Rapid systematic review of systematic reviews: what befriending, social support and low intensity psychosocial interventions, delivered remotely, may reduce social isolation and loneliness among older adults and how? [version 2; peer review: 2 approved with reservations]

Previously titled: "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?"

Elisabeth Boulton 1,2*, Dylan Kneale 3*, Claire Stansfield 3, Paul Heron 4, Katy Sutcliffe 3, Brenda Hayanga 3, Alex Hall 1,2, Peter Bower 1,2, Dymphna Casey 5, Dawn Craig 6, Simon Gilbody 4, Barbara Hanratty 6, Dean McMillan 4, James Thomas 3, Chris Todd 1,2

1 National Institute for Health Research (NIHR) Older People and Frailty Policy Research Unit, School of Health Sciences, University of Manchester, Manchester, UK
2 Manchester Academic Health Science Centre, Manchester, UK
3 EPPI-Centre, UCL Social Research Institute, University College London, London, UK
4 University of York and Hull York Medical School (HYMS), York, UK
5 School of Nursing & Midwifery, National University of Ireland, Galway, Galway, Ireland
6 National Institute for Health Research (NIHR) Older People and Frailty Policy Research Unit, Population Health Sciences Institute, Newcastle University, Newcastle-upon-Tyne, UK

* Equal contributors

Abstract
Background: During the COVID-19 pandemic ‘social distancing’ has highlighted the need to minimise loneliness and isolation among older adults (aged 50+). We wanted to know what remotely delivered befriending, social support and low intensity psychosocial interventions may help to alleviate social isolation and loneliness and how they work.

Methods: We followed a systematic ‘review of reviews’ approach. Searches of 11 databases from the fields of health, social care, psychology and social science were undertaken during April 2020.
Reviews meeting our PICOS criteria were included if they focussed on the evaluation of remote interventions to reduce levels of social isolation or loneliness in adults aged 50+ and were critically appraised using AMSTAR2. Narrative synthesis was used at a review 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 evidence around effectiveness. Focussing on processes and mechanisms, using ICA and QCA, we found that the interventions that were most successful 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 specific modes of support, due to the heterogeneity of interventions.

**Keywords**
social isolation, loneliness, remote interventions, review of reviews
Introduction

During the height of the first wave of the COVID-19 pandemic, millions of people aged 70 years and over were advised to avoid social contact with those outside their household, with older age identified as a risk factor for poorer COVID-19 prognosis. 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. Social isolation and loneliness adversely affect quality of life, wellbeing and mental health, and are associated with physical ill health and mortality. 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. Here we use a broad definition of ‘older’ adult, defined as those aged 50+, which captures those in middle age who may be nearing or experiencing age-related transitions, such as retirement or unpaid caring, or living with age-related long term conditions.

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’. Fulfilment of such roles requires that:

(i) the programmes and interventions staffed by these volunteers are effective and have minimal adverse consequences for older adults; 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’. Social isolation reflects the number of social contacts that people have, and people who are socially isolated tend to have social networks of low density that are not maintained through frequent engagement. 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. However, we recognise that defining social isolation and loneliness is challenging, particularly as researchers have used terms involving social relationships, including social isolation, loosely. Furthermore, while we recognise social isolation and loneliness as distinct concepts, here we explore both simultaneously as the COVID-19 pandemic and measures adopted to mitigate its spread have exacerbated both isolation and loneliness.

A number of evidence reviews have highlighted the diverse range of interventions to alleviate loneliness amongst older adults in a variety of settings. In the main, these have been face-to-face interventions, either in groups or between individuals. During the height of the first wave of COVID-19 pandemic, and during subsequent waves, 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 specifically 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, using the innovative methods of Intervention Component Analysis and Qualitative Comparative Analysis.

(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. 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. Although broad frameworks for conducting overviews exist, specific guidance that can be used in a directive way to carry out overviews is lacking. Nevertheless, we followed elements of practice recommended by Caird and colleagues in balancing some of the challenges of conducting reviews of reviews with the need to produce policy-relevant evidence at speed in the context of the COVID-19 pandemic, and the present review was developed over a four-week period in April-May 2020. We also examined how existing reviews of reviews in the area, and particularly a review conducted by Chippins and colleagues, navigated the challenge around differences between the scope of a systematic review and the scope of the review of the reviews.

For the purposes of this review, we define ‘older adults’ as those aged 50 years and above.

The review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) checklist for the reporting of systematic reviews. 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 April–24 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 in the community and in residential settings.

2) **Interventions** that enable remote delivery: technology, remote communication, telephone, helplines, self-help, bibliotherapy.

3) **Outcomes**: loneliness, social isolation (or measures focussed on a particular aspect e.g. social support and social contact).

4) **Study design**: systematic reviews.

An example search history for Medline is presented in the full report and as Extended data.

**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). 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 adults who were socially isolated, lonely, or who were otherwise at risk of loneliness or isolation.

While we identified all reviews on older adults, we only synthesised evidence from reviews focussed on populations of older adults. We did not synthesise evidence from reviews focussed exclusively on particular groups of older adults, specifically older caregivers, although interventions including caregivers are well represented in the evidence presented. The decision to synthesise evidence from a subset of reviews was in line 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 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.

As outlined earlier, 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’. Social isolation reflects the number of social contacts that people have, and people who are socially isolated tend to have social networks of low density that are not maintained through frequent engagement. Based on previous reviews, we expected various measures of loneliness and
social isolation to be reported, including measures that ranged in the degree of subjectivity. Despite a number of tools for measuring social isolation being available, many of the available comprehensive measures of social isolation in particular are underutilised within many intervention studies (for example), and we planned to draw on narrower measures where necessary and appropriate, for example reports of contact with family and friends and levels of social support. This is in accordance with conceptualisations of social isolation elsewhere, for example with social support being viewed as indicative of individuals’ everyday social worlds and a key indicator of social isolation in several studies (see, for example).

**Study design:** We defined systematic reviews as those that met at least four of the following criteria:

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.
As we were expecting some heterogeneity in the question being addressed by reviews, and expected this to be reflected in the design of primary studies included within reviews, we did not specify that source systematic reviews had to be confined to a particular study design. In line with previous reviews in the field, we expected studies measuring quantitative outcomes to be composed of single-group pre-post studies, non-randomised comparison studies, and randomised comparison group studies.

**Study selection and data extraction**

We exported search records to EPPI-Reviewer web 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 (with levels of agreement reached 93%). 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, 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 adults);
- 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.

Once eligible reviews had been identified, primary papers were extracted if they met the criteria in line with the review inclusion and exclusion criteria stated above. That is:

**Population**: older adults, located in the community or residential care, socially isolated or lonely, or at risk of social isolation or loneliness.

