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Global evidence on falls and subsequent social isolation in older adults: A scoping review

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ABSTRACT

Objective: To summarize evidence on falls and subsequent social isolation and/or loneliness in older adults in any setting, including the role of fear of falling, other risk factors, and how the COVID-19 context affects this relationship.

Methods: MEDLINE, CINAHL, Embase, and Ageline databases were searched from inception until January 11, 2021, in addition to a grey literature search. Studies were eligible for inclusion if the population had a mean age of 60 years or older, they examined falls and subsequent social isolation, loneliness, fear of falling or risk factors, and were primary studies (e.g., experimental, quasi-experimental, observational, qualitative).

Results: After screening 4,993 citations and 304 full-text articles, 39 studies were included in this review. Most studies included participants with a history of falling, ranging from 11 to 100 percent of the study population. Most studies were conducted in Europe (44%) and North America (33%) and were of the cross-sectional study design (66.7%), in the community (79%). Studies utilized 15 different scales. Six studies examined risk factors for social isolation and activity restriction associated with fear of falling. Six studies reported mental health outcomes related to falls and subsequent social isolation. No studies evaluated falls and social isolation in the context of COVID-19.

Conclusions: Consistency in outcome measurement is recommended, as multiple outcomes were used across the included studies. Further research is warranted in this area, given the aging population and the importance of falls and social isolation to the health of older adults.

Scoping Review Registration: 10.17605/OSF.IO/2R8HM

Word count: 243/250 (abstract), 2960/3000 (main text)

Keywords: scoping review, older adults, falling, social isolation, loneliness, fear of falling

Strengths and Limitations of this Study:

- A robust methodology including a thorough and extensive literature search was used to review the literature in the area.
- There was no date limits or language limits for studies eligible for inclusion in this scoping review.
- Scoping reviews do not assess the quality of included studies and we cannot confirm the directional causality between falls and social isolation.

INTRODUCTION

Globally, falls are the second leading cause of unintentional injury death, making falls a major public health concern [1]. In Canada, falls are the leading cause of injury-related hospitalizations among adults aged 65 years and older, and 20-30% of older adults experience at least one fall each year [2]. Falls may result in serious health-related consequences including physical (e.g., fractures), physiological (e.g., cognitive decline), and psychological (e.g., anxiety, depressive symptoms, fear of falling, and social isolation) outcomes [3].

Specific to social isolation, this is a priority in Canada, as over 30% older adults are at risk of social isolation [4]. Social isolation among older adults is associated with adverse health outcomes including cognitive decline, depression, anxiety, and dementia [5]. Given the detrimental outcomes associated with both falls and social isolation, there is a need to understand the relationship between falls and subsequent social isolation in older adults. The current scoping review is focused on falling and the subsequent experience of social isolation and/or loneliness and to ascertain whether the COVID-19 context affected the relationship between falls and subsequent social isolation.

METHODS

Protocol and registration

The protocol for this scoping review was developed in accordance with the JBI (formerly Joanna Briggs Institute) guidance for scoping reviews and registered with Open Science Framework [6]. An integrated knowledge translation approach was used [7], whereby colleagues from the Public Health Agency of Canada (YJ, KA, MdG, AGB) co-developed the review and were included as coauthors on this review, along with our patient partner (JB). The results are reported using the

Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) extension to scoping reviews [8] supplemented by the updated PRISMA 2020 statement [9].

Patient and Public Involvement

Through the Strategy for Patient-Oriented Research (SPOR) Evidence Alliance, we worked with a patient partner who provided feedback on our protocol, participated in a full-text screening pilot, provided input for revisions to the draft and final manuscript, and is a coauthor on this paper (JB).

Search strategy

An experienced information specialist developed our comprehensive literature search strategy, which was peer-reviewed by a second information specialist using the Peer Review of Electronic Search Strategies (PRESS) checklist [10]. MEDLINE, CINAHL, Embase, and Ageline were searched from inception until January 11, 2021 (Appendix 1). References of included studies and relevant reviews were scanned. Grey literature (i.e., unpublished or difficult to locate studies) was searched using the Canadian Agency for Drugs and Technologies in Health's Grey Matters checklist [11].

Eligibility criteria

The population of interest was studies of older adults, with a mean age of 60 years or older. The core concept examined was the relationship between falls and subsequent social isolation, loneliness. As mentioned in our related systematic review on interventions for social isolation after falling, social isolation and loneliness are distinct concepts [12]. We defined social isolation as including any of the following: decreased number of social contacts, decreased feeling of belonging, reduced or lack of fulfilling relationships, decreased engagement with others, and reduced quality of the members in one's network [12]. We defined loneliness as "the unpleasant

experience that occurs when a person's network of social relations is deficient in some way, either quantitatively or qualitatively"[13]. The context included any community or institutional setting, and for our secondary objective, this was limited to the COVID-19 context (i.e., studies that specified consideration of the COVID-19 pandemic in their work). Studies including participants reporting a history of falling (i.e., regardless of the proportion of the sample who fell), the role of fear of falling in this relationship, as well as any risk or protective factors were considered eligible for inclusion.

Eligible study designs included primary research studies of experimental (e.g., randomized controlled trials), quasi-experimental (eg, non-randomized controlled trials, controlled before and after studies, interrupted time series), observational (e.g., cohort studies, case-control studies, cross-sectional studies), qualitative (phenomenological, ethnography, qualitative interview, etc.) and mixed method (e.g., convergent parallel, embedded, explanatory sequential) design. No restrictions based on study year, language of publication, or study duration were applied.

Study selection

A screening form was developed based on the eligibility criteria, and those contributing to article reviews/extraction completed a training exercise using 50 citations to ensure adequate agreement was achieved. After achieving 80% agreement during the training exercise, all remaining titles and abstracts identified in the search were screened independently by pairs of reviewers (SMT, AP, JF, GM, AH). All discrepancies were resolved by a third reviewer.

Similarly, a training exercise was completed for screening of full-text articles. After completing two training exercises (achieving 27% and 40% agreement, respectively), and then

revising our screening criteria form for clarity, full-text articles were assigned to independent pairs of reviewers, and any discrepancies were resolved by a third reviewer.

Data charting

A charting form was developed to capture data on study characteristics, population characteristics and outcomes of interest. Relevant outcomes included any data illustrating the relationship between falls and subsequent social isolation, including the role of fear of falling, and other risk factors or protective factors. A training pilot exercise was conducted using five studies. After achieving sufficient agreement based on discussion with the team and a systematic review methodologist, full data charting was completed by independent pairs of reviewers and discrepancies were resolved by a third reviewer.

Analysis and presentation of results

The review findings were summarized descriptively using summary tables.

RESULTS

After screening 4993 citations and 304 full-text articles against our eligibility criteria, 39 studies were identified as eligible for inclusion based on our primary objective for this review (Figure 1). No studies were identified when limiting to the COVID-19 context for our secondary objective. Study and patient characteristics have been summarized in Table 1 and detailed data are reported in Appendices 2 and 3.

Table 1: Summary of study and patient characteristics

Characteristics	Number (%)
Study Characteristics (n=39)	
Geographical region	
Asia	5 (12.8%)
Australia	1 (2.5%)
Europe	17 (43.6%)
North America	13 (33.3%)
South America	3 (7.7%)

Study design	
Cohort	6 (13.8%)
Cross-sectional	26 (66.7%)
Qualitative	7 (19.4%)
Study duration	
NA	29 (74.3%)
≤ 1 year	5 (12.8%)
≥ 1 year	5 (12.8%)
Patient characteristics	
Mean age	74.9 (range, 65.0 to 95.0)
NR	11 (28.2%)
65.0-69.9 years	4 (10.2%)
70.0-74.9 years	8 (20.5%)
75.0-79.9 years	14 (35.9%)
≥80.0 years	2 (5.1%)
Proportion of female participants	Mean: 65.3% (range, 42.5 to 88.9)
Sample size	Mean: 3043.6 (9 to 43487)
<100	11 (28.2%)
100-499	11 (28.2%)
500-999	3 (7.7%)
1000-1999	4 (10.2%)
2000-5000	4 (10.2%)
>5000	6 (15.4%)
Study setting	
Community	31 (79.4%)
Medical	6 (15.4%)
Nursing home	1 (2.5%)
Multi-site	1 (2.5%)
Participants living alone	44.1% (range, 0 to 100)
Participants with a history of falling	Mean: 50.8% (range, 11.2 to 100)
Not reported*	11 (28.2%)
≤25%	6 (15.4%)
25-40%	10 (25.6%)
40-85%	5 (12.8%)
>85%	7 (17.9%)

Abbreviations: NA, not applicable; *not reported for the overall sample

Study characteristics

The publication year for included studies ranged from 1987 to 2020, with more than half published since 2010. Most studies were conducted in Europe (17/39, 44%) and North America (13/39, 33%). More than half of the studies were cross-sectional study design (66.7%) and 7

qualitative studies were included. Most were conducted in the community (79%). Studies utilized 15 different scales and a variety of self reported responses to assess variables such as social isolation, loneliness. (e.g., 18-item Lubben Social Network Scale, 6-item de Jong-Gierveld Loneliness Scale). Six studies identified risk factors for social isolation and for activity restriction due to fear of falling (Table 2). Six studies reported mental health outcomes (Appendix 4).

Table 2: Potential risk factors for social isolation and activity restriction associated with fear of falling

Author, Year	Risk factor	Associated evidence
Social Isolation after injurious fall		
Nicholson, 2005	Sex (female)	The authors noted a strong positive correlation between injurious falls and social isolation for women (ρ= -0.5; p=0.01), but this was not significant for men.
Activity Restriction due to fear of falling		
Zijlstra, 2007	Aged 80 years or older	OR: 1.56 (95% CI, 1.24-1.95)
	Fair perceived general health	OR: 2.92 (95% CI, 2.43-3.52)
	Poor perceived general health	OR: 5.7 (95% CI, 3.57-9.12)
Curcio, 2009	Poor perceived health	OR: 1.38 (95% CI, 1.06-1.79)
	Depression	OR: 1.76 (95% CI, 1.38-2.24)
	Low social participation	OR: 1.52 (95% CI, 1.20-1.92)
	Difficulties in activities of daily living	OR: 1.65 (95% CI, 1.16-2.32)
	Decreased physical activity	OR: 1.35 (95% CI, 1.06-1.70)
	Polypharmacy	OR: 1.56 (95% CI, 1.14-2.14)
	Below poverty level	OR: 1.32 (95% CI, 1.05-1.65)
Dias, 2011	Depression	Chi-square=15.2, p=0.004
	Exhaustion (frailty)	Chi-square=9.2, p=0.01
	Participation in social activities	Chi-square=10.4, p=0.016
Murphy, 2002	Two or more chronic conditions	ARR: 1.34 (95% CI, 1.08-1.65)
	Slow-timed physical performance	ARR: 1.44 (95% CI, 1.18-1.75)

Merchant, 2020	Sarcopenia	OR, 8.13 (95% CI, 1.52–43.41)

Abbreviations: OR, odds ratio; ARR, adjusted risk ratio

Patient characteristics

Across all studies, the total number of included patients was 118,702, with an average of 3,043 patients per study. Their mean age ranged from 65 to 95 years, and approximately 65% of patients were female. Most studies included participants with a history of falling, ranging from 11 to 100 percent of the study population.

Cohort studies

Among the 39 included studies, six were cohort studies (Appendix 5). Tinetti et al (1998) demonstrated a significant relationship between experiencing multiple non-injurious falls and a decline in social functioning (Regression coefficient = -0.538 ($p<0.05$)), which was measured using the Social Activity scale, in a sample of 770 older adults after 3 years of follow-up [14]. Similarly, Pin et al. (2016) found that in their cohort of 16,583 participants, individuals who experienced a fall showed decreased social participation after falling ($p<0.001$), which was no longer statistically significant when frailty was added in the model [15].

Vellas et al. (1987) compared people who fall to people who had not experienced a fall in two populations: a retirement home (n=118) and older adults living at home (n=60) [16]. Among the older adults who lived at home, they noted that fewer fallers were able to maintain the same level of activity after 6 months of follow-up when compared to non-fallers ($p<0.02$).

Van der Meulen et al. (2014) assessed social participation (using the Frenchay Activities Index) in 260 older adults with low and high levels of concern about falling over a 14-month period [17]. They reported significant differences (specific results not reported) between the

groups, with lower social participation scores in those who had a higher level of concern about falling.

In 4,680 older adults, Yu et al. (2021) reported a statistically significant relationship between the number of falls and loneliness scores (measured using the 3 item University of California, Los Angeles (UCLA) Loneliness Scale) across three time points over a 4-year period ($B = 0.008$, $p<0.05$) [18]. A cohort study by Hajek et al. (2020) looked at loneliness (as measured using the Bude and Lantermann scale) and social isolation (measured using the De Jong Gierveld Loneliness Scale) and their link to fear of falling 669 older adults [19]. They compared older adults with an onset of fear of falling, to those whose fear of falling had ended. Their findings revealed that the end of fear of falling was associated with lower loneliness scores ($\beta = -0.06$, $p<0.05$) and other negative psychosocial outcomes (e.g., increased depressive symptoms).

Cross-sectional studies related to falls and social isolation

Of the twenty-six cross-sectional studies included in this review, 11 reported on the relationship between falls and social isolation or loneliness (Appendix 6).

Quach et al. (2016) examined the relationship between falls and scores on the Social Relationship Index including 8,464 participants [20]. They noted that participants who reported experiencing a fall or multiple falls had a lower social relationship index score (mean, 3.24 and 3.08 respectively) compared to those who had not fallen (mean, 3.34; $p<0.0001$).

Hajek et al (2017) examined variables associated with a history of falling in 7,808 participants [21]. They found those reporting a fall in the previous 12 months had higher loneliness scores (De Jong Gierveld Loneliness Scale; $\beta = .08$, $p < .001$) and social exclusion scores (Bude and Lantermann scale; $\beta = .08$, $p < .001$) compared to those who had not fallen.

Schnittger et al. (2012) conducted a study in 579 older adults identifying risk factors for different pathways of loneliness – emotional loneliness, social loneliness (both measured using the De Jong Gierveld Loneliness Scale), and social support (measured using the Lubben Social Network Scale) [22]. A history of falls was the only biological variable that was identified as a statistically significant risk factor for inclusion in the model for social support (correlation coefficient= -0.247; $p<0.003$).

Stel et al (2004) reported a statistically significant decline in social activities in 204 older adults who experienced a fall inside their home (OR: 2.6 (95% CI: 1.1-6.5); $p<0.05$) [23], and Vanden Wyngaert et al. (2020) reported an association between risk of falls and participation in social roles and activities in 154 older adult haemodialysis patients (PROMIS questionnaire; $R^2=0.11$; $p=0.01$) [24]. Finally, Nicholson et al. (2005) reported a strong positive relationship between experiencing an injurious fall and increasing social isolation in a sample of 68 older adults (Lubben Social Network Scale; $\rho= -0.4$; $p<0.05$), and highlighted that this relationship was stronger in women ($\rho= -0.5$; $p=0.01$) [25]. Additionally, they assessed this relationship using both the Family and Friends subscales of the Lubben Social Network Scale and found that the correlation was specific to the Friends subscale ($\rho= -0.43$; $p<0.05$).

Iliffe et al. (2007) and Robins et al. (2018) found no statistically significant associations between falls and social isolation using the Lubben Social Network Scale in a sample of 3,139 older adults and the Friendship Scale for social isolation in a sample of 245 older adults, respectively [26, 27]. Similarly, Van Lankveld et al. (2011) and Faria et al. (2020) found no correlation between falls and loneliness, using the De Jong Gierveld Loneliness scale in a sample of 579 older adults, and the UCLA scale in a sample of 48 older adults, respectively [28, 29].

Additionally, Finn et al. (2001) noted no difference in scores for the OARS social support scale when comparing fallers to non-fallers in a nursing home setting (n=49) [30].

Cross-sectional studies related to fear of falling and social isolation

Seven studies examined fear of falling linked to falls and social isolation (Appendix 7). Gagnon et al. (2005) reported a statistically significant positive relationship between fear of falling and social support in a sample of 105 older adults (measured using the confiding-relationships component of the Bedford Life Events and Difficulties Schedule modified for elderly subjects; Wald chi-square= 3.77; p=0.05) [31]. Curcio et al. (2009) reported a strong relationship between fear of falling and low social participation in 1,668 older adults (OR, 1.52; 95% CI, 1.20-1.92; p<0.01) [32]. Petrinec et al. (2020) identified fear of falling as an independent predictor of social functioning (as measured by the Medical Outcomes Study 36-item Short-Form General Health Survey; β= -0.29) in 108 older adults [33].

Merchant et al. (2020) and Iliffe et al. (2007) showed no statistically significant relationship between fear of falling and social isolation in 493 older adults and 3,139 older adults, respectively [26, 34]. Ferreira et al. (2018) and Kara et al. (2009) showed no association between fear of falling and social participation (n= 7,935) or fear of falling and loneliness (n=47), respectively [35, 36].

Cross-sectional studies related to falls and activity restriction due to fear of falling

Eight studies examined the relationship between falls and activity restriction due to fear of falling (Appendix 7). Tinetti et al (1994) and Apikomonkon et al. (2003) both reported a statistically significant decrease in activity due to fear of falling in individuals who experienced a fall compared to those who had not (n=1,103, chi-square= 13.1, p < 0.001; and n=546, chi-square=5.49, p<0.05, respectively) [37, 38]. Similarly, in 1,668 older adults, Curcio et al. (2009)

demonstrated that those who restricted activity due to fear of falling were more likely to have experienced a fall in the year prior (OR: 1.48 (95%CI, 1.18-1.86); p=0.001) [32], and Mendes da Costa et al. (2012) demonstrated that activity restriction increased in those with multiple falls over the past year (OR, 3.04; 95% CI, 1.70-5.42) [39]. Murphy et al. (2002) , and Choi et al. (2015) showed that a history of injurious falls was independently associated with activity restriction due to fear of falling (n=1,064, ARR: 1.36; 95% CI, 1.11-1.66; p=0.003; and n=4,247, OR, 3.03; 95% CI, 1.21-7.54, p=0.008, respectively) [40, 41].

Howland et al. (1998) reported no relationship between the experience of a fall and activity restriction in a sample of 266 older adults (OR: 1.094; 95% CI, 0.376-3.177; p=0.869)[42], as did Choi et al. (2015) (OR, 2.12; 95% CI, 0.96-4.67; p=0.062) among 4,247 older adults [41]. Similarly, Merchant et al. (2020) also reported no significant relationship between the number of falls and fear-based activity restriction in 493 older adults (OR, 1.4; 95% CI, 0.94–2.20)[34].

Qualitative studies

Seven qualitative studies were included (Appendix 8). All participants interviewed were older adults (n=124), and of that aggregated group, 51 were stroke survivors [43, 44] and 10 were experiencing frailty [45]. Common categories identified across these studies include: activity restriction as a strategy to manage fear of falling, changing behaviours to avoid falling again [43, 45-47], feeling restricted due to reduced mobility after falling [43, 44, 48], increasing dependence on caregivers [43, 45], developing fear of falling [43, 45], feelings of loneliness or isolation [43, 48], and a negative impact on identity or autonomy [47].

DISCUSSION

We conducted a comprehensive scoping review including 39 studies examining the relationship between falls and subsequent social isolation. We limited the scoping review to studies that identified social isolation after a fall, although many studies investigated the association between social isolation and a subsequent fall; this was due to the request of the commissioning knowledge user. More than half of the studies were published since 2010, suggesting increased interest in the relationship between falls and social isolation in older adults. Social isolation and loneliness were measured using a variety of outcome measures across studies, such as degree of activity, and varying scales for loneliness, social isolation, social participation, social support, etc. This highlights the growing need for consistency in the measurement of social isolation and loneliness to allow for meaningful comparison across studies.

Only a few studies examined risk factors and mental health outcomes related to falls and subsequent social isolation. Risk factors linked to social isolation and activity restriction included age, sex/gender, poor perceived health, poverty, frailty, and comorbidity. Few studies also documented an association between activity restriction due to fear of falling and depression. Our findings suggest the presence of gaps in the literature for these important outcomes, highlighting the need for further research.

We did not identify any studies on falls and subsequent social isolation that were specific to the COVID-19 context, highlighting another gap in the evidence base. Particularly as lockdowns related to the pandemic are likely to cause social isolation for older adults. Closing of community centers could risk deconditioning of older adults and lead to an increase in falls as things re-open.

There are several strengths to our scoping review, such as the use of the JBI guide for the methods, and the PRISMA-ScR for structuring and writing the results. Included studies were

gathered through a thorough and extensive literature search from numerous databases and grey literature sources to ensure relevant studies were included. Several different types of study designs were included, such as cohort, cross-sectional and qualitative studies. However, limitations include that all studies were conducted in middle-high- or high-income economy countries. This suggests that our results may not be generalizable to low- and middle-income countries, highlighting a gap in the literature. It should be noted that as many of the included studies were cross-sectional, we cannot confirm the directional causality between falls and social isolation without more robust research.

In summary, we identified 39 studies examining social isolation after a fall in older adults. We found a dearth of research, particularly examining risk factors and mental health outcomes. Further research is warranted in this area, given the importance of falls and social isolation to the health of older adults.

LIST OF ABBREVIATIONS

ARR	Absolute Risk Reduction
CADTH	Canadian Agency for Drugs and Technologies in Health
CI	Confidence interval
OR	Odds Ratio
PRESS	Peer Review of Electronic Search Strategies
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses

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Ethics approval

Not required.

Consent for publication

Not applicable.

Availability of data and materials

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

Conflict of interests

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

Author Contribution

ACT and ST wrote and revised the final manuscript. All authors revised the manuscript and approved of the final version. ST, AP, AH, JF, GM, JW screened citations and full text articles, abstracted and verified data. ST interpreted results and ST and AP wrote the first draft manuscript. ACT developed the protocol, obtained funding, interpreted results, and edited the manuscript.

Role of the funder

The funders were co-developers of this research project and contributed to the design of the study and reviewed/approved of the manuscript.

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SUPPLEMENTAL FILES

Supplemental File 1: PRISMA Checklist

Supplemental File 2: Appendices

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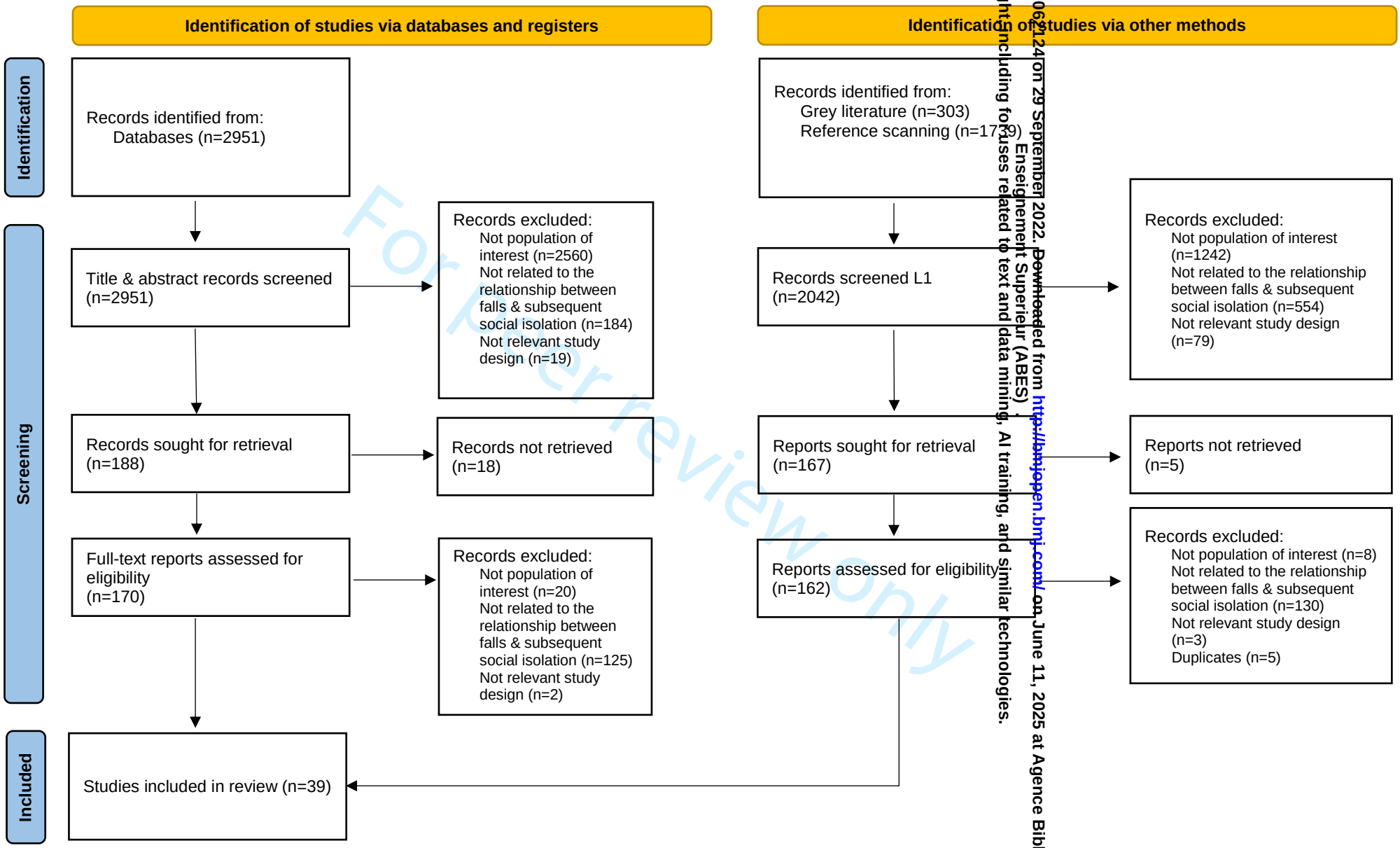
FIGURE LEGEND:

Figure 1 – PRISMA 2020 study flow diagram.

Figure 1: PRISMA 2020 study flow diagram



Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	5
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	5
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	5-6
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	6-7
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	6
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Appendix 1
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	6
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	7-8
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	7
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	N/A
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	Appendix 4-6

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	8; Figure 1
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	8; Table 1; Appendix 7
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	9-13
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	Table 2
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	13-14
Limitations	20	Discuss the limitations of the scoping review process.	14-15
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	15
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	16-17

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. Ann Intern Med. 2018;169:467–473. doi: 10.7326/M18-0850.

Supplementary File 2: Appendices

Appendix 1: Literature search strategies

Ovid MEDLINE(R) ALL <1946 to Jan 11, 2021>

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 January Week 2 2021>

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 2021 January 11>

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 January 11, 2021>, EBM Reviews - ACP Journal Club <1991 to January 11, 2021>, EBM Reviews - Cochrane Clinical Answers <January 2021>, 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.

