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# BMJ Open

## Interventions for social isolation in older adults who have experienced a fall: A systematic review

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# Interventions for social isolation in older adults who have experienced a fall:

## A systematic review

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- 2                    **A systematic review**
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3 36 **ABSTRACT**  
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5 37 **Objectives:** The objective of our systematic review was to identify effective interventions to  
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8 38 prevent or mitigate social isolation in older adults who experienced a fall.  
9

10 39 **Design:** Systematic review  
11

12 40 **Data Sources:** MEDLINE, Embase, the Cochrane Central Register of Controlled Trials, and  
13  
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15 41 Ageline were searched (inception to February 2020).  
16

17 42 **Methods:** Studies were eligible if they described any intervention for social isolation in older  
18  
19 43 adults living in a community setting who experienced a fall, and reported outcomes related to  
20  
21 44 social isolation or loneliness.  
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23  
24 45 Two independent reviewers screened citations, abstracted data, and appraised risk of bias. The  
25  
26 46 results were summarized descriptively.  
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28 47 **Results:** After screening 4,069 citations and 55 full-text articles, 4 studies were included. The  
29  
30 48 four studies varied in study design, including a randomized controlled trial, non-randomized  
31  
32 49 controlled trial, an uncontrolled before-after study, and a quasi-experimental study. Interventions  
33  
34 50 varied widely, and included singing in a choir, a patient-centred, interprofessional primary care  
35  
36 51 team-based approach, a multifactorial assessment targeting fall risk, appropriate medication use,  
37  
38 52 loneliness and frailty, and a community-based care model that included comprehensive  
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40 53 assessments and multilevel care coordination. Outcome measures varied and included scales for  
41  
42 54 loneliness, social isolation, social interaction, social networks, and social satisfaction. Mixed  
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44 55 results were found, with three studies reporting no differences in social isolation after the  
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46 56 intervention. Only the multifactorial assessment intervention demonstrated a small positive effect  
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48 57 on loneliness compared to the control group after adjustment (B= -0.18, 95% CI= -0.35 to -0.02).  
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3 58 **Conclusions:** Few studies examined interventions for social isolation in older adults who  
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5 59 experienced a fall. More research is warranted in this area.  
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7  
8 60 **Systematic Review Registration:** PROSPERO (CRD42020198487)  
9

10 61 **Word count:** 260 (abstract), 2671 (main text)  
11

12 62 **Keywords:** systematic review, older adults, falling, social isolation, loneliness, interventions  
13

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15 63 **Strengths and limitations of this study:**  
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- 17 64 • We conducted a comprehensive search of 4 databases, using a search strategy which was  
18  
19 65 peer-reviewed by a second librarian, and supplemented this by searching grey literature  
20  
21 66 and scanning references of included studies and relevant reviews.  
22  
23  
24 67 • We followed the methodology outlined by the Cochrane Handbook, with screening, data  
25  
26 68 abstraction, and risk of bias appraisal being conducted in duplicate by independent  
27  
28 69 reviewers, and our findings were reported using the PRISMA-2020 checklist.  
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30  
31 70 • We deviated from our protocol slightly due to the limited of data on older adults in a  
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33 71 community setting who had experienced a fall, and expanded our inclusion criteria to  
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35 72 include studies where some participants (not all) had a history of falling.  
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38 73 • Our included studies were plagued by risk of bias across several components, including  
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40 74 poor allocation concealment, lack of random sequence generation, and a lack of blinding  
41  
42 75 of participants, personnel, and outcome assessors.  
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44  
45 76 • A lack of standardization was observed across the outcomes assessed in the included  
46  
47 77 studies, due to lack of consensus on measures for social isolation and loneliness.  
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## 78 INTRODUCTION

79 Worldwide, more than 37 million falls occur requiring medical attention every year[1]. Almost  
80 650,000 people die every year from a fall, with those aged 65 years and older experiencing the  
81 greatest number of fatal falls[1]. Falls are associated with considerable negative outcomes on  
82 older adults, such as physical inactivity, anxiety, depressive symptoms, and fear of falling[2, 3].

83 Social isolation is a serious consequence among older adults who have experienced a  
84 fall[4]. Social isolation is a complex phenomenon that can be characterized by five key  
85 attributes: decreased number of social contacts, decreased feeling of belonging, reduced or lack  
86 of fulfilling relationships, decreased engagement with others, and reduced quality of the  
87 members in one's network[5]. Recent studies examined the bidirectional relationship between  
88 falling and social isolation, and some research focused on the risk of falling amongst older adults  
89 who were socially isolated[6-8]. Other research has focused on the risk of social isolation after  
90 experiencing a fall, since people who have experienced a fall are less likely to continue their  
91 activities of daily living[4]. For example, one study reported a statistically significant  
92 relationship between feelings of loneliness and social exclusion after experiencing a fall[4].

93 Regardless of the direction of the relationship, social isolation among older adults is  
94 associated with many adverse health outcomes, including cognitive decline, depression, anxiety,  
95 and dementia[9]. Interventions to mitigate social isolation after older adults experience a fall is  
96 of paramount importance. The objective of our systematic review was to identify effective  
97 interventions to mitigate social isolation in older adults who lived independently in a community  
98 setting with a history of falling.

## 99 METHODS

### 100 Protocol



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3 101 The protocol for this systematic review was developed in accordance with the Preferred  
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5 102 Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) checklist,  
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7 103 with consultation from knowledge users and clinical experts and was registered on PROSPERO  
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9 104 (CRD42020198487). This systematic review was conducted according to methodology outlined  
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11 105 in the Cochrane Handbook[10], and the PRISMA checklist (Supplementary File 1) was used to  
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13 106 guide the reporting of our results[11].  
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### 15 107 Search strategy and selection criteria

16  
17 108 A comprehensive literature search strategy was developed by an experienced information  
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19 109 specialist and peer-reviewed by a second information specialist using the Peer Review of  
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21 110 Electronic Search Strategies (PRESS) checklist[12]. MEDLINE, Embase, the Cochrane Central  
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23 111 Register of Controlled Trials, and Ageline were searched from inception until February 25, 2020  
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25 112 (Appendix 1). The reference lists of included studies and relevant reviews were also scanned. A  
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27 113 search for grey literature was conducted using the Canadian Agency for Drugs and Technologies  
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29 114 in Health (CADTH)'s Grey Matters checklist[13].  
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33 115 Our eligibility criteria are summarized in Table 2. Studies were eligible for inclusion if  
34  
35 116 they described any intervention for social isolation in older adults (mean age 65 years and older)  
36  
37 117 with a history of falling and who lived independently in a community setting. Eligible study  
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39 118 designs included randomized controlled trials (RCTs), cohort studies, case control studies, non-  
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41 119 randomized controlled trials, quasi-experimental studies, interrupted time series or  
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43 120 controlled/uncontrolled before after studies. Case reports, case series, cross-sectional studies,  
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45 121 qualitative studies, and reviews were not eligible for inclusion. Outcomes of interest included  
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47 122 any changes in social isolation as measured using validated scales, such as the De Jong Gierveld  
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3 123 loneliness scale[14] and the Bude & Lantermann scale for social exclusion[15], or any other  
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5 124 quantitative measure of social isolation or loneliness.  
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8 125 All citations were screened by two independent reviewers after the entire team completed  
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10 126 a training exercise on 50 citations and 78% agreement was achieved. Full-text screening by two  
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12 127 independent reviewers began after a training exercise on 22 articles amongst the team with an  
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14 128 agreement of 75%. Discrepancies for both levels of screening were resolved by a third reviewer  
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16  
17 129 or through discussion.  
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### 19 130 Data abstraction and risk of bias appraisal

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21 131 Data abstraction and risk of bias appraisal were also conducted independently by pairs of  
22  
23 132 reviewers after a training pilot exercise reached sufficient agreement, and discrepancies were  
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26 133 resolved by a third reviewer. The risk of bias appraisal was conducted using the Cochrane  
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28 134 Effective Practice and Organisation of Care (EPOC) risk of bias tool, as it was expected that a  
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31 135 mixture of study designs would be included[16].  
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### 33 136 Synthesis

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35 137 The findings of this review were summarized descriptively, reporting study and patient  
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37 138 characteristics, quality appraisal assessment, and intervention details. As outlined in our review  
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39 139 protocol, we planned to conduct a meta-analysis if more than one study evaluated the same  
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42 140 intervention, and a network meta-analysis for connected networks of trials with pre-specified  
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44 141 intervention nodes if over 10 trials were available and the number of trials was greater than the  
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46 142 number of interventions. However, as these conditions were not met, no statistical analyses were  
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49 143 conducted.  
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### 51 52 144 Patient and Public Involvement 53 54 55 56 57 58 59 60

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3 145 A patient partner with previous experience of a fall was identified and involved in this study  
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5 146 from the protocol development stage. The patient partner provided input on our research question  
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7 147 and outcome measures to ensure that the patient perspective was incorporated. They also  
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9 148 participated in the screening training exercises for citations and full-text articles, provided  
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11 149 feedback on screening eligibility criteria, and reviewed the manuscript as a coauthor.  
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## 15 150 **RESULTS**

### 16 151 Study flow

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20 152 After screening 4,069 citations and 55 full-text articles against our eligibility criteria, 4  
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22 153 studies[17-19] met the eligibility criteria and were included in this review (Figure 1).  
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### 25 154 Study and patient characteristics

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27 155 Study and patient characteristics are summarized in Table 1 and detailed characteristics are  
28  
29 156 reported in Appendices 1 and 2. The mean age of participants across included studies was 77.8  
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31 157 years (range: 76 to 79.5 years). Three of the included studies were conducted in North America  
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33 158 (75.0%) and one in Europe (25.0%) and they were conducted in a variety of settings including  
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35 159 the community setting, a combination of participant homes and community setting, a  
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37 160 combination of primary care and community setting, or a combination of participant homes and  
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39 161 primary care. Only one study provided data on frailty of the included participants, reporting  
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41 162 20.2% of participants with frailty (Appendix 2). The four studies varied in study design,  
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43 163 including a randomized controlled trial, a non-randomized controlled trial, an uncontrolled  
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45 164 before-after study, and a quasi-experimental study in which data from one randomized site was  
46  
47 165 combined with data from four controlled before-after sites. Two of the studies had a study  
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49 166 duration of 12 months, and the other two had a duration of 6 months. The sample size in the  
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51 167 studies ranged from 21 to 2325 and, on average, 71.3% of participants were female.  
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3 168 Risk of bias results  
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5 169 An overall summary of risk of bias across the four studies can be found in Appendix 3, and  
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7 170 detailed risk of bias assessments can be found in Appendix 4. All of the studies had low risk of  
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9 171 bias for baseline outcome measurements (100% low, 0% unclear, 0% high), and other bias  
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11 172 (100% low, 0% unclear, 0% high). Two of the studies had low risk and two had unclear risk of  
12  
13 173 bias for selective reporting (50% low, 50% unclear, 0% high). One study had high risk, two  
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15 174 studies unclear risk, and one had low risk of bias for incomplete outcome data (25% low, 50%  
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17 175 unclear, 25% high). However, three of four studies had high risk of bias for blinding of outcome  
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19 176 assessment (25% low, 0% unclear, 75% high), blinding of participants and personnel (25% low,  
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21 177 0% unclear, 75% high), random sequence generation (25% low, 0% unclear, 75% high), and  
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23 178 allocation concealment (25% low, 0% unclear, 75% high).  
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28 179 Outcome results  
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30 180 The relevant findings from the four included studies are summarized in Appendix 6.  
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32 181 Cohen et al. (2006) conducted a non-randomized controlled trial in the United States assessing  
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34 182 the effects of singing in a chorale compared to usual care in 166 older adults. The chorale  
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36 183 intervention involved attendance at weekly singing rehearsals and several public performances,  
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38 184 while the usual care group continued their usual activities. Both groups had a similar baseline  
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40 185 history of falling over the past 12 months (average of 0.40 falls per person in the intervention  
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42 186 group, and 0.36 per person in the control group). After 12 months of follow-up, they noted a  
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44 187 reduction in loneliness (as measured using the UCLA Loneliness Scale-III) in both groups  
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46 188 (chorale: baseline mean: 35.1 (SD, 8.1) and follow-up mean: 34.6 (SD, 7.9); usual care: baseline  
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48 189 mean: 38.3 (SD, 10.1) and follow-up mean: 37.0 (SD, 10.3). While the chorale intervention  
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3 190 reported lower loneliness scores than the usual care group after 12 months of follow-up, no  
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5 191 statistically significant difference was observed ( $F(1,126) = 3.08; p = 0.08$ ).

7 192 Scharlach et al. (2015) conducted an uncontrolled before-after study in the United States  
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10 193 assessing the effectiveness of their ElderHelp Concierge Club intervention in a sample of 21  
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12 194 participants. The Concierge Club intervention was a community-based care model that provided  
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14 195 different tiers of services to their members including information and referrals, transportation, or  
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16 196 in-house assessments. The baseline mean number of falls over the past 6 months was 1.3. They  
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18 197 noted that social isolation, as measured using an unnamed 3-item scale[20], did not change  
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20 198 significantly after 6 months of follow-up (baseline mean: 8.7 (SD, 3.2) and follow-up mean: 7.0  
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22 199 (SD, 3.8)). Similarly, although all participants reported having contact with friends/relatives after  
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24 200 the intervention, this was not found to be a significant change from baseline (baseline: 76% of  
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26 201 participants, follow-up: 100% of participants).

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30 202 Franse et al. (2018) conducted a quasi-experimental study comparing the effectiveness of  
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32 203 the Urban Health Centres Europe (UHCE) approach compared to usual care in a sample of 1,844  
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34 204 older adults across the United Kingdom, Greece, Croatia, the Netherlands, and Spain. The UHCE  
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36 205 approach involved a preventative multidimensional health assessment, which informed the  
37  
38 206 coordination of specific care pathways targeting the individual's needs (such as fall risk,  
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40 207 appropriate medication use, loneliness, and frailty). The usual care group received their usual  
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42 208 care and had access to any already existing services. At baseline, 30.2% of participants reported  
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44 209 having experienced a fall in the past 12 months. Their adjusted analysis found a small positive  
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46 210 effect of the UHCE approach on loneliness, as measured using the short De Jong Gierveld  
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48 211 Loneliness scale[21], when compared to usual care ( $B = -0.18, 95\% CI = -0.35 \text{ to } -0.02$ ).

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3 212 Dolovich et al. (2019) conducted a randomized controlled trial comparing the  
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5 213 effectiveness of the Health TAPESTRY (Health Teams Advancing Patient Experience:  
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7 214 STRengthening qualitY) intervention compared to usual care in a sample of 312 older adults in  
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10 215 Canada. This intervention involved the collection of information on patients' health goals and  
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12 216 needs by trained volunteers, who then summarized these findings in a report for the  
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14 217 interprofessional primary care team. The primary care team used these reports to generate and  
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16 218 act on plans of care for how the team, community agencies, and volunteers could help address  
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18 219 each patient's goals. The control group received usual care. Approximately 9.3% of participants  
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20 220 reported experiencing at least one fall. After 6 months of follow-up, they found no statistically  
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22 221 significant difference between the intervention and control groups in terms of their social  
23  
24 222 network scores (mean difference, 0.038 (95% CI: -0.25 to 0.33) and social satisfaction scores  
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26 223 (mean difference, 0.102 (95% CI, -0.35 to 0.55), as measured using the Duke Social Support  
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28 224 Index[22].  
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## 34 225 **DISCUSSION**

35  
36 226 We conducted a comprehensive systematic review of interventions to mitigate social isolation  
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38 227 and loneliness in older adults living independently in a community setting who experienced a  
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40 228 fall. Very few studies were identified that fulfilled our eligibility criteria, indicating a dearth of  
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42 229 evidence on this important topic. Only 4 studies were included and as each examined different  
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44 230 types of interventions, this precluded any statistical pooling of results. Furthermore, studies  
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46 231 varied on the proportion of participants who reported experiencing a fall and multiple types of  
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48 232 outcomes were assessed for loneliness and social isolation, making it challenging to provide any  
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50 233 meaningful interpretation of results.  
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3 234 Across the four studies in this systematic review, only the quasi-experimental study by  
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5 235 Franse et al. (2018)[19], which assessed the impact of multifactorial health assessments and  
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7 236 coordinated care pathways targeting fall risk, medication use, loneliness and frailty, found a  
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10 237 small positive effect on loneliness (i.e. reduction) when comparing those that received the  
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12 238 intervention with the control group. However, given the paucity of data in older adults with a  
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14 239 history of falling, the most effective intervention for preventing or reducing social isolation  
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16 240 remains unclear. Only one randomized controlled trial was identified in this review, highlighting  
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18 241 the need for more robust research in this important area.

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21 242 Gardiner et al. (2016) conducted an integrative review on interventions for social  
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23 243 isolation in older adults[23]. While this review was not specific to individuals who had  
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25 244 experienced a fall, it discusses characteristics of effective social isolation interventions in the  
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27 245 broader older adult population and could be applicable to the subset of this population that  
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29 246 experiences falling. While the majority of interventions they identified showed at least a  
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31 247 moderate positive effect on social isolation or loneliness, they noted that the quality of the  
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33 248 evidence was poor, making it difficult to identify a particular intervention as most effective[23].  
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35 249 This is consistent with our determination of the need for more robust research on the  
36  
37 250 effectiveness of social isolation interventions in older adults with a history of falling. They  
38  
39 251 identified adaptability to local contexts, community participation in the design and  
40  
41 252 implementation of the intervention, and productive engagement (as opposed to passive activities)  
42  
43 253 as common features among successful interventions[23]. Future studies should consider these  
44  
45 254 factors in the development and evaluation of interventions for social isolation.  
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51 255 Across our included studies, all four interventions appeared to be adapted to their local  
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53 256 contexts. The UHCE approach by Franse et al. (2018) and the Health TAPESTRY intervention  
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2  
3 257 by Dolovich et al. (2019) also involved strong community participation by tailoring their  
4  
5 258 intervention to each participant's health care needs, however it is unclear whether the subsequent  
6  
7 259 care pathways or plans allowed for productive engagement. Cohen et al. (2006)'s chorale  
8  
9  
10 260 intervention provided productive engagement to participants but may have benefited from further  
11  
12 261 community participation in the implementation of the intervention.  
13

14  
15 262 There are many strengths to our systematic review. Our search strategy was peer-  
16  
17 263 reviewed by a second librarian and was comprehensive through the inclusion of four databases,  
18  
19 264 searching grey literature and scanning references of included studies and relevant reviews. Our  
20  
21 265 methodology was informed by the Cochrane Handbook[10], with screening, data abstraction, and  
22  
23 266 risk of bias appraisal being conducted in duplicate by independent reviewers, and our findings  
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26 267 were reported using PRISMA-2020[11]. However, there are some limitations. We deviated from  
27  
28 268 our protocol slightly to allow for inclusion of studies where only some participants had a history  
29  
30 269 of falling, given the paucity of data on older adults in a community setting who had experienced  
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32  
33 270 a fall. Further, studies were plagued by risk of bias across several components, including to risk  
34  
35 271 of bias from poor allocation concealment, lack of random sequence generation, and a lack of  
36  
37 272 blinding of participants, personnel, and outcome assessors. A lack of standardization was  
38  
39 273 observed across the outcomes assessed in the included studies, suggesting that future work could  
40  
41 274 focus on developing consensus on measures for social isolation and loneliness that have already  
42  
43 275 been validated to establish a core outcomes dataset. Indeed, a study by Cornwell et al. (2009)  
44  
45 276 highlights the wide variation in indicators for isolation and loneliness and proposed combining  
46  
47 277 these varying indicators to develop two parsimonious scales to measure social disconnectedness  
48  
49 278 and perceived isolation [24], however, these scales were not used by the included studies here.  
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3 279 We recommend updating this systematic review as more literature becomes available on  
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5 280 this topic. Effective interventions are necessary to support older people who are at increased risk  
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7 281 of social isolation, particularly after experiencing a fall. In addition, further work is required to  
8  
9 282 examine the relationship between social isolation and falling, and the directionality of this  
10  
11 283 relationship, as different intervention approaches may be warranted depending on which  
12  
13 284 experience comes first.  
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16  
17 285 In conclusion, we identified four studies examining interventions for social isolation  
18  
19 286 amongst older adults with a history of falling. The interventions examined varied widely, from  
20  
21 287 singing in a chorale to community-base care coordination, as did the outcome measures used to  
22  
23 288 assess the effectiveness of the interventions. We identified only one quasi-experimental study  
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25 289 which demonstrated that multifactorial health assessments and coordinated care pathways  
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27 290 resulted in a small positive effect on loneliness in this population. Future research is warranted in  
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29 291 this under-studied area.  
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3 292 **LIST OF ABBREVIATIONS**  
4

5 293 CADTH Canadian Agency for Drugs and Technologies in Health  
6  
7 294 CI Confidence interval  
8  
9 295 EPOC Effective Practice and Organisation of Care  
10  
11 296 IQR Interquartile range  
12  
13 297 PRESS Peer Review of Electronic Search Strategies  
14  
15 298 PRISMA Preferred Reporting Items for Systematic Reviews and Meta-Analyses  
16  
17 299 RCT Randomized controlled trial  
18  
19 300 SD Standard deviation  
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24

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26

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28

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42

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1  
2  
3 315 Ethics approval

4  
5 316 Not required.

