% felt somewhat or very much connected with their peer advocate, and 81.6% felt that the peer advocate helped them cope (somewhat or very much so) with their breast cancer. Perceived social support increased significantly over the four months, but the intervention included more elements than just telephone support (computer and internet training, discussion group, 'ask an expert' service and written guidelines).

**Online discussion groups/forums to reduce social isolation and/or loneliness, or to improve/maintain social connectedness.** Two reviews contained eight quantitative studies and one mixed-methods (questionnaires and focus groups) on online discussion groups and forums. The studies included synchronous and asynchronous communication: real-time chat discussions, instant peer-messaging, email contact with professionals, and discussion boards. Interventions were designed to support women with chronic illness or breast cancer<sup>40,44,47,50</sup>; people with diabetes or heart transplant recipients<sup>41–43</sup>; and caregivers of people with dementia or stroke survivors<sup>45,46</sup>. The qualitative evidence suggested that discussion groups helped older adults to build social networks and friendships and to feel more familiar with people through regular connections<sup>45,46</sup>. The quantitative evidence showed mixed results with regard to loneliness and social isolation. The majority of studies showed increases in social support, but only two showed reductions in loneliness, with four studies not measuring loneliness at all. The asynchronous chat room 'Koffee Klatch' in Hill *et al.*'s<sup>44</sup> primary study provided a forum for women with chronic illnesses to share their feelings, concerns, life experiences and provide support to each other over 22 weeks, resulting in significant improvement in social support, but not in loneliness, compared to the control group. The Sharing Circle in Weinert *et al.*<sup>47</sup> provided the same opportunities, with the addition of discussion of self-study units and internet-based health information. This study saw statistically significant improvements in loneliness, but not in social support, compared to the control group. See [Table 1](#) for details of reviews and studies on online discussion groups/forums.

<sup>iii</sup> It was also unclear whether the intraclass correlation had been accounted for in calculating measures of effect.

**Table 1. Characteristics of included reviews and primary studies.**

Included review	Type of review and study numbers	Review focus / aim	AMSTAR2 rating	Primary studies included in our review	Population and setting	Study design and intervention	Measure of loneliness /social isolation	Outcomes	Quality tool used in review (rating)
Beneito-Montegut et al. (2018).	Literature review that includes a synthesis of a systematic review of 25 studies	To review previous research that investigates the relationship between internet use for communication and social isolation and loneliness, including its effects on social relationships in later life.	Critically Low	Bilalayne et al. (2010)  Tsai & Tsai (2011)	Participants: n=90 older adults, age range 69-85. 3 males, 1 female. Living at home, Australia.  Participants: n=90 older adults, age over 60 yrs Experimental (n=40; females=22) Control (n=50; females=30). Nursing home residents, Taiwan.	Pilot project to evaluate use of social network sites (SNS) at 14. An on-one tutoring, in how to use the social networking site, supported throughout the intervention, by project team member.  Quasi-experimental. Supported video-conferencing. Experimental group received at least 5 minutes/week for 3 months of video-conference interaction with their family members in addition to usual family visits. Videoconferencing supported by trained research assistant.  Comparison group received regular family visits only.	Qualitative: Loneliness (proxy for isolation)  Loneliness (UCLA Loneliness Scale)	The utilisation of a SNS has the potential to reduce loneliness. Positive effects of SNS on temporal loneliness (especially in the evening) and connectedness.  Alleviated perceived loneliness at 3, 6, and 12m after the intervention. Experimental group had significantly lower mean loneliness and depressive status scores at 3m (-5.40, P < .001, -2.64, P < .001, respectively), 6m (-6.47, P < .001, -4.33, P < .001), and 12m (-6.27, P = .001, -4.40, P < .001) compared with baseline than those in the comparison group. Experimental group had significantly lower mean loneliness and depressive status scores at 3m (-0.42, P = .03), 6m (-0.42, P = .03), 9m (-0.42, P = .03), 12m (-0.41, P = .03) and higher mean change in emotional social support at 3m (0.74, P < .001) and 12m (0.61, P = .02), and in appraisal support at 3m (0.74, P = .001).  No significant differences between experimental and control group regarding informational social support.	None
Bennett (2015)	Systematic review (part of doctoral dissertation) 10 studies	To answer what impact video-communication has on older adults existing relationships and their psychological well-being when it is used to communicate with friends and relatives.	Critically Low	Dennis et al. (2008)  Schwinderhammer, (2013)	Participants: n=4 older adults, age 65+. Nursing home residents, USA.  Participants: n=80 older adults, age 65+ Intervention condition: n=40, mean age 85.42 (6.88). Control condition: n=40, mean age 86.82 (5.28). Nursing home residents, USA.	Qualitative: Supported videophone intervention. Both residents and family members were asked to conduct a videocal at least once/week for 12 weeks. They had 150 minutes a week for a form after each social to document the technical quality. Participants supported by long term care facility staff to use videophone.  Quasi-experimental within-between repeated measures: Supported video-conferencing Experimental group received ten Skype sessions over a 14-week period, 10-30 minutes each time. Supported by researcher. Control group had regular care.	Qualitative: Thematic synthesis  UCLA Loneliness Scale	Themes reported included; participants being included into family interactions and feeling part of the family; participants valuing seeing the other persons facial expressions, videoconferencing reduced feelings of isolation, video found better than the telephone for emotional conversations and concerns with using the technology.  The results indicate the intervention group felt a significantly decreased level of loneliness after videoconferencing with family members than before, while the control group did not significantly change their loneliness level from pre-intervention to post-intervention.	None
Tsai and Tsai (2010)				Tsai and Tsai (2010)	Participants: n=34 older adults, age range=60-95. Nursing home residents, Taiwan.	Qualitative: Supported video-conferencing intervention. Videoconferencing programme once/week for three weeks. Contact with spouse, child or grandchild. The programme was supported by either MSN or SKYPE, using a large laptop. Residents assisted to use technology by a trained research assistant, who spent at least five minutes/week with residents at the appointment time.	Qualitative: Thematic synthesis	Themes included: enriched life, second best option for visiting, life adjustments and true picture of family life.	None
Tsai and Tsai (2011) (Duplicate - see description in Beneito-Montegut (2018))				Tsai and Tsai (2011)	Participants: n=57 older adults, experimental group, n=24 Mean age = 78 and control group, n = 33; Mean age = 74). Nursing home residents, Taiwan.	Quasi-experimental. Supported video-conferencing intervention. Experimental group received at least 5 minutes/week for 3 months of video-conference interaction with their family members in addition to usual family visits. Videoconferencing was supported by a trained research assistant. Comparison group received regular family visits.	Depressive symptoms, loneliness and social support (Social support behavior scale (Helsing, 1999)), via self-report questionnaires, administered at baseline, three, six and twelve months.	From baseline, compared to the control groups, video-communication significantly reduced feelings of loneliness at one week (β = -1.21, P = .002) and three months (β = -2.84, P = .003), and depressive status at three months. From baseline scores, changes in emotional social support scores at one week and three months and appraisal support scores at one week and three months were found to be significantly higher in the experimental group compared to the changes in the control groups. Subjects in the experimental group had significantly higher mean emotional and appraisal social support scores at one week (β = .61, p< .001) and three months (β = .68, P< .001), after baseline than those in the control group.	None
Tsai et al., (2010)				Tsai et al., (2010)	Participants: n=130 older adults with no prior experience of video communication, mean age=73.2. Living in the community, accessing homecare. The Netherlands.	Pre-post intervention study (non-randomised): CareTV - video/voice network package, (24/7 communication facility with a nurse practitioner). CareTV applications are (1) Alarm Service; (2) Care Service; (3) Good morning/good evening service; (4) Welfare and housing; and (5) Family Contact.	Loneliness scale (Jong Gierveld & Kamphuis 1985). Clients' experiences were evaluated in open questions in the survey.	Average feeling of loneliness at group level decreased significantly (p<0.001) from 5.97 (sd 2.77) to 4.02 (sd 3.91) between the start and end of the study on a scale from 0 to 11. Social loneliness (5-items) as well as emotional loneliness (6-items) showed significant decreases.	
van der Heide et al. (2012)				van der Heide et al. (2012)					