**Intervention**: interventions that sought to reduce levels of social isolation or loneliness, through strengthening individuals’ social contacts and social relationships. Interventions were delivered on a one-to-one basis (e.g. befriending), or as remote group-based interventions (e.g. discussion groups).

**Comparator/control**: studies with most forms of control group (randomised and non-randomised) and those without a control group (pre-post designs).

**Outcomes**: measures of social isolation or loneliness, including measures focussed on a particular aspect, such as social support.

**Critical appraisal**

Included systematic reviews were critically appraised using AMSTAR-2 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).

The quality of the primary studies was reported where it had been assessed by the review authors. Not all reviews included a quality assessment of their included studies.

**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.

*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\textsuperscript{39}, 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)\textsuperscript{39}. This information is then used in conducting the QCA.

The second approach, QCA, is applied to numeric data and is based on set-theory\textsuperscript{30}. 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\textsuperscript{41}. 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\textsuperscript{42}. 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\textsuperscript{43}. Further explanation of the approach is provided alongside the results.

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 (described in the methods section). 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 \textsuperscript{33} ‘Fund of Sociability’ theory. 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\textsuperscript{34}. Table 1 outlines the six categories, their definitions and how we interpreted them in relation to the interventions in the QCA.

\textsuperscript{3} This theory also served as the conceptual framework underpinning one of the included studies 49. Weiner C, Cadney 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.

\textsuperscript{4} Four of the reviews focussed exclusively on interventions to support caregivers: 40. Corry M, Neenan K, Brabyn S, \textit{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); 41. Elvish R, Lever S-J, Johnstone J, \textit{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.; 42. Hopwood J, Walker N, McDonagh L, \textit{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 43. Lins S, Hayder-Beichel D, Ruecker G, \textit{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).

\textsuperscript{5} 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.
Table 1. Six categories of the fund of sociability theory.

| Category                                      | Definition in Weiss 1969                                                                                           | Application in Qualitative Comparative Analysis                                                                                                                                 |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Intimacy (which we describe as close relationships in our narrative) | ‘An effective emotional integration in which individuals can express their feelings freely and without self-consciousness’ (p.38) | Intervention supports participants to express feelings freely and without self-consciousness (e.g. opportunities for unstructured discussions with peers) |
| 2. Interaction                                | ‘Participants share concerns, either because of similar situations (“we are in the same boat”) or because they are striving for similar objectives’ (p.39) | 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.) |
| 3. Nurturance                                  | ‘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) | Intervention values / encourages participant sharing of experiences for others benefit (e.g. group discussions / bulletin boards invite participants to share experiences) |
| 4. Self-worth (control)                       | ‘Relationships that attest to an individual’s competence in some role’ (p.39)                                        | Intervention enhances sense of competence by offering control over design / delivery (e.g. participants determine frequency of discussion groups / identify topics for discussion) |
| 5. Availability                                | ‘Assistance that is not limited in time and extent’ (p.40)                                                           | 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)) |
| 6. Support                                    | ‘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) | 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) |

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 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\(^{44-48}\).
- Telephone befriending to reduce social isolation\(^{49,50}\).
- Online discussion groups foraums to reduce social isolation and/or loneliness, or to improve/maintain social connectedness\(^{51-57}\).
- Supported use of social networking sites for mitigating social isolation and loneliness\(^{58}\).
- Multi-tool interventions (PC, training, messaging, chat groups) to reduce loneliness and/or social isolation, or increase social connectedness\(^{54,57,59,60}\).

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\(^{53-56}\), with the other two reporting on the videoconferencing element of the ACTION service in Sweden and Norway\(^{57,58}\). The qualitative evidence suggests the interventions were generally regarded positively by older adults, with increased feelings of connection with their family members\(^{53-56}\). The quantitative evidence showed some evidence of decreases in feelings of loneliness and increases in social support scores. Two quantitative studies\(^{47,48}\) found reduced feelings of loneliness at one week, three months and 12 months, although this achieved statistical significance in only one study\(^{47}\). Torp et al.’s\(^{56}\) mixed-methods pilot cohort study, employing questionnaires and focus groups, further highlights the potential benefits of videoconferencing for individuals with social isolation and loneliness.
Table 2. Characteristics of included reviews and primary studies.

| Included review | Type of review and study numbers | Review focus/aim | AMSTAR2 rating | Primary studies included in review | Population and setting | Study design and intervention | Outcome measures/ Loneliness | Gratzones | Quality tool used in review (rating) |
|-----------------|----------------------------------|------------------|----------------|-----------------------------------|------------------------|-----------------------------|---------------------------|-----------|------------------------------------|
| Bennet & Montagu (2018) | Literature review that meets the definition of a systematic review and includes 25 studies | To answer what impact video communication has on older adult's relationships and their psychological well-being, when is it used to communicate with friends and relatives | Critically Low | Participates: n=491 adults, age range 60-88, 321 males, 170 females. Living at home, Australia. | Print project: to evaluate use of social network site (SNS) user age 73 years. | Qualitative: Mixed-method, qualitative research | The utilization of SNS has the potential to reduce loneliness in older adults. | None | None |
| Table 2. | Characteristics of included reviews and primary studies. | | | | | | | |

