Fall-related risk factors among older men: A scoping review

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Abstract

Unintentional falls cause significant morbidity and are major contributors to mortality among older adults, but less is known about fall-related risk for older men. This study identified modifiable and nonmodifiable risk factors for incident and recurrent falls among older males ages ≥60 years. We searched Medline (OVID), CINAHL Ultimate, Cochrane, and Embase for observational studies showing risk factor association with falls among community-based older adult populations. Two hundred studies were identified and 38 met the inclusion criteria. Sixty risk factors, ranging from behavior to environmental, were reviewed. The main risk factors associated with incident and recurrent falls include pain, age, depression, fear of falling, activity/mobility limitations, sleep disorder/chronic hypoxemia, and multimorbidity. Some risk factors, such as pain and multimorbidity, demonstrated dose-response relationships with recurrent falls. Primary studies are needed to investigate the effects of these risk factors on falling among older adult males, with considerations for racial/ethnicity differences.

Keywords: falls; men; risk factors

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Background

Falls are a major mechanism/cause of unintentional injury among older adults globally (World Health Organization [WHO], 2022). The burden of injury from falls is extensive and imposes a significant strain on healthcare, the economy, and society (James et al., 2020). A study conducted on the global burden of falls showed a minimal 27-year decline in incidence and prevalence between 1990 and 2017, but it also showed a substantial burden with increasing age (James et al., 2020). Further, a recent meta-analysis showed that the prevalence of falls among older adults globally was 26.5% and that the American continent had the second-highest fall prevalence for older adults (27.9%) (Salari et al., 2022). As a health outcome closely associated with aging (Zhang et al., 2020), falls are particularly problematic in developed countries such as the United States, which are already experiencing accelerated population aging (Moreland et al., 2020; Vincent & Velkoff, 2010; WHO, 2022). Current projections show that aging populations in developing countries are also increasing (WHO, 2022), which is likely to exacerbate the global burden of falls.

In the United States, estimates from 2014 showed that about 29% of older adults reported at least one episode of a fall (Bergen et al., 2016). However, a similar but slightly lower rate was observed in 2018 (Moreland et al., 2020), suggesting that the prevalence of falls has been mostly steady in previous years. More recently, increases in annual incidence have been reported nationwide (Hoffman et al., 2022). As the leading cause of injury-related morbidity and mortality (Moreland & Lee, 2021), there was a 30% increase in the death rate from 2007 to 2016 (Centers for Disease Control and Prevention [CDC], 2021). Between 2000 and 2013, the age-adjusted death rate from falls among older adults increased almost twofold (Kramarow et al., 2015). By 2014, fatalities from falls were approximately 27,000 older adults (Bergen et al., 2016), and in 2019, 34,000 deaths in this population occurred due to falls (CDC, 2021), a 26% increase in preventable mortality over five years. Overall, the burden of falls is expected to increase because of increasing incidence (Hoffman et al., 2022) and the rising proportion of the older adult population in the United States (Moreland et al., 2020), and indeed, many countries around the globe (WHO, 2022).

In many studies, a single episode of a fall is termed an incident fall, and recurrent falls are defined as the occurrence at least twice within a specified period, usually months (Nicklett & Taylor, 2014). The distinction between an incident fall and a recurrent fall needs to be established because individuals who experience recurrent falls tend to have associated risk factors that pose a unique set of clinical and public health challenges (Sun et al., 2016). Further, there is almost a threefold increase in the risk of recurrent falls within one year of an incident fall (Ganz et al., 2007).

Age is consistently the predominant intrinsic risk factor for falls (Gale et al., 2018). In 2018, visits to the emergency room (ER) due to fall-related injuries were 2,678 per 100,000 persons among adults aged 65 to 74 years. This rate almost quadrupled among adults aged 85 years and older (Moreland & Lee, 2021). Aging physiology and frailty increase the risk of falls and recurrent falls (Jehu et al., 2021) because it can cause impairments in cognitive, musculoskeletal, proprioceptive, visual, and neurological functions among older adults (Ambrose et al., 2013). The largest increases in mortality from falls tend to occur quite commonly after age 85 (Moreland et al., 2020) and before age 95 (Hartholt et al., 2019). Thus, biologically and statistically, age can be regarded as the major risk factor for falls and fall-related morbidity and mortality (Kramarow et al., 2015).

While many studies have found the risk of falls to be substantially higher among women (Chang & Do, 2015; Moreland et al., 2021; Nicklett & Taylor, 2014), after accounting for the effects of age, a review of the literature found that fall-related mortality is higher among men than women (Ambrose et al., 2013). Some individual studies have also shown higher fall rates (Zhao et al., 2019) and associated mortality among men (Burns & Kakara, 2018; Lohman et al., 2019; Orces, 2008). This disparate impact of falls on survivability among older men informs the need to understand the current literature about the factors contributing to the gender disparities in fall risk.

Previous reviews have mainly focused on investigating risk among older adults in general (Jehu et al., 2021; Ambrose et al., 2013), and most of their included studies have significantly larger proportions of women in their samples. However, many studies have shown that the impacts of risk factors, except for age in most cases (Gale et al., 2018), are not universal or consistent between men and women (Chang & Do, 2015; Ek et al., 2019; El Fakiri, 2015; Yi et al., 2021). Therefore, the purpose of this scoping review is to summarize the published evidence regarding falls and fall-related risk factors among community-dwelling older adult males, with particular attention to the risk for incident and recurrent falls.

Methods

Search Strategy

Searches were performed using the following databases: Medline (OVID), CINAHL

Ultimate, Cochrane, and Embase. Additional sources were also searched, including the reference lists of selected articles and previous review articles. Publication dates ranged between 2012 and 2022. All articles that satisfied the search criteria were included until December 2022. The Cochrane methodology consisting of Population, Intervention, Comparison, and Outcome (PICO) was used to guide the relevant keywords to be used in the search. The articles generated were subsequently imported onto the Covidence software. This software was selected because of its excellent usability ratings compared to other software packages commonly used for systematic reviews, as well as its wide acceptance (Cleo et al., 2019; Harrison et al., 2020). All duplicates were automatically excluded by the software.

Selection Criteria

The early stages of the review involved title and abstract screening and the assessment of studies for eligibility through full-text review. All stages of the review were completed by at least two reviewers. Conflicts were resolved through discussions and further review of other literature to reach a consensus. In other cases, the consensus was reached by involving a third (sometimes fourth) reviewer. The following criteria were used to determine which study was included in the final review:

Inclusion and Exclusion Criteria

All studies included in the review were primary studies addressing at least one risk factor for incident falls or recurrent falls among community-dwelling adult men ages 60 years and older. All included studies must have contained detailed, separate data about older adult males. Studies with a small sample size less than 400 participants (Ha et al., 2021) and participants younger than 60 years were excluded. Systematic reviews, studies with female participants only, and studies with hospitalized or institutionalized participants at the time of data collection were excluded.

Additionally, studies that did not provide clear, separate reporting of male-specific data, such as adjusted odds ratios and other measures of association indicating the statistical associations between independent variables and falls in men, were excluded. Further, studies with dependent variables other than falls and recurrent falls (screening tests, scales, or physical tests) were excluded.

Data Extraction/Risk of Bias Assessment

Utilizing the Covidence software, full texts were further reviewed for adjusted odds ratios and other measures of association depending on the study design. Relevant data, such as study demographics and characteristics, incidence and/or prevalence of falls, type of fall, and main study findings were extracted from each article and recorded on the modified extraction template on

Covidence. This was followed by a risk of bias assessment. The risk of bias assessment template was modified based on the Johanna Briggs' Institute (JBI) Critical

Appraisal Tools, each designed for specific study designs (Munn et al., 2014; Porritt et al., 2014). The qualitative appraisal for each article was completed based on eight items/response categories on the JBI critical appraisal tool. Assessment of each article's quality was based on response categories, such as "yes," "no," "maybe," or "not applicable." Based on the JBI critical appraisal tool, the final appraisal for each included study was determined by each reviewer as either "include," "exclude," or "seek further information." In the absence of a scoring system on the JBI critical appraisal tool, the appraisal of each study was performed by two reviewers, and conflicts were resolved by a third, and occasionally a fourth, reviewer to ensure a more objective reporting of bias risk.