6  
7  
8 317 Consent for publication

9  
10 318 Not applicable.

11  
12 319 Availability of data and materials

13  
14  
15 320 The full dataset is available from the corresponding author upon reasonable request.

16  
17 321 Conflict of interests

18  
19 322 All authors do not have any potential (or perceived) conflicts of interest.

20  
21 323 Role of the funder

22  
23 324 The funder had no role in the design and conduct of the study; collection, management, analysis,

24  
25 325 and interpretation of the data; preparation, review, or approval of the manuscript; or decision to

26  
27 326 submit the manuscript for publication.

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30 327 **SUPPLEMENTAL FILES**

31  
32 328 Supplemental File 1: PRISMA Checklist

33  
34 329 Supplemental File 2: Appendices

35  
36 330 **FIGURES**

37  
38 331 Figure 1 – PRISMA study flow of included studies (n=4)

## TABLES

Table 1 – Study and Patient Characteristics

<b>Summary characteristics</b>	
Mean age (range)	77.8 (76 to 79.6)*
Mean % of female participants (range)	71.3 (60.8 to 91)**
Mean sample size (range)	837.3 (21 to 2325)
Mean % of participants living alone (range)	52.6 (38.1 to 67)*
Mean % of participants with history of falling (range)	19.6 (9.3 to 30.2)*
<b>Individual study details</b>	
<b>Cohen, 2006 → Chorale intervention</b>	
Country of conduct: United States	
Study design: Non-randomized controlled trial	
Study duration: 12 months	
Sample size: 166	
Intervention setting: Community	
<b>Scharlach, 2015 → ElderHelp Concierge Club (CC) intervention</b>	
Country of conduct: United States	
Study design: Uncontrolled before-after study	
Study duration: 6 months	
Sample size: 21	
Intervention setting: Participant homes and community	
<b>Fransé, 2018 → Urban Health Centres Europe (UHCE) approach</b>	
Country of conduct: United Kingdom, Greece, Croatia, the Netherlands, Spain	
Study design: Quasi-experimental (one site randomized, four sites controlled before-after)	
Study duration: 12 months	
Sample size: 2325	
Intervention setting: Primary care and community settings	
<b>Dolovich, 2019 → Health TAPESTRY (Health Teams Advancing Patient Experience: STRengthening Quality) intervention</b>	
Country of conduct: Canada	
Study design: Randomized controlled trial	
Study duration: 6 months	
Sample size: 312	
Intervention setting: Participant homes and primary care	

\*Only two of four studies reported on these variables

\*\*Only three of four studies reported on this variable

Table 2 – Screening Eligibility Criteria

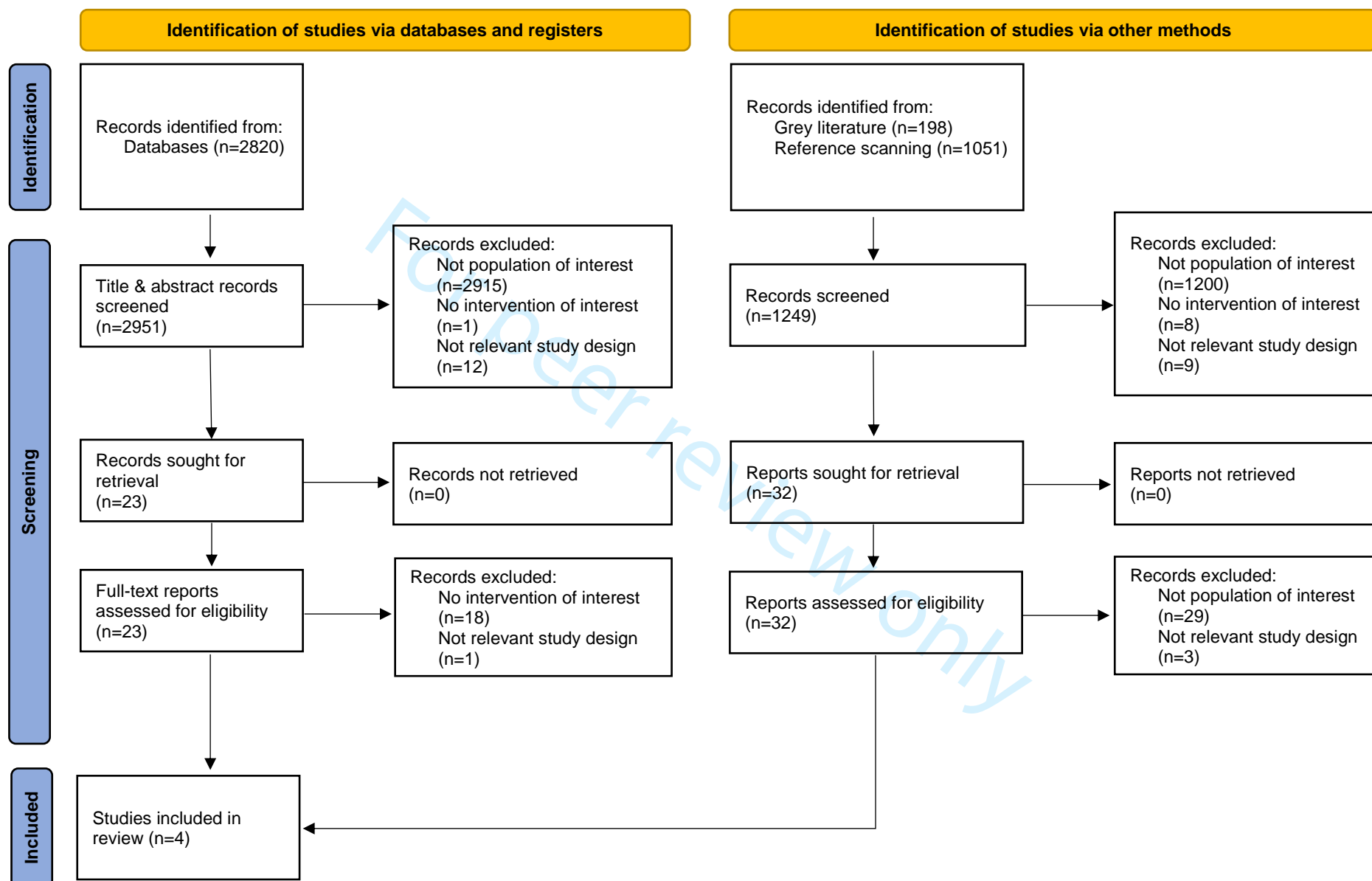
Population	Older adults (mean age 65 years and older) living independently in a community setting with a history of falling
Intervention	Any intervention for social isolation
Comparator	Usual care or another intervention for social isolation
Outcomes	Any quantitative measures of changes in social isolation Ex: the quantity of social interactions, Lubben Social Network Scale for social isolation, De Jong Gierveld Loneliness Scale, Bude & Lantermann scale for social exclusion, etc.
Study designs	Randomized controlled trial (RCT), non-RCT, quasi-experimental, interrupted time series, controlled or uncontrolled before-after, case control studies, cohort studies
Time	No time restrictions

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Figure 1 – PRISMA study flow of included studies (n=4)





## Supplementary File 1: PRISMA Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
<b>TITLE</b>			
Title	1	Identify the report as a systematic review.	1
<b>ABSTRACT</b>			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	3-4
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	5
<b>METHODS</b>			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	6, Table 2
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	6
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Appendix 1
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	7
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	7
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	6-7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	7
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	7
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	N/A
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	7
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	7
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	7

Section and Topic	Item #	Checklist item	Location where item is reported
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	7
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	N/A
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	7
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	N/A
<b>RESULTS</b>			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	8, Figure 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	N/A
Study characteristics	17	Cite each included study and present its characteristics.	9-11, Table 1, Appendix 2
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	9, Appendix 5
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	9-11, Appendix 6
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	N/A
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	N/A
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	N/A
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	N/A
<b>DISCUSSION</b>			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	11-13
	23b	Discuss any limitations of the evidence included in the review.	13
	23c	Discuss any limitations of the review processes used.	13
	23d	Discuss implications of the results for practice, policy, and future research.	14
<b>OTHER INFORMATION</b>			

Section and Topic	Item #	Checklist item	Location where item is reported
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	2
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	6
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	13
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	15-16
Competing interests	26	Declare any competing interests of review authors.	16
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	16

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: <http://www.prisma-statement.org/>

## Supplementary File 2: Appendices

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Appendix 5 – Quality appraisal assessments using Cochrane Risk of Bias tool modified by EPOC .....	8
Appendix 6 – Outcome summary table for included studies (n=4).....	9

## Appendix 1 – Database Search Strategies

### Ovid MEDLINE(R) ALL <1946 to Feb 25, 2020>

1 Accidental Falls/  
 2 (slip\* or trip\* or stumbl\* or tumbl\*).tw,kf.  
 3 (fall\* or fell or "fall-related" or "near-fall").tw,kf.  
 4 or/1-3  
 5 limit 4 to "all aged (65 and over)"  
 6 exp Aged/ or geriatrics/  
 7 (geriatric\* or elder\* or age\* or "of age" or aging or senior\* or older  
 adult\* or retired or retiree\* or elder\* or pensioner\* or older people or older  
 patient\* or gerontology or Sexagenarian\* or septuagenarian\* or  
 octogenarian or nonagenarian\* or centenarian\* or sixties or seventies or  
 eighties or nineties).tw,kf.  
 8 4 and (6 or 7)  
 9 5 or 8  
 10 Social Isolation/  
 11 loneliness/  
 12 exp social support/  
 13 (social barrier\* or social isolat\* or social support\* or social car\* or  
 psychosocial support\* or psycho-social support\* or social frailt\* or  
 friendship\* or "social\* connected\*" or connectedness or lonely or loneliness  
 or "feel\* alone\*" or companionship).tw,kf.  
 14 ((lack or absence or minimi\*) adj2 (contact or communication or  
 support\*)),tw,kf.  
 15 or/10-14  
 16 9 and 15  
 17 animals/ not humans/  
 18 16 not 17

### PsycINFO <1806 to February Week 4 2020>

1 falls/  
 2 (slip\* or trip\* or stumbl\* or tumbl\*).tw.  
 3 (fall\* or fell or "fall-related" or "near-fall").tw.  
 4 or/1-3  
 5 limit 4 to "380 aged <age 65 yrs and older">  
 6 (geriatric\* or elder\* or age\* or "of age" or aging or senior\* or older  
 adult\* or retired or retiree\* or elder\* or pensioner\* or older people or older

patient\* or gerontology or Sexagenarian\* or septuagenarian\* or  
 octogenarian or nonagenarian\* or centenarian\* or sixties or seventies or  
 eighties or nineties).tw.  
 7 4 and 6  
 8 5 or 7  
 9 social isolation/ or loneliness/ or social support/ or friendship/  
 10 (social barrier\* or social isolat\* or social support\* or social car\* or  
 psychosocial support\* or psycho-social support\* or social frailt\* or  
 friendship\* or "social\* connected\*" or connectedness or lonely or loneliness  
 or "feel\* alone\*" or companionship).tw.  
 11 ((lack or absence or minimi\*) adj2 (contact or communication or  
 support\*)),tw.  
 12 or/9-11  
 13 8 and 12  
 14 Limit 13 to human

### Embase Classic+Embase <1947 to 2020 February 25>

1 falling/  
 2 (slip\* or trip\* or stumbl\* or tumbl\*).tw.  
 3 (fall\* or fell or "fall-related" or "near-fall").tw.  
 4 or/1-3  
 5 limit 4 to aged <65+ years>  
 6 loneliness/ or social support/ or friendship/  
 7 exp social isolation/  
 8 (social barrier\* or social isolat\* or social support\* or social car\* or  
 psychosocial support\* or psycho-social support\* or social frailt\* or  
 friendship\* or "social\* connected\*" or connectedness or lonely or loneliness  
 or "feel\* alone\*" or companionship).tw.  
 9 ((lack or absence or minimi\*) adj2 (contact or communication or  
 support\*)),tw.  
 10 or/6-9  
 11 5 and 10  
 12 limit 11 to human

### Database: EBM Reviews - Cochrane Database of Systematic Reviews <2005 to February 25, 2020>, EBM Reviews - ACP Journal Club <1991

**to February 2020>, EBM Reviews - Cochrane Clinical Answers  
<February 2020>, EBM Reviews - Database of Abstracts of Reviews of  
Effects <1st Quarter 2016>**

- 1 (slip\* or trip\* or stumbl\* or tumbl\*).mp.
- 2 (fall\* or fell or "fall-related" or "near-fall").mp.
- 3 1 or 2
- 4 (geriatric\* or elder\* or age\* or "of age" or aging or senior\* or older adult\* or retired or retiree\* or elder\* or pensioner\* or older people or older patient\* or gerontology or Sexagenarian\* or septuagenarian\* or octogenarian or nonagenarian\* or centenarian\* or sixties or seventies or eighties or nineties).mp.
- 5 3 and 4
- 6 (social barrier\* or social isolat\* or social support\* or social car\* or psychosocial support\* or psycho-social support\* or social frailt\* or friendship\* or "social\* connected\*" or connectedness or lonely or loneliness or "feel\* alone\*" or companionship).mp.
- 7 ((lack or absence or minimi\*) adj2 (contact or communication or support\*)).mp.
- 8 6 or 7
- 9 5 and 8

**Joanna Briggs Institute EBP Database - <Current to February 25,  
2020>**

- 1 (slip\* or trip\* or stumbl\* or tumbl\*).mp.
- 2 (fall\* or fell or "fall-related" or "near-fall").mp.
- 3 1 or 2
- 4 (geriatric\* or elder\* or age\* or "of age" or aging or senior\* or older adult\* or retired or retiree\* or elder\* or pensioner\* or older people or older patient\* or gerontology or Sexagenarian\* or septuagenarian\* or octogenarian or nonagenarian\* or centenarian\* or sixties or seventies or eighties or nineties).mp.
- 5 3 and 4
- 6 (social barrier\* or social isolation\* or social support\* or social car\* or psychosocial support\* or psycho-social support\* or social frailt\* or friendship\* or "social\* connected\*" or connectedness or lonely or loneliness or "feel\* alone\*" or companionship).mp.
- 7 ((lack or absence or minimi\*) adj2 (contact or communication or support\*)).mp.
- 8 6 or 7
- 9 5 and 8

**AMED (Allied and Complementary Medicine) <1985 to February  
2020>**

- 1 (slip\* or trip\* or stumbl\* or tumbl\*).mp.
- 2 (fall\* or fell or "fall-related" or "near-fall").mp.
- 3 1 or 2
- 4 (geriatric\* or elder\* or age\* or "of age" or aging or senior\* or older adult\* or retired or retiree\* or elder\* or pensioner\* or older people or older patient\* or gerontology or Sexagenarian\* or septuagenarian\* or octogenarian or nonagenarian\* or centenarian\* or sixties or seventies or eighties or nineties).mp.
- 5 3 and 4
- 6 (social barrier\* or social isolation\* or social support\* or social car\* or psychosocial support\* or psycho-social support\* or social frailt\* or friendship\* or "social\* connected\*" or connectedness or lonely or loneliness or "feel\* alone\*" or companionship).mp.
- 7 ((lack or absence or minimi\*) adj2 (contact or communication or support\*)).mp.
- 8 6 or 7
- 9 5 and 8

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Appendix 2 – Study Characteristics

Author, year	Study title	Journal name	Country	Study design	Study duration (months)
Cohen, 2006	The impact of professionally conducted cultural programs on the physical health, mental health, and social functioning of older adults	The Gerontologist	United States	Non-randomized controlled trial	12
Scharlach, 2015	An Integrated Model of Co-ordinated Community-Based Care	The Gerontologist	United States	Uncontrolled before-after study	6
Fransse, 2018	The effectiveness of a coordinated preventive care approach for healthy ageing (UHCE) among older persons in five European cities: A pre-post controlled trial	International Journal of Nursing Studies	United Kingdom, Greece, Croatia, the Netherlands, Spain	Quasi-experimental (one site was randomized, four sites were controlled before-after)	12
Dolovich, 2019	Combining volunteers and primary care teamwork to support health goals and needs of older adults: a pragmatic randomized controlled trial	Canadian Medical Association Journal	Canada	Randomized controlled trial	6

## Appendix 3 – Patient Characteristics

DEMOGRAPHICS								
Author, year	Overall sample size	Overall age value	Overall age type	Overall age variance value	Overall age variance type	% female*		
Cohen, 2006	166	NR (Reported mean age by group: intervention - 79.0 years, comparison - 79.6 years)	NR	NR	NR	NR		
Scharlach, 2015	21	76	median	NR	NR	91		
Franse, 2018	2325	79.5	mean	5.6	SD	60.8		
Dolovich, 2019	312	NR (Reported mean age by group: intervention - 78.1 years, control - 79.1 years)	NR	NR	NR	62.2		
SETTING DATA								
Author, year	Intervention Setting	Participants living alone (%)	Description of access to caregivers				Description of baseline social network	
Cohen, 2006	Community	NR	NR				NR	
Scharlach, 2015	Participant homes and community	67	NR				NR	
Franse, 2018	Primary care and community settings	38.1	Care use i.e., hours per week receiving help in household work due to health problems and hours per week receiving help in caring for oneself was assessed. Hours/wk household help = control: 1.5 (5.3); intervention 1.0 (3.3).				NR	
Dolovich, 2019	Participant homes and primary care	NR	NR				NR	
FALLS AND FRAILITY DATA								
Author, year	Participants with history of falling	List of comorbidities	Participants with frailty (%)	Frailty scale	Overall frailty score	Overall frailty score type	Frailty variance value	Frailty variance type
Cohen, 2006	baseline average falls per person - intervention: 0.40 control: 0.36	NR	NR	NR	NR	NR	NR	NR