/bmjopen-2022-062124 on 29 September 2022. Downloaded from

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 January 11, 2021>
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 January 2021>
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

Appendix 2: Study Characteristics (n=39)

Author, year	Study title	Journal name	Country	Study design	Study duration (months)
Apikomonkon, 2003[26]	Fear of falling and fall circumstances in Thailand	NA	Thailand	cross-sectional	NA
Chiu, 2011[37]	Psychosocial responses to falling in older Chinese immigrants living in the community	Dissertation Abstracts International Section A: Humanities and Social Sciences	Canada	qualitative	6
Choi, 2015[30]	Characteristics associated with fear of falling and activity restriction in South Korean older adults	Journal of Aging and Health	South Korea	cross-sectional	NA
Curcio, 2009[4]	Activity restriction related to fear of falling among older people in the Colombian Andes Mountain	Journal of Aging and Health	Columbia	cross-sectional	NA
Dias, 2011[5]	Characteristics associated with activity restriction induced by fear of falling in community-dwelling elderly	Revista Brasileira de Fisioterapia	Brazil	cross-sectional	NA
Faes, 2010[36]	Qualitative study on the impact of falling in frail older persons and family caregivers: Foundations for an intervention to prevent falls	Aging & Mental Health	Netherlands	qualitative	NA
Faria, 2020[22]	Elderly residents in the community: gaining knowledge to support a rehabilitation nursing program	Revista Brasileira de Enfermagem	Portugal	cross-sectional	NA
Ferreira, 2018[31]	Aspects of social participation and neighborhood perception: ELSI-Brazil	Revista de saude Publica	Brazil	cross-sectional	NA
Finn, 2001[14]	The relationship between falls and fall-related efficacy, depression, and social resources	Dissertation Abstracts International: Section B: The Sciences and Engineering	USA	cross-sectional	NA
Gagnon, 2005[3]	Affective correlates of fear of falling in elderly persons	American Journal of Geriatric Psychiatry	Canada	cross-sectional	NA
Hajek, 2017[20]	The association of falls with loneliness and social exclusion: evidence from the DEAS German Ageing Survey	BMC Geriatrics	Germany	cross-sectional	NA

Hajek, 2020[13]	What are the psychosocial consequences when fear of falling starts or ends? Evidence from an asymmetric fixed effects analysis based on longitudinal data from the general population	International Journal of Geriatric Psychiatry	Germany	cohort	36
Host, 2011[38]	Older people's perception of and coping with falling, and their motivation for fall-prevention programmes	Scandinavian Journal of Public Health	Denmark	qualitative	2
Howland, 1998[25]	Covariates of fear of falling and associated activity curtailment	The Gerontological Society of America	USA	cross-sectional	NA
Iliffe, 2007[16]	Health risk appraisal in older people 2: the implications for clinicians and commissioners of social isolation risk in older people	British Journal of General Practice	England	cross-sectional	NA
Kara, 2009[28]	Evaluation of home environment and life satisfaction and falling in geriatrics: Examination of its relationship with fear	Physiotherapy Rehabilitation	Turkey	cross-sectional	NA
Mendes da Costa, 2012[29]	Fear of falling and associated activity restriction in older people. results of a cross-sectional study conducted in a Belgian town	Archives of Public Health	Belgium	cross-sectional	NA
Merchant, 2020[7]	Relationship between fear of falling, fear-related activity restriction, frailty, and sarcopenia	Journal of the American Geriatrics Society	Singapore	cross-sectional	NA
Meric, 2007[34]	A qualitative study on the perceptions of old individuals regarding the life of the fall and its effect on their daily lives	Turkish Journal of Geriatrics	Turkey	qualitative	2
Murphy, 2002[1]	Characteristics associated with fear of falling and activity restriction in community-living older Persons	Journal of the American Geriatrics Society	USA	cross-sectional	NA
Nakaya, 2013[6]	The association between self-reported history of physical diseases and psychological distress in a community-dwelling Japanese population: the Ohsaki Cohort 2006 Study	European Journal of Public Health	Japan	cross-sectional	NA
Nicholson, 2005[15]	The relationship between injurious falls, fear of falling, social isolation, and depression	NA	USA	cross-sectional	NA
Petrinec, 2020[32]	Health-related quality of life of older women religious: negative influence of frailty	Western Journal of Nursing Research	USA	cross-sectional	NA
Pin, 2016[11]	Impact of falling on social participation and social support trajectories in a middle-aged and elderly European sample	Social Science and Medicine - Population Health	Denmark, Sweden, Netherlands, Austria, Germany, France, Belgium,	cohort	72

			Switzerland, Italy, Spain		
Quach, 2016[19]	Social determinants of falls: The role of social support and depression among community-dwelling older adults	Dissertation Abstracts International: Section B: The Sciences and Engineering	USA	cohort	36
Robins, 2018[21]	The association between physical activity and social isolation in community-dwelling older adults	Aging & Mental Health	Australia	cross-sectional	NA
Schmid, 2009[35]	Consequences of poststroke falls: activity limitation, increased dependence, and the development of fear of falling	American Journal of Occupational Therapy	USA	qualitative	6
Schnittger, 2012[18]	Risk factors and mediating pathways of loneliness and social support in community-dwelling older adults	Aging & Mental Health	Ireland	cross-sectional	NA
Stel, 2004[2]	Consequences of falling in older men and women and risk factors for health service use and functional decline	Age and Ageing	Netherlands	cross-sectional	NA
Tinetti, 1998[9]	The effect of falls and fall injuries on functioning in community-dwelling older persons	Journal of Gerontology	USA	cohort	36
Tinetti, 1994[24]	Fear of falling and fall-related efficacy in relationship to functioning among community-living elders	Journal of Gerontology	USA	cross-sectional	NA
van der Meulen, 2014[10]	Effect of fall-related concerns on physical, mental, and social function in community-dwelling older adults: A prospective cohort study	Journal of American Geriatrics Society	Netherlands	cohort	14
van Lankveld, 2011[17]	Age-related health hazards in old patients with first-time referral to a rheumatologist: A descriptive study	Arthritis	Netherlands	cross-sectional	NA
Vanden Wyngaert, 2020[23]	Associations between the measures of physical function, risk of falls and the quality of life in haemodialysis patients: a cross-sectional study	BMC Nephrology	Belgium		
Vellas, 1987[8]	Prospective study of restriction of activity in old people after falls	Age and Ageing	France	cohort	6
Ward-Griffin, 2004[33]	Falls and fear of falling among community dwelling seniors: the dynamic tension between exercising precaution and striving for independence	Canadian Journal on Aging	Canada	qualitative	NA

Xu, 2019[39]	Developing a falls prevention program for community-dwelling stroke survivors in Singapore: client and caregiver perspectives	Disability and Rehabilitation	Singapore	Qualitative	NA
Yu, 2020[12]	Longitudinal Assessment of the relationships between geriatric conditions and loneliness	Journal of the American Medical Directors Association	USA	Cohort	96
Zijlstra, 2007[27]	Prevalence and correlates of fear of falling, and associated avoidance of activity in the general population of community-living older people	Age and Ageing	Netherlands	Cross-sectional	NA

Appendix 3: Patient Characteristics (n=39)

DEMOGRAPHIC DATA							
Author, year	**Overall sample size**	**Overall age (years)**	**Overall age (type)**	**Overall age variance (value)**	**Overall age variance (type)**	**% female**	**% male**
Apikomonkon, 2003[26]	546	NR	NR	60-94	range	61	39
Chiu, 2011[37]	18	81	mean	71 to 94	range	88.9	11.1
Choi, 2015[30]	4,247	NR	NR	NR	NR	21	NR
Curcio, 2009[4]	1668	70.9	mean	7.4	SD	54.5	45.5
Dias, 2011[5]	113	74.5	mean	7	SD	85	15
Faes, 2010[36]	10	70-90	range	NR	NR	60	40
Faria, 2020[22]	48	75	mean	6.8	SD	66.67	33.33
Ferreira, 2018[31]	7935	NR	NR	NR	NR	56.9	43.1
Finn, 2001[14]	49	NR	mean	NR	SD	NR	NR
Gagnon, 2005[3]	105	78.2	mean	8.9	SD	86.7	13.3
Hajek, 2017[20]	7808	73.8	mean	5.9	SD	46.2	53.8
Hajek, 2020[13]	8836	65.5	mean	10.7	SD	50.4	49.6
Host, 2011[38]	14	77	mean	68-87	range	64.3	35.7
Howland, 1998[25]	266	76.3	mean	7.9	SD	77	23
Iliffe, 2007[16]	3139	NR	NR	65-75+	range	54.5	45.5
Kara, 2009[28]	47	71.7	mean	5.6	SD	55.3	44.7
Mendes da Costa, 2012[29]	501	NR	NR	65-85+	NR	57.7	42.3
Merchant, 2020[7]	493	73	mean	8	SD	79.3	20.7
Meric, 2007[34]	22	NR	NR	65-83+	range	63.6	36.4
Murphy, 2002[1]	1064	79.6	mean	5.3	SD	73	27
Nakaya, 2013[6]	43487	65+	range	NR	NR	53.9	46.1
Nicholson, 2005[15]	68	78.5	mean	6.3	SD	60.4	39.6
Petrinec, 2020[32]	108	75.6	mean	65–93	range	100	0
Pin, 2016[11]	16583	50-95	range	NR	NR	NR	NR
Quach, 2016[19]	8464	74	mean	7	SD	58.7	41.3
Robins, 2018[21]	245	77	mean	6	SD	60	40
Schmid, 2009[35]	42	67.5	mean	11.93	SD	NR	NR
Schnittger, 2012[18]	579	NR	NR	NR	NR	69.1	30.9
Stel, 2004[2]	204	78.7	mean	6.3	SD	54.9	45.1
Tinetti, 1998[9]	1103	NR	NR	NR	NR	NR	NR
Tinetti, 1994[24]	1103	79.6	mean	5.2	SD	73	27

van der Meulen, 2014[10]	260	77.9	mean	5	SD	72.7	27.3
van Lankveld, 2011[17]	154	79.2	mean	5.1	SD	78	21
Vanden Wyngaert, 2020[23]	113	67.5	mean	16	SD	42.5	57.5
Vellas, 1987[8]	178	65-85+	range	NR	NR	76.4	23.6
Ward-Griffin, 2004[33]	9	81.7	mean	72-92	range	78	22.3
Xu, 2019[39]	17	65	mean	7	SD	44	55.6
Yu, 2020[12]	4680	74.01	mean	9.69	SD	56	43.9
Zijlstra, 2007[27]	4376	77.1	mean	4.9	SD	59	40.1

SETTING DATA				
Author, year	**Setting**	**Streamlined setting description**	**Participants living alone (%)**	**Description of access to caregivers**
Apikomonkon, 2003[26]	Community in 4 provinces of Thailand	Community	9.9	NR
Chiu, 2011[37]	Community in the Greater Toronto Area, Canada	Community	61	Two respondents lived with their children. The rest lived alone or only with their spouse. Only seven of 18 respondents had at least one grown child living in the same city who might provide assistance when needed.
Choi, 2015[30]	Community setting in Korea	Community	NR	NR
Curcio, 2009[4]	Community in Columbian Andes Mountains	Community	9.5	NR
Dias, 2011[5]	Community setting in Brazil	Community	38	NR
Faes, 2010[36]	Home and outpatient clinic in Netherlands	Community + Medical	10	All participants had access to a caregiver (either child or spouse)
Faria, 2020[22]	Urban health unit in northern Portugal	Medical	NR	NR
Ferreira, 2018[31]	Urban communities in Brazil	Community	NR	NR
Finn, 2001[14]	Two nursing homes in the Chicago Metropolitan Area, USA	Nursing home	0	In general, they have entered a nursing home because of an inability to adequately care for themselves, and they do not have anyone who can ably assist them, or they lack financial resources.
Gagnon, 2005[3]	Medical or orthopedic wards of 3 hospitals in Toronto, Canada	Medical	65.7	NR
Hajek, 2017[20]	Communities in Germany	Community	NR	NR

Hajek, 2020[13]	Community in Germany	Community	28.9	NR
Host, 2011[38]	Copenhagen area in Denmark	Community	64.3	NR
Howland, 1998[25]	Communities in Eastern Massachusetts	Community	87	NR
Iliffe, 2007[16]	Community in London, England	Community	32.8	NR
Kara, 2009[28]	Districts of Narlıdere, Gülbahçe and Mordoğan in Izmir, Turkey	Community	27.7	NR
Mendes da Costa, 2012[29]	Community in Walloon region of Belgium	Community	36.4	NR
Merchant, 2020[7]	Community in northwest region of Singapore	Community	NR	NR
Meric, 2007[34]	Geriatric Outpatient of Gülhane Military Medical Academy in Turkey	Medical	13.6	NR
Murphy, 2002[1]	Community setting in New Haven, Connecticut, USA	Community	70	NR
Nakaya, 2013[6]	Community in Japan	Community	NR	87.3% reported sufficient social support, 12.2% reported lack of social support, 4.2% unknown.
Nicholson, 2005[15]	Community in United States	Community	53.4	NR
Petrinec, 2020[32]	Cleveland Catholic Diocese in USA	Community	100	Participants were not included if they needed caregiver assistance.
Pin, 2016[11]	Communities in 10 European Countries (Denmark, Sweden, The Netherlands, Austria, Germany, France, Belgium, Switzerland, Italy, and Spain)	Community	NR	NR
Quach, 2016[19]	Communities in USA	Community	23.3	One-third did not have the perceived support with basic personal care (eating or dressing) when needed.
Robins, 2018[21]	Communities in Australia	Community	49	NR
Schmid, 2009[35]	Community in United States	Community	NR	All participants had a caregiver.
Schnittger, 2012[18]	Technology Research for Independent Living (TRIL) clinic at St James's Hospital, Dublin.	Medical	NR	NR
Stel, 2004[2]	Community in three regions in the Netherlands	Community	NR	NR

Tinetti, 1998[9]	Community in New Haven, Connecticut, USA	Community	NR	NR
Tinetti, 1994[24]	Community in New Haven, Connecticut, USA	Community	69	NR
van der Meulen, 2014[10]	Community in the Netherlands	Community	53.1	NA
van Lankveld, 2011[17]	Community in the Netherlands	Community	NR	NR
Vanden Wyngaert, 2020[23]	Dialysis centres in Belgium	Medical	NR	NR
Vellas, 1987[8]	Community in Toulouse, France	Community	NR	NR
Ward-Griffin, 2004[33]	Community in Canada (11 senior apartment towers and in the Health Information and Promotion Centre)	Community	77.7	NR
Xu, 2019[39]	Community rehabilitation centers in Singapore	Medical	0	Four family caregivers (two male) and four maids (all female) were interviewed. 33% employed a maid as a main caregiver.
Yu, 2020[12]	Community in USA	Community	NR	NR
Zijlstra, 2007[27]	Community in two urban areas in the Netherlands	Community	44	NR

FALLS AND FRAILTY DATA								
Author, year	**Participants with history of falling (%)**	**List of comorbidities [comorbidity 1 (%), etc.]**	**Participants with frailty (%)**	**Frailty scale**	**Overall frailty score**	**Overall frailty score type**	**Frailty variance value**	**Frailty variance type**
Apikomonkon, 2003[26]	21	NR	NR	NR	NR	NR	NR	NR
Chiu, 2011[37]	100	All participants reported having chronic conditions. The most common physical conditions reported were diabetes and hypertension.	NR	NR	NR	NR	NR	NR
Choi, 2015[30]	NR	NR	NR	NR	NR	NR	NR	NR
Curcio, 2009[4]	31.9	Hypertension (53.0), Osteoarthritis (39.2), heart disease (20.2), COPD	NR	NR	NR	NR	NR	NR

		(16.8), Diabetes Mellitus (13.4), Lower extremities fracture (11.7), Pain in joints (33.1), Dizziness (15.2), Breathlessness (11.4), Hearing impairment (33.0), visual impairment (68.9)						
Dias, 2011[5]	NR	NR	NR	NR	NR	NR	NR	NR
Faes, 2010[36]	100	Cognitive impairment (70%)	NR	NR	NR	NR	NR	NR
Faria, 2020[22]	25	Cardiovascular diseases (76.6), endocrine diseases (56.8), musculoskeletal diseases (45.7), depression (16.3), respiratory diseases (14.3) and cerebrovascular diseases (9.3).	NR	NR	NR	NR	NR	NR
Ferreira, 2018[31]	NR	Overweight (women=65.2%, men=59.0%)	NR	NR	NR	NR	NR	NR
Finn, 2001[14]	51	NR	NR	NR	NR	NR	NR	NR
Gagnon, 2005[3]	100	NR	NR	NR	NR	NR	NR	NR
Hajek, 2017[20]	17.6	NR	NR	NR	NR	NR	NR	NR
Hajek, 2020[13]	NR	Number of physical illnesses is mean = 2.6, SD = 1.9	NR	NR	NR	NR	NR	NR
Host, 2011[38]	100	NR	NR	NR	NR	NR	NR	NR
Howland, 1998[25]	35	Vision problems (26), stroke (11), dizziness (29)	NR	NR	NR	NR	NR	NR
Iliffe, 2007[16]	11.20	Two or more chronic conditions (59.0%), takes 4 or more meds (33.4%)	NR	NR	NR	NR	NR	NR
Kara, 2009[28]	29.9	NR	NR	NR	NR	NR	NR	NR
Mendes da Costa, 2012[29]	31.6	NR	NR	NR	NR	NR	NR	NR
Merchant, 2020[7]	mean = 0.4	NR	51.3	FRAIL scale	NR	NR	NR	NR
Meric, 2007[34]	81	NR	NR	NR	NR	NR	NR	NR
Murphy, 2002[1]	39.70	Chronic dizziness (24.2), 5 or more medications (35.8), vision impairment (40.5)	NR	NR	NR	NR	NR	NR
Nakaya, 2013[6]	17.3	NR	NR	NR	NR	NR	NR	NR
Nicholson, 2005[15]	100	NR	NR	NR	NR	NR	NR	NR

Petrinec, 2020[32]	NR	Hypertension (60), Cataracts (60), Thyroid disorders (30), Osteoporosis (17), Diabetes (7)	19	Tilburg Frailty Indicator (TFI)	NR	NR	NR	NR
Pin, 2016[11]	2.8	NR	NR	NR	NR	NR	NR	NR
Quach, 2016[19]	38.0	NR	NR	NR	NR	NR	NR	NR
Robins, 2018[21]	38	Congestive heart failure (4%); Heart disease (33%); stroke (9%); Cancer (25%); diabetes (18%); lung disease (16%); Parkinson's disease (1%)	NR	NR	NR	NR	NR	NR
Schmid, 2009[35]	NR	Stroke (100%)	NR	NR	NR	NR	NR	NR
Schnittger, 2012[18]	NR	NR	NR	NR	NR	NR	NR	NR
Stel, 2004[2]	100	Dizziness (27.9%), visual impairment (23%)	NR	NR	NR	NR	NR	NR
Tinetti, 1998[9]	30.3	NR	NR	NR	NR	NR	NR	NR
Tinetti, 1994[24]	39	One or more chronic conditions (78%)	NR	NR	NR	NR	NR	NR
van der Meulen, 2014[10]	55.5	NA	NR	NA	NA	NA	NA	NA
van Lankveld, 2011[17]	44	Cardiac 36%, hypertension 40%, vascular 25%, respiratory 12%, EENT 21%, upper GI 14%, lower GI 10%, Hepatic 3%, kidney 3%, other GU 16%, neurological 18%, endocrine 21%, psychiatric 8%, Rhuematic disease general (56%), Osteoarthritis (49%), Spondylosis(31%), Rheumatoid arthritis(17%), Arthritis otherwise defined (12%), Gout (6%), Chodrocalcinosis (12%), Osteoporosis (1%), Shoulder problem (6%), Polymyalgia rheumatica (3%), Soft tissue (1%), Carpal tunnel syndrome (2%), Others (6%)	NR	NR	NR	NR	NR	NR
Vanden Wyngaert, 2020[23]	NR	Cardiovascular disease (74.3%) diabetes (46.0%) musculoskeletal complications (44.2%), Neuropathy (28.3), retinopathy (31.9), respiratory complications (24.8), hepatopathy (17.7), pain (27.4%), depression	NR	NR	NR	NR	NR	NR

		(23.9%), fatigue (18.6%), anxiety (15.0%), sleep disturbances (12.4%)						
Vellas, 1987[8]	50	NR	NR	NR	NR	NR	NR	NR
Ward-Griffin, 2004[33]	NR	NR	NR	NR	NR	NR	NR	NR
Xu, 2019[39]	100	Stroke (100%)	NR	NR	NR	NR	NR	NR
Yu, 2020[12]	mean =0.74	The mean number of comorbidities at baseline was 2.24 (SD=1.38)	NR	NR	NR	NR	NR	NR
Zijlstra, 2007[27]	32.6	NR	NR	NR	NR	NR	NR	NR

Appendix 4: Mental health outcomes related to falls, fear of falling, and social isolation (n=6)

Author, Year	Sample	Results	Text description/ interpretation of findings
Murphy, 2002[1]	n=1064	**Variables independently associated with activity restriction in participants with fear of falling** *Depression (CES-D scale)* Adj relative risk: 1.27 (95% CI, 1.00-1.60); p=0.048	"We found that a history of an injurious fall within the past year, slow timed physical performance, two or more chronic conditions, and depressive symptoms were all independently associated with activity restriction."
Stel, 2004[2]	n=204	**Relationship between higher depression score and decline in social activities because of a fall** OR: 2.0 (95% CI: 1.2-3.3); p<0.05	"A decline in functional status, social activities, and physical activities was reported more often in respondents with a higher depression score."
Gagnon, 2005[3]	n=105	**Variables associated with fear of falling** (Comparing subjects with no/slight fear and subjects with moderate/severe fear) **Depression** (Structured Clinical Interview for DSM-IV (SCID)) Wald chi-square= 8.76; p=0.03 **Anxiety** (Structured Clinical Interview for DSM-IV (SCID)) Wald chi-square= 5.95; p<0.02	"Not only were depressive disorders and depression severity independently associated with fear of falling, but depression had the strongest association with this fear among the variables that we measured. Given that this was a cross-sectional study, a causal relationship between depression and fear of falling cannot be inferred. [...] It is possible, therefore, that in some individuals, fear of falling is an anxious manifestation of depression. However, depression could also be a consequence of activity restriction or social isolation resulting from a fear of falling" "Depressive disorders and anxiety disorders were significantly associated with categorical fear of falling, independently of these variables"
Curcio, 2009[4]	n=1668	**Variables associated with activity restriction related to fear of falling** **Depression** OR: 1.76 (95%CI, 1.38-2.24)	"A second model was then constructed with the psychosocial associated factors and other clinical and functional covariates (see Table 4). After adjustment, functional and clinical factors remained independently associated with activity restriction related to fear of falling. Only depression and poor perceived health variables emerged as independent factors."
Dias, 2011[5]	n=113	**Variables associated with activity restriction due to fear of falling** (compared to no FOF or FOF alone)	"The variables that best discriminated the groups were depression, exhaustion and participation in social activities, demonstrated in the diagram (Figure 1). For the grouping obtained through the Chi-square

		Depression Chi-square=15.2, p=0.004	Automatic Interaction Detection (CHAID) method, it may be observed that the first distinctive characteristic was depression, evaluated using GDS. Those with positive symptoms for depression showed 90% chance of restricting activities due to fear of falling. Additionally, the presence of depressive symptoms seems to modulate the factors that are associated with activity restriction due to fear of falling. A greater risk for depression has been associated with inadequate evaluation of coping self-efficacy in stressful events of life. It is worth noting that the participants of the present study who restricted activities by FOF showed lower self-efficacy in relation to the other participants. Thus, it is possible that elders with depressive symptoms perceive themselves less capable of performing certain tasks and, because of that, restrict their activities.
Nakaya, 2013[6]	n=43487	**Relationship between history of falling and psychological distress** <u>Sufficient social support</u> OR, 1.6 (95% CI: 1.3-1.9) p<0.01 <u>Lack of social support</u> OR, 2.0 (95% CI: 1.4-2.8) p<0.01	"We also conducted stratified analyses regarding OR of psychological distress according to differences in social support status. Almost all subjects with a history of physical disease (including those with history of fall/fracture) were at increased risk of psychological distress, regardless of social support."
Merchant, 2020[7]	n=493	**Variables associated with fear of falling alone** **Depression** OR, 4.90 (95% CI, 1.06–22.67) p<0.05 **Variables associated with fear of falling + fear-based activity restriction** **Depression** OR, 5.17 (95% CI, 1.84–14.54)	"In our study, FOF and/or FAR were both significantly associated with **depression** in univariate and multivariate logistics regression model. Those with FOF + FAR were nine times more likely to be depressed than those with no FOF. […] Strong links between depressive symptoms with FOF and/or FAR have been reported in various studies, and their association is believed to be bidirectional, where management of one condition would improve the other."

Appendix 5: Findings from included cohort studies (n=6)

Author, Year	Sample	Results	Text description/ interpretation of findings
Vellas, 1987[8]	n=178 Studied two populations: 1) Individuals living in a retirement home (Fall victims = 59; Non-fallers=59) 2) Individuals living at home (Fall victims = 30; Non-fallers=30)	Retirement home (n=118) Among the fall victims there was a tendency towards restriction of activity: 3% walked less indoors, 5% went outside less, 4% had no leisure activity, 7% no longer visited their children and 11% no longer visited their friends. The lack of significance (P>0.05) is linked both to the very low level of activity on day 1 of the aged population living in retirement homes and to our small sample. At home (n=60) On day 1, the fallers and control group had identical levels of activity. Reported a significant difference in the number of participants who maintained the same level of activity after 6 months, with this number being reduced in fall victims compared to non-fallers (p<0.02)	"The interpersonal relationships of the fallers were very poor: 90% did not belong to any group, 54% never visited their children, 40% never visited anybody." "A fall may lead to loss of autonomy. Factors arising as a result of falls have been identified by Isaacs and his co-workers. Our prospective study confirms these findings and demonstrates restriction of activity following a fall without fracture." "Falls in elderly persons give rise to a decrease in activity and social life. The fear of recurrence often leads to 'institutionalizing' the patient. But, it is difficult to show whether falls are an indication or the cause of the loss of autonomy."
Tinetti, 1998[9]	n=1103 at baseline, 770 at 3 years follow-up	**Effect of having 2 or more non-injurious falls on social functioning** (Social Activity Scale)**:** Regression coefficient = -0.538 (p<0.05)	"While there did not appear to be an increased risk of decline in social functioning among participants experiencing a single noninjurious fall, repetitive fallers experienced a decline in social functioning in both short- and long-term follow-up analyses. The relationship between repetitive falling and decline in social functioning remained after adjusting for each category of covariates. Experiencing a serious fall injury, on the other hand, was only marginally associated with decline in social functioning over the 1-year follow-up, and not at all over the 3-year follow-up. Preferential loss to follow-up of persons experiencing decline in social functioning between the 1- and 3-year follow-up interviews might at least partially explain the lack of relationship between injurious falls and change in social activities."

Van der Meulen, 2014[10]	n=260 Low level of concern about falling (n=127) High level of concern about falling (n=129) Follow-up = 14 months	**Social participation** (Frenchay Activities Index) Low level falling concern: Baseline mean, 39.9 (SD, 7.1) Follow-up mean, 38.8 (SD, 7.6) High level falling concern: Baseline mean, 36.8 (SD, 7) Follow-up mean, 35.7 (SD, 7.7) **p-value = 0.006**	"High and low levels of fall-related concerns predicted significant differences in ADL dysfunction and social participation that were persistent over 14 months of follow-up. […] Accompanying effect size estimations were medium (social participation) to large (ADL dysfunction)."
Pin, 2016[11]	n=16583 Fallers (n=411) Non-fallers (n=14205)	**Effect of falls on social participation** (binary variable based on if they reported performing at least one activity from a prespecifed list of activities) Model 2 adjusted by time, age, sociodemographic variables and health indicators: OR, 0.86 [95% CI, 0.76-0.89] (p<0.001) Model 3 added adjustment for frailty: OR, 0.95 [95% CI, 0.89-1.02] The interaction between initial frailty status and falling was significant (Table 4, Model 7a). Contrast analyses revealed that the probability of social participation was less among frail people than among people who did not meet any of the frailty criteria in both fallers ($\chi 2$ (1)=6.93;p<0.01) and non-fallers ($\chi 2$ (1)=41.21; p<0.001)	"Falling significantly decreased the probability of social participation in each of these activities and of participation in at least one of them, but only before frailty was introduced into the models (Table 3, Models 2 and 3). Frailty is indeed a strong confounder in the relationship between falls and social participation. When it is taken in consideration in multivariate models, the size of the effect of falling decreased and was no longer significant." "Then, we demonstrated the major role of frailty in the relationship between falling and social participation. The construction of the frailty phenotype (Fried et al., 2001; Santos-Eggimann et al., 2009) was based on its physical component. In this manner frailty and falling were very close constructs. They shared similar risk factors, such as mobility disorders or bone density, and they had similar consequences in terms of disability or mortality. Moreover, we showed that they had similar consequences in terms of social participation. Thus, it may be difficult to distinguish between the two concepts and to identify a specific impact of falling (Nowak & Hubbard, 2009). However, our analyses showed that the continuity in or disengagement from social activities was due to a long-term process that was amplified by health events, rather than by the falls themselves."
Yu, 2020[12]	n=4680	**Relationship between number of falls and loneliness over 3 time-points** (3 item UCLA Loneliness Scale) Regression coefficient = 0.008, SE = 0.04, p =0.048;	"Only the number of falls was significantly correlated with the loneliness score in the next time point, and more frequent loneliness at the previous wave predicts an increased number of falls in 4 years […]The results suggest that a vicious circle relationship exists between loneliness and falls. […] An increased number of falls also predicted more frequent loneliness in 4 years. These findings support evidence reported in cross-

		Wave 1-2: β=0.030, Wave 2-3: β= 0.068	sectional studies that the occurrence of falls was related to social exclusion. […] Older adults who have fallen more frequently might choose to avoid risky activities such as going outside of the home and engaging in social activities. This could lead to a discrepancy in desired and actual social engagement, which in turn results in more frequent experience of loneliness.”
Hajek, 2020[13]	n=8836 In total, 669 individuals changed fear of falling (FOF) status from wave 5 to wave 6. More specifically, while the onset of FOF occurred in 431 individuals, the end of FOF occurred in 238 individuals.	**Relationship between fear of falling and loneliness** (Bude and Lantermann scale) **Onset of FOF** β=0.02, SE=0.02, p=NR **End of FOF** β= -0.06, SE=0.03, p<0.05 **Relationship between fear of falling and social isolation** (De Jong Gierveld Loneliness Scale) **Onset of FOF** β=0.06, SE=0.03, p<0.1 **End of FOF** β= 0.01, SE=0.04, p=NR	“The end of FOF was associated with reduced depressive symptoms (β = −1.08, P < .05), decreased loneliness scores (β = −0.06, P < .05), as well as decreased negative affect (β = −0.07, P < .05). We assume that the end of FOF has the potential to mark a decisive turning point in life for individuals who scored high in these adverse conditions (severe depressive symptoms, strong loneliness, or frequent negative emotions) when they had FOF.” “The end of FOF was associated with decreases in negative psychosocial outcome measures (depressive symptoms, negative affect, and loneliness). However, and in contrast to the other negative psychosocial outcome measures, it is quite puzzling why the end of FOF was not associated with decreases in social isolation. A possible explanation may be that even a major life event, such as the end of FOF, does not have the power to reduce social isolation because feelings of isolation may remain largely stable over the years among middle-aged and older adults with FOF. Thus, individuals developing feelings of social isolation caused by FOF, several years ago, may have difficulties in overcoming these feelings of isolation”

Appendix 6: Cross-sectional studies reporting on falls and social isolation/loneliness (n=11)

Author, Year	Sample	Results	Text description/ interpretation of findings
Finn, 2001[14]	n=49	**Social Resources** (OARS Social Support Scale) Fallers (n=25) Mean: 2.4 (SD, 1) Non-Fallers (n=24) Mean: 2.0 (SD, 0.78) p = 0.59	"The data from the present study supports the conclusion that the social resources of nursing home residents are the same, regardless of a history of falls that does not change their level of previous functioning. Most nursing home residents are already in a position where they have to rely on others to come to them for visits, outings, etc.. Unlike many community-based elderly individuals most nursing home residents do not have the means or capabilities to visit others who are not in their immediate environment. Therefore, regardless of fall-history the social resources available to nursing home residents are dependent on others."
Stel, 2004[2]	n=204	**Relationship between falls inside and decline in social activities because of a fall** OR: 2.6 (95% CI: 1.1-6.5); p<0.05	"A decline in social activities after falling is significantly associated with falls inside. The current study shows that falls could also have consequences on the level of functioning of older people: respondents reported a decline in functional status (35.3%), a decline in social activities outside the house (16.7%) and physical activities (15.2%) as a direct consequence of the last fall."
Nicholson, 2005[15]	n=68	**Relationship between injurious falls and social isolation** (Lubben Social Network Scale) **Social isolation** ρ= -0.4; p<0.05 **Female** ρ= -0.5; p=0.01 **Family Sub Scale of Social Isolation** ρ= -0.2; p=0.12	"Results suggest that there is a strong positive relationship between injurious falls and social isolation. Results from this sample suggest that there is an association between lower scores on the LSNS and higher number of injurious falls, which means that increased injurious falls are related to increased social isolation. In the findings for this sample it appears that there may be some direct link between injurious falls and social isolation. Gender appeared to play a role when examining H4. Males as a group did not show a significant relationship between number of injurious falls and social isolation. The relationship for females as a group was positive and significant. This female sample showed a high Pearson's correlation coefficient (see Table 4). This suggests that injurious falls may trigger some direct link to social isolation in females. "When examining the family subscale of the LSNS, there was no correlation between injurious falls and social isolation (see Table 3). It is possible that as the participant continues to have injurious falls and becomes less likely to leave the house due to a fear of future injurious falls, he/she will eventually become socially isolated. This is not necessarily the case when families are involved."