Results

Search Results

Figure 1 summarizes the selection procedure for the included studies. The initial search of the five databases yielded 620 articles, and a review of references from selected studies yielded an additional 28 articles. Following the removal of duplicates, 456 articles were selected.

Subsequent screening of the titles and abstracts yielded 238 articles that were examined in detail and assessed for eligibility based on the study's inclusion criteria.

A total of 38 (30 from database search and eight from references) fulfilled the study's inclusion criteria and were included in this review for qualitative synthesis. Other articles were excluded for the following reasons: 53 studies did not provide detailed, extractable data on the relevant population (51 lacked detailed data on males and two lacked data on older adults); 20 studies were older than ten years prior; 30 studies could not be accessed, largely due to being only available as abstracts and/or not fully published; 39 studies had significantly lower sample sizes than predetermined for this project (Ha et al., 2021); 13 studies had other outcome variables, such as fear of falling or fractures; 13 studies were conducted in nursing homes, hospital inpatient, or settings excluding community-dwelling ambulatory older adults; 15 studies focused only on women or individuals younger than 60 years; four studies were systematic reviews, including one survey; and one study was not in English. Of the 38 studies that fulfilled the inclusion criteria, five focused on US older adult male subpopulations. From the risk of bias assessment, all 38 studies were unanimously judged as "include" by the reviewers.

Study Populations and Study Designs

The study designs and population characteristics of included studies are highlighted in Table 1. Apart from the five studies that were conducted in the US, studies were conducted in eleven other countries: Sweden (n=8), Australia (n=5), Japan (n=4), the United Kingdom (n=4), Canada (n=3), France (n=2), Taiwan (n=1), the Netherlands (n=1), Austria (n=1), Germany (n=1), and Korea (n=1). There were two multi-country studies, which covered Sweden, the United States, and Hong Kong (Karlsson et al., 2012; Karlsson et al., 2014).

Figure 1

PRISMA flow diagram of the article selection procedure

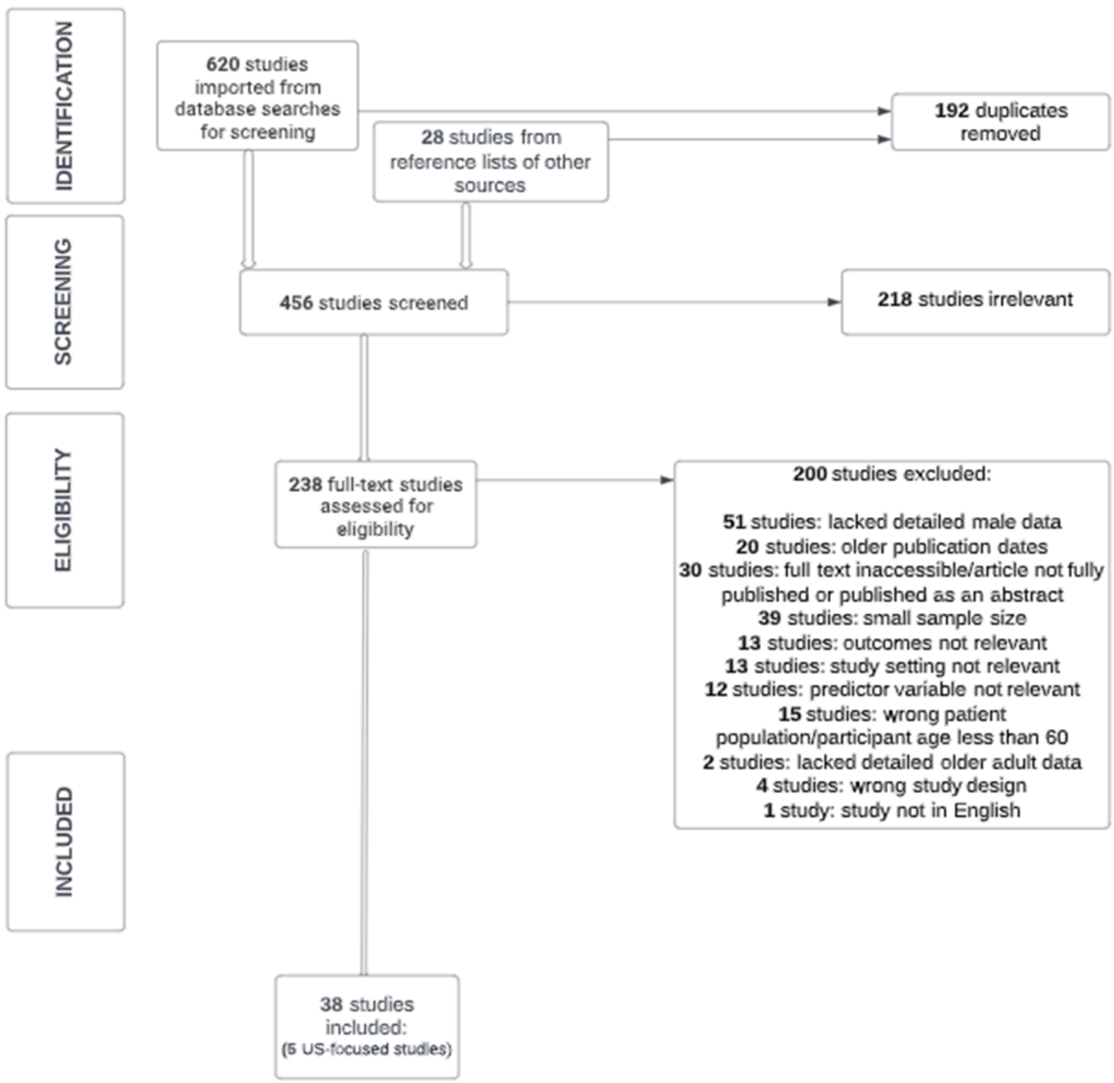

Table 1
Study characteristics and incidence of falls among older adult males

Author(s)	Country	Study design/Methods	Incidence/Prevalence	Age/Population description	Sample size
Blain et al 2021	France	Cross-sectional study	N/S	Mean age 72.7year-old men visiting a health resort	485
Cauley et al 2014	United States	Prospective cohort study at six clinical centers. Objective, comprehensive sleep assessment. Falls assessed in the year following every four months	N/S	Men ages 67+ years	2,911
Chang & Do 2015	Canada	Cross-sectional study. Utilized a multistage stratified sampling	17.3% prevalence. Prevalence increased to 23.2% in men 85+ years	Participant age: 65+ years	1,969,493 (weighted sample size)
Dallmeier et al 2016	Germany	Cohort study. Stratified random sample. Utilized a falls calendar which was reviewed every 3 months	42.6 per 100 person-years	Mean age 75.4 years	759
Ek et al 2019	Sweden	Longitudinal cohort. Random sampling method. Data collected from participants and with the help of a proxy	6.2% after <4 years of follow-up; 13% in 4-10 years	71.5±9.9-year-old community dwelling men	1,131