| Included review | Type of review and study numbers | Review focus/aim | AMSTAR2 rating | Primary studies included in review | Population and setting | Study design, intervention, comparison | Measure of loneliness Social isolation | Gratzones | Quality tool used in review (rating) |
|-----------------|----------------------------------|------------------|----------------|-----------------------------------|------------------------|-----------------------------|---------------------------|-----------|------------------------------------|
| Bennett (2015)  | Systematic review (part of doctoral dissertation) | To answer what impact video communication has on older adult's relationships and their psychological well-being, when is it used to communicate with friends and relatives | Critically Low | Participants: n=491 adults, age 60+. Nursing home residents, USA | Qualitative: Supported video phone intervention. Both residents and family members were asked to conduct a video call at least once a week for five minutes (more if they choose to do so) and complete a form after each video call to document its technical quality. Participants supported by long-term care facility staff to use videophone. | Qualitative: Thematic synthesis | Themecorporatedmidt participanted, participantedbeing included into family interactions and feedback from family, participants valued seeing the other person's facial expressions, video-communication reduced feelings of loneliness, video-found better than telephone for emotional conversations, and concerns with using the technology. | None | None |
| Schwindenhammer, (2013) | Quasi-experimental | n=180 older adults, age 65+ Intervention condition: n=90; Control condition: n=90 | Experimental group received intervention through video-communication. Experimental group had significantly lower mean levels of loneliness at one week (β = -1.21, p = .002) and three months (β = -2.84, p = .003), and depressive status (β = -2.84, p = .003). | Experiment group received intervention supported video-conferencing programme for three months. Contact with purposeful, choral group. The software at the facilities was either Skype or RHPC, using large laptop. Residents assisted to use technology by a trained research assistant who spent at least five minutes with residents at the appointment time. | Qualitative: Thematic synthesis | Themes included: meaningful, second best option for visiting, like adjustments and importance of family life. | None | None |
| Tsai and Tsai (2011) | Quasi-experimental | n=60 older adults, age range=60-64 | Experimental group n=30, Control group n=30 | Clinical trial | Qualitative: Supported video conferencing intervention. | Qualitative: Thematic synthesis | Themecorporatedmidt participanted, participantedbeing included into family interactions and feedback from family, participants valued seeing the other person's facial expressions, video-communication reduced feelings of loneliness, video-found better than telephone for emotional conversations, and concerns with using the technology. | None | None |
| Tsai and Tsai (2011) | Quasi-experimental | n=60 older adults, age range=60-64 | Experimental group n=30, Control group n=30 | Clinical trial | Qualitative:Supported video conferencing intervention . | Qualitative: Thematic synthesis | Themecorporatedmidt participanted, participantedbeing included into family interactions and feedback from family, participants valued seeing the other person's facial expressions, video-communication reduced feelings of loneliness, video-found better than telephone for emotional conversations, and concerns with using the technology. | None | None |
| van der Kreijden et al (2012) | Qualitative | n=120 older adults with no prior experience of videocommunications, mean age=73.2. Living in the community, according to the Netherlands. | Experimental group n=60, Control group n=60 | Pre-post intervention study (n=240), n=120 videocommunications, n=240 videocommunications, n=240 videocommunications. | Qualitative: Connectedness (proximity for isolation) | Qualitative: Connectedness (proximity for isolation) | The utilization of SNS has the potential to reduce loneliness in older adults. | None | None |

Average feeling of loneliness in group was significantly decreased (p<0.001). At 3 months, participants in the experimental group compared to the change in the control group. The utilization of SNS has the potential to reduce loneliness in older adults. The results indicate the intervention group felt significantly less loneliness after intervention. Experimental group had significantly lower mean level of loneliness after 3m (β = -5.40, P < .001; –2.64, P < .001, respectively), 6m (β = -6.47, P < .001; –4.33, P < .001), and 12m (β = -6.27, P < .001) compared with baseline than those in the comparison group. Experimental group had significantly lower mean change in instrumental social support scores at 3m, 6m (β = -4.51; P = .004) and 12m (β = -4.45, P = .005), and higher mean change in emotional social support at 3m (β = 7.74, P = .001) and 12m (β = 7.53, P = .02), and in nepotism support at 3m (β = 4.7, P = .001). No significant differences between experimental and control group regarding informational social support.
| 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 to 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  | Participants: n=40; female, isolated, and/or lonely; age range = mild 55– early 90s; mostly living at home, UK. | Individually interviews. Telephone befriending interventions. Call in Time: Telephone befriending. | Qualitative.                          | Reduces of social isolation, loneliness, depression, and anxiety; improved state of mind, contentment with life, confidence level, and physical health (pre-pandemic). | Effective Public Health Practice Project (EPHPP): N/A |                                |
| Savolainen (2008)        | Participants: n=40 vulnerable, isolated, and/or lonely, age range = mid 55s – early 90s. Living at home, Sweden. | Individually interviews. Videoconferencing using the ACTOnnect project (ICT to support frail older adults and their family carers). | Qualitative. | Seven out of the eight participants reported a positive impact on loneliness. | EPHPP: N/A                                |                                        |                                                                                           |                                |
| Torp et al. (2008)       | Participants: n=19 carers of people with stroke or dementia. Mean age 73 (57–85), M11, F8. Living at home, Norway. | Pilot 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. | Social contacts measured by Social support: 15 item Personal Resource Questionnaire (PRQ) 2000. Social support was measured with a 20 item scale developed by Rossiter et al. (1980). Focus Groups conducted. | Social contacts measured by the Family and Friendship Contacts Scale. Social support was measured with a 20 item scale developed by Rossiter et al. (1980). | EPHPP: Strong                          |                                        | Positive and significant change in scores with regard to contact with family and friends (P < 0.05) and a sense of social support from other persons (P < 0.05). |                                |
| Khosravi et al. (2016)   | Systematic review 34 studies     | Identify ICT that are designed to help seniors reduce their social isolation and loneliness, and assess the effectiveness of these technologies in supporting seniors’ wellbeing. | Critically Low  | Participants: n=100 women with various chronic conditions. Intervention: n=55; Control n=45; Age 25–65 (80% > 50yrs). Living at home, USA. | ICT: Online self-help support group (Women to Women Program). 22 weeks participation in an online, asynchronous peer-led support group provided health teaching units. WebCT (2005) platform used to deliver the intervention and was available 24/7, allowing women to participate at any convenient time. Access to Infito-Klatch, an asynchronous chat room in which they were able to exchange feelings, express concerns, provide support, and share life experiences. Access to each other and the research team via email. Peer support and expert facilitated chat room: Health Roundtable. | Qualitative.                          | Statistically significant effects on social support (p<0.002) but not on loneliness (p=0.05). | Social support: 15 item Personal Resource Questionnaire (PRQ). Loneliness: UCLA Loneliness Scale. | EPHPP: Strong                          |
| Hill et al. (2006)       | Participants: n=100 women with various chronic conditions. Intervention: n=55; Control n=45; Age 25–65 (80% > 50yrs). Living at home, USA. | ICT: Online self-help support group (Women to Women Program). 22 weeks participation in an online, asynchronous peer-led support group provided health teaching units. WebCT (2005) platform used to deliver the intervention and was available 24/7, allowing women to participate at any convenient time. Access to Infito-Klatch, an asynchronous chat room in which they were able to exchange feelings, express concerns, provide support, and share life experiences. Access to each other and the research team via email. Peer support and expert facilitated chat room: Health Roundtable. | Qualitative. | Participants interacted using avatars and online time that in virtual environment (Second Life platform) in an 8-week support group. | Social support: 15 item Personal Resource Questionnaire (PRQ). Loneliness: UCLA Loneliness Scale. | Qualitative.                          | Statistically significant effects on social support (p<0.002) but not on loneliness (p=0.05). | Social support: 15 item Personal Resource Questionnaire (PRQ). Loneliness: UCLA Loneliness Scale. | EPHPP: None                          |
| O’Connor et al. (2014)   | Participants: n=7 Demographic categories: age range 30–69; Gender: 70. Living at home, USA. | Pre-post intervention 3D virtual environment. Participants interacted using avatars and online time that in virtual environment (Second Life platform) in an 8-week support group. | Qualitative. | Participants interacted using avatars and online time that in virtual environment (Second Life platform) in an 8-week support group. | UCLA Loneliness Scale. | Qualitative.                          | Lower levels of depression and loneliness across participants. | UCLA Loneliness Scale. | None                                           |
| Tsai and Tsai (2011)     | (Duplicate - see description in Bennett (2015)) | Prompt the effectiveness of this intervention in reducing social isolation and loneliness. | Qualitative. | Participants interacted using avatars and online time that in virtual environment (Second Life platform) in an 8-week support group. | UCLA Loneliness Scale. | Qualitative.                          | Lower levels of depression and loneliness across participants. | UCLA Loneliness Scale. | None                                           |
| van der Heide et al. (2012) | (Duplicate - see description in Bennett (2015)) | Prompt the effectiveness of this intervention in reducing social isolation and loneliness. | Qualitative. | Participants interacted using avatars and online time that in virtual environment (Second Life platform) in an 8-week support group. | UCLA Loneliness Scale. | Qualitative.                          | Lower levels of depression and loneliness across participants. | UCLA Loneliness Scale. | None                                           |
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.  
**Quality**  
Low