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		Friend Sub Scale of Social Isolation ρ= -0.43; p<0.05	"On the other hand, in the case of the friends subscale, there was a strong correlation between injurious falls and social isolation, such that a greater number of injurious falls was associated with a greater degree of social isolation. A possible explanation for this may be the opposite of the phenomenon with family and social isolation. The participant who has increasing injurious falls may become more likely to stay in the house thus losing contact with friends. Friends of the participants tend to be around the same age as the participant and are less likely to increase the amount of visits to the participant to make up for the lack of contact the participant suffers as a result of being homebound."
Iliffe, 2007[16]	n=3139	**Falls and social isolation** (Lubben social network scale) Socially isolated (n=368) 13.6% reported multiple falls in the past 12 months Not socially isolated (n=2133) 10.7% reported multiple falls in the past 12 months p=0.11	Multivariate analysis taking into account all statistically significant associations shows a different pattern. The risk of social isolation appears to be associated with depressed mood and living alone, while male sex, memory impairment and perceived poor health may be weakly associated. For the other factors [multiple] listed in the second hypothesis, no significant associations in bivariate or multivariate analyses were found.
Van Lankveld, 2011[17]	n=154	**Relationship of falls with loneliness** (De Jong Gierveld Loneliness scale) Correlation coefficient = 0.14 p=not significant	"Health status indicators were unrelated to falls and cognitive functioning, and showed low to moderate relations with the remaining health hazards."
Schnittger, 2012[18]	n=579	**Association between history of falls and pathways of loneliness** **Emotional loneliness** (de Jong-Gierveld Loneliness Scale) Correlation coefficient=0.134 p<0.003 **Social loneliness** (de Jong-Gierveld Loneliness Scale) Correlation coefficient=0.09 p=not significant	"Interestingly, social support was the only outcome in which a biological variable, falls history, emerged in the final model; this may indicate the relative importance of health factors compared to psychosocial factors in the loneliness models"

		Social support (Lubben Social Network Scale) Correlation coefficient= -0.247 p<0.003	
Quach, 2016[19]	n=8464 No falls group (n=5249) One fall group (n=1352) At least two falls group (n=1863)	**Social Relationship Index [mean (SD)]** No falls: 3.34 (1.32) One fall: 3.24 (1.35) At least two falls: 3.08 (1.35) p<0.0001 *Note: this is a cohort study, but the outcomes relevant to our review question are from a cross-sectional survey given to participants at baseline*	"Respondents who fell had a higher prevalence of clinically significant depression symptoms, were more often not married, had fewer good friends living in their neighborhood, were less likely to attend religious services or to be a volunteer, and were less likely to have perceived support from friends or relatives, when needed. The average score of the social relationship index for fallers (3.08 and 3.24 for respondents with at least 2 falls or one fall respectively) tended to be lower than for respondents who did not fall (3.34 score on the index, p<.0001)"
Hajek, 2017[20]	n=7808	**Variables associated with history of falls** **Social exclusion** (Bude and Lantermann scale) β =0.08; SE, -0.02; p<0.001 **Loneliness** (De Jong Gierveld Loneliness Scale) β =0.08; SE, -0.02; p<0.001	Controlling for potential confounders, linear regression analysis showed that reporting a fall in the previous 12 months was associated with higher social exclusion scores (β = .08, p < .001), and higher loneliness scores (β = .08, p < .001). Contrarily, reporting a fall in the preceding 12 months was not associated with the number of important people in regular contact.
Robins, 2018[21]	n=245	**Relationship between falls and social isolation** (Friendship Scale for social isolation) OR 1.03 (95% CI: 0.66-1.62); p=0.9	No statistically significant association reported between experiencing a fall in the past 12 months and social isolation.
Faria, 2020[22]	n=48	**Relationship between falls and loneliness** (UCLA scale) p=0.384	No statistically significant association reported between experiencing a fall in the past 6 months and loneliness

Vanden Wyngaert, 2020[23]	n=113	**Variables associated with risk of falls** **Ability to participate in social roles and activities** (PROMIS questionnaire) R^2=0.11; p=0.01 **Depression** R^2=0.08; p=0.01	"Regarding the PROMIS questionnaire, low associations were found between measures of the risk of falls and the appreciation of participation in social roles and activities on the one hand (R2 = 0.11), and depression on the other (R2 = 0.08)" "Remarkably, the risk of falls on itself was identified as a determinant of difficulties on psycho-social well-being (i.e. depression and social isolation) and of objective health utility [...]. As such, falls and an increased risk of falls may deter subjects to continue their outdoor social activities, resulting in changes in means and location of social contact to less stimulating activities (e.g. a phone call rather than a rendezvous point), promoting the risk of impairments in mental health and depression"

Appendix 7: Cross-sectional studies reporting on fear of falling and activity restriction due to fear of falling (n= 15)

Author, Year	Sample	Results	Text description/ interpretation of findings
Tinetti, 1994[24]	n=1103	**Fear of falling** (Falls Efficacy Scale – modified so low score corresponds with low confidence or greater fear) Fallers Mean, 79.8 (SD 23.4) Non-fallers Mean, 88.1 (SD 17.9) p < .0001 **Activity restriction because of fear of falling** Fallers = 24% Non-fallers =15% chi-square= 13.1; p < 0.001	In order to examine the impact of recent falls, we also determined the proportion of subjects reporting fear and the mean fall-related efficacy scores separately for subjects who did and did not experience a fall in the year prior to the interview. The proportion of subjects reporting a decrease in activity because of fear of falling was 24% among fallers vs 15% among non-fallers (chi-square= 13.1; p < .001). The mean fall-related efficacy scores were 79.8 (SD 23.4) and 88.1 (SD 17.9) among fallers and non-fallers, respectively (p < .0001).
Howland, 1998[25]	n=266	**Relationship between falls and fear of falling** OR: 2.498 (95% CI: 1.013-6.159); p=0.05 **Relationship between falls and activity curtailment among those afraid of falling** OR: 1.094 (95% CI: 0.376-3.177); p=0.869 **Relationship between social support and activity curtailment among those afraid of falling** (Social Support Scale) OR: 1.574 (95% CI: 1.082-2.290); p=0.018 *Note: Here a higher social support score indicates lower levels of social support*	"The contribution of personal falls experience to fear of falling was apparent. Those who suffered a previous fall were more likely to have a fear of falling." "Surprisingly, neither the degree of fear of falling nor the experience of falls was associated with activity restriction. This finding suggests that activity curtailment is not just associated with extreme levels of fear. The presence of social support was, however, important. Those who could rely on others or talk with friends about falling were least likely to report activity curtailment. Thus, support of family and friends may be an important prerequisite for continuing to remain active even in the face of fear of falling. This support may serve as a buffer to the potentially debilitating consequences of fear of falling. It is possible this support is manifested as encouragement for remaining active." "Those who curtailed activities […] did not differ with respect to social integration but were significantly (p = .024) less likely to be able to rely on friends or relatives in times of crisis (social support)"
Murphy, 2002[1]	n=1064	**Variables independently associated with activity restriction in participants with fear of falling**	"We found that a history of an injurious fall within the past year, slow timed physical performance, two or more chronic conditions, and

		Injurious fall Adjusted relative risk (ARR): 1.36 (95% CI, 1.11-1.66); p=0.003 *Two or more chronic conditions* ARR: 1.34 (95% CI, 1.08-1.65); p=0.007 *Slow-timed physical performance* ARR: 1.44 (95% CI, 1.18-1.75); p=0.0004	depressive symptoms were all independently associated with activity restriction."
Apikomonkon, 2003[26]	n=546	**Relationship between falls and activity restriction** Chi-square=5.49, p<0.05 **Relationship between fear of falling and activity restriction** Chi-square=23.27, p<0.001	"Compared with non-fallers, the older people with falls experiences were more likely to have activity restriction (28% vs 16%). The Chi-square test indicated that fall history was associated with activity restriction measured by dichotomous question. "Older people with FOF were more likely to have activity restriction (26% vs 10%). The FOF using the SAFE FOF version was significantly associated with activity restriction as measured by dichotomous question."
Gagnon, 2005[3]	n=105	**Variables associated with fear of falling** (Comparing subjects with no/slight fear and subjects with moderate/severe fear) **Social support** (confiding-relationships component of the Bedford Life Events and Difficulties Schedule modified for elderly subjects) Wald chi-square= 3.77; p=0.05	"The following secondary independent variables were significantly associated with categorical fear of falling: dizziness (Wald chi-square 6.58; p 0.01), total number of medications (Wald chi-square 5.40; p 0.02), and social support (Wald chi-square 3.77; p 0.05). (Note: Higher scores mean less support.)"
Zijlstra, 2007[27]	n=4376	**Variables significantly associated with avoidance of activity due to fear of falling** **Multiple falls in past 6 months** OR: 1.97 (95% CI, 1.52-2.54)	"When fear of falling was added as an additional variable (model 3; Table 3), odds ratios of all variables that showed significance in model 2 decreased. Nevertheless, the association for the highest age group (≥80 years), fair and poor perceived general health and multiple falls with avoidance of activities remained statistically significant. Our findings regarding avoidance of activity remained fairly similar when fear of falling was entered into the logistic model. Although sometimes, often and very often experiencing fear of falling were

		Aged 80 years or older OR: 1.56 (95% CI, 1.24-1.95) **Fair perceived general health** OR: 2.92 (95% CI, 2.43-3.52) **Poor perceived general health** OR: 5.7 (95% CI, 3.57-9.12)	strongly associated with avoidance of activity. Higher age (≥80 years), fair and poor perceived health and multiple falls remained independently associated with avoidance of activity in community-living older people. This implies that interventions aimed at reducing avoidance of activity should not focus on fear of falling alone, but on other modifiable factors, like falls, as well"
Iliffe, 2007[16]	n=3139	**Relationship between fear of falling and social isolation** (Lubben Social Network Scale) OR: 1.21 (95%CI, 0.88-1.65)	Multivariate analysis taking into account all statistically significant associations shows a different pattern. The risk of social isolation appears to be associated with depressed mood and living alone, while male sex, memory impairment and perceived poor health may be weakly associated. For the other factors [(fear of falling)] listed in the second hypothesis, no significant associations in bivariate or multivariate analyses were found.
Curcio, 2009[4]	n=1668	**Variables associated with activity restriction related to fear of falling** **At least 1 fall in past year** OR: 1.48 (95%CI, 1.18-1.86); p=0.001 **Low social participation** OR: 1.52 (95%CI, 1.20-1.92); p<0.01 **Poor perceived health** OR: 1.38 (95%CI, 1.06-1.79) **Difficulties in activities of daily living** OR: 1.65 (95%CI, 1.16-2.32) **Decreased physical activity** OR: 1.35 (95%CI, 1.06-1.70)	"Those who had activity restriction related to fear of falling were significantly more likely to have had a fall within the past year, with a trend to suffer recurrent falls and injurious falls." "Table 3 shows the bivariate relationships between activity restriction related to fear of falling and psychosocial factors. Activity restriction related to fear of falling had a strong bivariate association with poor perceived health, depression, low social participation, and poor life satisfaction." "A second model was then constructed with the psychosocial associated factors and other clinical and functional covariates (see Table 4). After adjustment, functional and clinical factors remained independently associated with activity restriction related to fear of falling. Only depression and poor perceived health variables emerged as independent factors." "logistic regression analyses for activity restriction related to fear of falling. In the first model, 19 demographic, functional, and health-related variables with p values less than .05 derived from the bivariate analysis were entered into the logistic regression as independent variables. Difficulties in ADL, decreased physical activity, polypharmacy, and

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		Polypharmacy OR: 1.56 (95%CI, 1.14-2.14) **Below poverty level** OR: 1.32 (95%CI, 1.05-1.65)	extreme poverty were independently associated with activity restriction related to fear of falling. A second model was then constructed with the psychosocial associated factors and other clinical and functional covariates (see Table 4). After adjustment functional and clinical factors remained independently associated with activity restriction related to fear of falling."
Kara, 2009[28]	n=47	**Relationship between fear of falling and loneliness** (Philadelphia Geriatric Center Morale Scale) ρ= 0.258; p=Not significant	When the correlation between the fear of falling and the subscales of the Philadelphia Geriatric Center Morale Scale was examined, no correlations were found (Table 5).
Dias, 2011[5]	n=113	**Variables associated with activity restriction due to fear of falling** (compared to no FOF or FOF alone) **Fear of falling intensity** Mean 3.4 (SD, 0.9); p<0.0 **Depression** Chi-square=15.2, p=0.004 **Exhaustion** Chi-square=9.2, p=0.01 **Participation in social activities** Chi-square=10.4, p=0.016	"The three groups were statistically different in relation to FOF evaluated using the question about fear intensity. The group that reported FOF and activity restriction demonstrated higher levels of fear when compared with the other groups" "The variables that best discriminated the groups were depression, exhaustion and participation in social activities, demonstrated in the diagram (Figure 1). For the grouping obtained through the Chi-square Automatic Interaction Detection (CHAID) method, it may be observed that the first distinctive characteristic was depression, evaluated using GDS. Those with positive symptoms for depression showed 90% chance of restricting activities due to fear of falling. Additionally, the presence of depressive symptoms seems to modulate the factors that are associated with activity restriction due to fear of falling. A greater risk for depression has been associated with inadequate evaluation of coping self-efficacy in stressful events of life. It is worth noting that the participants of the present study who restricted activities by FOF showed lower self-efficacy in relation to the other participants. Thus, it is possible that elders with depressive symptoms perceive themselves less capable of performing certain tasks and, because of that, restrict their activities. Out of the elders that did not have depressive symptoms, those who had positive result for exhaustion of the frailty phenotype had 78% chance of restricting activities due to fear of falling." "Out of the ones who did not show positive result for exhaustion, the other distinctive characteristic was participation in social activities. Those who stopped performing activities had 83% chance of restricting activities due to fear of falling.

			Participation in social activities was the last discriminatory factor for the studied sample; however this variable did not show association with activity restriction in the bivariate analysis. It is possible that this difference in relation to the participation in social activities only occurs for a subgroup and not for the whole sample"
Mendes da Costa, 2012[29]	n=501	**Relationship between activity restriction due to fear of falling and number of falls in past 12 months** 2 or more falls OR, 3.04 (95% CI, 1.70-5.42) 1 fall OR, 1.33 (95% CI, 0.66-2.68)	"activity restriction was increased significantly with age and with the number of falls within the past 12 months, accounting however one quarter of the subjects who did not fall. In the logistic regression model, these associations remained significant"
Choi, 2015[30]	n=4247	**Relationship between falls and fear-induced activity restriction** <u>Previous fall experiences</u> OR, 2.12 [95% CI, 0.96-4.67] p=0.062 <u>Injurious falls</u> OR, 3.03 [95% CI, 1.21-7.54] p=0.008	Characteristics independently associated with fear-induced activity restriction were low socioeconomic status, cognitive impairment, difficulty with activities of daily living, and a history of injurious falls.
Ferreira, 2018[31]	n=7935	**Relationship between fear of falling because of sidewalk defects and social participation** OR 1.01 (95% CI: 0.99-1.04)	"As in the univariate analysis, the fear of falling because of defects in sidewalks and the perception of violence in the neighborhood were not associated with social participation."
Petrinec, 2020[32]	n=108	**Relationship between fear of falling and social functioning** (Medical Outcomes Study 36-item Short-Form General Health Survey) β= -0.29	"Fear of falls was an independent predictor for role physical, physical functioning, and social functioning."
Merchant, 2020[7]	n=493	**Variables associated with fear of falling alone** **Number of falls**	"The multivariate logistics regression in Table 2 shows that female sex (OR = 3.54; 95% CI = 1.82–6.90), number of medications (OR = 1.28; 95% CI = 1.03–13.60), prefrail or frail (OR = 2.17; 95% CI = 1.26–3.73), depression (OR = 4.90; 95% CI = 1.06–22.67) and number of falls in the

		OR, 2.13 (95% CI, 1.20–3.78) p<0.05 **Social isolation** OR, 0.99 (95% CI, 0.51–1.89) p=not significant **Variables associated with fear of falling + fear-based activity restriction** **Number of falls** OR, 1.4 (95% CI, 0.94–2.20) p=not significant **Social isolation** OR, 1.7 (95% CI, 0.82–3.55) p=not significant **Sarcopenia** OR, 8.13 (95% CI, 1.52–43.41)	past 12 months (OR = 2.13; 95% CI = 1.20–3.78) were significantly associated with FOF. Only sarcopenia (OR = 8.13; 95% CI = 1.52–43.41) and depression (OR = 5.17; 95% CI = 1.84–14.54) were significantly associated with FOF + FAR. "**History of falling** is a well-known risk factor for FOF and/or FAR as persons who have experienced falls are more likely to develop fear. However, three-quarters of those with FOF + FAR and two-thirds of those with FOF + FAR had never experienced a fall during the study" "**Social isolation** is another factor that is rarely studied. In our study, one in three older adults with FOF + FAR were at risk of social isolation compared with one in five with no FOF" "Prefrailty, frailty, and **sarcopenia** have significant association with FOF and/or FAR in both univariate and multivariate analysis."

Appendix 8: Relevant findings from qualitative studies (n=7)

Author, Year	Qualitative analysis approach, and sample size	Results
Ward-Griffin, 2004[33]	Phenomenological approach n=9	"***Restricting activities was a second strategy identified by the participants, which involved avoiding certain social activities or/and physical environments. Participants used this strategy when they wanted to "play it safe" in times of inclement weather or in situations where ambulation might be difficult***. Precarious weather conditions seemed to heighten their awareness and fear of falling. As Sarah explained, "I do not fear falling, except around steps. They terrify me to death [along with] scaffolding around the town—that bothers me. Little kids on bicycles on the sidewalk— that bothers me. And I am restricted to the house when there's fresh snow on the ground." Similarly Wilfred stated, "When it's really, really icy, and I don't have to go out, I don't drive the car. I don't go out either." "
Meric, 2007[34]	Analysis approach not reported n=22	"***After having a falling experience, elderly individuals had behavioral changes, which decreased the competency of achieving daily life activities, such as staying away from the crowded environment, not going outside alone, acting very slowly, not able to do daily activities alone***: "... I can't go out anymore. I haven't been out alone for 2 years, there are always people next to me." (75; woman). "… I take my man's arm on the street, I can't get out much in case I fall into the street." (71; woman)." "
Schmid, 2009[35]	Latent content analysis n=42	"***Quotes regarding the subsequent consequences of poststroke falls categorized into the following three themes: (1) limiting activity and participation, (2) increasing dependence, and (3) developing a fear of falling***" "*Limiting activity: Because falling became common for some participants, talk about strategies for the prevention of future falls was common and emerged naturally during interviews.* ***A significant consequence was the choice to limit everyday life activities at home and in the community to help manage and prevent falls***" "Increasing dependence: Participants discussed their dependence on assistive devices such as walkers, canes, and wheelchairs to reduce falls and feel secure in their environment. Some participants indicated use of the furniture, walls, or people as alternative assistive devices. Many discussed dependence on caregivers for maintaining balance and preventing falls. ***Participants easily became isolated because they were fearful to leave their home, and some were even fearful to move about their own home, becoming increasingly dependent***." "Developing fear of falling: This initial experience of falling with stroke onset was a traumatic event that consequently resulted in participants expressing fear that future falls would mean having another stroke. They also discussed the ***subsequent development of fear of falling and the fear of being left on the floor for hours at a time***. ***Participants described genuine fear of falling and fear about being hurt as well as the subsequent impact on function and independence. Some participants discussed falls becoming a frequent event and a common and pervasive concern; fear, worry, and concern became a daily consequence of poststroke falls. Some participants were fearful that they would fall while out in the community and addressed the embarrassment of a public fall. They were concerned about how they looked while walking around and seemed to be worried about the stigma related to falls and decreased mobility.*** Managing falls and fear of falling in everyday life became an important aspect of poststroke adjustment."

Faes, 2010[36]	Grounded theory approach n=10	"***Patients described social withdrawal and attributed this to their fear of falling and the loss of physical capabilities after falling. Patients recognised that they became (more) dependent on their caregiver after falling. One patient experienced social benefits from her fall, since she now receives more attention from her children***" "P#1 I can't travel anymore because of my limited mobility. I injured my leg in a fall. P#4 I stay at home more often and don't visit my friends anymore. I am afraid to fall when I go out. P#5 My grandson is almost one year old. I still haven't seen his room. His room is upstairs; I am too anxious to fall when climbing the stairs." "Furthermore, ***our findings confirmed the consequences of falls in cognitively unimpaired older persons that are mentioned in the literature; these include a fear of falling and social withdrawal due to the fear of falling and physical limitations***"
Chiu, 2011[37]	Focussed ethnographic approach n=18	"Following their initial fall, it appeared that changes occurred in individuals' independent living and use of informal support networks. While activities of daily living are continued either independently, with help from —hourly maids during the rehabilitation period or for longer, ***recreational activities usually were second priority and were soon discontinued***. Mah-Jong, one of the most popular tile games among Chinese was mentioned by 12 respondents as a favourite pass time. Other social activities mentioned included Cantonese opera, volunteering within their communities, and dim sum with friends. ***After a fall, these activities were interrupted for two main reasons: 1) lack of transportation means and 2) lower mobility capabilities. Feelings of loneliness arose as the respondents felt that they were cut off from their friends***." "Intuitive changes included modifications made to personal behaviours. ***Avoidance behaviour was reported as an intuitive change. Specifically, fallers would avoid outdoor activities***. Other intuitive changes include being more careful ("taking care") when walking and slowing down."
Host, 2011[38]	Phenomenographic approach n=14	"Others ***stopped doing certain activities to avoid falling and they did not choose activities that made them scared and nervous and caused bodily pain. They thus perceived that physical activity was not good and therefore stopped the activity***. The families and the general practitioner (GP) supported their choices. Conversely, some felt that it was a loss if they had to stop activities they had enjoyed because it increased their risk of falling." "***Fall accidents had implications for older people's identity and autonomy, and they could lead to social isolation.***" "Conversely, social interaction in the context of participation in fall-prevention activities was not always welcomed because it placed the respondents in a context in which they did not like to see themselves." "For others, ***support from professionals was important in how they coped with falls*** and their prevention. The GP was a good support when they needed knowledge about appropriate and applicable preventive activities."
Xu, 2019[39]	Thematic analysis n=17	Identified theme of restricted mobility and social participation.

		"***Stroke participants felt that they were restricted after the fall, particularly around having reduced balance, and this affected their mobility functions and degree of social participation***: I am getting worse, especially my balance. I used to walk for a short distance outside but now I can't. (S7) There was a big difference … I used to walk with walking stick. But I have not been able to walk since that fall. (S8) Last time I could take public transport, go to [central area] and take a walk, now it's too difficult for me. (S1)"

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Global evidence on falls and subsequent social isolation in older adults: A scoping review

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ABSTRACT

Background: Falls are a leading cause of injury-related hospitalizations among adults aged 65 years and older and may result in social isolation.

Objective: To summarize evidence on falls and subsequent social isolation and/or loneliness in older adults through a scoping review.

Eligibility criteria: Studies were eligible for inclusion if the population had a mean age of 60 years or older, they examined falls and subsequent social isolation, loneliness, fear of falling or risk factors, and were primary studies (e.g., experimental, quasi-experimental, observational, qualitative).

Sources of evidence: MEDLINE, CINAHL, Embase, Ageline, and grey literature from inception until January 11, 2021.

Charting methods: A screening and charting form was developed and pilot-tested. Subsequently, two reviewers screened citations and full-text articles, and charted the evidence.

Results: After screening 4,993 citations and 304 full-text articles, 39 studies were included in this review. Participants had a history of falling (range: 11 to 100%). Most studies were conducted in Europe (44%) and North America (33%) and were of the cross-sectional study design (66.7%), in the community (79%). Studies utilized 15 different scales. Six studies examined risk factors for social isolation and activity restriction associated with fear of falling. Six studies reported mental health outcomes related to falls and subsequent social isolation.

Conclusions: Consistency in outcome measurement is recommended, as multiple outcomes were used across the included studies. Further research is warranted in this area, given the aging population and the importance of falls and social isolation to the health of older adults.

Scoping Review Registration: 10.17605/OSF.IO/2R8HM

Word count: 246/250 (abstract), 2981/3000 (main text)

Keywords: scoping review, older adults, falling, social isolation, loneliness, fear of falling

Strengths and Limitations of this Study:

- A robust methodology including a thorough and extensive literature search was used to review the literature in the area.
- There was no date limits or language limits for studies eligible for inclusion in this scoping review.
- Scoping reviews do not assess the quality of included studies and we cannot confirm the directional causality between falls and social isolation.

INTRODUCTION

Addressing social isolation in older adults is a growing priority in Canada, as over 30% older adults are at risk of social isolation [1]. Social isolation among older adults is associated with adverse health outcomes including cognitive decline, depression, anxiety, and dementia [2]. Globally, falls are the second leading cause of unintentional injury death, making falls a major public health concern [3]. In Canada, falls are the leading cause of injury-related hospitalizations among adults aged 65 years and older, and 20-30% of older adults experience at least one fall each year [4]. Falls may result in serious health-related consequences including physical (e.g., fractures), physiological (e.g., cognitive decline), and psychological (e.g., anxiety, depressive symptoms, fear of falling, and social isolation) outcomes [5].

Given the detrimental outcomes associated with both falls and social isolation, there is a need to understand the relationship between falls and subsequent social isolation in older adults. The current scoping review is focused on falling and the subsequent experience of social isolation and/or loneliness and to ascertain whether the COVID-19 context affected the relationship between falls and subsequent social isolation.

METHODS

Protocol and registration

The protocol for this scoping review was developed in accordance with the JBI (formerly Joanna Briggs Institute) guidance for scoping reviews and registered with Open Science Framework [6]. An integrated knowledge translation approach was used [7], whereby colleagues from the Public Health Agency of Canada (YJ, KA, MdG, AGB) co-developed the review. The results are reported using the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) extension to scoping reviews [8] supplemented by PRISMA 2020 [9].

Patient and Public Involvement

Through the Strategy for Patient-Oriented Research (SPOR) Evidence Alliance, we collaborated closely with a patient partner who provided feedback on our protocol, participated in full-text screening piloting, and provided input on the manuscript (JB).

Search strategy

An experienced librarian developed our comprehensive literature search strategy, which was peer-reviewed by a second information specialist using the Peer Review of Electronic Search Strategies (PRESS) checklist [10]. MEDLINE, CINAHL, Embase, and Ageline were searched from inception until January 11, 2021 (Appendix 1). References of included studies and relevant reviews were scanned. Grey literature (i.e., unpublished or difficult to locate studies) was searched using the Canadian Agency for Drugs and Technologies in Health's Grey Matters checklist [11].

Eligibility criteria

The population of interest were older adults with a mean age of 60 years or older. The concept was the relationship between falls and subsequent social isolation or loneliness. As mentioned in our related systematic review on interventions for social isolation after falling, social isolation and loneliness are distinct concepts [12]. Social isolation included a decrease in any of the following: number of social contacts, feeling of belonging, fulfilling relationships, engagement with others, and quality of their personal network [12]. We defined loneliness as "the unpleasant experience that occurs when a person's network of social relations is deficient in some way, either quantitatively or qualitatively" [13]. For our primary objective, the context included any community or institutional setting. For our secondary objective, we limited the context to include studies that specified their consideration of the COVID-19 pandemic. Studies including

participants reporting a history of falling (i.e., regardless of the proportion of the sample who fell), the role of fear of falling in this relationship, as well as any risk (e.g. medication use, frailty) or protective (e.g. exercise, gait or balance training) factors were considered eligible for inclusion.

Eligible study designs included primary research studies of experimental (e.g., randomized controlled trials), quasi-experimental (e.g. non-randomized controlled trials, controlled before and after studies, interrupted time series), observational (e.g., cohort studies, case-control studies, cross-sectional studies), qualitative (phenomenological, ethnography, qualitative interview, etc.) and mixed method (e.g., convergent parallel, embedded, explanatory sequential) design. No restrictions based on study year, language of publication, or study duration were applied.

Study selection

A screening form was developed and a pilot-test using 50 citations was completed with 80% agreement, and subsequently, all remaining titles and abstracts were screened independently by pairs of reviewers (SMT, AP, JF, GM, AH). Discrepancies were resolved by a third reviewer.

Similarly, two pilot-tests were completed for full-text article screening (achieving 27% and 40% agreement, respectively), screening criteria were revised, and subsequently, full-text articles were assigned to independent pairs of reviewers. Discrepancies were resolved by a third reviewer.

Data charting

A charting form was developed to capture data on study characteristics, population characteristics and outcomes of interest. Relevant outcomes included any data illustrating the relationship between falls and subsequent social isolation, including the role of fear of falling,

and other risk factors or protective factors. A pilot-test was conducted using five studies, sufficient agreement was achieved, and subsequently, full data charting was completed by independent pairs of reviewers. Discrepancies were resolved by a third reviewer.

Analysis and presentation of results

The review findings were summarized descriptively using summary tables.

RESULTS

After screening 4993 citations and 304 full-text articles against our eligibility criteria, 39 studies were identified as eligible for inclusion based on our primary objective for this review (Figure 1). No studies were identified when limiting to the COVID-19 context for our secondary objective. Study and patient characteristics have been summarized in Table 1 and detailed data are reported in Appendices 2 and 3.

Table 1: Summary of study and patient characteristics

Characteristics	Number (%)
Study Characteristics (n=39)	
Geographical region	
Asia	5 (12.8%)
Australia	1 (2.5%)
Europe	17 (43.6%)
North America	13 (33.3%)
South America	3 (7.7%)
Study design	
Cohort	6 (13.8%)
Cross-sectional	26 (66.7%)
Qualitative	7 (19.4%)
Study duration	
NA	29 (74.3%)
≤ 1 year	5 (12.8%)
≥ 1 year	5 (12.8%)
Patient characteristics	
Mean age	74.9 (range, 65.0 to 95.0)
NR	11 (28.2%)
65.0-69.9 years	4 (10.2%)
70.0-74.9 years	8 (20.5%)
75.0-79.9 years	14 (35.9%)

≥80.0 years	2 (5.1%)
Proportion of female participants	Mean: 65.3% (range, 42.5 to 88.9)
Sample size	Mean: 3043.6 (9 to 43487)
<100	11 (28.2%)
100-499	11 (28.2%)
500-999	3 (7.7%)
1000-1999	4 (10.2%)
2000-5000	4 (10.2%)
>5000	6 (15.4%)
Study setting	
Community	31 (79.4%)
Medical	6 (15.4%)
Nursing home	1 (2.5%)
Multi-site	1 (2.5%)
Participants living alone	44.1% (range, 0 to 100)
Participants with a history of falling	Mean: 50.8% (range, 11.2 to 100)
Not reported*	11 (28.2%)
≤25%	6 (15.4%)
25-40%	10 (25.6%)
40-85%	5 (12.8%)
>85%	7 (17.9%)

Abbreviations: NA, not applicable; *not reported for the overall sample

Study characteristics

The publication year for included studies ranged from 1987 to 2020, with more than half published since 2010. Most studies were conducted in Europe (17/39, 44%) and North America (13/39, 33%). More than half of the studies were cross-sectional study design (66.7%) and 7 qualitative studies were included. Most were conducted in the community (79%). Studies utilized 15 different scales and a variety of self reported responses to assess variables such as social isolation, loneliness. (e.g., 18-item Lubben Social Network Scale, 6-item de Jong-Gierveld Loneliness Scale). Six studies identified risk factors for social isolation and for activity restriction due to fear of falling (Table 2). Six studies reported mental health outcomes (Appendix 4).

Table 2: Potential risk factors for social isolation and activity restriction associated with fear of falling

Author, Year	Risk factor	Associated evidence
Social Isolation after injurious fall		
Nicholson, 2005	Sex (female)	The authors noted a strong positive correlation between injurious falls and social isolation for women (ρ= -0.5; p=0.01), but this was not significant for men.
Activity Restriction due to fear of falling		
Zijlstra, 2007	Aged 80 years or older	OR: 1.56 (95% CI, 1.24-1.95)
	Fair perceived general health	OR: 2.92 (95% CI, 2.43-3.52)
	Poor perceived general health	OR: 5.7 (95% CI, 3.57-9.12)
Curcio, 2009	Poor perceived health	OR: 1.38 (95% CI, 1.06-1.79)
	Depression	OR: 1.76 (95% CI, 1.38-2.24)
	Low social participation	OR: 1.52 (95% CI, 1.20-1.92)
	Difficulties in activities of daily living	OR: 1.65 (95% CI, 1.16-2.32)
	Decreased physical activity	OR: 1.35 (95% CI, 1.06-1.70)
	Polypharmacy	OR: 1.56 (95% CI, 1.14-2.14)
	Below poverty level	OR: 1.32 (95% CI, 1.05-1.65)
Dias, 2011	Depression	Chi-square=15.2, p=0.004
	Exhaustion (frailty)	Chi-square=9.2, p=0.01
	Participation in social activities	Chi-square=10.4, p=0.016
Murphy, 2002	Two or more chronic conditions	ARR: 1.34 (95% CI, 1.08-1.65)
	Slow-timed physical performance	ARR: 1.44 (95% CI, 1.18-1.75)
Merchant, 2020	Sarcopenia	OR, 8.13 (95% CI, 1.52–43.41)

Abbreviations: OR, odds ratio; ARR, adjusted risk ratio

Patient characteristics

Across all studies, the number of included patients was 118,702, with an average of 3,043 patients per study. Their mean age ranged from 65 to 95 years. Approximately 65% of patients

were female. Most studies included participants with a history of falling, ranging from 11% to 100% of the study population.