Fonad et al 2015	Sweden	Cross-sectional study. Participants responded to a questionnaire. The questionnaire was initially pilot tested to test its functionality.	34% any fall	75+-year-old male participants	455
Gale et al 2016	UK	Cross-sectional study	23.5%	60+ year-old men who had participated in a survey	1,994
Gale et al 2018	UK	Cohort study	21.1% fall in the previous 12 months; 41.8% incident fall over 4 years of follow-up	60+-year-old men	1,515
Hammarlund et al 2016	Sweden	Cross-sectional study. Fall risk was assessed by the Downton Fall Risk Index. Data were collected from participants by registered nurses during home visits.	39.4% prevalence. Prevalence increased among men 80+ years	70+ participants of a preventive home visits program. Participants in this study lived at home without receiving help from municipal services	634
Handrigan et al 2017	Canada	Cross-sectional study	N/S	65+ years	6,399
Hedman et al 2013	Sweden	Community-based case-control study	N/S	75-year-old men living at home	471
Henstra et al 2019	The Netherlands	A longitudinal study of participants with available Geriatric Depression Scale (GDS) data	N/S	65+-year-old men with elevated homocysteine blood levels at baseline	1,445

Holloway et al 2016	Australia	Cross-sectional study. Random sampling	21.6%	Mean age 73.4 years	487
Hung et al 2017	Taiwan	Cross-sectional study	25.5% any fall; 11% recurrent falls	85.5±5.2 years. Older male veterans living in the Veteran Retirement Communities	871
Jefferis et al 2014	UK	Cross-sectional study. An objective measure of mobility utilized in the study	9% had one fall; 12% had recurrent falls	Men ages 71-92 who participated in an ongoing population cohort	1,680
Jefferis et al 2015	UK	Prospective cohort study. Mobility limitations objectively measured. Falls and recurrent falls were ascertained in the subsequent one year	9% one fall; 10% recurrent falls	71-93 years	700
Karlsson et al 2012	Multicenter	A cross-sectional study of community dwelling older adult males across three countries; stratified sampling was done for Hong Kong participants.	11% one fall and 7.7% recurrent falls	65+-year-old community-dwelling older men recruited across three countries (MrOs International study)	10,977

Karlsson et al 2014	Multicenter	Cross-sectional study	65-69 (16.5% any fall; 6.3% recurrent falls); 80-84 (24.8% any fall; 10.1% recurrent falls); 90+ (43.2% any fall; 18.2% recurrent falls)	65+-year-old community-dwelling older men recruited across three countries (MrOs International study)	10,998
Khalatbari-Soltani et al 2021	Australia	Cohort study	47% any falls; 27% recurrent falls after a mean follow-up of 42.6 months	77.3 ±5.4 years	1,624
Kim et al 2017	Korea	Cross-sectional study	N/S	61+ years	92,660
Klein et al 2013	Austria	Cross-sectional study. Participants had undergone health examination and filled out a questionnaire	N/S	60+ years	1,574
Kojima et al 2016	Japan	Prospective cohort study	7.8%	Men who participated in health checkups at 64 and follow-up at 70 years	986
Kubo et al 2021	Japan	Retrospective longitudinal study	N/S	70.4 ±3.4 mean age	2,091
Lee 2021	United States	Cross-sectional study in an ongoing longitudinal study	26.6%	65+ years from the National Health and Aging Trends Study	2,845

Marshall et al 2017	United States	Prospective cohort study Participants completed baseline questionnaire and visit at one of the six clinical sites. collected data on self-reported falls every four months during 1 year of follow-up	25% any fall; 11.8% recurrent falls	65+ YEARS	5,568
Mesinovic et al 2021	Australia	Cohort study	N/S	70+ years	1,705
Mochida et al 2018	Japan	Longitudinal Study. Utilized two surveys (baseline and follow-up). Participants were asked "how many times have you fallen within the past year?" "one" and "none" were combined, and "multiple times" was used as the outcome variable. Authors considered incident fallers to be more similar in risk to non-fallers than recurrent fallers.	2.4%	65+ years	19,995

Munch et al 2015	United States	Multicenter prospective cohort study at six clinical sites. Pain was assessed subjectively by self-administered questionnaires	25.3% reported any falls; 11.8% reported recurrent falls	65+ years	5,993
Ohlsson et al 2018	Sweden	Cohort study. Falls were ascertained triennially. Mean follow-up 2.7 years	16.3% prevalence; 38.5% incidence of any fall	69 to 81 years	2,516
Robinson et al 2015	Sweden	Cohort study	N/S	mean age 72 years	267,154
Sandmark et al 2012	Sweden	Cross-sectional study design	13% prevalence	75+ year-old community-dwelling older adult males	471
Scott et al 2019	Australia	Longitudinal study. Participants were contacted every two years to ascertain incident falls.	N/S	70+ year old participants of the Concord Health and Ageing in Men Project. Participants were predominantly urban dwellers	1,575
Scott et al 2020	Australia	Cohort study	N/S	70+ years	1,326

Stone et al 2014	United States	Prospective observational of community dwelling men at six academic clinical centers. Objective sleep assessments were conducted, and falls/recurrent falls were ascertained in the subsequent year	14.2% had recurrent falls in one year	67+ years, mean 76 years	3,101
Tominaga et al 2016	Japan	Cohort study	17.7%	68.1 ±7.7 years	593
Torres et al 2015	France	Cohort study: participants in the falls subsample had been randomly recruited from electoral roles of three cities in France. Five follow-up examinations conducted 12 years following inclusion in study.	55.8% reported any fall after 12 years of follow-up	65+	2,528
Welk et al 2015	Canada	Retrospective cohort study.	N/S	66+ year-old men who had either been prescribed α antagonists or not	147,084

Welmer et al 2016	Sweden	Population-based longitudinal study. Participants were followed for three and ten years to assess falls and fall outcomes. Stratified by age, then participants were selected randomly from each resulting age cohort	25.8 per 1000 person-years after 3 years of follow-up	60+	1,096

N/S: not stated

The age of the study population was strictly 60 years and older, and some participants were as old as 106 years (Fonad et al., 2015). There were 16 cohort studies (Cauley et al., 2014; Dallmeier et al., 2016; Gale et al., 2018; Jefferis et al., 2015; Khalatbari-Soltani, et al., 2021; Kojima et al., 2016; Marshall et al., 2017; Mesinovic et al., 2021; Munch et al., 2015; Ohlsson et al., 2018; Robinson et al., 2015; Scott et al., 2020; Stone et al., 2014; Tominaga et al., 2016; Torres et al., 2015; Welk et al., 2015); 15 cross-sectional studies (Blain et al., 2021; Chang & Do, 2015; Fonad et al., 2015; Gale et al., 2016; Hammarlund et al., 2016; Handrigan et al., 2017; Holloway et al., 2016; Hung et al., 2017; Jefferis et al., 2014; Karlsson et al., 2014; Karlsson et al., 2012; Kim et al., 2017; Klein et al., 2013; Lee, 2021; Sandmark et al., 2012); six longitudinal studies (Ek et al., 2019; Henstra et al., 2019; Kubo et al., 2021; Mochida et al., 2018; Scott et al., 2019; Welmer et al., 2017); and one case-control study (Hedman et al., 2013).

Apart from Chang & Do (2015), where a weighted sample size of 1,969,493 was used, this review assessed a total sample of 606,397 ≥60-year-old community-dwelling males. Seven studies reported the use of different types of random sampling approaches (Chang & Do, 2015; Dallmeier et al., 2016; Ek et al., 2019; Holloway et al., 2016; Karlsson et al., 2012; Torres et al., 2015; Welmer et al., 2017). Four studies were conducted at multicenter sites or utilized data was collected at those sites (Cauley et al., 2014; Marshall et al., 2017; Munch et al., 2015; Stone et al., 2014; Torres et al., 2015; Karlsson et al., 2012).

