

Addressing Social Isolation To Improve the Health of Older Adults: A Rapid Review



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Prepared by:

Scientific Resource Center
Portland, OR

Investigators:

Stephanie Veazie, M.P.H.
Jennifer Gilbert, M.D., M.P.H.
Kara Winchell, M.A.
Robin Paynter, M.L.I.S.
Jeanne-Marie Guise, M.D., M.P.H.

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Purpose of Review

To rapidly evaluate the effect of interventions targeting social isolation/loneliness in community-dwelling older adults (60 years and older) on outcomes of social isolation/loneliness, health and health care utilization.

Key Messages

- Physical activity interventions to reduce social isolation showed the most promise at improving the health of older adults; however, effects were inconsistent and short-term. Three of the four interventions that found a positive effect on health or social isolation met more than once per week and involved a health care professional in the delivery of the intervention.
- Among interventions that improved social isolation or health/health care utilization outcomes, there was no clear relationship between effects on social isolation and effects on health or health care utilization.
- Looking across studies, we found several methodological issues: lack of consistency on whether and how social isolation and/or loneliness are measured; follow-up not being long enough to see health benefits, and lack of measurement of health care utilization or potential harms.
- Interventions that connect socially isolated older adults to health services are conceptually promising and need good-quality studies.

This report is based on research conducted by the Scientific Resource Center under contract to the Agency for Healthcare Research and Quality (AHRQ), Rockville, MD (Contract No. 290-2017-00003-C). The findings and conclusions in this document are those of the authors, who are responsible for its contents; the findings and conclusions do not necessarily represent the views of AHRQ. Therefore, no statement in this report should be construed as an official position of AHRQ or of the U.S. Department of Health and Human Services.

None of the investigators have any affiliations or financial involvement that conflicts with the material presented in this report.

The information in this report is intended to help health care decisionmakers—patients and clinicians, health system leaders, and policymakers, among others—make well-informed decisions and thereby improve the quality of health care services. This report is not intended to be a substitute for the application of clinical judgment. Anyone who makes decisions concerning the provision of clinical care should consider this report in the same way as any medical reference and in conjunction with all other pertinent information, i.e., in the context of available resources and circumstances presented by individual patients.

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Preface

Recognized for excellence in conducting comprehensive systematic reviews, the Agency for Healthcare Research and Quality (AHRQ) Evidence-based Practice Center (EPC) Program is expanding its portfolio to include Rapid Evidence Products. The program has begun to develop a range of Rapid Evidence Products to assist end-users in making specific decisions in a limited timeframe. The Scientific Resource Center (SRC) supports the activities of the EPC program, including piloting and producing Rapid Evidence Products.

In 2014, AHRQ EPCs produced a taxonomy of rapid evidence products produced by leading organizations around the world.^{abc} This taxonomy now informs the development of Rapid Evidence Products. Based on level of synthesis, the report classified products as inventories, rapid responses, and rapid reviews. On one end of the spectrum, evidence inventories offer an assessment of the quantity and type of evidence without presenting results. On the other end, rapid reviews adapt and streamline traditional systematic review methods to provide a limited evidence synthesis.

To shorten timelines, reviewers must make strategic choices about which processes to abridge. Common adaptations to provide rapid evidence include: narrowly focusing questions, limiting the number of databases searched and/or modifying search strategies, using a single reviewer and/or abstractor with a second to provide verification, and restricting to studies published in the English language. However, the adaptations made for expediency may limit the certainty and generalizability of the findings from the review, particularly in areas with a large literature base. Transparent reporting of the methods used, the resulting limitations of the evidence synthesis, and the strength of evidence of included studies is extremely important. While tradeoffs will likely differ for each topic, they are described so readers can adjudicate the limitations of the findings and conclusions of the review.

While rapid evidence products are often sufficient for decisionmaking on their own, at other times they can uncover a large complex literature base that encourages end-users to seek a full review. Even in this instance, the rapid evidence review can provide a map of the evidence and assist decisionmakers in targeting resources to areas of highest interest and greatest potential value.

AHRQ expects that these rapid evidence products will be helpful to health plans, providers, purchasers, government programs, and the health care system as a whole. Transparency and stakeholder input are essential to the Effective Health Care Program. If you have comments on this report, they may be sent by mail to the Task Order Officer named below at: Agency for Healthcare Research and Quality, 5600 Fishers Lane, Rockville, MD 20857, or by email to epc@ahrq.hhs.gov.

^a Hartling L, Guise J-M, Hempel S, et al. EPC methods: AHRQ End-user perspectives of rapid reviews. Rockville (MD): 2016. <https://www.ncbi.nlm.nih.gov/pubmed/27195347>

^b Hartling L, Guise JM, Kato E, et al. EPC Methods: An Exploration of Methods and Context for the Production of Rapid Reviews. Rockville (MD): 2015. <https://www.ncbi.nlm.nih.gov/pubmed/25654160>

^c Hartling L, Guise J-M, Hempel S, et al. Fit for purpose: perspectives on rapid reviews from end-user interviews. *Systematic Reviews*. 2017;6:32. doi: 10.1186/s13643-017-0425-7. PMID: PMC5316162.

Gopal Khanna, M.B.A.
Director
Agency for Healthcare Research and Quality

Arlene S. Bierman, M.D., M.S.
Director
Center for Evidence and Practice
Improvement
Agency for Healthcare Research and Quality

Stephanie Chang
Director
Evidence-based Practice Center Program
Center for Evidence and Practice
Improvement
Agency for Healthcare Research and Quality

Christine Chang, M.D., M.P.H.
Task Order Officer
Center for Evidence and Practice
Improvement
Agency for Healthcare Research and Quality

Peer Reviewers

Prior to publication of the final evidence report, the SRC sought input from independent Peer Reviewers without financial conflicts of interest. However, the conclusions and synthesis of the scientific literature presented in this report do not necessarily represent the views of individual reviewers.

Peer Reviewers must disclose any financial conflicts of interest greater than \$5,000 and any other relevant business or professional conflicts of interest. Because of their unique clinical or content expertise, individuals with potential nonfinancial conflicts may be retained. The TOO and the EPC work to balance, manage, or mitigate any potential nonfinancial conflicts of interest identified.

The list of Peer Reviewers follows:

Chantelle Garrity, D.C.S., M.Sc.
Senior Research Program Manager
Ottawa Hospital Research Institute
Ottawa, Ontario, Canada

Lisa Hartling, M.Sc., Ph.D.
Director, Alberta Research Center for Health Evidence
University of Alberta
Edmonton, Alberta, Canada

Elaine Wethington, Ph.D.
Professor
Cornell University
Ithaca, NY

Addressing Social Isolation To Improve the Health of Older Adults: A Rapid Review

Structured Abstract

Background. Social isolation and loneliness in older adults are substantial public health problems. Interventions have been examined for their effect on reducing social isolation and loneliness; however, it is unclear which are effective at improving health outcomes and avoiding unnecessary health care utilization.

Purpose. To review recent literature evaluating the effectiveness of interventions that target social isolation and loneliness to improve health and/or health care utilization.

Methods. We used rapid review methods to evaluate recent research. We systematically searched Ovid/Medline[®], PsycInfo[®], and CINAHL[®] from 2013 to 2018 for systematic reviews and from 2016 to 2018 for primary studies. We used predetermined criteria to select primary studies from systematic reviews published in 2018, in addition to the primary study search. We extracted study-level data, conducted quality assessments, and synthesized results.

Findings. Sixteen studies were included: one good-quality randomized controlled trial [RCT], seven fair-quality studies (6 RCTs and 1 pre-post), and eight poor-quality studies (7 pre-post and 1 cross-sectional with post-test survey). Of the eight good- or fair-quality studies, five examined physical activity, two examined social interventions, and one examined an arts and recreation intervention. Two were associated with a positive effect on health outcomes: a resistance training, nutrition, and psychosocial support intervention improved functionality, depression, diet, and social capital, and a physical/leisure activity intervention improved quality of life but not social support. Two interventions (group tai chi and facilitated group discussion) improved loneliness but not health outcomes (e.g. quality of life or depression). Of the four fair- or good-quality studies reporting a positive impact on social isolation or health outcomes, three involved a health care professional in delivery, and three met more than once/week. Most poor-quality studies showed improvement in health but not social isolation; however, study design issues limited the reliability of these results. Five of 16 studies reported on harms and none were clinically significant. Three reported on health care utilization, with conflicting results.

Implications. Of interventions to reduce social isolation, physical activity interventions show the most promise at improving the health of older adults; however, effects were inconsistent and studies short term. Information on the effect of interventions on health care utilization is sparse and inconsistent. Health systems should target interventions to the needs of their population while keeping in mind that the documented impact of such interventions specific to social isolation, health, and health care utilization outcomes is limited. Health systems should rigorously evaluate their efforts to increase the evidence base and share results with other health care systems.

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Background

One in five Americans report feeling socially isolated or lonely.¹ A recent analysis found that 162,000 deaths each year in the United States are attributable to low social support; that is more than the number of deaths due to lung cancer.^{2, 3} Social isolation and low support are particularly concerning for older adults.

The population of the United States is aging, with the number of adults aged 65 and older growing from 35 million in 2000 to 49.2 million in 2016.⁴ Older adults are at higher risk for being socially isolated due to age-related changes in health and social connections, such as limitations to hearing and vision, reduced mobility, and loss of family and friends.¹ These changes can contribute to social isolation and loneliness, defined respectively as the lack of sustained meaningful connection to other people and the perceived lack of interaction with others.⁵ In recent nationally representative surveys, 40 percent of older adults reported feeling lonely⁶ and 24 percent were socially isolated.⁷ Adults who are lonely or socially isolated self-report worse physical health,⁸ are at higher risk of dementia,⁹ have more physician visits,¹⁰ and have higher rates of mortality.^{6, 11}

The relationship between social isolation, health, and health care utilization is complex.¹² Poor health has been theorized to be both a contributor to social isolation (e.g., declining health may keep older adults from maintaining social relationships) and a result of social isolation (e.g., the stress brought on by social isolation may affect health outcomes).^{13, 14} Along the same lines, previous research has found that older adults with weaker social relationships have higher rates of certain types of high-cost and potentially avoidable health care services such as hospital readmissions and longer hospital stays, but similar rates of lower cost services such as ambulatory care visits.^{15 16}

Due to the evidence linking social isolation with poor health and potentially avoidable health care utilization, there have been large-scale efforts to promote the inclusion of older adults into society. Initiatives include the World Health Organization's creation of the Global Network for Age-friendly Cities and Communities¹⁷ and the United Kingdom's assignment of a Minister of Loneliness.¹⁸ These groups have also issued guidelines on addressing social isolation. The World Health Organization (WHO) recommends identifying and supporting networks for older adults, providing access to appropriate assist devices, and developing confidence in using technology.¹⁹ In addition, the WHO notes that interventions that are participatory and have a theoretical foundation are usually more effective than those without. The UK's National Institute for Health and Clinical Excellence (NICE) recommends health care practitioners identify and address social isolation among older adults by providing advice and resources about social activities and consider contracting with voluntary and community sectors to provide these services.²⁰ In the US, Centers for Disease Control and Prevention, and Centers for Medicare and Medicaid Services (CMS)—recommend that health systems collect information on social determinants of health, ideally in electronic health records.²¹

Increasingly, there has been interest from health systems, payers, public health departments, advocacy groups, and community organizations to play a role in developing and implementing interventions to address the social determinants of health, including social isolation and loneliness.²²⁻²⁵ This topic was nominated for a new rapid evidence product by Kaiser Permanente Northwest (KPNW) Center for Health Research (CHR), representing a large integrated health system in the United States. KPNW CHR partnered with a major academic integrated statewide health system (Oregon Health & Science University [OHSU]) and a community access program (Project Access Now) to hold a healthy aging summit that brought together community groups,

the public, and health systems to develop and implement interventions and develop a research agenda to improve health outcomes and health care utilization for older adults in Oregon. Social isolation was a major focus of this summit.

An up-to-date review of recent evidence on the effectiveness of social isolation interventions on health and health care utilization in older adults was conducted to inform and support the summit that was occurring in a matter of months.

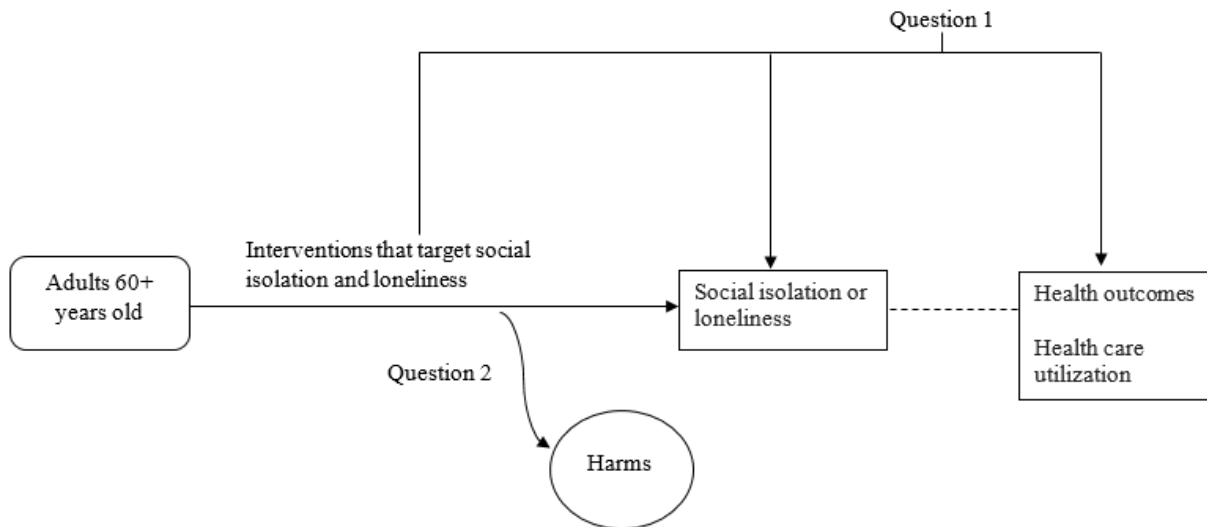
Objective and Guiding Questions

Our objective was to rapidly evaluate and synthesize the most recent evidence on interventions to reduce social isolation and loneliness to improve health and reduce unnecessary health care utilization among older adults. The following questions guided the literature search and inclusion/exclusion criteria.