Cohort studies

Among the 39 included studies, six were cohort studies (Appendix 5). Tinetti et al (1998) demonstrated a significant relationship between multiple non-injurious falls and a decline in social functioning (Regression coefficient = -0.538 ($p<0.05$)), measured using the Social Activity scale, in a sample of 770 older adults after 3 years of follow-up [14]. Similarly, Pin et al. (2016) found that in their cohort of 16,583 participants, those who fell showed decreased social participation after falling ($p<0.001$), which was no longer statistically significant when frailty was added in the model [15].

Vellas et al. (1987) compared people who fall versus those who did not in two populations: a retirement home (n=118) and older adults living at home (n=60) [16]. Among the older adults who lived at home, they noted that fewer fallers were able to maintain the same level of activity after 6 months of follow-up when compared to non-fallers ($p<0.02$).

Van der Meulen et al. (2014) assessed social participation (using the Frenchay Activities Index) in 260 older adults with low and high levels of concern about falling over 14-months [17]. They reported significant differences (specific results not reported) between the groups, with lower social participation scores in those who had a higher level of concern about falling.

In 4,680 older adults, Yu et al. (2021) reported a significant relationship between the number of falls and loneliness scores (measured using the 3 item University of California, Los Angeles (UCLA) Loneliness Scale) across three time points over 4-years ($B = 0.008$, $p<0.05$) [18]. A cohort study by Hajek et al. (2020) looked at loneliness (as measured using the Bude and Lantermann scale) and social isolation (measured using the De Jong Gierveld Loneliness Scale)

and their link to fear of falling 669 older adults [19]. They compared older adults with an onset of fear of falling, to those who had no fear. Their findings revealed that the end of fear of falling was associated with lower loneliness scores ($\beta = -0.06$, $p<0.05$) and other negative psychosocial outcomes (e.g., increased depressive symptoms).

Cross-sectional studies related to falls and social isolation

Of the twenty-six cross-sectional studies included in this review, 11 reported on the relationship between falls and social isolation or loneliness (Appendix 6).

Quach et al. (2016) examined the relationship between falls and scores on the Social Relationship Index including 8,464 participants [20]. They noted that participants who reported experiencing a fall or multiple falls had a lower social relationship index score (mean, 3.24 and 3.08 respectively) compared to those who had not fallen (mean, 3.34; $p<0.0001$).

Hajek et al (2017) examined variables associated with a history of falling in 7,808 participants [21]. They found those reporting a fall in the previous 12 months had higher loneliness scores (De Jong Gierveld Loneliness Scale; $\beta = .08$, $p < .001$) and social exclusion scores (Bude and Lantermann scale; $\beta = .08$, $p < .001$) compared to those who had not fallen.

Schnittger et al. (2012) conducted a study in 579 older adults identifying risk factors for different pathways of loneliness – emotional loneliness, social loneliness (both measured using the De Jong Gierveld Loneliness Scale), and social support (measured using the Lubben Social Network Scale) [22]. A history of falls was the only biological variable that was identified as a statistically significant risk factor for inclusion in the model for social support (correlation coefficient= -0.247; $p<0.003$).

Stel et al (2004) reported a statistically significant decline in social activities in 204 older adults who experienced a fall inside their home (OR: 2.6 (95% CI: 1.1-6.5); $p<0.05$) [23], and

Vanden Wyngaert et al. (2020) reported an association between risk of falls and participation in social roles and activities in 154 older adult haemodialysis patients (PROMIS questionnaire; R^2=0.11; p=0.01) [24]. Finally, Nicholson et al. (2005) reported a strong positive relationship between experiencing an injurious fall and increasing social isolation in a sample of 68 older adults (Lubben Social Network Scale; ρ= -0.4; p<0.05), and highlighted that this relationship was stronger in women (ρ= -0.5; p=0.01) [25]. Additionally, they assessed this relationship using both the Family and Friends subscales of the Lubben Social Network Scale and found that the correlation was specific to the Friends subscale (ρ= -0.43; p<0.05).

Iliffe et al. (2007) and Robins et al. (2018) found no statistically significant associations between falls and social isolation using the Lubben Social Network Scale in a sample of 3,139 older adults and the Friendship Scale for social isolation in a sample of 245 older adults, respectively [26, 27]. Similarly, Van Lankveld et al. (2011) and Faria et al. (2020) found no correlation between falls and loneliness, using the De Jong Gierveld Loneliness scale in a sample of 579 older adults, and the UCLA scale in a sample of 48 older adults, respectively [28, 29]. Additionally, Finn et al. (2001) noted no difference in scores for the OARS social support scale when comparing fallers to non-fallers in a nursing home setting (n=49) [30].

Cross-sectional studies related to fear of falling and social isolation

Seven studies examined fear of falling linked to falls and social isolation (Appendix 7). Gagnon et al. (2005) reported a statistically significant positive relationship between fear of falling and social support in a sample of 105 older adults (measured using the confiding-relationships component of the Bedford Life Events and Difficulties Schedule modified for elderly subjects; Wald chi-square= 3.77; p=0.05) [31]. Curcio et al. (2009) reported a strong relationship between fear of falling and low social participation in 1,668 older adults (OR, 1.52; 95% CI, 1.20-1.92;

p<0.01) [32]. Petrinec et al. (2020) identified fear of falling as an independent predictor of social functioning (as measured by the Medical Outcomes Study 36-item Short-Form General Health Survey; β= -0.29) in 108 older adults [33].

Merchant et al. (2020) and Iliffe et al. (2007) showed no statistically significant relationship between fear of falling and social isolation in 493 older adults and 3,139 older adults, respectively [26, 34]. Ferreira et al. (2018) and Kara et al. (2009) showed no association between fear of falling and social participation (n= 7,935) or fear of falling and loneliness (n=47), respectively [35, 36].

Cross-sectional studies related to falls and activity restriction due to fear of falling

Eight studies examined the relationship between falls and activity restriction due to fear of falling (Appendix 7). Tinetti et al (1994) and Apikomonkon et al. (2003) both reported a statistically significant decrease in activity due to fear of falling in individuals who experienced a fall compared to those who had not (n=1,103, chi-square= 13.1, p < 0.001; and n=546, chi-square=5.49, p<0.05, respectively) [37, 38]. Similarly, in 1,668 older adults, Curcio et al. (2009) demonstrated that those who restricted activity due to fear of falling were more likely to have experienced a fall in the year prior (OR: 1.48 (95%CI, 1.18-1.86); p=0.001) [32], and Mendes da Costa et al. (2012) demonstrated that activity restriction increased in those with multiple falls over the past year (OR, 3.04; 95% CI, 1.70-5.42) [39]. Murphy et al. (2002) , and Choi et al. (2015) showed that a history of injurious falls was independently associated with activity restriction due to fear of falling (n=1,064, ARR: 1.36; 95% CI, 1.11-1.66; p=0.003; and n=4,247, OR, 3.03; 95% CI, 1.21-7.54, p=0.008, respectively) [40, 41].

Howland et al. (1998) reported no relationship between the experience of a fall and activity restriction in a sample of 266 older adults (OR: 1.094; 95% CI, 0.376-3.177; p=0.869)

[42], as did Choi et al. (2015) (OR, 2.12; 95% CI, 0.96-4.67; p=0.062) among 4,247 older adults [41]. Similarly, Merchant et al. (2020) also reported no significant relationship between the number of falls and fear-based activity restriction in 493 older adults (OR, 1.4; 95% CI, 0.94–2.20) [34].

Qualitative studies

Seven qualitative studies were included (Appendix 8). All participants interviewed were older adults (n=124), including 51 stroke survivors [43, 44] and 10 experiencing frailty [45]. Common categories identified across these studies were activity restriction to manage fear of falling, changing behaviours to avoid falling [43, 45-47], feeling restricted due to reduced mobility after falling [43, 44, 48], increasing dependence on caregivers [43, 45], developing fear of falling [43, 45], feelings of loneliness or isolation [43, 48], and a negative impact on identity or autonomy [47].

DISCUSSION

We conducted a comprehensive scoping review including 39 studies examining the relationship between falls and subsequent social isolation. We limited the scoping review to studies that identified social isolation after a fall, this was due to the request of the commissioning knowledge user. More than half of the studies were published since 2010, suggesting increased interest in the relationship between falls and social isolation in older adults. Social isolation and loneliness were measured using a variety of outcome measures across studies, such as degree of activity, and varying scales for loneliness, social isolation, social participation, social support, etc. This highlights the growing need for consistency in the measurement of social isolation and loneliness to allow for meaningful comparison across studies. Cornwall et al. (2009) highlight previous efforts to consolidate different measures of social isolation and build off this work.

They combined multiple measures of social isolation to develop two scales that measure distinct dimensions of social isolation – social disconnectedness and perceived isolation [49].

Only a few studies examined risk factors and mental health outcomes related to falls and subsequent social isolation. Risk factors linked to social isolation and activity restriction included age, sex/gender, poor perceived health, poverty, frailty, and comorbidity. Few studies also documented an association between activity restriction due to fear of falling and depression. Our findings suggest the presence of gaps in the literature for these important outcomes, highlighting the need for further research. No randomized trials exploring interventions for social isolation after a fall were identified in our scoping review, highlighting another gap in the literature and an area for future research to explore.

We did not identify any studies on falls and subsequent social isolation that were specific to the COVID-19 context, highlighting another gap in the evidence base. A scoping review by Kasar et al. (2021) suggests that older adults face increased social isolation as a result of pandemic-related restrictions, which can result in increased loneliness and reduced quality of life [50]. They also highlighted how technology can be used to deliver virtual or tele-health support services, and to allow older adults stay connected with their social networks [50]. A systematic review by Larson et al. (2021) assessed the impact of COVID-19 lockdowns on physical activity in older adults and reported that most studies demonstrated a decline in physical activity or an increase in sedentary behaviours in this population. The effectiveness of physical activity and exercise in preventing falls and fractures in older adults is well-established in the literature [51-53]. A decline in physical activity in older adults could lead to sarcopenia, and an increased risk of falls or fractures [53].

There are several strengths to our scoping review, such as the use of the JBI guide, and the PRISMA-ScR. A comprehensive literature search was conduced and several different types of study designs were included. However, limitations include that all studies were conducted in middle-high- or high-income economy countries. This suggests that our results may not be generalizable to low- and middle-income countries, highlighting a gap in the literature. Many of the included studies were cross-sectional and we cannot confirm the directional causality between falls and social isolation without more robust research.

In summary, we found a dearth of research, particularly examining risk factors and mental health outcomes related to social isolation and falling older adults. Further research is warranted in this area, given the importance of falls and social isolation to the health of older adults.

LIST OF ABBREVIATIONS

ARR	Absolute Risk Reduction
CADTH	Canadian Agency for Drugs and Technologies in Health
CI	Confidence interval
OR	Odds Ratio
PRESS	Peer Review of Electronic Search Strategies
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses

DECLARATIONS

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Ethics approval

Not required.

Consent for publication

Not applicable.

Availability of data and materials

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

Conflict of interests

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

Author Contribution

ACT obtained funding for this study. SMT, ACT, YJ, MdG, and KA conceptualized the study. SMT drafted the protocol, with input from ACT, YJ, MdG, KA, JB, JW, and SES. SMT oversaw screening, full-text review, and data abstraction. SMT, AP, JF, GM, AH, and JB screened citations and full text articles, abstracted and verified data. SMT and ACT interpreted results, and SMT, AP, and ACT drafted the manuscript and revised the final version of the manuscript. JF, GM, AH, YJ, MdG, KA, AGB, JB, JW, and SES critically reviewed the manuscript. All authors approved of the final version.

Role of the funder

The funders were co-developers of this research project and contributed to the design of the study and reviewed/approved of the manuscript.

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SUPPLEMENTAL FILES

Supplemental File 1: PRISMA Checklist

Supplemental File 2: Appendices

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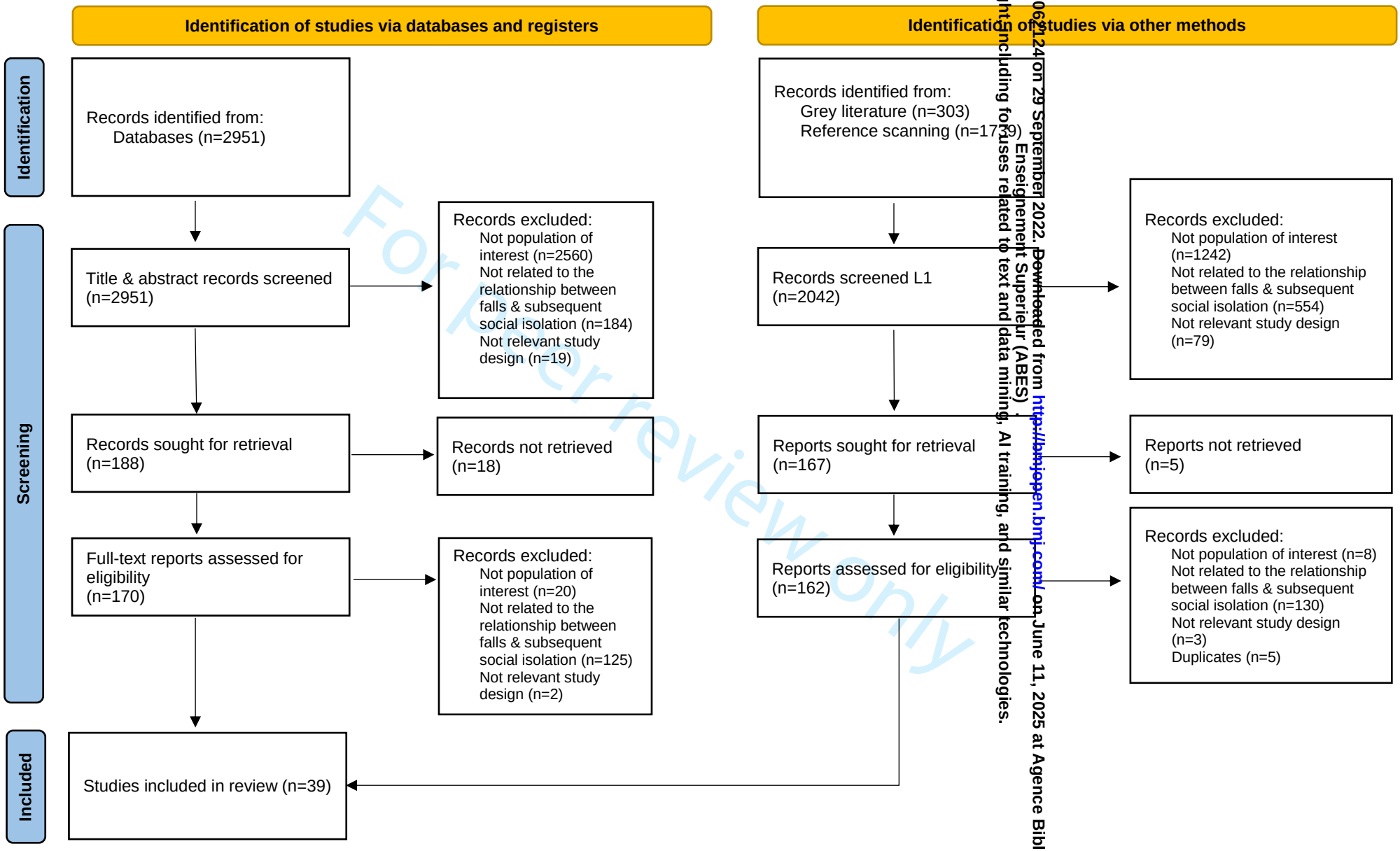
FIGURE LEGEND:

Figure 1 – PRISMA 2020 study flow diagram.

Figure 1: PRISMA 2020 study flow diagram



Supplementary File 2: Appendices

Appendix 1: Literature search strategies

Ovid MEDLINE(R) ALL <1946 to Jan 11, 2021>

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 January Week 2 2021>

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 2021 January 11>

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 January 11, 2021>, EBM Reviews - ACP Journal Club <1991 to January 11, 2021>, EBM Reviews - Cochrane Clinical Answers <January 2021>, 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.

bmjopen-2022-062124 on 29 September 2022. Downloaded from

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 January 11, 2021>
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 January 2021>
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

Appendix 2: Study Characteristics (n=39)

Author, year	Study title	Journal name	Country	Study design	Study duration (months)
Apikomonkon, 2003[26]	Fear of falling and fall circumstances in Thailand	NA	Thailand	cross-sectional	NA
Chiu, 2011[37]	Psychosocial responses to falling in older Chinese immigrants living in the community	Dissertation Abstracts International Section A: Humanities and Social Sciences	Canada	qualitative	6
Choi, 2015[30]	Characteristics associated with fear of falling and activity restriction in South Korean older adults	Journal of Aging and Health	South Korea	cross-sectional	NA
Curcio, 2009[4]	Activity restriction related to fear of falling among older people in the Colombian Andes Mountain	Journal of Aging and Health	Columbia	cross-sectional	NA
Dias, 2011[5]	Characteristics associated with activity restriction induced by fear of falling in community-dwelling elderly	Revista Brasileira de Fisioterapia	Brazil	cross-sectional	NA
Faes, 2010[36]	Qualitative study on the impact of falling in frail older persons and family caregivers: Foundations for an intervention to prevent falls	Aging & Mental Health	Netherlands	qualitative	NA
Faria, 2020[22]	Elderly residents in the community: gaining knowledge to support a rehabilitation nursing program	Revista Brasileira de Enfermagem	Portugal	cross-sectional	NA
Ferreira, 2018[31]	Aspects of social participation and neighborhood perception: ELSI-Brazil	Revista de saude Publica	Brazil	cross-sectional	NA
Finn, 2001[14]	The relationship between falls and fall-related efficacy, depression, and social resources	Dissertation Abstracts International: Section B: The Sciences and Engineering	USA	cross-sectional	NA
Gagnon, 2005[3]	Affective correlates of fear of falling in elderly persons	American Journal of Geriatric Psychiatry	Canada	cross-sectional	NA
Hajek, 2017[20]	The association of falls with loneliness and social exclusion: evidence from the DEAS German Ageing Survey	BMC Geriatrics	Germany	cross-sectional	NA

Hajek, 2020[13]	What are the psychosocial consequences when fear of falling starts or ends? Evidence from an asymmetric fixed effects analysis based on longitudinal data from the general population	International Journal of Geriatric Psychiatry	Germany	cohort	36
Host, 2011[38]	Older people's perception of and coping with falling, and their motivation for fall-prevention programmes	Scandinavian Journal of Public Health	Denmark	qualitative	2
Howland, 1998[25]	Covariates of fear of falling and associated activity curtailment	The Gerontological Society of America	USA	cross-sectional	NA
Iliffe, 2007[16]	Health risk appraisal in older people 2: the implications for clinicians and commissioners of social isolation risk in older people	British Journal of General Practice	England	cross-sectional	NA
Kara, 2009[28]	Evaluation of home environment and life satisfaction and falling in geriatrics: Examination of its relationship with fear	Physiotherapy Rehabilitation	Turkey	cross-sectional	NA
Mendes da Costa, 2012[29]	Fear of falling and associated activity restriction in older people. results of a cross-sectional study conducted in a Belgian town	Archives of Public Health	Belgium	cross-sectional	NA
Merchant, 2020[7]	Relationship between fear of falling, fear-related activity restriction, frailty, and sarcopenia	Journal of the American Geriatrics Society	Singapore	cross-sectional	NA
Meric, 2007[34]	A qualitative study on the perceptions of old individuals regarding the life of the fall and its effect on their daily lives	Turkish Journal of Geriatrics	Turkey	qualitative	2
Murphy, 2002[1]	Characteristics associated with fear of falling and activity restriction in community-living older Persons	Journal of the American Geriatrics Society	USA	cross-sectional	NA
Nakaya, 2013[6]	The association between self-reported history of physical diseases and psychological distress in a community-dwelling Japanese population: the Ohsaki Cohort 2006 Study	European Journal of Public Health	Japan	cross-sectional	NA
Nicholson, 2005[15]	The relationship between injurious falls, fear of falling, social isolation, and depression	NA	USA	cross-sectional	NA
Petrinec, 2020[32]	Health-related quality of life of older women religious: negative influence of frailty	Western Journal of Nursing Research	USA	cross-sectional	NA
Pin, 2016[11]	Impact of falling on social participation and social support trajectories in a middle-aged and elderly European sample	Social Science and Medicine - Population Health	Denmark, Sweden, Netherlands, Austria, Germany, France, Belgium,	cohort	72

			Switzerland, Italy, Spain		
Quach, 2016[19]	Social determinants of falls: The role of social support and depression among community-dwelling older adults	Dissertation Abstracts International: Section B: The Sciences and Engineering	USA	cohort	36
Robins, 2018[21]	The association between physical activity and social isolation in community-dwelling older adults	Aging & Mental Health	Australia	cross-sectional	NA
Schmid, 2009[35]	Consequences of poststroke falls: activity limitation, increased dependence, and the development of fear of falling	American Journal of Occupational Therapy	USA	qualitative	6
Schnittger, 2012[18]	Risk factors and mediating pathways of loneliness and social support in community-dwelling older adults	Aging & Mental Health	Ireland	cross-sectional	NA
Stel, 2004[2]	Consequences of falling in older men and women and risk factors for health service use and functional decline	Age and Ageing	Netherlands	cross-sectional	NA
Tinetti, 1998[9]	The effect of falls and fall injuries on functioning in community-dwelling older persons	Journal of Gerontology	USA	cohort	36
Tinetti, 1994[24]	Fear of falling and fall-related efficacy in relationship to functioning among community-living elders	Journal of Gerontology	USA	cross-sectional	NA
van der Meulen, 2014[10]	Effect of fall-related concerns on physical, mental, and social function in community-dwelling older adults: A prospective cohort study	Journal of American Geriatrics Society	Netherlands	cohort	14
van Lankveld, 2011[17]	Age-related health hazards in old patients with first-time referral to a rheumatologist: A descriptive study	Arthritis	Netherlands	cross-sectional	NA
Vanden Wyngaert, 2020[23]	Associations between the measures of physical function, risk of falls and the quality of life in haemodialysis patients: a cross-sectional study	BMC Nephrology	Belgium		
Vellas, 1987[8]	Prospective study of restriction of activity in old people after falls	Age and Ageing	France	cohort	6
Ward-Griffin, 2004[33]	Falls and fear of falling among community dwelling seniors: the dynamic tension between exercising precaution and striving for independence	Canadian Journal on Aging	Canada	qualitative	NA

Xu, 2019[39]	Developing a falls prevention program for community-dwelling stroke survivors in Singapore: client and caregiver perspectives	Disability and Rehabilitation	Singapore	Qualitative	NA
Yu, 2020[12]	Longitudinal Assessment of the relationships between geriatric conditions and loneliness	Journal of the American Medical Directors Association	USA	Cohort	96
Zijlstra, 2007[27]	Prevalence and correlates of fear of falling, and associated avoidance of activity in the general population of community-living older people	Age and Ageing	Netherlands	Cross-sectional	NA

Appendix 3: Patient Characteristics (n=39)

DEMOGRAPHIC DATA							
Author, year	**Overall sample size**	**Overall age (years)**	**Overall age (type)**	**Overall age variance (value)**	**Overall age variance (type)**	**% female**	**% male**
Apikomonkon, 2003[26]	546	NR	NR	60-94	range	61	39
Chiu, 2011[37]	18	81	mean	71 to 94	range	88.9	11.1
Choi, 2015[30]	4,247	NR	NR	NR	NR	21	NR
Curcio, 2009[4]	1668	70.9	mean	7.4	SD	54.5	45.5
Dias, 2011[5]	113	74.5	mean	7	SD	85	15
Faes, 2010[36]	10	70-90	range	NR	NR	60	40
Faria, 2020[22]	48	75	mean	6.8	SD	66.67	33.33
Ferreira, 2018[31]	7935	NR	NR	NR	NR	56.9	43.1
Finn, 2001[14]	49	NR	mean	NR	SD	NR	NR
Gagnon, 2005[3]	105	78.2	mean	8.9	SD	86.7	13.3
Hajek, 2017[20]	7808	73.8	mean	5.9	SD	46.2	53.8
Hajek, 2020[13]	8836	65.5	mean	10.7	SD	50.4	49.6
Host, 2011[38]	14	77	mean	68-87	range	64.3	35.7
Howland, 1998[25]	266	76.3	mean	7.9	SD	77	23
Iliffe, 2007[16]	3139	NR	NR	65-75+	range	54.5	45.5
Kara, 2009[28]	47	71.7	mean	5.6	SD	55.3	44.7
Mendes da Costa, 2012[29]	501	NR	NR	65-85+	NR	57.7	42.3
Merchant, 2020[7]	493	73	mean	8	SD	79.3	20.7
Meric, 2007[34]	22	NR	NR	65-83+	range	63.6	36.4
Murphy, 2002[1]	1064	79.6	mean	5.3	SD	73	27
Nakaya, 2013[6]	43487	65+	range	NR	NR	53.9	46.1
Nicholson, 2005[15]	68	78.5	mean	6.3	SD	60.4	39.6
Petrinec, 2020[32]	108	75.6	mean	65–93	range	100	0
Pin, 2016[11]	16583	50-95	range	NR	NR	NR	NR
Quach, 2016[19]	8464	74	mean	7	SD	58.7	41.3
Robins, 2018[21]	245	77	mean	6	SD	60	40
Schmid, 2009[35]	42	67.5	mean	11.93	SD	NR	NR
Schnittger, 2012[18]	579	NR	NR	NR	NR	69.1	30.9
Stel, 2004[2]	204	78.7	mean	6.3	SD	54.9	45.1
Tinetti, 1998[9]	1103	NR	NR	NR	NR	NR	NR
Tinetti, 1994[24]	1103	79.6	mean	5.2	SD	73	27

van der Meulen, 2014[10]	260	77.9	mean	5	SD	72.7	27.3
van Lankveld, 2011[17]	154	79.2	mean	5.1	SD	78	21
Vanden Wyngaert, 2020[23]	113	67.5	mean	16	SD	42.5	57.5
Vellas, 1987[8]	178	65-85+	range	NR	NR	76.4	23.6
Ward-Griffin, 2004[33]	9	81.7	mean	72-92	range	78	22.3
Xu, 2019[39]	17	65	mean	7	SD	44	55.6
Yu, 2020[12]	4680	74.01	mean	9.69	SD	56	43.9
Zijlstra, 2007[27]	4376	77.1	mean	4.9	SD	59	40.1

SETTING DATA				
Author, year	**Setting**	**Streamlined setting description**	**Participants living alone (%)**	**Description of access to caregivers**
Apikomonkon, 2003[26]	Community in 4 provinces of Thailand	Community	9.9	NR
Chiu, 2011[37]	Community in the Greater Toronto Area, Canada	Community	61	Two respondents lived with their children. The rest lived alone or only with their spouse. Only seven of 18 respondents had at least one grown child living in the same city who might provide assistance when needed.
Choi, 2015[30]	Community setting in Korea	Community	NR	NR
Curcio, 2009[4]	Community in Columbian Andes Mountains	Community	9.5	NR
Dias, 2011[5]	Community setting in Brazil	Community	38	NR
Faes, 2010[36]	Home and outpatient clinic in Netherlands	Community + Medical	10	All participants had access to a caregiver (either child or spouse)
Faria, 2020[22]	Urban health unit in northern Portugal	Medical	NR	NR
Ferreira, 2018[31]	Urban communities in Brazil	Community	NR	NR
Finn, 2001[14]	Two nursing homes in the Chicago Metropolitan Area, USA	Nursing home	0	In general, they have entered a nursing home because of an inability to adequately care for themselves, and they do not have anyone who can ably assist them, or they lack financial resources.
Gagnon, 2005[3]	Medical or orthopedic wards of 3 hospitals in Toronto, Canada	Medical	65.7	NR
Hajek, 2017[20]	Communities in Germany	Community	NR	NR

Hajek, 2020[13]	Community in Germany	Community	28.9	NR
Host, 2011[38]	Copenhagen area in Denmark	Community	64.3	NR
Howland, 1998[25]	Communities in Eastern Massachusetts	Community	87	NR
Iliffe, 2007[16]	Community in London, England	Community	32.8	NR
Kara, 2009[28]	Districts of Narlıdere, Gülbahçe and Mordoğan in Izmir, Turkey	Community	27.7	NR
Mendes da Costa, 2012[29]	Community in Walloon region of Belgium	Community	36.4	NR
Merchant, 2020[7]	Community in northwest region of Singapore	Community	NR	NR
Meric, 2007[34]	Geriatric Outpatient of Gülhane Military Medical Academy in Turkey	Medical	13.6	NR
Murphy, 2002[1]	Community setting in New Haven, Connecticut, USA	Community	70	NR
Nakaya, 2013[6]	Community in Japan	Community	NR	87.3% reported sufficient social support, 12.2% reported lack of social support, 4.2% unknown.
Nicholson, 2005[15]	Community in United States	Community	53.4	NR
Petrinec, 2020[32]	Cleveland Catholic Diocese in USA	Community	100	Participants were not included if they needed caregiver assistance.
Pin, 2016[11]	Communities in 10 European Countries (Denmark, Sweden, The Netherlands, Austria, Germany, France, Belgium, Switzerland, Italy, and Spain)	Community	NR	NR
Quach, 2016[19]	Communities in USA	Community	23.3	One-third did not have the perceived support with basic personal care (eating or dressing) when needed.
Robins, 2018[21]	Communities in Australia	Community	49	NR
Schmid, 2009[35]	Community in United States	Community	NR	All participants had a caregiver.
Schnittger, 2012[18]	Technology Research for Independent Living (TRIL) clinic at St James's Hospital, Dublin.	Medical	NR	NR
Stel, 2004[2]	Community in three regions in the Netherlands	Community	NR	NR

Tinetti, 1998[9]	Community in New Haven, Connecticut, USA	Community	NR	NR
Tinetti, 1994[24]	Community in New Haven, Connecticut, USA	Community	69	NR
van der Meulen, 2014[10]	Community in the Netherlands	Community	53.1	NA
van Lankveld, 2011[17]	Community in the Netherlands	Community	NR	NR
Vanden Wyngaert, 2020[23]	Dialysis centres in Belgium	Medical	NR	NR
Vellas, 1987[8]	Community in Toulouse, France	Community	NR	NR
Ward-Griffin, 2004[33]	Community in Canada (11 senior apartment towers and in the Health Information and Promotion Centre)	Community	77.7	NR
Xu, 2019[39]	Community rehabilitation centers in Singapore	Medical	0	Four family caregivers (two male) and four maids (all female) were interviewed. 33% employed a maid as a main caregiver.
Yu, 2020[12]	Community in USA	Community	NR	NR
Zijlstra, 2007[27]	Community in two urban areas in the Netherlands	Community	44	NR

FALLS AND FRAILTY DATA								
Author, year	**Participants with history of falling (%)**	**List of comorbidities [comorbidity 1 (%), etc.]**	**Participants with frailty (%)**	**Frailty scale**	**Overall frailty score**	**Overall frailty score type**	**Frailty variance value**	**Frailty variance type**
Apikomonkon, 2003[26]	21	NR	NR	NR	NR	NR	NR	NR
Chiu, 2011[37]	100	All participants reported having chronic conditions. The most common physical conditions reported were diabetes and hypertension.	NR	NR	NR	NR	NR	NR
Choi, 2015[30]	NR	NR	NR	NR	NR	NR	NR	NR
Curcio, 2009[4]	31.9	Hypertension (53.0), Osteoarthritis (39.2), heart disease (20.2), COPD	NR	NR	NR	NR	NR	NR