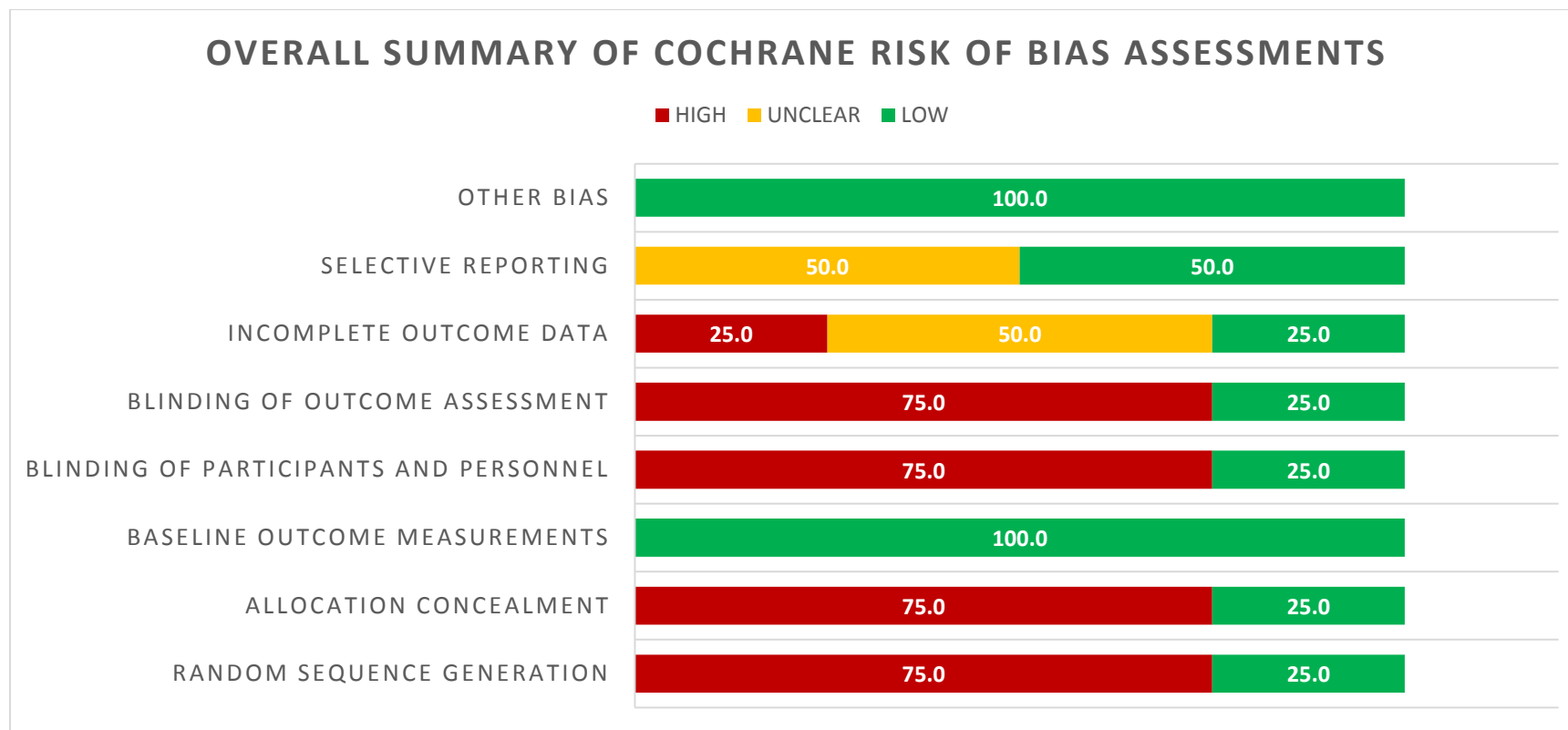
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Scharlach, 2015	mean of 1.3 falls at baseline	NR	NR	NR	NR	NR	NR	NR
Franse, 2018	30.2% had a fall in the previous year	NR	20.2	Tilburg Frailty indicator (TFI)	5.1	mean	3.2	SD
Dolovich, 2019	9.3% of participants had experienced 1 or more falls	NR	NR	NR	NR	NR	NR	NR

**Abbreviations:** NR, not reported; SD, standard deviation  
 \*No studies reported having individuals who do not identify as female or male

For peer review only

Appendix 4 – Overall risk of bias across included studies (n=4)



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Appendix 5 – Quality appraisal assessments using Cochrane Risk of Bias tool modified by EPOC

Author, Year	Trial identifier	Random sequence generation	Allocation concealment	Baseline outcome measurements	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias	Funding details:
Cohen, 2006	NR	High risk	High risk	Low risk	High risk	High risk	Unclear risk	Unclear risk	Low risk	National Endowment for the Arts (lead sponsor); Center for Mental Health Services, Substance Abuse and Mental Health Services Administration, Department of Health and Human Services; National Institute of Mental Health, National Institutes of Health; National Retired Teachers Association/AARP; International Foundation for Music Research; Stella and Charles Guttman Foundation, New York City.
Scharlach, 2015	NR	High risk	High risk	High risk	High risk	High risk	Unclear risk	Unclear risk	Low risk	The SCAN Foundation
Franse, 2018	NR	High risk	High risk	Low risk	High risk	High risk	High risk	Low risk	Low risk	European Union, CHAFEA, third Health programme, grant number 20131201
Dolovich, 2019	NCT02283723	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Health Canada (grant no. 6817-06-2013/5570001), Government of Ontario (grant no. 06547 for INSPIRE-PHC), McMaster University & McMaster Family Health Organization

## Appendix 6 – Outcome summary table for included studies (n=4)

Author, Year	Treatment arms	History of falls	Results	Text description of effectiveness
Cohen, 2006  <i>Design: non-RCT</i>	<p><b>Singing in a chorale</b> (n=90) The intervention consisted of participating in a professionally conducted chorale in which there were weekly singing rehearsals for 30 weeks as well as public performances several times during the intervention period.</p> <p><b>Usual activities</b> (n=76) Participants in the comparison group continued their regular activities as usual, with the study introducing no changes other than the assessments.</p>	Baseline average of 0.40 falls per person in the intervention group, and 0.36 per person in the control group in the past 12 months	<p><b>UCLA Loneliness scale III</b> Baseline: 35.1 (SD, 8.1) Follow-up: 34.6 (SD, 7.9)</p> <p>Baseline: 38.3 (SD, 10.1) Follow-up: 37.0 (SD, 10.3)</p>	Both groups evidenced a slight decrease in loneliness at the 12-month follow-up; however, the decrease in loneliness was greater for the intervention group than for the comparison. Analysis of covariance of the 12-month follow-up assessment continued to demonstrate a marginally significant difference between the two groups, $F(1,126) = 3.08$ ; $p = .08$ .
Scharlach, 2015  <i>Design: Uncontrolled before-after</i>	<p><b>ElderHelp Concierge Club (CC)</b> (n=21) Integrated community-based care model that includes comprehensive personal and environmental, assessment, multilevel care co-ordination, a mix of professional and volunteer service providers, and a capitated, income-adjusted fee model. When individuals contact CC for information or services, they receive a brief assessment designed to determine their eligibility for CC services, as well as the type of services they appear to need: information and referral services only (Tier 1), transportation services only, or other CC services including in-home assessment by the CC Intake Specialist (Tiers 2 and 3).</p>	Baseline mean of 1.3 falls over the past 6 months	<p><b>Social Isolation (3-item scale)</b> Baseline: 8.7 (SD, 3.2) Follow-up: 7.0 (SD, 3.8)</p> <p><b>Social interaction</b> <i>Interact with friends/relatives weekly</i> Baseline: 76% of participants Follow-up: 100% of participants</p> <p><i>Attend monthly meetings</i> Baseline: 33% of participants Follow-up: 48% of participants</p>	Social isolation did not change significantly; nor did contact with friends and relatives or participation in meetings of organized groups.

<p>1 2 3 4 5 6 7 8 9 10 11 12 13</p> <p>Franse, 2018</p> <p><i>Design: one site randomized, 4 sites controlled before-after design; results combined all sites, so classified as quasi-experimental</i></p>	<p><b>Urban Health Centres Europe (UHCE) approach</b> (n=986) Preventive multidimensional health assessment and if person at risk, coordinated care pathways targeted at fall risk, appropriate medication use, loneliness and frailty</p> <p><b>Usual Care</b> (n=858) Usual care included access to their GP</p>	<p>30.2% of participants experienced a fall in the previous year</p>	<p><b>Loneliness (short JG scale)</b> Baseline: 0.6 (SD, 0.7) Follow-up: 0.6 (SD, 0.7)</p> <p>Baseline: 0.6 (SD, 0.7) Follow-up: 0.7 (SD, 0.7)</p>	<p>When comparing persons who enrolled in any type of care-pathway with all persons in the control group there was a positive effect on loneliness after adjusting for city clustering, age, gender, living situation, education, and baseline status of outcome (B= -0.18, 95% CI= -0.35 to -0.02).</p>
<p>14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47</p> <p>Dolovich, 2019</p> <p><i>Design: RCT</i></p>	<p><b>Health TAPESTRY (Health Teams Advancing Patient Experience: STrengthening Quality) intervention</b> (n=158) Trained community volunteers visited patients to collect information on their life and health goals, risks and needs, daily life activities and general health, using structured surveys and unstructured narratives. The volunteers sent a report summarizing patients’ goals, alerts, key issues and observations to the primary care interprofessional “huddle” team at the clinics. These interprofessional teams reviewed the reports and then generated, prioritized and acted upon plans of care for how the team, community agencies and volunteers could address clients’ goals and health issues, with iterative follow-up</p> <p><b>Usual Care</b> (n=154) The control group received usual care and did not have volunteer visits. There was no restriction on receiving care from the same team members as the intervention group</p>	<p>9.3% of participants experienced 1 or more falls</p>	<p><b>Social network score (DSSI-10)</b> Baseline: Mean, 8.84 (SD, 1.52) Follow-up: Mean, 8.75 (SD, 1.52)</p> <p><b>Social satisfaction score (DSSI-10)</b> Baseline: Mean, 18.89 (SD, 2.41) Follow-up: Mean, 18.96 (SD, 2.87)</p> <p><b>Social network score (DSSI-10)</b> Baseline: Mean, 8.74 (SD, 1.61) Follow-up: Mean, 8.69 (SD, 1.53)</p> <p><b>Social satisfaction score (DSSI-10)</b> Baseline: Mean, 19.19 (SD, 2.37) Follow-up: Mean, 19.04 (SD, 2.76)</p>	<p>There were no statistically significant between-group differences in participant ratings of self-efficacy, quality of life, optimal aging, social support</p>

# BMJ Open

## Interventions for social isolation in older adults who have experienced a fall: A systematic review

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<b>Primary Subject Heading</b>:	Geriatric medicine
Secondary Subject Heading:	Rehabilitation medicine
Keywords:	REHABILITATION MEDICINE, GERIATRIC MEDICINE, PREVENTIVE MEDICINE

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1  
2  
3 34 **ABSTRACT**  
4

5 35 **Objectives:** The objective of our systematic review was to identify effective interventions to  
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8 36 prevent or mitigate social isolation and/or loneliness in older adults who experienced a fall.  
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10 37 **Design:** Systematic review  
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12 38 **Data Sources:** MEDLINE, Embase, the Cochrane Central Register of Controlled Trials, and  
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15 39 Ageline were searched (inception to February 2020).  
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17 40 **Methods:** Studies were eligible if they described any intervention for social isolation in older  
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19 41 adults living in a community setting who experienced a fall, and reported outcomes related to  
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21 42 social isolation or loneliness.  
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23  
24 43 Two independent reviewers screened citations, abstracted data, and appraised risk of bias using  
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26 44 the Cochrane risk-of-bias tool. The results were summarized descriptively.  
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28 45 **Results:** After screening 4,069 citations and 55 full-text articles, 4 studies were included. The  
29  
30 46 four studies varied in study design, including a randomized controlled trial, non-randomized  
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32 47 controlled trial, an uncontrolled before-after study, and a quasi-experimental study. Interventions  
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34 48 varied widely, and included singing in a choir, a patient-centred, interprofessional primary care  
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36 49 team-based approach, a multifactorial assessment targeting fall risk, appropriate medication use,  
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38 50 loneliness and frailty, and a community-based care model that included comprehensive  
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40 51 assessments and multilevel care coordination. Outcome measures varied and included scales for  
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42 52 loneliness, social isolation, social interaction, social networks, and social satisfaction. Mixed  
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44 53 results were found, with three studies reporting no differences in social isolation or loneliness  
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46 54 after the intervention. Only the multifactorial assessment intervention demonstrated a small  
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48 55 positive effect on loneliness compared to the control group after adjustment (B= -0.18, 95% CI=  
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3 57 **Conclusions:** Few studies examined interventions for social isolation or loneliness in older  
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5 58 adults who experienced a fall. More research is warranted in this area.  
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8 59 **Systematic Review Registration:** PROSPERO (CRD42020198487)  
9

10 60 **Word count:** 266 (abstract), 2953 (main text)  
11

12 61 **Keywords:** systematic review, older adults, falling, social isolation, loneliness, interventions  
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14

15 62 **Strengths and limitations of this study:**  
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- 17 63 • We conducted a comprehensive search of 4 databases, using a search strategy which was  
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19 64 peer-reviewed by a second librarian, and supplemented this by searching grey literature  
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21 65 and scanning references of included studies and relevant reviews.  
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24 66 • We followed the methodology outlined by the Cochrane Handbook, with screening, data  
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26 67 abstraction, and risk of bias appraisal being conducted in duplicate by independent  
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28 68 reviewers, and our findings were reported using the PRISMA-2020 checklist.  
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31 69 • We deviated from our protocol slightly due to the limited of data on older adults in a  
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33 70 community setting who had experienced a fall and expanded our inclusion criteria to  
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35 71 include studies where some participants (not all) had a history of falling.  
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38 72 • Our included studies were plagued by risk of bias across several components, including  
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40 73 poor allocation concealment, lack of random sequence generation, and a lack of blinding  
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42 74 of participants, personnel, and outcome assessors.  
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45 75 • A lack of standardization was observed across the outcomes assessed in the included  
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47 76 studies, due to lack of consensus on measures for social isolation and loneliness.  
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## 77 INTRODUCTION

78 Worldwide, more than 37 million falls occur requiring medical attention every year(1). Almost  
79 650,000 people die every year from a fall, with those aged 65 years and older experiencing the  
80 greatest number of fatal falls(1). Falls are associated with considerable negative outcomes on  
81 older adults, such as physical inactivity, anxiety, depressive symptoms, and fear of falling(2, 3).

82 Social isolation is a serious consequence among older adults who have experienced a  
83 fall(4). Social isolation is a complex phenomenon that can be characterized by five key  
84 attributes: decreased number of social contacts, decreased feeling of belonging, reduced or lack  
85 of fulfilling relationships, decreased engagement with others, and reduced quality of the  
86 members in one's network(5). Loneliness is another consequence that may occur after a fall and  
87 can be defined as "the unpleasant experience that occurs when a person's network of social  
88 relations is deficient in some way, either quantitatively or qualitatively"(6). Some research has  
89 focused on the risk of social isolation and loneliness after experiencing a fall, since people who  
90 have experienced a fall are less likely to continue their activities of daily living(4). For example,  
91 one study reported a statistically significant relationship between feelings of loneliness and social  
92 exclusion after experiencing a fall(4).

93 Although social isolation and loneliness are related, it is important to note that they are  
94 two distinct concepts(7). Social isolation is more objective, as it can be measured by examining  
95 the presence or absence of relationships with other people, whereas loneliness is a person's  
96 subjective experience and is more difficult to measure. This distinction is important, as different  
97 interventions might be required for each of these outcomes after experiencing a fall.

98 Social isolation and loneliness among older adults is associated with many adverse health  
99 outcomes, including cognitive decline, depression, anxiety, and dementia(8). Interventions to

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3 100 mitigate social isolation and loneliness after older adults experience a fall is of paramount  
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5 101 importance. Examples of interventions may include participating in social activities, outreach  
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7 102 calls from peers or healthcare workers, and group exercise. The objective of our systematic  
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9 103 review was to identify effective interventions to mitigate social isolation and loneliness in older  
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11 104 adults who lived independently in a community setting with a history of falling.  
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## 15 105 **METHODS**

### 16 106 Protocol

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20 107 The protocol for this systematic review was developed in accordance with the Preferred  
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22 108 Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) checklist,  
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24 109 with consultation from knowledge users and clinical experts and was registered on PROSPERO  
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26 110 (CRD42020198487). This systematic review was conducted according to methodology outlined  
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28 111 in the Cochrane Handbook(9), and the PRISMA checklist (Supplementary File 1) was used to  
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30 112 guide the reporting of our results(10).  
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### 34 113 Search strategy and selection criteria

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36 114 A comprehensive literature search strategy was developed by an experienced information  
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38 115 specialist and peer-reviewed by a second information specialist using the Peer Review of  
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40 116 Electronic Search Strategies (PRESS) checklist(11). MEDLINE, Embase, the Cochrane Central  
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42 117 Register of Controlled Trials, and Ageline were searched from inception until February 25, 2020  
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44 118 (Appendix 1). The reference lists of included studies and relevant reviews were also scanned. A  
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46 119 search for grey literature was conducted using the Canadian Agency for Drugs and Technologies  
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48 120 in Health (CADTH)'s Grey Matters checklist(12).  
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52 121 Our eligibility criteria are summarized in Table 1. Studies were eligible for inclusion if  
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54 122 they described any intervention for social isolation or feelings of loneliness in older adults (mean  
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3 123 age 65 years and older) with any participant reporting a history of falling (i.e., regardless of the  
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5 124 proportion of the sample who fell) and who lived independently in a community setting. Eligible  
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8 125 study designs included randomized controlled trials (RCTs), cohort studies, case control studies,  
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10 126 non-randomized controlled trials, quasi-experimental studies, interrupted time series or  
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12 127 controlled/uncontrolled before after studies. Case reports, case series, cross-sectional studies,  
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14 128 qualitative studies, and reviews were not eligible for inclusion. Outcomes of interest included  
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16 129 any changes in social isolation or loneliness as measured using validated scales, such as the De  
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18 130 Jong Gierveld loneliness scale(13) and the Bude & Lantermann scale for social exclusion(14),  
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20 131 or any other quantitative measure of social isolation or loneliness. Social isolation was defined as  
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22 132 a decrease in the number of social contacts, decreased feeling of belonging, reduced or lack of  
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24 133 fulfilling relationships, decreased engagement with others, and reduced quality of the members  
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26 134 in one's network(5). Loneliness was defined as "the unpleasant experience that occurs when a  
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28 135 person's network of social relations is deficient in some way, either quantitatively or  
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31 136 qualitatively(6).

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35 137 All citations were screened by two independent reviewers after the entire team completed  
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37 138 a training exercise on 50 citations and 78% agreement was achieved. Full-text screening by two  
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39 139 independent reviewers began after a training exercise on 22 articles amongst the team with an  
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41 140 agreement of 75%. Discrepancies for both levels of screening were resolved by a third reviewer  
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43 141 or through discussion.