Included review	Type of review and study numbers	Review focus / aim	AMSTAR2 rating	Primary studies included in our review	Population and setting	Study design, intervention, comparison	Measure of loneliness/ social isolation	Outcomes	Quality tool used in review (rating)
Chen and Schulz (2016)	Systematic review 25 studies	Explore the effects of ICT interventions on reduced social isolation of older people	Critically Low	Cattan <i>et al.</i> (2011)  Savolainen (2008)  Torp <i>et al.</i> (2008)	Participants: n=40 vulnerable, isolated, and/or lonely, age range = mid 50s – early 90s. Mostly living at home, UK.  Participants: n=8 older adults with frailty, age range= mid 50s – early 90s. Living at home, Sweden  Participants: n=19 carers of people with stroke or dementia. Mean age 73 (57-85), M11, F8. Living at home, Norway.	In-depth interviews; Telephone befriending intervention, <i>Call In Time</i> . Telephone befriending.  In-depth interviews; Videoconferencing in the ACTION project (ICT to support frail older people and their family carer). Videoconferencing with family or professional carers.  Pilot cohort study without control group (mixed methods) ICT- and web-based ACTION service. Received broadband connected PC, 9 hours training over 3 weeks; connection to online discussion with peers; videophone for peer communication and contact with health personnel. Peer support facilitated by qualified nurses.	Qualitative.  Qualitative.  Social contacts measured by the Family and Friendship Contacts Scale. Social support was measured with a 20-item scale developed by Russel <i>et al.</i> (1980). Focus Groups conducted.	Reduction of social isolation, loneliness, depression, and anxiety; improved state of mind, contentment with life, confidence level, and physical health (less pain).  Seven out of the eight participants reported a positive impact on loneliness.  Positive and significant change in scores with regard to contact with family and friends ( $p = 0.036$ ) and a sense of social support from other persons ( $P = 0.010$ ). Carers explained that the frequent contact they had via the videophone and discussion forum in-between the monthly meetings was important to build social networks and friendships.	Effective Public Health Practice Project (EPHPP): N/A  EPHPP: N/A  EPHPP: Weak
Included review	Type of review and study numbers	Review focus / aim	AMSTAR2 rating	Studies included in our review	Population and setting	Study design, intervention, comparison	Measure of loneliness/ social isolation	Outcomes	Quality tool used in review (rating)
Rhosravi <i>et al.</i> (2016)	Systematic review 34 studies	Identify ICTs that are designed to help seniors reduce social isolation and loneliness and assess the effectiveness of these technologies in supporting seniors' wellbeing.	Critically Low	Balshynne <i>et al.</i> 2010. (Duplicate - see description in Bennett (2015))  Hill <i>et al.</i> (2006)  O'Connor <i>et al.</i> (2014)  Tsai and Tsai, (2011) (Duplicate - see description in Bennett (2015)) van der Heide <i>et al.</i> (2012). (Duplicate - see description in Bennett (2015))	Participants: n=100 women with various chronic illnesses in intervention; n=100 women in control group (65% > 50y). Living at home, USA.  Participants: n=71 Benetton caregivers, age range=54-70. Living at home, USA  Pre-post intervention; 3D virtual environment. Participants interacted using avatars and facial expressions (Skype platform) in an 8-week support group.	RCT: Online self-help support group (Women to Women Program). 22-week participation in an online, asynchronous peer support group and health teaching units. WeAct (2005) platform used to deliver the intervention and was available 24/7, allowing women to participate at any convenient time. Access to Koffee Klatch, an asynchronous chat room in which they exchanged feelings, expressed concerns, provided support, and shared life experiences. Access to each other and research team via email. Peer support and expert facilitated chat room. Health Roundtable. Details of comparison arm not provided.	Social support: 15 item Personal Resource Questionnaire (PRQ) 2000 Loneliness: UCLA Loneliness Scale	Statistically significant effects on social support ( $p=0.38$ ) but not on loneliness ( $p=206$ ).	None  None  None