		(16.8), Diabetes Mellitus (13.4), Lower extremities fracture (11.7), Pain in joints (33.1), Dizziness (15.2), Breathlessness (11.4), Hearing impairment (33.0), visual impairment (68.9)						
Dias, 2011[5]	NR	NR	NR	NR	NR	NR	NR	NR
Faes, 2010[36]	100	Cognitive impairment (70%)	NR	NR	NR	NR	NR	NR
Faria, 2020[22]	25	Cardiovascular diseases (76.6), endocrine diseases (56.8), musculoskeletal diseases (45.7), depression (16.3), respiratory diseases (14.3) and cerebrovascular diseases (9.3).	NR	NR	NR	NR	NR	NR
Ferreira, 2018[31]	NR	Overweight (women=65.2%, men=59.0%)	NR	NR	NR	NR	NR	NR
Finn, 2001[14]	51	NR	NR	NR	NR	NR	NR	NR
Gagnon, 2005[3]	100	NR	NR	NR	NR	NR	NR	NR
Hajek, 2017[20]	17.6	NR	NR	NR	NR	NR	NR	NR
Hajek, 2020[13]	NR	Number of physical illnesses is mean = 2.6, SD = 1.9	NR	NR	NR	NR	NR	NR
Host, 2011[38]	100	NR	NR	NR	NR	NR	NR	NR
Howland, 1998[25]	35	Vision problems (26), stroke (11), dizziness (29)	NR	NR	NR	NR	NR	NR
Iliffe, 2007[16]	11.20	Two or more chronic conditions (59.0%), takes 4 or more meds (33.4%)	NR	NR	NR	NR	NR	NR
Kara, 2009[28]	29.9	NR	NR	NR	NR	NR	NR	NR
Mendes da Costa, 2012[29]	31.6	NR	NR	NR	NR	NR	NR	NR
Merchant, 2020[7]	mean = 0.4	NR	51.3	FRAIL scale	NR	NR	NR	NR
Meric, 2007[34]	81	NR	NR	NR	NR	NR	NR	NR
Murphy, 2002[1]	39.70	Chronic dizziness (24.2), 5 or more medications (35.8), vision impairment (40.5)	NR	NR	NR	NR	NR	NR
Nakaya, 2013[6]	17.3	NR	NR	NR	NR	NR	NR	NR
Nicholson, 2005[15]	100	NR	NR	NR	NR	NR	NR	NR

Petrinec, 2020[32]	NR	Hypertension (60), Cataracts (60), Thyroid disorders (30), Osteoporosis (17), Diabetes (7)	19	Tilburg Frailty Indicator (TFI)	NR	NR	NR	NR
Pin, 2016[11]	2.8	NR	NR	NR	NR	NR	NR	NR
Quach, 2016[19]	38.0	NR	NR	NR	NR	NR	NR	NR
Robins, 2018[21]	38	Congestive heart failure (4%); Heart disease (33%); stroke (9%); Cancer (25%); diabetes (18%); lung disease (16%); Parkinson's disease (1%)	NR	NR	NR	NR	NR	NR
Schmid, 2009[35]	NR	Stroke (100%)	NR	NR	NR	NR	NR	NR
Schnittger, 2012[18]	NR	NR	NR	NR	NR	NR	NR	NR
Stel, 2004[2]	100	Dizziness (27.9%), visual impairment (23%)	NR	NR	NR	NR	NR	NR
Tinetti, 1998[9]	30.3	NR	NR	NR	NR	NR	NR	NR
Tinetti, 1994[24]	39	One or more chronic conditions (78%)	NR	NR	NR	NR	NR	NR
van der Meulen, 2014[10]	55.5	NA	NR	NA	NA	NA	NA	NA
van Lankveld, 2011[17]	44	Cardiac 36%, hypertension 40%, vascular 25%, respiratory 12%, EENT 21%, upper GI 14%, lower GI 10%, Hepatic 3%, kidney 3%, other GU 16%, neurological 18%, endocrine 21%, psychiatric 8%, Rhuematic disease general (56%), Osteoarthritis (49%), Spondylosis(31%), Rheumatoid arthritis(17%), Arthritis otherwise defined (12%), Gout (6%), Chodrocalcinosis (12%), Osteoporosis (1%), Shoulder problem (6%), Polymyalgia rheumatica (3%), Soft tissue (1%), Carpal tunnel syndrome (2%), Others (6%)	NR	NR	NR	NR	NR	NR
Vanden Wyngaert, 2020[23]	NR	Cardiovascular disease (74.3%) diabetes (46.0%) musculoskeletal complications (44.2%), Neuropathy (28.3), retinopathy (31.9), respiratory complications (24.8), hepatopathy (17.7), pain (27.4%), depression	NR	NR	NR	NR	NR	NR

		(23.9%), fatigue (18.6%), anxiety (15.0%), sleep disturbances (12.4%)						
Vellas, 1987[8]	50	NR	NR	NR	NR	NR	NR	NR
Ward-Griffin, 2004[33]	NR	NR	NR	NR	NR	NR	NR	NR
Xu, 2019[39]	100	Stroke (100%)	NR	NR	NR	NR	NR	NR
Yu, 2020[12]	mean =0.74	The mean number of comorbidities at baseline was 2.24 (SD=1.38)	NR	NR	NR	NR	NR	NR
Zijlstra, 2007[27]	32.6	NR	NR	NR	NR	NR	NR	NR

Appendix 4: Mental health outcomes related to falls, fear of falling, and social isolation (n=6)

Author, Year	Sample	Results	Text description/ interpretation of findings
Murphy, 2002[1]	n=1064	**Variables independently associated with activity restriction in participants with fear of falling** *Depression (CES-D scale)* Adj relative risk: 1.27 (95% CI, 1.00-1.60); p=0.048	"We found that a history of an injurious fall within the past year, slow timed physical performance, two or more chronic conditions, and depressive symptoms were all independently associated with activity restriction."
Stel, 2004[2]	n=204	**Relationship between higher depression score and decline in social activities because of a fall** OR: 2.0 (95% CI: 1.2-3.3); p<0.05	"A decline in functional status, social activities, and physical activities was reported more often in respondents with a higher depression score."
Gagnon, 2005[3]	n=105	**Variables associated with fear of falling** (Comparing subjects with no/slight fear and subjects with moderate/severe fear) **Depression** (Structured Clinical Interview for DSM-IV (SCID)) Wald chi-square= 8.76; p=0.03 **Anxiety** (Structured Clinical Interview for DSM-IV (SCID)) Wald chi-square= 5.95; p<0.02	"Not only were depressive disorders and depression severity independently associated with fear of falling, but depression had the strongest association with this fear among the variables that we measured. Given that this was a cross-sectional study, a causal relationship between depression and fear of falling cannot be inferred. [...] It is possible, therefore, that in some individuals, fear of falling is an anxious manifestation of depression. However, depression could also be a consequence of activity restriction or social isolation resulting from a fear of falling" "Depressive disorders and anxiety disorders were significantly associated with categorical fear of falling, independently of these variables"
Curcio, 2009[4]	n=1668	**Variables associated with activity restriction related to fear of falling** **Depression** OR: 1.76 (95%CI, 1.38-2.24)	"A second model was then constructed with the psychosocial associated factors and other clinical and functional covariates (see Table 4). After adjustment, functional and clinical factors remained independently associated with activity restriction related to fear of falling. Only depression and poor perceived health variables emerged as independent factors."
Dias, 2011[5]	n=113	**Variables associated with activity restriction due to fear of falling** (compared to no FOF or FOF alone)	"The variables that best discriminated the groups were depression, exhaustion and participation in social activities, demonstrated in the diagram (Figure 1). For the grouping obtained through the Chi-square

		Depression Chi-square=15.2, p=0.004	Automatic Interaction Detection (CHAID) method, it may be observed that the first distinctive characteristic was depression, evaluated using GDS. Those with positive symptoms for depression showed 90% chance of restricting activities due to fear of falling. Additionally, the presence of depressive symptoms seems to modulate the factors that are associated with activity restriction due to fear of falling. A greater risk for depression has been associated with inadequate evaluation of coping self-efficacy in stressful events of life. It is worth noting that the participants of the present study who restricted activities by FOF showed lower self-efficacy in relation to the other participants. Thus, it is possible that elders with depressive symptoms perceive themselves less capable of performing certain tasks and, because of that, restrict their activities.
Nakaya, 2013[6]	n=43487	**Relationship between history of falling and psychological distress** <u>Sufficient social support</u> OR, 1.6 (95% CI: 1.3-1.9) p<0.01 <u>Lack of social support</u> OR, 2.0 (95% CI: 1.4-2.8) p<0.01	"We also conducted stratified analyses regarding OR of psychological distress according to differences in social support status. Almost all subjects with a history of physical disease (including those with history of fall/fracture) were at increased risk of psychological distress, regardless of social support."
Merchant, 2020[7]	n=493	**Variables associated with fear of falling alone** **Depression** OR, 4.90 (95% CI, 1.06–22.67) p<0.05 **Variables associated with fear of falling + fear-based activity restriction** **Depression** OR, 5.17 (95% CI, 1.84–14.54)	"In our study, FOF and/or FAR were both significantly associated with **depression** in univariate and multivariate logistics regression model. Those with FOF + FAR were nine times more likely to be depressed than those with no FOF. […] Strong links between depressive symptoms with FOF and/or FAR have been reported in various studies, and their association is believed to be bidirectional, where management of one condition would improve the other."

Appendix 5: Findings from included cohort studies (n=6)

Author, Year	Sample	Results	Text description/ interpretation of findings
Vellas, 1987[8]	n=178 Studied two populations: 1) Individuals living in a retirement home (Fall victims = 59; Non-fallers=59) 2) Individuals living at home (Fall victims = 30; Non-fallers=30)	Retirement home (n=118) Among the fall victims there was a tendency towards restriction of activity: 3% walked less indoors, 5% went outside less, 4% had no leisure activity, 7% no longer visited their children and 11% no longer visited their friends. The lack of significance (P>0.05) is linked both to the very low level of activity on day 1 of the aged population living in retirement homes and to our small sample. At home (n=60) On day 1, the fallers and control group had identical levels of activity. Reported a significant difference in the number of participants who maintained the same level of activity after 6 months, with this number being reduced in fall victims compared to non-fallers (p<0.02)	"The interpersonal relationships of the fallers were very poor: 90% did not belong to any group, 54% never visited their children, 40% never visited anybody." "A fall may lead to loss of autonomy. Factors arising as a result of falls have been identified by Isaacs and his co-workers. Our prospective study confirms these findings and demonstrates restriction of activity following a fall without fracture." "Falls in elderly persons give rise to a decline in activity and social life. The fear of recurrence often leads to 'institutionalizing' the patient. But, it is difficult to show whether falls are an indication or the cause of the loss of autonomy."
Tinetti, 1998[9]	n=1103 at baseline, 770 at 3 years follow-up	**Effect of having 2 or more non-injurious falls on social functioning** (Social Activity Scale)**:** Regression coefficient = -0.538 (p<0.05)	"While there did not appear to be an increased risk of decline in social functioning among participants experiencing a single noninjurious fall, repetitive fallers experienced a decline in social functioning in both short- and long-term follow-up analyses. The relationship between repetitive falling and decline in social functioning remained after adjusting for each category of covariates. Experiencing a serious fall injury, on the other hand, was only marginally associated with decline in social functioning over the 1-year follow-up, and not at all over the 3-year follow-up. Preferential loss to follow-up of persons experiencing decline in social functioning between the 1- and 3-year follow-up interviews might at least partially explain the lack of relationship between injurious falls and change in social activities."

Van der Meulen, 2014[10]	n=260 Low level of concern about falling (n=127) High level of concern about falling (n=129) Follow-up = 14 months	**Social participation** (Frenchay Activities Index) Low level falling concern: Baseline mean, 39.9 (SD, 7.1) Follow-up mean, 38.8 (SD, 7.6) High level falling concern: Baseline mean, 36.8 (SD, 7) Follow-up mean, 35.7 (SD, 7.7) **p-value = 0.006**	"High and low levels of fall-related concerns predicted significant differences in ADL dysfunction and social participation that were persistent over 14 months of follow-up. […] Accompanying effect size estimations were medium (social participation) to large (ADL dysfunction)."
Pin, 2016[11]	n=16583 Fallers (n=411) Non-fallers (n=14205)	**Effect of falls on social participation** (binary variable based on if they reported performing at least one activity from a prespecifed list of activities) Model 2 adjusted by time, age, sociodemographic variables and health indicators: OR, 0.86 [95% CI, 0.76-0.89] (p<0.001) Model 3 added adjustment for frailty: OR, 0.95 [95% CI, 0.89-1.02] The interaction between initial frailty status and falling was significant (Table 4, Model 7a). Contrast analyses revealed that the probability of social participation was less among frail people than among people who did not meet any of the frailty criteria in both fallers ($\chi 2$ (1)=6.93;p<0.01) and non-fallers ($\chi 2$ (1)=41.21; p<0.001)	"Falling significantly decreased the probability of social participation in each of these activities and of participation in at least one of them, but only before frailty was introduced into the models (Table 3, Models 2 and 3). Frailty is indeed a strong confounder in the relationship between falls and social participation. When it is taken in consideration in multivariate models, the size of the effect of falling decreased and was no longer significant." "Then, we demonstrated the major role of frailty in the relationship between falling and social participation. The construction of the frailty phenotype (Fried et al., 2001; Santos-Eggimann et al., 2009) was based on its physical component. In this manner frailty and falling were very close constructs. They shared similar risk factors, such as mobility disorders or bone density, and they had similar consequences in terms of disability or mortality. Moreover, we showed that they had similar consequences in terms of social participation. Thus, it may be difficult to distinguish between the two concepts and to identify a specific impact of falling (Nowak & Hubbard, 2009). However, our analyses showed that the continuity in or disengagement from social activities was due to a long-term process that was amplified by health events, rather than by the falls themselves."
Yu, 2020[12]	n=4680	**Relationship between number of falls and loneliness over 3 time-points** (3 item UCLA Loneliness Scale) Regression coefficient = 0.008, SE = 0.04, p =0.048;	"Only the number of falls was significantly correlated with the loneliness score in the next time point, and more frequent loneliness at the previous wave predicts an increased number of falls in 4 years […]The results suggest that a vicious circle relationship exists between loneliness and falls. […] An increased number of falls also predicted more frequent loneliness in 4 years. These findings support evidence reported in cross-

		Wave 1-2: β=0.030, Wave 2-3: β= 0.068	sectional studies that the occurrence of falls was related to social exclusion. […] Older adults who have fallen more frequently might choose to avoid risky activities such as going outside of the home and engaging in social activities. This could lead to a discrepancy in desired and actual social engagement, which in turn results in more frequent experience of loneliness."
Hajek, 2020[13]	n=8836 In total, 669 individuals changed fear of falling (FOF) status from wave 5 to wave 6. More specifically, while the onset of FOF occurred in 431 individuals, the end of FOF occurred in 238 individuals.	**Relationship between fear of falling and loneliness** (Bude and Lantermann scale) **Onset of FOF** β=0.02, SE=0.02, p=NR **End of FOF** β= -0.06, SE=0.03, p<0.05 **Relationship between fear of falling and social isolation** (De Jong Gierveld Loneliness Scale) **Onset of FOF** β=0.06, SE=0.03, p<0.1 **End of FOF** β= 0.01, SE=0.04, p=NR	"The end of FOF was associated with reduced depressive symptoms (β = −1.08, P < .05), decreased loneliness scores (β = −0.06, P < .05), as well as decreased negative affect (β = −0.07, P < .05). We assume that the end of FOF has the potential to mark a decisive turning point in life for individuals who scored high in these adverse conditions (severe depressive symptoms, high loneliness, or frequent negative emotions) when they had FOF." "The end of FOF was associated with decreases in negative psychosocial outcome measures (depressive symptoms, negative affect, and loneliness). However, and in contrast to the other negative psychosocial outcome measures, it is quite puzzling why the end of FOF was not associated with decreases in social isolation. A possible explanation may be that even a major life event, such as the end of FOF, does not have the power to reduce social isolation because feelings of isolation may remain largely stable over the years among middle-aged and older adults with FOF. Thus, individuals developing feelings of social isolation caused by FOF, several years ago, may have difficulties in overcoming these feelings of isolation"

Appendix 6: Cross-sectional studies reporting on falls and social isolation/loneliness (n=11)

Author, Year	Sample	Results	Text description/ interpretation of findings
Finn, 2001[14]	n=49	**Social Resources** (OARS Social Support Scale) Fallers (n=25) Mean: 2.4 (SD, 1) Non-Fallers (n=24) Mean: 2.0 (SD, 0.78) p = 0.59	"The data from the present study supports the conclusion that the social resources of nursing home residents are the same, regardless of a history of falls that does not change their level of previous functioning. Most nursing home residents are already in a position where they have to rely on others to come to them for visits, outings, etc.. Unlike many community-based elderly individuals most nursing home residents do not have the means or capabilities to visit others who are not in their immediate environment. Therefore, regardless of fall-history the social resources available to nursing home residents are dependent on others."
Stel, 2004[2]	n=204	**Relationship between falls inside and decline in social activities because of a fall** OR: 2.6 (95% CI: 1.1-6.5); p<0.05	"A decline in social activities after falling is significantly associated with falls inside. The current study shows that falls could also have consequences on the level of functioning of older people: respondents reported a decline in functional status (35.3%), a decline in social activities outside the house (16.7%) and physical activities (15.2%) as a direct consequence of the last fall."
Nicholson, 2005[15]	n=68	**Relationship between injurious falls and social isolation** (Lubben Social Network Scale) **Social isolation** ρ= -0.4; p<0.05 **Female** ρ= -0.5; p=0.01 **Family Sub Scale of Social Isolation** ρ= -0.2; p=0.12	"Results suggest that there is a strong positive relationship between injurious falls and social isolation. Results from this sample suggest that there is an association between lower scores on the LSNS and higher number of injurious falls, which means that increased injurious falls are related to increased social isolation. In the findings for this sample it appears that there may be some direct link between injurious falls and social isolation. Gender appeared to play a role when examining H4. Males as a group did not show a significant relationship between number of injurious falls and social isolation. The relationship for females as a group was positive and significant. This female sample showed a high Pearson's correlation coefficient (see Table 4). This suggests that injurious falls may trigger some direct link to social isolation in females. "When examining the family subscale of the LSNS, there was no correlation between injurious falls and social isolation (see Table 3). It is possible that as the participant continues to have injurious falls and becomes less likely to leave the house due to a fear of future injurious falls, he/she will eventually become socially isolated. This is not necessarily the case when families are involved."

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		Friend Sub Scale of Social Isolation ρ= -0.43; p<0.05	"On the other hand, in the case of the friends subscale, there was a strong correlation between injurious falls and social isolation, such that a greater number of injurious falls was associated with a greater degree of social isolation. A possible explanation for this may be the opposite of the phenomenon with family and social isolation. The participant who has increasing injurious falls may become more likely to stay in the house thus losing contact with friends. Friends of the participants tend to be around the same age as the participant and are less likely to increase the amount of visits to the participant to make up for the lack of contact the participant suffers as a result of being homebound."
Iliffe, 2007[16]	n=3139	**Falls and social isolation** (Lubben social network scale) Socially isolated (n=368) 13.6% reported multiple falls in the past 12 months Not socially isolated (n=2133) 10.7% reported multiple falls in the past 12 months p=0.11	Multivariate analysis taking into account all statistically significant associations shows a different pattern. The risk of social isolation appears to be associated with depressed mood and living alone, while male sex, memory impairment and perceived poor health may be weakly associated. For the other factors [multiple ad] listed in the second hypothesis, no significant associations in bivariate or multivariate analyses were found.
Van Lankveld, 2011[17]	n=154	**Relationship of falls with loneliness** (De Jong Gierveld Loneliness scale) Correlation coefficient = 0.14 p=not significant	"Health status indicators were unrelated to falls and cognitive functioning, and showed low to moderate relations with the remaining health hazards."
Schnittger, 2012[18]	n=579	**Association between history of falls and pathways of loneliness** **Emotional loneliness** (de Jong-Gierveld Loneliness Scale) Correlation coefficient=0.134 p<0.003 **Social loneliness** (de Jong-Gierveld Loneliness Scale) Correlation coefficient=0.09 p=not significant	"Interestingly, social support was the only outcome in which a biological variable, falls history, emerged in the final model; this may indicate the relative importance of health factors compared to psychosocial factors in the loneliness models"

		Social support (Lubben Social Network Scale) Correlation coefficient= -0.247 p<0.003	
Quach, 2016[19]	n=8464 No falls group (n=5249) One fall group (n=1352) At least two falls group (n=1863)	**Social Relationship Index [mean (SD)]** No falls: 3.34 (1.32) One fall: 3.24 (1.35) At least two falls: 3.08 (1.35) p<0.0001 *Note: this is a cohort study, but the outcomes relevant to our review question are from a cross-sectional survey given to participants at baseline*	"Respondents who fell had a higher prevalence of clinically significant depression symptoms, were more often not married, had fewer good friends living in their neighborhood, were less likely to attend religious services or to be a volunteer, and were less likely to have perceived support from friends or relatives, when needed. The average score of the social relationship index for fallers (3.08 and 3.24 for respondents with at least 2 falls or one fall respectively) tended to be lower than for respondents who did not fall (3.34 score of the index, p<.0001)"
Hajek, 2017[20]	n=7808	**Variables associated with history of falls** **Social exclusion** (Bude and Lantermann scale) β =0.08; SE, -0.02; p<0.001 **Loneliness** (De Jong Gierveld Loneliness Scale) β =0.08; SE, -0.02; p<0.001	Controlling for potential confounders, linear regression analysis showed that reporting a fall in the previous 12 months was associated with higher social exclusion scores (β = .08, p < .001), and higher loneliness scores (β = .08, p < .001). Contrarily, reporting a fall in the preceding 12 months was not associated with the number of important people in regular contact.
Robins, 2018[21]	n=245	**Relationship between falls and social isolation** (Friendship Scale for social isolation) OR 1.03 (95% CI: 0.66-1.62); p=0.9	No statistically significant association reported between experiencing a fall in the past 12 months and social isolation.
Faria, 2020[22]	n=48	**Relationship between falls and loneliness** (UCLA scale) p=0.384	No statistically significant association reported between experiencing a fall in the past 6 months and loneliness

Vanden Wyngaert, 2020[23]	n=113	**Variables associated with risk of falls** **Ability to participate in social roles and activities** (PROMIS questionnaire) R^2=0.11; p=0.01 **Depression** R^2=0.08; p=0.01	"Regarding the PROMIS questionnaire, low associations were found between measures of the risk of falls and the appreciation of participation in social roles and activities on the one hand (R2 = 0.11), and depression on the other (R2 = 0.08)" "Remarkably, the risk of falls on itself was identified as a determinant of difficulties on psycho-social well-being (i.e. depression and social isolation) and of objective health utility [...]. As such, falls and an increased risk of falls may deter subjects to continue their outdoor social activities, resulting in changes in means and location of social contact to less stimulating activities (e.g. a phone call rather than a rendezvous point), promoting the risk of impairments in mental health and depression"

Appendix 7: Cross-sectional studies reporting on fear of falling and activity restriction due to fear of falling (n= 15)

Author, Year	Sample	Results	Text description/ interpretation of findings
Tinetti, 1994[24]	n=1103	**Fear of falling** (Falls Efficacy Scale – modified so low score corresponds with low confidence or greater fear) Fallers Mean, 79.8 (SD 23.4) Non-fallers Mean, 88.1 (SD 17.9) p < .0001 **Activity restriction because of fear of falling** Fallers = 24% Non-fallers =15% chi-square= 13.1; p < 0.001	In order to examine the impact of recent falls, we also determined the proportion of subjects reporting fear and the mean fall-related efficacy scores separately for subjects who did and did not experience a fall in the year prior to the interview. The proportion of subjects reporting a decrease in activity because of fear of falling was 24% among fallers vs 15% among non-fallers (chi-square= 13.1; p < .001). The mean fall-related efficacy scores were 79.8 (SD 23.4) and 88.1 (SD 17.9) among fallers and non-fallers, respectively (p < .0001).
Howland, 1998[25]	n=266	**Relationship between falls and fear of falling** OR: 2.498 (95% CI: 1.013-6.159); p=0.05 **Relationship between falls and activity curtailment among those afraid of falling** OR: 1.094 (95% CI: 0.376-3.177); p=0.869 **Relationship between social support and activity curtailment among those afraid of falling** (Social Support Scale) OR: 1.574 (95% CI: 1.082-2.290); p=0.018 *Note: Here a higher social support score indicates lower levels of social support*	"The contribution of personal falls experience to fear of falling was apparent. Those who suffered a previous fall were more likely to have a fear of falling." "Surprisingly, neither the degree of fear of falling nor the experience of falls was associated with activity restriction. This finding suggests that activity curtailment is not just associated with extreme levels of fear. The presence of social support was, however, important. Those who could rely on others or talk with friends about falling were least likely to report activity curtailment. Thus, support of family and friends may be an important prerequisite for continuing to remain active even in the face of fear of falling. This support may serve as a buffer to the potentially debilitating consequences of fear of falling. It is possible this support is manifested as encouragement for remaining active." "Those who curtailed activities […] did not differ with respect to social integration but were significantly (p = .024) less likely to be able to rely on friends or relatives in times of crisis (social support)"
Murphy, 2002[1]	n=1064	**Variables independently associated with activity restriction in participants with fear of falling**	"We found that a history of an injurious fall within the past year, slow timed physical performance, two or more chronic conditions, and

		Injurious fall Adjusted relative risk (ARR): 1.36 (95% CI, 1.11-1.66); p=0.003 *Two or more chronic conditions* ARR: 1.34 (95% CI, 1.08-1.65); p=0.007 *Slow-timed physical performance* ARR: 1.44 (95% CI, 1.18-1.75); p=0.0004	depressive symptoms were all independently associated with activity restriction."
Apikomonkon, 2003[26]	n=546	**Relationship between falls and activity restriction** Chi-square=5.49, p<0.05 **Relationship between fear of falling and activity restriction** Chi-square=23.27, p<0.001	"Compared with non-fallers, the older persons with falls experiences were more likely to have activity restriction (28% vs 16%). The Chi-square test indicated that fall history was associated with activity restriction measured by dichotomous question. "Older people with FOF were more likely to have activity restriction (26% vs 10%). The FOF using the SAFE final version was significantly associated with activity restriction as measured by dichotomous question."
Gagnon, 2005[3]	n=105	**Variables associated with fear of falling** (Comparing subjects with no/slight fear and subjects with moderate/severe fear) **Social support** (confiding-relationships component of the Bedford Life Events and Difficulties Schedule modified for elderly subjects) Wald chi-square= 3.77; p=0.05	"The following secondary independent variables were significantly associated with categorical fear of falling: dizziness (Wald chi-square 6.58; p 0.01), total number of medications (Wald chi-square 5.40; p 0.02), and social support (Wald chi-square 3.77; p 0.05). (Note: Higher scores mean less support.)"
Zijlstra, 2007[27]	n=4376	**Variables significantly associated with avoidance of activity due to fear of falling** **Multiple falls in past 6 months** OR: 1.97 (95% CI, 1.52-2.54)	"When fear of falling was added as an additional variable (model 3; Table 3), odds ratios of all variables that showed significance in model 2 decreased. Nevertheless, the association for the highest age group (≥80 years), fair and poor perceived general health and multiple falls with avoidance of activities remained statistically significant. Our findings regarding avoidance of activity remained fairly similar when fear of falling was entered into the logistic model. Although sometimes, often and very often experiencing fear of falling were

		Aged 80 years or older OR: 1.56 (95% CI, 1.24-1.95) **Fair perceived general health** OR: 2.92 (95% CI, 2.43-3.52) **Poor perceived general health** OR: 5.7 (95% CI, 3.57-9.12)	strongly associated with avoidance of activity. Higher age (≥80 years), fair and poor perceived health and multiple falls remained independently associated with avoidance of activity in community-living older people. This implies that interventions aimed at reducing avoidance of activity should not focus on fear of falling alone, but on other modifiable factors, like falls, as well"
Iliffe, 2007[16]	n=3139	**Relationship between fear of falling and social isolation** (Lubben Social Network Scale) OR: 1.21 (95%CI, 0.88-1.65)	Multivariate analysis taking into account all statistically significant associations shows a different pattern. The risk of social isolation appears to be associated with depressed mood and living alone, while male sex, memory impairment and perceived poor health may be weakly associated. For the other factors [(fear of falling)] listed in the second hypothesis, no significant associations in bivariate or multivariate analyses were found.
Curcio, 2009[4]	n=1668	**Variables associated with activity restriction related to fear of falling** **At least 1 fall in past year** OR: 1.48 (95%CI, 1.18-1.86); p=0.001 **Low social participation** OR: 1.52 (95%CI, 1.20-1.92); p<0.01 **Poor perceived health** OR: 1.38 (95%CI, 1.06-1.79) **Difficulties in activities of daily living** OR: 1.65 (95%CI, 1.16-2.32) **Decreased physical activity** OR: 1.35 (95%CI, 1.06-1.70)	"Those who had activity restriction related to fear of falling were significantly more likely to have had a fall within the past year, with a trend to suffer recurrent falls and injurious falls." "Table 3 shows the bivariate relationships between activity restriction related to fear of falling and psychosocial factors. Activity restriction related to fear of falling had a strong bivariate association with poor perceived health, depression, low social participation, and poor life satisfaction." "A second model was then constructed with the psychosocial associated factors and other clinical and functional covariates (see Table 4). After adjustment, functional and clinical factors remained independently associated with activity restriction related to fear of falling. Only depression and poor perceived health variables emerged as independent factors." "logistic regression analyses for activity restriction related to fear of falling. In the first model, 19 demographic, functional, and health-related variables with p values less than .05 derived from the bivariate analysis were entered into the logistic regression as independent variables. Difficulties in ADL, decreased physical activity, polypharmacy, and

		Polypharmacy OR: 1.56 (95%CI, 1.14-2.14) **Below poverty level** OR: 1.32 (95%CI, 1.05-1.65)	extreme poverty were independently associated with activity restriction related to fear of falling. A second model was then constructed with the psychosocial associated factors and other clinical and functional covariates (see Table 4). After adjustment functional and clinical factors remained independently associated with activity restriction related to fear of falling."
Kara, 2009[28]	n=47	**Relationship between fear of falling and loneliness** (Philadelphia Geriatric Center Morale Scale) ρ= 0.258; p=Not significant	When the correlation between the fear of falling and the subscales of the Philadelphia Geriatric Center Morale Scale was examined, no correlations were found (Table 5).
Dias, 2011[5]	n=113	**Variables associated with activity restriction due to fear of falling** (compared to no FOF or FOF alone) **Fear of falling intensity** Mean 3.4 (SD, 0.9); p<0.0 **Depression** Chi-square=15.2, p=0.004 **Exhaustion** Chi-square=9.2, p=0.01 **Participation in social activities** Chi-square=10.4, p=0.016	"The three groups were statistically different in relation to FOF evaluated using the question about fear intensity. The group that reported FOF and activity restriction demonstrated higher levels of fear when compared with the other groups" "The variables that best discriminated the groups were depression, exhaustion and participation in social activities, demonstrated in the diagram (Figure 1). For the grouping obtained through the Chi-square Automatic Interaction Detection (CHAID) method, it may be observed that the first distinctive characteristic was depression, evaluated using GDS. Those with positive symptoms for depression showed 90% chance of restricting activities due to fear of falling. Additionally, the presence of depressive symptoms seems to modulate the factors that are associated with activity restriction due to fear of falling. A greater risk for depression has been associated with inadequate evaluation of coping self-efficacy in stressful events of life. It is worth noting that the participants of the present study who restricted activities by FOF showed lower self-efficacy in relation to the other participants. Thus, it is possible that elders with depressive symptoms perceive themselves less capable of performing certain tasks and, because of that, restrict their activities. Out of the elders that did not have depressive symptoms, those who had positive result for exhaustion of the frailty phenotype had 78% chance of restricting activities due to fear of falling." "Out of the ones who did not show positive result for exhaustion, the other distinctive characteristic was participation in social activities. Those who stopped performing activities had 83% chance of restricting activities due to fear of falling.