Follow-up time varied across the cohort and longitudinal studies; some studies prospectively collected incident fall data within a follow-up of one year (Cauley et al., 2014; Dallmeier et al., 2016; Jefferis et al., 2015; Marshall et al., 2017; Stone et al., 2014). Ek et al. (2019) utilized short (<4 years) and long (4-10 years) follow-up periods. Three studies collected fall information every four months (Scott et al., 2019; Scott et al., 2020; Stone et al., 2014). Scott et al. (2019) had two years of follow-up, while Scott et al. (2020) had a follow-up period of 6.8 years. Two studies utilized a four-year follow-up period (Gale et al., 2018; Khalatbari-Soltani et al., 2021), and two other studies had an average follow-up period of 6.0±2.2 years (Mesinovic et al., 2021; Scott et al., 2019). Although a cohort study, Kojima et al. (2016) retrospectively assessed falls among men aged 70. Henstra et al. (2019) utilized a follow-up time of two years.

Retrospective studies used a 3-month (Klein et al., 2013), 12-month (Blain et al., 2021; Chang & Do, 2015; Fonad et al., 2015; Hammarlund et al., 2016; Handrigan et al., 2017; Holloway et al., 2016; Hung et al., 2017; Jefferis et al., 2014; Karlsson et al., 2014; Karlsson et al., 2012; Kim et al., 2017; Kubo et al., 2021; Lee, 2021; Mochida et al., 2018), and a two-year (Gale et al., 2016) fall recall period.

Fall Definitions and Measurements

During follow-up, studies ascertained falls through different mechanisms. While most studies provided the definitions of falls based on earlier studies, a few studies included the definition of recurrent falls in their data collection and analysis. Stone et al. (2014) defined recurrent falls as “having 2 or more falls in the subsequent year.” Jefferis et al. (2015) defined falls and recurrent falls in their study by asking a two-component question based on the high specificity of that format for quantifying the occurrence of falls: “Have you had a fall in the past 12 months?” [yes/no] and “If yes, how many falls have you had in the past 12 months?’’(Ganz et al., 2005). Another study asked participants: “have you had a fall in the past year?” This was followed by: “when you fell, did you go to the hospital?" (Tominaga et al., 2016).

In their evaluations of injurious falls, Ek et al. (2019) defined injurious fall as resulting in hospitalization (within the last four years; and between 4 to 10 years), while Kojima et al. (2016) asked respondents about injurious falls in the last year documented for them by the time they reached age 70. They defined injurious falls as leading to minor (bruises) or major (fractures) injuries. In their falls data collection approach, Khalatbari-Soltani et al. (2021) phoned participants every four months to assess falls over a period of four years, as did Ohlsson et al. (2018), although the latter had a mean follow-up period of 2.7 years. Dallmeier et al. (2016) utilized a fall calendar for the participants, and participants were responsible for completing the forms weekly. The information provided was reviewed by the research team every three months. Marshall et al. (2017) collected falls self-reports every four months during a one-year follow-up. Munch et al. (2015) defined a fall (and recurrent falls) based on the number of episodes that occurred one year after baseline. Overall, most of the studies examined risk factors for any type of fall without specifying the fall type, while the few remaining studies were specific to recurrent falls (Karlsson et al., 2012), injurious falls (Ek et al., 2019; Welmer et al., 2017), and both recurrent falls/any type of fall (Hung et al., 2017).

Incidence/Prevalence of Falls

Not all included studies reported fall incidence or prevalence. The incidence of falls varied between studies, depending on the sample and follow-up time in prospective studies.

Retrospective studies also differed in prevalence, as determined by the rates of fall recall. Among retrospective studies, the reported prevalence of falls among older adult males ranged from 2.4% (Mochida et al., 2018) to 39.4% (Hammarlund et al., 2016) for any fall and 7.7% (Karlsson et al., 2012) to 12% (Jefferis et al., 2014) for recurrent falls. Among prospective studies, incidence ranged from 6.2% (Ek et al., 2019) to 55.8% (Torres et al., 2015) for any fall and 7.7% (Karlsson et al., 2012) to 27% (Khalatbari-Soltani et al., 2021) for recurrent falls.

Risk Factors for Falls

All studies examined some type of risk factor for falls. Many studies addressed one specific intrinsic risk factor (Cauley et al., 2014; Dallmeier et al., 2016; Handrigan et al., 2017; Holloway et al., 2016; Kim et al., 2017; Klein et al., 2013; Marshall et al., 2017; Mochida et al., 2018; Munch et al., 2015; Ohlsson et al., 2018; Robinson et al., 2015; Scott et al., 2019; Scott et al., 2020; Stone et al., 2014; Tominaga et al., 2016; Torres et al., 2015; Welk et al., 2015; Welmer et al., 2017), including nocturnal hypoxemia, cardiac biomarkers for hemodynamic stress, body mass index, nocturia, blood pressure, back pain, oral health status, pain, 5 α reductase inhibitor (5 ARI) use, sleep disturbances, kyphotic posture, poor nutrition, and initiation of prostate-specific α antagonist. Other included studies addressed multiple intrinsic factors (Ek et al., 2019; Gale et al., 2016; Hung et al., 2017; Kubo et al 2021) as well as combined intrinsic and extrinsic factors (Chang & Do, 2015; Fonad et al., 2015; Gale et al., 2018; Hammarlund et al., 2016; Hedman et al., 2013; Karlsson et al., 2012; Khalatbari-Soltani et al., 2021; Lee, 2021; Mesinovic et al., 2021), such as marital status, obesity, stroke, and eye disorder; poor health, low food intake during the previous six months, four or more medications daily, type of residence, and poor oral health; age, greater comorbidity, higher levels of pain, poorer balance from inability to initiate full-tandem stand marital status, and household wealth.

Table 2
Risk factors for falls and pertinent findings from included studies.

Author(s)	Risk factor(s)	Type of fall	Main Findings (Association Statistic of risk factor vs falls)
Blain et al 2021	Multiple	Any fall	Fear of falling OR 2.16 (1.40-3.35); Fatigue OR 1.60 (1.04-2.47); Time held on one leg OR 1.49 (0.99-2.25)
Cauley et al 2014	Nocturnal hypoxemia	Any fall	≥10% sleep time with SPO2 <90%: RR 1.25 (1.04-1.51) for one or more falls; RR 1.43 (1.06-1.92) for recurrent falls
Chang & Do 2015	Multiple	Any fall	Widowed/separated/divorced OR 1.28 (1.03-1.61). Single (never married) OR 1.37 (0.90-2.09). Highest educational level: Secondary school degree OR 1.27 (0.96-1.67), Post–secondary school degree OR 1.68 (1.36-2.07). Body Mass Index: Overweight OR 0.93 (0.75-1.15) Obesity OR 1.27 (0.99-1.63). Nutritional risk (yes vs. no) OR 1.86 (1.50-2.31). Number of medications used in the previous month: 2–4 OR 1.05 (0.82-1.35); ≥5 OR 1.36 (0.961.94). Arthritis (yes vs. no) OR 1.27 (1.03-1.56). Stroke (yes vs. no) OR 1.91 (1.33-2.74). Eye disorder (yes vs. no) OR 1.35 (1.06-1.71).

Dallmeier et al 2016	Cardiac biomarkers for hemodynamic stress	Any fall	One-unit increment of log-transformed high-sensitive cardiac troponin I was associated with HR 1.26 (1.04-1.53). Men with high-sensitive cardiac troponin T ≥14ng/L had HR 1.74 (1.15-2.61).
Ek et al 2019	Multiple	Injurious falls	Low systolic blood pressure (HR=1.96, 1.04–3.71). Impaired chair stands (HR=3.00, 1.52–5.93). Previous falls (HR=2.81, 1.32–5.97). Long-term: Smoking (HR=1.71, 1.03–2.84). Heart disease (HR=2.20,1.5– 3.24). Impaired balance (HR=1.68, 1.08–2.62). Previous fall (HR=3.61, 1.98– 6.61)
Fonad et al 2015	Multiple	Any fall	Poor health: OR 1.91 (1.42-2.58). Low food intake during the previous six months: OR 0.46 (0.21-0.99). Four or more medications daily 1.33 (1.031.25). Poor oral health: 1.17 (1.07-1.39)
Gale et al 2016	Multiple	Any fall	Pain: mild OR 1.23 (0.89, 1.71); moderate OR 1.32 (0.98, 1.77); severe OR 1.92 (1.26, 1.94). Number of diagnosed comorbid conditions: 1 OR 1.40 (1.08, 1.81); 2 OR 1.38 (0.98, 1.94); 3 OR 1.13 (0.69, 1.85). Depressive symptoms (CES-D): ≥3 OR 1.33 (1.05, 1.68). Balance (full-tandem stand) <10s OR 1.27 (0.91, 1.78); Not attempted OR 3.32 (2.09, 5.29).