Included review	Type of review and study numbers	Review focus / aim	AMSTAR2 rating	Studies included in our review	Population and setting	Study design, intervention, comparison	Measure of loneliness/ social isolation	Outcomes	Quality tool used in review (rating)
Morris et al. (2014)	Systematic Review 18 studies	To conduct a systematic review of studies that assessed the effectiveness of smart technologies in improving or maintaining the social connectedness of older adults who live at home.	Low	Barrera et al. (2002)	Participants: n=160 people with type 2 diabetes. Mean age 59.3 (9.4), M/F: 5/5. Living at home, USA	4 Group RCT: 1) Information only; 2) Personal Coach only; 3) Social Support only; 4) Personal Internet-based support group - peer-directed (professionally supported) forum. Real time live chat discussions. Research staff monitored the forum and introduced topics for discussion.	Interpersonal Support Evaluation List (ISEL)	After 3m, individuals who participated in Internet-based social support interventions significantly increased their perceived availability of social support, relative to participants who only had computer access to information about diabetes. Effects found for general perceptions of support as well as with a measure of support that was assigned specifically for individuals who were assigned to the peer-supported intervention. Intervention effects $f = .27$ for the ISEL items.	Downs and Black checklist Not reported for individual studies. Range 13-22 (median 18.5). Box score = 27.
				Bond et al. (2010)	Participants: n=62 people with diabetes. Mean age intervention: 66.2 (5.7), Control: 68.2 (6.2) M/F: 4/18. Living at home, USA	RCT: Web-based interactive intervention. Monitored self-management by nurse; weekly online educational discussion group for peer support; peer email and instant messaging. Interaction between the study nurse and the intervention participants by synchronous (instant messaging and chat) and asynchronous communication (email and a bulletin board). Study nurse, social worker and psychologist moderated sessions. Control received standard diabetes care.	Diabetes-related social support was assessed using the Diabetes Social Support Scale.	Participants who received the Web intervention improved their depression, quality of life, self-efficacy, and social support ratings, compared with the control group ( $p=0.001$ ).	
				Dew et al. (2004)	Participants: n=64 heart transplant recipients and 60 care givers. Age: No data Gender: 46% female Living at home, USA	Matched controlled cohort study; multifaceted web-based intervention. Stress and medical regimen management workshops; monitored discussion groups; access to electronic communication with health professionals. Comparison groups of 40 patients and their caregivers who received only usual care were similarly assessed	Sub-scale reported on Quality of Life (QoL) reflects social functioning (ability to interact with others and engage in social activities).	QoL in social functioning improved significantly	
				Guatfalon, et al. (2005)	Participants: n=229 women with breast cancer. Mean age 51.6 (11.8) Living at home, USA	Cohort study; integrated web-based programme. Participants taught how to use computer, internet and CHES system (home based, discussion group and Ask an Expert service. Web-based support provided for 4 weeks. Participants matched to participants to make weekly phone calls to participants. Comparison group taken from separate recently completed study.	Six-item social support scale for assessing women's perception of emotional and instrumental support.	The discussion group was the most extensively used service (79.65% participants used, with average time of 66.4 minutes over 4 months). Perceived social support ( $p<0.000$ ). Of those who used a peer advocate 77.5% felt somewhat or very much supported. 77.5% felt somewhat or very much supported that the peer advocate helped them cope (some what or very much so) with their breast cancer.	
				Hill et al. (2006), (Duplicate - see description in Khosravi et al. (2016))					
				Torp et al. (2008), (Duplicate - see description in Chen & Schulz (2016))					
				Wehnert et al. (2008)	Participants: n=233 women with various chronic illnesses. Mean age 51.8 (2.17). Living at home, USA	RCT: Web-based 22 week intervention programme (Women to Women Program). Peer-led virtual support group, and self-study web skills. Online, asynchronous, peer-led support group (Koffee Klatch) and health teaching units, prepared by the research team, supplemented by asynchronous, expert-facilitated discussions (Health Roundtable). Comparison group received regular care.	Loneliness: UCLA Loneliness Scale. Social support: Personal Resource Questionnaire 2000.	Participants who had access to the online discussion boards showed a significant increase in self-efficacy ( $P = .04$ ) and social support ( $P = .03$ ) compared to the control groups who had no intervention.	
				Wehnert et al. (2011)	Participants: n=309 women with various chronic illnesses. Mean age 55.5. Intervention: 561 (77%), control 55 (9.1). Living at home, USA	RCT: Web-based 11-week intervention (Women to Women Program) (peer-led virtual support group) (asynchronous forum, Sharing Circle, to exchange feelings and life experiences, give and receive support, discuss issues related to the self-study health teaching units, and share health information) and (b) a series of self-study health teaching units focused on Web skills and the five skills of self-management. Monitored by advance practice nurse. Two comparator arms: Less-intense intervention group (self-study health units), and regular care.	Loneliness: UCLA Loneliness Scale. Social support: Personal Resource Questionnaire 2000.	Self-esteem ( $P = .018$ ), acceptance ( $P = .001$ ), depression ( $P = .010$ ), stress ( $P = .005$ ) and loneliness ( $P = .001$ ) were significantly lower in the intervention group compared to the control group. No statistically significant differences were seen between the two groups in social support ( $P = .097$ ).	