			Participation in social activities was the last discriminatory factor for the studied sample; however this variable did not show association with activity restriction in the bivariate analysis. It is possible that this difference in relation to the participation in social activities only occurs for a subgroup and not for the whole sample"
Mendes da Costa, 2012[29]	n=501	**Relationship between activity restriction due to fear of falling and number of falls in past 12 months** 2 or more falls OR, 3.04 (95% CI, 1.70-5.42) 1 fall OR, 1.33 (95% CI, 0.66-2.68)	"activity restriction was increased significantly with age and with the number of falls within the past 12 months, accounting however one quarter of the subjects who did not fall. In the logistic regression model, these associations remained significant"
Choi, 2015[30]	n=4247	**Relationship between falls and fear-induced activity restriction** <u>Previous fall experiences</u> OR, 2.12 [95% CI, 0.96-4.67] p=0.062 <u>Injurious falls</u> OR, 3.03 [95% CI, 1.21-7.54] p=0.008	Characteristics independently associated with fear-induced activity restriction were low socioeconomic status, cognitive impairment, difficulty with activities of daily living, and a history of injurious falls.
Ferreira, 2018[31]	n=7935	**Relationship between fear of falling because of sidewalk defects and social participation** OR 1.01 (95% CI: 0.99-1.04)	"As in the univariate analysis, the fear of falling because of defects in sidewalks and the perception of violence in the neighborhood were not associated with social participation."
Petrinec, 2020[32]	n=108	**Relationship between fear of falling and social functioning** (Medical Outcomes Study 36-item Short-Form General Health Survey) β= -0.29	"Fear of falls was an independent predictor for role physical, physical functioning, and social functioning."
Merchant, 2020[7]	n=493	**Variables associated with fear of falling alone** **Number of falls**	"The multivariate logistics regression in Table 2 shows that female sex (OR = 3.54; 95% CI = 1.82–6.90), number of medications (OR = 1.28; 95% CI = 1.03–13.60), prefrail or frail (OR = 2.17; 95% CI = 1.26–3.73), depression (OR = 4.90; 95% CI = 1.06–22.67) and number of falls in the

		OR, 2.13 (95% CI, 1.20–3.78) p<0.05 **Social isolation** OR, 0.99 (95% CI, 0.51–1.89) p=not significant **Variables associated with fear of falling + fear-based activity restriction** **Number of falls** OR, 1.4 (95% CI, 0.94–2.20) p=not significant **Social isolation** OR, 1.7 (95% CI, 0.82–3.55) p=not significant **Sarcopenia** OR, 8.13 (95% CI, 1.52–43.41)	past 12 months (OR = 2.13; 95% CI = 1.20–3.78) were significantly associated with FOF. Only sarcopenia (OR = 8.13; 95% CI = 1.52–43.41) and depression (OR = 5.17; 95% CI = 1.84–14.54) were significantly associated with FOF + FAR. "**History of falling** is a well-known risk factor for FOF and/or FAR as persons who have experienced falls are more likely to develop fear. However, three-quarters of those with FOF + FAR and two-thirds of those with FOF + FAR had never experienced a fall during the study" "**Social isolation** is another factor that is rarely studied. In our study, one in three older adults with FOF + FAR was at risk of social isolation compared with one in five with no FOF" "Prefrailty, frailty, and **sarcopenia** have significant association with FOF and/or FAR in both univariate and multivariate analysis."

Appendix 8: Relevant findings from qualitative studies (n=7)

Author, Year	Qualitative analysis approach, and sample size	Results
Ward-Griffin, 2004[33]	Phenomenological approach n=9	"***Restricting activities was a second strategy identified by the participants, which involved avoiding certain social activities or/and physical environments. Participants used this strategy when they wanted to "play it safe" in times of inclement weather or in situations where ambulation might be difficult***. Precarious weather conditions seemed to heighten their awareness and fear of falling. As Sarah explained, "I do not fear falling, except around steps. They terrify me to death [along with] scaffolding around the town—that bothers me. Little kids on bicycles on the sidewalk— that bothers me. And I am restricted to the house when there's fresh snow on the ground." Similarly Wilfred stated, "When it's really, really icy, and I don't have to go out, I don't drive the car. I don't go out either." "
Meric, 2007[34]	Analysis approach not reported n=22	"***After having a falling experience, elderly individuals had behavioral changes, which decreased the competency of achieving daily life activities, such as staying away from the crowded environment, not going outside alone, acting very slowly, not able to do daily activities alone***: "... I can't go out anymore. I haven't been out alone for 2 years, there are always people next to me." (75; woman). "… I take my man's arm on the street, I can't get out much in case I fall into the street." (71; woman)." "
Schmid, 2009[35]	Latent content analysis n=42	"***Quotes regarding the subsequent consequences of poststroke falls categorized into the following three themes: (1) limiting activity and participation, (2) increasing dependence, and (3) developing a fear of falling***" "*Limiting activity: Because falling became common for some participants, talk about strategies for the prevention of future falls was common and emerged naturally during interviews.* ***A significant consequence was the choice to limit everyday life activities at home and in the community to help manage and prevent falls***" "Increasing dependence: Participants discussed their dependence on assistive devices such as walkers, canes, and wheelchairs to reduce falls and feel secure in their environment. Some participants indicated use of the furniture, walls, or people as alternative assistive devices. Many discussed dependence on caregivers for maintaining balance and preventing falls. ***Participants easily became isolated because they were fearful to leave their home, and some were even fearful to move about their own home, becoming increasingly dependent***." "Developing fear of falling: This initial experience of falling with stroke onset was a traumatic event that consequently resulted in participants expressing fear that future falls would mean having another stroke. They also discussed the ***subsequent development of fear of falling and the fear of being left on the floor for hours at a time***. ***Participants described genuine fear of falling and fear about being hurt as well as the subsequent impact on function and independence. Some participants discussed falls becoming a frequent event and a common and pervasive concern; fear, worry, and concern became a daily consequence of poststroke falls. Some participants were fearful that they would fall while out in the community and addressed the embarrassment of a public fall. They were concerned about how they looked while walking around and seemed to be worried about the stigma related to falls and decreased mobility.*** Managing falls and fear of falling in everyday life became an important aspect of poststroke adjustment."

Faes, 2010[36]	Grounded theory approach n=10	"***Patients described social withdrawal and attributed this to their fear of falling and the loss of physical capabilities after falling. Patients recognised that they became (more) dependent on their caregiver after falling. One patient experienced social benefits from her fall, since she now receives more attention from her children***" "P#1 I can't travel anymore because of my limited mobility. I injured my leg in a fall. P#4 I stay at home more often and don't visit my friends anymore. I am afraid to fall when I go out. P#5 My grandson is almost one year old. I still haven't seen his room. His room is upstairs; I am too anxious to fall when climbing the stairs." "Furthermore, ***our findings confirmed the consequences of falls in cognitively unimpaired older persons that are mentioned in the literature; these include a fear of falling and social withdrawal due to the fear of falling and physical limitations***"
Chiu, 2011[37]	Focussed ethnographic approach n=18	"Following their initial fall, it appeared that changes occurred in individuals' independent living and use of informal support networks. While activities of daily living are continued either independently, with help from —hourly maids during the rehabilitation period or for longer, ***recreational activities usually were second priority and were soon discontinued***. Mah-Jong, one of the most popular tile games among Chinese was mentioned by 12 respondents as a favourite pass time. Other social activities mentioned included Cantonese opera, volunteering within their communities, and dim sum with friends. ***After a fall, these activities were interrupted for two main reasons: 1) lack of transportation means and 2) lower mobility capabilities. Feelings of loneliness arose as the respondents felt that they were cut off from their friends***." "Intuitive changes included modifications made to personal behaviours. ***Avoidance behaviour was reported as an intuitive change. Specifically, fallers would avoid outdoor activities***. Other intuitive changes include being more careful ("taking care") when walking and slowing down."
Host, 2011[38]	Phenomenographic approach n=14	"Others ***stopped doing certain activities to avoid falling and they did not choose activities that made them scared and nervous and caused bodily pain. They thus perceived that physical activity was not good and therefore stopped the activity***. The families and the general practitioner (GP) supported their choices. Conversely, some felt that it was a loss if they had to stop activities they had enjoyed because it increased their risk of falling." "***Fall accidents had implications for older people's identity and autonomy, and they could lead to social isolation.***" "Conversely, social interaction in the context of participation in fall-prevention activities was not always welcomed because it placed the respondents in a context in which they did not like to see themselves." "For others, ***support from professionals was important in how they coped with falls*** and their prevention. The GP was a good support when they needed knowledge about appropriate and applicable preventive activities."
Xu, 2019[39]	Thematic analysis n=17	Identified theme of restricted mobility and social participation.

		"***Stroke participants felt that they were restricted after the fall, particularly around having reduced balance, and this affected their mobility functions and degree of social participation***: I am getting worse, especially my balance. I used to walk for a short distance outside but now I can't. (S7) There was a big difference … I used to walk with walking stick. But I have not been able to walk since that fall. (S8) Last time I could take public transport, go to [central area] and take a walk, now it's too difficult for me. (S1)"

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Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	5
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	5
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	5-6
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	6-7
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	6
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Appendix 1
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	6
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	8
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	7-8
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	N/A
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	Appendix 4-6

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	8; Figure 1
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	8-11; Table 1; Appendix 7
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	11-15
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	Table 2
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	15-16
Limitations	20	Discuss the limitations of the scoping review process.	17
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	17
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	18

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

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Global evidence on falls and subsequent social isolation in older adults: A scoping review

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ABSTRACT

Background: Falls are a leading cause of injury-related hospitalizations among adults aged 65 years and older and may result in social isolation.

Objective: To summarize evidence on falls and subsequent social isolation and/or loneliness in older adults through a scoping review.

Eligibility criteria: Studies were eligible for inclusion if the population had a mean age of 60 years or older, they examined falls and subsequent social isolation, loneliness, fear of falling or risk factors, and were primary studies (e.g., experimental, quasi-experimental, observational, qualitative).

Sources of evidence: MEDLINE, CINAHL, Embase, Ageline, and grey literature from inception until January 11, 2021.

Charting methods: A screening and charting form was developed and pilot-tested. Subsequently, two reviewers screened citations and full-text articles, and charted the evidence.

Results: After screening 4,993 citations and 304 full-text articles, 39 studies were included in this review. Participants had a history of falling (range: 11 to 100%). Most studies were conducted in Europe (44%) and North America (33%) and were of the cross-sectional study design (66.7%), in the community (79%). Studies utilized 15 different scales. Six studies examined risk factors for social isolation and activity restriction associated with fear of falling. Six studies reported mental health outcomes related to falls and subsequent social isolation.

Conclusions: Consistency in outcome measurement is recommended, as multiple outcomes were used across the included studies. Further research is warranted in this area, given the aging population and the importance of falls and social isolation to the health of older adults.

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Keywords: scoping review, older adults, falling, social isolation, loneliness, fear of falling

Strengths and Limitations of this Study:

- A robust methodology including a thorough and extensive literature search was used to review the literature in the area.
- There was no date limits or language limits for studies eligible for inclusion in this scoping review.
- Scoping reviews do not assess the quality of included studies and we cannot confirm the directional causality between falls and social isolation.

INTRODUCTION

Addressing social isolation in older adults is a growing priority in Canada, as over 30% older adults are at risk of social isolation [1]. Social isolation among older adults is associated with adverse health outcomes including cognitive decline, depression, anxiety, and dementia [2]. Globally, falls are the second leading cause of unintentional injury death, making falls a major public health concern [3]. In Canada, falls are the leading cause of injury-related hospitalizations among adults aged 65 years and older, and 20-30% of older adults experience at least one fall each year [4]. Falls may result in serious health-related consequences including physical (e.g., fractures), physiological (e.g., cognitive decline), and psychological (e.g., anxiety, depressive symptoms, fear of falling, and social isolation) outcomes [5].

Given the detrimental outcomes associated with both falls and social isolation, there is a need to understand the relationship between falls and subsequent social isolation in older adults. The current scoping review is focused on falling and the subsequent experience of social isolation and/or loneliness and to ascertain whether the COVID-19 context affected the relationship between falls and subsequent social isolation.

METHODS

Protocol and registration

The protocol for this scoping review was developed in accordance with the JBI (formerly Joanna Briggs Institute) guidance for scoping reviews and registered with Open Science Framework [6]. An integrated knowledge translation approach was used [7], whereby colleagues from the Public Health Agency of Canada (YJ, KA, MdG, AGB) co-developed the review. The results are reported using the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) extension to scoping reviews [8] supplemented by PRISMA 2020 [9].

Patient and Public Involvement

Through the Strategy for Patient-Oriented Research (SPOR) Evidence Alliance, we collaborated closely with a patient partner who provided feedback on our protocol, participated in full-text screening piloting, and provided input on the manuscript (JB).

Search strategy

An experienced librarian developed our comprehensive literature search strategy, which was peer-reviewed by a second information specialist using the Peer Review of Electronic Search Strategies (PRESS) checklist [10]. MEDLINE, CINAHL, Embase, and Ageline were searched from inception until January 11, 2021 (Appendix 1). References of included studies and relevant reviews were scanned. Grey literature (i.e., unpublished or difficult to locate studies) was searched using the Canadian Agency for Drugs and Technologies in Health's Grey Matters checklist [11].

Eligibility criteria

The population of interest were older adults with a mean age of 60 years or older. The concept was the relationship between falls and subsequent social isolation or loneliness. As mentioned in our related systematic review on interventions for social isolation after falling, social isolation and loneliness are distinct concepts [12]. Social isolation included a decrease in any of the following: number of social contacts, feeling of belonging, fulfilling relationships, engagement with others, and quality of their personal network [12]. We defined loneliness as "the unpleasant experience that occurs when a person's network of social relations is deficient in some way, either quantitatively or qualitatively" [13]. For our primary objective, the context included any community or institutional setting. For our secondary objective, we limited the context to include studies that specified their consideration of the COVID-19 pandemic. Studies including

participants reporting a history of falling (i.e., regardless of the proportion of the sample who fell), the role of fear of falling in this relationship, as well as any risk (e.g. medication use, frailty) or protective (e.g. exercise, gait or balance training) factors were considered eligible for inclusion.

Eligible study designs included primary research studies of experimental (e.g., randomized controlled trials), quasi-experimental (e.g. non-randomized controlled trials, controlled before and after studies, interrupted time series), observational (e.g., cohort studies, case-control studies, cross-sectional studies), qualitative (phenomenological, ethnography, qualitative interview, etc.) and mixed method (e.g., convergent parallel, embedded, explanatory sequential) design. No restrictions based on study year, language of publication, or study duration were applied.

Study selection

A screening form was developed and a pilot-test using 50 citations was completed with 80% agreement, and subsequently, all remaining titles and abstracts were screened independently by pairs of reviewers (SMT, AP, JF, GM, AH). Discrepancies were resolved by a third reviewer.

Similarly, two pilot-tests were completed for full-text article screening (achieving 27% and 40% agreement, respectively), screening criteria were revised, and subsequently, full-text articles were assigned to independent pairs of reviewers. Discrepancies were resolved by a third reviewer.

Data charting

A charting form was developed to capture data on study characteristics, population characteristics and outcomes of interest. Relevant outcomes included any data illustrating the relationship between falls and subsequent social isolation, including the role of fear of falling,

and other risk factors or protective factors. A pilot-test was conducted using five studies, sufficient agreement was achieved, and subsequently, full data charting was completed by independent pairs of reviewers. Discrepancies were resolved by a third reviewer.

Analysis and presentation of results

The review findings were summarized descriptively using summary tables.

RESULTS

After screening 4993 citations and 304 full-text articles against our eligibility criteria, 39 studies were identified as eligible for inclusion based on our primary objective for this review (Figure 1). No studies were identified when limiting to the COVID-19 context for our secondary objective. Study and patient characteristics have been summarized in Table 1 and detailed data are reported in Appendices 2 and 3.

Table 1: Summary of study and patient characteristics

Characteristics	Number (%)
Study Characteristics (n=39)	
Geographical region	
Asia	5 (12.8%)
Australia	1 (2.5%)
Europe	17 (43.6%)
North America	13 (33.3%)
South America	3 (7.7%)
Study design	
Cohort	6 (13.8%)
Cross-sectional	26 (66.7%)
Qualitative	7 (19.4%)
Study duration	
Not applicable	29 (74.3%)
≤ 1 year	5 (12.8%)
≥ 1 year	5 (12.8%)
Patient characteristics	
Mean age	74.9 (range, 65.0 to 95.0)
Not reported	11 (28.2%)
65.0-69.9 years	4 (10.2%)
70.0-74.9 years	8 (20.5%)
75.0-79.9 years	14 (35.9%)

≥80.0 years	2 (5.1%)
Proportion of female participants	Mean: 65.3% (range, 42.5 to 88.9)
Sample size	Mean: 3043.6 (9 to 43487)
<100	11 (28.2%)
100-499	11 (28.2%)
500-999	3 (7.7%)
1000-1999	4 (10.2%)
2000-5000	4 (10.2%)
>5000	6 (15.4%)
Study setting	
Community	31 (79.4%)
Medical	6 (15.4%)
Nursing home	1 (2.5%)
Multi-site	1 (2.5%)
Participants living alone	44.1% (range, 0 to 100)
Participants with a history of falling	Mean: 50.8% (range, 11.2 to 100)
Not reported*	11 (28.2%)
≤25%	6 (15.4%)
25-40%	10 (25.6%)
40-85%	5 (12.8%)
>85%	7 (17.9%)

Note: *not reported for the overall sample

Study characteristics

The publication year for included studies ranged from 1987 to 2020, with more than half published since 2010. Most studies were conducted in Europe (17/39, 44%) and North America (13/39, 33%). More than half of the studies were cross-sectional study design (66.7%) and 7 qualitative studies were included. Most were conducted in the community (79%). Studies utilized 15 different scales and a variety of self reported responses to assess variables such as social isolation, loneliness. (e.g., 18-item Lubben Social Network Scale, 6-item de Jong-Gierveld Loneliness Scale). Six studies identified risk factors for social isolation and for activity restriction due to fear of falling (Table 2). Six studies reported mental health outcomes (Appendix 4).

Table 2: Potential risk factors for social isolation and activity restriction associated with fear of falling

Author, Year	Risk factor	Associated evidence
Social Isolation after injurious fall		
Nicholson, 2005	Sex (female)	The authors noted a strong positive correlation between injurious falls and social isolation for women (ρ= -0.5; p=0.01), but this was not significant for men.
Activity Restriction due to fear of falling		
Zijlstra, 2007	Aged 80 years or older	OR: 1.56 (95% CI, 1.24-1.95)
	Fair perceived general health	OR: 2.92 (95% CI, 2.43-3.52)
	Poor perceived general health	OR: 5.7 (95% CI, 3.57-9.12)
Curcio, 2009	Poor perceived health	OR: 1.38 (95% CI, 1.06-1.79)
	Depression	OR: 1.76 (95% CI, 1.38-2.24)
	Low social participation	OR: 1.52 (95% CI, 1.20-1.92)
	Difficulties in activities of daily living	OR: 1.65 (95% CI, 1.16-2.32)
	Decreased physical activity	OR: 1.35 (95% CI, 1.06-1.70)
	Polypharmacy	OR: 1.56 (95% CI, 1.14-2.14)
	Below poverty level	OR: 1.32 (95% CI, 1.05-1.65)
Dias, 2011	Depression	Chi-square=15.2, p=0.004
	Exhaustion (frailty)	Chi-square=9.2, p=0.01
	Participation in social activities	Chi-square=10.4, p=0.016
Murphy, 2002	Two or more chronic conditions	ARR: 1.34 (95% CI, 1.08-1.65)
	Slow-timed physical performance	ARR: 1.44 (95% CI, 1.18-1.75)
Merchant, 2020	Sarcopenia	OR, 8.13 (95% CI, 1.52–43.41)

Abbreviations: OR, odds ratio; ARR, adjusted risk ratio

Patient characteristics

Across all studies, the number of included patients was 118,702, with an average of 3,043 patients per study. Their mean age ranged from 65 to 95 years. Approximately 65% of patients were female. Most studies included participants with a history of falling, ranging from 11% to 100% of the study population.

Cohort studies

Among the 39 included studies, six were cohort studies (Appendix 5). Tinetti et al (1998) demonstrated a significant relationship between multiple non-injurious falls and a decline in social functioning (Regression coefficient = -0.538 ($p<0.05$)), measured using the Social Activity scale, in a sample of 770 older adults after 3 years of follow-up [14]. Similarly, Pin et al. (2016) found that in their cohort of 16,583 participants, those who fell showed decreased social participation after falling ($p<0.001$), which was no longer statistically significant when frailty was added in the model [15].

Vellas et al. (1987) compared people who fall versus those who did not in two populations: a retirement home (n=118) and older adults living at home (n=60) [16]. Among the older adults who lived at home, they noted that fewer fallers were able to maintain the same level of activity after 6 months of follow-up when compared to non-fallers ($p<0.02$).

Van der Meulen et al. (2014) assessed social participation (using the Frenchay Activities Index) in 260 older adults with low and high levels of concern about falling over 14-months [17]. They reported significant differences (specific results not reported) between the groups, with lower social participation scores in those who had a higher level of concern about falling.

In 4,680 older adults, Yu et al. (2021) reported a significant relationship between the number of falls and loneliness scores (measured using the 3 item University of California, Los Angeles (UCLA) Loneliness Scale) across three time points over 4-years ($B = 0.008$, $p<0.05$) [18]. A cohort study by Hajek et al. (2020) looked at loneliness (as measured using the Bude and Lantermann scale) and social isolation (measured using the De Jong Gierveld Loneliness Scale) and their link to fear of falling 669 older adults [19]. They compared older adults with an onset of fear of falling, to those who had no fear. Their findings revealed that the end of fear of falling

was associated with lower loneliness scores (β = −0.06, p<0.05) and other negative psychosocial outcomes (e.g., increased depressive symptoms).

Cross-sectional studies related to falls and social isolation

Of the twenty-six cross-sectional studies included in this review, 11 reported on the relationship between falls and social isolation or loneliness (Appendix 6).

Quach et al. (2016) examined the relationship between falls and scores on the Social Relationship Index including 8,464 participants [20]. They noted that participants who reported experiencing a fall or multiple falls had a lower social relationship index score (mean, 3.24 and 3.08 respectively) compared to those who had not fallen (mean, 3.34; p<0.0001).

Hajek et al (2017) examined variables associated with a history of falling in 7,808 participants [21]. They found those reporting a fall in the previous 12 months had higher loneliness scores (De Jong Gierveld Loneliness Scale; β = .08, p < .001) and social exclusion scores (Bude and Lantermann scale; β = .08, p < .001) compared to those who had not fallen.

Schnittger et al. (2012) conducted a study in 579 older adults identifying risk factors for different pathways of loneliness – emotional loneliness, social loneliness (both measured using the De Jong Gierveld Loneliness Scale), and social support (measured using the Lubben Social Network Scale) [22]. A history of falls was the only biological variable that was identified as a statistically significant risk factor for inclusion in the model for social support (correlation coefficient= -0.247; p<0.003).

Stel et al (2004) reported a statistically significant decline in social activities in 204 older adults who experienced a fall inside their home (OR: 2.6 (95% CI: 1.1-6.5); p<0.05) [23], and Vanden Wyngaert et al. (2020) reported an association between risk of falls and participation in social roles and activities in 154 older adult haemodialysis patients (PROMIS questionnaire;

R^2=0.11; p=0.01) [24]. Finally, Nicholson et al. (2005) reported a strong positive relationship between experiencing an injurious fall and increasing social isolation in a sample of 68 older adults (Lubben Social Network Scale; ρ= -0.4; p<0.05), and highlighted that this relationship was stronger in women (ρ= -0.5; p=0.01) [25]. Additionally, they assessed this relationship using both the Family and Friends subscales of the Lubben Social Network Scale and found that the correlation was specific to the Friends subscale (ρ= -0.43; p<0.05).

Iliffe et al. (2007) and Robins et al. (2018) found no statistically significant associations between falls and social isolation using the Lubben Social Network Scale in a sample of 3,139 older adults and the Friendship Scale for social isolation in a sample of 245 older adults, respectively [26, 27]. Similarly, Van Lankveld et al. (2011) and Faria et al. (2020) found no correlation between falls and loneliness, using the De Jong Gierveld Loneliness scale in a sample of 579 older adults, and the UCLA scale in a sample of 48 older adults, respectively [28, 29]. Additionally, Finn et al. (2001) noted no difference in scores for the OARS social support scale when comparing fallers to non-fallers in a nursing home setting (n=49) [30].

Cross-sectional studies related to fear of falling and social isolation

Seven studies examined fear of falling linked to falls and social isolation (Appendix 7). Gagnon et al. (2005) reported a statistically significant positive relationship between fear of falling and social support in a sample of 105 older adults (measured using the confiding-relationships component of the Bedford Life Events and Difficulties Schedule modified for elderly subjects; Wald chi-square= 3.77; p=0.05) [31]. Curcio et al. (2009) reported a strong relationship between fear of falling and low social participation in 1,668 older adults (OR, 1.52; 95% CI, 1.20-1.92; p<0.01) [32]. Petrinec et al. (2020) identified fear of falling as an independent predictor of social

functioning (as measured by the Medical Outcomes Study 36-item Short-Form General Health Survey; β= -0.29) in 108 older adults [33].

Merchant et al. (2020) and Iliffe et al. (2007) showed no statistically significant relationship between fear of falling and social isolation in 493 older adults and 3,139 older adults, respectively [26, 34]. Ferreira et al. (2018) and Kara et al. (2009) showed no association between fear of falling and social participation (n= 7,935) or fear of falling and loneliness (n=47), respectively [35, 36].

Cross-sectional studies related to falls and activity restriction due to fear of falling

Eight studies examined the relationship between falls and activity restriction due to fear of falling (Appendix 7). Tinetti et al (1994) and Apikomonkon et al. (2003) both reported a statistically significant decrease in activity due to fear of falling in individuals who experienced a fall compared to those who had not (n=1,103, chi-square= 13.1, $p < 0.001$; and n=546, chi-square=5.49, $p<0.05$, respectively) [37, 38]. Similarly, in 1,668 older adults, Curcio et al. (2009) demonstrated that those who restricted activity due to fear of falling were more likely to have experienced a fall in the year prior (OR: 1.48 (95%CI, 1.18-1.86); p=0.001) [32], and Mendes da Costa et al. (2012) demonstrated that activity restriction increased in those with multiple falls over the past year (OR, 3.04; 95% CI, 1.70-5.42) [39]. Murphy et al. (2002) , and Choi et al. (2015) showed that a history of injurious falls was independently associated with activity restriction due to fear of falling (n=1,064, ARR: 1.36; 95% CI, 1.11-1.66; p=0.003; and n=4,247, OR, 3.03; 95% CI, 1.21-7.54, p=0.008, respectively) [40, 41].

Howland et al. (1998) reported no relationship between the experience of a fall and activity restriction in a sample of 266 older adults (OR: 1.094; 95% CI, 0.376-3.177; p=0.869) [42], as did Choi et al. (2015) (OR, 2.12; 95% CI, 0.96-4.67; p=0.062) among 4,247 older adults

[41]. Similarly, Merchant et al. (2020) also reported no significant relationship between the number of falls and fear-based activity restriction in 493 older adults (OR, 1.4; 95% CI, 0.94–2.20) [34].

Qualitative studies

Seven qualitative studies were included (Appendix 8). All participants interviewed were older adults (n=124), including 51 stroke survivors [43, 44] and 10 experiencing frailty [45]. Common categories identified across these studies were activity restriction to manage fear of falling, changing behaviours to avoid falling [43, 45-47], feeling restricted due to reduced mobility after falling [43, 44, 48], increasing dependence on caregivers [43, 45], developing fear of falling [43, 45], feelings of loneliness or isolation [43, 48], and a negative impact on identity or autonomy [47].

DISCUSSION

We conducted a comprehensive scoping review including 39 studies examining the relationship between falls and subsequent social isolation. We limited the scoping review to studies that identified social isolation after a fall, this was due to the request of the commissioning knowledge user. More than half of the studies were published since 2010, suggesting increased interest in the relationship between falls and social isolation in older adults. Social isolation and loneliness were measured using a variety of outcome measures across studies, such as degree of activity, and varying scales for loneliness, social isolation, social participation, social support, etc. This highlights the growing need for consistency in the measurement of social isolation and loneliness to allow for meaningful comparison across studies. Cornwall et al. (2009) highlight previous efforts to consolidate different measures of social isolation and build off this work.

They combined multiple measures of social isolation to develop two scales that measure distinct dimensions of social isolation – social disconnectedness and perceived isolation [49].

Only a few studies examined risk factors and mental health outcomes related to falls and subsequent social isolation. Risk factors linked to social isolation and activity restriction included age, sex/gender, poor perceived health, poverty, frailty, and comorbidity. Few studies also documented an association between activity restriction due to fear of falling and depression. Our findings suggest the presence of gaps in the literature for these important outcomes, highlighting the need for further research. No randomized trials exploring interventions for social isolation after a fall were identified in our scoping review, highlighting another gap in the literature and an area for future research to explore.

We did not identify any studies on falls and subsequent social isolation that were specific to the COVID-19 context, highlighting another gap in the evidence base. A scoping review by Kasar et al. (2021) suggests that older adults face increased social isolation as a result of pandemic-related restrictions, which can result in increased loneliness and reduced quality of life [50]. They also highlighted how technology can be used to deliver virtual or tele-health support services, and to allow older adults stay connected with their social networks [50]. A systematic review by Larson et al. (2021) assessed the impact of COVID-19 lockdowns on physical activity in older adults and reported that most studies demonstrated a decline in physical activity or an increase in sedentary behaviours in this population. The effectiveness of physical activity and exercise in preventing falls and fractures in older adults is well-established in the literature [51-53]. A decline in physical activity in older adults could lead to sarcopenia, and an increased risk of falls or fractures [53].

There are several strengths to our scoping review, such as the use of the JBI guide, and the PRISMA-ScR. A comprehensive literature search was conduced and several different types of study designs were included. However, limitations include that all studies were conducted in middle-high- or high-income economy countries. This suggests that our results may not be generalizable to low- and middle-income countries, highlighting a gap in the literature. Many of the included studies were cross-sectional and we cannot confirm the directional causality between falls and social isolation without more robust research. Furthermore, none of the included studies specifically focused on culturally and linguistically diverse (CALD) backgrounds, who might be at greater risk of social isolation after experiencing a fall. Additional research is warranted in this area [54]. In addition, we were unable to update the literature search due to lack of capacity and funding.