#### 44 45 46 142 Data abstraction and risk of bias appraisal

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49 143 Data abstraction and risk of bias appraisal were also conducted independently by pairs of  
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51 144 reviewers after a training pilot exercise reached sufficient agreement, and discrepancies were  
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53 145 resolved by a third reviewer. The risk of bias appraisal was conducted using the Cochrane  
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3 146 Effective Practice and Organisation of Care (EPOC) risk of bias tool, as it was expected that a  
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5 147 mixture of study designs would be included(15).  
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### 8 148 Synthesis

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10 149 The findings of this review were summarized descriptively, reporting study and patient  
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12 150 characteristics, quality appraisal assessment, and intervention details. As outlined in our review  
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14 151 protocol, we planned to conduct a meta-analysis if more than one study evaluated the same  
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16 152 intervention, and a network meta-analysis for connected networks of trials with pre-specified  
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18 153 intervention nodes if over 10 trials were available and the number of trials was greater than the  
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20 154 number of interventions. However, as these conditions were not met, no statistical analyses were  
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23 155 conducted.  
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### 27 156 Patient and Public Involvement

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30 157 A patient partner with previous experience of a fall was identified and involved in this study  
31  
32 158 from the protocol development stage. The patient partner provided input on our research question  
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34 159 and outcome measures to ensure that the patient perspective was incorporated. They also  
35  
36 160 participated in the screening training exercises for citations and full-text articles, provided  
37  
38 161 feedback on screening eligibility criteria, and reviewed the manuscript as a coauthor.  
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## 43 162 **RESULTS**

### 44 45 163 Study flow

46  
47 164 After screening 4,069 citations and 55 full-text articles against our eligibility criteria, 4  
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49 165 studies(16-18) met the eligibility criteria and were included in this review (Figure 1).  
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### 52 166 Study and patient characteristics

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3 167 Study and patient characteristics are summarized in Table 2 and detailed characteristics are  
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5 168 reported in Appendices 1 and 2. The mean age of participants across included studies was 77.8  
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7 169 years (range: 76 to 79.5 years). Three of the included studies were conducted in North America  
8  
9 170 (75.0%) and one in Europe (25.0%) and they were conducted in a variety of settings including  
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11 171 the community setting, a combination of participant homes and community setting, a  
12  
13 172 combination of primary care and community setting, or a combination of participant homes and  
14  
15 173 primary care. Only one study provided data on frailty of the included participants, reporting  
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17 174 20.2% of participants with frailty (Appendix 2). The four studies varied in study design,  
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19 175 including a randomized controlled trial, a non-randomized controlled trial, an uncontrolled  
20  
21 176 before-after study, and a quasi-experimental study in which data from one randomized site was  
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23 177 combined with data from four controlled before-after sites. Two of the studies had a study  
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25 178 duration of 12 months, and the other two had a duration of 6 months. The sample size in the  
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27 179 studies ranged from 21 to 2325 and, on average, 71.3% of participants were female.

### 32 33 180 Risk of bias results

34  
35 181 An overall summary of risk of bias across the four studies can be found in Appendix 3, and  
36  
37 182 detailed risk of bias assessments can be found in Appendix 4. All studies had low risk of bias for  
38  
39 183 baseline outcome measurements (100% low, 0% unclear, 0% high), and other bias (mainly  
40  
41 184 funding bias; 100% low, 0% unclear, 0% high). Two of the studies had low risk and two had  
42  
43 185 unclear risk of bias for selective reporting (50% low, 50% unclear, 0% high). One study had high  
44  
45 186 risk, two studies unclear risk, and one had low risk of bias for incomplete outcome data (25%  
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47 187 low, 50% unclear, 25% high). However, three of four studies had high risk of bias for blinding of  
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49 188 outcome assessment (25% low, 0% unclear, 75% high), blinding of participants and personnel  
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3 189 (25% low, 0% unclear, 75% high), random sequence generation (25% low, 0% unclear, 75%  
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5 190 high), and allocation concealment (25% low, 0% unclear, 75% high).  
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### 8 191 Outcome results

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10 192 The relevant findings from the four included studies are summarized in Appendix 6.  
11  
12 193 Cohen et al. (2006) conducted a non-randomized controlled trial in the United States assessing  
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14 194 the effects of singing in a chorale to reduce loneliness compared to usual care in 166 older adults.  
15  
16 195 The chorale intervention involved attendance at weekly singing rehearsals and several public  
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18 196 performances, while the usual care group continued their usual activities. Both groups had a  
19  
20 197 similar baseline history of falling over the past 12 months (average of 0.40 falls per person in the  
21  
22 198 intervention group, and 0.36 per person in the control group). After 12 months of follow-up, they  
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24 199 noted a reduction in loneliness (as measured using the UCLA Loneliness Scale-III) in both  
25  
26 200 groups (chorale: baseline mean: 35.1 (SD, 8.1) and follow-up mean: 34.6 (SD, 7.9); usual care:  
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28 201 baseline mean: 38.3 (SD, 10.1) and follow-up mean: 37.0 (SD, 10.3). While the chorale  
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30 202 intervention reported lower loneliness scores than the usual care group after 12 months of  
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32 203 follow-up, no statistically significant difference was observed ( $F(1,126) = 3.08; p = 0.08$ ).  
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38 204 Scharlach et al. (2015) conducted an uncontrolled before-after study in the United States  
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40 205 assessing the effectiveness of their ElderHelp Concierge Club intervention on social isolation in  
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42 206 a sample of 21 participants(17). The Concierge Club intervention was a community-based care  
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44 207 model that provided different tiers of services to their members including information and  
45  
46 208 referrals, transportation, or in-house assessments. The baseline mean number of falls over the  
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48 209 past 6 months was 1.3. They noted that social isolation, as measured using an unnamed 3-item  
49  
50 210 scale(19), did not change significantly after 6 months of follow-up (baseline mean: 8.7 (SD, 3.2)  
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52 211 and follow-up mean: 7.0 (SD, 3.8)). Similarly, although all participants reported having contact  
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3 212 with friends/relatives after the intervention, this was not found to be a significant change from  
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5 213 baseline (baseline: 76% of participants, follow-up: 100% of participants).  
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7  
8 214 Franse et al. (2018) conducted a quasi-experimental study comparing the effectiveness of  
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10 215 the Urban Health Centres Europe (UHCE) approach compared to usual care on loneliness in a  
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12 216 sample of 1,844 older adults across the United Kingdom, Greece, Croatia, the Netherlands, and  
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14 217 Spain(18). The UHCE approach involved a preventative multidimensional health assessment,  
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16 218 which informed the coordination of specific care pathways targeting the individual's needs (such  
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18 219 as fall risk, appropriate medication use, loneliness, and frailty). The usual care group received  
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20 220 their usual care and had access to any already existing services. At baseline, 30.2% of  
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22 221 participants reported having experienced a fall in the past 12 months. Their adjusted analysis  
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24 222 found a small positive effect of the UHCE approach on loneliness, as measured using the short  
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26 223 De Jong Gierveld Loneliness scale(20), when compared to usual care (B= -0.18, 95% CI= -0.35  
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28 224 to -0.02).  
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33 225 Dolovich et al. (2019) conducted a randomized controlled trial comparing the  
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35 226 effectiveness of the Health TAPESTRY (Health Teams Advancing Patient Experience:  
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37 227 STREngthening qualityY) intervention compared to usual care on social isolation in a sample of  
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39 228 312 older adults in Canada(21). This intervention involved the collection of information on  
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41 229 patients' health goals and needs by trained volunteers, who then summarized these findings in a  
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43 230 report for the interprofessional primary care team. The primary care team used these reports to  
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45 231 generate and act on plans of care for how the team, community agencies, and volunteers could  
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47 232 help address each patient's goals. The control group received usual care. Approximately 9.3% of  
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49 233 participants reported experiencing at least one fall. After 6 months of follow-up, they found no  
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51 234 statistically significant difference between the intervention and control groups in terms of their  
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3 235 social network scores (mean difference, 0.038 (95% CI: -0.25 to 0.33) and social satisfaction  
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5 236 scores (mean difference, 0.102 (95% CI, -0.35 to 0.55), as measured using the Duke Social  
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8 237 Support Index(22).  
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## 10 11 238 **DISCUSSION** 12

13 239 We conducted a comprehensive systematic review of interventions to mitigate social isolation  
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15 240 and loneliness in older adults living independently in a community setting who experienced a  
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17 241 fall. Very few studies were identified that fulfilled our eligibility criteria, indicating a dearth of  
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19 242 evidence on this important topic. Only 4 studies were included and as each examined different  
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21 243 types of interventions, this precluded any statistical pooling of results. Furthermore, studies  
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23 244 varied on the proportion of participants who reported experiencing a fall and multiple types of  
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25 245 outcomes were assessed for loneliness and social isolation, making it challenging to provide any  
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27 246 meaningful interpretation of results.  
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32 247       Across the four studies in this systematic review, only the quasi-experimental study by  
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34 248 Franse et al. (2018)(18), which assessed the impact of multifactorial health assessments and  
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36 249 coordinated care pathways targeting fall risk, medication use, loneliness and frailty, found a  
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38 250 small positive effect on loneliness (i.e. reduction) when comparing those that received the  
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40 251 intervention with the control group. However, given the paucity of data in older adults with a  
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42 252 history of falling, the most effective intervention for preventing or reducing social isolation  
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44 253 remains unclear. Only one randomized controlled trial was identified in this review, highlighting  
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46 254 the need for more robust research in this important area.  
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50 255       We searched for previous reviews that were related and only one was identified. Gardiner  
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52 256 et al. (2016) conducted an integrative review on interventions for social isolation in older  
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54 257 adults(23). While this review was not specific to individuals who had experienced a fall, it  
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3 258 discusses characteristics of effective social isolation interventions in the broader older adult  
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5 259 population and could be applicable to the subset of this population that experiences falling.  
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8 260 While the majority of interventions they identified showed at least a moderate positive effect on  
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10 261 social isolation or loneliness, they noted that the quality of the evidence was poor, making it  
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12 262 difficult to identify a particular intervention as most effective(23). This is consistent with our  
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14 263 determination of the need for more robust research on the effectiveness of social isolation  
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16 264 interventions in older adults with a history of falling. They identified adaptability to local  
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18 265 contexts, community participation in the design and implementation of the intervention, and  
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20 266 productive engagement (as opposed to passive activities) as common features among successful  
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22 267 interventions(23). Future studies should consider these factors in the development and evaluation  
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25 268 of interventions for social isolation.

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28 269 Across our included studies, all four interventions appeared to be adapted to their local  
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30 270 contexts. The UHCE approach by Franse et al. (2018) and the Health TAPESTRY intervention  
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32 271 by Dolovich et al. (2019) also involved strong community participation by tailoring their  
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34 272 intervention to each participant's health care needs, however it is unclear whether the subsequent  
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36 273 care pathways or plans allowed for productive engagement. Cohen et al. (2006)'s chorale  
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38 274 intervention provided productive engagement to participants but may have benefited from further  
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40 275 community participation in the implementation of the intervention.

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44 276 There are many strengths to our systematic review. Our search strategy was peer-  
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46 277 reviewed by a second librarian and was comprehensive through the inclusion of four databases,  
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48 278 searching grey literature and scanning references of included studies and relevant reviews. Our  
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50 279 methodology was informed by the Cochrane Handbook(9), with screening, data abstraction, and  
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52 280 risk of bias appraisal being conducted in duplicate by independent reviewers, and our findings  
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3 281 were reported using PRISMA-2020(10). However, there are some limitations. We deviated from  
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5 282 our protocol slightly to allow for inclusion of studies where only some participants had a history  
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7 283 of falling, given the paucity of data on older adults in a community setting who had experienced  
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9 284 a fall. We were unable to update our literature search due to a lack of sufficient funding. Further,  
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11 285 studies were plagued by risk of bias across several components, including to risk of bias from  
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13 286 poor allocation concealment, lack of random sequence generation, and a lack of blinding of  
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15 287 participants, personnel, and outcome assessors. A lack of standardization was observed across  
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17 288 the outcomes assessed in the included studies, suggesting that future work could focus on  
18  
19 289 developing consensus on measures for social isolation and loneliness that have already been  
20  
21 290 validated to establish a core outcomes dataset. Indeed, a study by Cornwell et al. (2009)  
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23 291 highlights the wide variation in indicators for isolation and loneliness and proposed combining  
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25 292 these varying indicators to develop two parsimonious scales to measure social disconnectedness  
26  
27 293 and perceived isolation (24), however, these scales were not used by the included studies here.  
28  
29 294 Furthermore, additional examination of tailoring interventions to reduce loneliness and/or social  
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31 295 isolation is warranted, as there was a dearth of included studies to examine this fully in this  
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33 296 systematic review with two studies each focusing on social isolation and loneliness separately.  
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35 297 Further research is warranted on this, as social isolation and loneliness are distinct concepts and  
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37 298 different interventions may be required to target each outcome separately.  
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45 299 We recommend updating this systematic review as more literature becomes available on  
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47 300 this topic. Effective interventions are necessary to support older people who are at increased risk  
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49 301 of social isolation, particularly after experiencing a fall. In addition, further work is required to  
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51 302 examine the relationship between social isolation, loneliness, and falling, and whether other  
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53 303 variables influence this relationship, as this may warrant different intervention approaches.  
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3 304 In conclusion, we identified four studies examining interventions for social isolation  
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5 305 amongst older adults with a history of falling. The interventions examined varied widely, from  
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7 306 singing in a chorale to community-base care coordination, as did the outcome measures used to  
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10 307 assess the effectiveness of the interventions. We identified only one quasi-experimental study  
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12 308 which demonstrated that multifactorial health assessments and coordinated care pathways  
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14 309 resulted in a small positive effect on loneliness in this population. Future research is warranted in  
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16  
17 310 this under-studied area.  
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## 311 LIST OF ABBREVIATIONS

312	CADTH	Canadian Agency for Drugs and Technologies in Health
313	CI	Confidence interval
314	EPOC	Effective Practice and Organisation of Care
315	IQR	Interquartile range
316	PRESS	Peer Review of Electronic Search Strategies
317	PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
318	RCT	Randomized controlled trial
319	SD	Standard deviation

## 320 DECLARATIONS

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1  
2  
3 334 Ethics approval

4  
5 335 Not required.

6  
7  
8 336 Consent for publication

9  
10 337 Not applicable.

11  
12 338 Author Contribution

13  
14 339 Substantial contributions to the conception or design of the work (ACT, SMT, JW, SES);

15  
16 340 acquisition, analysis, or interpretation of data for the work (all authors); drafting the work (ACT,

17  
18 341 SMT) or revising it critically for important intellectual content (AR, NR, GM, JF, YJ, MdG, KA,

19  
20 342 JB, AG-B, JW, SES); final approval of the version to be published (all authors); agreement to be

21  
22 343 accountable for all aspects of the work in ensuring that questions related to the accuracy or

23  
24 344 integrity of any part of the work are appropriately investigated and resolved (all authors)

25  
26 345 Availability of data and materials

27  
28 346 The full dataset is available from the corresponding author upon reasonable request.

29  
30 347 Conflict of interests

31  
32 348 All authors do not have any potential (or perceived) conflicts of interest.

33  
34 349 Role of the funder

35  
36 350 The funder had no role in the design and conduct of the study; collection, management, analysis,

37  
38 351 and interpretation of the data; preparation, review, or approval of the manuscript; or decision to

39  
40 352 submit the manuscript for publication.

41  
42 353 **SUPPLEMENTAL FILES**

43  
44 354 Supplemental File 1: PRISMA Checklist

45  
46 355 Supplemental File 2: Appendices

47  
48 356 **FIGURES**

1  
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3 357 Figure 1 – PRISMA study flow of included studies (n=4)  
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For peer review only

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3 **TABLES**  
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5 Table 1 – Screening Eligibility Criteria  
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8 Population	Older adults (mean age 65 years and older) living independently in a community setting with any participant reporting a history of falling (i.e., regardless of the proportion of the sample who fell)
9 Intervention	Any intervention for social isolation or loneliness
10 Comparator	Usual care or another intervention for social isolation or loneliness
11 Outcomes	Any quantitative measures of changes in social isolation or loneliness Ex: the quantity of social interactions, Lubben Social Network Scale for social isolation, De Jong Gierveld Loneliness Scale, Bude & Lantermann scale for social exclusion, etc.
12 Study designs	Randomized controlled trial (RCT), non-RCT, quasi-experimental, interrupted time series, controlled or uncontrolled before-after, case control studies, cohort studies
13 Time	No time restrictions

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Table 2 – Study and Patient Characteristics

<b>Summary characteristics</b>	
Mean age (range)	77.8 (76 to 79.6)*
Mean % of female participants (range)	71.3 (60.8 to 91)**
Mean sample size (range)	837.3 (21 to 2325)
Mean % of participants living alone (range)	52.6 (38.1 to 67)*
Mean % of participants with history of falling (range)	19.6 (9.3 to 30.2)*
<b>Individual study details</b>	
<b>Cohen, 2006 → Chorale intervention</b>	
Country of conduct: United States	
Study design: Non-randomized controlled trial	
Study duration: 12 months	
Sample size: 166	
Intervention setting: Community	
<b>Scharlach, 2015 → ElderHelp Concierge Club (CC) intervention</b>	
Country of conduct: United States	
Study design: Uncontrolled before-after study	
Study duration: 6 months	
Sample size: 21	
Intervention setting: Participant homes and community	
<b>Franse, 2018 → Urban Health Centres Europe (UHCE) approach</b>	
Country of conduct: United Kingdom, Greece, Croatia, the Netherlands, Spain	
Study design: Quasi-experimental (one site randomized, four sites controlled before-after)	
Study duration: 12 months	
Sample size: 2325	
Intervention setting: Primary care and community settings	
<b>Dolovich, 2019 → Health TAPESTRY (Health Teams Advancing Patient Experience: STRengthening Quality) intervention</b>	
Country of conduct: Canada	
Study design: Randomized controlled trial	
Study duration: 6 months	
Sample size: 312	
Intervention setting: Participant homes and primary care	