**Table 2. AMSTAR-2 ratings for included systematic reviews (displayed as risk of bias).**

Review	1. PICO components	2. Protocol	3. Study design explanation	4. Comprehensive search strategy	5. Duplicate study selection	6. Duplicate data extraction	7. Details of excluded studies	8. Description of included studies	9a. Risk of Bias (RoB) assessment (RCTs)	9b. RoB assessment (NRSIs)	10. Funding sources	14. Heterogeneity	15. Publication bias	16. Reports conflicts of interest	Overall rating of quality
(Beneito-Montagut <i>et al.</i> , 2018)	+	-	-	?	+	+	?	+	?	-	-	-	?	-	-
(Bennett, 2015)	+	-	-	+	-	-	+	+	?	?	-	+	?	-	-
(Chen and Schulz, 2016)	+	-	+	?	-	+	+	+	?	?	-	+	?	+	-
(Khosravi <i>et al.</i> , 2016)	+	-	+	?	+	-	?	?	-	-	-	-	?	-	-
(Morris <i>et al.</i> , 2014)	+	-	-	?	+	+	?	+	?	?	-	+	?	-	-

+ = low risk of bias (equivalent to high confidence); ? = moderate or unclear (equivalent to moderate confidence); - = high risk of bias (equivalent to low or critically low confidence); Note chart shows only those items relevant to all included reviews.

**Supported use of social networking sites for mitigating social isolation and loneliness.** Two reviews included the same study on social networking sites<sup>48</sup>. The authors of this qualitative study found that the utilisation of a bespoke social networking site had the potential to reduce loneliness in older people, as there were positive impacts on temporal loneliness (especially in the evening) and on connectedness. Review authors suggested that older adults were more interested in a smaller number of strong relationships mediated through the internet, than they were in a larger network with weak ties. They report that perceived value could have been an issue for older adults, which may have been more obvious through supported social networking service interventions such as that reported by Ballentyne *et al.*<sup>48</sup>.

**Multi-tool interventions (PC, training, internet use, messaging, chat groups) to reduce loneliness and/or social isolation, or increase social connectedness.** Three reviews included a total of four quantitative studies on multi-tool interventions. van der Heide *et al.*<sup>49</sup> report on the Care TV package for people receiving home care in The Netherlands. This video and voice network allowed clients to communicate round-the-clock with a nurse practitioner. They received a 'Good Morning/Goodnight' call and could use the video facility to call family members. Average feelings of loneliness decreased substantially, with social and emotional loneliness showing pronounced decreases. The three other studies reported on web-based discussion groups in the Women-to-Women programme, with mixed results

regarding levels of loneliness and social support. Weinert *et al.*<sup>47</sup> reported on an RCT of a web-based discussion groups, with a peer-led online support group and self-study units supported by an Advance Practice Nurse. Improvements were found in loneliness, but there was no significant difference in social support between the intervention and comparison groups, following the 11-week intervention. Weinert *et al.*<sup>50</sup> found significant increases in both loneliness and social support, compared to the control group, over the 22-week intervention. Hill *et al.*<sup>44</sup>, found statistically significant effect on both social support and loneliness after 22 weeks. See Table 1 for contextual details of reviews and studies on multi-tool interventions.

### Intervention Component Analysis and Qualitative Comparative Analysis

QCA and ICA were undertaken to help us further identify the processes and mechanisms that were common across the interventions described in Table 1 and the narrative synthesis. To undertake QCA, we first conducted ICA to understand the nature of the interventions. We inductively coded the nature of intervention features (i.e. components) and used trialists' informally reported experiences of implementing the interventions (e.g. author reflections reported in introduction and/or discussion sections) to understand the importance and underlying mechanisms of particular features<sup>20</sup>.

**Theory selection and setting up the QCA.** A fundamental element of QCA is the selection of an appropriate theory to base

the analysis on, and to help identify suitable evidence to extract as part of the ICA. To understand which processes might be important to incorporate in interventions – regardless of specific mode of delivery (i.e. videoconferencing or internet chat group) – we drew on Robert Weiss's<sup>53</sup> 'Fund of Sociability' theory<sup>iv</sup>. The theory is intended to capture assumptions, content, and functions of social ties that can help to support developing social relationships. The theory specifies six characteristics of social interactions and relationships that are necessary for well-being and the avoidance of loneliness<sup>53</sup>. Table 3 outlines the six categories, their definitions and how we interpreted them in relation to the interventions in the QCA.

Our QCA built on the earlier descriptive and narrative synthesis, and addressed the question: 'Do the characteristics of social interactions and relationships stated in the fund of sociability theory explain differences between remotely delivered interventions found to be effective compared to those found to be ineffective?' To gain familiarity with the studies and attempt to gain 'deep case knowledge', we started by reading and re-reading the studies.

<sup>iv</sup> This theory also served as the conceptual framework underpinning one of the included studies 49. Weinert C, Cudney S, Hill WG. Rural women, technology, and self-management of chronic illness. *The Canadian journal of nursing research= Revue canadienne de recherche en sciences infirmieres* 2008;40(3):114.

**Selection of studies (cases)<sup>v</sup> for the QCA.** We focussed on studies that met our criteria for the QCA including that they (a) presented quantitative results, (b) were remotely delivered, (c) focussed on older people, and (d) actively sought to strengthen social relationships or prevent/offset loneliness. From the 18 primary studies described above, 12 met these criteria.