Barnea et al. (2002)  
4 Group RCT: To deliver an online self-help program mixed-methods study. 
**Participants:** 41 participants with age ≥ 40 years. Mean age 56.6 (8.4). M=7.5, F=7.5.  
Living at home, USA  
**Measure of loneliness/social isolation**  
Interpersonal Support Evaluation List (ISEL).  
**Outcomes**  
After 3m, individuals who participated in Internet-based social support interventions significantly increased their perceived availability of social support, relative to participants who were not exposed to it. Effects found for general perceptions of support and also with a measure of support that was designed specifically for individuals who participated in a computer-mediated intervention (Intervention Effect Size = 0.77 for the ESI item).

Bond et al. (2010)  
RCT: Web-based interaction intervention. 
**Participants:** 162 people with diabetes. Mean age 51.8 (7.9). M=6.5, F=3.5.  
Living at home, USA  
** Measure of loneliness/social isolation**  
Diabetes-related social support was assessed using the Diabetes Social Support Scale.  
**Outcomes**  
Participants who received the Web intervention improved their depression, quality of life, self-efficacy, and social support ratings, compared with the control group (p<0.01).

Dew et al. (2004)  
**Cohort study: Integrated web-based programme.**  
**Participants:** 224 women with breast cancer. Mean age 51.6 (11.8).  
Living at home, USA  
**Measure of loneliness/social isolation**  
QOL in social functioning improved significantly.  
**Outcomes**  
Six-item social support scale for assessing women's perceptions of emotional and instrumental support. The discussion group was the most extensively used service (75% of participants used, average time of 864 minutes per 4mths) of the personal and expert support (n=303). 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.

Hill et al. (2016)  
**Cohort study.**  
**Participants:** 371 women with breast cancer. Mean age 55.1 (11.5).  
Living at home, USA  
**Measure of loneliness/social isolation**  
The discussion group was the most extensively used service (75% of participants used, average time of 864 minutes per 4mths) of the personal and expert support (n=303). 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.

Toys et al. (2008)  
**Cohort study.**  
**Participants:** 223 women with various chronic illnesses. Mean age 57.8 (11.7).  
Living at home, USA  
**Measure of loneliness/social isolation**  
Loneliness: UCLA loneliness Scale. Social support: Personal Resource Questionnaire (n=303). Participants who had access to the online discussion board showed a significant increase in loneliness. (P = .020) compared to the control group who did not participate.

Welkens et al. (2008)  
**Cohort study.**  
**Participants:** 930 women with various chronic illnesses. Mean age 56.6 (11.5).  
Living at home, USA  
**Measure of loneliness/social isolation**  
Loneliness: UCLA loneliness Scale. Social support: Personal Resource Questionnaire (n=303). Participants who had access to the online discussion board showed a significant increase in loneliness. (P = .020) compared to the control group who did not participate.

Welkens et al. (2011)  
**Cohort study.**  
**Participants:** 371 women with breast cancer. Mean age 55.1 (11.5).  
Living at home, USA  
**Measure of loneliness/social isolation**  
Loneliness: UCLA loneliness Scale. Social support: Personal Resource Questionnaire (n=303). Participants who had access to the online discussion board showed a significant increase in loneliness. (P = .020) compared to the control group who did not participate.
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.\(^9\) 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\(^6\); 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.\(^9\), from the Morris et al.\(^7\) 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\(^1,4-5,7,10,24,35,50\); people with diabetes or heart transplant recipients\(^2,5,6,34\); and caregivers of people with dementia or stroke survivors\(^2,5,6\). 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\(^5,6\). 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

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**Table 3. AMSTAR-2 ratings for included systematic reviews (displayed as risk of bias).**

| Review                          | 1. PICO components | 2. Protocol | 3. Study design explanation strategy | 4. Comprehensive search | 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 | 11. Heterogeneity | 12. Publication bias | 13. Reports conflicts of interest | 14. Overall rating of quality |
|--------------------------------|--------------------|-------------|-------------------------------------|-------------------------|-----------------------------|------------------------------|--------------------------|---------------------------------|-------------------------------------|---------------------------------|-----------------------------|------------------|-------------------------|-----------------------------|-----------------------------|--------------------------|
| (Beneito-Montagut et al., 2018) | +                  | -           | -                                   | -                       | +                           | +                            | +                        | -                               | -                                   | -                               | -                           | -                | -                       | -                           | -                           | -                        |
| (Bennett, 2015)                  | +                  | -           | -                                   | +                       | -                           | -                            | -                        | +                               | +                                   | +                               | +                           | -                | -                       | -                           | -                           | -                        |
| (Chen and Schulz, 2016)          | +                  | -           | +                                   | -                       | +                           | +                            | -                        | +                               | +                                   | +                               | +                           | +                | +                       | -                           | -                           | +                        |
| (Khosravi et al., 2016)          | +                  | -           | +                                   | -                       | -                           | -                            | +                        | -                               | +                                   | +                               | -                           | -                | -                       | -                           | -                           | -                        |
| (Morris et al., 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.
chat room ‘Koffee Klatch’ in Hill et al.’s 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. 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.

Supported use of social networking sites for mitigating social isolation and loneliness. Two reviews included the same study on social networking sites. The authors of this review stated that the utilisation of a bespoke social networking site had the potential to reduce loneliness in older adults, 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.

