AN EXAMINATION OF INCIDENT AND RECURRENT FALL RISK AMONG OLDER ADULT MALES IN THE UNITED STATES

A Dissertation

by

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ABSTRACT

About one in every four older adults fall each year, and falls are among the leading causes of morbidity and mortality among older adults in the United States. While much is known about the complexities of fall-related modifiable and nonmodifiable risk factors, less is known about the risk for falls among men, specifically non-Hispanic Black and Hispanic men with chronic conditions. While any fall can be detrimental to the health of an older adult, additional examination is warranted to examine risk-related differences for incident falls and recurrent falls.

This dissertation examined the risk factors associated with incident and recurrent falls among older adult men in the United States. It included three interrelated studies. The first study was a scoping review of 38 studies, through which the evidence pertaining to approximately 60 fall-related risk factors was examined. Findings confirm the complexity and interrelation of fall-related risk factors among older adults, but few studies specifically focused on falls among men, and fewer examined race/ethnicity as a variable of interest.

The second study was a secondary data analysis to examine factors associated with incident and recurrent falls reported in the past 3 months among non-Hispanic White, non-Hispanic Black, and Hispanic older men with ≥1 chronic diseases who enrolled in an evidence-based fall prevention program. Findings revealed that about 19% reported an incident and recurrent fall, respectively. Men who had more fear of falling reported incident and recurrent falls. Men who limited their activities because of concerns about falling were more likely to report an incident fall and recurrent falls, respectively. Having more comorbidities was associated with increased reporting of recurrent falls.

The third study was a secondary data analysis to examine factors associated with incident and recurrent falls reported in the past 12 months among non-Hispanic Black and Hispanic men with ≥1 chronic diseases from a national survey. Findings revealed that 12.6% and 14.4% of men reported incident and recurrent falls, respectively. Men who reported good general health status and got help needed reported lower recurrent falls. Reporting more comorbidities and depression was associated with recurrent falls.

DEDICATION

This dissertation is dedicated to the glory of God. To my parents, Kayode and Cecilia Funke Olokunlade, whose patience and faith in me helped me to persevere. To my fiancée, Opeyemi Akinbobola, who didn't give up on me. To my uncle, Rotimi Ojifinni, who leads by example. To the memory of my paternal grandfather, who showed me the value of kindness, and to my late maternal grandfather, who taught me the value of formal education at a tender age.

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NOMENCLATURE

ACL Administration for Community Living

T3 Texas A&M Triads for Transformation Initiative

NWH Non-Hispanic White

NHB Non-Hispanic Black

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1. INTRODUCTION

The mortality rates from unintentional injuries are on the rise globally (World Health Organization [WHO], 2021). Falls are the second leading injury-related cause of death across all ages (GBD 2019 Diseases and Injuries Collaborators [GBD], 2020; WHO, 2021). However, falls are still not sufficiently studied across the globe (WHO, 2021). Falls contribute significantly to mortality and fall-related deaths are most pronounced among adults ages 60 and older (WHO, 2021; Ye et al., 2021). Even when not fatal, falls frequently lead to serious disabilities. For example, estimates of disability-adjusted life-years (DALYs) lost for people ages 75 years and older indicate that, falls are the eighth leading cause among all conditions, and the leading cause across all conditions, and the leading cause among all mechanisms of injury (GBD 2020).

In the United States, falls are responsible for increases in DALYs lost, resulting in more years lived in disability than other causes of unintentional injuries combined (McGrath et al., 2019; Stevens et al., 2006; Verma et al., 2016). Previously, studies showed that approximately 40% of the older adult population in the United States reported at least one fall annually (Ambrose et al., 2013; Chang & Do, 2015). More recently, it was reported that approximately 25% of this subpopulation experienced a fall (Moreland et al., 2020), an apparently improved prevalence rate. However, fall rates remain worse among older adults ages 85 years and older (Bergen et al., 2019; Moreland et al., 2020; Moreland & Lee, 2021).

The age-adjusted mortality from unintentional injuries increased by about 40%, between 1999 and 2017 (Olaisen et al., 2019). Among these, falls were responsible for the most deaths among adults ages 65 and older (Burns & Kakara, 2018; Olaisen et al., 2019). In 2019, there were 34,000 fatalities from falls in this age group in the United States (Moreland & Lee, 2021), while five years prior, there were only 27,000 deaths (Bergen et al., 2016). Overall trends in fall

related mortality among older adults reveal a 30% increase in the nine years leading up to 2018 (Centers for Disease Control and Prevention [CDC], 2020). These increases in burden continue to occur despite the availability of evidence-based fall prevention programs prioritizing older adult safety (Smith et al., 2018).

When falls do not result in fatalities, falls often result in fractures, complicated wounds, and/or moderate to severe head injuries (Komisar et al., 2022; Stevens et al., 2006), Many falls lead to frequent emergency room visits, with at least 40% of fallers requiring hospitalizations, and approximately 10% of these resulting in long-term disabilities (Stevens et al., 2006). With an increasing need for long-term care, the medical and economic costs of falls are prohibitively high; the direct costs of falls account for significant proportions of healthcare expenditure in the United States (Davis et al., 2010; Haddad et al., 2019). In 2015, the total medical costs from falls, including the cost of treating the approximate 3 million older adults who received emergency care that year, exceeded $50 billion (Florence et al., 2018), a 150% increase in spending compared to nearly a decade prior (Stevens et al., 2006). With the incidence of falls increasing nationwide (Hoffman et al., 2022) and the expansion of the older adult population (Moreland et al., 2020; U.S. Department of Health and Human Services [HHS], 2021), the total healthcare costs of falls may continue to increase (Burns et al., 2016). Thus, from a medical and economic perspective, falls among older adults are a significant national public health issue.

1.1 Definitions of Falls and Recurrent Falls

A fall is an unintentional change in position that causes a person to land at a lower level, on the floor, the ground or on an object, which cannot be explained by an abrupt onset of illness, paralysis, a seizure, or the application of significant external force (Feder et al., 2000; Leveille et al., 2009). By this definition, intentional shoving or pushing, or conditions which are usually

characterized or complicated by a fall are excluded (e.g., acute cardiac or neurological emergencies). Without consideration for these additional conditions, the World Health Organization simply defines a fall as an event that results in a person inadvertently resting on some lower level, ground, or floor (WHO, 2021).

The relevant common denominator in these definitions is that this dissertation study will focus on falls as a cause of unintentional injuries. A single or first episode of a fall, termed an incident fall, has an extensive body of research that has identified associated risk factors. The occurrence of two or more falls within a specified period, often ranging from three to twelve months, is termed recurrent falls (Klein et al., 2013; Nicklett & Taylor, 2014). Less research exists to differentiate the risk factors between incident and recurrent falls, but understanding their distinction is necessary because older adults who experience recurrence tend to represent a unique set of clinical and public health challenges beyond the known risk factors for an incident fall (Sun et al., 2016). In addition, an incident fall is strongly predictive of the likelihood of recurrent falls within a twelve-month period, especially among older adults (Nicklett & Taylor, 2014). As such, the factors that increase this risk of recurrent falls are of particular interest in this dissertation study.

1.2 Risk Factors for Falls (and Recurrent Falls)

The various behavioral, biologic, social, and environmental risk factors for falls may be broadly categorized into modifiable or nonmodifiable risk categories (Bergen et al., 2019). Both modifiable and nonmodifiable categories include a series of factors that may be within the physiologic system of an individual, known as intrinsic factors, or they may include environmental and social risk factors that increase the probability of recurrent falls, known as extrinsic factors. Quite commonly, there is an interplay of factors, where intrinsic factors

predispose the individual to the events, and the extrinsic serve as precipitants (Ambrose et al., 2013; Yamashita et al., 2012). Overall, a modifiable risk factor can be justifiably targeted for interventions, while control of nonmodifiable factors in this age group are less likely to bring about reduction in incidence and mortality. Unmodifiable factors provide the roadmap for identifying subpopulations that need to be prioritized for interventions. This dissertation study prominently focuses on the older adult male population because these risk factors have gender specific effects on the risk of falling among older adults (Gale et al., 2018), and many of the intrinsic factors that will be studied have been shown to impact males more than females (Hartholt et al., 2012), however, the current knowledge about fall-related risk factor distribution among males is limited. Additionally, little is known about the role of other unmodifiable factors, such as race/ethnicity among older adult males. This dissertation study includes a scoping review to determine what is known about recurrent falls and a series of two secondary data analyses that identify associations between specific variables (risk factors) and incident/recurrent falls.

1.3 Conceptual Framework for the Dissertation

This dissertation study has included multiple risk factors, across racial subgroups of men in the United States. Hence, one of the primary objectives of this dissertation was to examine the risk differences across the racial groups. Findings relating to the effects of race/ethnicity on the burden of falls have not been consistent in the falls literature (Karlsson et al., 2014; Nicklett & Taylor, 2014); however, it appears that older adults of color tend to report less falls, compared to their White counterparts. This is despite the findings of comprehensive risk profiles, which should place older Black adults at higher risk for falling (Nicklett & Taylor, 2014). These findings have been described in the context of incident falls, for both men and women, where

women constitute significant proportions of the study populations, but the details about the effects of race on recurrent falls with or without focus on men are less clear.