**Developing a data table.** QCA is based on set-theory with sets differentiated as belonging to a successful and unsuccessful set on the basis of their outcome. The outcome can be based on an objective measure or subjective or quality measure<sup>54</sup>, and on a single measure or a composite indicator<sup>55</sup>. The allocation of studies into a successful set and unsuccessful set can follow different strategies. Firstly, success may be defined through the observation of clinically or statistically significant change in the outcome (for example<sup>56</sup>). A second approach is for the researcher to set thresholds for determining success. A third strategy is ensure (approximately) equal representation of un/successful cases by ranking cases according to their effectiveness and allocating studies into un/successful outcome sets. A fourth strategy is to use a more qualitative approach where additional characteristics besides the outcome value are considered to ensure a representation of studies in the un/successful outcome set<sup>57</sup>.

<sup>v</sup> Terminology is used when conducting QCA that is distinct from other research approaches. This includes the use of 'cases' to denote studies; we use both terms interchangeably as appropriate.

**Table 3. Six categories of the fund of sociability theory.**

Category	Definition in Weiss 1969	Application in Qualitative Comparative Analysis
<b>1. Intimacy (which we describe as close relationships in our narrative)</b>	<i>'An effective emotional integration in which individuals can express their feelings freely and without self-consciousness' (p.38)</i>	Intervention supports participants to express feelings freely and without self-consciousness (e.g. opportunities for unstructured discussions with peers)
<b>2. Interaction</b>	<i>'Participants share concerns, either because of similar situations ("we are in the same boat") or because they are striving for similar objectives' (p.39)</i>	Target population has shared experience (e.g. being a carer, stroke survivor etc.) and shared characteristics (e.g. women only, people of similar age / SES etc.)
<b>3. Nurturance</b>	<i>'Opportunity for nurturant behavior ... absence of this function may be signalled by a sense that one's life is unfulfilled, meaningless, and empty of purpose' (p.39)</i>	Intervention values / encourages participant sharing of experiences for others benefit (e.g. group discussions / bulletin boards invite participants to share experiences)
<b>4. Self-worth (control)</b>	<i>'Relationships that attest to an individual's competence in some role' (p.39)</i>	Intervention enhances sense of competence by offering control over design / delivery (e.g. participants determine frequency of discussion groups / identify topics for discussion)
<b>5. Availability</b>	<i>'Assistance that is not limited in time and extent' (p.40)</i>	Intervention is available continuously and provides opportunities for asynchronous and 'real-time' interactions (e.g. website information resources (continuous), discussion board (asynchronous), videoconferencing / 'live-chat' (real-time))
<b>6. Support</b>	<i>'This function might be characterized as guidance, and may be provided by mental-health professionals such as social workers or psychiatrists or by ministers and priests, among others.' (p.40)</i>	Services include some form of pastoral care (e.g. light-touch oversight of a discussion forum by professionals or opportunities for participants to contact professionals for advice)

In a systematic review, stratifying studies by their characteristics to ensure a diversity in study size or study design among successful studies may ensure a more informative solution is produced.

To generate our outcome sets, and group interventions as being ‘successful’ or ‘unsuccessful’, we calculated an estimated effect size for each study. Effect sizes are used differently within QCA as opposed to meta-analysis; i.e. as a guide to allocating studies to successful (most effective) or unsuccessful (least effective) outcome sets, rather than to provide a pooled estimate of effect with precision. Most effect sizes were based on measures of social support, which we regarded as a proxy measure for social isolation. The exceptions were Schwindenhammer<sup>36</sup> and O’Connor, *et al.*<sup>45</sup> where a measure of loneliness was the only suitable outcome available. However, we did attempt to express the effect sizes in a common rubric where possible, e.g. prioritising post-test measures for studies that involved randomisation of participants or clusters (five studies), and change measures where these data were not available. For those studies with a comparator group (eight studies), effect sizes were calculated in the standard way see Thomas *et al.*, 2017<sup>58</sup>; for those studies that employed a pre- and post- evaluation design an effect size was estimated based on changes in the pre- and post- individual scores divided by the standard deviation at pre-test<sup>59,60</sup>; in some cases this involved using mean differences as proxy information and other approximations.

Using the effect size for indicative purposes, we grouped interventions into those that were ‘successful’ (studies with effect sizes over 0.5), ‘partially successful’ (studies with effect sizes between 0.2 and 0.5) and ‘not successful’ (studies with effect sizes under 0.2 or suggested negative impacts) based on thresholds suggested by Cohen<sup>61</sup> for interpreting effect sizes. However, combining the different study designs, and particularly those with and without a comparison group, using the same approach could lead us to overstate the effectiveness of studies without a comparison group. To mitigate this possibility we also present the results of a sensitivity analysis, where we imposed an additional ‘penalty’ on studies without a control group – studies with effect sizes of 0.5 and over were deemed to provide partial evidence of success (0.66); studies with effect sizes between 0.2 and 0.5 were deemed to provide weak evidence of being ‘not successful’ studies (0.33); while studies with values lower than 0.2 were deemed to provide strong evidence of being ‘not successful’ (0). This is akin to adding in additional ‘qualitative’ information – in this case on study design – to distinguish studies as belonging to a successful and unsuccessful outcome set<sup>57</sup>. We also examined the potential impact of omitting these four studies, although this is not a preferred option given that QCA models typically need 10 or more cases as a minimum.

To create our data table, a coding scheme was developed to determine whether the conditions reflecting the fund of sociability processes were actually present in the studies (see 10). The results of this coding and the data table are presented below in Table 4.