1. Among older adults, what is the effectiveness of interventions (volunteerism, peer support, transportation programs, etc.) that target social isolation and loneliness to improve health and reduce unnecessary health care utilization?
2. Among older adults, what are the harms associated with interventions (volunteerism, peer support, transportation programs, etc.) that target social isolation and loneliness to improve health and reduce unnecessary health care utilization?

Figure 1, below, is an analytic framework depicting the relationship between the questions and population, interventions, and outcomes of this rapid review.

Figure 1. Analytic framework



Methods

We conducted a rapid review of the last 5 years of research to inform health systems’ decisionmaking on a leading social determinant of health for the elderly—social isolation. This rapid review was guided by established rapid review methodology^{26, 27} and took the following steps to complete a product on a 4-6 month timeline:

- Defined a narrow scope (see Table 1).
- Conducted searches in a limited number of databases.
- Focused inclusion criteria on articles published in the last 5 years, articles in the general population of older adults, and articles published in English.
- Relied heavily on existing systematic reviews to identify primary studies.
- One reviewer assessed articles for inclusion and risk of bias and a second reviewer checked a 25 percent sample.
- Conducted focused data extraction.

We refined the scope of this rapid review in consultation with the nominator and a topic expert. The protocol was developed based on input from experts, registered in the PROSPERO database²⁸ (CRD42018100102) and publicly posted on the Agency for Healthcare Research and Quality (AHRQ) Effective Health Care Program Web site.²⁹ We provide a full description of our methods in Appendix A and provide a brief description here.

A librarian conducted formal searches for systematic reviews in PubMed[®], PsycInfo[®], and Cumulative Index of Nursing and Allied Health (CINAHL)[®] from January 2013 to May 2018, and targeted searches in databases routinely searched during topic development for the AHRQ Evidence-based Practice Center Program. The librarian updated the searches in PubMed, PsycINFO, and CINAHL in November 2018. See Appendix B for search strategies and the full list of databases searched. These systematic reviews provided a source from which to identify primary studies published since 2013. We searched for primary studies (January 2016 to May 2018) in PubMed, PsycInfo, and CINAHL based on the end date of the search of the most recent and most comprehensive systematic review. The librarian updated the searches in PubMed, PsycINFO, and CINAHL in November 2018 for both systematic reviews and primary studies. We specified and refined our inclusion and exclusion criteria based on the populations, interventions, comparators, outcomes, timing, and settings (PICOTS) of interest for this review (Table 1).

Table 1. Inclusion and exclusion criteria

PICOTS	Inclusion/Exclusion Criteria
Population	Include: Older adults (Medicare or retirement age [60 years or older]), community dwelling Exclude: People less than 60 years of age, exclusively focused on a single health condition (physical or sensory disability, specific mental illness, etc.), non-community dwelling (nursing home, institutional setting, etc.), exclusively focused on a specific subpopulation (indigenous populations, immigrants, veterans, etc.)
Intervention	Include: Interventions that target social isolation to improve health outcomes or reduce unnecessary health care utilization. Examples include volunteerism, programs delivered by peers or health care practitioners, transportation programs, etc. Exclude: Case management delivered by a trained health care professional, information technology (IT) focused interventions, telehealth, interventions not focused on reducing social isolation, not an intervention, interventions that did not measure impact on health outcomes.
Comparator	Include: Any comparator, no comparator

PICOTS	Inclusion/Exclusion Criteria
Outcomes	Include* Primary: <ul style="list-style-type: none"> • Physical and mental health outcomes (including but not limited to depression, quality of life, and chronic disease management) Secondary: <ul style="list-style-type: none"> • Social isolation and loneliness • Health care utilization (including but not limited to emergency department visits, hospitalizations, primary and specialty care appointments) • Harms (e.g., adverse events, worsening of health or social isolation, costs)
Setting	Include: Community settings Exclude: Low and middle-income countries, skilled nursing facilities, assisted living facilities, hospitals.
Study Design	Include: Quantitative or mixed-methods studies including observational studies. (We included only quantitative data.) Exclude: Qualitative studies, single timepoint studies (i.e., post-intervention survey)
Language	Include: English

* Systematic reviews were included if they report any of the primary or secondary outcomes of interest. Primary studies were only included if they report the primary outcome. PICOTS = population, intervention, comparator, outcomes, time, setting.

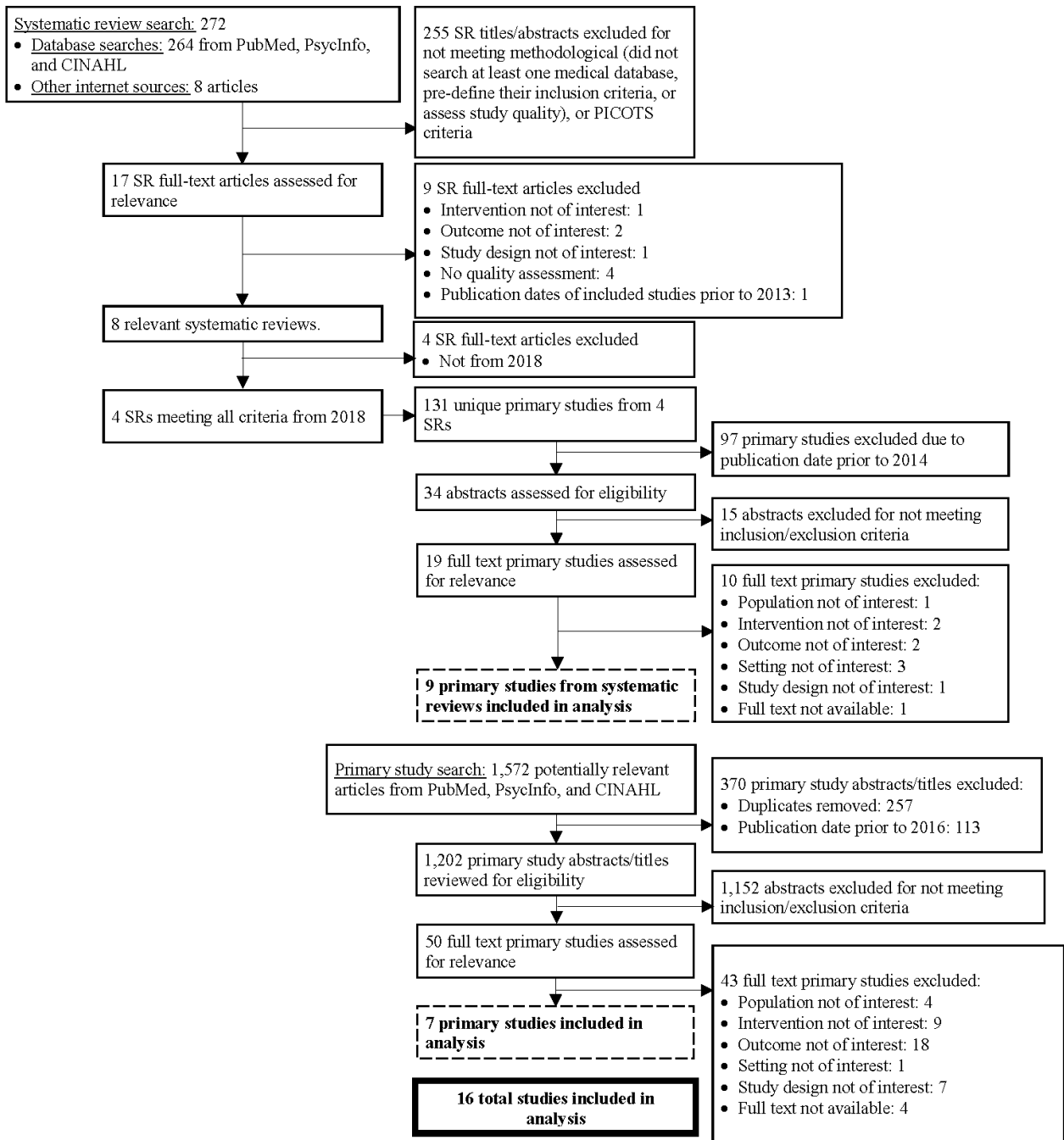
One reviewer evaluated titles, abstracts, and full texts of systematic reviews and primary studies based on predetermined criteria, and a 25 percent sample was verified by a second reviewer. One reviewer evaluated risk of bias using U.S. Preventive Services Task Force criteria³⁰ to evaluate study quality and a second reviewer checked a 25 percent sample. The risk of bias criteria are detailed in Appendix A. Data were extracted by one reviewer, and a second reviewed for accuracy and completeness. We also searched for guidelines and reached out to several research centers and health care collaboratives to identify ongoing and recently completed studies.

AHRQ did not directly participate in the literature search, determination of study eligibility criteria, data analysis, or interpretation of this report. AHRQ reviewed this report to assess adherence to methods. Two methodological experts, one topic expert, three AHRQ staff, and the nominator, a health system expert, peer reviewed the draft report.

Findings

The literature flow diagram (Figure 2) summarizes the search and selection of articles. We identified 272 systematic reviews. Eight met inclusion criteria, and we selected the four^{5, 31-33} most recent systematic reviews, which were published in 2018. We evaluated the 131 unique primary studies contained in these systematic reviews as well as 1,572 primary studies from a search from the past 2 years. After applying predefined inclusion and exclusion criteria, we included 16 studies³⁴⁻⁴⁹—9 from systematic reviews^{34-37, 39, 41, 42, 45, 46} and 7 from primary study searches.^{38, 40, 43, 44, 47-49} Of the 16 included studies (7 randomized controlled trials [RCTs],^{38, 44-49} 8 pre-post,^{34-37, 39-42} and 1 cross sectional with a post-test survey⁴³) including 17,656 patients, 5 involved physical activity interventions,⁴⁵⁻⁴⁹ 5 involved social interventions,^{35, 40-42, 44} 4 involved arts and recreation-based interventions,^{34, 36-38} and 2 involved improving health services access.^{39,}

Figure 2. Literature flowchart



SR = systematic review; PICOTS = population, intervention, comparator, outcomes, time, setting

Question 1. Among older adults, what is the effectiveness of interventions (volunteerism, peer support, transportation programs, etc.) that target social isolation and loneliness to improve health and reduce unnecessary health care utilization?

Of the 16 studies aimed at reducing social isolation or a related construct,³⁴⁻⁴⁹ 4^{40, 44, 45, 48} (3 RCT, 1 pre-post) demonstrated measurable improvement in loneliness, social capital, or social participation; 6^{34, 36, 38, 42, 46, 47} (3 RCTs and 3 pre-post) had no significant effect on loneliness, social support, or social networks; and 6^{35, 37, 39, 41, 43, 49} (1 RCT, 4 pre-post, and 1 cross-sectional) did not report an effect or the effect could not be determined. Five (2 RCTs^{46, 48} and 3 pre-post^{36, 39, 42}) of 16 studies reported improvements in health outcomes, including quality of life, frailty, depression, diet, functionality, stress, and chronic pain. Three studies^{40, 43, 49} measured health care utilization, two^{40, 43} of which reported sufficient information to determine if there was significant difference between groups over time. Half of the 16 studies were poor quality, making the interpretation and application of findings difficult. Study findings are organized by intervention and summarized below. Detailed study characteristics and findings are presented in Appendix C. An overview of study findings for good- and fair-quality studies appears in Table 2, and study findings for poor-quality studies are in Appendix D.

To better understand how the characteristics of these interventions might be contributing to effects, we compared each of the good- and fair-quality studies in terms of intervention duration and intensity, and whether a health care provider, lay person, or peer delivered the intervention, and then compared these to whether there was an effect on either a social isolation construct or health outcomes (Appendix E). Of the four fair- or good-quality studies⁴⁵⁻⁴⁸ that had a positive impact on either health or social isolation outcomes, three had a health care professional involved in the delivery (including a physical and leisure activity intervention delivered by a physical therapist, occupational therapist, and public health nurse; a tai chi intervention in which a nurse and social worker trained peer ambassadors to support older people in the intervention; and a facilitated group discussion intervention delivered by National Health Service and social care staff who were supervised by an occupational therapist). Of the same four studies, three were high intensity, meeting more than once a week.

By contrast, among the three fair-quality studies^{35, 38, 47} of interventions that had no effect on either health or social isolation outcomes, only one had a health care professional involved in the delivery (intervention that provided a choice of exercise, social activity, or personnel counseling had a rehabilitation counselor provide counseling), one was low intensity (met less than once a week), and two were medium-low intensity (met less than once a week or once a week, depending on intervention group). This suggests that having a health care professional involved and delivering an intervention at least once a week may be important to improving outcomes for older adults. Previous research has found that patients report better health and satisfaction when they trust their health care provider (e.g., nurse, physician, general practitioner, or psychiatrist);⁵⁰ it is therefore possible that interaction with a trusted health care provider played a role in improving patient outcomes in these interventions.

Physical activity interventions. Five fair-quality RCTs⁴⁵⁻⁴⁹ evaluated physical activity interventions in older adults.

Two RCTs^{46, 48} reported health benefits, both of which were multicomponent interventions that combined exercise with other interventions including social, leisure activities (e.g. cooking), and/or diet programming. One RCT (n=77)⁴⁸ examined a 3-month, twice-weekly, 100-minute resistance exercise program combined with either a nutritional or psychosocial program. This

intervention was delivered to pre-frail or frail older adults by trainers and study staff at a local community center. The nutritional program aimed to increase food variety through lectures on diet and group activities, while the psychosocial program involved group discussions of participants' hobbies, neighborhoods, and community resources. Improvements were seen in social capital, frailty, depression, diet, and physical function as measured through the Timed Up and Go test. The other RCT (n=52)⁴⁶ found improvements in health outcomes but not a social isolation construct. This study involved a 3-month multicomponent intervention delivered at a community center, but was conducted less frequently (once a week vs. twice a week). This intervention included two-hour sessions once a week of physical activity (e.g., walking, stretching, and weights) combined with leisure activities (e.g., cooking, games, and crafts). This study found no effect on social support but did report significant improvement in quality of life at 3 months. This intervention was delivered by health care professionals (e.g., physical therapist, occupational therapist, or public health nurse), while the other multicomponent intervention was conducted with study staff and trainers of unclear professional background.