Figure 1.1 presents a schematic that highlights the relationships and interplay between modifiable and nonmodifiable risk factors in the context of falls. This conceptual model considers several fall-associated risk factors among older men. Incident falls and recurrent falling may result from any one of these factors, but they are likely associated with an interplay of modifiable and nonmodifiable risk factors. Hence, incident falls and recurrent falls are a multifactorial phenomenon. For instance, compared to women, fear of falling tends be correlated with higher incidence of recurrent falls in men who have reduced activities of daily living (O & El Fakiri, 2015), but an incident fall is still the strongest risk factor for recurrent falls within the following year (Nicklett & Taylor, 2014). Fear of falling has also been identified as occurring more frequently among older adults of color (Chen & Kim, 2021; Washington et al., 2020), and some have credited this fear as a risk factor for increased falls (Sun et al., 2016). Although another study found lower fear of falling among older Black adults (Singh et al., 2020), which was suggested as a reason for reduced falls in this subpopulation, other authors found that fear of falling was correlated with recurrent falls among older adults because it impairs attitude and self-efficacy in adopting healthful aging behavior (Dolan & Taylor-Piliae, 2019). This inconsistency suggests the need for a comprehensive review of the evidence.

The immediate home environment of the older adult may be modifiable. However, because of the physiologic and psychosocial effects of aging (Leung et al., 2010; Payette et al., 2016), the larger physical and social neighborhood environments are essentially nonmodifiable for this age group. In addition, some aspects of the physical environment for older adults in rural communities are not amenable to modifications without disruptions to their living conditions and

ecosystems (Kitayuguchi et al., 2021). Similar conclusions can be reached about the socioeconomic status of older adult males.

These social determinants of health are important because they highlight many of the factors that are based on intrapersonal and/or interpersonal characteristics, such as attitudes, health beliefs, educational attainment, income, as well as factors that are largely derivatives of an individual's physical and social environment (Short & Mollborn, 2015). Hence, since health and health behaviors are outcomes of synergism between the different levels of the socio-ecological strata, these social determinants of health can provide better understanding about disparities in the context of older Black males' experiences of incident and recurrent falls.

Further, while many studies show that race is protective against incident and recurrent falls among older Black adults, some authors have argued that the attribution of falls to advanced age reflects the selection bias because there are significantly much older White adults in research studies, since the White individuals tend to live longer (Nicklett & Taylor, 2014). Hence, if race is not a clear protective factor from falls, this dissertation study will investigate how these factors act independently, or in concert, to explain the fall-related risk among older men of color.

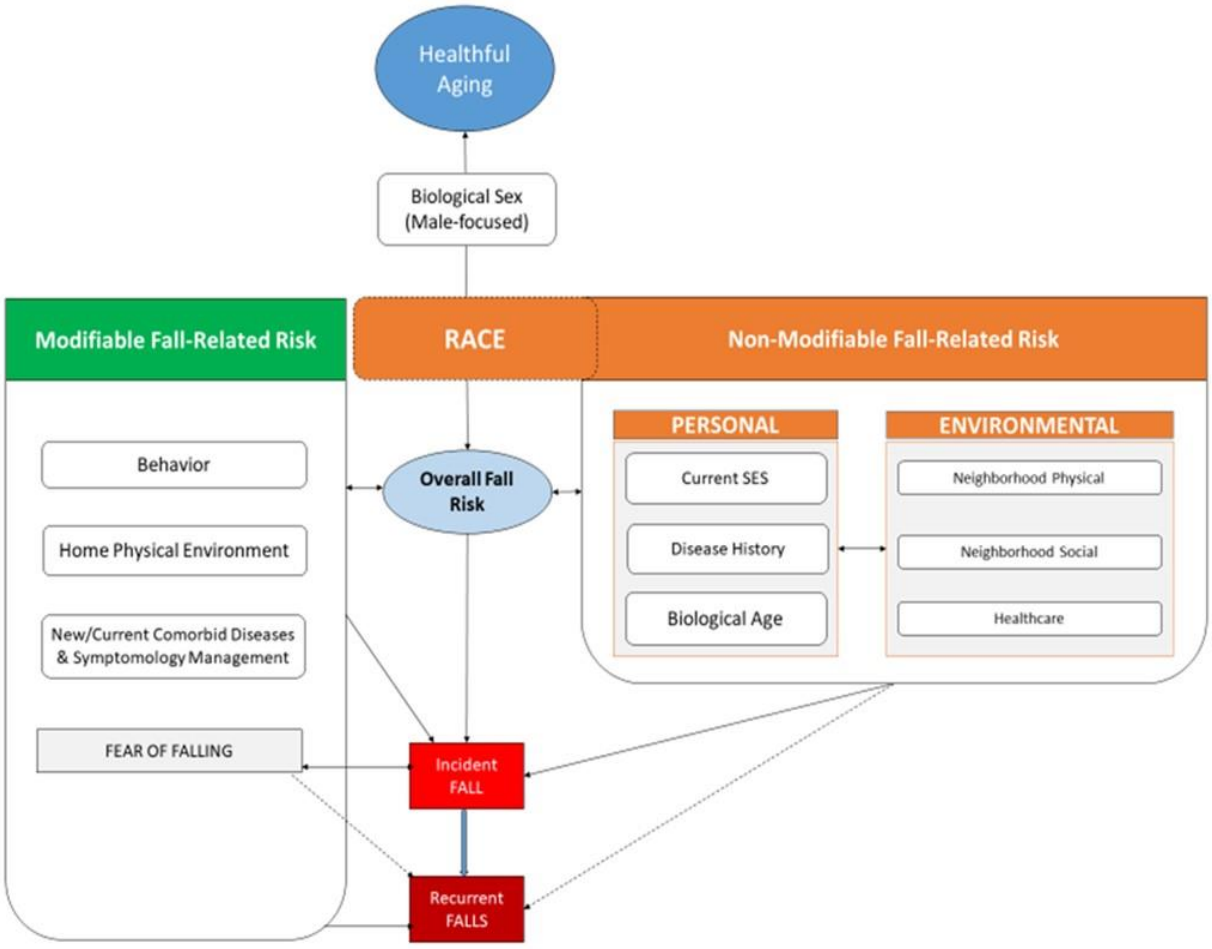

Figure 1.1 Schematic of the risk factors for recurrent falls

1.4 Dissertation Overview

An overarching objective of this dissertation study is to expand what is known about the risks of recurrent falls among older men (Hu & Baker, 2012; Peeters et al., 2018), with particular focus on older men of color. An understanding about risk factors and their occurrence in this population can potentially inform fall prevention programs and reduce mortality and morbidity from unintentional injuries. This dissertation study identified and analyzed potential disparities between non-Hispanic White, and non-Hispanic Black, and Hispanic male populations. As such, this dissertation study consists of three distinct yet interrelated components:

Study 1: Scoping Review of the Fall-Related Risk Factors among Older Males

This scoping literature review will assess the literature to identify the state of knowledge about risk factors for incident and recurrent falls among older men. The purpose of this scoping review is to summarize the published evidence about falls and fall-related risk factors among community-dwelling older adult males, with particular attention to the risk for incident and recurrent fall.

This review will show the incidence and/or prevalence of incident and recurrent falls across multiple samples of older adult males. This information will be useful toward identifying the burden of incident and recurrent falls and make comparisons across multiple studies, study centers and/or countries. Further, this review will highlight fall-related risk factor distribution among older males, show the strength of the association between specific risk factors and incident falls, and in addition, this review will demonstrate the effects of risk factors, including the effects of race/ethnicity on recurrent fall risk among older men with comorbid conditions.

Study 2: Factors Associated with Incident and Recurrent Falls among Evidence-Based Program Enrollees: An Examination of Race and Ethnicity

To examine race/ethnicity-based differences in factors associated with incident and recurrent falls, this study used a secondary dataset collected from a national dissemination of evidence-based fall prevention programs. To examine race- and ethnicity-based differences between non-Hispanic White (NHW), non-Hispanic Black (NHB), and Hispanic men, the primary purpose of this study was to identify the prevalence of incident and recurrent falls within a national sample of men ages 60 and older, with at least one chronic condition. The secondary

aim of this study was to identify the risk factors associated with incident and recurrent falls among these men. Baseline data were collected among older adults who registered to participate in a program. Analyses from this database did not attempt to evaluate the programs; rather, only cross-sectional baseline data were used.

By showing the prevalence of incident and recurrent falls, comparisons can be made between this nationally representative sample of older men and the current estimates about the prevalence of falls in other national samples. This study will demonstrate the risk factor distribution between NHW, NHB, and Hispanic males, and identify the prevalence of incident and recurrent falls by race/ethnicity. This study will also highlight the risk factors that are significant for recurrent falls within this sample of older men. Further, this study will demonstrate possible differences in risk profiles between incident and recurrent fallers.

Study 3: Factors Associated with Incident and Recurrent Falls among Non-Hispanic Black and Hispanic Men

To examine race/ethnicity-based differences among men of color in a larger study with more contextual variables, this study used a secondary dataset from a national survey of non-Hispanic Black and Hispanic men ages 60 years and older with chronic conditions. The purposes of this study were to identify: (1) the prevalence of incident and recurrent falls among non-Hispanic Black and Hispanic men with chronic conditions; and (2) factors associated with incident and recurrent falls among these understudied aging subgroups. An internet-delivered survey was used to collect data from a purposive sample of non-Hispanic Black and Hispanic men through a Qualtrics panel.