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. 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.77 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.78 found significant increases in both loneliness and social support, compared to the control group, over the 22-week intervention. Hill et al.79 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 2 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.

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 (described in the methods section). 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.

Selection of studies (cases) 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 adults, 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, and on a single measure or a composite indicator. 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 65). A second approach is for the researcher to set thresholds for determining success. A third strategy is to 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. 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 measure of a particular aspect of social isolation. The exceptions were Schwindenhammer\textsuperscript{16} and O’Connor, \textit{et al.}\textsuperscript{15} 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 \textit{et al.,} 2017\textsuperscript{27}; 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\textsuperscript{69,60}; 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\textsuperscript{2} 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\textsuperscript{66}. 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 15). 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\textsuperscript{1}. 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

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\textsuperscript{15}, 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’ 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 nurturing, were those that triggered a successful outcome (using a slightly lower consistency value of 0.825, which is still well within recommended thresholds\textsuperscript{15}). 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

\textsuperscript{15} Known as a parsimonious and intermediate 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.

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.

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        | 1           | 0.66    | 0.66       | 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     | 0.036                | 0               | 0                                      | 0.33     | 0           | 0       | 0.33       | 0       | 0            |
| Tsai 2011     | 0.051                | 0               | 0                                      | 0.33     | 0           | 0       | 0.33       | 0       | 0            |
| Weinert 2008  | 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| -0.098               | 0               | 0                                      | 0.33     | 0           | 0       | 0.33       | 0       | 0            |
| Dew           | 0.287                | 0.66            | 0.33                                   | 0.66     | 0.33        | 0       | 1          | 0       | 0.66         |
| Torp          | 0.552                | 1               | 0.66                                   | 1        | 1           | 1       | 1          | 1       | 0            |
| Cattan        | -0.687               | 0               | 0                                      | 0.66     | 0.33        | 0       | 0          | 0       | 0            |
| O’Connor      | 0.375                | 0.66            | 0.33                                   | 1        | 1           | 0.33    | 0.33       | 0.66    | 0.33         |

See also notes in methodology for further explanation.

Table 5. Reduced truth table.

| Configuration (Present: 1; Absent: 0) | Intimacy | Interaction | Support | Nurturance | Outcome | Number of studies | Consistency | PRI (Proportional Reduction 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          | 1       | 0                 | 0           | 0                                      |

9 Effect size based on post-test measurement and total social support at three months.
10 Effect size based on post-test measurement.
11 SD estimated from Weinert 2011, equal sample sizes assumed.
12 Effect size based on post-test measurement.
13 Note – effect size based on pre-post results for heart transplant recipients who received the intervention.
14 SD estimated from baseline value.
15 Mean and SD estimated from chart, error bars assumed to be based on SD (estimate of 12).

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.

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.

However, running a model based on only eight studies with four conditions would not be appropriate.
**Table 6. Solution.**

| Solution Consistency | PRI (Proportional Reduction in Inconsistency) | Solution coverage | Studies |
|-----------------------|---------------------------------------------|-------------------|---------|
| INTIMACY*INTERACTION* SUPPORT | 0.936 | 0.921 | 0.829 | (Barrera et al., 2002, Bond et al., 2010, Dew et al., 2004, Gustafson et al., 2005, O’Connor et al., 2014, Torp et al., 2008, Weinert et al., 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) |
|-------------------------------------|----------|-------------|---------|------------|---------|------------------|------------|-------------------------------------------|
| A                                   | 1        | 1           | 1       | 1          | 1       | 5                | 0.842      | 0.794                                    |
| B                                   | 1        | 1           | 0       | 0          | 0       | 1                | 0.502      | 0.405                                    |
| C                                   | 1        | 1           | 0       | 1          | 0       | 2                | 0.5        | 0                                         |
| D                                   | 0        | 0           | 0       | 0          | 0       | 3                | 0          | 0                                         |
| E                                   | 1        | 0           | 0       | 0          | 1       | 0                | 0          | 0                                         |

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

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

**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 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. 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 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, yet the call for NHS Volunteer Responders to make telephone calls to isolated older adults did not include any offers of training or support.

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 purposefully considered in future reviews, with a recent intervention involving cross-generational letter writing suggestive of positive impacts for older and younger people alike. 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, several of these interventions may not specifically address loneliness and are not targeted at older adults.

Since this overview was published, two further systematic reviews have been published in the area examining the role of digital technologies; both have suggested that the evidence on the effectiveness of certain forms of remotely delivered interventions is inconclusive. These inconclusive findings may reflect issues with the intervention approach and its implementation, but may also reflect the reality that evidence in this area is challenging to synthesise and characterised by heterogeneity in study design (with a preponderance of weak or flawed designs) and heterogeneity in outcomes that makes drawing conclusions challenging. For example, some of the interventions included in recent meta-analyses and in our own review were characterised as exhibiting negligible intervention impacts when considering differences in post-test outcome scores alone, although some of these studies also reported significant differences in the change between post-test and baseline, indicating that alternative analytical frameworks such as a meta-analysis of change scores should also be considered in future. In addition, the extent to which studies may impact on social isolation but not loneliness is unknown but is worth further investigation. Furthermore, given that the majority of studies in this area do not implement robust RCT designs, reviews that place stricter inclusion criteria on the study design may only capture a narrow slice of the evidence base. As reflected in the protocol, our own review set out to examine effectiveness in the anticipation of extant meta-analyses in the field, although at the time of searching (April 2020), no eligible review had undertaken meta-analyses.

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 adults to feel that their contributions could improve the outcomes of others (i.e. improved levels of self-worth) tended to be successful interventions. As the mobilisation of

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A condition reflecting self-worth was not used in the final QCA models because of the small number of studies.
thousands of volunteers takes place to support older adults who are currently shielding in the COVID-19 pandemic, recognising that older adults 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. In this case, the rapid element of 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 review 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 decision 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 and 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, 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 adults, for example in heightening their feelings of alienation. 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. Our original intention had been to examine the effectiveness of these approaches, although due to the heterogeneity in study design and the absence of existing meta-analyses in the literature at the time of searching, we were unable to do this directly. Instead in our QCA analyses, we identified studies and qualitatively allocated these into successful and unsuccessful groups based on their effect size and explored common characteristics of successful studies; we consider this to be a prudent way of mediating a need for a rapid evidence to inform policy with the need to implement robust and transparent methods to synthesise this evidence. As discussed, this literature has been developed further since the present review was completed, and further progression in this area is being tracked through living maps of synthesised evidence.

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. 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 (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](https://doi.org/10.17605/OSF.IO/VS2UX)

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](https://doi.org/10.17605/OSF.IO/VS2UX)

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](https://doi.org/10.17605/OSF.IO/VS2UX)

Data are available under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).