Of the three remaining RCTs, one (n=100)⁴⁹ did not provide data to compare groups over time, one (n=48)⁴⁵ involved a 3-month intervention of tai chi and found no impact on social networks, mental health, or self-esteem at 3 or 6 months but improvements in loneliness at 6 months, and one (n=223)⁴⁷ that randomized patients to the choice of physical activity (n=45), social activity (n=27), or counseling (n=33) reported no significant impact on loneliness, depression, or melancholy at 6 months. Only one physical activity study⁴⁹ reported health care utilization outcomes (hospital admissions, emergency department visits, and primary care visits); however, it did not provide data to compare groups over time.

Social interventions. Five studies^{39-42, 44} examined the effect of social interventions, including one good-quality RCT,⁴⁴ one fair-quality pre-post study with concurrent control,³⁹ and three poor-quality pre-post studies.⁴⁰⁻⁴²

Neither of the good- or fair-quality studies saw improvements in health outcomes or reported health care utilization outcomes. The good-quality RCT⁴⁴ (n=288) of facilitated group discussions on goal setting, strengths, and skills saw no effect on mental health, depression, or quality of life at 6 or 12 months, but did see an improvement in loneliness at 2 years. Study authors cautioned this finding was "questionable" because it is not clear if this was a minimal clinically important difference. The fair-quality pre-post study³⁵ (n=80), in which older adults read to children, found no effect on depression, but did note there was a significant group-x-time interaction effect for sense of coherence ($p < 0.10$). Study authors conducted simple effects analysis on subscales of the sense of coherence tool and determined there was a short-term effect on the subscale of meaningfulness but not subscales of comprehensibility or manageability. This study did not measure a social isolation construct.

Of the three poor-quality pre-post studies,⁴⁰⁻⁴² two^{40, 42} reported improvements in health outcomes including depression and perceived stress, but only one⁴⁰ reported improvements in loneliness and social participation. Only one poor-quality study reported health care utilization outcomes and found an increase in nurse visits (but not general practitioner or social work visits) over 1 year. However, it should be noted that the intervention was only 15 weeks long and it is unclear how the timing of the 1-year time span for potential visits aligned with these 15 weeks. Interventions in poor-quality studies ranged from older adults sharing memories with young people to social gatherings to combined phone calls, home visits, and social engagements. Findings of these studies should be interpreted with caution due to considerable potential for bias. All three studies lacked a control group and failed to report if they conducted appropriate









statistical analyses to account for drop-outs or adherence. One study⁴¹ measured outcomes at 3 weeks, which was too short to see an effect on certain important health outcomes.




Arts and recreation interventions. Four studies,^{34, 36-38} including one fair-quality RCT³⁸ and three poor-quality pre-post studies,^{34, 36, 37} tested the effects of arts and recreational interventions.

The fair-quality RCT³⁸ (n=31) involved a rhythm-centered music-making class and saw no improvement in social network, quality of life, depression, or sleep. Of the three poor-quality pre-post studies, one³⁴ (n=36) provided singing lessons and two^{36, 37} (n=51 and n=12) involved arts projects. The study³⁴ on singing found that depression worsened in one intervention subgroup; however, authors noted the effect was not clinically significant. This study reported no effect on loneliness. One pre-post study³⁶ on arts projects found an improvement in chronic pain at 2.5 years but not daily function, health status, depression, self-esteem, or social support. The other³⁷ did not report sufficient information to make a determination on well-being and did not measure a social isolation construct. These poor-quality studies had multiple methodological limitations including poorly defined interventions, high attrition rates, lack of valid and reliable outcome measurements, inadequate follow-up, and insufficient statistical analysis, which warrant cautious interpretation. None of these studies measured health care utilization outcomes.

Health services access interventions. Two poor-quality studies^{39, 43} examined the effects of linkages to health services in older adults—one pre-post and one cross-sectional study with a post-intervention survey. Both involved training community members and elderly to recognize older persons at risk and facilitate connections to the health system, although one pre-post study (n=328) evaluated those who were connected to the health system and the other (n=15,719) evaluated older adults who did the connecting. The study of those who were connected to services reported reduced depression at 1 year but did not report any health care utilization outcomes. The intervention using connectors reported reduced hospitalization days compared with a standby group. The intervention directed at older adults connected to services reported benefits in social isolation at 6 months,³⁹ while the study of older adults who were the connectors did not measure a social isolation construct.⁴³ These studies have a high potential for bias, in that they included groups that were not comparable at baseline, interventions were poorly defined, and measures were not validated for outcomes.

Table 2. Selected intervention characteristics and outcomes data from fair- and good-quality studies

Type of Intervention (Health Effect)	Study Information	Description of Intervention	Duration & Intensity	Staffing Requirements	Effect on SI/Loneliness	Effect on Health/Health Care
 (+) Kamegaya, 2014 ⁴⁶	RCT n=52 Mean age: 75 Fair quality	Walking, stretching, & weight exercise; games, crafts, & cooking	(D) 3 months** (I) 2 hours 1x/week ^{††}	Professional (PT, OT, & nurse) Lay person	No effect on social support (3 mo)	Improved subjective QoL (3 mo)
 (+) Seino, 2017 ⁴⁸	RCT n=77 Mean age: 75 Fair quality	Resistance exercise, nutrition, & psychosocial support	(D) 3 months** (I) 1 hour 40 min 2x/week ^{†††}	Lay person	Improvement in social capital (3 mo)	Decreased depression, improved frailty, diet, and functionality (3 mo)
 (-) Chan, 2017 ⁴⁵	RCT n=48 Mean age: 77 Fair quality	Tai chi qigong exercise	(D) 3 months** (I) 1 hour 2x/week ^{†††}	Lay person & professional (nurses and social workers)	Improvement in loneliness at 6 mo but not 3 mo. No effect on social network (3 or 6 mo)	No effect on mental health & self-esteem (3 & 6 mo)
 (-) Pynnonen, 2018 ⁴⁷	RCT n=223 Mean age: 77 Fair quality	Choice of exercise; group discussions, day-trips, & art projects; or counseling	(D) 15-21 weeks** (I) Max 2hrs 1x/week ^{††} Min 1hr 1x/every 3 wks [†]	Lay person & professional (rehabilitation counselor)	No effect on loneliness (6 or 12 mo)	No effect on depression or melancholy (6 mo)
 (-) Mountain, 2017 ⁴⁴	RCT n=288 Mean age: 72 Good quality	Facilitated group discussions on goal setting, sharing strengths & skills, & encouragement	(D) 4 months** (I) Group: 1x/week ^{†††} Facilitator: 1x/month ^{†††}	Professional (NHS or social care staff)	Improvement in loneliness at 2 yrs but not 6 mo	No effect on mental health, depression, self-efficacy or well-being (6 mo & 2 yr)
 (-) Murayama, 2015 ³⁵	Pre-post n=80 Mean age: 69 Fair quality	Reading to children	(D) 1 year*** (I) 1x/1-2 weeks ^{†/††}	Lay person	NR	No effect on depression (2 yr)
 (-) Yap, 2017 ³⁸	RCT n=31 Mean age: 75 Fair quality	Rhythm-centered music making with conga, cowbell, Djembe, Ashiko Tan-tans, Dunun, shakers, and wood blocks	(D) 11 weeks** (I) 1 hour x 10 sessions [†]	Lay person	No effect on social network (11 weeks)	No effect on QoL, depression or sleep (11 weeks)
 (=) Tarazona-Santabalbina, 2016 ⁴⁹	RCT n=100 Mean age: 80 Fair quality	Endurance, strength, coordination, balance, & flexibility exercises	(D) 6 months*** (I) 1 hour 5 min 5x/week ^{†††}	Professional (PT & nurse)	NR (6 mo)	NR (6 mo)

(+) = studies that had a positive effect on health/health care utilization outcomes; (-) = studies that had no effect; (=) = studies for which there was insufficient information to make a determination;  = Physical activity;  = Social;  = Arts and recreation; (D) = Duration of intervention; (I) = Intensity of intervention; (NR) = No results; (QoL) = Quality of life; (GP) = General practitioner; * = Low duration; ** = Medium duration; *** = High duration; † = Low intensity; †† = Medium intensity; ††† = High intensity; (PT) = Physical therapist; (OT) = Occupational therapist; (RCT) = Randomized controlled trial; (NHS) = National Health Service; (SI) = Social Isolation

Question 2. Among older adults, what are the harms associated with interventions (volunteerism, peer support, transportation programs, etc.) that target social isolation and loneliness to improve health and reduce unnecessary health care utilization?

Of the 16 studies aimed at reducing social isolation or loneliness,³⁴⁻⁴⁹ 1 good-quality⁴⁴ and 3 fair-quality RCTs^{38, 45, 48} reported information on harms, 1 fair-quality RCT⁴⁹ reported looking for harms but did not report whether any were found, 1 poor-quality pre-post study³⁴ reported a worsening of a health condition and 10 studies (2 fair-quality RCTs, 1 fair-quality and 6 poor-quality pre-post studies, 1 poor-quality cross-sectional study with a post-test survey)^{35-37, 40-42, 46, 47, 39, 43} did not report looking for or finding information on harms.

We identified several studies that described costs of interventions and summarize these in this section. Of the 16 studies, 3⁴²⁻⁴⁴ reported information on costs: 1 RCT reported the cost of delivering the intervention,⁴⁴ 1 pre-post study⁴² reported the fee charged to participants to participate in the program, and the cross-sectional study with a post-test survey⁴³ reported reductions in health care costs in the intervention versus control group.

Physical activity interventions. Of the five fair-quality RCTs on physical activity interventions, one⁴⁹ reported looking for serious adverse events such as death and hospitalization during follow-up but did not report whether any occurred, and two^{45, 48} reported no adverse events (including one that explicitly reported no injuries) in either intervention or control groups. The remaining two RCTs^{46, 47} did not report on whether they looked for or found harms of the interventions. No studies of physical activity interventions reported costs.

Social interventions. One good-quality study⁴⁴ on a facilitated group discussion intervention reported that serious adverse events were similar across intervention and control groups, and that serious adverse events in the treatment group were unrelated to the intervention. This intervention was estimated to cost between \$649 and \$868 per person, depending on the location in England or Wales during the study period of 2011 to 2015. The fair-quality study³⁵ and two poor-quality studies^{40, 41} on social interventions did not report whether they looked at or found harms related to the interventions. The remaining poor-quality study⁴² of a community liaison intervention did not report looking for or finding harms, but reported that the program charged annual membership fees of \$696 for an individual and \$895 for a household and offered reduced rates for lower income older adults, as of 2013.

Arts and recreation interventions. The fair-quality study on an arts and recreation intervention reported looking for harms of the intervention, and reported no adverse events.³⁸ However, one poor-quality study of weekly group singing sessions of in-home care recipients and community participants found worsening of scores on the Geriatric Depression Scale for in-home recipients but not in the community group.³⁴ As noted previously, authors commented that the difference was not clinically significant. The same study did not report whether they looked for or found harms of the interventions. Similarly, the two other poor-quality studies^{36, 37} did not report having looked for or finding harms related to the interventions.

Health services access interventions. Neither of the two poor-quality studies^{39, 43} on health services linkage interventions reported whether they looked for or found harms. One poor-quality study⁴³ of a peer support intervention found that both the intervention and standby groups had increases in medical expenses over a 2-year period between 2009 and 2013, but the increase was greater by \$432 in the standby group.

Discussion

Summary

Based on the past 5 years of research, there is limited available evidence that interventions to improve social isolation or a related construct have a significant effect on health outcomes, with the most promising evidence supporting physical activity interventions. Only two interventions with fair- or good-quality studies improved health outcomes, both of which were relatively time-intensive physical activity interventions combined with leisure, psychosocial, or nutritional activities. These two interventions did not measure costs, and only one recorded adverse events. Two additional interventions with fair- or good-quality studies—one a physical activity intervention and one a social intervention—were associated with a positive effect on social isolation, but not health outcomes. Only two studies measured quality of life (measured via the Satisfaction in Daily Life scale⁴⁶ and EQ-5D-3L⁴⁴), one of which saw an improvement. Health care utilization outcomes were measured in only one of the good- or fair-quality studies, but the study did not present analysis of between-group difference in differences so we could not determine if the intervention had effects on those outcomes. Interventions that were associated with a positive effect on either health or social isolation outcomes were more likely to have a health care provider involved in the implementation and deliver the intervention at least once a week than interventions that did not have an effect, although this was based on a small number of studies (n=8).

Of note, only one-quarter of the studies reported on harms. Two of these studies reported finding adverse events: one reported similar rates in both intervention and control groups, and one found worse outcomes (depression) in intervention versus control, but neither was clinically significant. Harms that were measured included death, hospitalization, and general adverse events. Only one study specifically said no injuries occurred, which is an important harm to report given the physical nature of many of the interventions and the health impact of injuries in older adults.

Our review is consistent with the four systematic reviews that met our criteria but were published prior to 2018⁵¹⁻⁵⁴ in that there is limited evidence that interventions involving physical activity and social interactions/social roles can positively impact social isolation/loneliness^{51, 52, 54} and health;⁵³ and that studies on the effectiveness of interventions to alleviate social isolation/loneliness are methodologically flawed.⁵¹⁻⁵³ However, our review adds to the evidence base by assessing the effect of these interventions on health care utilization and examining potential harms. The lack of evidence we identified on these outcomes points to the need for future researchers to address health care utilization and harms, as these are important considerations for health care decisionmakers.

It is perhaps not surprising that physical activity interventions, which are centered around improving health, had a positive effect on health outcomes. However, it is surprising that we did not see an association between reducing social isolation and improving health among physical activity or other interventions, as these two concepts have been linked in previous research. It is possible that the complexity of reasons contributing to social isolation, paired with the accumulating effect of isolation on health (such as gradual declines in health from age or chronic disease, or the loss of a life-long relationship with a sibling or spouse that cannot be replaced with a new relationship) means that a single, short-term intervention is not enough to change outcomes. If this is the case, larger, more intensive efforts that target the underlying reasons why people are socially isolated may be required.

Because the evidence supporting particular interventions for addressing social isolation is limited, health systems may want to focus on approaches that have been recommended to improve older adults' health outside of social isolation and leverage those programs to also address social isolation. For example, the National Prevention Council recommends physical activity, increasing access to and use of clinical preventive services and behavioral health care, and increasing access to healthy food to improve the health of older adults.⁵⁵ Physical activity in particular also been shown to have mild positive effects on cognition for adults both with and without cognitive impairment.⁵⁶ Health systems should target the interventions to the needs of their population and may want to consider piloting new efforts to address social isolation to improve health to inform future decisionmaking.