In summary, we found a dearth of research, particularly examining risk factors and mental health outcomes related to social isolation and falling older adults. Further research is warranted in this area, given the importance of falls and social isolation to the health of older adults.

LIST OF ABBREVIATIONS

ARR	Absolute Risk Reduction
CADTH	Canadian Agency for Drugs and Technologies in Health
CI	Confidence interval
OR	Odds Ratio
PRESS	Peer Review of Electronic Search Strategies
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses

DECLARATIONS

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Ethics approval

Not required.

Consent for publication

Not applicable.

Availability of data and materials

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

Conflict of interests

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

Author Contribution

ACT obtained funding for this study. SMT, ACT, YJ, MdG, and KA conceptualized the study. SMT drafted the protocol, with input from ACT, YJ, MdG, KA, JB, JW, and SES. SMT oversaw screening, full-text review, and data abstraction. SMT, AP, JF, GM, AH, and JB screened citations and full text articles, abstracted and verified data. SMT and ACT interpreted results, and SMT, AP, and ACT drafted the manuscript and revised the final version of the manuscript. JF, GM, AH, YJ, MdG, KA, AGB, JB, JW, and SES critically reviewed the manuscript. All authors approved of the final version.

Role of the funder

The funders were co-developers of this research project and contributed to the design of the study and reviewed/approved of the manuscript.

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SUPPLEMENTAL FILES

Supplemental File 1: PRISMA Checklist

Supplemental File 2: Appendices

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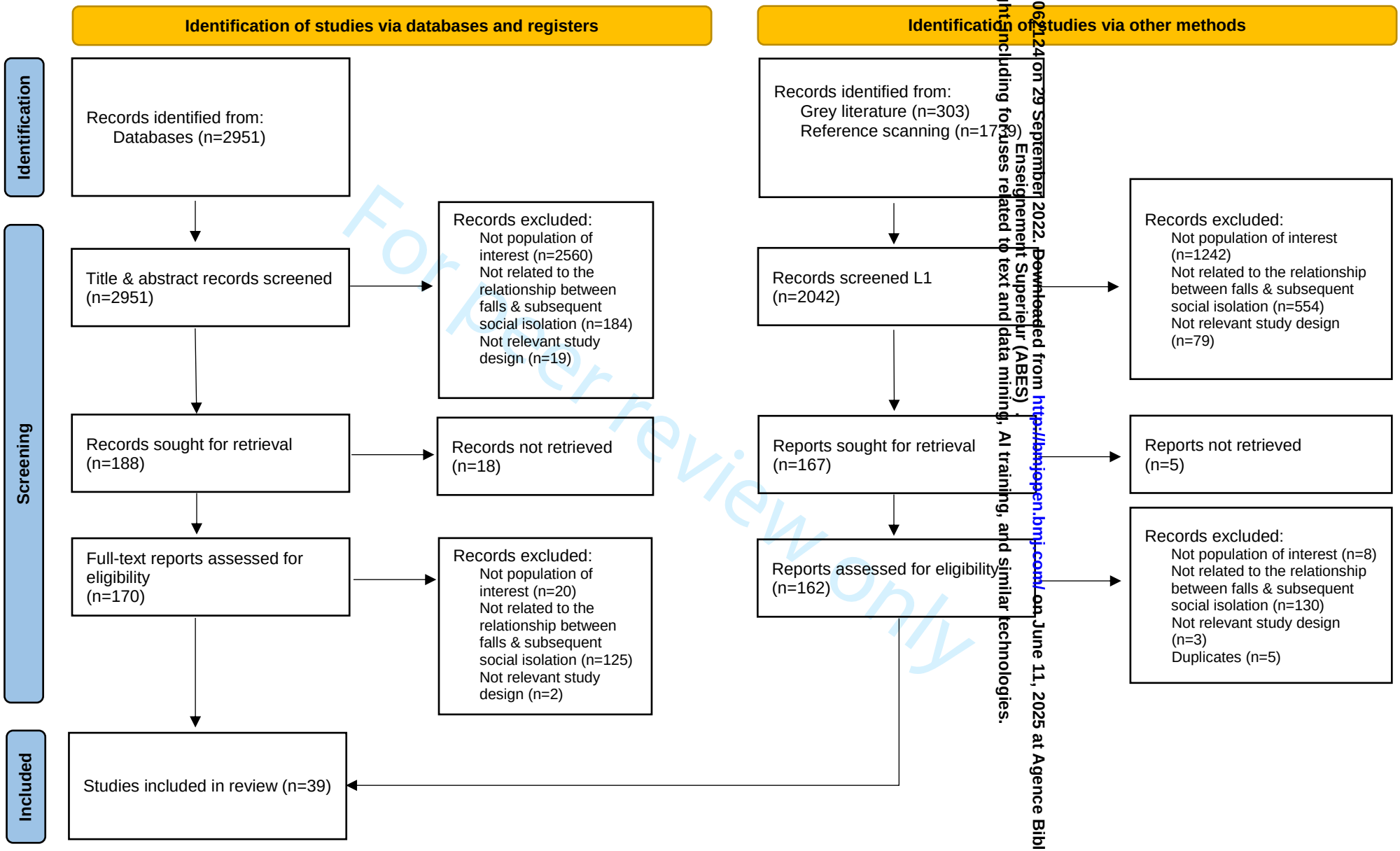
FIGURE LEGEND:

Figure 1 – PRISMA 2020 study flow diagram.

Figure 1: PRISMA 2020 study flow diagram



Supplementary File 2: Appendices

Appendix 1: Literature search strategies

Ovid MEDLINE(R) ALL <1946 to Jan 11, 2021>

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 January Week 2 2021>

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 2021 January 11>

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 January 11, 2021>, EBM Reviews - ACP Journal Club <1991 to January 11, 2021>, EBM Reviews - Cochrane Clinical Answers <January 2021>, 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.

bmjopen-2022-062124 on 29 September 2022. Downloaded from

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 January 11, 2021>
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 January 2021>
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

Appendix 2: Study Characteristics (n=39)

Author, year	Study title	Journal name	Country	Study design	Study duration (months)
Apikomonkon, 2003[26]	Fear of falling and fall circumstances in Thailand	NA	Thailand	cross-sectional	NA
Chiu, 2011[37]	Psychosocial responses to falling in older Chinese immigrants living in the community	Dissertation Abstracts International Section A: Humanities and Social Sciences	Canada	qualitative	6
Choi, 2015[30]	Characteristics associated with fear of falling and activity restriction in South Korean older adults	Journal of Aging and Health	South Korea	cross-sectional	NA
Curcio, 2009[4]	Activity restriction related to fear of falling among older people in the Colombian Andes Mountain	Journal of Aging and Health	Columbia	cross-sectional	NA
Dias, 2011[5]	Characteristics associated with activity restriction induced by fear of falling in community-dwelling elderly	Revista Brasileira de Fisioterapia	Brazil	cross-sectional	NA
Faes, 2010[36]	Qualitative study on the impact of falling in frail older persons and family caregivers: Foundations for an intervention to prevent falls	Aging & Mental Health	Netherlands	qualitative	NA
Faria, 2020[22]	Elderly residents in the community: gaining knowledge to support a rehabilitation nursing program	Revista Brasileira de Enfermagem	Portugal	cross-sectional	NA
Ferreira, 2018[31]	Aspects of social participation and neighborhood perception: ELSI-Brazil	Revista de saude Publica	Brazil	cross-sectional	NA
Finn, 2001[14]	The relationship between falls and fall-related efficacy, depression, and social resources	Dissertation Abstracts International: Section B: The Sciences and Engineering	USA	cross-sectional	NA
Gagnon, 2005[3]	Affective correlates of fear of falling in elderly persons	American Journal of Geriatric Psychiatry	Canada	cross-sectional	NA
Hajek, 2017[20]	The association of falls with loneliness and social exclusion: evidence from the DEAS German Ageing Survey	BMC Geriatrics	Germany	cross-sectional	NA

Hajek, 2020[13]	What are the psychosocial consequences when fear of falling starts or ends? Evidence from an asymmetric fixed effects analysis based on longitudinal data from the general population	International Journal of Geriatric Psychiatry	Germany	cohort	36
Host, 2011[38]	Older people's perception of and coping with falling, and their motivation for fall-prevention programmes	Scandinavian Journal of Public Health	Denmark	qualitative	2
Howland, 1998[25]	Covariates of fear of falling and associated activity curtailment	The Gerontological Society of America	USA	cross-sectional	NA
Iliffe, 2007[16]	Health risk appraisal in older people 2: the implications for clinicians and commissioners of social isolation risk in older people	British Journal of General Practice	England	cross-sectional	NA
Kara, 2009[28]	Evaluation of home environment and life satisfaction and falling in geriatrics: Examination of its relationship with fear	Physiotherapy Rehabilitation	Turkey	cross-sectional	NA
Mendes da Costa, 2012[29]	Fear of falling and associated activity restriction in older people. results of a cross-sectional study conducted in a Belgian town	Archives of Public Health	Belgium	cross-sectional	NA
Merchant, 2020[7]	Relationship between fear of falling, fear-related activity restriction, frailty, and sarcopenia	Journal of the American Geriatrics Society	Singapore	cross-sectional	NA
Meric, 2007[34]	A qualitative study on the perceptions of old individuals regarding the life of the fall and its effect on their daily lives	Turkish Journal of Geriatrics	Turkey	qualitative	2
Murphy, 2002[1]	Characteristics associated with fear of falling and activity restriction in community-living older Persons	Journal of the American Geriatrics Society	USA	cross-sectional	NA
Nakaya, 2013[6]	The association between self-reported history of physical diseases and psychological distress in a community-dwelling Japanese population: the Ohsaki Cohort 2006 Study	European Journal of Public Health	Japan	cross-sectional	NA
Nicholson, 2005[15]	The relationship between injurious falls, fear of falling, social isolation, and depression	NA	USA	cross-sectional	NA
Petrinec, 2020[32]	Health-related quality of life of older women religious: negative influence of frailty	Western Journal of Nursing Research	USA	cross-sectional	NA
Pin, 2016[11]	Impact of falling on social participation and social support trajectories in a middle-aged and elderly European sample	Social Science and Medicine - Population Health	Denmark, Sweden, Netherlands, Austria, Germany, France, Belgium,	cohort	72

			Switzerland, Italy, Spain		
Quach, 2016[19]	Social determinants of falls: The role of social support and depression among community-dwelling older adults	Dissertation Abstracts International: Section B: The Sciences and Engineering	USA	cohort	36
Robins, 2018[21]	The association between physical activity and social isolation in community-dwelling older adults	Aging & Mental Health	Australia	cross-sectional	NA
Schmid, 2009[35]	Consequences of poststroke falls: activity limitation, increased dependence, and the development of fear of falling	American Journal of Occupational Therapy	USA	qualitative	6
Schnittger, 2012[18]	Risk factors and mediating pathways of loneliness and social support in community-dwelling older adults	Aging & Mental Health	Ireland	cross-sectional	NA
Stel, 2004[2]	Consequences of falling in older men and women and risk factors for health service use and functional decline	Age and Ageing	Netherlands	cross-sectional	NA
Tinetti, 1998[9]	The effect of falls and fall injuries on functioning in community-dwelling older persons	Journal of Gerontology	USA	cohort	36
Tinetti, 1994[24]	Fear of falling and fall-related efficacy in relationship to functioning among community-living elders	Journal of Gerontology	USA	cross-sectional	NA
van der Meulen, 2014[10]	Effect of fall-related concerns on physical, mental, and social function in community-dwelling older adults: A prospective cohort study	Journal of American Geriatrics Society	Netherlands	cohort	14
van Lankveld, 2011[17]	Age-related health hazards in old patients with first-time referral to a rheumatologist: A descriptive study	Arthritis	Netherlands	cross-sectional	NA
Vanden Wyngaert, 2020[23]	Associations between the measures of physical function, risk of falls and the quality of life in haemodialysis patients: a cross-sectional study	BMC Nephrology	Belgium		
Vellas, 1987[8]	Prospective study of restriction of activity in old people after falls	Age and Ageing	France	cohort	6
Ward-Griffin, 2004[33]	Falls and fear of falling among community dwelling seniors: the dynamic tension between exercising precaution and striving for independence	Canadian Journal on Aging	Canada	qualitative	NA

Xu, 2019[39]	Developing a falls prevention program for community-dwelling stroke survivors in Singapore: client and caregiver perspectives	Disability and Rehabilitation	Singapore	Qualitative	NA
Yu, 2020[12]	Longitudinal Assessment of the relationships between geriatric conditions and loneliness	Journal of the American Medical Directors Association	USA	Cohort	96
Zijlstra, 2007[27]	Prevalence and correlates of fear of falling, and associated avoidance of activity in the general population of community-living older people	Age and Ageing	Netherlands	Cross-sectional	NA

Appendix 3: Patient Characteristics (n=39)

DEMOGRAPHIC DATA							
Author, year	**Overall sample size**	**Overall age (years)**	**Overall age (type)**	**Overall age variance (value)**	**Overall age variance (type)**	**% female**	**% male**
Apikomonkon, 2003[26]	546	NR	NR	60-94	range	61	39
Chiu, 2011[37]	18	81	mean	71 to 94	range	88.9	11.1
Choi, 2015[30]	4,247	NR	NR	NR	NR	21	NR
Curcio, 2009[4]	1668	70.9	mean	7.4	SD	54.5	45.5
Dias, 2011[5]	113	74.5	mean	7	SD	85	15
Faes, 2010[36]	10	70-90	range	NR	NR	60	40
Faria, 2020[22]	48	75	mean	6.8	SD	66.67	33.33
Ferreira, 2018[31]	7935	NR	NR	NR	NR	56.9	43.1
Finn, 2001[14]	49	NR	mean	NR	SD	NR	NR
Gagnon, 2005[3]	105	78.2	mean	8.9	SD	86.7	13.3
Hajek, 2017[20]	7808	73.8	mean	5.9	SD	46.2	53.8
Hajek, 2020[13]	8836	65.5	mean	10.7	SD	50.4	49.6
Host, 2011[38]	14	77	mean	68-87	range	64.3	35.7
Howland, 1998[25]	266	76.3	mean	7.9	SD	77	23
Iliffe, 2007[16]	3139	NR	NR	65-75+	range	54.5	45.5
Kara, 2009[28]	47	71.7	mean	5.6	SD	55.3	44.7
Mendes da Costa, 2012[29]	501	NR	NR	65-85+	NR	57.7	42.3
Merchant, 2020[7]	493	73	mean	8	SD	79.3	20.7
Meric, 2007[34]	22	NR	NR	65-83+	range	63.6	36.4
Murphy, 2002[1]	1064	79.6	mean	5.3	SD	73	27
Nakaya, 2013[6]	43487	65+	range	NR	NR	53.9	46.1
Nicholson, 2005[15]	68	78.5	mean	6.3	SD	60.4	39.6
Petrinec, 2020[32]	108	75.6	mean	65–93	range	100	0
Pin, 2016[11]	16583	50-95	range	NR	NR	NR	NR
Quach, 2016[19]	8464	74	mean	7	SD	58.7	41.3
Robins, 2018[21]	245	77	mean	6	SD	60	40
Schmid, 2009[35]	42	67.5	mean	11.93	SD	NR	NR
Schnittger, 2012[18]	579	NR	NR	NR	NR	69.1	30.9
Stel, 2004[2]	204	78.7	mean	6.3	SD	54.9	45.1
Tinetti, 1998[9]	1103	NR	NR	NR	NR	NR	NR
Tinetti, 1994[24]	1103	79.6	mean	5.2	SD	73	27

van der Meulen, 2014[10]	260	77.9	mean	5	SD	72.7	27.3
van Lankveld, 2011[17]	154	79.2	mean	5.1	SD	78	21
Vanden Wyngaert, 2020[23]	113	67.5	mean	16	SD	42.5	57.5
Vellas, 1987[8]	178	65-85+	range	NR	NR	76.4	23.6
Ward-Griffin, 2004[33]	9	81.7	mean	72-92	range	78	22.3
Xu, 2019[39]	17	65	mean	7	SD	44	55.6
Yu, 2020[12]	4680	74.01	mean	9.69	SD	56	43.9
Zijlstra, 2007[27]	4376	77.1	mean	4.9	SD	59	40.1

SETTING DATA				
Author, year	**Setting**	**Streamlined setting description**	**Participants living alone (%)**	**Description of access to caregivers**
Apikomonkon, 2003[26]	Community in 4 provinces of Thailand	Community	9.9	NR
Chiu, 2011[37]	Community in the Greater Toronto Area, Canada	Community	61	Two respondents lived with their children. The rest lived alone or only with their spouse. Only seven of 18 respondents had at least one grown child living in the same city who might provide assistance when needed.
Choi, 2015[30]	Community setting in Korea	Community	NR	NR
Curcio, 2009[4]	Community in Columbian Andes Mountains	Community	9.5	NR
Dias, 2011[5]	Community setting in Brazil	Community	38	NR
Faes, 2010[36]	Home and outpatient clinic in Netherlands	Community + Medical	10	All participants had access to a caregiver (either child or spouse)
Faria, 2020[22]	Urban health unit in northern Portugal	Medical	NR	NR
Ferreira, 2018[31]	Urban communities in Brazil	Community	NR	NR
Finn, 2001[14]	Two nursing homes in the Chicago Metropolitan Area, USA	Nursing home	0	In general, they have entered a nursing home because of an inability to adequately care for themselves, and they do not have anyone who can ably assist them, or they lack financial resources.
Gagnon, 2005[3]	Medical or orthopedic wards of 3 hospitals in Toronto, Canada	Medical	65.7	NR
Hajek, 2017[20]	Communities in Germany	Community	NR	NR

Hajek, 2020[13]	Community in Germany	Community	28.9	NR
Host, 2011[38]	Copenhagen area in Denmark	Community	64.3	NR
Howland, 1998[25]	Communities in Eastern Massachusetts	Community	87	NR
Iliffe, 2007[16]	Community in London, England	Community	32.8	NR
Kara, 2009[28]	Districts of Narlıdere, Gülbahçe and Mordoğan in Izmir, Turkey	Community	27.7	NR
Mendes da Costa, 2012[29]	Community in Walloon region of Belgium	Community	36.4	NR
Merchant, 2020[7]	Community in northwest region of Singapore	Community	NR	NR
Meric, 2007[34]	Geriatric Outpatient of Gülhane Military Medical Academy in Turkey	Medical	13.6	NR
Murphy, 2002[1]	Community setting in New Haven, Connecticut, USA	Community	70	NR
Nakaya, 2013[6]	Community in Japan	Community	NR	87.3% reported sufficient social support, 12.2% reported lack of social support, 4.2% unknown.
Nicholson, 2005[15]	Community in United States	Community	53.4	NR
Petrinec, 2020[32]	Cleveland Catholic Diocese in USA	Community	100	Participants were not included if they needed caregiver assistance.
Pin, 2016[11]	Communities in 10 European Countries (Denmark, Sweden, The Netherlands, Austria, Germany, France, Belgium, Switzerland, Italy, and Spain)	Community	NR	NR
Quach, 2016[19]	Communities in USA	Community	23.3	One-third did not have the perceived support with basic personal care (eating or dressing) when needed.
Robins, 2018[21]	Communities in Australia	Community	49	NR
Schmid, 2009[35]	Community in United States	Community	NR	All participants had a caregiver.
Schnittger, 2012[18]	Technology Research for Independent Living (TRIL) clinic at St James's Hospital, Dublin.	Medical	NR	NR
Stel, 2004[2]	Community in three regions in the Netherlands	Community	NR	NR

Tinetti, 1998[9]	Community in New Haven, Connecticut, USA	Community	NR	NR
Tinetti, 1994[24]	Community in New Haven, Connecticut, USA	Community	69	NR
van der Meulen, 2014[10]	Community in the Netherlands	Community	53.1	NA
van Lankveld, 2011[17]	Community in the Netherlands	Community	NR	NR
Vanden Wyngaert, 2020[23]	Dialysis centres in Belgium	Medical	NR	NR
Vellas, 1987[8]	Community in Toulouse, France	Community	NR	NR
Ward-Griffin, 2004[33]	Community in Canada (11 senior apartment towers and in the Health Information and Promotion Centre)	Community	77.7	NR
Xu, 2019[39]	Community rehabilitation centers in Singapore	Medical	0	Four family caregivers (two male) and four maids (all female) were interviewed. 33% employed a maid as a main caregiver.
Yu, 2020[12]	Community in USA	Community	NR	NR
Zijlstra, 2007[27]	Community in two urban areas in the Netherlands	Community	44	NR

FALLS AND FRAILTY DATA								
Author, year	**Participants with history of falling (%)**	**List of comorbidities [comorbidity 1 (%), etc.]**	**Participants with frailty (%)**	**Frailty scale**	**Overall frailty score**	**Overall frailty score type**	**Frailty variance value**	**Frailty variance type**
Apikomonkon, 2003[26]	21	NR	NR	NR	NR	NR	NR	NR
Chiu, 2011[37]	100	All participants reported having chronic conditions. The most common physical conditions reported were diabetes and hypertension.	NR	NR	NR	NR	NR	NR
Choi, 2015[30]	NR	NR	NR	NR	NR	NR	NR	NR
Curcio, 2009[4]	31.9	Hypertension (53.0), Osteoarthritis (39.2), heart disease (20.2), COPD	NR	NR	NR	NR	NR	NR

		(16.8), Diabetes Mellitus (13.4), Lower extremities fracture (11.7), Pain in joints (33.1), Dizziness (15.2), Breathlessness (11.4), Hearing impairment (33.0), visual impairment (68.9)						
Dias, 2011[5]	NR	NR	NR	NR	NR	NR	NR	NR
Faes, 2010[36]	100	Cognitive impairment (70%)	NR	NR	NR	NR	NR	NR
Faria, 2020[22]	25	Cardiovascular diseases (76.6), endocrine diseases (56.8), musculoskeletal diseases (45.7), depression (16.3), respiratory diseases (14.3) and cerebrovascular diseases (9.3).	NR	NR	NR	NR	NR	NR
Ferreira, 2018[31]	NR	Overweight (women=65.2%, men=59.0%)	NR	NR	NR	NR	NR	NR
Finn, 2001[14]	51	NR	NR	NR	NR	NR	NR	NR
Gagnon, 2005[3]	100	NR	NR	NR	NR	NR	NR	NR
Hajek, 2017[20]	17.6	NR	NR	NR	NR	NR	NR	NR
Hajek, 2020[13]	NR	Number of physical illnesses is mean = 2.6, SD = 1.9	NR	NR	NR	NR	NR	NR
Host, 2011[38]	100	NR	NR	NR	NR	NR	NR	NR
Howland, 1998[25]	35	Vision problems (26), stroke (11), dizziness (29)	NR	NR	NR	NR	NR	NR
Iliffe, 2007[16]	11.20	Two or more chronic conditions (59.0%), takes 4 or more meds (33.4%)	NR	NR	NR	NR	NR	NR
Kara, 2009[28]	29.9	NR	NR	NR	NR	NR	NR	NR
Mendes da Costa, 2012[29]	31.6	NR	NR	NR	NR	NR	NR	NR
Merchant, 2020[7]	mean = 0.4	NR	51.3	FRAIL scale	NR	NR	NR	NR
Meric, 2007[34]	81	NR	NR	NR	NR	NR	NR	NR
Murphy, 2002[1]	39.70	Chronic dizziness (24.2), 5 or more medications (35.8), vision impairment (40.5)	NR	NR	NR	NR	NR	NR
Nakaya, 2013[6]	17.3	NR	NR	NR	NR	NR	NR	NR
Nicholson, 2005[15]	100	NR	NR	NR	NR	NR	NR	NR

Petrinec, 2020[32]	NR	Hypertension (60), Cataracts (60), Thyroid disorders (30), Osteoporosis (17), Diabetes (7)	19	Tilburg Frailty Indicator (TFI)	NR	NR	NR	NR
Pin, 2016[11]	2.8	NR	NR	NR	NR	NR	NR	NR
Quach, 2016[19]	38.0	NR	NR	NR	NR	NR	NR	NR
Robins, 2018[21]	38	Congestive heart failure (4%); Heart disease (33%); stroke (9%); Cancer (25%); diabetes (18%); lung disease (16%); Parkinson's disease (1%)	NR	NR	NR	NR	NR	NR
Schmid, 2009[35]	NR	Stroke (100%)	NR	NR	NR	NR	NR	NR
Schnittger, 2012[18]	NR	NR	NR	NR	NR	NR	NR	NR
Stel, 2004[2]	100	Dizziness (27.9%), visual impairment (23%)	NR	NR	NR	NR	NR	NR
Tinetti, 1998[9]	30.3	NR	NR	NR	NR	NR	NR	NR
Tinetti, 1994[24]	39	One or more chronic conditions (78%)	NR	NR	NR	NR	NR	NR
van der Meulen, 2014[10]	55.5	NA	NR	NA	NA	NA	NA	NA
van Lankveld, 2011[17]	44	Cardiac 36%, hypertension 40%, vascular 25%, respiratory 12%, EENT 21%, upper GI 14%, lower GI 10%, Hepatic 3%, kidney 3%, other GU 16%, neurological 18%, endocrine 21%, psychiatric 8%, Rhuematic disease general (56%), Osteoarthritis (49%), Spondylosis(31%), Rheumatoid arthritis(17%), Arthritis otherwise defined (12%), Gout (6%), Chodrocalcinosis (12%), Osteoporosis (1%), Shoulder problem (6%), Polymyalgia rheumatica (3%), Soft tissue (1%), Carpal tunnel syndrome (2%), Others (6%)	NR	NR	NR	NR	NR	NR
Vanden Wyngaert, 2020[23]	NR	Cardiovascular disease (74.3%) diabetes (46.0%) musculoskeletal complications (44.2%), Neuropathy (28.3), retinopathy (31.9), respiratory complications (24.8), hepatopathy (17.7), pain (27.4%), depression	NR	NR	NR	NR	NR	NR

		(23.9%), fatigue (18.6%), anxiety (15.0%), sleep disturbances (12.4%)						
Vellas, 1987[8]	50	NR	NR	NR	NR	NR	NR	NR
Ward-Griffin, 2004[33]	NR	NR	NR	NR	NR	NR	NR	NR
Xu, 2019[39]	100	Stroke (100%)	NR	NR	NR	NR	NR	NR
Yu, 2020[12]	mean =0.74	The mean number of comorbidities at baseline was 2.24 (SD=1.38)	NR	NR	NR	NR	NR	NR
Zijlstra, 2007[27]	32.6	NR	NR	NR	NR	NR	NR	NR

Appendix 4: Mental health outcomes related to falls, fear of falling, and social isolation (n=6)

Author, Year	Sample	Results	Text description/ interpretation of findings
Murphy, 2002[1]	n=1064	**Variables independently associated with activity restriction in participants with fear of falling** *Depression (CES-D scale)* Adj relative risk: 1.27 (95% CI, 1.00-1.60); p=0.048	"We found that a history of an injurious fall within the past year, slow timed physical performance, two or more chronic conditions, and depressive symptoms were all independently associated with activity restriction."
Stel, 2004[2]	n=204	**Relationship between higher depression score and decline in social activities because of a fall** OR: 2.0 (95% CI: 1.2-3.3); p<0.05	"A decline in functional status, social activities, and physical activities was reported more often in respondents with a higher depression score."
Gagnon, 2005[3]	n=105	**Variables associated with fear of falling** (Comparing subjects with no/slight fear and subjects with moderate/severe fear) **Depression** (Structured Clinical Interview for DSM-IV (SCID)) Wald chi-square= 8.76; p=0.03 **Anxiety** (Structured Clinical Interview for DSM-IV (SCID)) Wald chi-square= 5.95; p<0.02	"Not only were depressive disorders and depression severity independently associated with fear of falling, but depression had the strongest association with this fear among the variables that we measured. Given that this was a cross-sectional study, a causal relationship between depression and fear of falling cannot be inferred. [...] It is possible, therefore, that in some individuals, fear of falling is an anxious manifestation of depression. However, depression could also be a consequence of activity restriction or social isolation resulting from a fear of falling" "Depressive disorders and anxiety disorders were significantly associated with categorical fear of falling, independently of these variables"
Curcio, 2009[4]	n=1668	**Variables associated with activity restriction related to fear of falling** **Depression** OR: 1.76 (95%CI, 1.38-2.24)	"A second model was then constructed with the psychosocial associated factors and other clinical and functional covariates (see Table 4). After adjustment, functional and clinical factors remained independently associated with activity restriction related to fear of falling. Only depression and poor perceived health variables emerged as independent factors."
Dias, 2011[5]	n=113	**Variables associated with activity restriction due to fear of falling** (compared to no FOF or FOF alone)	"The variables that best discriminated the groups were depression, exhaustion and participation in social activities, demonstrated in the diagram (Figure 1). For the grouping obtained through the Chi-square

		Depression Chi-square=15.2, p=0.004	Automatic Interaction Detection (CHAID) method, it may be observed that the first distinctive characteristic was depression, evaluated using GDS. Those with positive symptoms for depression showed 90% chance of restricting activities due to fear of falling. Additionally, the presence of depressive symptoms seems to modulate the factors that are associated with activity restriction due to fear of falling. A greater risk for depression has been associated with inadequate evaluation of coping self-efficacy in stressful events of life. It is worth noting that the participants of the present study who restricted activities by FOF showed lower self-efficacy in relation to the other participants. Thus, it is possible that elders with depressive symptoms perceive themselves less capable of performing certain tasks and, because of that, restrict their activities.
Nakaya, 2013[6]	n=43487	**Relationship between history of falling and psychological distress** <u>Sufficient social support</u> OR, 1.6 (95% CI: 1.3-1.9) p<0.01 <u>Lack of social support</u> OR, 2.0 (95% CI: 1.4-2.8) p<0.01	"We also conducted stratified analyses regarding OR of psychological distress according to differences in social support status. Almost all subjects with a history of physical disease (including those with history of fall/fracture) were at increased risk of psychological distress, regardless of social support."
Merchant, 2020[7]	n=493	**Variables associated with fear of falling alone** **Depression** OR, 4.90 (95% CI, 1.06–22.67) p<0.05 **Variables associated with fear of falling + fear-based activity restriction** **Depression** OR, 5.17 (95% CI, 1.84–14.54)	"In our study, FOF and/or FAR were both significantly associated with **depression** in univariate and multivariate logistics regression model. Those with FOF + FAR were nine times more likely to be depressed than those with no FOF. […] Strong links between depressive symptoms with FOF and/or FAR have been reported in various studies, and their association is believed to be bidirectional, where management of one condition would improve the other."