**Acknowledgements**

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Open Peer Review

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Sarwar Ghulam Sarwar Shah

1 NIHR Oxford Biomedical Research Centre, Oxford University Hospitals NHS Foundation Trust, Oxford, UK
2 Radcliffe Department of Medicine, University of Oxford, Level 6, West Wing, John Radcliffe Hospital, Oxford, UK

Thanks to the authors for considering reviewers’ comments and submitting a revision version of the manuscript, which is greatly improved. However, I have a few minor comments as follows:

1. The title is too long and it does not read smoothly. The authors may consider revising it so it reads better and is exciting.

2. Definition of older adults: It is given in the introduction section (para 1) as well as in the Methods section. This duplication can be removed by removing it from the methods section because it is again given in the population of interest in the inclusion criteria.

3. The definitions of ‘loneliness and social isolation’ are also repeated. These terms are defined in the introduction section (para 3) and again in the ‘outcomes’ in the methods section. Duplication of this information may be avoided.

4. Update of a reference: Ref # 76 Shah et al. published as a preprint in medRxiv has now been accepted by the Journal of Medical Internet Research; Hence, this reference may be updated as follows: Shah SGS, Nogueras D, van Woerden HC, Kiparoglou V. Evaluation of the Effectiveness of Digital Technology Interventions to Reduce Loneliness in Older Adults: A Systematic Review and Meta-Analysis. Journal of Medical Internet Research. 19/04/2021:24712 (forthcoming/in press)
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1. Shah SGS, Nogueras D, van Woerden HC, Kiparoglou V: Evaluation of the Effectiveness of Digital Technology Interventions to Reduce Loneliness in Older Adults: Systematic Review and Meta-
Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Public Health, Loneliness, Digital technology for health, Health inequalities, Systematic reviews and meta-analysis, Quantitative research, Patients’ access to electronic health/medical records.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Jennifer Chipps
School of Nursing, University of the Western Cape, Cape Town, South Africa

The authors did use the PRISMA reporting guidelines. I do have a few concerns:

1. There are already a few umbrella reviews - these are not commented on and as to what his paper adds.

2. Which methodology for umbrella reviews were used?

3. More detail needs to be provided on the criteria of the primary papers extracted from the systematic reviews. E.g. What was the inclusion and exclusion criteria, and how was the quality of the primary papers assessed?

4. In methodology the ‘rapid’ process needs to be explained – e.g. what time period.

5. Did the study include all residents in community and residential homes?

6. To address the question of effectiveness - only RCTS or QE studies should be included – there are qualitative papers in the synthesis which makes this confusing.

7. Social isolation and loneliness are separate concepts – need to be defined – this also related to the broad heterogenous measures included.
8. What are diverse population of older persons?

The ICA and QCA is interesting and a new addition to these umbrella reviews

**Are the rationale for, and objectives of, the Systematic Review clearly stated?**
Yes

**Are sufficient details of the methods and analysis provided to allow replication by others?**
Partly

**Is the statistical analysis and its interpretation appropriate?**
Yes

**Are the conclusions drawn adequately supported by the results presented in the review?**
Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Mental Health and systematic reviews

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

**Author Response 22 Mar 2021**

**Dylan Kneale,** University College London, London, UK

**Response to Reviewers:**

We thank the Reviewer for her constructive comments, which has given us the opportunity to improve the paper. We have addressed the comments and have revised the manuscript accordingly. Our point-by-point response is included below and we hope that we have satisfied the concerns of the reviewer.

**Response to Professor Jennifer Chipps:**

1. **There are already a few umbrella reviews - these are not commented on and as to what this paper adds.**

Thank you for this comment, enabling us to highlight what our paper adds. We have stated in the Introduction that a 'number of evidence reviews have highlighted the diverse range of interventions to alleviate loneliness amongst older adults in a variety of settings'. We included references for Cattan et al., 2005 and Victor et al., 2018 here. We have now added Jarvis et al., 2020, which had not been identified in our searches in April 2020, and Veronese et al., 2020, which had not been published until after this research was conducted. In addition, we noticed an error in the referencing of one umbrella review (Chipps et al) which
was introduced at the wrong place in the document. At the end of the introduction, we have made it clearer that our paper adds the explicit consideration of particular interventions (befriending, social support and low intensity psychosocial interventions) to address loneliness and social isolation, together with the innovative use of Intervention Component Analysis and Qualitative Comparative Analysis.

‘This rapid review examines evidence specifically on whether befriending, social support, and low intensity psychosocial interventions delivered remotely can reduce social isolation or loneliness among older adults.’

‘(iii) Generate new understandings on how interventions work and which core components and processes are associated with successful interventions, using the innovative methods of Intervention Component Analysis and Qualitative Comparative Analysis.’

2. Which methodology for umbrella reviews was used?

We have added the following text to the first paragraph of the Methods section:

Although broad frameworks for conducting overviews exist (Smith, Devane et al. 2011), specific guidance that can be used in a directive way to carry out overviews is lacking. Nevertheless, we followed elements of practice recommended by Caird and colleagues (2015) in balancing some of the challenges of conducting reviews of reviews with the need to produce policy-relevant evidence at speed in the context of the COVID-19 pandemic; the present review was developed over a four week period in April-May 2020. We also examined how existing reviews of reviews in the area, and particularly a review conducted by Chipps and colleagues (2017), navigated the challenge around differences between the scope of a systematic review and the scope of the review of the reviews.

3. More detail needs to be provided on the criteria of the primary papers extracted from the systematic reviews. E.g. What was the inclusion and exclusion criteria, and how was the quality of the primary papers assessed?

Thank you for pointing out that this should be included. We have added the following text to the ‘Study selection and data extraction’ and ‘Critical appraisal’ sections:

‘Once eligible reviews had been identified, primary papers were extracted if they met the criteria in line with the review inclusion and exclusion criteria stated above. That is:

- **Population:** older adults, located in the community or residential care, socially isolated or lonely, or at risk of social isolation or loneliness.
- **Intervention:** interventions that sought to reduce levels of social isolation or loneliness, through strengthening individuals’ social contacts and social relationships. Interventions were delivered on a one-to-one basis (e.g. befriending), or as remote group-based interventions (e.g. discussion groups).
- **Comparator/control:** studies with most forms of control group (randomised and non-randomised) and those without a control group (pre-post designs).
- **Outcomes:** measures of social isolation or loneliness, including bespoke and proxy measures, such as social connectedness.’
‘The quality of the primary studies was reported where it had been assessed by the review authors. Not all reviews included a quality assessment of their included studies.’