Limitations

Limitations of Rapid Review Methodology

Rapid reviews take streamlined steps in order to complete the work on a rapid timeline. In this review, narrowing the search to the past 5 years, identifying studies from the four 2018 systematic reviews and a recent search for primary studies (2016-18), and conducting single reviewer study inclusion with 25 percent check may have resulted in missing eligible studies. Additionally, for the sake of time we excluded qualitative studies which made it difficult to explain the mechanism through which these interventions addressed social isolation (e.g., through improving relationships, increasing access to health services, improving patients' self-efficacy, etc.).

Limitations of Primary Studies

We recognize that by limiting our population to only community-dwelling adults, we may have missed some populations of older adults which are most likely to have social isolation, such as those in long-term care. It is possible that the broader body of evidence (including these other populations) would have limited generalizability to our population of focus and vice versa.

As previously discussed, serious issues in the design and conduct of studies resulted in moderate to high risk of bias and serious inconsistency in study findings.

Studies varied in whether they measured a social isolation construct and if they did, what measures they used, with most studies measuring the subjective feeling of loneliness. Because of the variety of definitions and measurements used to capture these constructs, we could not draw any conclusions on the comparative effect of interventions on addressing social isolation or loneliness as separate entities. We describe the definitions of social isolation and loneliness used in each review in Appendix F, Table F-1. In general, social isolation is conceptualized as an absence or paucity of contacts and interactions, whereas loneliness is conceptualized as “a subjective feeling state of being alone, separated or apart from others, and has been conceptualized as an imbalance between desired social contacts and actual social contacts.”³¹ Studies varied widely in their conceptions about social isolation and what if anything was measured: seven evaluated loneliness, six measured social support or network, one measured structural social capital, one measured perceived togetherness, one measured social participation, one measured social isolation, and three did not have any measurement. Among those that contained a measure, no universal instrument was used, and there was wide range in the length of the instruments and the types of questions asked (Appendix F, Table F-2).

Loneliness instruments asked about different types of loneliness, including general, social, and emotional. Social isolation and social support instruments asked about number and role of relatives and friends, as well as presence and level of engagement with a social support network. The De Jong Gierveld Loneliness Scale,⁵⁷ Lubben Social Network Scale,⁵⁸ and University of California Los Angeles (UCLA) Loneliness Scale⁵⁹ were the most commonly used instruments in this review, with each used in at least two studies. A recent review⁶⁰ identified 54 instruments used to measure social relationships in those 65 and older, of which only 5 overlapped with the 13 tools used in our identified studies. This highlights the need to come to a shared understanding of social isolation and agree upon an appropriate and validated metric in order to make progress in this field.

Fewer than half of the included studies were rated fair or good quality. The main methodological issues of these fair- and good-quality studies included differential drop-out rates between groups, follow-up periods that were too short to show an effect, and not accounting for confounders, losses to follow-up, or missing data. The majority of studies were poor quality. These studies similarly had follow-up periods that were too short to show an effect (such as one study⁴¹ of a 3-week intervention that measured changes in quality of life), and did not use appropriate analyses to control for confounders, losses to follow-up, or missing data. These studies had additional methodological issues such as failing to use validated measures, not blinding outcome assessors, not adequately describing the intervention, and having overall drop-out rates that were above 30 percent. Many of these poor-quality studies also did not have a concurrent control group. Therefore, it was difficult to determine whether any changes in outcomes were due to the intervention or a secular trend. Findings from these studies should be interpreted with caution, but they provide helpful information for stakeholders to get an understanding of the breadth of interventions that have been delivered to reduce social isolation and loneliness.

In addition to methodological flaws, most studies were conducted in countries other than the United States, including Hong Kong, Singapore, Japan, Finland, Italy, Spain, Australia, Canada, and the UK. These countries vary both in terms of cultural expectations around the inclusion of older adults in society and the extent to which social programs exist to support the needs of older adults, so it is unclear whether findings from the studies are generalizable to the United States.

Research Recommendations

We recommend researchers take the following approaches to improve the quality of studies and help to fill evidence gaps.

- Be explicit about how their proposed intervention would theoretically impact social isolation to improve health (e.g., explain how the outcomes would change according to behavior change theory).
- Collaborate with health systems, payers, and patient advocacy groups to agree upon standardized definitions and measures for social isolation and loneliness. As mentioned previously, social isolation is currently measured with myriad constructs and measures, which complicates the ability to draw conclusions between social isolation and health outcomes.
- Compare the intervention group with a control group or otherwise control for confounding variables in order to better determine intervention effectiveness.

- Recruit and report results for a diverse population (only one³⁸ of the eight good- or fair-quality studies reported the ethnicity of its participants) to determine important population differences.
- Carefully select outcomes depending on the duration and intensity of the intervention to be studied. For example, for shorter duration interventions of less than a month, consider focusing on shorter term outcomes such as participant satisfaction with intervention as opposed to quality of life. For outcomes that involve subscales, report the results of the complete scale. Consistently report between-group difference-in-difference for outcomes.
- Measure health care utilization outcomes, in addition to health outcomes. Health systems, payers and other stakeholders are very interested in both health and health care utilization outcomes to determine the ideal intervention to address social isolation in older adults with limited resources.
- Conduct longer term interventions and measure longer-term outcomes, including health care utilization, to assist health care systems in determining where to focus limited resources. Large, longitudinal, multi-site studies that are randomized at the site rather than participant level may be needed to capture the effect of real-world implementation of interventions on important health outcomes such as quality of life and chronic disease management, as well as utilization outcomes such as emergency department visits and primary care visits.
- Report all harms for studies, including both serious adverse events (e.g., hospitalization) and less severe adverse events (e.g., musculoskeletal injuries for physical activity interventions). Consider other types of study designs such as cohort, case-control, or cross-sectional to capture information on harms over long periods of time and large groups of people.⁶¹

Conclusion

Health system researchers are just beginning to evaluate the effectiveness of some potentially promising interventions to address social determinants of health. Through the Centers for Medicare & Medicaid Services Accountable Communities Model, health systems are evaluating the health care and utilization effects of identifying and referring patients to address social determinants of health.⁶² Preliminary data also suggest that coordinating delivery of social determinants of health to high-risk patients through clinical and non-clinical care staff may improve certain health and health care utilization outcomes.⁶³ One health system used peers as community health workers for Medicare patients and evaluated the effects on health care utilization outcomes (including emergency department visits, hospital admissions, and annual wellness visits) as well as patient-centered outcomes (e.g., patient satisfaction).⁶⁴ In addition, an academic medical center–led initiative is focusing on how technology can facilitate the health and independence, and decrease the social isolation, of older adults.⁶⁵ Another model for addressing social isolation in people of all ages is a company that facilitates creation of relationships through exchange of interests and abilities.⁶⁶ Case management services, such as those provided by ElderTree, have also been used to address social support and other health needs of older adults, although that was not the focus of this review.⁶⁷

Social isolation is a complex construct with an unclear relationship to health outcomes, and research should attempt to capture this complexity. Particularly when targeting interventions on health effects, researchers should measure other important personal domains that may be affected by social isolation and are potential intermediaries to health but go beyond simply social

interactions such as personal agency, comfort being alone, and/or self-efficacy. With health systems attempting multiple innovative interventions for social determinants of health, we recommend that they rigorously evaluate these interventions and share their data on effectiveness with other health systems.

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Appendix A. Full Methods

Literature Search

Our goal was to rapidly identify the most recent (past five years) research on this topic. We searched for systematic reviews in PubMed, PsycInfo, and Cumulative Index of Nursing and Allied Health (CINAHL) from January 2013 to May 2018, as well as databases routinely searched during topic development for the Agency for Healthcare Research and Quality (AHRQ) Evidence-based Practice Center Program (Cochrane Database of Systematic Reviews, Agency for Healthcare Research and Quality evidence report and technical assessment portfolio, PubMed Health, PROSPERO, Veterans Affairs Evidence-based Synthesis Program, Centre for Reviews and Dissemination [CRD database], Canadian Agency for Drugs and Technologies in Health [CADTH], Database of promoting health effectiveness reviews [DOPHER], ECRI Institute, Systematic Reviews Journal, and McMaster Health System Evidence). We selected the four most recent reviews, reviewed their included studies, and searched for additional primary studies published in the last two years (January 2016 to April/May 2018) in PubMed, PsycInfo and CINAHL. The librarian updated the searches in PubMed, PsycINFO, and CINAHL in November 2018 for both systematic reviews and primary studies. A two-year primary study search was chosen as this was the end date of the search of the systematic review with the most recent, broadest scope. The complete search strategy is listed in Appendix A.

We also searched for guidelines at UK National Institute for Health and Clinical Excellence (NICE), American College of Physicians, and World Health Organization, and contacted Edward R. Roybal Centers for Translation Research in the Behavioral and Social Sciences of Aging and health systems in the High Value Health Care Collaborative (HVHC) asking if they were conducting any interventions focused on social isolation in the elderly. None of 13 Roybal Centers and two HVHCs (Baylor Scott and White, and Intermountain Healthcare) were engaged in work on social isolation meeting our eligibility criteria and none had published studies to share but one (Baylor Scott and White) shared a power point highlighting key findings.

Study Selection

We specified and refined our inclusion and exclusion criteria based on the populations, interventions, comparators, outcomes, timing, and settings (PICOTS) identified for this review (Table A-1). Due to our rapid timeline, we decided to focus on studies that addressed a broad population of healthy, community-dwelling older adults and therefore excluded studies that focused on specific subgroups (e.g., Veterans, indigenous populations, those with specific health conditions). We also decided to exclude information technology (IT) interventions as we wanted to focus on interventions that a broad range of partners (e.g., health systems, advocacy groups, community organizations) could implement. We included all measurements of physical and mental health outcomes (e.g., we included validated scales for quality of life and self-reported overall health)

We included systematic reviews if they searched at least two medical databases, pre-defined their inclusion criteria, and assessed study quality. We initially planned to include all relevant primary studies from included systematic reviews published within the last 10 years; however due to the large number of studies retrieved, and our partner's focus on the most recently available evidence, we only included studies which were published in the last five years. One reviewer evaluated titles, abstracts, and full texts of systematic reviews and primary studies

based on predetermined criteria and a 25 percent sample was checked by a second reviewer. Disagreements were resolved through discussion.

Table A-1. Inclusion and exclusion criteria

PICOTS	Inclusion/Exclusion Criteria
Population	Include: Older adults (Medicare or retirement age [60 years or older]), community dwelling Exclude: People less than 60 years of age, exclusively focused on, a single health condition (e.g. physical or sensory disability, specific mental illness, etc.), non-community dwelling (e.g. nursing home, institutional setting, etc.), exclusively focused on a specific subpopulation (indigenous populations, immigrants, veterans, etc.)
Intervention	Include: Interventions that target social isolation to improve health outcomes or reduce unnecessary health care utilization. Examples include volunteerism, programs delivered by peers or health care practitioners, transportation programs, etc. Exclude: Case management delivered by a trained health care professional, information technology (IT) focused interventions, telehealth, interventions not focused on reducing social isolation, not an intervention, interventions that did not measure impact on health outcomes.
Comparator	Include: Any comparator, no comparator
Outcomes	Include* Primary: <ul style="list-style-type: none"> Physical and mental health outcomes (including but not limited to depression, quality of life, and chronic disease management) Secondary: <ul style="list-style-type: none"> Social isolation and loneliness Health care utilization (including but not limited to Emergency Department visits, hospitalizations, primary and specialty care appointments) Harms (e.g., adverse events, worsening of health or social isolation, costs)
Setting	Include: Community settings Exclude: Low and middle-income countries, skilled nursing facilities, assisted living facilities, hospitals.
Study Design	Include: Quantitative or mixed-methods studies including observational studies (we only included quantitative data) Exclude: Qualitative studies, single time point studies (i.e., post-intervention survey)
Timing	Include: Studies published since 2013
Language	Include: English

* Systematic reviews were included if they report any of the primary or secondary outcomes of interest. Primary studies were only included if they report the primary outcome. PICOTS = population, intervention, comparator, outcomes, time, setting

Data Extraction

For each included study, one investigator extracted information about design, population, intervention, and outcomes, and a second reviewer reviewed for completeness and accuracy. For studies that measured multiple, similar, intermediate health outcomes, we prioritized patient-centered outcomes (e.g., we extracted body mass index and weight but not arm girth or leg girth) and for mixed methods studies we focused on quantitative outcomes.

For studies with a comparator, only between-group difference-in-differences and p-values were extracted. For pre-post studies, only pre-post differences and p-values were extracted. We only extracted these values if the effect was significant ($p < 0.05$); otherwise, we reported that no significant effect was seen for that outcome. When studies reported overall results of scales (such as the SF-36) that also had subscales (such as the SF-36 mental health or physical health), we limited reporting of results for overall scales, with the exception of when study authors pre-specified that a subscale was their primary outcome. In these cases, we only reported the subscale.

We extracted reported measures of social isolation and included measures of social capital, social networks, social support, and social participation in our construct of social isolation. While

we initially did not plan to extract this detailed information, we decided it was important to inform stakeholder decisions by clarifying which interventions have an effect on both social isolation/loneliness outcomes and health/health care outcomes, either set of outcomes or neither set of outcomes.

Risk of Bias/Quality Assessment

One reviewer evaluated the quality of each study as good, fair, or poor, using criteria developed by the U.S. Preventive Services Task Force guidance¹ (see Table A-2) and a second reviewer evaluated a 25 percent sample. Reviewers completed training before assessing risk of bias to improve inter-rater reliability, including pilot testing the risk of bias tool and pre-specifying how to rate each criterion as high, unclear, or low risk of bias. Disagreements were resolved through discussion.

Of note, we considered the presence of a control group when determining overall study quality since the lack of a control group creates bias by severely limiting the ability to determine if effects are due to secular trends (e.g., a simultaneously implemented community policy).

Table A-2. Risk of bias criteria based on U.S. Preventive Services Task Force guidance

#	Criterion
1	Groups were adequately randomized (RCT only)
2	Allocation was adequately concealed (RCT only)
3	Inclusion and exclusion criteria were consistently used across groups.
4	Participant characteristics were balanced or there was adjustment for potential important confounders.
5	Comparable groups were maintained, including low overall drop-out rate, equal drop-outs between groups, and efforts to minimize contamination between groups.
6	Interventions were clearly defined, including any co-interventions.
7	Outcome measurements were used consistently across groups, explicitly defined, valid and reliable, important, multiple outcomes were measured, and outcome assessors were blinded.
8	Followup was equal between groups and long enough for outcomes to occur.
9	Study conducted appropriate sensitivity analysis or other statistical adjustment related to confounders, inclusion/exclusion criteria, losses to follow-up, missing data, or adherence to intervention, as needed.