\*Only two of four studies reported on these variables

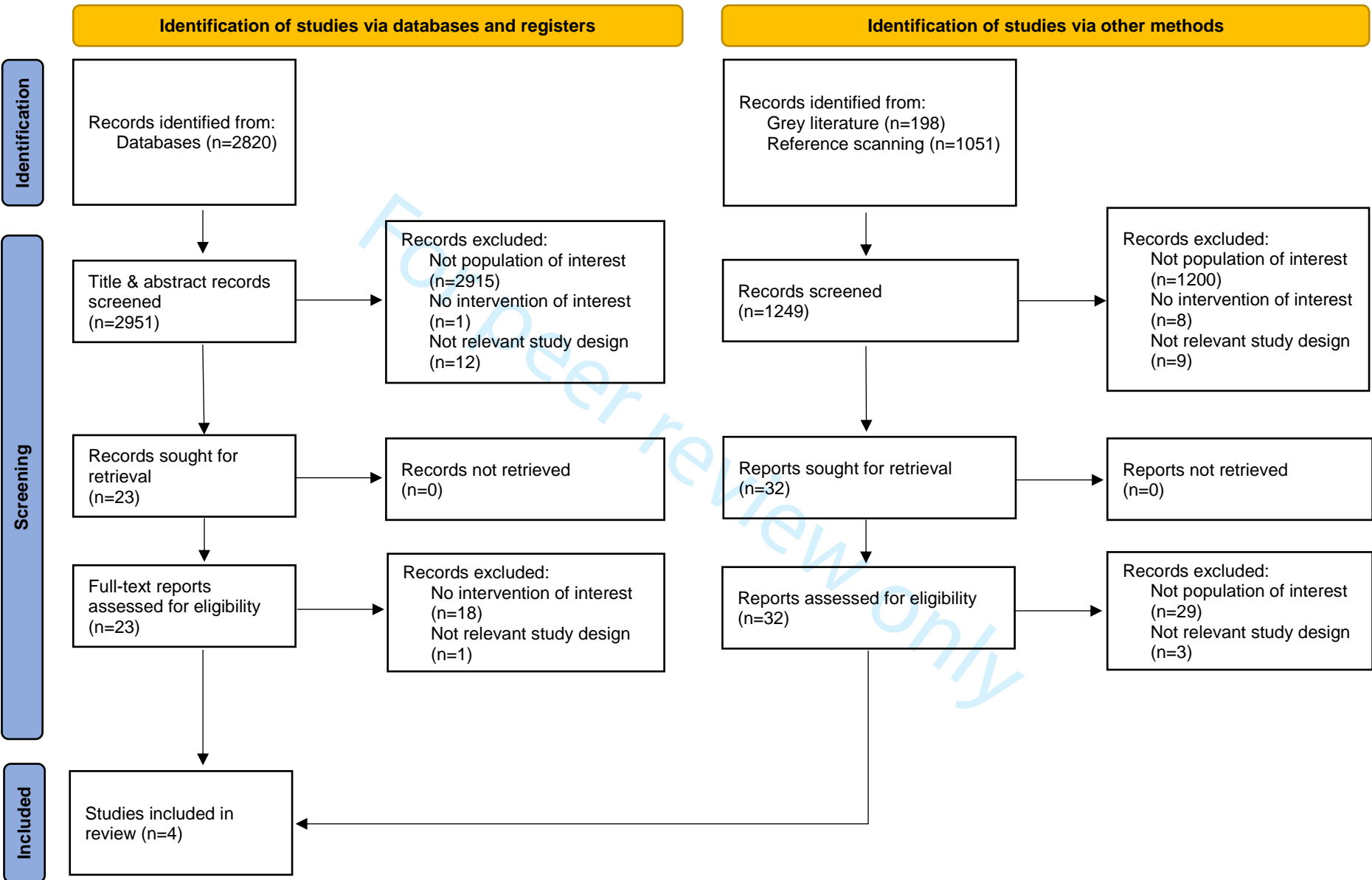
\*\*Only three of four studies reported on this variable

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Figure 1 – PRISMA study flow of included studies (n=4)



## Supplementary File 1: PRISMA Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
<b>TITLE</b>			
Title	1	Identify the report as a systematic review.	1
<b>ABSTRACT</b>			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	3-4
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	5
<b>METHODS</b>			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	6, Table 1
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	6
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Appendix 1
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	6-7
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	7
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	7
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	8
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	N/A
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	8
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	8
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	8



Section and Topic	Item #	Checklist item	Location where item is reported
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	8
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	N/A
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	8
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	N/A
<b>RESULTS</b>			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	9, Figure 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	N/A
Study characteristics	17	Cite each included study and present its characteristics.	9-11, Table 2, Appendix 2
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	9, Appendix 5
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	9-11, Appendix 6
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	N/A
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	N/A
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	N/A
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	N/A
<b>DISCUSSION</b>			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	12-14
	23b	Discuss any limitations of the evidence included in the review.	14
	23c	Discuss any limitations of the review processes used.	14
	23d	Discuss implications of the results for practice, policy, and future research.	13-15
<b>OTHER INFORMATION</b>			

Section and Topic	Item #	Checklist item	Location where item is reported
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	4
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	6
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	14
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	16-17
Competing interests	26	Declare any competing interests of review authors.	17
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	17

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: <http://www.prisma-statement.org/>

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## Appendix 1 – Database Search Strategies

### Ovid MEDLINE(R) ALL <1946 to Feb 25, 2020>

1 Accidental Falls/  
 2 (slip\* or trip\* or stumbl\* or tumbl\*).tw,kf.  
 3 (fall\* or fell or "fall-related" or "near-fall").tw,kf.  
 4 or/1-3  
 5 limit 4 to "all aged (65 and over)"  
 6 exp Aged/ or geriatrics/  
 7 (geriatric\* or elder\* or age\* or "of age" or aging or senior\* or older  
 adult\* or retired or retiree\* or elder\* or pensioner\* or older people or older  
 patient\* or gerontology or Sexagenarian\* or septuagenarian\* or  
 octogenarian or nonagenarian\* or centenarian\* or sixties or seventies or  
 eighties or nineties).tw,kf.  
 8 4 and (6 or 7)  
 9 5 or 8  
 10 Social Isolation/  
 11 loneliness/  
 12 exp social support/  
 13 (social barrier\* or social isolat\* or social support\* or social car\* or  
 psychosocial support\* or psycho-social support\* or social frailt\* or  
 friendship\* or "social\* connected\*" or connectedness or lonely or loneliness  
 or "feel\* alone\*" or companionship).tw,kf.  
 14 ((lack or absence or minimi\*) adj2 (contact or communication or  
 support\*)),tw,kf.  
 15 or/10-14  
 16 9 and 15  
 17 animals/ not humans/  
 18 16 not 17

### PsycINFO <1806 to February Week 4 2020>

1 falls/  
 2 (slip\* or trip\* or stumbl\* or tumbl\*).tw.  
 3 (fall\* or fell or "fall-related" or "near-fall").tw.  
 4 or/1-3  
 5 limit 4 to "380 aged <age 65 yrs and older">  
 6 (geriatric\* or elder\* or age\* or "of age" or aging or senior\* or older  
 adult\* or retired or retiree\* or elder\* or pensioner\* or older people or older

patient\* or gerontology or Sexagenarian\* or septuagenarian\* or  
 octogenarian or nonagenarian\* or centenarian\* or sixties or seventies or  
 eighties or nineties).tw.  
 7 4 and 6  
 8 5 or 7  
 9 social isolation/ or loneliness/ or social support/ or friendship/  
 10 (social barrier\* or social isolat\* or social support\* or social car\* or  
 psychosocial support\* or psycho-social support\* or social frailt\* or  
 friendship\* or "social\* connected\*" or connectedness or lonely or loneliness  
 or "feel\* alone\*" or companionship).tw.  
 11 ((lack or absence or minimi\*) adj2 (contact or communication or  
 support\*)),tw.  
 12 or/9-11  
 13 8 and 12  
 14 Limit 13 to human

### Embase Classic+Embase <1947 to 2020 February 25>

1 falling/  
 2 (slip\* or trip\* or stumbl\* or tumbl\*).tw.  
 3 (fall\* or fell or "fall-related" or "near-fall").tw.  
 4 or/1-3  
 5 limit 4 to aged <65+ years>  
 6 loneliness/ or social support/ or friendship/  
 7 exp social isolation/  
 8 (social barrier\* or social isolat\* or social support\* or social car\* or  
 psychosocial support\* or psycho-social support\* or social frailt\* or  
 friendship\* or "social\* connected\*" or connectedness or lonely or loneliness  
 or "feel\* alone\*" or companionship).tw.  
 9 ((lack or absence or minimi\*) adj2 (contact or communication or  
 support\*)),tw.  
 10 or/6-9  
 11 5 and 10  
 12 limit 11 to human

### Database: EBM Reviews - Cochrane Database of Systematic Reviews <2005 to February 25, 2020>, EBM Reviews - ACP Journal Club <1991

**to February 2020>, EBM Reviews - Cochrane Clinical Answers  
<February 2020>, EBM Reviews - Database of Abstracts of Reviews of  
Effects <1st Quarter 2016>**

- 1 (slip\* or trip\* or stumbl\* or tumbl\*).mp.
- 2 (fall\* or fell or "fall-related" or "near-fall").mp.
- 3 1 or 2
- 4 (geriatric\* or elder\* or age\* or "of age" or aging or senior\* or older adult\* or retired or retiree\* or elder\* or pensioner\* or older people or older patient\* or gerontology or Sexagenarian\* or septuagenarian\* or octogenarian or nonagenarian\* or centenarian\* or sixties or seventies or eighties or nineties).mp.
- 5 3 and 4
- 6 (social barrier\* or social isolat\* or social support\* or social car\* or psychosocial support\* or psycho-social support\* or social frailt\* or friendship\* or "social\* connected\*" or connectedness or lonely or loneliness or "feel\* alone\*" or companionship).mp.
- 7 ((lack or absence or minimi\*) adj2 (contact or communication or support\*)).mp.
- 8 6 or 7
- 9 5 and 8

**Joanna Briggs Institute EBP Database - <Current to February 25,  
2020>**

- 1 (slip\* or trip\* or stumbl\* or tumbl\*).mp.
- 2 (fall\* or fell or "fall-related" or "near-fall").mp.
- 3 1 or 2
- 4 (geriatric\* or elder\* or age\* or "of age" or aging or senior\* or older adult\* or retired or retiree\* or elder\* or pensioner\* or older people or older patient\* or gerontology or Sexagenarian\* or septuagenarian\* or octogenarian or nonagenarian\* or centenarian\* or sixties or seventies or eighties or nineties).mp.
- 5 3 and 4
- 6 (social barrier\* or social isolation\* or social support\* or social car\* or psychosocial support\* or psycho-social support\* or social frailt\* or friendship\* or "social\* connected\*" or connectedness or lonely or loneliness or "feel\* alone\*" or companionship).mp.
- 7 ((lack or absence or minimi\*) adj2 (contact or communication or support\*)).mp.
- 8 6 or 7
- 9 5 and 8

**AMED (Allied and Complementary Medicine) <1985 to February  
2020>**

- 1 (slip\* or trip\* or stumbl\* or tumbl\*).mp.
- 2 (fall\* or fell or "fall-related" or "near-fall").mp.
- 3 1 or 2
- 4 (geriatric\* or elder\* or age\* or "of age" or aging or senior\* or older adult\* or retired or retiree\* or elder\* or pensioner\* or older people or older patient\* or gerontology or Sexagenarian\* or septuagenarian\* or octogenarian or nonagenarian\* or centenarian\* or sixties or seventies or eighties or nineties).mp.
- 5 3 and 4
- 6 (social barrier\* or social isolation\* or social support\* or social car\* or psychosocial support\* or psycho-social support\* or social frailt\* or friendship\* or "social\* connected\*" or connectedness or lonely or loneliness or "feel\* alone\*" or companionship).mp.
- 7 ((lack or absence or minimi\*) adj2 (contact or communication or support\*)).mp.
- 8 6 or 7
- 9 5 and 8

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4 Appendix 2 – Study Characteristics  
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Author, year	Study title	Journal name	Country	Study design	Study duration (months)
Cohen, 2006	The impact of professionally conducted cultural programs on the physical health, mental health, and social functioning of older adults	The Gerontologist	United States	Non-randomized controlled trial	12
Scharlach, 2015	An Integrated Model of Co-ordinated Community-Based Care	The Gerontologist	United States	Uncontrolled before-after study	6
Fransen, 2018	The effectiveness of a coordinated preventive care approach for healthy ageing (UHCE) among older persons in five European cities: A pre-post controlled trial	International Journal of Nursing Studies	United Kingdom, Greece, Croatia, the Netherlands, Spain	Quasi-experimental (one site was randomized, four sites were controlled before-after)	12
Dolovich, 2019	Combining volunteers and primary care teamwork to support health goals and needs of older adults: a pragmatic randomized controlled trial	Canadian Medical Association Journal	Canada	Randomized controlled trial	6

## Appendix 3 – Patient Characteristics

DEMOGRAPHICS								
Author, year	Overall sample size	Overall age value	Overall age type	Overall age variance value	Overall age variance type	% female*		
Cohen, 2006	166	NR (Reported mean age by group: intervention - 79.0 years, comparison - 79.6 years)	NR	NR	NR	NR		
Scharlach, 2015	21	76	median	NR	NR	91		
Franse, 2018	2325	79.5	mean	5.6	SD	60.8		
Dolovich, 2019	312	NR (Reported mean age by group: intervention - 78.1 years, control - 79.1 years)	NR	NR	NR	62.2		
SETTING DATA								
Author, year	Intervention Setting	Participants living alone (%)	Description of access to caregivers				Description of baseline social network	
Cohen, 2006	Community	NR	NR				NR	
Scharlach, 2015	Participant homes and community	67	NR				NR	
Franse, 2018	Primary care and community settings	38.1	Care use i.e., hours per week receiving help in household work due to health problems and hours per week receiving help in caring for oneself was assessed. Hours/wk household help = control: 1.5 (5.3); intervention 1.0 (3.3).				NR	
Dolovich, 2019	Participant homes and primary care	NR	NR				NR	
FALLS AND FRAILTY DATA								
Author, year	Participants with history of falling	List of comorbidities	Participants with frailty (%)	Frailty scale	Overall frailty score	Overall frailty score type	Frailty variance value	Frailty variance type
Cohen, 2006	baseline average falls per person - intervention: 0.40 control: 0.36	NR	NR	NR	NR	NR	NR	NR

Scharlach, 2015	mean of 1.3 falls at baseline	NR	NR	NR	NR	NR	NR	NR
Franse, 2018	30.2% had a fall in the previous year	NR	20.2	Tilburg Frailty indicator (TFI)	5.1	mean	3.2	SD
Dolovich, 2019	9.3% of participants had experienced 1 or more falls	NR	NR	NR	NR	NR	NR	NR

**Abbreviations:** NR, not reported; SD, standard deviation

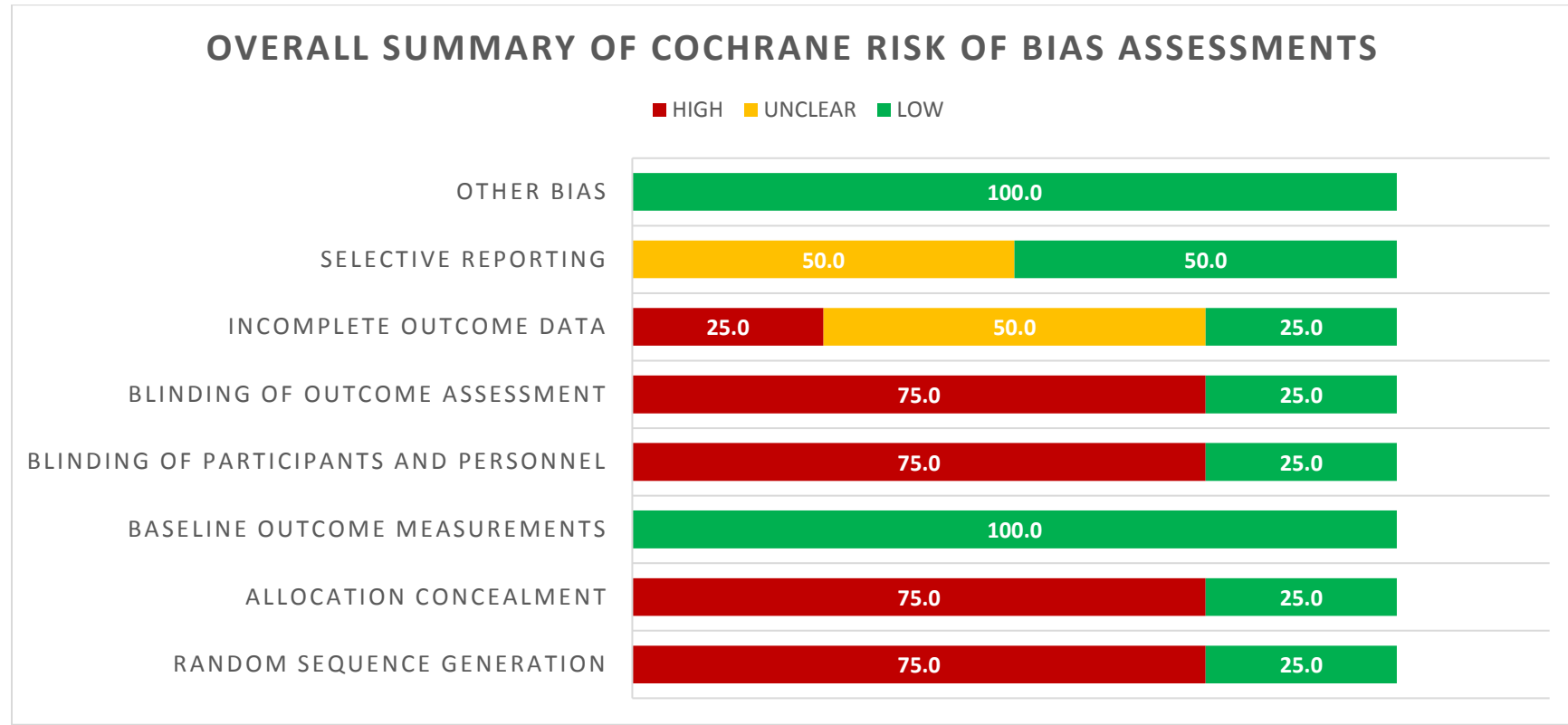
\*No studies reported having individuals who do not identify as female or male

For peer review only



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Appendix 4 – Overall risk of bias across included studies (n=4)



## Appendix 5 – Quality appraisal assessments using Cochrane Risk of Bias tool modified by EPOC

Author, Year	Trial identifier	Random sequence generation	Allocation concealment	Baseline outcome measurements	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias	Funding details:
Cohen, 2006	NR	High risk	High risk	Low risk	High risk	High risk	Unclear risk	Unclear risk	Low risk	National Endowment for the Arts (lead sponsor); Center for Mental Health Services, Substance Abuse and Mental Health Services Administration, Department of Health and Human Services; National Institute of Mental Health, National Institutes of Health; National Retired Teachers Association/AARP; International Foundation for Music Research; Stella and Charles Guttman Foundation, New York City.
Scharlach, 2015	NR	High risk	High risk	High risk	High risk	High risk	Unclear risk	Unclear risk	Low risk	The SCAN Foundation
Franse, 2018	NR	High risk	High risk	Low risk	High risk	High risk	High risk	Low risk	Low risk	European Union, CHAFEA, third Health programme, grant number 20131201
Dolovich, 2019	NCT02283723	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Health Canada (grant no. 6817-06-2013/5570001), Government of Ontario (grant no. 06547 for INSPIRE-PHC), McMaster University & McMaster Family Health Organization

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Appendix 6 – Outcome summary table for included studies (n=4)

Author, Year	Treatment arms	History of falls	Results	Text description of effectiveness
<p>Cohen, 2006</p> <p><i>Design: non-RCT</i></p>	<p><b>Singing in a chorale</b> (n=90) The intervention consisted of participating in a professionally conducted chorale in which there were weekly singing rehearsals for 30 weeks as well as public performances several times during the intervention period.</p> <p><b>Usual activities</b> (n=76) Participants in the comparison group continued their regular activities as usual, with the study introducing no changes other than the assessments.</p>	<p>Baseline average of 0.40 falls per person in the intervention group, and 0.36 per person in the control group in the past 12 months</p>	<p><b>UCLA Loneliness scale III</b> Baseline: 35.1 (SD, 8.1) Follow-up: 34.6 (SD, 7.9)</p> <p>Baseline: 38.3 (SD, 10.1) Follow-up: 37.0 (SD, 10.3)</p>	<p>Both groups evidenced a slight decrease in loneliness at the 12-month follow-up; however, the decrease in loneliness was greater for the intervention group than for the comparison. Analysis of covariance of the 12-month follow-up assessment continued to demonstrate a marginally significant difference between the two groups, <math>F(1,126) = 3.08</math>; <math>p = .08</math>.</p>
<p>Scharlach, 2015</p> <p><i>Design: Uncontrolled before-after</i></p>	<p><b>ElderHelp Concierge Club (CC)</b> (n=21) Integrated community-based care model that includes comprehensive personal and environmental, assessment, multilevel care co-ordination, a mix of professional and volunteer service providers, and a capitated, income-adjusted fee model. When individuals contact CC for information or services, they receive a brief assessment designed to determine their eligibility for CC services, as well as the type of services they appear to need: information and referral services only (Tier 1), transportation services only, or other CC services including in-home assessment by the CC Intake Specialist (Tiers 2 and 3).</p>	<p>Baseline mean of 1.3 falls over the past 6 months</p>	<p><b>Social Isolation (3-item scale)</b> Baseline: 8.7 (SD, 3.2) Follow-up: 7.0 (SD, 3.8)</p> <p><b>Social interaction</b> <i>Interact with friends/relatives weekly</i> Baseline: 76% of participants Follow-up: 100% of participants</p> <p><i>Attend monthly meetings</i> Baseline: 33% of participants Follow-up: 48% of participants</p>	<p>Social isolation did not change significantly; nor did contact with friends and relatives or participation in meetings of organized groups.</p>