4. **In methodology the ‘rapid’ process needs to be explained – e.g. what time period.**

We have included the time period in the first paragraph of the Methods section: ‘the present review was developed over a four week period in April-May 2020.’

5. **Did the study include all residents in community and residential homes?**

We have added the following text into the Search strategy section:

‘1) **Population:** older and middle-aged populations aged 50+ years in the community and in residential settings.’

6. **To address the question of effectiveness - only RCTS or QE studies should be included – there are qualitative papers in the synthesis which makes this confusing.**

Thank you for highlighting this issue, which we have addressed through:

- editing the title of the manuscript to better reflect our research;
- adding a note on the study design in the Methods section:

‘As we were expecting some heterogeneity in the question being addressed by reviews, and expected this to be reflected in the design of primary studies included within reviews, we did not specify that source systematic reviews had to be confined to a particular study design. In line with previous reviews in the field, we expected studies measuring quantitative outcomes to be composed of single-group pre-post studies, non-randomised comparison studies, and randomised comparison group studies.’

7. **Social isolation and loneliness are separate concepts – need to be defined – this also related to the broad heterogenous measures included.**

We have defined social isolation and loneliness, as separate concepts, in the introduction and have added text to highlight this in the outcomes section of the ‘Inclusion and exclusion criteria’ section:

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’. Social isolation reflects the number of social contacts that people have and people who are socially isolated tend to have social networks of low density
that are not maintained through frequent engagement. 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. However, we recognize that defining social isolation and loneliness is challenging, particular as researchers have used terms involving social relationships, including social isolation, loosely (Valtorta, Kanaan et al. 2016). Furthermore, while we recognize social isolation and loneliness as distinct concepts, here we explore both simultaneously as the COVID-19 pandemic and measures adopted to mitigate its spread have exacerbated both isolation and loneliness.

8. What are diverse population of older persons?

Thank you for highlighting this lack of clarity. We have removed the word ‘diverse’ from the ‘Inclusion and exclusion criteria’ section, as it was unnecessary.

Competing Interests: We have no competing interests to declare

Reviewer Report 25 January 2021

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Sarwar Ghulam Sarwar Shah
1 NIHR Oxford Biomedical Research Centre, Oxford University Hospitals NHS Foundation Trust, Oxford, UK
2 Radcliffe Department of Medicine, University of Oxford, Level 6, West Wing, John Radcliffe Hospital, Oxford, UK

Many thanks for inviting me to review the manuscript entitled “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?”

Loneliness is a major public health issue that has become critical now due to increased social isolation and lockdowns in the current COVID-19 pandemic.

Therefore, this manuscript reporting a rapid review of reviews on remote interventions and their effectiveness in tackling loneliness in older people is timely.

I have the following comments on the manuscript.

Abstract:
In systematic reviews, reporting of the sources of literature, selection criteria and publication
period are important but these are missing in the abstract. The authors need to add this information in the methods section of the abstract. If however there were no strict criteria such as restrictions on publication dates, then these need to be mentioned. The population of interest was ‘older adults’ and their age is reported as 50 years and above. This means no upper age limit therefore some participants might be very old such as above 70 years of age and they could be called as ‘elderly’. The two terms i.e. older and elderly, are interpreted differently; therefore, the authors might like to change the term ‘older adults’ to ‘adults aged 50 years and above’ to avoid the confusion. The Results section should also provide a summary of data extracted about characteristics of studies, population and interventions. Determination of the effectiveness of the interventions was one of the objectives and authors have reported a mixed quantitative evidence of effectiveness in the results section but nothing about the effectiveness is reported in the conclusion. The authors should include concluding remarks on the effectiveness in the conclusion in the abstract.

Introduction:
In the introduction section, the authors mention older adults over 70 years while in the abstract they report 50 years plus. The authors need to be consistent in reporting the term older people and years of age covered. The authors might like to describe the term ‘older adults’ including age in years included in the review in the methods section.

The authors have mentioned that ‘During the height of the COVID-19 pandemic these interventions were of limited...’. This suggests that the peak intensity of the COVID-19 pandemic is over, which it is not because there are second and third waves of COVID in different countries. For example, the UK is currently going through a very serious second wave of COVID-19 and strict lockdown is in place across the country. Therefore, the authors need to change the above statement such as ‘during the height of the first wave of COVID-19 in 2020...’.

Methods:
Different researchers were involved in the screening and shortlisting of articles but no information on the interrater reliability/agreement is reported. Reporting of a relevant statistic such as the Kappa static will be helpful.

Results:
The results section includes some paragraphs such as the ‘Theory selection and setting up the QCA’, ‘Developing a data table’ and ‘Truth table’. These paragraphs describe the theory and methodological procedures; hence, these should be reported in the methods section.

Discussion:
The authors might like to refer to some recent meta-analyses on the effectiveness of interventions to tackle loneliness, which show that digital interventions are not effective in adults aged 70 years and above (Shah et al., 2020) and especially video calls (Noone et al., 2020).

Conclusion:
The conclusion section is more about the inclusion of the processes and principles suggested in the QCA. The authors need to include their overall inference about the effectiveness of different types interventions reviewed in the population of interest.

References
1. Shah S, Nogueras D, van Woerden H, Kiparoglou V: Are digital technology interventions effective to reduce loneliness in older adults? A systematic review and meta-analysis. *medRxiv*. 2020. Publisher Full Text
2. Noone C, McSharry J, Smalle M, Burns A, et al.: Video calls for reducing social isolation and loneliness in older people: a rapid review. *Cochrane Database of Systematic Reviews*. 2020. Publisher Full Text

**Are the rationale for, and objectives of, the Systematic Review clearly stated?**
Yes

**Are sufficient details of the methods and analysis provided to allow replication by others?**
Partly

**Is the statistical analysis and its interpretation appropriate?**
Partly

**Are the conclusions drawn adequately supported by the results presented in the review?**
Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Public Health, Loneliness, Digital technology for health, Health inequalities, Systematic reviews and meta-analysis, Quantitative research, Patients’ access to electronic health/medical records.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

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Author Response 22 Mar 2021

**Dylan Kneale**, University College London, London, UK

**Response to Reviewers.**

We thank the Reviewer for his constructive comments, which has given us the opportunity to improve the paper. We have addressed the comments and have revised the manuscript accordingly. Our point-by-point response is included below and we hope that we have satisfied the concerns of the reviewer.