Gale et al 2018	Multiple	Incident fall	Age OR 1.10 (1.04,1.18). Greater comorbidity OR 1.04 (1.00-1.08). Higher levels of pain OR 1.10 (1.04-1.17). Poorer balance from inability to initiate full-tandem stand OR 1.23 (1.04-1.47).
Hammarlund et al 2016	Multiple	Any fall	Cohabiting OR 1.13 (0.77–1.66)
Handrigan et al 2017	Body Mass Index (Obesity)	Any fall	Obesity (reference normal weight) OR 1.33 (1.04–1.70). Obesity (referent overweight) OR 1.39 (1.07–1.81)
Hedman et al 2013	Health complaints and symptoms	Any fall	Poor self-rated health: OR 1.69 (1.22-2.35). Urine incontinence: OR 1.67 (1.13-2.47)
Henstra et al 2019	Apathy/decline in physical performance	Any fall	Model 1 IRR 1.27 (1.03–1.56). Model 2 IRR 1.35 (1.09–1.67) (All models adjusted for some variables). Model 3 IRR 1.26 (1.01–1.58)
Holloway et al 2016	Anxiety disorders	Any fall	Adjusted OR 2.96 (1.07–8.21) with falls and OR 3.46 (1.13–10.6) with Elderly Falls Screening Test score
Hung et al 2017	Multiple	Incident + recurrent falls	Depression measured on the Geriatric Depression Scale (GDS-5) vs incident (OR 1.26 (1.09–1.44) and recurrent falls (OR 1.48 (1.27-1.73). Urinary Incontinence vs recurrent falls only (OR 2.37 (1.45-3.82).

Jefferis et al 2014	Physical activity, mobility limitations	Any fall	Among men with recurrent falls, daily activity levels were lower than among non-fallers; 942 (95% CI 503, 1381) fewer steps/day, 12 (95% CI 2, 22) minutes less in light activity, 10 (95% CI 5, 15) minutes less in moderate to vigorous physical activity and 22 (95% CI 9, 35) minutes sedentary behavior.
Jefferis et al 2015	Physical activity, mobility limitations	Any fall	Men without mobility limitations: for every 30 minutes of moderate to vigorous physical activity (MVPA), IRR 1.50 (1.10-2.03). Step count ≥9000 steps per day for every additional 1000 steps IRR 1.59 (1.16-2.18). Men with mobility limitations, falls risk decreased with increasing activity: for every 1000 steps per day 1RR 0.80 (0.70-0.91). For every 30 minutes of MVPA, IRR 0.61 (0.42-0.89). For every additional 30 minutes of sedentary behavior of ≥600 minutes/day, IRR 1.22 (1.07-1.40).
Karlsson et al 2012	Poor physical performance on physical ability tests	Recurrent falls	Poor right-hand grip strength test: OR 2.4 (1.7-3.4) vs no falls; OR 2.0 (1.33.4) vs occasional fall.

Karlsson et al 2014	Multiple	Any fall + recurrent falls	The proportion of men who experienced falls was highest in the US sample and lowest in Hong Kong. US non-Hispanic White men population in the sample had the highest falls. Based on race/ethnicity: No statistically significant difference in the proportion of men ages 65 to 84 years, who experienced falls in the US, for any fall and/or recurrent falls.
Khalatbari-Soltani et al 2021	Socioeconomic status	Any fall	Australian-born men with: Low education IRR 1.66 (1.16-2.37). Low occupational ranks IRR 1.45 (1.09-1.93). Men from non-English speaking countries: No significant association found for occupational rank, but the rate of falls was lower in those with low educational attainment.
Kim et al 2017	Nocturia	Any fall	Based on number of instances: 1 instance 1.26 1.12±1.41; 2 instances 1.36 1.20±1.54; 3 instances 1.34 1.15±1.56; 4 instances 1.59 1.29±1.95; ≥5 instances 1.73 1.41±2.11. all compared to "none" as referent.
Klein et al 2013	Blood pressure (BP)	Any fall	Systolic BP <120 OR 2.46 (1.10-5.54). Diastolic BP <80 1.77 (1.02-3.07)

Kojima et al 2016	Depressive symptoms/visual impairment	Any fall	Depressive symptoms OR 1.22 (0.63–2.25). Impaired vision OR 1.05 (0.48–2.07). With depressive symptoms but without impaired vision OR 1.25 (0.60–2.42). Without depressive symptoms but with impaired vision OR 1.06 (0.42– 2.37). With depressive symptoms and with impaired vision OR 1.16 (0.26– 3.65).
Kubo et al 2021	Multiple	Any fall	Can you climb stairs without needing support using handrails or the wall? (No) OR 1.98 (1.25-3.13). Do you find it difficult to do things you could do easily before? (Yes) OR 1.64 (1.17-2.31). Do you feel that you forget things a lot? (Yes) OR 1.44 (1.03-2.01).
Lee 2021	Multiple (Indoor/Outdoor environmental hazards)	Any fall	Outdoor environmental hazards (OR 1.34, 1.02–1.75); Non-Hispanic White OR 1.60 (1.22–2.08); No job or retirement OR 0.69 (0.51–0.92); Fear of falling OR 1.81 (1.38–2.37); Balance impairment OR 2.80 (2.15–3.65); Use of a walking aid OR 1.82 (1.31–2.52); Walk for exercise OR 0.78 (0.62–0.98).

Marshall et al 2017	Back pain	Any fall	Recurrent fall: Risk Ratio 1.36 (1.14, 1.63) for any back pain. 1 location for back pain RR 1.26 (1.04, 1.52); 2 sites RR 1.50 (1.20, 1.89); 3 to 5 sites 1.85 (1.42, 2.42). For any falls RR 1.26 (1.13, 1.40) for any back pain. 1 location for back pain RR 1.27 (1.14, 1.42); 2 sites RR 1.33 (1.16, 1.53); 3 to 5 sites 1.40 (1.18, 1.67). Any falls and recurrent falls occurred with increasing severity of back pain RR for severe back pain (1.64 (1.25, 2.15) any falls; 1.56 (1.32–1.84) recurrent falls). Any falls and recurrent falls occurred with increasing frequency of back pain RR for back pain occurring most/all the time (1.62 (1.29, 2.04) any falls; 1.41 (1.22, 1.62) recurrent falls). Any falls and recurrent falls occurred with limitation from back pain (1.79 (1.45, 2.20) any falls; 1.54 (1.36, 1.74) recurrent falls**)**.
Mesinovic et al 2021	Multiple	Incident fall	Men with Type 2 DM: depression (IRR: 1.87 [1.05, 3.34]), sulfonylurea usage (IRR: 2.07 [1.30, 3.27]) and a greater number of prescription medications (IRR: 1.13 [1.03, 1.24])
Mochida et al 2018	Oral health status	Incident fall	Dry mouth OR 1.41 (1.12-1.77)