Data Synthesis and Analysis

We constructed evidence tables with study characteristics, results, and risk-of-bias ratings for all included studies and summary tables to highlight the main findings. Given the heterogeneity of interventions to address social isolation and our partner’s focus on identifying the evidence for specific interventions, we did not conduct a meta-analysis or use a formal process to grade the evidence.

Reference for Appendix A

1. Harris RP, Helfand M, Woolf SH, et al. Current methods of the US Preventive Services Task Force: a review of the process. *Am J Prev Med.* 2001 Apr;20(3 Suppl):21-35. PMID: 11306229.

Appendix B. Search Strategies

Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) 1946 to Present

Update Search Date: November 13, 2018

Searched by: Robin Paynter, MLIS

Searches
1 social alienation/ or social Isolation/ or social networking/ or social participation/ or Loneliness/ or ((social* adj3 (alienat* or connect* or engag* or exclusion or exclude* or isolat* or network* or participat* or relation* or support*)) or loneliness or lonely or marginal* or solitude or psychosocial or psycho-social or wellbeing or well-being).ti,kf.
2 (aged/ or "Aged, 80 and over"/ or frail elderly/ or (aged or elder* or geriatric* or gerontol* or nonagenarian* or octogenarian* or older or "oldest old" or senior* or septuagenarian* or sexagenarian* or "very old").ti,kf.) not (adolescent/ or child/ or child, preschool/ or infant/ or infant, newborn/ or middle aged/ or young adult/ or (adolescen* or infant* or child or children or "middle aged" or "school-aged" or "young adult*").tw,kf.)
3 and/1-2
4 limit 3 to yr="2013 -Current"
5 limit 4 to english language
6 limit 5 to (meta analysis or systematic reviews)
7 social alienation/ or social Isolation/ or social networking/ or social participation/ or Loneliness/ or ((social* adj3 (alienat* or connect* or engag* or exclusion or exclude* or isolat* or network* or participat* or relation* or support*)) or loneliness or lonely or marginal* or solitude or psychosocial or psycho-social or wellbeing or well-being).ti,kf.
8 program evaluation/ or (alleviat* or evaluat* or group or improv* or increas* or initiative* or innovat* or intervention* or manag* or "patient navigator*" or peer or peers or pilot* or project* or program* or reduc*).ti,kf.
9 1 and 2 and 8
10 limit 9 to yr="2013 -Current"
11 limit 10 to english language
12 remove duplicates from 11
13 12 not 6

CINAHL Plus with Full Text

Update Search Date: November 20, 2018

Searched by: Information Specialist

#	Search	Actions
S10	S8 NOT S9	
S9	S8	Limiters – Publication Type: Case Study, Commentary, Editorial, Letter
S8	S7 NOT S3	Limiters – Published Date: 20160101-20180531; English Language; Exclude MEDLINE records
S7	S1 AND S2 AND S6	
S6	(MH "Program Evaluation") OR TI (alleviat* or assess* or change or "community-based" or evaluat* or decreas* or group or improv* or increas* or initiative* or innovat* or intervention* or partnering or partnership* or pilot* or project* or program* or reduc*)	
S5	S4 NOT S3	Limiters – Published Date: 20130101-20180531; English Language; Exclude MEDLINE records; Publication Type: Meta Analysis, Meta Synthesis, Systematic Review
S4	S1 AND S2	
S3	TI ("care homes" OR carer* OR caregiver* OR "case manag*" OR employe* OR facility OR facilities OR family OR families OR student* OR prison* OR worker* OR workplace* OR "residential care" OR "residential setting" OR cancer* OR dementia OR diabetes OR "hepatitis c" OR HIV OR parkinson* OR psychos?s OR psychotic OR schizophren* OR app OR apps OR computer* OR Internet OR phone OR online OR videoconferenc* OR video-conferenc*)	
S2	(MH "Aged") OR (MH "Aged, 80 and Over") OR (MH "Frail Elderly") OR (MH "Middle Age") OR TI ((aged OR ageing OR aging OR "assisted living" OR "community-dwelling" OR "community-residing" OR elder* OR geriatric* OR gerontol* OR nonagenarian* OR octogenarian* OR (older N2 (adult* OR men OR people OR person* OR women)) OR "oldest old" OR pensioner* OR retired OR retiree* OR retirement OR "senior citizen*" OR seniors OR septuagenarian* OR sexagenarian* OR "very old") NOT (adolescen* OR ((college O ...	
S1	(MH "Social Isolation") OR (MH "Loneliness") OR (MH "Social Alienation") OR (MH "Social Participation") OR (MH "Support, Psychosocial") OR (MH "Social Isolation In Old Age") OR (MH "Loneliness In Old Age") OR (MH "Social Participation In Old Age") OR TI (((communit* or neighbor* or social*) N3 (alienat* or connect* or cooperat* or engag* or exchang* or exclusion or exclude* or include* or inclusion or integrat* or interaction* or involv* or isolat* or network* or participat* or relation* or supp ...	

Ovid PsycINFO 1806 to Present

Update Search Date: November 13, 2018

Searched by: Robin Paynter, MLIS

#	Searches
1	Social Isolation/ or Loneliness/ or Social Capital/ or Social Interaction/ or Social Networks/ or Social Support/ or (((communit* or social*) adj3 (alienat* or connect* or cooperat* or co-operat* or engag* or exchang* or exclusion or exclude* or include* or inclusion or integrat* or interaction* or involv* or isolat* or network* or participat* or relation* or support*)) or loneliness or lonely or marginal* or psychosocial* or psycho-social* or "social capital" or solitude or wellbeing or well-being).ti,id.
2	(Aging/ or Aging in Place/ or Physiological Aging/ or "Aged (Attitudes Toward)"/ or "Aging (Attitudes Toward)"/ or Geriatric Psychiatry/ or Geriatric Psychotherapy/ or Geriatrics/ or Gerontology/ or Geropsychology/ or Retirement/ or ("360" or "380" or "390").ag. or "2860".cc. or (aged or ageing or aging or "assisted living" or "community-dwelling" or "community-residing" or elder* or geriatric* or gerontol* or nonagenarian* or octogenarian* or ((old or older) adj2 (adult* or men or people or person* or women)) or "oldest old" or pensioner* or retired or retiree* or retirement or "senior citizen*" or seniors or septuagenarian* or sexagenarian* or "very old").ti,id.) not (adolescenc* or ((college or men or school or women) adj2 aged) or infant* or child or children or pediatri* or (young adj2 (adult* or men or women)) or teenage* or youth*).tw,id.
3	and/1-2
4	limit 3 to yr="2013 -Current"
5	limit 4 to english language
6	limit 5 to (meta analysis or systematic reviews)
7	Program Evaluation/ or Mental Health Program Evaluation/ or (alleviat* or assess* or change or "community-based" or evaluat* or decreas* or group or improv* or increas* or initiative* or innovat* or intervention* or partnering or partnership* or pilot* or project* or program* or reduc*).ti,id.
8	and/1-2,7
9	limit 8 to yr="2016 -Current"
10	limit 9 to english language
11	limit 10 to ("column/opinion" or "comment/reply" or editorial or letter)
12	10 not 11
13	(carer* or caregiver* or "case manag*" or employe* or family or families or student* or prison* or worker* or workplace* or cancer* or dementia or diabetes or "hepatitis c" or HIV or parkinson* or psychos?s or psychotic or schizophren* or app or apps or computer* or Internet or phone or online or videoconferenc* or video-conferenc*).ti,id.
14	12 not 13
15	limit 14 to case reports
16	14 not 15
17	16 not (case adj1 (report* or study or studies or series)).tw,id.
18	17 not 6

Appendix C. Study Details

Table C-1. Physical activity interventions

Author, Year Study Design Duration Country Study Quality	Population	Intervention vs. Comparator	Health and Health Care Outcomes Measured	Effect on Loneliness and Social Isolation	Effect on Health and Health Care Outcomes
Chan et. al, 2017 ¹ RCT 3 months Hong Kong, SAR Study Quality: Fair	<ul style="list-style-type: none"> • 48 participants that were “hidden elderly” aged 60 and above that did not engage in any social activities • Age range: 66-103; mean: 77.3 • 24% male • Race ethnicity: NR 	<p><i>Intervention</i></p> <ul style="list-style-type: none"> • Tai chi qigong group attended one 60-minute exercise class twice per week for 3 months. • The class was held in an elderly community center and provided by an experienced tai chi qigong instructor. • Participants were instructed to self-practice tai chi qigong for 30 minutes every day. • Volunteer “health ambassadors” aged 55 or above were recruited and trained for 4 weeks in a variety of elderly issues before being assigned to participants to build peer relationships while facilitating participation in the program, additional daily practice sessions and recording progress. <p><i>Comparator</i></p> <ul style="list-style-type: none"> • Usual care, which included irregular home visits from social workers ranging from monthly to quarterly 	Data collected at baseline, 3 months and 6 months: <ul style="list-style-type: none"> • Health-related quality of life [Short Form Health Survey (SF-12)] • Mental health status [mental health inventory (MHI-18)] • Self-esteem (Rosenberg self-esteem scale) 	At 3 months: <ul style="list-style-type: none"> • No significant effect on loneliness (De Jong Gierveld loneliness scale) • No significant effect on social network (Lubben social network scale) • Total score on social support (revised social support questionnaire) NR At 6 months: <ul style="list-style-type: none"> • Significant improvement on loneliness (De Jong Gierveld loneliness scale) (p=0.033) • No significant effect on social network (Lubben social network scale) • Total score on social support (revised social support questionnaire) NR 	At 3 and 6 months: <ul style="list-style-type: none"> • Overall health-related quality of life score not reported. • No significant effect on mental health status or self-esteem at 3 or 6 months.

Author, Year Study Design Intervention Duration Country Study Quality	Population	Intervention vs. Comparator	Health and Health Care Outcomes Measured	Effect on Loneliness and Social Isolation	Effect on Health and Health Care Outcomes
Kamegaya et al., 2014 ² RCT 3 months Japan Study Quality: Fair	<ul style="list-style-type: none"> • N=52 • Age range: 65-87 years old; mean=74.9 • 9.6% male • Race/ethnicity: NR • No baseline loneliness/social isolation data 	<p><i>Intervention</i></p> <ul style="list-style-type: none"> • Program consisted of physical activity (walking, stretching and weights) and leisure activities (games, crafts, cooking) • Delivered by health care professionals including a physical therapist, occupational therapist, and public health nurse, and 3-5 senior citizen volunteers for 12 weeks. • Participants attended the program for 2-hours once per week, with 45 minutes devoted to the exercise program. • Administered at a community center <p><i>Comparator</i></p> <ul style="list-style-type: none"> • Control group did not participate in the program 	Data collected at baseline and 3 months: <ul style="list-style-type: none"> • Subjective quality of life (satisfaction in daily life) • Subjective health status ("How is your health in general?") • Cognitive function (Five-Cog Test) • Executive function (Wechsler Digit Symbol Substitution Test and Yamaguchi Kanji-Symbol Substitution Test) • Physical function (grip strength test, timed up-and-go test, 5-m maximum walking times test, and functional reach test) Functional capacity (Tokyo Metropolitan Institute of Gerontology Index of Competence) • Depressive symptoms (15-item short version of the Geriatric Depression Scale) 	At three months: <ul style="list-style-type: none"> • No significant effect on social support (Lubben Social Network Scale Revised) 	At 3 months: <ul style="list-style-type: none"> • Subjective quality of life significantly improved (F-value=4.773, p=.035). • No significant improvements seen on subjective health status, executive function, physical function, functional capacity, or depressive symptoms. Total score on cognitive function not reported.

Author, Year Study Design Intervention Duration Country Study Quality	Population	Intervention vs. Comparator	Health and Health Care Outcomes Measured	Effect on Loneliness and Social Isolation	Effect on Health and Health Care Outcomes
Pynnonen et. al, 2018 ³ RCT (treatment group had choice of treatment) 6 months Finland Study Quality: Fair	<ul style="list-style-type: none"> • 223 participants that all reported feeling lonely, melancholy, or depressed mood. • Age range: 75-79; mean age: 77.0 • 24.7% male • Race/ethnicity: NR 	<p><i>Intervention</i></p> <ul style="list-style-type: none"> • Intervention group participants could choose to participate in exercise program group, personal counseling, or social activity group. <ul style="list-style-type: none"> ○ The exercise program was delivered by qualified instructors at municipal gyms. Met weekly for 1 hour, for a total of 19-21 sessions. ○ The social activity program was delivered by health care university students at a city library. The social activities included group discussions, day-trips, and artistic self-expression. Met weekly for 2 hours, for 19-21 sessions. ○ The personal counseling was conducted by a rehabilitation counselor in a health care center. Attended 4-5 meetings, for 1 hour roughly every third week. <p><i>Comparator</i></p> <ul style="list-style-type: none"> • The control group received one counseling session prior to randomization. • Controls had access to the usual services offered by the city. 	Data collected at baseline and 6 months: <ul style="list-style-type: none"> • Depression (Geriatric Depression Scale short form) • Melancholy 	At 6 and 12 months: <ul style="list-style-type: none"> • No significant group x time effect for feeling of loneliness at 6 months or 12 months • The overall group x time score for perceived togetherness (Social Provisions Scale) was not reported; however, study authors did an analysis of simple effects of the six subscales, and social integration scores improved in the intervention group but not control group at 6 months. 	At 6 months: <ul style="list-style-type: none"> • No significant effect on depression or melancholy.