This study will compare risk factor distribution between Hispanic and NHB subgroups of older males, determine the factors that are significant for predicting the likelihood of reporting recurrent falls among older adult men of color, and highlight the effects of multimorbidity in this sample. This study will also highlight the factors that distinguish incident fallers from recurrent fallers among older men of color. This will help identify additional areas of research and intervention.

2. SCOPING REVIEW OF THE FALL-RELATED RISK FACTORS AMONG OLDER MALES

2.1 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 falls 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 the aging proportions in developing countries are also increasing (WHO, 2022), likely to worsen 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 recurrent falls 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). Among older adults, 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 adult (Ambrose et al., 2013). The largest increases in mortality from falls tend to occur quite commonly after age

85 (Moreland et al., 2020), and by 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; O & El Fakiri, 2015; Yi et al., 2021). Therefore, the purpose of this scoping review is to summarize the published evidence about falls and fall-related risk factors among community-dwelling older adult males, with particular attention to the risk for incident and recurrent falls.

2.2 Methods

2.2.1 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, 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 chosen 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.

2.2.2 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:

2.2.3 Inclusion and Exclusion Criteria

All studies included in the review were primary studies addressing at least one risk factor for incident fall or recurrent falls in community-dwelling adult males ages 60 years and older. All included studies must have contained detailed, separate data about older adult males. Studies with 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. Studies with dependent variables other than falls and recurrent falls (screening tests, scales, or physical tests) were excluded.

2.2.4 Data Extraction/Risk of Bias Assessment

On 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 the items 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". This appraisal was performed by two reviewers and conflicts were resolved by involving a third reviewer and occasionally, a fourth, reviewer.

2.3 Results

2.3.1 Search Results

Figure 2.1 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 which 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 2 lacked data on older adults); 20 studies were older than ten years prior; 30 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 or hospital inpatient, and 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.

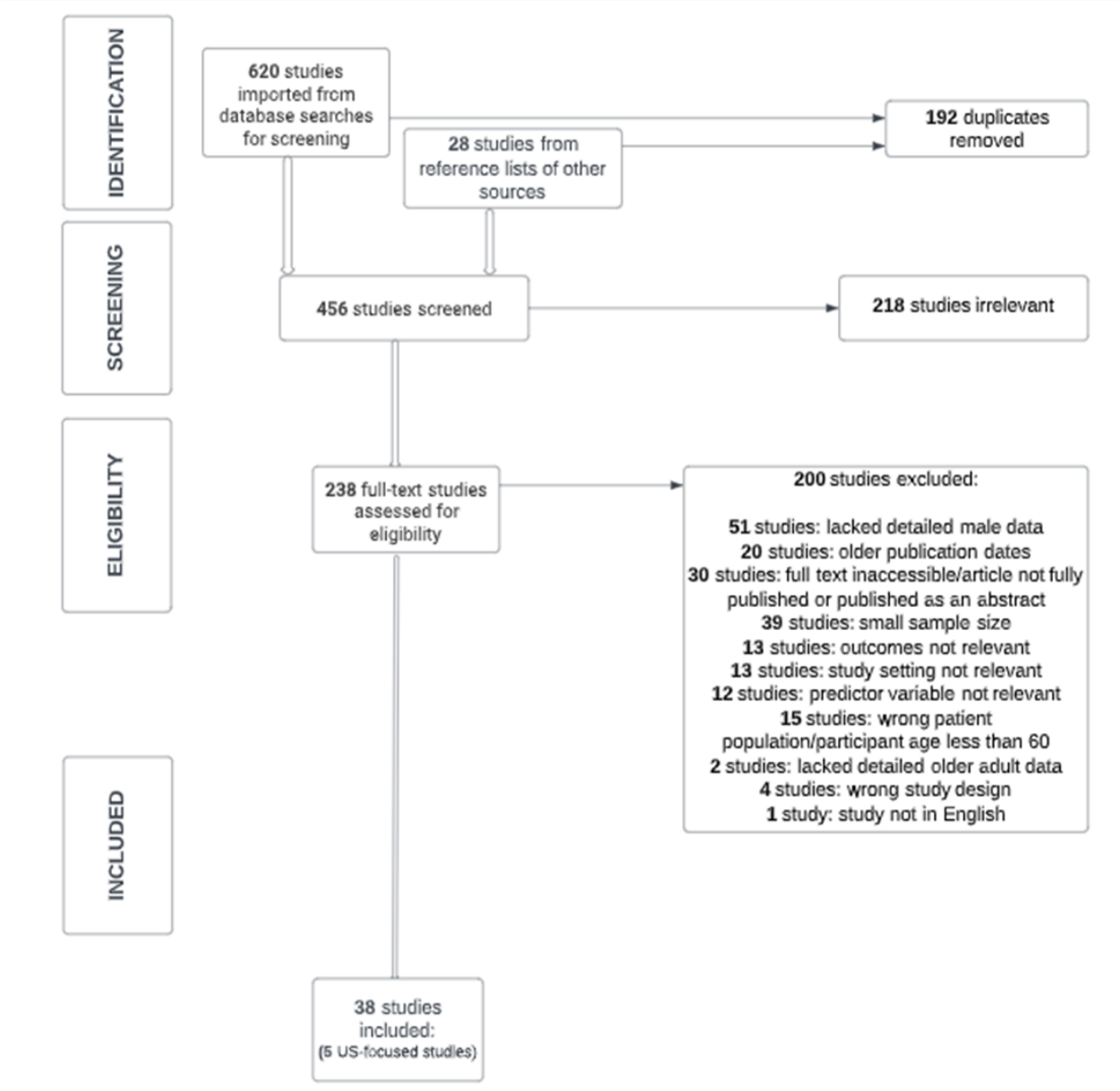

Figure 2.1 PRISMA flow diagram of the article selection procedure

2.3.2 Study Populations and Study Designs

The study designs and population characteristics of included studies are highlighted in Table 2.1. 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).

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., 2016); 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., 2016). Four studies were conducted at multicenter sites or utilized data 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., 2021), 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.

2.3.3 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 the two-component question: “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?’’, based on the high specificity of that format for quantifying the occurrence of falls

(Ganz et al., 2005). Another study asked participants, “have you had a fall in the past year?” and 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 4 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 4 months to assess falls over a period of 4 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 3 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., 2016), and both recurrent falls/any type of fall (Hung et al., 2017).

2.3.4 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.

Table 2.1 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

2.3.5 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., 2016), 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.

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.

2.3.6 Findings from International Studies

Table 2.2 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 fall vary, depending on the sampling methods, study design, and the unique sociodemographic characteristics of the sample.

2.3.6.1 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).

2.3.6.2 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., 2016). 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., 2017) 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).

2.3.7 Findings from US-based studies

2.3.7.1 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.

2.3.7.2. 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 involved in the 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).

2.3.7.3. 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).

Table 2.2 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) one or more falls; RR

			1.43 (1.06-1.92) recurrent falls
Chang & Do 2015	Multiple	Any fall	Widowed/separated/divorced OR 1.28 (1.03-1.61). Single (never married) 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	A one-unit increment of log-transformed high-sensitive cardiac troponin I (hs-cTnI) was associated with a HR 1.26 (1.04-1.53). Men with high-sensitive cardiac troponin T (hs-cTnT) ≥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 factors include 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). Pain had a significant dose-response relationship with falls.
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 men 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); (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 IRR1.35 (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	After adjusting for psychotropic medications, mobility and blood pressure, anxiety disorder was associated with falling OR 2.96 (1.07–8.21) and with Elderly Falls Screening Test score OR 3.46 (1.13–10.6)
Hung et al 2017	Multiple	Incident + recurrent falls	Depression measured on the Geriatric Depression Scale (GDS-5) was significantly associated with incident (OR 1.26 (1.09–1.44) and recurrent falls (OR 1.48 (1.27-1.73). Urinary Incontinence was significantly associated with recurrent falls only (OR 2.37 (1.45-3.82), but not incident fall.
Jefferis et al 2014	Physical activity, mobility limitations	Any fall	Among the 12% of men who had 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 PA [MVPA] and 22(95% CI 9, 35) minutes more in sedentary behavior.

Jefferis et al 2015	Physical activity, mobility limitations	Any fall	In 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). In men with mobility limitations, falls risk decreased with increasing activity, such that for every 1000 steps per day 1RR 0.80 (0.70-0.91). also, 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 NHW men population in the sample had the highest falls. Based on race/ethnicity, there was 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 educational attainment 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	The risk of falling increased with increasing instances of nocturia in the elderly male subpopulation of this study: 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, without impaired vision OR 1.25 (0.60–2.42). Without depressive symptoms, with impaired vision OR 1.06 (0.42– 2.37). With depressive symptoms, 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 0.78* (0.62–0.98).
Marshall et al 2017	Back pain	Any fall	For recurrent fall risk: 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	Among 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]) were independently associated with increased fall rates

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	Although women report more pain than men, men experience more injurious falls from pain than women. 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

2.4 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 many 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 not be limited to study methodology, but also to 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 literature about the risk factors for falls and recurrent falls among older adult males is limited, and there are much fewer studies on the effects of race on the subject for this subpopulation. This review examined the risk factors in the current literature, to highlight the findings of studies, gaps in the current understanding about race/ethnicity and recurrent falls and provide a basis for recommending further research on the subject, focusing on older adult males.