**Truth table.** As we had a limited set of cases for the number of conditions, our analytical strategy involved first creating a ‘truth table’ based on six conditions, and then producing a reduced truth table containing four conditions and minimised solution<sup>24</sup>. A ‘truth table’ sorts cases according to the configuration of conditions they exhibit. Although we noted that both ‘availability’ and ‘control’ were conditions generally only observed in successful intervention studies, they did not appear to be as critical to outcome success as the other conditions, appearing in fewer studies. Our reduced truth table thus contained four conditions (intimacy, interaction, support and nurturance) with five of a possible 16 configurations represented (Table 5). Two configurations are observed as triggering a successful outcome; in one, supported by five studies, all four conditions are present; in the second, supported by two studies, three of four conditions are present. On the right side of the table is a column marked consistency; this indicates the strength to which studies that belong to the condition set are also a subset of the outcome set. A value of 1 indicates perfect consistency; all cases in the configuration are strong members of the condition set and the successful outcome set; and there is strong evidence that these intervention characteristics trigger successful outcomes. A value of 0 indicates perfect inconsistency and there is no evidence that these intervention characteristics trigger successful outcomes. Values in between indicate some degree of ambiguity, which was expected given that we used a “fuzzy-set coding scheme” which allowed studies to be partial members of sets (using a value of 0.85 to denote membership).

**Boolean minimisation and formation of a solution.** We applied Boolean minimisation to obtain the simplest expression of those conditions (intervention processes) that were associated with triggering a successful intervention. We developed a complex solution based on the observed data only, and found that those interventions that ensured the following processes took place were those in the successful outcome set:

#### INTIMACY and INTERACTION and SUPPORT

Within QCA, information from unobserved configurations (logical remainders) can be used to simplify the solution and check the quality of the solution. We incorporated these logical remainders to develop two further solutions<sup>vi</sup>, although incorporating logical remainders in this model did not help to simplify the solution above. Our model and details of its fit are presented below (Table 6). The high consistency value for the solution suggests that when this configuration of conditions is observed in an intervention, it is generally sufficient to trigger a successful intervention (i.e. a substantial change in social support). The coverage statistic suggests that the model broadly accounts for the successful interventions observed.

**Sensitivity and additional technical quality checks.** Using an alternative measure of effect size that incorporates a ‘penalty’

<sup>vi</sup> Known as a parsimonious and intermediate solution.

**Table 4. Data table for Qualitative Comparative Analysis.**

Study	Effect Size Estimate	Effect Size Set	Effect Size Set (sensitivity analysis)	Intimacy	Interaction	Control	Nurturance	Support	Availability
Barrera	0.530	1	1	1	0.66	0.66	1	1	1
Bond	0.634	1	1	1	1	0.33	1	0.66	1
Gustafson	0.619	1	1	1	1	0.33	1	0.66	0.66
Tsai 2010 <sup>9</sup>	0.036	0	0	0.33	0	0	0	0.33	0
Tsai 2011 <sup>10</sup>	0.051	0	0	0.33	0	0	0	0.33	0
Weinert 2008 <sup>11</sup>	0.314	0.66	0.66	1	1	0.66	1	1	0.66
Weinert 2011	0.131	0	0	1	1	0.33	1	0	0.66
Schwindenhammer <sup>12</sup>	-0.098	0	0	0.33	0	0	0	0.33	0
Dew <sup>13</sup>	0.287	0.66	0.33	0.66	0.66	0.33	0	1	0.66
Torp <sup>14</sup>	0.552	1	0.66	1	1	1	1	1	1
Cattan	-0.687	0	0	0.66	0.33	0	0	0	0
O'Connor <sup>15</sup>	0.375	0.66	0.33	1	1	0.33	0.33	0.66	0.33

See also notes in methodology for further explanation.

<sup>9</sup> Effect size based on post-test measurement and total social support at three months.

<sup>10</sup> Effect size based on post-test measurement.

<sup>11</sup> SD estimated from Weinert 2011, equal sample sizes assumed.

<sup>12</sup> Effect size based on post-test measurement.

<sup>13</sup> Note – effect size based on pre-post results for heart transplant recipients who received the intervention.

<sup>14</sup> SD estimated from baseline value.

<sup>15</sup> Mean and SD estimated from chart, error bars assumed to be based on SD (estimate of 12).

**Table 5. Reduced truth table.**

Configuration (1=Present; 0=Absent)	Intimacy	Interaction	Support	Nurturance	Outcome	Number of studies	Consistency	PRI (Proportional Reduction in Inconsistency)
A	1	1	1	1	1	5	0.921	0.907
B	1	1	1	0	1	2	1	1
C	1	1	0	1	0	1	0.502	0.405
D	0	0	0	0	0	3	0	0
E	1	0	0	0	0	1	0	0

reflecting the greater uncertainty around pre-post studies, we re-ran the analysis described above. The truth table (Table 7) with this alternative outcome showed one configuration of successful studies. This suggested that studies which incorporated all three processes observed earlier, as well as nurturance, were those that triggered a successful outcome (using a slightly lower consistency value of 0.825, which is still well within recommended thresholds<sup>24</sup>). Coverage was slightly lower for this solution, although the solution still provided a comprehensive explanation of why some interventions were successful (Table 8). The replication of the same three core conditions provides a degree of triangulation that our main solution identified in Table 6 provides a robust account; the inclusion of nurturance as an additional condition below is not contradictory, but suggestive that as a condition it may help to distinguish a smaller pool of studies as successful.

**Table 6. Solution.**

	Solution Consistency	PRI (Proportional Reduction in Inconsistency)	Solution coverage	Studies
<b>INTIMACY*INTERACTION* SUPPORT</b>	0.936	0.921	0.829	(Barrera <i>et al.</i> , 2002, Bond <i>et al.</i> , 2010, Dew <i>et al.</i> , 2004, Gustafson <i>et al.</i> , 2005, O'Connor <i>et al.</i> , 2014, Torp <i>et al.</i> , 2008, Weinert <i>et al.</i> , 2008)

**Table 7. Truth table - sensitivity analysis with alternative outcome.**

Configuration (1=Present; 0=Absent)	Intimacy	Interaction	Support	Nurturance	Outcome	Number of studies	Consistency	PRI (Proportional Reduction in Inconsistency)
<b>A</b>	1	1	1	1	1	5	0.842	0.794
<b>B</b>	1	1	1	0	0	1	0.502	0.405
<b>C</b>	1	1	0	1	0	2	0.5	0
<b>D</b>	0	0	0	0	0	3	0	0
<b>E</b>	1	0	0	0	0	1	0	0