Munch et al 2015	Pain	Any fall	Any pain: physical performance, any falls OR 1.55 (1.32–1.81), recurrent falls OR 1.79 (1.47–2.19); frailty, any falls OR 1.53 (1.31–1.78), recurrent falls OR 1.82 (1.50–2.21). Hip pain: physical performance any falls OR 1.24 (1.06–1.43), recurrent falls OR 1.37 (1.13–1.67), frailty, any falls OR 1.27 (1.10–1.47), recurrent falls OR 1.43 (1.19–1.73). Knee pain: physical performance, any falls OR 1.36 (1.18–1.57), recurrent falls OR 1.65 (1.37–1.99); frailty, any falls OR 1.41 (1.23–1.62), recurrent falls OR 1.72 (1.43– 2.06)
Ohlsson et al 2018	Serum dehydroepiandrosterone (DHEA) and dehydroepiandrosterone sulphate (DHEAS)	Incident fall	DHEA OR 0.85 (0.78-0.92); DHEAS OR 0.88 (0.81-0.95)
Robinson et al 2015	5 α reductase inhibitor (5 ARI) use	Any fall	Current 5-ARI user HR 1.04 (0.98–1.10) HR 1.02 (0.96–1.08). Former 5-ARI user HR 1.12 (1.05–1.20) HR 1.11 (1.04–1.19).
Sandmark et al 2012	Multiple	Any fall	Unsteady gait (OR 2.22, 1.01-4.90)
Scott et al 2019	Osteoporosis/osteopenia/sarcopenia	Incident fall	Incident Rate Ratio (IRR) 1.41 (1.02-1.95)
Scott et al 2020	Appendicular lean mass (ALM), total fat mass (FM)	Any fall	Any fall from year 2 to year 5: ALM+[#]/FM-[*] OR 1.05 (0.84–1.31); ALM/FM+[**] OR 1.20 (0.90–1.61); ALM-[##]/FM- OR 1.07 (0.75–1.54). Any fall from year 2 to 8.8 years: ALM+/FM- OR 0.76 (0.64–0.92); ALM-/FM+ OR 1.73 (1.37–2.18); ALM-/FM- OR 0.66 (0.48–0.91)

Stone et al 2014	Sleep disturbances	Any fall	Excessive daytime sleepiness (ESS >10) vs recurrent falls: OR 1.52 (1.142.03). ≤5 hours sleep (compared with 7/8 hours) vs recurrent falls: OR 1.79 (1.22-2.60). Nocturnal hypoxemia (≥10% of sleep time with SPO2 <90%: OR 1.62 (1.17-2.24).
Tominaga et al 2016	Kyphotic posture	Any fall	OR 2.14 (1.01-4.57) for severe kyphosis. Falls resulting in medical care: OR 1.93 [0.36–1.46] for mild kyphosis. OR 4.72 [1.18–18.90] for severe kyphosis
Torres et al 2015	Poor nutrition	Any fall	HR 1.67 (1.36–2.05)
Welk et al 2015	Initiation of prostate-specific α antagonist	Any fall	OR 1.14 (1.07-1.21)
Welmer et al 2016	Pain	Injurious falls	Presence of pain and intensity of pain increased the risk after adjusting for several covariates.

*= absence of fat mass; **= presence of fat mass; #= presence of appendicular lean mass; ##= absence of appendicular lean mass; RR=Risk Ratio; IRR=Incidence Rate Ratio; OR=Odds Ratio; HR=Hazard Ratio

Most studies included patients with chronic diseases except for Kojima et al. (2016), which excluded patients with chronic diseases at baseline to ensure that the incidence rate of falls was not influenced by the preexisting fall episodes. It was included in this review because it assessed the effects of other intrinsic risk factors (i.e., visual impairment and depression) on falls.

Findings from International Studies

Table 2 details the findings and association statistics between risk factors that showed statistical significance with falls and/or recurrent falls. Many studies have been conducted worldwide, which have examined associations between these risk factors and falls. The studies in this review have utilized different study designs and fall assessment methods, and the statistical approaches are not homogenous. Hence, the findings on the effects of specific risk factors on falls vary depending on the sampling methods, study design, and the unique sociodemographic characteristics of the sample.

Sociodemographic Factors and Falls

In one cross-sectional study, the prevalence rate of any fall increased even more among men who were ≥80 years old (Hammarlund et al., 2016). Increasing age was positively correlated with recurrent falls, and this effect was consistent across all included studies (Hung et al., 2017; Jefferis et al., 2014; Jefferis et al., 2015; Karlsson et al., 2012; Karlsson et al., 2014; Khalatbari-Soltani et al., 2021; Marshall et al., 2017; Munch et al., 2015; Stone et al., 2014). In the case of race/ethnicity, only two studies outside of the United States considered race/ethnicity variability in the incidence or prevalence of falls and recurrent falls among older adult males. More specifically, the Chang & Do (2015) study conducted in Canada considered race/ethnicity, and an Australian study used country of origin (English speaking versus non-English speaking) as variables (Khalatbari-Soltani et al., 2021).

In their analyses, Chang & Do (2015) found no difference in the risk of falling between White and non-White subgroups of the sample (crude OR 0.79, 95% CI, 0.53-1.18), although the non-White participants were less than 10% of the White participant subpopulation. In the Australian study, the rate of falling was higher among Australian-born men with lower educational attainment, but the reverse was true among men born in non-English speaking countries with similar levels of formal education (Khalatbari-Soltani et al., 2021). Widowed/separated/divorced status was associated with increased risk of falling (Chang & Do, 2015). Only one study reported the effects of socioeconomic status, which found that the risk of falls was higher among Australian-born men with low educational and occupational levels, while the risk was lower among men born in non-English speaking countries who had low formal education (Khalatbari-Soltani et al., 2021).

Intrinsic Risk Factors and Falls

After adjusting for other covariates, a history of falls achieved stronger effect size in its association with the risk of injurious falls (Ek et al., 2019). Psychological factors, such as fear of falling (Blain et al., 2021; Lee, 2021), apathy (Henstra et al., 2019), anxiety disorders (Holloway et al., 2016), depressive illness (Gale et al., 2016; Hung et al., 2017; Kojima et al., 2016;

Mesinovic et al., 2021), perception of poor health or poor self-rating of health (Fonad et al., 2015; Hedman et al., 2013), and being forgetful (Kubo et al., 2021) were independently associated with increased fall risk. Depression was also associated with increased risk of recurrent falls (Hung et al., 2017).

Sedentary lifestyle/reduced physical activity increased the risk of recurrent falls in a study evaluating the effects of physical activity and mobility limitations (Jefferis et al., 2014), and the risk of any fall decreased with increasing activity (Jefferis et al., 2015). Smoking (Ek et al., 2019) had long-term effects on the risk of injurious falls (Ek et al., 2019). Low food intake reduced the risk of any falls (Fonad at al., 2015), while nutritional risk was positively correlated with the risk of any fall type (Chang & Do, 2015; Torres et al., 2015).

Pain and multimorbidity (Gale et al., 2016; Gale et al., 2018) were associated with falls.

Like multimorbidity, pain also had a significant dose-response relationship with injurious falls (Gale et al., 2016; Gale et al., 2018) even after adjusting for other variables (Welmer et al., 2017). Individual comorbid diseases, such as sleep disorders, balance/gait disorders (Ek et al., 2019; Gale et al., 2016; Gale et al., 2018; Kubo et al., 2021; Sandmark et al., 2012), skeletal malformations/joint disorders (Chang & Do, 2015; Scott et al., 2019; Tominaga et al., 2016), vision disorders (Kojima et al., 2016), urine incontinence/nocturia (Hedman et al., 2013; Kim et al., 2017), poor oral health (Fonad et al., 2015; Mochida et al., 2018), cardiovascular and cardiometabolic disease (Dallmeier et al., 2016; Chang & Do, 2015; Ek et al., 2019; Klein et al., 2013, fatigue (Blain et al., 2021), and obesity (Handrigan et al., 2017) were all significantly associated with fall risk. Medication use (Welk et al., 2015) and polypharmacy also increased the risk of any falls (Fonad et al., 2015; Mesinovic et al., 2021). Loss in lean and fat mass had a long-term effect in increasing the risk of falls (Stone et al., 2014). For cardiovascular disease, the effects of blood pressure on falling were observed when participants reported low blood pressure for both systolic and diastolic pressures (Ek et al., 2019; Klein et al., 2013).