2.4.1 Risk Factors

About 60 risk factors were identified across the 38 studies. These risk factors, shown in Table 2.2, are similar to the ones that have been 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. (2015) 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., 2016). As chronic diseases characterized by chronic inflammation, they contribute to frailty and cause secondary sarcopenia (Cruz-Jentoft et al., 2019; Watson, 2012), which predisposes to recurrent falls among older adult males (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, which are consistent with some individual studies that have demonstrated an increased risk of falls (McDaniels-Davidson et al., 2018; van der Jagt-Willems et al., 2015), combined with the fact that kyphosis tends to be higher among men than women (Kado et al., 2007), suggest 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.

2.4.2 Recurrent Falls and Risk Factors

Information about the risk for incident and recurrent falls were 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). Also, 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).

In addition, this review showed 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.

2.4.3 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 with 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 categories. 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

categories 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. Like 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, 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., 2021). 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.

2.4.4 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 the studies.

Most of the retrospective studies used a recall period of 12 months, while only one used 3 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). To reduce the impacts of recall bias, there is need to include more objective fall ascertainment methods, such as electronic medical records, during the collection of fall data among older participants. The drawback to this is the tendency of older adults to seek care, if a fall does not result in major injury (Hoffman et al., 2018). In addition to recall bias, the stigmatization of frailty predisposes older adults to hiding any signs of weakness (Cummings et al., 1988; Garcia et al., 2015; Peel, 2000), likely contributing to underreporting.

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 include 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.

2.5 Conclusion

This review confirms that falls among older adults are multifactorial in their etiology. It is clear from the included studies that the prevalence of falls, however widely varied across study samples, is high among older adult males with comorbid conditions and other associated factors. Further, chronic diseases and frailty are strong predictors of falls among older adult men. More evidence is needed to understand risk factors identified by fewer studies or factors lacking statistical consensus, especially for race/ethnicity.

3. FACTORS ASSOCIATED WITH INCIDENT AND RECURRENT FALLS AMONG EVIDENCE-BASED PROGRAM ENROLLEES: AN EXAMINATION OF RACE AND ETHNICITY

3.1 Background

Physiologic age-related changes, which are largely adaptational, progressive, and often multisystemic, facilitate the development of chronic diseases, and worsen or accelerate frailty (Boros & Freemont, 2017; Harridge & Lazarus, 2017; Roberts et al., 2016). The aging musculoskeletal system prominently manifests the effects of frailty as the older adult becomes increasingly susceptible to falls (Immonen et al., 2020).

Falls are a major public health issue and are the leading cause of unintentional injury, which is a major cause of mortality among older adults, in the United States (Moreland & Lee, 2021). Out of the 2.4 million cases of unintentional injury that were seen in the emergency room (ER) in 2018, approximately 92% of them were due to falls (Moreland & Lee, 2021). Also, falls are the leading cause of death from unintentional injury among older adults (Kramarow et al., 2015); in 2018, 32,522 deaths among older adults were attributed to falls, out of a total of 57,213 deaths from unintentional injury (CDC, 2021).

In 2018, about 28% of older adults in the United States reported at least a fall, and this rate followed a two-year decline (Moreland et al., 2020). Prior to the decline, between 2012 and 2016, significant increases in fall reporting in this population had been previously observed (Moreland et al., 2020). A 2014 estimate showed that approximately 29% of older adults reported at least a fall in that year (Bergen et al., 2016). Despite the slight decline in rates, health care costs from unintentional injuries due to falls are expected to increase, as the older adult population in the United States increases (Moreland et al., 2020). In addition, more recently, new

findings show that incidence has been increasing at the rate of 1.5% annually (Hoffman et al., 2022). Taking all these into account, the prevalence of falls among older adults has not significantly diminished (Bergen et al., 2016; Moreland et al., 2020).

The literature on falls consistently demonstrates that age/aging is a major risk factor for falls (Hartholt et al., 2019; Lohman et al., 2019). This is underscored by the fact that when compared to other common causes of injury, beyond ER visits, falls accounted for most of hospitalizations from unintentional injuries among older adults, and the frequency of visits among adults aged 85 years and older was approximately four times as high as those reported in the 65 to 74-year age group (Moreland & Lee, 2021).

In addition to an aging physiology, modifiable coexisting chronic conditions have been identified in many studies as factors that can complicate the risk of falls in older adults, especially in the settings of higher multiples of comorbidities (Immonen et al., 2020; Kwon et al., 2018). Other risk factors include behavioral; sociodemographic, such as race/ethnicity; as well as social; and environmental, which are extrinsic to the individual. In the presence of one or more chronic diseases, older adults tend to fall more frequently (Kwon et al., 2018), leading to increased recurrence.

Important epidemiologic findings on the associations between risk factors and falls show that older adults, regardless of gender, are at risk of falls. Many studies reveal that risk is higher among women (Chang & Do, 2015; Moreland et al., 2021; Nicklett & Taylor, 2014; Sun et al., 2016; Verma et al., 2016). However, some authors show an increasing trend in incidence among men (Hartholt et al., 2012), and a small number of studies found higher risk (O& El Fakiri, 2015) and higher mortality rates in men (Burns & Kakara, 2018; Lohman et al., 2019; Orces, 2008). A review of the literature found that while women were more likely to suffer a fall, the mortality

rate was much higher in men (Ambrose et al., 2013). More specifically, a study that compared estimates between the Centers for Disease Control and Prevention (CDC) vital record data and data from the Health and Retirement Study (HRS), found that advanced age, male gender, and history of self-reported falls were independent risk factors for mortality from falls (Lohman et al., 2019). In addition, some studies comparing risk based on gender found that these risk factors tend to have different impacts, depending on sex; fall risk profiles in men differ significantly from women (Chang & Do, 2014; Ek et al., 2019; O & El Fakiri, 2015; Yi et al., 2021), especially comorbidities, which tend to be higher in men (Gale et al., 2018). Further, prevalence studies and studies on risk factor association with falls have been conducted among older adults, but data on prevalence and risk factor association with incident and recurrent falls, with detailed male data, highlighting national racial/ethnic distributions, are limited in US populations and/or lack consistency (Alamgir et al., 2012; Murphy et al., 2014; Wendelboe & Landen, 2011).

Moreover, despite the extensive body of literature on falls among older adults, it is important to investigate further, these specific risk factors, focusing on older adult males only, since many previous studies with community-dwelling participants present results for both sexes, where women make up significantly higher proportions of the sample size, for practical purposes (Dickinson et al., 2012). However, significant gender imbalance within a sample size may threaten the external validity of a study (Green & Glasgow, 2006). This current study utilized a large sample of male participants, to highlight the evidence needed to inform interventions that focus or depend on considerations for the differences in risk imposed by specific subgroup characteristics, such as gender and/or race/ethnicity.

To investigate the extent of the problem and examine race- and ethnicity-based differences between non-Hispanic White (NHW), non-Hispanic Black (NHB), and Hispanic

men, the primary aim of this study was to identify the prevalence of incident and recurrent falls within a national sample of men ages 60 and older, with at least one chronic condition, who enrolled in an evidence-based fall prevention program. The secondary aim of this study was to identify the risk factors associated with incident and recurrent falls among these men.

3.2 Methods

3.2.1 Study Participants and Procedures

The database used in this study was exported from a national repository of participants who enrolled in evidence-based fall prevention programming in the United States from August 2014 to February 2019. All grantees funded by the Administration for Community Living (ACL) to deliver fall prevention programs were required to enter workshop and participant data as well as information about workshop attendance and delivery sites. Additionally, grantees were required to collect and enter data at or before the first workshop session regarding participants' sociodemographics, fall history, fear of falling, and other fall-related risk factors. This study utilized these baseline participant data to meet study aims. The intention of this paper was not to assess the effectiveness of any fall prevention program for which the participants enrolled. Institutional Review Board approval was granted from The University of Georgia (#00000249) for this non-human subject research of secondary, de-identified data.

3.2.2 Measures

3.2.2.1 Dependent variables

The dependent variables were based on the number of times participants self-reported a fall in the previous three months. Participants were asked, "In the past 3 months, how many times have you fallen?" A fall was defined as unintentionally changing position to rest on the ground, floor, or any lower level. Responses were collected continuously but initially grouped

into three distinct categories: 0 falls (i.e., non-faller); 1 fall (i.e., incident faller); and 2 or more falls (i.e., recurrent faller). This trichotomous dependent variable was used to assess characteristics of incident and recurrent fallers relative to those who did not fall in the past 3 months. Subsequently, to examine differences between incident and recurrent fallers, participants who reported 0 falls were omitted from analyses to create a dichotomized variable to directly compare incident and recurrent fallers (i.e., 1 fall vs. 2 or more falls).

3.2.2.2 Independent variables

The primary independent variable of interest was race/ethnicity, which was a three-category variable (i.e., non-Hispanic White, non-Hispanic Black, Hispanic). Additional sociodemographic variables were included to account for variance in the dependent variable. Age was collected as a continuous variable in years but collapsed into a 4-category variable for analyses (i.e., 60-69, 70-79, 80-89, 90+). Educational status was assessed on a scale ranging from “less than high school” to “college graduate or higher”, which was collapsed to create a 3category variable (i.e., Less than high school, High school/GED/vocational training, College graduate or higher). Participants were also asked if they lived alone (i.e., yes, no). Using the ZIP code of the delivery location for the workshop, the ZIP Code Tabulation Area (ZCTA) was obtained and used to determine the median household income (2011-inflation-adjusted dollars), as a proxy indicator of affluence according to geographic location (Smith et al., 2018).