<p>Fransé, 2018</p> <p><i>Design: one site randomized, 4 sites controlled before-after design; results combined all sites, so classified as quasi-experimental</i></p>	<p><b>Urban Health Centres Europe (UHCE) approach</b> (n=986) Preventive multidimensional health assessment and if person at risk, coordinated care pathways targeted at fall risk, appropriate medication use, loneliness and frailty</p> <p><b>Usual Care</b> (n=858) Usual care included access to their GP</p>	<p>30.2% of participants experienced a fall in the previous year</p>	<p><b>Loneliness (short JG scale)</b> Baseline: 0.6 (SD, 0.7) Follow-up: 0.6 (SD, 0.7)</p> <p>Baseline: 0.6 (SD, 0.7) Follow-up: 0.7 (SD, 0.7)</p>	<p>When comparing persons who enrolled in any type of care-pathway with all persons in the control group there was a positive effect on loneliness after adjusting for city clustering, age, gender, living situation, education, and baseline status of outcome (B= -0.18, 95% CI= -0.35 to -0.02).</p>
<p>Dolovich, 2019</p> <p><i>Design: RCT</i></p>	<p><b>Health TAPESTRY (Health Teams Advancing Patient Experience: STREngthening Quality) intervention</b> (n=158) Trained community volunteers visited patients to collect information on their life and health goals, risks and needs, daily life activities and general health, using structured surveys and unstructured narratives. The volunteers sent a report summarizing patients' goals, alerts, key issues and observations to the primary care interprofessional "huddle" team at the clinics. These interprofessional teams reviewed the reports and then generated, prioritized and acted upon plans of care for how the team, community agencies and volunteers could address clients' goals and health issues, with iterative follow-up</p> <p><b>Usual Care</b> (n=154) The control group received usual care and did not have volunteer visits. There was no restriction on receiving care from the same team members as the intervention group</p>	<p>9.3% of participants experienced 1 or more falls</p>	<p><b>Social network score (DSSI-10)</b> Baseline: Mean, 8.84 (SD, 1.52) Follow-up: Mean, 8.75 (SD, 1.52)</p> <p><b>Social satisfaction score (DSSI-10)</b> Baseline: Mean, 18.89 (SD, 2.41) Follow-up: Mean, 18.96 (SD, 2.87)</p> <p><b>Social network score (DSSI-10)</b> Baseline: Mean, 8.74 (SD, 1.61) Follow-up: Mean, 8.69 (SD, 1.53)</p> <p><b>Social satisfaction score (DSSI-10)</b> Baseline: Mean, 19.19 (SD, 2.37) Follow-up: Mean, 19.04 (SD, 2.76)</p>	<p>There were no statistically significant between-group differences in participant ratings of self-efficacy, quality of life, optimal aging, social support</p>

# BMJ Open

## Interventions for social isolation in older adults who have experienced a fall: A systematic review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-056540.R2
Article Type:	Original research
Date Submitted by the Author:	08-Feb-2022
Complete List of Authors:	Tricco, Andrea; St Michael's Hospital Li Ka Shing Knowledge Institute, Knowledge Translation Program; University of Toronto Dalla Lana School of Public Health, Epidemiology Division and Institute for Health, Management, and Evaluation Thomas, Sonia; St Michael's Hospital Li Ka Shing Knowledge Institute, Knowledge Translation Program Radhakrishnan, Amruta; St Michael's Hospital Li Ka Shing Knowledge Institute, Knowledge Translation Program Ramkissoon, Naveeta; St Michael's Hospital Li Ka Shing Knowledge Institute, Knowledge Translation Program Mitchell, Gary; Queen's University Belfast, Fortune, Jennifer; RCSI University of Medicine and Health Sciences, Department of Public Health and Epidemiology Jiang, Ying; Public Health Agency of Canada, Applied Research Division de Groh, Margaret; Public Health Agency of Canada, Applied Research Division Anderson, Kerry; Public Health Agency of Canada, Centre for Health Promotion Barker, Joan; St Michael's Hospital Li Ka Shing Knowledge Institute, Knowledge Translation Program Gauthier-Beaupré, Amélie; Public Health Agency of Canada, Centre for Health Promotion; University of Ottawa, Faculty of Health Sciences Watt, Jennifer; St Michael's Hospital Li Ka Shing Knowledge Institute, Knowledge Translation Program; University of Toronto Faculty of Medicine, Department of Geriatric Medicine Straus, Sharon; St Michael's Hospital Li Ka Shing Knowledge Institute, Knowledge Translation Program; University of Toronto Faculty of Medicine, Department of Geriatric Medicine
<b>Primary Subject Heading</b>:	Geriatric medicine
Secondary Subject Heading:	Rehabilitation medicine
Keywords:	REHABILITATION MEDICINE, GERIATRIC MEDICINE, PREVENTIVE MEDICINE

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3 **1 Interventions for social isolation in older adults who have experienced a fall:**

4  
5 **2 A systematic review**

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1  
2  
3 34 **ABSTRACT**  
4

5 35 **Objectives:** The objective of our systematic review was to identify effective interventions to  
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7  
8 36 prevent or mitigate social isolation and/or loneliness in older adults who experienced a fall.  
9

10 37 **Design:** Systematic review  
11

12 38 **Data Sources:** MEDLINE, Embase, the Cochrane Central Register of Controlled Trials, and  
13  
14  
15 39 Ageline were searched (inception to February 2020).  
16

17 40 **Methods:** Studies were eligible if they described any intervention for social isolation in older  
18  
19  
20  
21  
22 41 adults living in a community setting who experienced a fall, and reported outcomes related to  
23  
24 42 social isolation or loneliness.

25  
26 43 Two independent reviewers screened citations, abstracted data, and appraised risk of bias using  
27  
28 44 the Cochrane risk-of-bias tool. The results were summarized descriptively.

29 45 **Results:** After screening 4,069 citations and 55 full-text articles, 4 studies were included. The  
30  
31 46 four studies varied in study design, including a randomized controlled trial, non-randomized  
32  
33 47 controlled trial, an uncontrolled before-after study, and a quasi-experimental study. Interventions  
34  
35 48 varied widely, and included singing in a choir, a patient-centred, interprofessional primary care  
36  
37 49 team-based approach, a multifactorial assessment targeting fall risk, appropriate medication use,  
38  
39  
40 50 loneliness and frailty, and a community-based care model that included comprehensive  
41  
42 51 assessments and multilevel care coordination. Outcome measures varied and included scales for  
43  
44 52 loneliness, social isolation, social interaction, social networks, and social satisfaction. Mixed  
45  
46 53 results were found, with three studies reporting no differences in social isolation or loneliness  
47  
48  
49 54 after the intervention. Only the multifactorial assessment intervention demonstrated a small  
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51 55 positive effect on loneliness compared to the control group after adjustment (B= -0.18, 95% CI=  
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54 56 -0.35 to -0.02).  
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3 57 **Conclusions:** Few studies examined interventions for social isolation or loneliness in older  
4  
5 58 adults who experienced a fall. More research is warranted in this area.  
6

7  
8 59 **Systematic Review Registration:** PROSPERO (CRD42020198487)  
9

10 60 **Word count:** 266 (abstract), 3055 (main text)  
11

12 61 **Keywords:** systematic review, older adults, falling, social isolation, loneliness, interventions  
13

14  
15 62 **Strengths and limitations of this study:**  
16

- 17 63 • We conducted a comprehensive search of 4 databases, using a search strategy which was  
18  
19 64 peer-reviewed by a second librarian, and supplemented this by searching grey literature  
20  
21 65 and scanning references of included studies and relevant reviews.  
22  
23  
24 66 • We followed the methodology outlined by the Cochrane Handbook, with screening, data  
25  
26 67 abstraction, and risk of bias appraisal being conducted in duplicate by independent  
27  
28 68 reviewers, and our findings were reported using the PRISMA-2020 checklist.  
29  
30  
31 69 • We deviated from our protocol slightly due to the limited of data on older adults in a  
32  
33 70 community setting who had experienced a fall and expanded our inclusion criteria to  
34  
35 71 include studies where some participants (not all) had a history of falling.  
36  
37  
38 72 • Our included studies were plagued by risk of bias across several components, including  
39  
40 73 poor allocation concealment, lack of random sequence generation, and a lack of blinding  
41  
42 74 of participants, personnel, and outcome assessors.  
43  
44  
45 75 • A lack of standardization was observed across the outcomes assessed in the included  
46  
47 76 studies, due to lack of consensus on measures for social isolation and loneliness.  
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## 77 INTRODUCTION

78 Worldwide, more than 37 million falls occur requiring medical attention every year(1). Almost  
79 650,000 people die every year from a fall, with those aged 65 years and older experiencing the  
80 greatest number of fatal falls(1). Falls are associated with considerable negative outcomes on  
81 older adults, such as physical inactivity, anxiety, depressive symptoms, and fear of falling(2, 3).

82 Social isolation is a serious consequence among older adults who have experienced a  
83 fall(4). Social isolation is a complex phenomenon that can be characterized by five key  
84 attributes: decreased number of social contacts, decreased feeling of belonging, reduced or lack  
85 of fulfilling relationships, decreased engagement with others, and reduced quality of the  
86 members in one's network(5). Loneliness is another consequence that may occur after a fall and  
87 can be defined as "the unpleasant experience that occurs when a person's network of social  
88 relations is deficient in some way, either quantitatively or qualitatively"(6). Some research has  
89 focused on the risk of social isolation and loneliness after experiencing a fall, since people who  
90 have experienced a fall are less likely to continue their activities of daily living(4). For example,  
91 one study reported a statistically significant relationship between feelings of loneliness and social  
92 exclusion after experiencing a fall(4).

93 Although social isolation and loneliness are related, it is important to note that they are  
94 two distinct concepts(7). Social isolation is more objective, as it can be measured by examining  
95 the presence or absence of relationships with other people, whereas loneliness is a person's  
96 subjective experience and is more difficult to measure. This distinction is important, as different  
97 interventions might be required for each of these outcomes after experiencing a fall.

98 Social isolation and loneliness among older adults is associated with many adverse health  
99 outcomes, including cognitive decline, depression, anxiety, and dementia(8). Interventions to

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2  
3 100 mitigate social isolation and loneliness after older adults experience a fall is of paramount  
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5 101 importance. Examples of interventions may include participating in social activities, outreach  
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7 102 calls from peers or healthcare workers, and group exercise. We are unaware of a previous  
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9 103 systematic review that examined this important issue. As such, the objective of our systematic  
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11 104 review was to identify effective interventions to mitigate social isolation and loneliness in older  
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13 105 adults who lived independently in a community setting with a history of falling.  
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## 18 106 **METHODS**

### 19 20 107 Protocol

21  
22 108 The protocol for this systematic review was developed in accordance with the Preferred  
23  
24 109 Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) checklist,  
25  
26 110 with consultation from knowledge users from the Public Health Agency of Canada who  
27  
28 111 commissioned this work and clinical experts on the team and was registered on PROSPERO  
29  
30 112 (CRD42020198487). This systematic review was conducted according to methodology outlined  
31  
32 113 in the Cochrane Handbook(9), and the PRISMA checklist (Supplementary File 1) was used to  
33  
34 114 guide the reporting of our results(10).  
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### 38 39 115 Search strategy and selection criteria

40  
41 116 A comprehensive literature search strategy was developed by an experienced information  
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43 117 specialist and peer-reviewed by a second information specialist using the Peer Review of  
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45 118 Electronic Search Strategies (PRESS) checklist(11). MEDLINE, Embase, the Cochrane Central  
46  
47 119 Register of Controlled Trials, and Ageline were searched from inception until February 25, 2020  
48  
49 120 (Appendix 1). The reference lists of included studies and relevant reviews were also scanned. A  
50  
51 121 search for grey literature was conducted using the Canadian Agency for Drugs and Technologies  
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53 122 in Health (CADTH)'s Grey Matters checklist(12).  
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3 123 Our eligibility criteria are summarized in Table 1. Studies were eligible for inclusion if  
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5 124 they described any intervention for social isolation or feelings of loneliness in older adults (mean  
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8 125 age 65 years and older) with any participant reporting a history of falling (i.e., regardless of the  
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10 126 proportion of the sample who fell). The knowledge users from the Public Health Agency of  
11  
12 127 Canada requested that we focus this systematic review on participants who lived independently  
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14 128 in a community setting. Eligible study designs included randomized controlled trials (RCTs),  
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16 129 cohort studies, case control studies, non-randomized controlled trials, quasi-experimental studies,  
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18 130 interrupted time series or controlled/uncontrolled before after studies. Case reports, case series,  
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20 131 cross-sectional studies, qualitative studies, and reviews were not eligible for inclusion. Outcomes  
21  
22 132 of interest included any changes in social isolation or loneliness as measured using validated  
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24 133 scales, such as the De Jong Gierveld loneliness scale(13) and the Bude & Lantermann scale for  
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26 134 social exclusion(14), or any other quantitative measure of social isolation or loneliness. Social  
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28 135 isolation was defined as a decrease in the number of social contacts, decreased feeling of  
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31 136 belonging, reduced or lack of fulfilling relationships, decreased engagement with others, and  
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33 137 reduced quality of the members in one's network(5). Loneliness was defined as "the unpleasant  
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36 138 experience that occurs when a person's network of social relations is deficient in some way,  
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38  
39 139 either quantitatively or qualitatively(6).

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41  
42 140 All citations were screened by two independent reviewers who worked in pairs after the  
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44 141 entire team completed a training exercise on 50 citations and 78% agreement was achieved. Full-  
45  
46 142 text screening by two independent reviewers who worked in pairs began after a training exercise  
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48 143 on 22 articles amongst the team with an agreement of 75%. Discrepancies for both levels of  
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50 144 screening were resolved by a third reviewer or through discussion.

#### 51 52 53 145 Data abstraction and risk of bias appraisal

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3 146 Data abstraction and risk of bias appraisal were also conducted independently by pairs of  
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5 147 reviewers who worked in pairs after a training pilot exercise reached sufficient agreement, and  
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7 148 discrepancies were resolved by a third reviewer. The risk of bias appraisal was conducted using  
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9 149 the Cochrane Effective Practice and Organisation of Care (EPOC) risk of bias tool, as it was  
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11 150 expected that a mixture of study designs would be included(15).  
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### 14 151 Synthesis

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17 152 The findings of this review were summarized descriptively, reporting study and patient  
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19 153 characteristics, quality appraisal assessment, and intervention details. As outlined in our review  
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21 154 protocol, we planned to conduct a meta-analysis if more than one study evaluated the same  
22  
23 155 intervention, and a network meta-analysis for connected networks of trials with pre-specified  
24  
25 156 intervention nodes if over 10 trials were available and the number of trials was greater than the  
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27 157 number of interventions. However, as these conditions were not met, no statistical analyses were  
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29 158 conducted.  
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### 34 159 Patient and Public Involvement

35  
36  
37 160 A patient partner with previous experience of a fall was identified and involved in this study  
38  
39 161 from the protocol development stage. The patient partner provided input on our research question  
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41 162 and outcome measures to ensure that the patient perspective was incorporated. They also  
42  
43 163 participated in the screening training exercises for citations and full-text articles, provided  
44  
45 164 feedback on screening eligibility criteria, and reviewed the manuscript as a coauthor.  
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## 50 165 **RESULTS**

### 51 52 166 Study flow 53 54 55 56 57 58 59 60

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3 167 After screening 4,069 citations and 55 full-text articles against our eligibility criteria, 4  
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5 168 studies(16-18) met the eligibility criteria and were included in this review (Figure 1).  
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8 169 Study and patient characteristics  
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10 170 Study and patient characteristics are summarized in Table 2 and detailed characteristics are  
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12 171 reported in Appendices 1 and 2. The mean age of participants across included studies was 77.8  
13  
14 172 years (range: 76 to 79.5 years). Three of the included studies were conducted in North America  
15  
16 173 (75.0%) and one in Europe (25.0%) and they were conducted in a variety of settings including  
17  
18 174 the community setting, a combination of participant homes and community setting, a  
19  
20 175 combination of primary care and community setting, or a combination of participant homes and  
21  
22 176 primary care. Only one study provided data on frailty of the included participants, reporting  
23  
24 177 20.2% of participants with frailty (Appendix 2). The four studies varied in study design,  
25  
26 178 including a randomized controlled trial, a non-randomized controlled trial, an uncontrolled  
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28 179 before-after study, and a quasi-experimental study in which data from one randomized site was  
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31 180 combined with data from four controlled before-after sites. Two of the studies had a study  
32  
33 181 duration of 12 months, and the other two had a duration of 6 months. The sample size in the  
34  
35 182 studies ranged from 21 to 2325 and, on average, 71.3% of participants were female.  
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40 183 Risk of bias results  
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42 184 An overall summary of risk of bias across the four studies can be found in Appendix 3, and  
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44 185 detailed risk of bias assessments can be found in Appendix 4. All studies had low risk of bias for  
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46 186 baseline outcome measurements (100% low, 0% unclear, 0% high), and other bias (mainly  
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48 187 funding bias; 100% low, 0% unclear, 0% high). Two of the studies had low risk and two had  
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50 188 unclear risk of bias for selective reporting (50% low, 50% unclear, 0% high). One study had high  
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52 189 risk, two studies unclear risk, and one had low risk of bias for incomplete outcome data (25%  
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3 190 low, 50% unclear, 25% high). However, three of four studies had high risk of bias for blinding of  
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5 191 outcome assessment (25% low, 0% unclear, 75% high), blinding of participants and personnel  
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7 192 (25% low, 0% unclear, 75% high), random sequence generation (25% low, 0% unclear, 75%  
8  
9 193 high), and allocation concealment (25% low, 0% unclear, 75% high).

#### 12 194 Outcome results

14 195 The relevant findings from the four included studies are summarized in Appendix 6.  
15  
16 196 Cohen et al. (2006) conducted a non-randomized controlled trial in the United States assessing  
17  
18 197 the effects of singing in a chorale to reduce loneliness compared to usual care in 166 older adults.  
19  
20 198 The chorale intervention involved attendance at weekly singing rehearsals and several public  
21  
22 199 performances, while the usual care group continued their usual activities. Both groups had a  
23  
24 200 similar baseline history of falling over the past 12 months (average of 0.40 falls per person in the  
25  
26 201 intervention group, and 0.36 per person in the control group). After 12 months of follow-up, they  
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28 202 noted a reduction in loneliness (as measured using the UCLA Loneliness Scale-III) in both  
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30 203 groups (chorale: baseline mean: 35.1 (SD, 8.1) and follow-up mean: 34.6 (SD, 7.9); usual care:  
31  
32 204 baseline mean: 38.3 (SD, 10.1) and follow-up mean: 37.0 (SD, 10.3). While the chorale  
33  
34 205 intervention reported lower loneliness scores than the usual care group after 12 months of  
35  
36 206 follow-up, no statistically significant difference was observed ( $F(1,126) = 3.08; p = 0.08$ ).