Author, Year Study Design Intervention Duration Country Study Quality	Population	Intervention vs. Comparator	Health and Health Care Outcomes Measured	Effect on Loneliness and Social Isolation	Effect on Health and Health Care Outcomes
Seino, 2017 ⁴ Crossover RCT 3 months Japan Study Quality: Fair	<ul style="list-style-type: none"> N=77 pre-frail or frail, community dwelling, older adults Mean age: 74.6 69% male Race/ethnicity: NR Loneliness/social isolation: NR 	<p><i>Intervention</i></p> <ul style="list-style-type: none"> First three-month period: Immediate intervention group (IIG) subjected to intervention group. Delayed intervention group (DIG) given no intervention. Second three-month period: Both groups were crossed over. Intervention was a twice weekly multifactorial intervention (100 min per session) consisting of resistance exercise (60 min), rest (10 min) and nutritional or psychosocial programs (30 min, each, once every two weeks) over a three-month period. Intervention given in a local community center by project staff. <p><i>Comparators</i></p> <ul style="list-style-type: none"> Delayed intervention group (DIG) given no intervention. 	Data collected at baseline, 3 months, and 6 months (after cross-over): <ul style="list-style-type: none"> Frailty (Check-List 15) Depression (Geriatric Depression Score) Dietary variety (Dietary Variety Score) Food frequency (Food frequency score) Health-related quality of life (Short-Form Health Survey) Self-rated health Physical functioning (Timed Up and Go test, maximum gait speed, usual gait speed, timed-up-and-go, hand grip strength, one-legged stance with eyes open) Weight Body-mass Index (BMI) 	At 3 months: <ul style="list-style-type: none"> Significant improvement in structural social capital (social and voluntary activities domain of Check List for Vivid Social Activities) at 3 months (p=0.023) 	At 3 months, there were improvements in: <ul style="list-style-type: none"> Frailty (-0.36, p= 0.024) Depression (-0.92, p = 0.037) Dietary variety (0.65, p =0.034) Food frequency (2.2, p < 0.001) Timed Up and Go (seconds) (-0.25, p = 0.005) At 3 months, there were no improvements in: <ul style="list-style-type: none"> Overall health-related quality of life not reported. No significant effect on self-rated health, other physical functioning scores besides Timed Up and Go, weight, or BMI.

Author, Year Study Design Intervention Duration Country Study Quality	Population	Intervention vs. Comparator	Health and Health Care Outcomes Measured	Effect on Loneliness and Social Isolation	Effect on Health and Health Care Outcomes
Tarazona-Santabalbina, 2016 ⁵ RCT 6 months Spain Study Quality: Fair	<ul style="list-style-type: none"> • 100 sedentary, community-dwelling, frail older adults • Mean age: 79.7 (intervention) and 80.3 (control) • 43.1% male (intervention) and 49.0% male (control) • Race/ethnicity: NR • Living alone: 54.9% (intervention) and 55.1 (control) 	<p><i>Intervention</i></p> <ul style="list-style-type: none"> • Participated in a multicomponent group exercise program (65 minutes of supervised daily activities designed to improve endurance, strength, coordination, balance, and flexibility) 5 days per week • Implemented by 4 physical therapists and 4 nurses. • 24 weeks <p><i>Comparator</i></p> <ul style="list-style-type: none"> • For 24 weeks, received no training. • Attended regular primary care program at the center. 	<p>Data collected at baseline and 24 weeks:</p> <ul style="list-style-type: none"> • Quality of life (EuroQol quality of life-scale [EQ-5D]) • Mental status (Mini-mental State Examination [MMSE]) • Depression (Yesavage Geriatric Depression [YGD]) • Number of falls (prior 6 mos.) • Number of risk factors for falls (prior 6 mos.) • Number of voluntary hospital admissions (prior 6 mos.) • Number of visits to the emergency service (prior 6 mos.) • Number of visits to primary care center (prior 6 mos.) • Body mass index (BMI) • Weight • Short Physical Performance Battery (SPPB) • Physical Performance Test (PPT) • Physical functioning (performance in Activities of Daily Living [Barthel Index], instrumental Activities of Daily Living [Lawton and Brody], gait and balance [Tinetti], timed-up-and-go, 6-minute-walk test, Functional Ambulation Categories [FAC], handgrip strength • Frailty (Fried frailty criteria and Edmonton frailty scale) • Adverse events 	<p>At 24 weeks:</p> <ul style="list-style-type: none"> • Social support (Duke social support) measured but p-values NR, so this outcome cannot be deemed statistically significant. 	<p>At 24 weeks:</p> <ul style="list-style-type: none"> • No harms reported • For all measures, difference-in-difference could be calculated but p-value NR, therefore none of these outcomes can be deemed statistically significant.

Abbreviations: BMI=Body Mass Index; DIG=Delayed Intervention Group; EQ-5D= European Quality of Life-5 Dimensions; FAC=Functional Ambulation Categories; GDS=Geriatric Depression Scale; IIG=Immediate Intervention Group; MHI-18=Mental Health Inventory-18; MMSE=Mini-mental State Examination; NR=Not Reported; PPT=Physical Performance Test; RCT=Randomized Controlled Trial; SAR=Special Administrative Region; SPPB=Short Physical Performance Battery; YGD=Yesavage Geriatric Depression.

Table C-2. Social interventions

Author, Year Study Design Intervention Duration Country Study Quality	Population	Intervention vs. Comparator	Health and Health Care Outcomes Measured	Effect on Loneliness and Social Isolation	Effect on Health and Health Care Outcomes
Mountain, 2017 ⁶ RCT 4 months UK Study Quality: Good	<ul style="list-style-type: none"> N=288 participants with reasonable cognitive ability from two UK cities Age: 65-92; mean: 72.1 31.9% male 99.7% Caucasian 54.5% living alone 	<p><i>Intervention</i></p> <ul style="list-style-type: none"> Participants met in groups of up to 12 once per week and with a facilitator once a month. Meeting topics included identification of participants' goals, empowerment through sharing strengths and skills, and providing support to enable them to practice new or neglected activities independently. Facilitators: National Health Service (NHS) or social care staff who were provided with training and supervised by occupational therapists 4-month intervention <p><i>Comparator</i></p> <ul style="list-style-type: none"> Usual care – Accessing health and social care acute and community services as appropriate to meet their needs 	Data collected at baseline, 6 and 24 months: <ul style="list-style-type: none"> Mental Health (Short Form Health Survey [SF-36]) Depression (Patient Health Questionnaire [PHQ]) Quality of life (EQ-5D-3L) Self-Efficacy (General Self-Efficacy Scale [GSE]) Well-being (Office for National Statistics [ONS]) 	At 6 months: <ul style="list-style-type: none"> No significant effect on loneliness (De Jong Gierveld Loneliness Scale) At 24 months: <ul style="list-style-type: none"> Significant improvement on loneliness (De Jong Gierveld Loneliness Scale) (p=0.026) 	At 6 months and 24 months: <ul style="list-style-type: none"> No significant effect on SF-36 mental health component, depression scores on the patient health questionnaire, quality of life scores on the EQ-5D-3L, self-efficacy, or ONS well-being measures.

Author, Year Study Design Intervention Duration Country Study Quality	Population	Intervention vs. Comparator	Health and Health Care Outcomes Measured	Effect on Loneliness and Social Isolation	Effect on Health and Health Care Outcomes
Murayama, 2014 ⁷ Pre-Post 12 months Japan Study Quality: Fair	<ul style="list-style-type: none"> • N=80 seniors from 3 municipalities • Mean age: 69.1 • 16.2% male • Race/ethnicity: NR • 17.5% living alone 	<p><i>Intervention</i></p> <ul style="list-style-type: none"> • Participants attended weekly training seminars for three months involving picture book reading projects. Participants then worked as book-reading volunteers for children at collaborating educational institutions once every 1-2 week for 12 months. • Intervention took place at Educational centers (mostly schools) • Training led by lay people and project staff <p><i>Comparator</i></p> <ul style="list-style-type: none"> • Conventional social activities 	Data collected at baseline, either 3 or 9 months (inconsistent in article), 1 year, and 2 years: <ul style="list-style-type: none"> • Depression (Geriatric Depression Scale-Short Version-Japanese [GDS-S-J]) • Sense of coherence (13-item scale measuring comprehensibility, manageability, and meaningfulness) 	All time points: <ul style="list-style-type: none"> • Neither loneliness nor social isolation were measured. 	Group x time effects <ul style="list-style-type: none"> • Geriatric depression: no significant effect • Sense of coherence: After finding a significant ($p < .10$) group x time interaction effect for sense of coherence, the study authors conducted simple effects analyses and found there was a short-term improvement in meaningfulness (one of three subscales) at time 1 that was sustained throughout the study.

Author, Year Study Design Intervention Duration Country Study Quality	Population	Intervention vs. Comparator	Health and Health Care Outcomes Measured	Effect on Loneliness and Social Isolation	Effect on Health and Health Care Outcomes
Coll-Planas et. al, 2017 ⁸ Pre-post observational study 15 weeks Spain Study Quality: Poor	<ul style="list-style-type: none"> N=38 community-dwelling participants that reported feeling lonely “sometimes, often or always” Age range: 63-89, mean=77.24 5% male Race/ethnicity: NR 	<p><i>Intervention</i></p> <ul style="list-style-type: none"> Combined group-based program with coordinated action intervention (raising community awareness, training older people as volunteers, and building a team of professionals to design and conduct the program). The program included group discussions of feelings and visits to community activity centers. The program was delivered by 3 nurses and 3 social workers 1.5 hours a week for 15 weeks. One mixed rural-urban and 2 urban areas in senior centers and primary care centers <p><i>No comparator</i></p>	Data collected at baseline, unclear post-test, and 2 years: <ul style="list-style-type: none"> Health related quality of life (SF-12) Self-rated health (excellent or very good, good, regular, poor) Depressive Symptoms (Geriatric Depression Scale-5) Anxiolytic and/or antidepressant use Health service usage (retrieved from computerized medical records) including nurse, social work, and general practitioner visits for 12 months before intervention, just after it, and 6 months later. 	Post-test and 2 years: <ul style="list-style-type: none"> Significant improvement in loneliness (both feelings and Gierveld Loneliness Scale) and social participation at post-test and 2 years (p<.001). 	Post-test <ul style="list-style-type: none"> No significant change in health-related quality of life, self-rated health, depressive symptoms, anxiolytic and/or antidepressant use, all health service usage other than nurse visits, in past 12 months, which increased from 6.65 to 10.42 (p=0.005) 2 years <ul style="list-style-type: none"> No changes in self-rated health. Depressive symptoms were significantly reduced from 2.05 to 1.17 (p=0.032). The study does not report antidepressant use, anxiolytic use or number of medical visits from previous 12 months in follow up.

Author, Year Study Design Intervention Duration Country Study Quality	Population	Intervention vs. Comparator	Health and Health Care Outcomes Measured	Effect on Loneliness and Social Isolation	Effect on Health and Health Care Outcomes
Gaggioli, et. al, 2014 ⁹ Pre-post observational study 3 weeks Italy Study Quality: Poor	<ul style="list-style-type: none"> 32 older adults recruited from senior centers in Milan, Italy Mean age: 67.53 Gender: NR Race/ethnicity: NR Loneliness/social isolation: NR 	<p><i>Intervention</i></p> <ul style="list-style-type: none"> Reminiscence groups comprised of 2 older adults and 6-8 students. The older adults were encouraged to share memories and promote interaction with the students. Groups were led by a psychologist Groups met once a week for 2 hours, over a period of 3 weeks. <p><i>No comparator</i></p>	Data collected at baseline and week 3: <ul style="list-style-type: none"> Quality of Life (WHOQoL-Old) Self-esteem (Rosenberg) 	At 3 weeks: <ul style="list-style-type: none"> Overall score on loneliness (Italian Loneliness Scale) NR. 	At 3 weeks: <ul style="list-style-type: none"> No significant effect on quality of life or self-esteem.
Gonyea, 2013 ¹⁰ Pre-post observational study 9 months USA Study Quality: poor	<ul style="list-style-type: none"> N=33 residents participating in a community enhancement program for seniors (“Aging Well at Home Program”). Age range: 69-95; mean: 81 85% Caucasian/white women Within normal loneliness range for the age group at enrollment 53% lived alone 	<p><i>Intervention</i></p> <ul style="list-style-type: none"> 3 parts: <ul style="list-style-type: none"> Community liaison maintained contact with participants via phone calls, home visits, and invitations to social events. “Warm homes” where participants gathered in neighbor’s homes for social, cultural, or recreational events (e.g. meals, coffee). Community forums held to solicit input from residents in shaping the program as a whole. Intervention delivered for 9 months Delivered in community spaces and participants homes <p><i>No comparator</i></p>	Data collected at baseline and 9 months: <ul style="list-style-type: none"> 10-item Perceived Stress Scale (PSS) 15-item Geriatric Depression Scale (GDS) – Short Form 	At 9 months: <ul style="list-style-type: none"> No significant effect on loneliness at 9 months (20-item UCLA loneliness scale, version 3) 	At 9 months: <ul style="list-style-type: none"> Perceived stress: significant improvement in intervention group (-2.23 p<.001) Depression: no significant difference.

Abbreviations: EQ-5D=European Quality of Life-5 Dimensions; GDS=Geriatric Depression Scale; GSE=General Self-Efficacy Scale; NHS=National Health Service; NR=Not Reported; ONS=Office for National Statistics; PHQ=Patient Health Questionnaire; PSS=Perceived Stress Scale; RCT=Randomized Controlled Trial; SF-36/12=Short Form-36/12; UCLA=University of California Los Angeles; UK=United Kingdom; USA=United States of America; WHOQoL-Old=World Health Organization Quality of Life-Old.

Table C-3. Arts and recreation interventions

Author, Year Study Design Intervention Duration Country Study Quality	Population	Intervention vs. Comparator	Health and Health Care Outcomes Measured	Effect on Loneliness and Social Isolation	Effect on Health and Health Care Outcomes
Yap et al., 2017 ¹¹ Crossover RCT 11 weeks Singapore Study Quality: Fair	<ul style="list-style-type: none"> • N=31 healthy older adults (i.e., not on palliative care or bed-bound) • Age: All 65+, Mean age: 74.65 ± 6.40 years. • 6% male • 100% Chinese 	<p><i>Intervention</i></p> <ul style="list-style-type: none"> • Rhythm-centered music making (RMM). • All RMM sessions were facilitated by 3 experienced instructors. Participants sit in a circle with one of many instruments in front of them (conga, cowbell, Djembe, Ashiko Tan-tans, Dunun, Shakers, and wood blocks). • Total of 10 sessions over 11 weeks, each session 1 hour long • 54 participants were recruited with 27 participants in each arm. <p><i>Comparator</i></p> <ul style="list-style-type: none"> • In phase 1, group A underwent the intervention with group B as the control. In phase 2, group B underwent the intervention with group A as the control. 	Data collected at baseline, 11 weeks (after intervention) <ul style="list-style-type: none"> • Quality of Life (European Quality of Life-5 Dimensions [EQ-5D]) • Depression (Geriatric Depression Scale [GDS]) • Sleep Quality (Pittsburg Sleep Quality Index [PSQI]) 	At 11 weeks: <ul style="list-style-type: none"> • No improvement in social network (Lubben Social Network Scale) 	At 11 weeks: <ul style="list-style-type: none"> • Linear regression models found no significant effect on quality of life, depression, or sleep. • No reported adverse events.