Findings from US-based studies

Sociodemographic Factors and Falls

All US-focused studies in this review included race/ethnicity in their analyses of participant characteristics (Cauley et al., 2014; Lee, 2021; Marshall et al., 2017; Munch et al.,

2015; Stone et al., 2014), including one multicenter study, in which a US sample of older adult participants was one of the subpopulations studied, and thus included race/ethnicity in their final analyses (Karlsson et al., 2014). According to Karlsson et al. (2014), non-Hispanic White (NHW) males in the US subpopulation had the highest rates of falling compared to the population in the other two countries in the sample. This was also consistent with the findings of Lee (2021), where the risk of NHW males experiencing any falls was twice as high as the risk among non-White subpopulations.

Intrinsic Risk Factors and Falls

Back pain, regardless of site, increased the risk of falls and recurrent falls. The presence of pain and limitation from pain at different sites on the back increased the risk of any falls and recurrent falls (Munch et al., 2015), especially in a dose-response fashion, depending on the number of body parts in pain (Marshall et al., 2017). Sleep disorders, with or without low blood oxygen saturation, increased the risk of any falls and recurrent falls (Cauley et al., 2014; Stone et al., 2014). Frailty also increased the risk of falls and recurrent falls, especially in the context of chronic pain (Munch et al., 2015).

Extrinsic Risk Factors and Falls

Outdoor environmental hazards, the use of walking aids, and unemployment are some of the extrinsic factors identified in this review. Unemployment had a protective effect from any fall, while outdoor environmental hazards and the use of walking aid increased the risk of falls (Lee, 2021).

Discussion

This scoping review examined the association between multiple risk factors for incident and recurrent falls among community-dwelling older adult males. There were significant differences between the studies in terms of study characteristics, sampling methods, and sample size. There were also variations in incidence rates, which reflect the large variations in follow-up time for prospective studies (Ek et al., 2019; Torres et al., 2015). Although most of the retrospective studies utilized similar recall periods (i.e., 12 months), there were large variations in the prevalence of the outcome variables (Mochida et al., 2018; Hammarlund et al., 2016). The possible reasons for these variations may be limited to study methodology, as well as cultural and lifestyle factors, which potentially influence and introduce biases in reporting (Kwan et al., 2011).

However, since several studies did not report incidence and prevalence rates, the true extent of the variations cannot be ascertained in this current review. The current published literature about the risk factors for falls and recurrent falls among older men is limited, and there are even fewer studies about the effects of race on falls for this subpopulation. This review examined the risk factors in the current literature to highlight findings and identify gaps in the current understanding about race/ethnicity and recurrent falls. It also provides a basis for recommending further research about falls and related risk among older men.

Risk Factors

About 60 risk factors were identified across the 38 studies. These risk factors, shown in Table 2, confirm those reported in previous reviews (Ambrose et al., 2013; Deandrea et al., 2010; Jehu et al., 2021; Kwan et al., 2011). As shown in a previous review and meta-analysis, frailty is associated with recurrent falls among older adults (Jehu et al., 2021). This is consistent with the findings of the current review, which also shows that the features of frailty, especially disorders of balance and mobility (Jehu et al., 2021; Gale et al., 2018; Kubo et al., 2021; Munch et al., 2015), suggest that with or without other risk factors, older adults at advanced ages are intrinsically predisposed to multiple falls. The similarity in the findings of the current review align with the findings of Jehu et al. (2021) and shows that the primary sarcopenia that accompanies an aging physiology is consistently a risk factor for all older adults, but particularly problematic in older adult males. This finding is also consistent with the results of another earlier systematic review and meta-analysis, which found that the older adult males in their sample who had sarcopenia experienced more falls than the combined sample of older adult males and females (Zhang et al., 2020).

These findings are important because they highlight the syndrome of frailty in older males as a multisystemic health outcome characterized by progressive depletion in energy and metabolic reserves, making older adult males more susceptible to intrinsic and extrinsic stressors, decline in the quality of life, and comorbid diseases (Carmeli, 2017). As in the case of age and frailty, other intrinsic risk factors such as pain, depression, and comorbidities were consistently supported statistically across the studies in this review as independent risk factors for falls and recurrent falls.

Pain and musculoskeletal diseases, such as osteoarthritis and osteoporosis, were all associated with frailty in this review (Munch et al., 2015; Scott et al., 2019), and the effect sizes of these variables increased with falls, even after adjusting for other variables (Welmer et al., 2017). Chronic diseases are characterized by chronic inflammation, which in turn worsens or accelerates frailty and secondary sarcopenia (Cruz-Jentoft et al., 2019; Walston, 2012), thus predisposing older adult males to recurrent falls (Kwon et al., 2018). In the case of pain specifically, a previous systematic review and meta-analysis showed that older adults who experienced persistent pain at baseline developed twice the risk of frailty at follow-up (Saraiva et al., 2018).

The musculoskeletal diseases in this review also exhibited strong dose-response relationships with the risk of falling (Marshall et al., 2017; Munch et al., 2015; Tominaga et al., 2016) and recurrent falls (Marshall et al., 2017). Kyphotic posture, a musculoskeletal condition that is associated with old age and frailty (Koelé et al., 2020), was also found to exhibit a strong effect size in influencing the risk of falls (Tominaga et al., 2016). The findings in this review are consistent with some individual studies that have demonstrated an increased risk of falls with musculoskeletal disease (McDaniels-Davidson et al., 2018; van der Jagt-Willems et al., 2015). This is combined with the fact that kyphosis tends to be higher among men than women (Kado et al., 2007), suggesting that musculoskeletal disease contributes significantly to the burden of comorbidities and their associations with falls in men.

Apart from musculoskeletal conditions, nocturia (Kim et al., 2017) and sleep disorders (Stone et al., 2014) in this review also had dose-response relationships with falls. Nocturia is related to a few chronic conditions among the elderly. In its association with urinary incontinence, it has been suggested as an important modifier of the relationship between urinary incontinence and falling (Brown et al., 2000). Nocturia is also associated with cognitive dysfunction among older adults (Haddad et al., 2020). Both conditions have been independently shown to be associated with any fall (Hedman et al., 2013; Kubo et al., 2021) and recurrent falls (Hung et al., 2017) in this review.

Recurrent Falls and Risk Factors

Information about the risk for incident and recurrent falls was explored in this study. However, it is worth noting that some of the risk factors that predisposed to recurrent falls in this review are also associated with a major risk factor for recurrent falls, namely, frailty (Cheng & Chang, 2017). Nocturnal hypoxemia associated with sleep disorders (Cauley et al., 2014; Stone et al., 2014), pain (Marshall et al., 2017; Munch et al., 2015), depression (Hung et al., 2017), physical limitation and frailty (Jefferis et al., 2014; Karlsson et al., 2012; Munch et al., 2015), and race (Karlsson et al., 2014) have all been implicated in the frailty-fall association. For instance, chronic hypoxia has been shown in clinical studies to disrupt tissue metabolism, predispose to inflammation and chronic diseases, and accelerate cellular senescence and aging (Wei et al., 2022).

The effects of depressive illness on recurrent falls can be understood in the context of a systematic review that showed depressive illness as a strong predictor of frailty, and in some instances, may coexist with frailty and other comorbid conditions among older adults (Vaughan et al., 2015). Poor physical fitness and sedentary behavior have also been shown in studies to increase frailty (Blodgett et al., 2014; Blodgett et al., 2015). Furthermore, this review indicates that a previous fall is a risk factor for subsequent, more serious injurious falls (Ek et al., 2019; Jo et al., 2020; Lam et al., 2019), which may lead to more morbidity and reduced survivability among males (Lohman et al., 2019). This higher severity of fall sequelae with recurrence in men suggests the need to investigate the associated risk factors further among specific samples of older adult males.