**Table 8. Solution - sensitivity analysis with alternative outcome.**

	Solution Consistency	PRI (Proportional Reduction in Inconsistency)	Solution coverage	Studies
<b>INTIMACY*INTERACTION* NURTURANCE*SUPPORT</b>	0.842	0.794	0.729	(Barrera <i>et al.</i> , 2002, Bond <i>et al.</i> , 2010, Gustafson <i>et al.</i> , 2005, Torp <i>et al.</i> , 2008, Weinert <i>et al.</i> , 2008)

We also undertook quality checks to understand whether our solution, or the assumptions we made in its derivation, could also predict unsuccessful outcomes, and found little evidence that this was a possibility. We also explored whether focussing only on the 10 studies that measured social support would change our interpretation, and again found little evidence that this would influence the model. Similarly, focussing only on studies that had a comparison group showed a similar pattern descriptively<sup>vii</sup>.

**Interpretation of the solution.** The successful outcome set contained those interventions that: (i) supported participants to

form ‘intimate’ relationships and express their feelings freely without self-consciousness between peers; (ii) ensured that there were shared characteristics between participants and their peers (beyond a single experience, and beyond geography alone); and (iii) included some form of pastoral care or support (e.g. light-touch oversight of a discussion forum by professionals or opportunities for participants to contact professionals for advice). This configuration explained the majority of the successful outcomes we observed.

Taken together, albeit with some caveats, these characteristics can form a set of design principles for future interventions that are delivered remotely which aim to increase support available to older adults and offset the risks of social isolation and loneliness. The interventions that were not in the successful outcome set did not provide evidence that all three processes

<sup>vii</sup> However, running a model based on only eight studies with four conditions would not be appropriate.

had been part of the interventions, and some indicated that processes to the contrary had taken place.

## Summary and discussion

### Summary of findings

In this rapid review of reviews, narrative synthesis showed that supported video-communication interventions are regarded positively by older adults and can have positive effects on loneliness and social support. However, the quantitative evidence remains uncertain and, although they were placed in the effective set of studies in QCA analysis, uncertainty about effectiveness is a shared conclusion in other similar reviews<sup>62</sup>. Evidence about online discussion groups and forums also demonstrated mixed results, with increases in social support, but less evidence for improvements in loneliness. Telephone befriending has not been widely researched, but qualitative evidence suggested this intervention model may be helpful in addressing loneliness and social isolation, although quantitative evidence did not show this. The evidence for social networking sites was weak. Multi-tool interventions showed decreases in loneliness, but not always increases in social support. Clearly, these interventions vary greatly, so it is difficult to isolate the effective elements. Similarly, conceptualisations of loneliness and social isolation vary, making comparisons and conclusions challenging.

Using QCA, we looked beyond specific models of intervention to explore which intervention processes are aligned with being in an effective intervention set. We have shown that the following processes are enabled in effective interventions including (i) supporting development of intimate relationships; (ii) supporting interactions through ensuring participants share experiences/characteristics; (iii) supporting participants through pastoral guidance.

### Discussion

**Gaps in the evidence.** Despite our extensive searches, we found only one study of telephone befriending<sup>39</sup> included within a single systematic review. This was also the one of the few studies that made use of volunteers. There was no information provided about the training and support provided to the volunteers, as the focus was on the experience of older adults receiving the service. Similarly, we found little information about training and support provided to staff members supporting other forms of intervention. Information, communication, support, moderation and mediation was provided to older adults by research staff and health professionals (nurses, psychologists, advance nurse practitioners) within the primary studies, but there was little detail about *how* staff (paid and volunteer) were trained or supported to provide these. The evidence identified in the QCA finds that successful interventions are effective because they are able to enhance complex psychosocial processes and abilities, highlighting that staff may need specialist training in delivering interventions successfully. In addition, support and training is likely to be important for managing the wellbeing of those delivering the intervention. Guidelines published elsewhere suggest volunteers or staff members should receive high-quality training and regular supervision to be competent<sup>63</sup>,

yet the call for NHS Volunteer Responders to make telephone calls to isolated older adults did not include any offers of training or support<sup>4</sup>.

Most of the studies included in this review involved some form of new technology, with just two involving an intervention delivered through (traditional) telephone. No study examined an intervention delivered through a smartphone. Similarly, our inclusion criteria could have theoretically allowed other forms of remotely delivered interventions to be included, such as letter writing, although no such study was identified. These forms of interventions could be purposively considered in future reviews, with a recent intervention involving cross-generational letter writing suggestive of positive impacts for older and younger people alike<sup>64</sup>. There may be scope in the future for inter or cross-generational interventions that can help to provide both befriending, and technological support, while maintaining the principles outlined earlier.

We found few studies reporting on low intensity psychosocial interventions, which could be due to our focus on loneliness and/or social isolation as outcomes of interest. In the broader literature, whilst some studies have demonstrated positive impacts on depression, wellbeing and general mental health of delivering therapies through remote means<sup>65</sup>, several of these interventions may not specifically address loneliness and are not targeted at older adults<sup>66</sup>.

**Empowering and supporting older adults involved in remote interventions.** Overall, the results here suggest that older adults can be empowered to support each other through online discussions and forums. In the narrative synthesis we found reviews containing several studies with peer support, provided through synchronous and asynchronous messaging, chat rooms and discussion forums. This challenges the assumption that older adults must always be on the receiving end of an intervention to address social isolation and loneliness. When we moved to study-level synthesis, we also found that studies that enabled older people to feel that their contributions could improve the outcomes of others (i.e. improved levels of self-worth<sup>40–42,46,50</sup>) tended to be successful interventions<sup>viii</sup>. As the mobilisation of thousands of volunteers takes place to support older people who are currently shielding in the COVID-19 pandemic, recognising that older people can be both providers and recipients of support simultaneously is likely to be an important principle to adhere to in the design of activities.