Author, Year Study Design Intervention Duration Country Study Quality	Population	Intervention vs. Comparator	Health and Health Care Outcomes Measured	Effect on Loneliness and Social Isolation	Effect on Health and Health Care Outcomes
Davidson et. al, 2014 ¹² Pre-post observational study 8 weeks Australia Study Quality: poor	<ul style="list-style-type: none"> • All participants were 70 or older, living independently • Subgroup 1: n=17 Silver-chain (recipients of home care services) <ul style="list-style-type: none"> ○ Age range: NR; mean age: 79 ○ 6% male ○ Race/ethnicity: NR • Subgroup 2: n=19 community-based. <ul style="list-style-type: none"> ○ Age range: NR; mean age=76 ○ 42% male ○ Race/ethnicity: NR • Subgroups were differentiated by referral source, but proceeded through study as single group • Both groups had similar UCLA loneliness scores comparable to their age group 	<p><i>Intervention</i></p> <ul style="list-style-type: none"> • 8 consecutive weekly group singing sessions lasting 90 minutes • Sessions were led by an experienced community musician at a local community center • Both groups received the intervention together <p><i>Comparator</i></p> <ul style="list-style-type: none"> • No control group 	<p>Data was collected pre- and post-intervention (exact timepoint NR) using:</p> <ul style="list-style-type: none"> • Physical and mental health: Medical Outcomes Study short-form (SF-36) • Depression (Geriatric Depression Scale [GDS]) <p>Survey at the conclusion of intervention asked participants about perceived positive experiences from the intervention. Participants stated whether these experiences happened frequently, infrequently, or never.</p>	<p>Exact timepoint not reported:</p> <ul style="list-style-type: none"> • No significant change in loneliness (UCLA loneliness scale) at conclusion of intervention • 35% of participants said they made social contacts • 71% said they became a member of a group. 	<p>Exact timepoint not reported:</p> <ul style="list-style-type: none"> • Overall SF-36 scores not reported. • Significant increase in (worsening of) mean GDS in Silver Chain group following intervention (p=.05), but not in the community participants group. • 55% reported frequently experiencing increased energy levels • 68% reported frequently experiencing improved sense of well-being • 81% frequently reported relaxation, reduced stress • 64% frequently reported mental alertness.

Author, Year Study Design Intervention Duration Country Study Quality	Population	Intervention vs. Comparator	Health and Health Care Outcomes Measured	Effect on Loneliness and Social Isolation	Effect on Health and Health Care Outcomes
Phinney, 2014 ¹³ Pre-post observational 3 years Canada Study Quality: poor	<ul style="list-style-type: none"> N=51 community dwelling seniors Age range: 55-90; mean age: 71 (age data was only collected from 24 participants) 20% male (n=51) Race/ethnicity: NR 	<p><i>Intervention</i></p> <ul style="list-style-type: none"> Subjects participated in weekly arts sessions, each lasting 2 hours. The program lasted for three years, and was delivered in four community centers. Intervention delivered in 4 groups, each with diverse participants: 1 consisted of Chinese-speaking women, 1 consisted of LGBT seniors, 2 others were social activity groups Facilitators: Artists and seniors' workers based at the community center. <p><i>Comparator</i></p> <ul style="list-style-type: none"> No control group 	<p>Data collected in first year of program and approximately 2.5 years later:</p> <ul style="list-style-type: none"> Daily function (OARS-ADL) Perceived health status (Single item perceived overall health) Chronic pain (Single item verbal descriptor scale) Depression symptoms (Geriatric Depression Scale[GDS]) Self-esteem (Rosenberg Self-Esteem Scale) Morale (Philadelphia Geriatric Center [PGC] Morale Scale) Life satisfaction (Satisfaction with Life Scale) Sense of purpose (Life engagement test) 	<p>At approximately 2.5 years:</p> <ul style="list-style-type: none"> Total score on community connections index not reported. No effect on social support (Multi-dimensional Scale of Perceived Social Support) 	<p>At approximately 2.5 years:</p> <ul style="list-style-type: none"> Chronic pain (n = 23): significant improvement 0.52, p < .05 No significant effect on daily function, perceived health status, depression, self-esteem, morale, life satisfaction, or sense of purpose.
Vogelpoel 2014 ¹⁴ Pre-post study 12 weeks UK Study Quality: poor	<ul style="list-style-type: none"> N=12 sensory (hearing, vision, or both) impaired and socially isolated older adults Participants had a range of age-related cognitive, emotional and physical impairments, as well as mobility issues, within the group. Age range: 61-95; mean age: over 80 25% male Race/ethnicity: NR 	<p><i>Intervention</i></p> <ul style="list-style-type: none"> 12-week arts program Social prescribed service commissioned by Voluntary Action Rotherham, and coordinated by the national charity for deafblind people, Sense. The model had three foci: participation in an arts workshop program; ongoing individual assessments of health status; and ongoing observations of participant's health statuses. Referrals from GPs to coordinator at Sense Program ran at fully accessible resource center in central Rotherham managed by Sense <p><i>Comparator</i></p> <ul style="list-style-type: none"> No control group 	<p>Scales delivered at baseline and 12 weeks:</p> <ul style="list-style-type: none"> Wellbeing (Warwick and Edinburgh Mental Wellbeing Scale): a self-reporting measure completed at the first and last session 	<p>At 12 weeks:</p> <ul style="list-style-type: none"> No quantitative measurement of social isolation. 	<p>At 12 weeks:</p> <ul style="list-style-type: none"> Mental wellbeing: Average score increased from 41 to 47 (n=8) on a scale of 14 to 70 with 3 to 8-point increase being meaningful. Not statistically significant. No p-value reported.

Abbreviations: EQ-5D=European Quality of Life-5 Dimensions; GDS=Geriatric Depression Scale; GDS-S-J=Geriatric Depression Scale- Short Version- Japan; GP=General Practitioner; LGBT=Lesbian, Gay, Bisexual, Transgender; NR=Not Reported; OARS-ADL= Older Americans Resources and Services Activities of Daily Living Scale; PGC=Pittsburg Geriatric Center;

Table C-4. Health services access interventions

Author, Year Study Design Intervention Duration Country Study Quality	Population	Intervention vs. Comparator	Health and Health Care Outcomes Measured	Effect on Loneliness and Social Isolation	Effect on Health and Health Care Outcomes
Bartsch et. al, 2013 ¹⁵ Pre-post observational study 26-28 months USA Study Quality: Poor	<ul style="list-style-type: none"> • All participants were 60 or older, living independently, and had emotional/behavioral problems, poor health, social isolation, or abuse, neglect, or substance abuse problems. • Colorado group: n=138 <ul style="list-style-type: none"> ○ Mean age: 74.1 years old ○ 24.6% male ○ Race/ethnicity: NR ○ Loneliness/social isolation: NR • Kansas group: n=190 <ul style="list-style-type: none"> ○ Mean age: 74.3 years old ○ 30% male ○ Race/ethnicity: NR ○ Loneliness/social isolation: NR 	<p><i>Intervention</i></p> <ul style="list-style-type: none"> • Each program first trained community members as gatekeepers who referred at-risk seniors to care managers and mental health professionals, who recommended mental health, care management or information/referral treatments. • Community interventions were also provided (strength-based, recovery treatment, family support, consultation, advocacy, coordination and crisis intervention). • Gatekeepers were either traditional (PCPs, adult protective services, county human services, etc.) or non-traditional (restaurant and retail staff, bus drivers, senior center staff, etc.) <p><i>No comparator</i></p>	Data collected at baseline, and either 6 months or program discharge, whichever was earlier. The Colorado program results were taken from 28 months of operation, while the Kansas program results were from 26 months. Follow-up at 12 months: <ul style="list-style-type: none"> • Geriatric Depression Scale (GDS) • Self-report surveys regarding emotional disturbance, cognitive impairment, and physical impairment. 	12-month follow up: <ul style="list-style-type: none"> • Study reports significant improvement in both groups self-reported measures of social isolation but p-value NR. 	12-month follow-up: <ul style="list-style-type: none"> • GDS (Colorado): study states this is significant, but p-value was NR. • GDS (Kansas): significantly more improvement in intervention (-3.1, p-value < .05) • Study states that all self-report measurements (emotional disturbance, cognitive impairment, physical impairment) for both Colorado and Kansas were significantly improved except for physical impairment in Colorado; but p-values were NR.

Author, Year Study Design Intervention Duration Country Study Quality	Population	Intervention vs. Comparator	Health and Health Care Outcomes Measured	Effect on Loneliness and Social Isolation	Effect on Health and Health Care Outcomes
<p>Kim, 2018¹⁶</p> <p>Cross-sectional study of participants vs. standby and post-test survey of recipients</p> <p>Unclear intervention length</p> <p>South Korea</p> <p>Study Quality: Poor</p>	<p>Cross-sectional study of those who participated (healthy older adults that provided care) for at least 3 months in 2013 vs. those on standby</p> <ul style="list-style-type: none"> • n=12,412 participants • n=3,307 on standby • Average age NR, but all were 65+ • Gender, race, and loneliness/social isolation NR. <p>2014 survey on health status, subjective health improvement, and depression from a sample of 31,477 of recipients (vulnerable older adults that received care)</p> <ul style="list-style-type: none"> • n= 508 survey participants • Average age NR, but all were 65+ • Gender, race, and loneliness/ social isolation NR. 	<p>Cross-sectional study</p> <p><i>Intervention</i></p> <ul style="list-style-type: none"> • Elderly care through the elderly program (ECEP) – healthy older adults (participants) provide emotional and other support for vulnerable older adults (recipients) with limited mobility. • Examples of emotional and other support include checking on health status, talking, reading books, helping with household chores, taking to medical appointments and pharmacy • Healthy older adults are paid. <p><i>Comparator</i></p> <ul style="list-style-type: none"> • ECEP standby – elderly people on standby to become a participant in the ECEP program care) <p>Survey</p> <p><i>Intervention is the same as above, no comparator.</i></p>	<p>Cross-sectional study, data gathered on those who participated for five years in a row:</p> <ul style="list-style-type: none"> • Utilization of medical care by participants and people on standby <p>Survey on subjective health condition completed “during and after” intervention. Depression survey taken at one unclear time point:</p> <ul style="list-style-type: none"> • Subjective health condition measured on a 5-point scale • Depression (Geriatric Depression Scale-Korean [SBDS-K]) 	<p>Data gathered on those who participated for five years in a row:</p> <ul style="list-style-type: none"> • Results for neither loneliness nor social isolation were reported. 	<p>Data gathered on those who participated for five years in a row:</p> <p><i>Cross-sectional study</i></p> <ul style="list-style-type: none"> • Fewer hospitalization days among intervention than standby group (2.24 days, p < 0.0001) • No significant difference between intervention and standby groups for changes in medical care days, outpatient days, or medication prescription days. <p>Timepoint at which the survey was conducted is unclear:</p> <p><i>Survey</i></p> <ul style="list-style-type: none"> • Significant effect on subjective health condition (0.28, p < 0.0001) but no information on whether that’s an improvement. • Mean score of 7.70 from the short form of the Geriatric Depression Scale (not clear whether this is during or after intervention)

ECEP = Elderly Care Through the Elderly Program; GDS = Geriatric Depression Scale; NR = Not Reported; PCP = Primary Care Physician; SBDS-K = Geriatric Depression Scale-Korean; USA = United States of America.









References for Appendix C




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Appendix D. Poor-Quality Studies

Table D-1. Selected intervention characteristics and outcomes data for poor-quality studies

Type of Intervention (Health Effect)	Study Information	Description of Intervention	Duration & Intensity	Staffing Requirements	Effect on SI/Loneliness	Effect on Health/Health Care
 (+) Coll-Planas, 2017 ¹	Pre-post n=38 Mean age: 77 Poor quality	Group discussions on feelings & visits to community centers	(D) 15 weeks** (I) 1.5 hrs/week††	Professional (nurses & social workers)	Decreased loneliness (post-test & 2 yr)	Improved depression at 2 yrs but not post-test. More nurse visits but no difference in GP or social work visits or prescription use (post-test). No effect on health-related QoL or self-rated health (post-test & 2 yr).
 (+) Gonyea, 2013 ²	Pre-post n=33 Mean age: 81 Poor quality	Phone calls, home visits, and social engagement	(D) 9 months*** (I) NR	Lay person	No effect on loneliness (9 mo)	Improvements in perceived stress (9 mo). No effect on depression (9 mo).
 (+) Phinney, 2014 ³	Pre-post n=51 Mean age: 71 Poor quality	Art projects	(D) 3 years*** (I) 2 hrs 1x/week††	Lay person	No effect on social support (2.5 yrs)	Improvements in chronic pain (2.5 yr). No effect on daily function, perceived health status, depression or self-esteem (2.5 yr).
 (+) Bartsch, 2013 ⁴	Pre-post n=328 Mean age: 74 Poor quality	Training community members and elder service providers to recognize at-risk elders and provide referrals to services	(D) 26-28 months*** (I) NR	Professional & lay person	NR	Improved depression (12 mos)
 (+) Kim, 2018 ⁵	Cross-sectional w/ survey n=12,412 Age: 65+ Poor quality	Peers checking on health, helping with chores & transportation, and social engagement	(D) NR (I) NR	Lay person	NR	Fewer hospital days, but no difference in medical care days, outpatient days, or medication prescription days
 (-) Gaggioli, 2014 ⁶	Pre-post n=32 Mean age: 68 Poor quality	Share memories and promote interactions between elders and youth	(D) 3 weeks* (I) 2hrs 1x/week††	Professional (psychologist)	NR	No effect on quality of life or self-esteem (3 weeks)
 (-) Davidson, 2014 ⁷	Pre-post n=36 Mean age: 78 Poor quality	Singing sessions	(D) 8 weeks** (I) 1 hour 30 min 1x/week††	Lay person	No effect on loneliness (8 weeks)	Worsened depression (8 weeks)
 (=) Vogelpoel, 2014 ⁸	Pre-post n=12 Mean age: 80+ Poor quality	Art projects	(D) 12 weeks** (I) NR	Professional (GP referred) & lay person	NR	NR