**Response to Dr Shah:**

- **Abstract:**
  In systematic reviews, reporting of the sources of literature, selection criteria and publication period are important but these are missing in the abstract. The authors need to add this information in the methods section of the abstract. If however there were no strict criteria such as restrictions on publication dates,
then these need to be mentioned. The population of interest was ‘older adults’ and their age is reported as 50 years and above. This means no upper age limit therefore some participants might be very old such as above 70 years of age and they could be called as ‘elderly’. The two terms i.e. older and elderly, are interpreted differently; therefore, the authors might like to change the term ‘older adults’ to ‘adults aged 50 years and above’ to avoid the confusion. The Results section should also provide a summary of data extracted about characteristics of studies, population and interventions. Determination of the effectiveness of the interventions was one of the objectives and authors have reported a mixed quantitative evidence of effectiveness in the results section but nothing about the effectiveness is reported in the conclusion. The authors should include concluding remarks on the effectiveness in the conclusion in the abstract.

○ Introduction:
In the introduction section, the authors mention older adults over 70 years while in the abstract they report 50 years plus. The authors need to be consistent in reporting the term older people and years of age covered. The authors might like to describe the term ‘older adults’ including age in years included in the review in the methods section.

The authors have mentioned that ‘During the height of the COVID-19 pandemic these interventions were of limited...’. This suggests that the peak intensity of the COVID-19 pandemic is over, which it is not because there are second and third waves of COVID in different countries. For example, the UK is currently going through a very serious second wave of COVID-19 and strict lockdown is in place across the country. Therefore, the authors need to change the above statement such as ‘during the height of the first wave of COVID-19 in 2020...’.

Thank you for your comments and helpful suggested revisions to the abstract. We have included some further detail about the methods employed, within the confines of the word limit. We have added the fields which the 11 databases covered (‘from the fields of health, social care, psychology and social science). We have also added the selection was guided by our PICOS criteria.

Thank you for pointing out the inconsistencies with regard to the age groups covered in the manuscript. The review included research studies with populations aged 50 years and above, whereas the UK Government guidance aimed at protecting older adults during the first wave of the pandemic was targeted at those aged 70 years and above. Thank you for helping us to clarify the time period with your wording about the first wave. We have changed the wording of the introduction to:

‘During the height of the first wave of the COVID-19 pandemic in 2020, millions of people aged 70 years and over were advised to avoid social contact with those outside their household. with older age identified as a risk factor for poorer COVID-19 prognosis (Mueller, McNamara et al. 2020).’
We have also changed the wording in the abstract, although the word limit has restricted what we could add here:

‘During the COVID-19 pandemic ‘social distancing’ has highlighted the need to minimise loneliness and isolation among older adults (aged 50+).’

With regard to the use of the term ‘older adults’, we feel that this term does encompass the full range of ages from 50 years and upwars. The term is commonplace in our research groups and we would prefer to keep it as it is, as many people in their 50s and 60s experience poor health and life transitions at an earlier age, meaning that they live with age-related conditions from 50+. As recommended, we have ensured that the term ‘older adults’ is defined in the introduction and at the beginning of our methods section, so that the reader is clear about the population in our paper, and is used consistently throughout. As such, we have changed all instances of ‘older people’ to ‘older adults’.

Introduction: ‘Here we use a broad definition of ‘older’ adult, defined as those aged 50+, which captures those in middle age who may be nearing or experiencing age-related transitions, such as retirement or unpaid caring, or living with age-related long term conditions.’

Methods: ‘For the purposes of this review, we define ‘older adults’ as those aged 50 years and above.’

- **Methods:**
  Different researchers were involved in the screening and shortlisting of articles but no information on the interrater reliability/agreement is reported. Reporting of a relevant statistic such as the Kappa statistic will be helpful.

We have now reported the level of agreement (93%) in the manuscript.

- **Results:**
  The results section includes some paragraphs such as the ‘Theory selection and setting up the QCA’, ‘Developing a data table’ and ‘Truth table’. These paragraphs describe the theory and methodological procedures; hence, these should be reported in the methods section.

The theory has now been moved to the methods section. However, as the data table and truth table sections also include results, and provide a description of how to interpret the data presented, we think that these sections should remain in the results. As QCA is a relatively new method applied to systematic reviews, we believe that having this explanation alongside the results will provide clarity for the reader.

- **Discussion:**
  The authors might like to refer to some recent meta-analyses on the effectiveness of interventions to tackle loneliness, which show that digital interventions are not effective in adults aged 70 years and above (Shah et al., 2020[1]) and especially video calls (Noone et al., 2020[2]).
Thank you for this suggestion, which has enabled us to improve the Discussion section. We have added the following paragraph at the end of the ‘Gaps in the evidence’ section:

‘Since this overview was published, two further systematic reviews have been published in the area examining the role of digital technologies (Noone, McSharry et al. 2020, Shah, Nogueras et al. 2020); both have suggested that the evidence on the effectiveness of certain forms of remotely delivered interventions is inconclusive. These inconclusive findings may reflect issues with the intervention approach and its implementation, but may also reflect the reality that evidence in this area is challenging to synthesise and characterised by heterogeneity in study design (with a preponderance of weak or flawed designs) and heterogeneity in outcomes that makes drawing conclusions challenging. For example, some of the interventions included in recent meta-analyses and in our own review were characterised as exhibiting negligible intervention impacts when considering post-test outcome scores alone, although significant changes between post-test and baseline scores suggest that a meta-analysis of change scores should also be considered in future.

Furthermore, given that the majority of studies in this area do not implement robust RCT designs, reviews that place stricter inclusion criteria on the study design may only capture a narrow slice of the evidence base. As reflected in the protocol, our own review set out to examine effectiveness in the anticipation of extant meta-analyses in the field, although at the time of searching (April 2020), no eligible review had undertaken meta-analyses.’

○ Conclusion:
The conclusion section is more about the inclusion of the processes and principles suggested in the QCA. The authors need to include their overall inference about the effectiveness of different types interventions reviewed in the population of interest.

Thank you for highlighting this. We have added the following text to the end of the first paragraph of the ‘Further research and conclusions’ section:

‘Our original intention had been to examine the effectiveness of these approaches, although due to the heterogeneity in study design and the absence of existing meta-analyses in the literature at the time of searching, we were unable to do this directly. Instead in our QCA analyses, we identified studies and qualitatively allocated these into successful and unsuccessful groups based on their effect size and explored common characteristics of successful studies; we consider this to be a prudent way of mediating a need for a rapid evidence to inform policy with the need to implement robust and transparent methods to synthesise this evidence. As discussed, this literature has been developed further since the present review was completed (Gorenko, Moran et al. 2020, Noone, McSharry et al. 2020, Shah, Nogueras et al. 2020, Dubé, Paquet et al. 2021), and further progression in this area is being tracked through living maps of synthesised evidence (IPPO 2021).’

Competing Interests: We have no competing interests to declare
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