**Strengths and limitations.** The strengths of this rapid systematic review of reviews include the transparent and robust approach to searches, data extraction, review quality appraisal and analysis, ensured through pre-publication of a protocol on the EPPI-Centre website. Despite the rapid nature of this review process, we have conducted the review according to systematic review methodology<sup>67</sup>. In this case, the rapid element of

<sup>viii</sup> A condition reflecting self-worth was not used in the final QCA models because of the small number of studies.

the review was primarily reflected in the decision to exclude reviews focussed on caregivers from the synthesis; other stages were conducted according to standard systematic reviewing practice. A further strength was the diversity of synthesis approaches conducted, including QCA and ICA.

Searching for systematic reviews means that we may have missed some more recent primary studies in this area, but it ensured that our review was achievable within the four-week timeframe required for a timely response during the COVID-19 crisis. We applied the AMSTAR2 quality appraisal tool to the included reviews, although the reviews included in the synthesis were found to have a low quality rating. In addition, we did not conduct any quality assessment of the primary studies that we looked at in more detail. Some of these had been assessed by the review authors, but many had not. There were very few identifiably robust primary studies that met our inclusion criteria. Only one primary study was identified by review authors as ‘strong’, with others rated as ‘weak’ or with no quality appraisal at all. The poor, or lack of, quality rating for many of the included studies means that findings should be considered with caution. In addition, few of the studies considered potential adverse impacts of the interventions. However, this is the case for many reviews in this research area and is not unique to our rapid review.

Owing to the rapid nature of this review, we focussed on reviews addressing interventions to mitigate loneliness or social isolation on the general older adult population. This meant we excluded reviews identified through the searches focussing exclusively on caregivers that may have provided additional insights. Other limitations included our treatment of primary studies in the QCA, where neither the precision of the effect size, study design, or quality were included in the model or the allocation into different outcome sets in our main model. Studies with weaker designs, and effect sizes derived from these, were treated in the same way as those with more robust designs in our main model. Although this is not uncommon in QCA practice, further synthesis could be conducted focussing on only those studies with a more robust design in future.

**Further research and conclusions.** Loneliness and social isolation are extremely complex phenomena<sup>6</sup>, and require a deep understanding and deliberative treatment that was beyond the remit of this rapid review. The risk of running unsuccessful interventions may be higher than many triallists appear to recognise, and a failure to ensure that the processes identified as important in effective interventions are incorporated into intervention design may have adverse impacts for older people, for example in heightening their feelings of alienation<sup>68</sup>. Our findings do not lead us to recommend one particular mode of delivering befriending, social support, or low-intensity psychosocial interventions over another (e.g. videoconferencing, telephone calls, chat rooms or forums), and all may be of benefit, but our findings do suggest that the principles highlighted from the QCA should be incorporated into the delivery of an intervention.

We were surprised by the identification of only one systematic review including a telephone befriending intervention. Given the

UK Government’s interest in encouraging volunteers to make phone calls to physically isolating and shielding older adults, under the ‘stay at home’ guidance, a systematic review of telephone befriending interventions is needed, to identify evidence to inform policy in this area. A review by Sharma *et al.*<sup>69</sup> suggested that a large portion of such interventions may be found in grey literature. In the current context of the COVID-19 pandemic, a number of befriending interventions are being delivered by a variety of organisations, and there is scope to incorporate learning from these in future systematic reviews in this area.

As the training and support components of the technology-mediated interventions were unreported in the reviews and studies that we synthesised, there is a need to search for these elsewhere. Evaluations of existing telephone befriending and psychosocial support services, often found in the grey literature, could act as a starting point. Additional valuable information could be obtained through contact with voluntary sector and NHS organisations delivering befriending, peer support and low-intensity psychosocial interventions. A review of these training and support components could add valuable insight for policy-makers and service providers to ensure that volunteers are well trained, empowered and supported in delivering interventions adhering to the principles outlined earlier. Although we believe all of the intervention modes in scope here have the capacity to include the processes found to lead to more successful interventions (supporting the development of intimate relationships; supporting interactions through ensuring participants share experiences/characteristics; provide pastoral guidance), a more encompassing piece of research is needed in order to identify which mode is most effective, or has the greatest potential, for changing outcomes.

## Data availability

### Underlying data

All underlying data as published on the Open Science Framework

Open Science Framework (OSF): Rapid systematic review of systematic reviews: what befriending, social support and low intensity psychosocial interventions, delivered remotely, are effective in reducing social isolation and loneliness among older adults? How do they work? <https://doi.org/10.17605/OSF.IO/VS2UX><sup>13</sup>

This project contains the following underlying data:

- Data and example evidence for studies included in QCA and conditions included in truth tables.docx
- Data extracted on reviews and primary studies for narrative synthesis.docx
- Data used for QCA.csv

### Extended data

Open Science Framework (OSF): Rapid systematic review of systematic reviews: what befriending, social support and low intensity psychosocial interventions, delivered remotely, are effective in reducing social isolation and loneliness among older

adults? How do they work? <https://doi.org/10.17605/OSF.IO/VS2UX<sup>13</sup>>

This project contains the following extended data:

- Search history - medline example.docx
- Further details of exclusion criteria.docx

## Reporting guidelines

Open Science Framework (OSF): PRIMSA checklist for “Rapid systematic review of systematic reviews: what befriending, social support and low intensity psychosocial interventions, delivered remotely, are effective in reducing social isolation

and loneliness among older adults? How do they work?”. <https://doi.org/10.17605/OSF.IO/VS2UX<sup>13</sup>>

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