37  
38 207 Scharlach et al. (2015) conducted an uncontrolled before-after study in the United States  
39  
40 208 assessing the effectiveness of their ElderHelp Concierge Club intervention on social isolation in  
41  
42 209 a sample of 21 participants(17). The Concierge Club intervention was a community-based care  
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44 210 model that provided different tiers of services to their members including information and  
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46 211 referrals, transportation, or in-house assessments. The baseline mean number of falls over the  
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48 212 past 6 months was 1.3. They noted that social isolation, as measured using an unnamed 3-item  
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3 213 scale(19), did not change significantly after 6 months of follow-up (baseline mean: 8.7 (SD, 3.2)  
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5 214 and follow-up mean: 7.0 (SD, 3.8)). Similarly, although all participants reported having contact  
6  
7 215 with friends/relatives after the intervention, this was not found to be a significant change from  
8  
9 216 baseline (baseline: 76% of participants, follow-up: 100% of participants).

12 217 Franse et al. (2018) conducted a quasi-experimental study comparing the effectiveness of  
13  
14 218 the Urban Health Centres Europe (UHCE) approach compared to usual care on loneliness in a  
15  
16 219 sample of 1,844 older adults across the United Kingdom, Greece, Croatia, the Netherlands, and  
17  
18 220 Spain(18). The UHCE approach involved a preventative multidimensional health assessment,  
19  
20 221 which informed the coordination of specific care pathways targeting the individual's needs (such  
21  
22 222 as fall risk, appropriate medication use, loneliness, and frailty). The usual care group received  
23  
24 223 their usual care and had access to any already existing services. At baseline, 30.2% of  
25  
26 224 participants reported having experienced a fall in the past 12 months. Their adjusted analysis  
27  
28 225 found a small positive effect of the UHCE approach on loneliness, as measured using the short  
29  
30 226 De Jong Gierveld Loneliness scale(20), when compared to usual care (B= -0.18, 95% CI= -0.35  
31  
32 227 to -0.02).

37 228 Dolovich et al. (2019) conducted a randomized controlled trial comparing the  
38  
39 229 effectiveness of the Health TAPESTRY (Health Teams Advancing Patient Experience:  
40  
41 230 STRengthening qualitY) intervention compared to usual care on social isolation in a sample of  
42  
43 231 312 older adults in Canada(21). This intervention involved the collection of information on  
44  
45 232 patients' health goals and needs by trained volunteers, who then summarized these findings in a  
46  
47 233 report for the interprofessional primary care team. The primary care team used these reports to  
48  
49 234 generate and act on plans of care for how the team, community agencies, and volunteers could  
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51 235 help address each patient's goals. The control group received usual care. Approximately 9.3% of  
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3 236 participants reported experiencing at least one fall. After 6 months of follow-up, they found no  
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5 237 statistically significant difference between the intervention and control groups in terms of their  
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8 238 social network scores (mean difference, 0.038 (95% CI: -0.25 to 0.33) and social satisfaction  
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10 239 scores (mean difference, 0.102 (95% CI, -0.35 to 0.55), as measured using the Duke Social  
11  
12 240 Support Index(22).

## 15 241 **DISCUSSION**

16  
17  
18 242 We conducted a comprehensive systematic review of interventions to mitigate social isolation  
19  
20 243 and loneliness in older adults living independently in a community setting who experienced a  
21  
22 244 fall. Very few studies were identified that fulfilled our eligibility criteria, indicating a dearth of  
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24  
25 245 evidence on this important topic. Only 4 studies were included and as each examined different  
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27 246 types of interventions, this precluded any statistical pooling of results. Furthermore, studies  
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29 247 varied on the proportion of participants who reported experiencing a fall and multiple types of  
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32 248 outcomes were assessed for loneliness and social isolation, making it challenging to provide any  
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34 249 meaningful interpretation of results.

35  
36 250       Across the four studies in this systematic review, only the quasi-experimental study by  
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38  
39 251 Franse et al. (2018)(18), which assessed the impact of multifactorial health assessments and  
40  
41 252 coordinated care pathways targeting fall risk, medication use, loneliness and frailty, found a  
42  
43 253 small positive effect on loneliness (i.e. reduction) when comparing those that received the  
44  
45 254 intervention with the control group. However, given the paucity of data in older adults with a  
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47  
48 255 history of falling, the most effective intervention for preventing or reducing social isolation  
49  
50 256 remains unclear. Only one randomized controlled trial was identified in this review, highlighting  
51  
52 257 the need for more robust research in this important area.

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2  
3 258 We searched for previous reviews that were related and only one was identified. Gardiner  
4  
5 259 et al. (2016) conducted an integrative review on interventions for social isolation in older  
6  
7 260 adults(23). While this review was not specific to individuals who had experienced a fall, it  
8  
9 261 discusses characteristics of effective social isolation interventions in the broader older adult  
10  
11 262 population and could be applicable to the subset of this population that experiences falling.  
12  
13 263 While the majority of interventions they identified showed at least a moderate positive effect on  
14  
15 264 social isolation or loneliness, they noted that the quality of the evidence was poor, making it  
16  
17 265 difficult to identify a particular intervention as most effective(23). This is consistent with our  
18  
19 266 determination of the need for more robust research on the effectiveness of social isolation  
20  
21 267 interventions in older adults with a history of falling. They identified adaptability to local  
22  
23 268 contexts, community participation in the design and implementation of the intervention, and  
24  
25 269 productive engagement (as opposed to passive activities) as common features among successful  
26  
27 270 interventions(23). Future studies should consider these factors in the development and evaluation  
28  
29 271 of interventions for social isolation. Finally, we focused on the community setting at the request  
30  
31 272 of the Public Health Agency of Canada who felt that these results were most relevant to their  
32  
33 273 decision-making needs.  
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40 274 Across our included studies, all four interventions appeared to be adapted to their local  
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42 275 contexts. The UHCE approach by Franse et al. (2018) and the Health TAPESTRY intervention  
43  
44 276 by Dolovich et al. (2019) also involved strong community participation by tailoring their  
45  
46 277 intervention to each participant's health care needs, however it is unclear whether the subsequent  
47  
48 278 care pathways or plans allowed for productive engagement. Cohen et al. (2006)'s chorale  
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50 279 intervention provided productive engagement to participants but may have benefited from further  
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52 280 community participation in the implementation of the intervention.  
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3 281           There are many strengths to our systematic review. Our search strategy was peer-  
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5 282 reviewed by a second librarian and was comprehensive through the inclusion of four databases,  
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7 283 searching grey literature and scanning references of included studies and relevant reviews. Our  
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9 284 methodology was informed by the Cochrane Handbook(9), with screening, data abstraction, and  
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11 285 risk of bias appraisal being conducted in duplicate by independent reviewers, and our findings  
12  
13 286 were reported using PRISMA-2020(10). However, there are some limitations. We deviated from  
14  
15 287 our protocol slightly to allow for inclusion of studies where only some participants had a history  
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17 288 of falling, given the paucity of data on older adults in a community setting who had experienced  
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19 289 a fall. We were unable to update our literature search due to a lack of sufficient funding. Further,  
20  
21 290 studies were plagued by risk of bias across several components, including to risk of bias from  
22  
23 291 poor allocation concealment, lack of random sequence generation, and a lack of blinding of  
24  
25 292 participants, personnel, and outcome assessors. A lack of standardization was observed across  
26  
27 293 the outcomes assessed in the included studies, suggesting that future work could focus on  
28  
29 294 developing consensus on measures for social isolation and loneliness that have already been  
30  
31 295 validated to establish a core outcomes dataset. Indeed, a study by Cornwell et al. (2009)  
32  
33 296 highlights the wide variation in indicators for isolation and loneliness and proposed combining  
34  
35 297 these varying indicators to develop two parsimonious scales to measure social disconnectedness  
36  
37 298 and perceived isolation (24), however, these scales were not used by the included studies here.  
38  
39 299 Furthermore, additional examination of tailoring interventions to reduce loneliness and/or social  
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41 300 isolation is warranted, as there was a dearth of included studies to examine this fully in this  
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43 301 systematic review with two studies each focusing on social isolation and loneliness separately.  
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45 302 Further research is warranted on this, as social isolation and loneliness are distinct concepts and  
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3 303 different interventions may be required to target each outcome separately. Finally, we focused  
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5 304 our review on the community setting, at the request of the  
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8 305 We recommend updating this systematic review as more literature becomes available on  
9  
10 306 this topic. Effective interventions are necessary to support older people who are at increased risk  
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12 307 of social isolation, particularly after experiencing a fall. In addition, further work is required to  
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14 308 examine the relationship between social isolation, loneliness, and falling, and whether other  
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16 309 variables influence this relationship, as this may warrant different intervention approaches.  
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19 310 In conclusion, we identified four studies examining interventions for social isolation  
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21 311 amongst older adults with a history of falling. The interventions examined varied widely, from  
22  
23 312 singing in a chorale to community-base care coordination, as did the outcome measures used to  
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25 313 assess the effectiveness of the interventions. We identified only one quasi-experimental study  
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27 314 which demonstrated that multifactorial health assessments and coordinated care pathways  
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29 315 resulted in a small positive effect on loneliness in this population. Future research is warranted in  
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31 316 this under-studied area.  
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3 317 **LIST OF ABBREVIATIONS**  
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5 318 CADTH Canadian Agency for Drugs and Technologies in Health  
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7 319 CI Confidence interval  
8  
9 320 EPOC Effective Practice and Organisation of Care  
10  
11 321 IQR Interquartile range  
12  
13 322 PRESS Peer Review of Electronic Search Strategies  
14  
15 323 PRISMA Preferred Reporting Items for Systematic Reviews and Meta-Analyses  
16  
17 324 RCT Randomized controlled trial  
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19 325 SD Standard deviation  
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26

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3 340 Ethics approval

4  
5 341 Not required.

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7  
8 342 Consent for publication

9  
10 343 Not applicable.

11  
12 344 Author Contribution

13  
14 345 Substantial contributions to the conception or design of the work (ACT, SMT, JW, SES);

15  
16 346 acquisition, analysis, or interpretation of data for the work (all authors); drafting the work (ACT,

17  
18 347 SMT) or revising it critically for important intellectual content (AR, NR, GM, JF, YJ, MdG, KA,

19  
20 348 JB, AG-B, JW, SES); final approval of the version to be published (all authors); agreement to be

21  
22 349 accountable for all aspects of the work in ensuring that questions related to the accuracy or

23  
24 350 integrity of any part of the work are appropriately investigated and resolved (all authors)

25  
26 351 Availability of data and materials

27  
28 352 The full dataset is available from the corresponding author upon reasonable request.

29  
30 353 Conflict of interests

31  
32 354 All authors do not have any potential (or perceived) conflicts of interest.

33  
34 355 Role of the funder

35  
36 356 The funder had no role in the design and conduct of the study; collection, management, analysis,

37  
38 357 and interpretation of the data; preparation, review, or approval of the manuscript; or decision to

39  
40 358 submit the manuscript for publication.

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42 359 **SUPPLEMENTAL FILES**

43  
44 360 Supplemental File 1: PRISMA Checklist

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46 361 Supplemental File 2: Appendices

47  
48 362 **FIGURES**



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3 363 Figure 1 – PRISMA study flow of included studies (n=4)  
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For peer review only

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3 **TABLES**  
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5 Table 1 – Screening Eligibility Criteria  
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8 Population	Older adults (mean age 65 years and older) living independently in a community setting with any participant reporting a history of falling (i.e., regardless of the proportion of the sample who fell)
9 Intervention	Any intervention for social isolation or loneliness
10 Comparator	Usual care or another intervention for social isolation or loneliness
11 Outcomes	Any quantitative measures of changes in social isolation or loneliness Ex: the quantity of social interactions, Lubben Social Network Scale for social isolation, De Jong Gierveld Loneliness Scale, Bude & Lantermann scale for social exclusion, etc.
12 Study designs	Randomized controlled trial (RCT), non-RCT, quasi-experimental, interrupted time series, controlled or uncontrolled before-after, case control studies, cohort studies
13 Time	No time restrictions

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Table 2 – Study and Patient Characteristics

<b>Summary characteristics</b>	
Mean age (range)	77.8 (76 to 79.6)*
Mean % of female participants (range)	71.3 (60.8 to 91)**
Mean sample size (range)	837.3 (21 to 2325)
Mean % of participants living alone (range)	52.6 (38.1 to 67)*
Mean % of participants with history of falling (range)	19.6 (9.3 to 30.2)*
<b>Individual study details</b>	
<b>Cohen, 2006 → Chorale intervention</b>	
Country of conduct: United States	
Study design: Non-randomized controlled trial	
Study duration: 12 months	
Sample size: 166	
Intervention setting: Community	
<b>Scharlach, 2015 → ElderHelp Concierge Club (CC) intervention</b>	
Country of conduct: United States	
Study design: Uncontrolled before-after study	
Study duration: 6 months	
Sample size: 21	
Intervention setting: Participant homes and community	
<b>Franse, 2018 → Urban Health Centres Europe (UHCE) approach</b>	
Country of conduct: United Kingdom, Greece, Croatia, the Netherlands, Spain	
Study design: Quasi-experimental (one site randomized, four sites controlled before-after)	
Study duration: 12 months	
Sample size: 2325	
Intervention setting: Primary care and community settings	
<b>Dolovich, 2019 → Health TAPESTRY (Health Teams Advancing Patient Experience: STRengthening Quality) intervention</b>	
Country of conduct: Canada	
Study design: Randomized controlled trial	
Study duration: 6 months	
Sample size: 312	
Intervention setting: Participant homes and primary care	

\*Only two of four studies reported on these variables

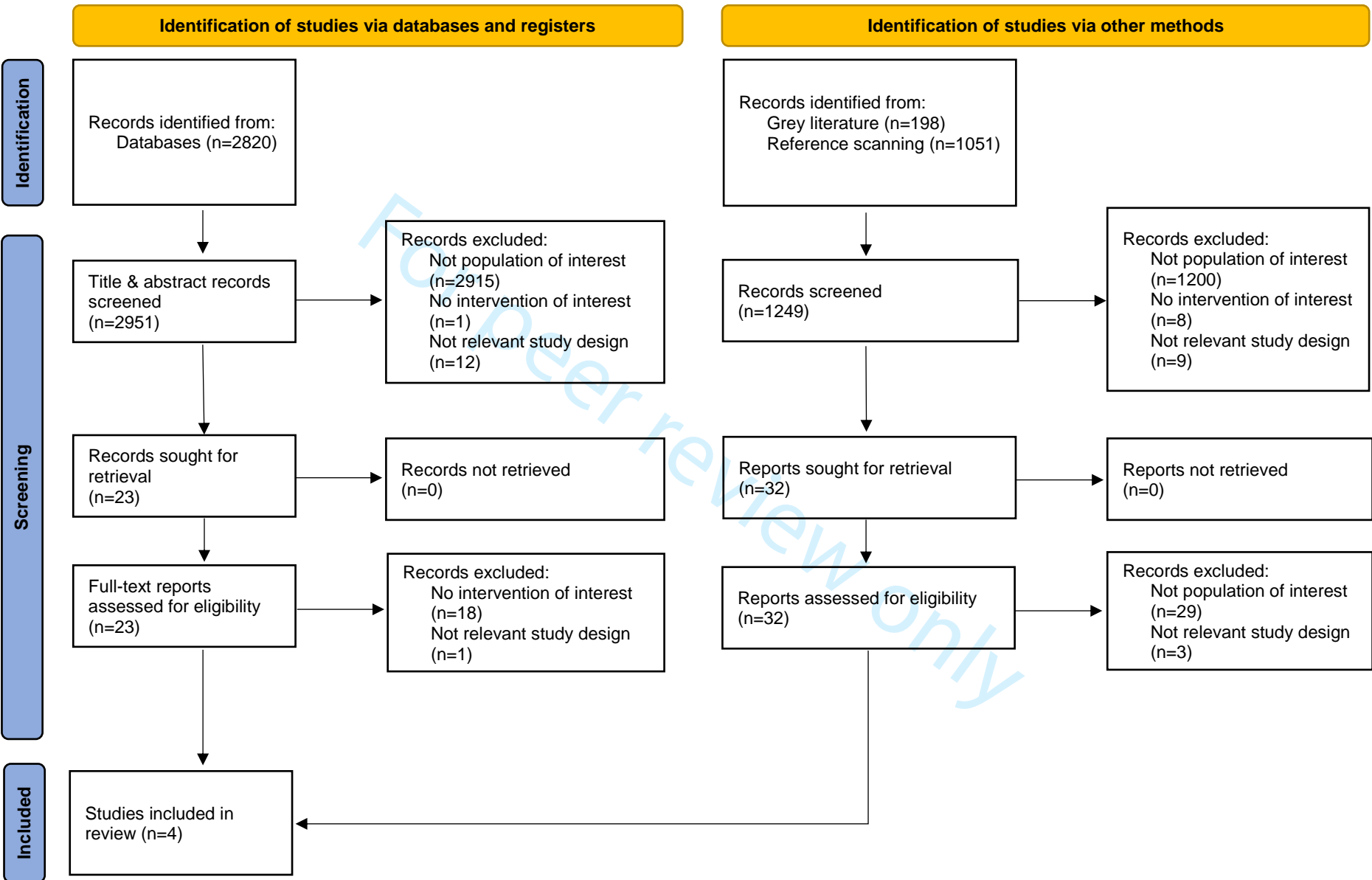
\*\*Only three of four studies reported on this variable

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Figure 1 – PRISMA study flow of included studies (n=4)



## Supplementary File 1: PRISMA Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
<b>TITLE</b>			
Title	1	Identify the report as a systematic review.	1
<b>ABSTRACT</b>			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	3-4
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	5
<b>METHODS</b>			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	6, Table 1
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	6
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Appendix 1
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	6-7
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	7
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	7
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	8
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	N/A
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	8
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	8
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	8

Section and Topic	Item #	Checklist item	Location where item is reported
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	8
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	N/A
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	8
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	N/A
<b>RESULTS</b>			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	9, Figure 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	N/A
Study characteristics	17	Cite each included study and present its characteristics.	9-11, Table 2, Appendix 2
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	9, Appendix 5
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	9-11, Appendix 6
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	N/A
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	N/A
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	N/A
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	N/A
<b>DISCUSSION</b>			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	12-14
	23b	Discuss any limitations of the evidence included in the review.	14
	23c	Discuss any limitations of the review processes used.	14
	23d	Discuss implications of the results for practice, policy, and future research.	13-15
<b>OTHER INFORMATION</b>			



Section and Topic	Item #	Checklist item	Location where item is reported
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	4
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	6
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	14
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	16-17
Competing interests	26	Declare any competing interests of review authors.	17
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	17

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: <http://www.prisma-statement.org/>

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## Supplementary File 2: Appendices

Appendix 1 – Database Search Strategies ..... 2

Appendix 2 – Study Characteristics..... 4

Appendix 3 – Patient Characteristics ..... 5

Appendix 4 – Overall risk of bias across included studies (n=4) ..... 7

Appendix 5 – Quality appraisal assessments using Cochrane Risk of Bias tool modified by EPOC ..... 8