To better understand participants’ health status, they were asked to report if a healthcare provider ever told them that they had any of seven chronic conditions (e.g., arthritis/rheumatic disease, heart disease or blood circulation problem, diabetes, depression, cancer). The number of endorsed conditions were summed to create a count variable, which was used continuously in analyses (ranging from 0 to 7). Participants were asked to rate their general health status on a

5point Likert-type scale that ranged from “poor” (scored 1) to “excellent” (scored 5) (CDC, 2018), which was treated continuously in analyses.

Two fall-related risk factors were included in analyses based on their relevance to incident and recurrent falling. Participants were asked to rate their fear of falling using a 4-point Likert-type scale ranging from “not at all” (scored 1) to “a lot” (scored 4), which was treated continuously in analyses. They were also asked “During the last 4 weeks, to what extent has your concern about falling interfered with your normal social activities with family, friends, neighbors or groups?” Responses ranged from “not at all" (scored 1) to “extremely” (scored 5) and were treated continuously in analyses.

3.2.3 Statistical Analyses

All analyses were performed using SPSS version 28. Descriptive statistics were calculated for all variables of interest. Bivariate analyses were performed to compare sample characteristics by the three race/ethnicity categories of participants (i.e., NHW, NHB, and Hispanic). Pearson’s chi-square tests were used to assess the proportional differences across race/ethnicity for categorical variables. One-way Analysis of Variance (ANOVA) was used to assess mean differences for continuous variables. Bivariate analyses were also performed to estimate the prevalence of falls and recurrent falls among study participants and compare sample characteristics across three categories of fall status (no falls, one fall, and two or more falls). Pearson’s chi-square tests were used to assess the proportional differences across fall status categories for categorical variables. One-way ANOVA were used to assess mean differences for continuous variables. Statistical significance for this study was set a $p < 0.05$. Only variables with statistically significant bivariate associations with falls status were included in multivariable regression models.

A multinomial logistic regression model was fitted to identify factors associated with incident and recurrent falling relative to men who did not report a fall. Men who reported no falls in the past three months served as the referent category. Using the variance inflation factor, multicollinearity was assessed between the independent variables (Lee, 2021). The results of the multinomial regression model are presented as adjusted odds ratios, alongside their respective 95% confidence intervals (CI) and p-values. Then, the same independent variables used in the multinomial logistic regression were included in a binomial logistic regression to assess factors associated with recurrent falls among men who had fallen. Men who reported no falls in the past three months were excluded from this model, and incident fallers (i.e., 1 fall in the past three months) served as the referent category. The results of the binary logistic regression model are presented as adjusted odds ratio, 95% CI and p-values.

3.3 Results

3.3.1 Sample characteristics

As presented in Table 3.1, this sample contains 7,207 men ages 60 to 101 years with one or more chronic conditions. Of these men, 89.7% were non-Hispanic White (n=6,465), 5.0% were non-Hispanic Black (n=355), and 5.3% were Hispanic (n=387).

Of the participants, 62.1% reported no falls in the past 3 months, 19.1% reported one fall in the past 3 months, and 18.9% reported two or more falls in the past 3 months. The average age of participants was 77.8 (±8.0) years. Approximately 18% were ages 60 to 69 years, 38.7% were ages 70 to 79 years, 37.1% were ages 80 to 89 years, and 6.6% were 90 years and older. About 52% of participants had a college degree or higher, and 6.4% had less than high school education. About 24% of participants lived alone. The median household income in the ZIP

Code where they enrolled for the fall prevention program was $63,457. On average, participants reported 2.0 (±1.1) chronic conditions.

3.3.2 Sample characteristics by race/ethnicity

When comparing sample characteristics by race/ethnicity, a significantly larger proportion of NHW reported incident and recurring falls in the past three months ($\chi2=31.15$, $p<0.001$) relative to NHB and Hispanic participants. A larger proportion of NHW were in the older age groups relative to NHB and Hispanic participants ($\chi2=161.80$, $p<0.001$). While the majority (54%) of White men had college education or higher, larger proportions of NHB and Hispanic men had high school, GED, or vocational degree levels of education (49.9% and 42.4%) ($\chi2=530.07$, $p<0.001$). Across all three racial subgroups, fewer people lived alone, but a larger proportion of NHB participants lived alone relative to NHWs and Hispanic men ($\chi2=60.31$, $p<0.001$). On average, NHW men enrolled in programs delivered in areas with higher median household incomes ($f=89.39$, $p<0.001$). On average, NHW participants reported significantly higher general health status (3.1±0.8) compared to NHB (2.9±0.8) and Hispanic (2.8±0.9) participants, respectively ($f=35.02$, $p<0.001$). On average, Hispanic men reported higher fear of falling levels ($f=19.16$, $p<0.001$) and more activity limitations because of their concerns about falling ($f=3.24$, $p=0.039$) relative to their NHW and NHB counterparts, respectively.

3.3.3 Sample characteristics by fall status.

When comparing sample characteristics by fall status, a significantly larger proportion of men in the 65 to 79 age groups reported recurrent falls (i.e., 2 or more falls; $\chi2=32.15$, $p<0.001$). On average, men reporting recurrent falls reported significantly more chronic conditions

(f=47.31, p<0.001), worse general health status (f=97.14, p<0.001), higher fear of falling (f=221.42, p<0.001), and more activity limitations because of their concerns about falling (f=332.76, p<0.001) relative to those reporting no falls or an incident fall only, respectively.

Table 3.1 Bivariate Associations of sample characteristics by race/ethnicity and falls.

			Race/Ethnicity					**Falls in the past 3 months**				
	Frequency (n=7207)	**Total (n=7207)**	**NHW (n=6465)**	**NHB (n=355)**	**Hispanic (n=387)**	**X^2/f**	**P**	**0 Falls (n=4474)**	**1 Fall (n=1374)**	**≥2 Falls (n=1359)**	**X^2/f**	**P**
Number of Falls (past 3 months)						32.15	<0.001					
0 Falls	4474	62.1%	61.0%	74.4%	68.2%			--	--	--		
1 Fall	1374	19.1%	19.5%	13.5%	16.3%			--	--	--		
≥2 Falls	1359	18.9%	19.4%	12.1%	15.5%			--	--	--		
Race/Ethnicity											32.15	<0.001
Non-Hispanic White (NHW)	6465	89.7%	--	--	--			88.2%	91.9%	92.4%		
Non-Hispanic Black (NHB)	355	4.9%	--	--	--			5.9%	3.5%	3.2%		
Hispanic	387	5.4%	--	--	--			5.9%	4.6%	4.4%		
Age						130.81	<0.001				19.61	0.003
60-69	1267	17.6%	16.1%	36.9%	25.3%			17.3%	15.9%	20.1%		
70-79	2790	38.7%	38.8%	36.1%	39.3%			39.1%	37.6%	38.6%		
80-89	2672	37.1%	38.2%	22.3%	31.3%			37.6%	38.4%	34.1%		
90+	478	6.6%	6.9%	4.8%	4.1%			6.0%	8.1%	7.2%		
Education											2.90	0.574
Less than HS	462	6.4%	4.4%	18.3%	29.7%	530.07	<0.001	6.6%	6.3%	5.9%		
High School GED/Vocational	3036	42.1%	41.7%	49.9%	42.4%			41.8%	41.5%	44.0%		

College Grad or Higher	3709	51.5%	54.0%	31.8%	27.9%			51.7%	52.2%	50.1%		
Live Alone						60.31					0.72	0.698
Yes	1766	24.5%	23.4%	41.1%	28.2%		<0.001	24.7%	24.8%	23.6%		
No	5441	75.5%	76.6%	58.9%	71.8%			75.3%	75.2%	76.4%		
Median Household Income	--	63457.5 (±24578.4)	64733.5 (±24167.1)	50180.5 (±23072)	54320.1 (±27123.9)	89.39	<0.001	63621.3 (±25189.4)	63987.5 (±24193.6)	62382.6 (±228853.2)	1.72	0.179
Number of Chronic Conditions	--	2.0(±1.1)	2.0(±1.1)	2.1(±1.2)	2.1(±1.2)	0.31	0.736	1.9(±1.1)	2.1(±1.1)	2.3(±1.3)	47.31	<0.001
General Health Status	--	3.1(±0.8)	3.1(±0.8)	2.9(±0.8)	2.8(±0.9)	35.02	<0.001	3.2(±0.8)	3.0(±0.8)	2.9(±0.8)	97.14	<0.001
Fearful of Falling	--	2.4(±0.9)	2.4(±0.9)	2.1(±1.0)	2.8(±0.9)	19.16	<0.001	2.24(±0.9)	2.5(±0.8)	2.8(±0.9)	221.42	<0.001
Concerns about Falling Limit Activities	--	2.0(±1.0)	2.0(±1.0)	2.0(±1.2)	2.1(±1.2)	3.24	0.039	1.8(±0.9)	2.1(±1.0)	2.5(±1.1)	332.76	<0.001

3.3.4 Factors associated with incident and recurrent falls relative to no falls.

From the significant associations demonstrated in the bivariate analysis, Table 3.2 presents the findings of the multinomial logistic regression examining factors associated with reporting an incident fall and recurrent falls relative to reporting no falls in the past three months. Compared to NHW men, NHB (OR 0.55, 95% CI 0.40-0.76) and Hispanic (OR 0.70, 95% CI 0.52-0.93) were significantly less likely to report an incident fall. Men who perceived themselves to have better general health status were less likely to report an incident fall (OR 0.89, 95% CI 0.82-0.97). Conversely, men who were more fearful of falling (OR 1.16, 95% CI 1.08-1.26) and reported more activity limitations because of concerns about falls (OR 1.32, 95% CI 1.24-1.42) were more likely to report an incident fall.