Appendix 5: Findings from included cohort studies (n=6)

Author, Year	Sample	Results	Text description/ interpretation of findings
Vellas, 1987[8]	n=178 Studied two populations: 1) Individuals living in a retirement home (Fall victims = 59; Non-fallers=59) 2) Individuals living at home (Fall victims = 30; Non-fallers=30)	Retirement home (n=118) Among the fall victims there was a tendency towards restriction of activity: 3% walked less indoors, 5% went outside less, 4% had no leisure activity, 7% no longer visited their children and 11% no longer visited their friends. The lack of significance (P>0.05) is linked both to the very low level of activity on day 1 of the aged population living in retirement homes and to our small sample. At home (n=60) On day 1, the fallers and control group had identical levels of activity. Reported a significant difference in the number of participants who maintained the same level of activity after 6 months, with this number being reduced in fall victims compared to non-fallers (p<0.02)	"The interpersonal relationships of the fallers were very poor: 90% did not belong to any group, 54% never visited their children, 40% never visited anybody." "A fall may lead to loss of autonomy. Factors arising as a result of falls have been identified by Isaacs and his co-workers. Our prospective study confirms these findings and demonstrates restriction of activity following a fall without fracture." "Falls in elderly persons give rise to a decline in activity and social life. The fear of recurrence often leads to 'institutionalizing' the patient. But, it is difficult to show whether falls are an indication or the cause of the loss of autonomy."
Tinetti, 1998[9]	n=1103 at baseline, 770 at 3 years follow-up	**Effect of having 2 or more non-injurious falls on social functioning** (Social Activity Scale)**:** Regression coefficient = -0.538 (p<0.05)	"While there did not appear to be an increased risk of decline in social functioning among participants experiencing a single noninjurious fall, repetitive fallers experienced a decline in social functioning in both short- and long-term follow-up analyses. The relationship between repetitive falling and decline in social functioning remained after adjusting for each category of covariates. Experiencing a serious fall injury, on the other hand, was only marginally associated with decline in social functioning over the 1-year follow-up, and not at all over the 3-year follow-up. Preferential loss to follow-up of persons experiencing decline in social functioning between the 1- and 3-year follow-up interviews might at least partially explain the lack of relationship between injurious falls and change in social activities."

Van der Meulen, 2014[10]	n=260 Low level of concern about falling (n=127) High level of concern about falling (n=129) Follow-up = 14 months	**Social participation** (Frenchay Activities Index) Low level falling concern: Baseline mean, 39.9 (SD, 7.1) Follow-up mean, 38.8 (SD, 7.6) High level falling concern: Baseline mean, 36.8 (SD, 7) Follow-up mean, 35.7 (SD, 7.7) **p-value = 0.006**	"High and low levels of fall-related concerns predicted significant differences in ADL dysfunction and social participation that were persistent over 14 months of follow-up. […] Accompanying effect size estimations were medium (social participation) to large (ADL dysfunction)."
Pin, 2016[11]	n=16583 Fallers (n=411) Non-fallers (n=14205)	**Effect of falls on social participation** (binary variable based on if they reported performing at least one activity from a prespecifed list of activities) Model 2 adjusted by time, age, sociodemographic variables and health indicators: OR, 0.86 [95% CI, 0.76-0.89] (p<0.001) Model 3 added adjustment for frailty: OR, 0.95 [95% CI, 0.89-1.02] The interaction between initial frailty status and falling was significant (Table 4, Model 7a). Contrast analyses revealed that the probability of social participation was less among frail people than among people who did not meet any of the frailty criteria in both fallers ($\chi 2$ (1)=6.93;p<0.01) and non-fallers ($\chi 2$ (1)=41.21; p<0.001)	"Falling significantly decreased the probability of social participation in each of these activities and of participation in at least one of them, but only before frailty was introduced into the models (Table 3, Models 2 and 3). Frailty is indeed a strong confounder in the relationship between falls and social participation. When it is taken in consideration in multivariate models, the size of the effect of falling decreased and was no longer significant." "Then, we demonstrated the major role of frailty in the relationship between falling and social participation. The construction of the frailty phenotype (Fried et al., 2001; Santos-Eggimann et al., 2009) was based on its physical component. In this manner frailty and falling were very close constructs. They shared similar risk factors, such as mobility disorders or bone density, and they had similar consequences in terms of disability or mortality. Moreover, we showed that they had similar consequences in terms of social participation. Thus, it may be difficult to distinguish between the two concepts and to identify a specific impact of falling (Nowak & Hubbard, 2009). However, our analyses showed that the continuity in or disengagement from social activities was due to a long-term process that was amplified by health events, rather than by the falls themselves."
Yu, 2020[12]	n=4680	**Relationship between number of falls and loneliness over 3 time-points** (3 item UCLA Loneliness Scale) Regression coefficient = 0.008, SE = 0.04, p =0.048;	"Only the number of falls was significantly correlated with the loneliness score in the next time point, and more frequent loneliness at the previous wave predicts an increased number of falls in 4 years […]The results suggest that a vicious circle relationship exists between loneliness and falls. […] An increased number of falls also predicted more frequent loneliness in 4 years. These findings support evidence reported in cross-

		Wave 1-2: β=0.030, Wave 2-3: β= 0.068	sectional studies that the occurrence of falls was related to social exclusion. […] Older adults who have fallen more frequently might choose to avoid risky activities such as going outside of the home and engaging in social activities. This could lead to a discrepancy in desired and actual social engagement, which in turn results in more frequent experience of loneliness."
Hajek, 2020[13]	n=8836 In total, 669 individuals changed fear of falling (FOF) status from wave 5 to wave 6. More specifically, while the onset of FOF occurred in 431 individuals, the end of FOF occurred in 238 individuals.	**Relationship between fear of falling and loneliness** (Bude and Lantermann scale) **Onset of FOF** β=0.02, SE=0.02, p=NR **End of FOF** β= -0.06, SE=0.03, p<0.05 **Relationship between fear of falling and social isolation** (De Jong Gierveld Loneliness Scale) **Onset of FOF** β=0.06, SE=0.03, p<0.1 **End of FOF** β= 0.01, SE=0.04, p=NR	"The end of FOF was associated with reduced depressive symptoms (β = −1.08, P < .05), decreased loneliness scores (β = −0.06, P < .05), as well as decreased negative affect (β = −0.07, P < .05). We assume that the end of FOF has the potential to mark a decisive turning point in life for individuals who scored high in these adverse conditions (severe depressive symptoms, high loneliness, or frequent negative emotions) when they had FOF." "The end of FOF was associated with decreases in negative psychosocial outcome measures (depressive symptoms, negative affect, and loneliness). However, and in contrast to the other negative psychosocial outcome measures, it is quite puzzling why the end of FOF was not associated with decreases in social isolation. A possible explanation may be that even a major life event, such as the end of FOF, does not have the power to reduce social isolation because feelings of isolation may remain largely stable over the years among middle-aged and older adults with FOF. Thus, individuals developing feelings of social isolation caused by FOF, several years ago, may have difficulties in overcoming these feelings of isolation"

Appendix 6: Cross-sectional studies reporting on falls and social isolation/loneliness (n=11)

Author, Year	Sample	Results	Text description/ interpretation of findings
Finn, 2001[14]	n=49	**Social Resources** (OARS Social Support Scale) Fallers (n=25) Mean: 2.4 (SD, 1) Non-Fallers (n=24) Mean: 2.0 (SD, 0.78) p = 0.59	"The data from the present study supports the conclusion that the social resources of nursing home residents are the same, regardless of a history of falls that does not change their level of previous functioning. Most nursing home residents are already in a position where they have to rely on others to come to them for visits, outings, etc.. Unlike many community-based elderly individuals most nursing home residents do not have the means or capabilities to visit others who are not in their immediate environment. Therefore, regardless of fall-history the social resources available to nursing home residents are dependent on others."
Stel, 2004[2]	n=204	**Relationship between falls inside and decline in social activities because of a fall** OR: 2.6 (95% CI: 1.1-6.5); p<0.05	"A decline in social activities after falling is significantly associated with falls inside. The current study shows that falls could also have consequences on the level of functioning of older people: respondents reported a decline in functional status (35.3%), a decline in social activities outside the house (16.7%) and physical activities (15.2%) as a direct consequence of the last fall."
Nicholson, 2005[15]	n=68	**Relationship between injurious falls and social isolation** (Lubben Social Network Scale) **Social isolation** ρ= -0.4; p<0.05 **Female** ρ= -0.5; p=0.01 **Family Sub Scale of Social Isolation** ρ= -0.2; p=0.12	"Results suggest that there is a strong positive relationship between injurious falls and social isolation. Results from this sample suggest that there is an association between lower scores on the LSNS and higher number of injurious falls, which means that increased injurious falls are related to increased social isolation. In the findings for this sample it appears that there may be some direct link between injurious falls and social isolation. Gender appeared to play a role when examining H4. Males as a group did not show a significant relationship between number of injurious falls and social isolation. The relationship for females as a group was positive and significant. This female sample showed a high Pearson's correlation coefficient (see Table 4). This suggests that injurious falls may trigger some direct link to social isolation in females. "When examining the family subscale of the LSNS, there was no correlation between injurious falls and social isolation (see Table 3). It is possible that as the participant continues to have injurious falls and becomes less likely to leave the house due to a fear of future injurious falls, he/she will eventually become socially isolated. This is not necessarily the case when families are involved."

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		Friend Sub Scale of Social Isolation ρ= -0.43; p<0.05	"On the other hand, in the case of the friends subscale, there was a strong correlation between injurious falls and social isolation, such that a greater number of injurious falls was associated with a greater degree of social isolation. A possible explanation for this may be the opposite of the phenomenon with family and social isolation. The participant who has increasing injurious falls may become more likely to stay in the house thus losing contact with friends. Friends of the participants tend to be around the same age as the participant and are less likely to increase the amount of visits to the participant to make up for the lack of contact the participant suffers as a result of being homebound."
Iliffe, 2007[16]	n=3139	**Falls and social isolation** (Lubben social network scale) Socially isolated (n=368) 13.6% reported multiple falls in the past 12 months Not socially isolated (n=2133) 10.7% reported multiple falls in the past 12 months p=0.11	Multivariate analysis taking into account all statistically significant associations shows a different pattern. The risk of social isolation appears to be associated with depressed mood and living alone, while male sex, memory impairment and perceived poor health may be weakly associated. For the other factors [multiple ad] listed in the second hypothesis, no significant associations in bivariate or multivariate analyses were found.
Van Lankveld, 2011[17]	n=154	**Relationship of falls with loneliness** (De Jong Gierveld Loneliness scale) Correlation coefficient = 0.14 p=not significant	"Health status indicators were unrelated to falls and cognitive functioning, and showed low to moderate relations with the remaining health hazards."
Schnittger, 2012[18]	n=579	**Association between history of falls and pathways of loneliness** **Emotional loneliness** (de Jong-Gierveld Loneliness Scale) Correlation coefficient=0.134 p<0.003 **Social loneliness** (de Jong-Gierveld Loneliness Scale) Correlation coefficient=0.09 p=not significant	"Interestingly, social support was the only outcome in which a biological variable, falls history, emerged in the final model; this may indicate the relative importance of health factors compared to psychosocial factors in the loneliness models"

		Social support (Lubben Social Network Scale) Correlation coefficient= -0.247 p<0.003	
Quach, 2016[19]	n=8464 No falls group (n=5249) One fall group (n=1352) At least two falls group (n=1863)	**Social Relationship Index [mean (SD)]** No falls: 3.34 (1.32) One fall: 3.24 (1.35) At least two falls: 3.08 (1.35) p<0.0001 *Note: this is a cohort study, but the outcomes relevant to our review question are from a cross-sectional survey given to participants at baseline*	"Respondents who fell had a higher prevalence of clinically significant depression symptoms, were more often not married, had fewer good friends living in their neighborhood, were less likely to attend religious services or to be a volunteer, and were less likely to have perceived support from friends or relatives, when needed. The average score of the social relationship index for fallers (3.08 and 3.24 for respondents with at least 2 falls or one fall respectively) tended to be lower than for respondents who did not fall (3.34 score of the index, p<.0001)"
Hajek, 2017[20]	n=7808	**Variables associated with history of falls** **Social exclusion** (Bude and Lantermann scale) β =0.08; SE, -0.02; p<0.001 **Loneliness** (De Jong Gierveld Loneliness Scale) β =0.08; SE, -0.02; p<0.001	Controlling for potential confounders, linear regression analysis showed that reporting a fall in the previous 12 months was associated with higher social exclusion scores (β = .08, p < .001), and higher loneliness scores (β = .08, p < .001). Contrarily, reporting a fall in the preceding 12 months was not associated with the number of important people in regular contact.
Robins, 2018[21]	n=245	**Relationship between falls and social isolation** (Friendship Scale for social isolation) OR 1.03 (95% CI: 0.66-1.62); p=0.9	No statistically significant association reported between experiencing a fall in the past 12 months and social isolation.
Faria, 2020[22]	n=48	**Relationship between falls and loneliness** (UCLA scale) p=0.384	No statistically significant association reported between experiencing a fall in the past 6 months and loneliness

Vanden Wyngaert, 2020[23]	n=113	**Variables associated with risk of falls** **Ability to participate in social roles and activities** (PROMIS questionnaire) R^2=0.11; p=0.01 **Depression** R^2=0.08; p=0.01	"Regarding the PROMIS questionnaire, low associations were found between measures of the risk of falls and the appreciation of participation in social roles and activities on the one hand (R2 = 0.11), and depression on the other (R2 = 0.08)" "Remarkably, the risk of falls on itself was identified as a determinant of difficulties on psycho-social well-being (i.e. depression and social isolation) and of objective health utility [...]. As such, falls and an increased risk of falls may deter subjects to continue their outdoor social activities, resulting in changes in means and location of social contact to less stimulating activities (e.g. a phone call rather than a rendezvous point), promoting the risk of impairments in mental health and depression"

Appendix 7: Cross-sectional studies reporting on fear of falling and activity restriction due to fear of falling (n= 15)

Author, Year	Sample	Results	Text description/ interpretation of findings
Tinetti, 1994[24]	n=1103	**Fear of falling** (Falls Efficacy Scale – modified so low score corresponds with low confidence or greater fear) Fallers Mean, 79.8 (SD 23.4) Non-fallers Mean, 88.1 (SD 17.9) p < .0001 **Activity restriction because of fear of falling** Fallers = 24% Non-fallers =15% chi-square= 13.1; p < 0.001	In order to examine the impact of recent falls, we also determined the proportion of subjects reporting fear and the mean fall-related efficacy scores separately for subjects who did and did not experience a fall in the year prior to the interview. The proportion of subjects reporting a decrease in activity because of fear of falling was 24% among fallers vs 15% among non-fallers (chi-square= 13.1; p < .001). The mean fall-related efficacy scores were 79.8 (SD 23.4) and 88.1 (SD 17.9) among fallers and non-fallers, respectively (p < .0001).
Howland, 1998[25]	n=266	**Relationship between falls and fear of falling** OR: 2.498 (95% CI: 1.013-6.159); p=0.05 **Relationship between falls and activity curtailment among those afraid of falling** OR: 1.094 (95% CI: 0.376-3.177); p=0.869 **Relationship between social support and activity curtailment among those afraid of falling** (Social Support Scale) OR: 1.574 (95% CI: 1.082-2.290); p=0.018 *Note: Here a higher social support score indicates lower levels of social support*	"The contribution of personal falls experience to fear of falling was apparent. Those who suffered a previous fall were more likely to have a fear of falling." "Surprisingly, neither the degree of fear of falling nor the experience of falls was associated with activity restriction. This finding suggests that activity curtailment is not just associated with extreme levels of fear. The presence of social support was, however, important. Those who could rely on others or talk with friends about falling were least likely to report activity curtailment. Thus, support of family and friends may be an important prerequisite for continuing to remain active even in the face of fear of falling. This support may serve as a buffer to the potentially debilitating consequences of fear of falling. It is possible this support is manifested as encouragement for remaining active." "Those who curtailed activities […] did not differ with respect to social integration but were significantly (p = .024) less likely to be able to rely on friends or relatives in times of crisis (social support)"
Murphy, 2002[1]	n=1064	**Variables independently associated with activity restriction in participants with fear of falling**	"We found that a history of an injurious fall within the past year, slow timed physical performance, two or more chronic conditions, and

		Injurious fall Adjusted relative risk (ARR): 1.36 (95% CI, 1.11-1.66); p=0.003 *Two or more chronic conditions* ARR: 1.34 (95% CI, 1.08-1.65); p=0.007 *Slow-timed physical performance* ARR: 1.44 (95% CI, 1.18-1.75); p=0.0004	depressive symptoms were all independently associated with activity restriction."
Apikomonkon, 2003[26]	n=546	**Relationship between falls and activity restriction** Chi-square=5.49, p<0.05 **Relationship between fear of falling and activity restriction** Chi-square=23.27, p<0.001	"Compared with non-fallers, the older persons with falls experiences were more likely to have activity restriction (28% vs 16%). The Chi-square test indicated that fall history was associated with activity restriction measured by dichotomous question. "Older people with FOF were more likely to have activity restriction (26% vs 10%). The FOF using the SAFE final version was significantly associated with activity restriction as measured by dichotomous question."
Gagnon, 2005[3]	n=105	**Variables associated with fear of falling** (Comparing subjects with no/slight fear and subjects with moderate/severe fear) **Social support** (confiding-relationships component of the Bedford Life Events and Difficulties Schedule modified for elderly subjects) Wald chi-square= 3.77; p=0.05	"The following secondary independent variables were significantly associated with categorical fear of falling: dizziness (Wald chi-square 6.58; p 0.01), total number of medications (Wald chi-square 5.40; p 0.02), and social support (Wald chi-square 3.77; p 0.05). (Note: Higher scores mean less support.)"
Zijlstra, 2007[27]	n=4376	**Variables significantly associated with avoidance of activity due to fear of falling** **Multiple falls in past 6 months** OR: 1.97 (95% CI, 1.52-2.54)	"When fear of falling was added as an additional variable (model 3; Table 3), odds ratios of all variables that showed significance in model 2 decreased. Nevertheless, the association for the highest age group (≥80 years), fair and poor perceived general health and multiple falls with avoidance of activities remained statistically significant. Our findings regarding avoidance of activity remained fairly similar when fear of falling was entered into the logistic model. Although sometimes, often and very often experiencing fear of falling were

		Aged 80 years or older OR: 1.56 (95% CI, 1.24-1.95) **Fair perceived general health** OR: 2.92 (95% CI, 2.43-3.52) **Poor perceived general health** OR: 5.7 (95% CI, 3.57-9.12)	strongly associated with avoidance of activity. Higher age (≥80 years), fair and poor perceived health and multiple falls remained independently associated with avoidance of activity in community-living older people. This implies that interventions aimed at reducing avoidance of activity should not focus on fear of falling alone, but on other modifiable factors, like falls, as well"
Iliffe, 2007[16]	n=3139	**Relationship between fear of falling and social isolation** (Lubben Social Network Scale) OR: 1.21 (95%CI, 0.88-1.65)	Multivariate analysis taking into account all statistically significant associations shows a different pattern. The risk of social isolation appears to be associated with depressed mood and living alone, while male sex, memory impairment and perceived poor health may be weakly associated. For the other factors [(fear of falling)] listed in the second hypothesis, no significant associations in bivariate or multivariate analyses were found.
Curcio, 2009[4]	n=1668	**Variables associated with activity restriction related to fear of falling** **At least 1 fall in past year** OR: 1.48 (95%CI, 1.18-1.86); p=0.001 **Low social participation** OR: 1.52 (95%CI, 1.20-1.92); p<0.01 **Poor perceived health** OR: 1.38 (95%CI, 1.06-1.79) **Difficulties in activities of daily living** OR: 1.65 (95%CI, 1.16-2.32) **Decreased physical activity** OR: 1.35 (95%CI, 1.06-1.70)	"Those who had activity restriction related to fear of falling were significantly more likely to have had a fall within the past year, with a trend to suffer recurrent falls and injurious falls." "Table 3 shows the bivariate relationships between activity restriction related to fear of falling and psychosocial factors. Activity restriction related to fear of falling had a strong bivariate association with poor perceived health, depression, low social participation, and poor life satisfaction." "A second model was then constructed with the psychosocial associated factors and other clinical and functional covariates (see Table 4). After adjustment, functional and clinical factors remained independently associated with activity restriction related to fear of falling. Only depression and poor perceived health variables emerged as independent factors." "logistic regression analyses for activity restriction related to fear of falling. In the first model, 19 demographic, functional, and health-related variables with p values less than .05 derived from the bivariate analysis were entered into the logistic regression as independent variables. Difficulties in ADL, decreased physical activity, polypharmacy, and

		Polypharmacy OR: 1.56 (95%CI, 1.14-2.14) **Below poverty level** OR: 1.32 (95%CI, 1.05-1.65)	extreme poverty were independently associated with activity restriction related to fear of falling. A second model was then constructed with the psychosocial associated factors and other clinical and functional covariates (see Table 4). After adjustment functional and clinical factors remained independently associated with activity restriction related to fear of falling."
Kara, 2009[28]	n=47	**Relationship between fear of falling and loneliness** (Philadelphia Geriatric Center Morale Scale) ρ= 0.258; p=Not significant	When the correlation between the fear of falling and the subscales of the Philadelphia Geriatric Center Morale Scale was examined, no correlations were found (Table 5).
Dias, 2011[5]	n=113	**Variables associated with activity restriction due to fear of falling** (compared to no FOF or FOF alone) **Fear of falling intensity** Mean 3.4 (SD, 0.9); p<0.0 **Depression** Chi-square=15.2, p=0.004 **Exhaustion** Chi-square=9.2, p=0.01 **Participation in social activities** Chi-square=10.4, p=0.016	"The three groups were statistically different in relation to FOF evaluated using the question about fear intensity. The group that reported FOF and activity restriction demonstrated higher levels of fear when compared with the other groups" "The variables that best discriminated the groups were depression, exhaustion and participation in social activities, demonstrated in the diagram (Figure 1). For the grouping obtained through the Chi-square Automatic Interaction Detection (CHAID) method, it may be observed that the first distinctive characteristic was depression, evaluated using GDS. Those with positive symptoms for depression showed 90% chance of restricting activities due to fear of falling. Additionally, the presence of depressive symptoms seems to modulate the factors that are associated with activity restriction due to fear of falling. A greater risk for depression has been associated with inadequate evaluation of coping self-efficacy in stressful events of life. It is worth noting that the participants of the present study who restricted activities by FOF showed lower self-efficacy in relation to the other participants. Thus, it is possible that elders with depressive symptoms perceive themselves less capable of performing certain tasks and, because of that, restrict their activities. Out of the elders that did not have depressive symptoms, those who had positive result for exhaustion of the frailty phenotype had 78% chance of restricting activities due to fear of falling." "Out of the ones who did not show positive result for exhaustion, the other distinctive characteristic was participation in social activities. Those who stopped performing activities had 83% chance of restricting activities due to fear of falling.

			Participation in social activities was the last discriminatory factor for the studied sample; however this variable did not show association with activity restriction in the bivariate analysis. It is possible that this difference in relation to the participation in social activities only occurs for a subgroup and not for the whole sample"
Mendes da Costa, 2012[29]	n=501	**Relationship between activity restriction due to fear of falling and number of falls in past 12 months** 2 or more falls OR, 3.04 (95% CI, 1.70-5.42) 1 fall OR, 1.33 (95% CI, 0.66-2.68)	"activity restriction was increased significantly with age and with the number of falls within the past 12 months, accounting however one quarter of the subjects who did not fall. In the logistic regression model, these associations remained significant"
Choi, 2015[30]	n=4247	**Relationship between falls and fear-induced activity restriction** <u>Previous fall experiences</u> OR, 2.12 [95% CI, 0.96-4.67] p=0.062 <u>Injurious falls</u> OR, 3.03 [95% CI, 1.21-7.54] p=0.008	Characteristics independently associated with fear-induced activity restriction were low socioeconomic status, cognitive impairment, difficulty with activities of daily living, and a history of injurious falls.
Ferreira, 2018[31]	n=7935	**Relationship between fear of falling because of sidewalk defects and social participation** OR 1.01 (95% CI: 0.99-1.04)	"As in the univariate analysis, the fear of falling because of defects in sidewalks and the perception of violence in the neighborhood were not associated with social participation."
Petrinec, 2020[32]	n=108	**Relationship between fear of falling and social functioning** (Medical Outcomes Study 36-item Short-Form General Health Survey) β= -0.29	"Fear of falls was an independent predictor for role physical, physical functioning, and social functioning."
Merchant, 2020[7]	n=493	**Variables associated with fear of falling alone** **Number of falls**	"The multivariate logistics regression in Table 2 shows that female sex (OR = 3.54; 95% CI = 1.82–6.90), number of medications (OR = 1.28; 95% CI = 1.03–13.60), prefrail or frail (OR = 2.17; 95% CI = 1.26–3.73), depression (OR = 4.90; 95% CI = 1.06–22.67) and number of falls in the

		OR, 2.13 (95% CI, 1.20–3.78) p<0.05 **Social isolation** OR, 0.99 (95% CI, 0.51–1.89) p=not significant **Variables associated with fear of falling + fear-based activity restriction** **Number of falls** OR, 1.4 (95% CI, 0.94–2.20) p=not significant **Social isolation** OR, 1.7 (95% CI, 0.82–3.55) p=not significant **Sarcopenia** OR, 8.13 (95% CI, 1.52–43.41)	past 12 months (OR = 2.13; 95% CI = 1.20–3.78) were significantly associated with FOF. Only sarcopenia (OR = 8.13; 95% CI = 1.52–43.41) and depression (OR = 5.17; 95% CI = 1.84–14.54) were significantly associated with FOF + FAR. "**History of falling** is a well-known risk factor for FOF and/or FAR as persons who have experienced falls are more likely to develop fear. However, three-quarters of those with FOF + FAR and two-thirds of those with FOF + FAR had never experienced a fall during the study" "**Social isolation** is another factor that is rarely studied. In our study, one in three older adults with FOF + FAR was at risk of social isolation compared with one in five with no FOF" "Prefrailty, frailty, and **sarcopenia** have significant association with FOF and/or FAR in both univariate and multivariate analysis."

Appendix 8: Relevant findings from qualitative studies (n=7)

Author, Year	Qualitative analysis approach, and sample size	Results
Ward-Griffin, 2004[33]	Phenomenological approach n=9	"***Restricting activities was a second strategy identified by the participants, which involved avoiding certain social activities or/and physical environments. Participants used this strategy when they wanted to "play it safe" in times of inclement weather or in situations where ambulation might be difficult***. Precarious weather conditions seemed to heighten their awareness and fear of falling. As Sarah explained, "I do not fear falling, except around steps. They terrify me to death [along with] scaffolding around the town—that bothers me. Little kids on bicycles on the sidewalk— that bothers me. And I am restricted to the house when there's fresh snow on the ground." Similarly Wilfred stated, "When it's really, really icy, and I don't have to go out, I don't drive the car. I don't go out either." "
Meric, 2007[34]	Analysis approach not reported n=22	"***After having a falling experience, elderly individuals had behavioral changes, which decreased the competency of achieving daily life activities, such as staying away from the crowded environment, not going outside alone, acting very slowly, not able to do daily activities alone***: "... I can't go out anymore. I haven't been out alone for 2 years, there are always people next to me." (75; woman). "… I take my man's arm on the street, I can't get out much in case I fall into the street." (71; woman)." "
Schmid, 2009[35]	Latent content analysis n=42	"***Quotes regarding the subsequent consequences of poststroke falls categorized into the following three themes: (1) limiting activity and participation, (2) increasing dependence, and (3) developing a fear of falling***" "*Limiting activity: Because falling became common for some participants, talk about strategies for the prevention of future falls was common and emerged naturally during interviews.* ***A significant consequence was the choice to limit everyday life activities at home and in the community to help manage and prevent falls***" "Increasing dependence: Participants discussed their dependence on assistive devices such as walkers, canes, and wheelchairs to reduce falls and feel secure in their environment. Some participants indicated use of the furniture, walls, or people as alternative assistive devices. Many discussed dependence on caregivers for maintaining balance and preventing falls. ***Participants easily became isolated because they were fearful to leave their home, and some were even fearful to move about their own home, becoming increasingly dependent***." "Developing fear of falling: This initial experience of falling with stroke onset was a traumatic event that consequently resulted in participants expressing fear that future falls would mean having another stroke. They also discussed the ***subsequent development of fear of falling and the fear of being left on the floor for hours at a time***. ***Participants described genuine fear of falling and fear about being hurt as well as the subsequent impact on function and independence. Some participants discussed falls becoming a frequent event and a common and pervasive concern; fear, worry, and concern became a daily consequence of poststroke falls. Some participants were fearful that they would fall while out in the community and addressed the embarrassment of a public fall. They were concerned about how they looked while walking around and seemed to be worried about the stigma related to falls and decreased mobility.*** Managing falls and fear of falling in everyday life became an important aspect of poststroke adjustment."

Faes, 2010[36]	Grounded theory approach n=10	"***Patients described social withdrawal and attributed this to their fear of falling and the loss of physical capabilities after falling. Patients recognised that they became (more) dependent on their caregiver after falling. One patient experienced social benefits from her fall, since she now receives more attention from her children***" "P#1 I can't travel anymore because of my limited mobility. I injured my leg in a fall. P#4 I stay at home more often and don't visit my friends anymore. I am afraid to fall when I go out. P#5 My grandson is almost one year old. I still haven't seen his room. His room is upstairs; I am too anxious to fall when climbing the stairs." "Furthermore, ***our findings confirmed the consequences of falls in cognitively unimpaired older persons that are mentioned in the literature; these include a fear of falling and social withdrawal due to the fear of falling and physical limitations***"
Chiu, 2011[37]	Focussed ethnographic approach n=18	"Following their initial fall, it appeared that changes occurred in individuals' independent living and use of informal support networks. While activities of daily living are continued either independently, with help from —hourly maids during the rehabilitation period or for longer, ***recreational activities usually were second priority and were soon discontinued***. Mah-Jong, one of the most popular tile games among Chinese was mentioned by 12 respondents as a favourite pass time. Other social activities mentioned included Cantonese opera, volunteering within their communities, and dim sum with friends. ***After a fall, these activities were interrupted for two main reasons: 1) lack of transportation means and 2) lower mobility capabilities. Feelings of loneliness arose as the respondents felt that they were cut off from their friends***." "Intuitive changes included modifications made to personal behaviours. ***Avoidance behaviour was reported as an intuitive change. Specifically, fallers would avoid outdoor activities***. Other intuitive changes include being more careful ("taking care") when walking and slowing down."
Host, 2011[38]	Phenomenographic approach n=14	"Others ***stopped doing certain activities to avoid falling and they did not choose activities that made them scared and nervous and caused bodily pain. They thus perceived that physical activity was not good and therefore stopped the activity***. The families and the general practitioner (GP) supported their choices. Conversely, some felt that it was a loss if they had to stop activities they had enjoyed because it increased their risk of falling." "***Fall accidents had implications for older people's identity and autonomy, and they could lead to social isolation.***" "Conversely, social interaction in the context of participation in fall-prevention activities was not always welcomed because it placed the respondents in a context in which they did not like to see themselves." "For others, ***support from professionals was important in how they coped with falls*** and their prevention. The GP was a good support when they needed knowledge about appropriate and applicable preventive activities."
Xu, 2019[39]	Thematic analysis n=17	Identified theme of restricted mobility and social participation.

		"***Stroke participants felt that they were restricted after the fall, particularly around having reduced balance, and this affected their mobility functions and degree of social participation***: I am getting worse, especially my balance. I used to walk for a short distance outside but now I can't. (S7) There was a big difference … I used to walk with walking stick. But I have not been able to walk since that fall. (S8) Last time I could take public transport, go to [central area] and take a walk, now it's too difficult for me. (S1)"

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Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	5
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	5
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	5-6
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	6-7
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	6
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Appendix 1
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	6
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	8
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	7-8
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	N/A
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	Appendix 4-6

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	8; Figure 1
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	8-11; Table 1; Appendix 7
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	11-15
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	Table 2
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	15-16
Limitations	20	Discuss the limitations of the scoping review process.	17
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	17
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	18

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

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