Appendix 6 – Outcome summary table for included studies (n=4) ..... 9

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## Appendix 1 – Database Search Strategies

### Ovid MEDLINE(R) ALL <1946 to Feb 25, 2020>

1 Accidental Falls/  
 2 (slip\* or trip\* or stumbl\* or tumbl\*).tw,kf.  
 3 (fall\* or fell or "fall-related" or "near-fall").tw,kf.  
 4 or/1-3  
 5 limit 4 to "all aged (65 and over)"  
 6 exp Aged/ or geriatrics/  
 7 (geriatric\* or elder\* or age\* or "of age" or aging or senior\* or older  
 adult\* or retired or retiree\* or elder\* or pensioner\* or older people or older  
 patient\* or gerontology or Sexagenarian\* or septuagenarian\* or  
 octogenarian or nonagenarian\* or centenarian\* or sixties or seventies or  
 eighties or nineties).tw,kf.  
 8 4 and (6 or 7)  
 9 5 or 8  
 10 Social Isolation/  
 11 loneliness/  
 12 exp social support/  
 13 (social barrier\* or social isolat\* or social support\* or social car\* or  
 psychosocial support\* or psycho-social support\* or social frailt\* or  
 friendship\* or "social\* connected\*" or connectedness or lonely or loneliness  
 or "feel\* alone\*" or companionship).tw,kf.  
 14 ((lack or absence or minimi\*) adj2 (contact or communication or  
 support\*)),tw,kf.  
 15 or/10-14  
 16 9 and 15  
 17 animals/ not humans/  
 18 16 not 17

### PsycINFO <1806 to February Week 4 2020>

1 falls/  
 2 (slip\* or trip\* or stumbl\* or tumbl\*).tw.  
 3 (fall\* or fell or "fall-related" or "near-fall").tw.  
 4 or/1-3  
 5 limit 4 to "380 aged <age 65 yrs and older">  
 6 (geriatric\* or elder\* or age\* or "of age" or aging or senior\* or older  
 adult\* or retired or retiree\* or elder\* or pensioner\* or older people or older

patient\* or gerontology or Sexagenarian\* or septuagenarian\* or  
 octogenarian or nonagenarian\* or centenarian\* or sixties or seventies or  
 eighties or nineties).tw.  
 7 4 and 6  
 8 5 or 7  
 9 social isolation/ or loneliness/ or social support/ or friendship/  
 10 (social barrier\* or social isolat\* or social support\* or social car\* or  
 psychosocial support\* or psycho-social support\* or social frailt\* or  
 friendship\* or "social\* connected\*" or connectedness or lonely or loneliness  
 or "feel\* alone\*" or companionship).tw.  
 11 ((lack or absence or minimi\*) adj2 (contact or communication or  
 support\*)),tw.  
 12 or/9-11  
 13 8 and 12  
 14 Limit 13 to human

### Embase Classic+Embase <1947 to 2020 February 25>

1 falling/  
 2 (slip\* or trip\* or stumbl\* or tumbl\*).tw.  
 3 (fall\* or fell or "fall-related" or "near-fall").tw.  
 4 or/1-3  
 5 limit 4 to aged <65+ years>  
 6 loneliness/ or social support/ or friendship/  
 7 exp social isolation/  
 8 (social barrier\* or social isolat\* or social support\* or social car\* or  
 psychosocial support\* or psycho-social support\* or social frailt\* or  
 friendship\* or "social\* connected\*" or connectedness or lonely or loneliness  
 or "feel\* alone\*" or companionship).tw.  
 9 ((lack or absence or minimi\*) adj2 (contact or communication or  
 support\*)),tw.  
 10 or/6-9  
 11 5 and 10  
 12 limit 11 to human

### Database: EBM Reviews - Cochrane Database of Systematic Reviews <2005 to February 25, 2020>, EBM Reviews - ACP Journal Club <1991

**to February 2020>, EBM Reviews - Cochrane Clinical Answers  
<February 2020>, EBM Reviews - Database of Abstracts of Reviews of  
Effects <1st Quarter 2016>**

- 1 (slip\* or trip\* or stumbl\* or tumbl\*).mp.
- 2 (fall\* or fell or "fall-related" or "near-fall").mp.
- 3 1 or 2
- 4 (geriatric\* or elder\* or age\* or "of age" or aging or senior\* or older adult\* or retired or retiree\* or elder\* or pensioner\* or older people or older patient\* or gerontology or Sexagenarian\* or septuagenarian\* or octogenarian or nonagenarian\* or centenarian\* or sixties or seventies or eighties or nineties).mp.
- 5 3 and 4
- 6 (social barrier\* or social isolat\* or social support\* or social car\* or psychosocial support\* or psycho-social support\* or social frailt\* or friendship\* or "social\* connected\*" or connectedness or lonely or loneliness or "feel\* alone\*" or companionship).mp.
- 7 ((lack or absence or minimi\*) adj2 (contact or communication or support\*)).mp.
- 8 6 or 7
- 9 5 and 8

**Joanna Briggs Institute EBP Database - <Current to February 25,  
2020>**

- 1 (slip\* or trip\* or stumbl\* or tumbl\*).mp.
- 2 (fall\* or fell or "fall-related" or "near-fall").mp.
- 3 1 or 2
- 4 (geriatric\* or elder\* or age\* or "of age" or aging or senior\* or older adult\* or retired or retiree\* or elder\* or pensioner\* or older people or older patient\* or gerontology or Sexagenarian\* or septuagenarian\* or octogenarian or nonagenarian\* or centenarian\* or sixties or seventies or eighties or nineties).mp.
- 5 3 and 4
- 6 (social barrier\* or social isolation\* or social support\* or social car\* or psychosocial support\* or psycho-social support\* or social frailt\* or friendship\* or "social\* connected\*" or connectedness or lonely or loneliness or "feel\* alone\*" or companionship).mp.
- 7 ((lack or absence or minimi\*) adj2 (contact or communication or support\*)).mp.
- 8 6 or 7
- 9 5 and 8

**AMED (Allied and Complementary Medicine) <1985 to February  
2020>**

- 1 (slip\* or trip\* or stumbl\* or tumbl\*).mp.
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- 5 3 and 4
- 6 (social barrier\* or social isolation\* or social support\* or social car\* or psychosocial support\* or psycho-social support\* or social frailt\* or friendship\* or "social\* connected\*" or connectedness or lonely or loneliness or "feel\* alone\*" or companionship).mp.
- 7 ((lack or absence or minimi\*) adj2 (contact or communication or support\*)).mp.
- 8 6 or 7
- 9 5 and 8

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4 Appendix 2 – Study Characteristics  
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Author, year	Study title	Journal name	Country	Study design	Study duration (months)
Cohen, 2006	The impact of professionally conducted cultural programs on the physical health, mental health, and social functioning of older adults	The Gerontologist	United States	Non-randomized controlled trial	12
Scharlach, 2015	An Integrated Model of Co-ordinated Community-Based Care	The Gerontologist	United States	Uncontrolled before-after study	6
Fransse, 2018	The effectiveness of a coordinated preventive care approach for healthy ageing (UHCE) among older persons in five European cities: A pre-post controlled trial	International Journal of Nursing Studies	United Kingdom, Greece, Croatia, the Netherlands, Spain	Quasi-experimental (one site was randomized, four sites were controlled before-after)	12
Dolovich, 2019	Combining volunteers and primary care teamwork to support health goals and needs of older adults: a pragmatic randomized controlled trial	Canadian Medical Association Journal	Canada	Randomized controlled trial	6

## Appendix 3 – Patient Characteristics

DEMOGRAPHICS								
Author, year	Overall sample size	Overall age value	Overall age type	Overall age variance value	Overall age variance type	% female*		
Cohen, 2006	166	NR (Reported mean age by group: intervention - 79.0 years, comparison - 79.6 years)	NR	NR	NR	NR		
Scharlach, 2015	21	76	median	NR	NR	91		
Franse, 2018	2325	79.5	mean	5.6	SD	60.8		
Dolovich, 2019	312	NR (Reported mean age by group: intervention - 78.1 years, control - 79.1 years)	NR	NR	NR	62.2		
SETTING DATA								
Author, year	Intervention Setting	Participants living alone (%)	Description of access to caregivers				Description of baseline social network	
Cohen, 2006	Community	NR	NR				NR	
Scharlach, 2015	Participant homes and community	67	NR				NR	
Franse, 2018	Primary care and community settings	38.1	Care use i.e., hours per week receiving help in household work due to health problems and hours per week receiving help in caring for oneself was assessed. Hours/wk household help = control: 1.5 (5.3); intervention 1.0 (3.3).				NR	
Dolovich, 2019	Participant homes and primary care	NR	NR				NR	
FALLS AND FRAILITY DATA								
Author, year	Participants with history of falling	List of comorbidities	Participants with frailty (%)	Frailty scale	Overall frailty score	Overall frailty score type	Frailty variance value	Frailty variance type
Cohen, 2006	baseline average falls per person - intervention: 0.40 control: 0.36	NR	NR	NR	NR	NR	NR	NR

Scharlach, 2015	mean of 1.3 falls at baseline	NR	NR	NR	NR	NR	NR	NR
Franse, 2018	30.2% had a fall in the previous year	NR	20.2	Tilburg Frailty indicator (TFI)	5.1	mean	3.2	SD
Dolovich, 2019	9.3% of participants had experienced 1 or more falls	NR	NR	NR	NR	NR	NR	NR

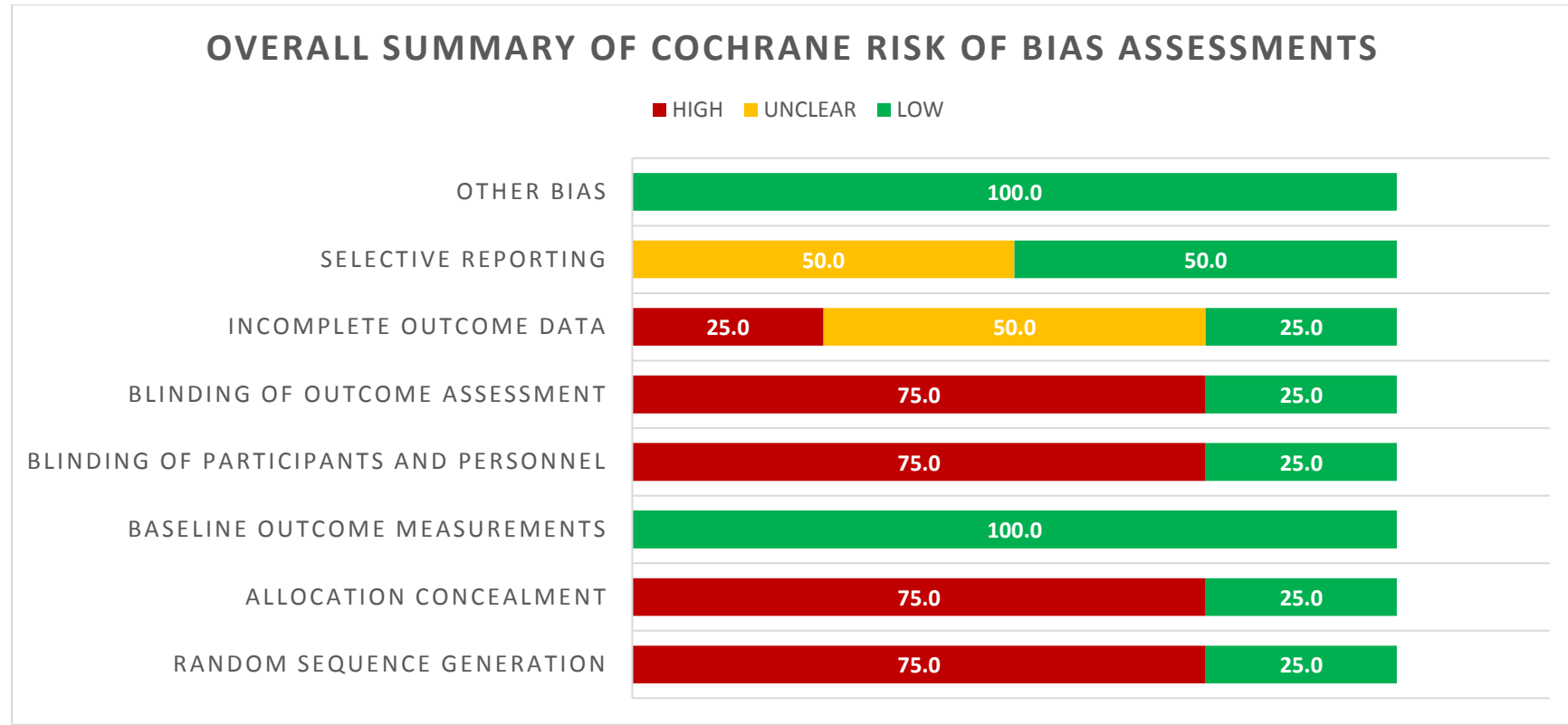
**Abbreviations:** NR, not reported; SD, standard deviation

\*No studies reported having individuals who do not identify as female or male

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Appendix 4 – Overall risk of bias across included studies (n=4)





## Appendix 5 – Quality appraisal assessments using Cochrane Risk of Bias tool modified by EPOC

Author, Year	Trial identifier	Random sequence generation	Allocation concealment	Baseline outcome measurements	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias	Funding details:
Cohen, 2006	NR	High risk	High risk	Low risk	High risk	High risk	Unclear risk	Unclear risk	Low risk	National Endowment for the Arts (lead sponsor); Center for Mental Health Services, Substance Abuse and Mental Health Services Administration, Department of Health and Human Services; National Institute of Mental Health, National Institutes of Health; National Retired Teachers Association/AARP; International Foundation for Music Research; Stella and Charles Guttman Foundation, New York City.
Scharlach, 2015	NR	High risk	High risk	High risk	High risk	High risk	Unclear risk	Unclear risk	Low risk	The SCAN Foundation
Franse, 2018	NR	High risk	High risk	Low risk	High risk	High risk	High risk	Low risk	Low risk	European Union, CHAFEA, third Health programme, grant number 20131201
Dolovich, 2019	NCT02283723	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Health Canada (grant no. 6817-06-2013/5570001), Government of Ontario (grant no. 06547 for INSPIRE-PHC), McMaster University & McMaster Family Health Organization

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Appendix 6 – Outcome summary table for included studies (n=4)

Author, Year	Treatment arms	History of falls	Results	Text description of effectiveness
<p>Cohen, 2006</p> <p><i>Design: non-RCT</i></p>	<p><b>Singing in a chorale</b> (n=90) The intervention consisted of participating in a professionally conducted chorale in which there were weekly singing rehearsals for 30 weeks as well as public performances several times during the intervention period.</p> <p><b>Usual activities</b> (n=76) Participants in the comparison group continued their regular activities as usual, with the study introducing no changes other than the assessments.</p>	<p>Baseline average of 0.40 falls per person in the intervention group, and 0.36 per person in the control group in the past 12 months</p>	<p><b>UCLA Loneliness scale III</b> Baseline: 35.1 (SD, 8.1) Follow-up: 34.6 (SD, 7.9)</p> <p>Baseline: 38.3 (SD, 10.1) Follow-up: 37.0 (SD, 10.3)</p>	<p>Both groups evidenced a slight decrease in loneliness at the 12-month follow-up; however, the decrease in loneliness was greater for the intervention group than for the comparison. Analysis of covariance of the 12-month follow-up assessment continued to demonstrate a marginally significant difference between the two groups, <math>F(1,126) = 3.08</math>; <math>p = .08</math>.</p>
<p>Scharlach, 2015</p> <p><i>Design: Uncontrolled before-after</i></p>	<p><b>ElderHelp Concierge Club (CC)</b> (n=21) Integrated community-based care model that includes comprehensive personal and environmental, assessment, multilevel care co-ordination, a mix of professional and volunteer service providers, and a capitated, income-adjusted fee model. When individuals contact CC for information or services, they receive a brief assessment designed to determine their eligibility for CC services, as well as the type of services they appear to need: information and referral services only (Tier 1), transportation services only, or other CC services including in-home assessment by the CC Intake Specialist (Tiers 2 and 3).</p>	<p>Baseline mean of 1.3 falls over the past 6 months</p>	<p><b>Social Isolation (3-item scale)</b> Baseline: 8.7 (SD, 3.2) Follow-up: 7.0 (SD, 3.8)</p> <p><b>Social interaction</b> <i>Interact with friends/relatives weekly</i> Baseline: 76% of participants Follow-up: 100% of participants</p> <p><i>Attend monthly meetings</i> Baseline: 33% of participants Follow-up: 48% of participants</p>	<p>Social isolation did not change significantly; nor did contact with friends and relatives or participation in meetings of organized groups.</p>

<p>Fransé, 2018</p> <p><i>Design: one site randomized, 4 sites controlled before-after design; results combined all sites, so classified as quasi-experimental</i></p>	<p><b>Urban Health Centres Europe (UHCE) approach</b> (n=986) Preventive multidimensional health assessment and if person at risk, coordinated care pathways targeted at fall risk, appropriate medication use, loneliness and frailty</p> <p><b>Usual Care</b> (n=858) Usual care included access to their GP</p>	<p>30.2% of participants experienced a fall in the previous year</p>	<p><b>Loneliness (short JG scale)</b> Baseline: 0.6 (SD, 0.7) Follow-up: 0.6 (SD, 0.7)</p> <p>Baseline: 0.6 (SD, 0.7) Follow-up: 0.7 (SD, 0.7)</p>	<p>When comparing persons who enrolled in any type of care-pathway with all persons in the control group there was a positive effect on loneliness after adjusting for city clustering, age, gender, living situation, education, and baseline status of outcome (B= -0.18, 95% CI= -0.35 to -0.02).</p>
<p>Dolovich, 2019</p> <p><i>Design: RCT</i></p>	<p><b>Health TAPESTRY (Health Teams Advancing Patient Experience: STREngthening Quality) intervention</b> (n=158) Trained community volunteers visited patients to collect information on their life and health goals, risks and needs, daily life activities and general health, using structured surveys and unstructured narratives. The volunteers sent a report summarizing patients' goals, alerts, key issues and observations to the primary care interprofessional "huddle" team at the clinics. These interprofessional teams reviewed the reports and then generated, prioritized and acted upon plans of care for how the team, community agencies and volunteers could address clients' goals and health issues, with iterative follow-up</p> <p><b>Usual Care</b> (n=154) The control group received usual care and did not have volunteer visits. There was no restriction on receiving care from the same team members as the intervention group</p>	<p>9.3% of participants experienced 1 or more falls</p>	<p><b>Social network score (DSSI-10)</b> Baseline: Mean, 8.84 (SD, 1.52) Follow-up: Mean, 8.75 (SD, 1.52)</p> <p><b>Social satisfaction score (DSSI-10)</b> Baseline: Mean, 18.89 (SD, 2.41) Follow-up: Mean, 18.96 (SD, 2.87)</p> <p><b>Social network score (DSSI-10)</b> Baseline: Mean, 8.74 (SD, 1.61) Follow-up: Mean, 8.69 (SD, 1.53)</p> <p><b>Social satisfaction score (DSSI-10)</b> Baseline: Mean, 19.19 (SD, 2.37) Follow-up: Mean, 19.04 (SD, 2.76)</p>	<p>There were no statistically significant between-group differences in participant ratings of self-efficacy, quality of life, optimal aging, social support</p>