Psychological factors, such as fear of falling and depressive illness, can restrict older adults from performing routine activities such as walking, which may prevent them from participating in structured exercise interventions or programs that target falls (Byun et al., 2020). Not participating in such exercise interventions or programs may perpetuate a vicious cycle of primary/secondary sarcopenia or uncontrolled chronic diseases, which may consequently predispose older men to recurrent falls (Olokunlade et al., 2024). Pain is associated with physical and psychological risk factors for falls (Byun et al., 2020). As a symptom of chronic inflammation, pain can worsen frailty, directly result in recurrent falls, or increase fall-related risk because of its association with sarcopenia (Chen et al., 2023; Sahin & Sentürk, 2023) and fear of falling (Fernandes et al., 2022).

Race/Ethnicity and Falls

The findings of Karlsson et al. (2014) showed that the risks of falling and recurrent falls were highest in the United States compared to two other countries within the same study. This was attributable to the high prevalence among non-Hispanic White (NHW) men. Lee (2021) also demonstrated a high prevalence of falls among NHW men compared to other racial/ethnic demographics. In addition to their findings about the increased risk in NHW men, Karlsson et al. (2014) found that further analyses did not show any difference in rates across the racial/ethnic demographics within the United States, consistent with the findings of Nicklett & Taylor (2014) after they adjusted for other covariates.

It is worth noting that the latter study included both male and female subpopulations of older adults. As indicated by Nicklett & Taylor (2014), the primary studies and reviews investigating the effects of race/ethnicity on falling have provided inconsistent evidence. Kwon et al. (2018) showed that non-Hispanic Black (NHB) adults had higher rates than Hispanic, and Bergen et al. (2019), highlighting the similarity in risk between Hispanic and NHW adults, showed that NHB older adults had reduced risk when compared to both NHW and Hispanic. This latter finding contradicts earlier studies, which showed that Hispanic older adults were at lower risk than NHW (Landy et al., 2012; Landy et al., 2011).

In a review of the literature examining racial/ethnic differences in falls among older adults in the United States and internationally, the authors found that the results across the studies have been largely inconsistent (Han et al., 2014). This current review, however, showed that the risk is higher among NHW older adult males. The paucity of literature on this subpopulation of older adults suggests the need for more primary studies to compare risk across the racial/ethnic groups. Further, for a multicultural and diverse society like the United States, studies show that race/ethnicity and the uniqueness of culture are essential drivers of health and health outcomes among older adults (Campos & Kim, 2017; Menkin et al., 2017), often because race is closely associated with the social determinants of health in the United States (Flanagin et al., 2021).

Although some international authors suggest that the effects of race may be diminished by other social determinants of health (El Fakiri et al., 2018), other studies show that the risk of falls among older adults differ based on race/ethnicity (Geng et al., 2017; Kalula et al., 2015; Wehner-Hewson et al., 2022), and these effects may continue to grow more (Chen et al., 2018), with the effects more pronounced among certain racial ethnic groups than others (Nicklett & Taylor, 2014). Thus, an assessment of the distribution of falls based on racial/ethnic categories among men will expand the evidence on the association between race/ethnicity and any fall type among older men in the United States.

Internationally, the limited data on the effects of race/ethnicity in this review may be partly due to challenges and questions that arise regarding the role of race in the evolution of disease, as well as the political and social implications of spotlighting race in health research in many European countries that are not ethnically diverse (Jugert et al., 2022). As a result, the inclusion of race/ethnicity might have been impractical for these studies. However, the sociodemographic changes occurring in Europe, partly due to immigration (Nguyen, 2011;

Warnes et al., 2004), indicate that attention to health research needs to include race/ethnicity

(Han et al., 2014). Although they did not show specific racial/ethnic categories, Khalatbari-Soltani et al. (2021) showed the differences in their analysis of the variations in fall risk that occur between men born in Australia and immigrants. This was the only study in this review that included immigrants in their analyses. A study among Chinese older adults showed that immigration influenced fall-related behavior in significant ways (Kwan et al., 2013). Thus, as part of gaining further understanding of the impacts of race/ethnicity, the role of culture and changes in immigrant behavior needs to be included in research in multiracial societies like the United States.

Limitations

There were variabilities in study methods, likely introducing heterogeneity to the overall review and limiting generalizability. There were large variabilities in the sample sizes, where sample sizes ranged from 455 to 267,154. The presence of extremes may potentially prevent meaningful comparisons of risk across studies. Most of the retrospective studies used a recall period of 12 months, while only one used three months (Klein et al., 2013). This likely introduced recall bias to the overall review. This often happens because many older adults are unable to accurately recall falls that did not result in injury or hospitalization (Cummings et al., 1988).

In addition to recall bias, older men may underreport fall events because of the stigmatization of frailty, which may predispose older men to hide signs of weakness or infirmity (Cummings et al., 1988; Garcia et al., 2015; Peel, 2000). To reduce the impacts of recall bias and underreporting of fall events, more objective fall ascertainment methods, such as wearable technologies, should be considered in future studies for fall-related data collection within this population. Although these technological solutions can be designed to fit the needs of an aging population (Mazuz et al., 2020), potential barriers to uptake should be considered, which may include access, feasibility, cost, learnability, and usability.

Most of the studies in this review did not explore the impacts of these risk factors in the context of race/ethnicity. Thus, the information about the impact of race/ethnicity among older adult males with risk factors for recurrent falls, such as chronic diseases, is limited. Most of the US-focused studies in this review included race as a participant characteristic rather than including it in their main analyses. Also, many studies exploring the effects of race, including both studies that addressed race/ethnicity effects, were predominantly Caucasian in their sample (Chang & Do, 2015; Karlsson et al., 2014), and the distribution and effects of these risk factors among other racial groups may remain unclear. Studies exploring these effects within a significant sample of older males of color will be beneficial in the future.

Implications for Health Behavior Research and Practice

This scoping review highlights that the prevalence of falls, although widely varied across study samples, is high among older men with comorbid conditions and other associated risk factors. While this review confirms that falls among older men are multifactorial in their etiology, it also suggests that focusing on chronic disease management is needed to reduce the risk of recurrent falls. Chronic Disease Self-Management Education (CDSME) programs have been shown to effectively increase the management of disease symptomatology by addressing self-management techniques including exercise, nutrition, communication with healthcare professionals, and medication management (Lorig et al., 2001; Smith et al., 2017). Considering that many issues addressed in CDSME are also the most prominent fall risk factors as described in the current review, this study highlights the need for expanding support for CDSME program delivery to older men nationwide who are underrepresented among participants served (Smith et al., 2017; Smith et al., 2018a). Additionally, to specifically address fall-related risk, referral efforts are needed in clinical and community settings to engage older men and enroll them in evidence-based fall prevention programs which address risk factors found in this review (e.g., fear of falling, physical inactivity), are available throughout the United States (Brach et al, 2022; Smith et al., 2018b), and can be 'bundled' with CDSME programs and other evidence-based programs for additive impact (Lee et al., 2018). Furthermore, additional studies are needed to address the lack of consensus between some risk factors and falls, especially for men from understudied races and ethnicities (Olokunlade et al., 2024). These studies should utilize qualitative and quantitative research methods combined with technology for objective measurement of falls, physical activity, and other fall-related risks (Mazuz et al., 2020).

Discussion Questions

From this review, what are the most modifiable risk factors for incident and recurrent falls among men?

What areas of research would complement our knowledge about what is known related to the risk for incident and recurrent falls among men of different races and ethnicities?

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