In terms of recurrent falls, compared to NHW men, NHB (OR 0.41, 95% CI 0.29-0.59) and Hispanic (OR 0.58, 95% CI 0.43-0.79) men were significantly less likely to report recurrent falls. Relative to men ages 60 to 69 years, those in age groups 70 to 79 (OR 0.79, 95% CI 0.660.95) and 80-89 (OR 0.68, 95% CI 0.56-0.82) were less likely to report recurrent falls. Each additional chronic condition reported increased the likelihood of recurrent falls (OR 1.10, 95% CI 1.04-1.16). Men who perceived themselves to have better general health status were less likely to report recurrent falls (OR 0.82, 95% CI 0.75-0.89). Conversely, men who were more fearful of falling (OR 1.46, 95% CI 1.34-1.59) and reported more activity limitations because of concerns about falls (OR 1.71, 95% CI 1.60-1.84) were more likely to report recurrent falls.

Table 3.2 Factors associated with incident and recurrent falls.

	1 FALL				**≥2 FALLS**			
		95% CI				**95% CI**		
	OR	**Lower**	**Upper**	**p**	**OR**	**Lower**	**Upper**	**p**
Non-Hispanic White (NHW) (referent)	1.00	--	--	--	1.00	--	--	--
Non-Hispanic Black (NHB)	0.55	0.40	0.76	<0.001	0.41	0.29	0.59	<0.001
Hispanic	0.70	0.52	0.93	0.015	0.58	0.43	0.79	<0.001
Age: 60-69 (referent)	1.00	--	--	--	1.00	--	--	--
Age: 70-79 (vs 60-69)	0.99	0.82	1.19	0.907	0.79	0.66	0.95	0.012
Age: 80-89 (vs 60-69)	1.01	0.84	1.22	0.912	0.68	0.56	0.82	<.001
Age: 90+ (vs 60-69)	1.25	0.95	1.64	0.110	0.80	0.60	1.06	0.121
Number of Chronic Conditions	1.04	0.99	1.11	0.131	1.10	1.04	1.16	0.001
General Health Status	0.89	0.82	0.97	0.005	0.82	0.75	0.89	<0.001
Fearful of Falling	1.16	1.08	1.26	<0.001	1.46	1.34	1.59	<0.001
Concerns about Falling Limit Activities	1.32	1.24	1.42	<0.001	1.71	1.60	1.84	<0.001

Referent: 0 Fall

3.3.5 Factors associated with recurrent falls relative to incident falls.

Table 3.3 reports findings of the binary logistic regression examining factors associated with reporting recurrent falls relative to an incident fall in the past three months. Relative to men ages 60 to 69 years, men 80-89 (OR 0.73, 95% CI 0.58-0.92) and 90+ years (OR 0.67, 95% CI 0.48-0.94) were less likely to report recurrent falls. Men who reported being fearful of falling (OR 1.28, 95% CI 1.16-1.41) and reported more activity limitations because of concerns about falls (OR 1.31, 955 CI 1.21-1.42) were more likely to report recurrent falls.

Table 3.3 Factors associated with recurrent falls relative to incident falls.

		95% CI		
	OR	**Lower**	**Upper**	**p**
Non-Hispanic White (NHW) (referent)	1.00			
Non-Hispanic Black (NHB)	0.73	0.47	1.14	0.168
Hispanic	0.80	0.55	1.17	0.243
Age: 60-69 (referent)	1.00			
Age: 70-79 (vs 60-69)	0.85	0.68	1.06	0.144
Age: 80-89 (vs 60-69)	0.73	0.58	0.92	0.006
Age: 90+ (vs 60-69)	0.67	0.48	0.94	0.021
Number of Chronic Conditions	1.06	0.99	1.13	0.118
General Health Status	0.92	0.83	1.02	0.102
Fearful of Falling	1.28	1.16	1.41	<0.001
Concerns about Falling Limit Activities	1.31	1.21	1.42	<0.001

Referent: 1 fall

3.4 Discussion

This study identified factors associated with incident and recurrent falls among older NHW, NHB, and Hispanic men with chronic conditions. With a mean age of 77.8 (±8.0) years, the proportion of men who reported at least one fall was approximately 38% (19.1% for incident fallers and 18.9% for recurrent fallers). This is much higher than the proportion of men who reported at least one fall in some previous studies; a study conducted in Canada reported a prevalence of 17.3% among men (Chang & Do, 2015), a Turkish study using four objective testing measures for falls, reported a 25.4% prevalence (Dokuzlar et al., 2020), and among community-dwelling men in the US, one study observed a 25% rate of reporting falls (Munch et al., 2015), while another showed a 26.5% prevalence among men (Paliwal et al., 2017).

The samples in many of these earlier studies had lower average ages than the current study and participants reported falls after 12 months (Chang & Do, 2015; Munch et al., 2015; Paliwal et al., 2017), as opposed to the current study's past three months reporting period. In a prospective study in Australia focusing only on older men, with similar average age (77.3 years) but fall reporting during a mean follow-up period of 42.6±8.7 months, recorded higher rates of fall reporting among men (47%) (Khalatbari-Soltani et al., 2021). The shorter reporting period may have reduced fall underreporting, compared to older studies that relied on longer reporting times (Fujimoto et al., 2000; Karlsson et al., 2014). The presence of multimorbidity among participants may also indicate that the men in the current study may not be as healthy as those in other studies, which may also account for the higher reported fall rate in the current study. Further, because the men in the current study actively enrolled in a fall prevention program, it is possible that they recently experienced a fall or were more fearful of falling than other men not electing to enroll in such a program (i.e., possible self-selection bias).

Although NHB and Hispanic men had more predominant risk factors associated with falls when compared to their NHW counterparts, respectively, they reported significantly fewer incident and recurrent falls than NHW men. This contradicts the findings of an international study, in which falls among US older adult males were compared across racial/ethnic groups, but there were no significant differences (Karlsson et al., 2014). In this current study's sample, NHW men were generally older than NHB and Hispanic men and have longer life expectancies generally (Bond & Herman, 2016; Sun et al., 2016) which may explain the widened fall-related disparities between older men based on race/ethnicity. However, despite differences in prevalence, some authors found that fall-related mortality does not differ by race/ethnicity among older adult men and women combined (Nicklett & Taylor, 2014).

This study adds to the current literature by highlighting the fact that race/ethnicity may be a significant predictor of recurrent falls within the previous three months among older men. These findings support those from previous studies about race/ethnicity-based differences in fall prevalence (Geng et al., 2017; Nicklett & Taylor, 2014; Wehner-Hewson et al., 2021). The current study findings also contradict findings from earlier studies identifying no such differences (Karlsson et al., 2014; Kwon et al., 2018) however, these studies were not specific to older men living with chronic conditions.

Although cultural considerations suggest that older adults of color tend to live with caregiving relatives, which is sometimes supported by data (Okoye et al., 2021), the NHB men in the current study were significantly more likely to live alone, compared to NHW and Hispanic men (Verdery & Margolis, 2017). However, this is somewhat contradictory to another study reporting that both NHW and NHB men are equally likely to live alone (Sun et al., 2016). It appears that although living alone may independently increase the risk of falls among older

adults (Ek et al., 2019; Zeytinoglu et al., 2021), the characteristics of the homes and neighborhoods in which older adults live are equally strong factors when considering living situations, and the homes of older adults who report recurrent falls tend to be characterized by disorderliness and disrepair (Okoye et al., 2021).

On average, participants reported having 2.0 (±1.1) chronic conditions, and the current study's findings suggest that higher comorbidities were associated with incident and recurrent falls. For incident falls, contrary to what this current study found, one study showed that this relationship is either more pronounced or observed only in women (Chang & Do, 2015), while another study found that the dose-response relationship exists in older adults regardless of gender (Immonen et al., 2020). In a study conducted among community-dwelling older adults who had been previously hospitalized for a fall-related injury, comorbidity and higher multiples of comorbid conditions were found to be overwhelmingly higher among men than in women (Vu et al., 2011). Overall, in the context of falls and injury, comorbid diseases tend to have serious effects in older adults, especially in men with advanced ages (Ek et al., 2019), because comorbidities increase the recurrence of falls (Kwon et al., 2018; Okoye et al., 2021) by being associated with or directly causing significant morbidity and disability in already severely sarcopenic men (Burns & Kakara, 2018; Gregg et al., 2000; Yang et al., 2016). Also, by activating chronic inflammation, decreasing activity, and causing impairments in metabolism, comorbidities directly cause sarcopenia in older adults (Watson, 2012), so-called secondary sarcopenia (Cruz-Jentoft et al., 2019), a strong predictor of falls (Bischoff-Ferrari et al., 2015; Schaap et al., 2018). The current study adds to the literature because it specifically identifies that having more comorbidities was associated with recurrent falls among older men with chronic conditions.