(+) = studies that had a positive effect on health/health care utilization outcomes; (-) = studies that had no effect; (=) = studies for which there was insufficient information to make a determination;  = Social;  = Arts and recreation;  = Health access; (D) = Duration of intervention; (I) = Intensity of intervention; (NR) = No results; (QoL) = Quality of life; (GP) = General practitioner; (SI) = Social Isolation; * = Low duration; ** = Medium duration; *** = High duration; † = Low intensity; †† = Medium intensity; ††† = High intensity

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Appendix E. Characteristics of Interventions in Fair- to Good-Quality Studies

Table E-1. Characteristics of studies that had a positive effect on either SI/loneliness or health/healthcare utilization outcomes

Author, Year	Type of Intervention	Health care provider involved?	Duration of intervention	Intensity of intervention
Kamegaya 2014	Physical activity	Yes (PT, OT, and public health nurse)	3 months (med duration)	2 hours 1x/week (med intensity)
Seino 2017	Physical activity	No	3 months (med duration)	1 hour 40 mins 2x/week (high intensity)
Chan 2017	Physical activity	Yes (nurse and social worker)	3 months (med duration)	1 hour 2x/week (high intensity)
Mountain 2017	Social	Yes (NHS or social care staff)	4 months (med duration)	1x a week with group and 1x a month with facilitator (high intensity)
Total	75% were physical activity interventions	75% had provider involved, 25% did not	100% were medium duration	75% were high intensity, 25% were medium intensity

Table E-2. Characteristics of studies that had no effect on either SI/loneliness or health/healthcare utilization outcomes

Author, Year	Type of Intervention	Health care provider involved?	Duration of intervention	Intensity of intervention
Pynnonen 2018	Physical activity	Yes (rehabilitation counselor)	15-21 weeks (med duration)	Max 2 hours 1x/week Min 1 hour 1x/3 weeks (medium-low intensity)
Murayama 2015	Social	No	1 year (high duration)	1x every 1-2 weeks (medium-low intensity)
Yap 2017	Arts and recreation	No	11 weeks (med duration)	1 hour/10 sessions (low intensity)
Total	33% were physical activity, 33% were social, 33% were arts & recreation interventions	33% had provider involved, 66% did not.	66% were medium duration, 33% were high duration	66% were medium-low intensity, 33% were low intensity

Table E-3. Characteristics of studies for which the effect on SI/loneliness or health/healthcare utilization outcomes could not be determined

Author, Year	Type of Intervention	Health care provider involved?	Duration of intervention	Intensity of intervention
Tarazona-Santabalbina 2016	Physical activity	Yes (PT and nurse)	6 months (high duration)	1 hour 5 min 5x/week (high intensity)

CND = Could Not Determine; NHS = National Health Service; OT = Occupational Therapist; PA = Physical Activity; PT = Physical Therapist; SI=Social Isolation

Appendix F. Social Isolation and Loneliness Definitions and Measures

Table F-1. Definitions of social isolation and loneliness

Institution	Definitions
National Health Service – Centre for Reviews and Dissemination ¹	<u>Social isolation</u> : The lack of social contact or support ¹ <u>Loneliness</u> : The feeling of being alone or isolated ¹
Review	Definitions
Gardiner et al, 2018 ²	<u>Social isolation</u> : The objective absence or paucity of contacts and interactions between a person and a social network. ³ <u>Loneliness</u> : A subjective feeling state of being alone, separated or apart from others, and has been conceptualized as an imbalance between desired social contacts and actual social contacts. ^{4,5}
Poscia et al, 2018 ⁶	<u>Social isolation</u> : An objective lack of meaningful and sustained communication. ⁶ <u>Loneliness</u> : The way people perceive and experience the lack of interaction. ⁶
Shvedko et al, 2018 ⁷	<u>Social isolation</u> : A state in which the individual lacks a sense of belonging socially, lacks engagement with others, has a minimal number of social contacts, and they are deficient in fulfilling and quality relationships. ⁸ <u>Loneliness</u> : A discrepancy between a person's desired and actual social relationships. ⁹
Ronzi et al, 2018 ¹⁰	(Social isolation and loneliness not measured) <u>Social inclusion</u> : Has explicit links with concepts such as equality, human rights and social cohesion, and it has focused on barriers that prevent people from participating meaningfully in society. ¹¹

Table F-2. Measures of social isolation and loneliness

Study	Construct: Measure	Measure Explanation/Questions
Seino, 2017 ¹²	<ul style="list-style-type: none"> Structural social capital: Check List for Vivid Social Activities¹³ – “social participation and voluntary activities” domain 	Check List for Vivid Social Activities¹³ <ul style="list-style-type: none"> Unable to find original checklist and unable to find full-text of the study which validated the measure.

Study	Construct: Measure	Measure Explanation/Questions
Chan, 2017 ¹⁴	<ul style="list-style-type: none"> • Social network: Lubben Social Network Scale-6¹⁵ • Loneliness: De Jong Gierveld Loneliness Scale¹⁶ • Social support: Revised Social Support Questionnaire (also known as the SSQ6)¹⁷ 	<p>Lubben Social Network Scale-6¹⁵</p> <ul style="list-style-type: none"> • Measures social isolation by measuring frequency, size, and closeness of contacts of the respondent's social network by assessing the perceived level of support they get from friends and families. • Scoring is as follows: 0=none; 1=one; 2=two; 3=three or four; 4=five thru eight; 5=nine or more. Total scores from 0-30 with higher scores indicating larger social networks • Three questions on family, and 3 on friends. Questions are framed the same way across family/ friends. • Scale questions: <ul style="list-style-type: none"> ○ How many relatives/friends do you see or hear from at least once a month? ○ How many relatives/friends do you feel at ease with that you can talk about private matters? ○ How many relatives/friends do you feel close to such that you could call on them for help? <p>De Jong Gierveld Loneliness Scale¹⁶</p> <ul style="list-style-type: none"> • Measures emotional and social loneliness. • Six statements, three measuring emotional loneliness and three measuring social loneliness, each with three choices including yes, more or less, and no. Scores range from 0-6, with 6 indicating higher loneliness. • Emotional loneliness statements: <ul style="list-style-type: none"> ○ "I experience a general sense of emptiness"; "I miss having people around me"; and "I often feel rejected" • Social loneliness statements: <ul style="list-style-type: none"> ○ "There are plenty of people I can rely on when I have problems"; "There are many people I can trust completely"; and "There are enough people I feel close to." <p>Revised Social Support Questionnaire (SSQ6)¹⁷</p> <ul style="list-style-type: none"> • Six-item measure of social support wherein respondents indicate the number of people they feel they have available to provide support in six areas: <ul style="list-style-type: none"> ○ "Who can you count on when you need help?" ○ "Whom can you really count on to help you feel more relaxed when you are under pressure or tense?" ○ "Who accepts you totally, including both your worse and best points?" ○ "Who can you really count on to care about you, regardless of what is happening to you?" ○ "Who can you really count on to help you feel better when you are feeling generally down in the dumps?" ○ "Who can you count on to console you when you are very upset?" • Each question has a follow up scale regarding how satisfied the respondent is with support given in each area.
Pynnonen, 2018 ¹⁸	<ul style="list-style-type: none"> • Loneliness: developed their own measure • Perceived togetherness: Social Provisions Scale¹⁹ 	<p>Measure for loneliness</p> <ul style="list-style-type: none"> • Participants were asked "Do you feel lonely?" • Answer options were: very rarely or never, sometimes, and often or almost always <p>Social Provisions Scale¹⁹</p> <ul style="list-style-type: none"> • 24-statement scale, split into six dimensions: attachment, social integration, reliable alliance, guidance, opportunity for nurturance, and reassurance of worth • Scale from 1 (strongly disagree) to 4 (strongly agree). Larger final score indicates greater degree of perceived support. • Examples of statements include: "There are people I know will help me if I really need it"; "I have close relationships that make me feel good"; and "I feel a strong emotional tie with at least one other person."

Study	Construct: Measure	Measure Explanation/Questions
Tarazona-Santabalbina, 2016 ²⁰	<ul style="list-style-type: none"> • Social support: Duke Social Support Index. (NOTE: The study was non-specific. They state they used "Duke Social Support" with no associated reference. There is no tool by this name. There is the Duke Social Support Index,²¹ and an abbreviated version of this tool. We provide information on the most current version when the study came out: the DSSI-10.²²) 	<p>Duke Social Support Index-10²²</p> <ul style="list-style-type: none"> • Originally 35 items long, this index was reworked in 2013, and the current 10-item assessment, which measures social support, has two subscales: social interaction and subjective social satisfaction. Higher scores indicate more social support • Example questions in the social interaction subscale include: "What is the number of times in the past week spent with someone not living with you?" and "What is the number of times in the past week you talked with friends/relatives on the telephone?" • Example questions in the social support subscale include: "Do you feel useful to your family and friends?" and "Can you talk about your deepest problems?"
Kamegaya, 2014 ²³	<ul style="list-style-type: none"> • Social support: Lubben Social Network Scale Revised¹⁵ 	<p>Lubben Social Network Scale-6¹⁵</p> <ul style="list-style-type: none"> • See "Lubben Social Network Scale-6" under Chan, 2017
Mountain, 2017 ²⁴	<ul style="list-style-type: none"> • Loneliness: De Jong Gierveld Loneliness Scale¹⁶ 	<p>De Jong Gierveld Loneliness Scale¹⁶</p> <ul style="list-style-type: none"> • See "De Jong Gierveld Loneliness Scale" under Chan, 2017
Gonyea, 2013 ²⁵	<ul style="list-style-type: none"> • Loneliness: UCLA Loneliness Scale Version 3²⁶ 	<p>UCLA Loneliness Scale Version 3²⁶</p> <ul style="list-style-type: none"> • 20-question tool used to assess subjective feelings of loneliness or social isolation. All questions are framed using "how often do you feel..." and choices include never, rarely, sometimes, and often. Scores range from 20 to 80, with a higher score indicating greater loneliness. • Examples of questions include: "How often do you feel a lack on companionship?"; "How often do you feel left out?"; and "How often do you feel isolated from others?"
Coll-Planas, 2017 ²⁷	<ul style="list-style-type: none"> • Loneliness: De Jong Gierveld Loneliness Scale¹⁶ • Social support (as cognitive aspect of social capital): Social Resources Inventory in Older Adults • Social participation (as structural aspect of social capital): Subjective Social Participation Index²⁸ 	<p>De Jong Gierveld Loneliness Scale¹⁶</p> <ul style="list-style-type: none"> • See "De Jong Gierveld Loneliness Scale" under Chan, 2017 <p>Social Resources Inventory in Older Adults</p> <ul style="list-style-type: none"> • Unable to find inventory and unable to find full-text of the study which validated the measure. <p>Subjective Social Participation Index²⁸</p> <ul style="list-style-type: none"> • Of note, we could only find this scale in Spanish. We used Google Translate to translate the scale into English, so some questions may not translate perfectly. • This 15-question scale is broken into three "Factors" – perception of social support, use of new technologies, and index of subjective social participation. • This study used to the four questions asked in the social participation factor: <ul style="list-style-type: none"> ○ During the week and on weekends do you call other people to go outside? ○ Do you find it easy to make friends? ○ Do you go to any park, association, home of the pensioner (retirement home) where you relate to other elders? ○ Do you like to participate in leisure activities that are organized in your neighborhood/town? • Answers to these four questions are always=0, sometimes=1, or never=2. Low scores indicate increased social participation.

Study	Construct: Measure	Measure Explanation/Questions
Gaggioli, 2014 ²⁹	<ul style="list-style-type: none"> Loneliness: Italian Loneliness Scale³⁰ 	<p>Italian Loneliness Scale³⁰</p> <ul style="list-style-type: none"> This 18-item scale is broken into three subscales: emotional loneliness, social loneliness, and general loneliness. Questions are answered on a 4-point Likert-type scale (ranging from 1=never to 4=always). The emotional loneliness subscale has six negative statements, including "Often I feel rejected," and "I miss having people around." The social loneliness subscale has five positive statements such as "There are enough people that I feel close to," and "I can call on my friends whenever I need them." The general loneliness subscale has seven negative statements such as "I feel left out," and "People are around me but not with me."
Yap, 2017 ³¹	<ul style="list-style-type: none"> Social network: Lubben Social Network Scale-6¹⁵ 	<p>Lubben Social Network Scale-6¹⁵</p> <ul style="list-style-type: none"> See "Lubben Social Network Scale-6" under Chan, 2017
Phinney, 2014 ³²	<ul style="list-style-type: none"> Social support: Multidimensional Scale of Perceived Social Support³³ 	<p>Multidimensional Scale of Perceived Social Support³³</p> <ul style="list-style-type: none"> This 12-item scale is broken into three factor groups (source of social support): family, friends, and significant other. This scale is scored on a 1 (very strongly disagree) to 7 (very strongly agree) Likert-type scale. Four is neutral. Higher scores indicate high levels of social support. Statements in the family factor group include: "My family really tries to help me"; "I get the emotional help and support I need from my family"; "I can talk about my problems with my family"; and "My family is willing to help me make decisions." Statements in the friend factor group include: "My friends really try to help me"; "I can count on my friends when things go wrong"; "I have friends with whom I can share my joys and sorrows"; "I can talk about my problems with my friends." Statements in the significant other factor group include: "There is a special person who is around when I am in need"; "There is a special person with whom I can share my joys and sorrows"; "I have a special person who is a real source of comfort to me"; and "There is a special person in my life who cares about my feelings."
Davidson, 2014 ³⁴	<ul style="list-style-type: none"> Loneliness: UCLA Loneliness Scale Version 3²⁶ 	<p>UCLA Loneliness Scale Version 3²⁶</p> <ul style="list-style-type: none"> See "UCLA Loneliness Scale Version 3" under Gonyea, 2013
Bartsch, 2013 ³⁵	<ul style="list-style-type: none"> Social isolation: developed own survey, called the "Care Manager Survey" 	<p>Care Manager Survey</p> <ul style="list-style-type: none"> This survey was given at intake and discharge for all clients. The survey measured five potential isolators: emotional disturbance, cognitive impairment, <i>social isolation</i>, physical impairment, and economic disadvantage. The scoring for each isolator is as follows: 0 for <i>no problem with the isolator</i> to 4 for <i>a major problem with the isolator</i>.

Studies that did not measure social isolation or loneliness: Murayama, 2014; Vogelpoel, 2014; Kim, 2018.

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