When looking at the full sample, participants' perceived general health status, fear of falling, and activity limitations because of fall-related concerns were associated with incident or recurrent falls. More specifically, compared to men who did not fall, men reporting incident and recurrent falls reported worse health status, more fear of falling, and more activity limitations because of fall-related concerns. From this study, being fearful and being concerned about falling increased the likelihood of reporting a fall, and these two increased the risk of reporting recurrent falls. This is consistent with the findings of an earlier study, which compared the risk of falls from fear of falling across multiple racial/ethnic groups; NHW adults reported more fear of falling than NHB, which they suggested could explain the lower incidence of falls among NHB adults (Singh et al., 2020).

Individuals who have experienced a fall may develop fear of falling, which eventually modifies behavior toward further adopting sedentary lifestyle (Pellicer-García et al., 2020). Hence, as these older adults become frailer, they tend to become less active (Liu et al., 2021), likely for fear of suffering an injurious or fatal fall. As fear of falling and/or concern about falling reduces motivation or self-efficacy to adopt recommended health practices, or act as a potential barrier to socializing or engaging in physical activity programs (Okoye et al., 2022), older adults continue to avoid physical activities, and a vicious cycle of disuse atrophy and sarcopenia of the lower limb muscles occurs, which, in an individual with multiple comorbid conditions, worsens the risk of more falls or recurrent falls (Jiang et al., 2022).

While fear of falling is more likely associated with females (Birhanie et al., 2021; Liu et al., 2021; Singh et al., 2020), a study among older adults with activity of daily living (ADL) impairments showed that fear of falling was more strongly associated with recurrent falls among men than women (O & El Fakiri, 2015). Thus, further investigation into the effects of fear of

falling among men, especially older men of color, will contribute to our understanding of the gender-specific associations between fear of falling and falls.

An interesting finding from this study is that contrary to the previous literature, older men were less likely than older men to report incent and recurrent falls, respectively. There are a few possible interpretations of these unique findings. Because these male participants self-selected to enroll in an evidence-based fall prevention program, it is possible that they may have experienced a recent fall, had more severe fall-related consequences, and/or been encouraged to enroll by a healthcare professional or family member. Having higher risk or more adverse events may be especially relevant for the younger men ages 60-69 years, who are well below the mean age for evidence-based fall prevention programs (Smith et al., 2018). Another possibility is that the older men in this study, despite their age, were less at-risk for falls relative to their younger counterparts because of their lifestyle, living situation, and/or chronic disease status. For example, it may be that the older men in this study were not working or less mobile in the community, which may have been a protective factor in this study, despite sedentary behavior and immobility being known risks factors for falls (Bergen et al., 2019; Deandrea et al., 2010). More research is needed to better understand the relationship between age and falling among men enrolling in fall prevention programming.

Although the current study analyzed data from older men with chronic conditions who enrolled in evidence-based fall prevention programs (Smith et al., 2018), it did not evaluate the effectiveness of these programs to reduce falls or fall-related risk factors. Such evidence-based programs have demonstrated efficacy to reduce fear of falling (Yoshikawa et al., 2020) improve physical activity (Fernández-Argüelles et al., 2015; Sherrington et al., 2017) increase confidence to prevent and manage a fall (Arnold et al., 2011), and prevent falls (Guirguis-Blake et al., 2018).

One aspect of interventions that is of particular importance is the management of chronic diseases, either tailored to address specific individual comorbid conditions (Smith et al., 2017) or multimorbidity, where feasible (Ory et al., 2013), since these have been shown in the past to be effective in preventing hospitalizations and improving healthy behaviors in general (Lorig et al., 1999). The findings of the current study suggest that efforts that prioritize chronic disease management among older adult males can potentially reduce or prevent recurrent falls (Immonen et al., 2020; Paliwal et al., 2017), because many of these modifiable comorbid risk factors can be targeted long before the individual experiences the first episode of a fall, since a previous episode of fall is a risk factor for recurrent falls (Pellicer-García et al., 2020), and likely much more adversely eventful falls among older men (Ek et al., 2019). While many current interventions tend to produce inconsistent effects on the risk of falling, there is evidence that some multifactorial and/or tailored approaches are still effective in reducing falls among older adults (Guirguis-Blake et al., 2018). Finally, although differences in the number of chronic conditions based on race/ethnicity did not exist in the current study's sample, further exploration of the effects of chronic diseases on falls among older males of color will substantially provide more evidence to address falls in these subpopulations of older adult males, since older adults of color tend to report more comorbidities and physical impairments (Kwon et al., 2018; Nicklett & Taylor, 2014; Sun et al., 2016).

3.4.1 Strengths and limitations

This study was not without limitations. First, it relied on self-reported data, which may have introduced recall bias and inaccurate reporting. Many falls among community-dwelling older adults are not witnessed by others, or not severe enough to cause injuries or require medical care, they often go unreported (Hoffman et al., 2018). Although older adults are more

likely to recall falls that result in injury or hospitalizations (Chan et al., 2007), the impacts of recall bias on the internal validity of measures such as non-injurious falls were minimized by the relatively short passage of time in the current study (i.e., past 3 months).

Second, the sample may have been biased because all participants in the dataset were enrolled to participate in an evidence-based fall prevention program. As such, this means that these men may not have been representative of the larger male population because they voluntarily elected to participate in a fall-related intervention. For example, relative to the average older adult male, it is possible that the men in this sample were more likely to have experienced a fall or been more fearful of falling. In addition, the proportions in this sample are not completely reflective of the racial proportions in the United States (United States Census Bureau, 2022), suggesting that the findings of this study may not be generalizable to the larger, national male population. This study had a substantially larger proportion of NHW compared to NHB and Hispanic men, hence, additional studies are needed that purposively examine incident and recurrent falls, and related risk factors, among older NHB and Hispanic men.

Third, because these data were used cross-sectionally (i.e., only using baseline measures), this study could not determine causality between reported falls and specific risk factors. However, this study provides direction for other studies that seek to investigate causality and the underlying mechanisms between some of these risk factors and falls.

Fourth, while this study had a large sample size and allowed for the control of a sufficient number of confounders in this ethnically diverse national sample, assessing gender-specific risk factors, the variables available in the baseline data was limited. There may have been many important factors contributing to incident and recurrent falls that were not measured in this

dataset (e.g., social supports like marital status, household composition, household income, barriers to disease self-management, details about disease history and treatment).

3.5 Conclusion

This descriptive study highlights the prevalence of risk factors for incident and recurring falls among older men with chronic conditions. Findings suggest that NHW men report more incident and recurrent falls, despite NHB and Hispanic men having more risk factors at younger ages. This study reinforces that known risk factors are associated with recurrent falls (i.e., older age, more comorbidities, worse general health, fear of falling, limited activity because of fall concerns), but these findings are specific to a sample of older men with one or more chronic conditions. These findings may guide future research to identify risk for and prevent incident and recurrent falls among older men. Further, this study may help contextualize the men enrolling in fall prevention programming in their communities. Efforts to improve chronic disease management among these men may be particularly useful to alleviate physical and psychosocial issues brought about by their conditions, which in turn, can reduce risk related to incident or recurrent falls.

4. FACTORS ASSOCIATED WITH INCIDENT AND RECURRENT FALLS AMONG NON-HISPANIC BLACK AND HISPANIC MEN

4.1 Background

Falls are among the leading causes of morbidity and mortality among older adults in the United States (Centers for Disease Control and Prevention [CDC], 2022; Kramarow et al., 2015) and can lead to prolonged and costly hospitalizations and premature death (Burns et al., 2022). More than one-quarter of the population of adults who are 65 years and older experience a fall annually (Moreland et al., 2020), with high hospitalization rates among those who are 85 years and older (Bergen et al., 2019; Moreland et al., 2020; Moreland & Lee, 2021). Recently, incidence rates were shown to be increasing by about 1.5% annually (Hoffman et al., 2022). With the rapid expansion of the older adult population (Moreland et al., 2020; U.S. Department of Health and Human Services [HHS], 2021) and steady rise in risk and mortality among older adult men (Ambrose et al., 2013; Burns & Kakara, 2018; Lohman et al., 2019; O & El Fakiri, 2015), falls in the United States continue to constitute a worsening burden of disease. Beyond incident falls and their negative consequences, recurrent falls among older adults tend to be associated with more adverse complications (Jo et al., 2020; Sun et al., 2016).

While the prevalence rates of incident and recurrent falls are often higher among non-Hispanic White adults (Bergen et al., 2019; Moreland et al., 2020; Paliwal et al., 2017; Sun et al., 2016), some studies have reported higher prevalence or similar prevalence between NHW and older adults of color (Grudstrom et al., 2012; Karlsson et al., 2014; Kwon et al., 2018; Niclett & Taylor, 2014). The expansion in this subpopulation is also accompanied by significant shifts in racial/ethnic subgroups, such that people of color may represent most of the United States' population by 2044 (Frey, 2014). These demographic shifts raise concerns because of the current

risk profiles of certain minority groups, who tend to experience more comorbid diseases and functional impairments (e.g., cardiovascular disease, musculoskeletal problems) (Kwon et al., 2018; Nicklett & Taylor, 2014; Sun et al., 2016) because many of these systemic pathologies, especially musculoskeletal disease, predispose them to frequent falls (Immonen et al., 2020; Paliwal et al., 2017).

Broadly, fall-related risk factors are categorized as either modifiable or nonmodifiable, which can be intrinsic (e.g., age, gender, race/ethnicity, and comorbidities) or extrinsic (e.g., physical and social environments, socioeconomic status, access to care) to the older adult (Ambrose et al., 2013). Compared to older women, who tend to report more falls, older men who fall experience more severe complications and poorer outcomes (Burns & Kakara, 2018; Lohman et al., 2019). Because the frequency and severity of falls differ between the two genders, after accounting for age (Chang & Do, 2014; Ek et al., 2019; Gale et al., 2018; O & El Fakiri, 2015; Yi et al., 2021), the higher health complications among men after a fall warrants additional attention to understand factors that may predict incident and recurrent falls among older males.

Falling may partly be attributed to older adults having higher rates of frailty and more comorbid conditions, and partly due to poor access to care and preventive services and programs, which can protect against recurring episodes of falls, especially among minorities (Nicklett & Taylor, 2014). While frailty is common to older adults, self-efficacy to manage health (Okoye et al., 2022) and the availability of social support (Assari & Moghani-Lankarani, 2018) have been shown to significantly differ between racial and ethnic groups. Within the adult population, variation in fall-related risk across racial groups is mostly clear (Kwon et al., 2018; Moreland et al., 2020; Moreland & Lee, 2021 Nicklett & Taylor, 2014; Okoye et al., 2021; Sun et al., 2016), without considering gender-specific risks. However, the evidence pertaining to racial differences

in falls is limited among men (Karlsson et al., 2014), and less is known about the comparison of risk of both incident and recurrent falls between older Black and Hispanic subgroups of men with comorbid diseases in the United States. Investigating falls among older men of color is imperative to highlight the impacts of health disparities on the life-course of aging minorities (Herd et al., 2011). Further, considering the growth of older adult minority populations in the United States, and the limited and inconsistent data about older adult male risk factors for falls and recurrent falls (Karlsson et al., 2014; Nicklett & Taylor, 2014), it is essential to investigate this health problem across minority subpopulations. Therefore, the purposes of this study are to identify: (1) the prevalence of incident and recurrent falls among NHB and Hispanic men with chronic conditions; and (2) factors associated with incident and recurrent falls among these understudied aging subgroups.

4.2 Methods

4.2.1 Study Participants and Procedures

Data for this cross-sectional study utilized secondary data collected between September and November 2019 from an internet-delivered survey using a Qualtrics panel. Data were examined as part of a larger study investigating health-related attitudes and behaviors, and facilitators to and barriers of medical and preventive health service utilization, among non-Hispanic Black (NHB) and Hispanic men ages 40 years and older with one or more chronic diseases (Sherman et al., 2021; Smith et al., 2022).

Overall, 2,028 men meeting inclusion criteria completed the questionnaire. Participants completed a 105-item survey developed by the research team, which was largely comprised of content from other validated sources (Smith et al., 2022). This study was reviewed and approved by the Institutional Review Board at Texas A&M University (#2018-1684). Given this study's

focus on older adult falls, 1,249 men were omitted because they were ages 40 to 59 years. The remaining analytic sample of 779 NHB and Hispanic men were ages 60 and older with one or more chronic conditions.

4.2.2 Measures

4.2.2.1 Dependent variables

The dependent variables were based on the number of self-reported falls reported by participants in the previous twelve months. Participants were asked, "In the past 12 months, how many times have you fallen?". Data were reported continuously but responses were collapsed into three categories: 0 falls (i.e., non-faller); 1 fall (i.e., incident faller); and 2 or more falls (i.e., recurrent faller). Trichotomizing this variable was used to compare characteristics of incident and recurrent fallers relative to those who did not experience a fall in the past 12 months. Then, to directly compare incident fallers to recurrent fallers, men who reported 0 falls were omitted to create a dichotomous variable (i.e., 1 fall vs. 2 or more falls).

4.2.2.2 Independent variables

Sociodemographic

The primary independent variable of interest was race/ethnicity (i.e., non-Hispanic Black, Hispanic). Additional personal characteristics of interest included (i.e., 60-64, 65-69, 70-74, 75+), educational attainment (i.e., ≤high school graduate, some college/2-year degree, ≥4-year degree), relationship status (i.e., married/partnered, never married/divorced/separated/widowed), number of persons living in the household (including self), annual household income level (treated continuously in mostly $10,000 USD increments), residential rurality (i.e., metro, nonmetro), and if they currently had insurance (i.e., no, yes).

Health Status

Participants were asked to report if a healthcare provider ever told them that they had any of 18 chronic conditions (i.e., asthma/emphysema/other chronic breathing or lung problem, arthritis/rheumatic disease, cancer/cancer survivor, chronic pain, diabetes, heart disease, high cholesterol, high blood pressure, kidney disease, memory problem, obesity, osteoporosis, obstructive sleep apnea, schizophrenia or other psychotic disorder, stroke, thyroid problem, urinary incontinence, other chronic condition). The number of endorsed conditions were summed to create a count variable for the number of chronic conditions. Participants were asked to report the number of medications they took daily, which was treated continuously in analyses: "How many different medications do you take each day?". This generated a variable that was treated continuously (range from 0 to ≥6). General health status was measured on a 5-point Likert-type scale that ranged from "poor" (scored 1) to "excellent" (scored 5) (CDC, 2018), and was treated continuously in analyses. Depressive symptomatology was assessed using the Patient Health Questionnaire-2 (PHQ-2), which consists of two questions (Kroenke et al., 2003; Spitzer, 1999). Both items were scored on 4-point scales and summed to have a range from 0 to 6. This study used the recommended threshold to identify no current depressive symptomatology (0–2 score) and current depressive symptomatology (3–6 score). Participants were also asked to report if they "had a routine check-up with a healthcare provider within the past year" (i.e., no, yes).

Perceived Support

Participants were asked to report the degree to which they got the help and support needed to improve their health and manage their health problems. Responses were collected on a 5-point scale, which is dichotomized (i.e., never/rarely/occasionally, frequently/always).

Disease Self-Management Efficacy Scale

Participants were asked to rate their ability to manage their chronic conditions on 10 items, with each using a 4-point Likert scale from strongly disagree (scored 1) to strongly agree (scored 4). Scores were summed to create a composite score ranging from 10 to 40, which was treated continuously in analyses (Ory et al., 2013; Smith et al., 2022). Higher scores indicate stronger self-efficacy. The Cronbach's alpha for this scale in the current sample was 0.904.

4.2.3 Statistical Analyses

All analyses were performed using SPSS version 28. Descriptive statistics were calculated for all variables of interest. Bivariate analyses were performed to compare sample characteristics by the race and ethnicity of study participants (i.e., NHB and Hispanic). Pearson's chi-square tests were used to assess the proportional differences across race/ethnicity for categorical variables. To compare study variables by race/ethnicity, independent sample ttests were used to assess mean differences for continuous variables. Bivariate analyses were also performed to estimate the prevalence of incident and recurrent falls among study participants and compare sample characteristics across three categories of fall status (i.e., no falls, one fall, and two or more falls). Pearson's chi-square tests were used to assess the proportional differences across fall status categories for categorical variables. One-way ANOVA was used to assess mean differences for continuous variables. Statistical significance for this study was set at $p < 0.05$. Only variables with statistically significant bivariate associations with falls status were included in multivariable regression models.

A multinomial logistic regression model was fitted to identify factors associated with incident and recurrent falling. Men who reported no falls in the past twelve months served as the referent category. Using the variance inflation factor, multicollinearity was assessed between the independent variables. The results of the multinomial regression model are presented as adjusted

odds ratios, alongside their respective 95% confidence intervals (CI), and p-values. Then, the same independent variables used in the multinomial logistic regression were included in a binomial logistic regression to assess factors associated with recurrent falls among men who had fallen. As such, men who reported no falls in the past twelve months were excluded from this model, and incident fallers (i.e., 1 fall in the past three months) served as the referent category. The results of the binary logistic regression model are presented as adjusted odds ratio, 95% CI and p-values.

4.3 Results

4.3.1 Sample characteristics

As seen in Table 4.1, this sample contains 779 non-Hispanic Black (n=458) and Hispanic (n=321) men, ages 60 to 93 years with one or more chronic conditions. Of the participants, 73% reported no falls in the past 12 months, 12.6% reported one fall in the past 12 months, and 14.4% reported two or more falls in the past 12 months. The average age of these men was 66.8 (±5.4) years. About 40% were ages 60 to 64, while 32% were ages 65 to 69 years, 18.7% were ages 70 to 74 years, and 9.6% were ages 75 years and older. About 40.9% of participants had a college degree or higher, and 16.4% had a high school education or less. Approximately 60% of participants were married or had partners. The average annual income was in the range of $50,000-59,999. Participants reported an average of 3.8(±2.7) chronic diseases and an average of 2.2(±1.2) persons in their households. Approximately 95% of participants had some health insurance and lived in urban areas, respectively.

4.3.1.1 Sample characteristics by race/ethnicity

When comparing sample characteristics by race/ethnicity, a significantly larger proportion of Hispanic men reported incident and recurring falls in the past twelve months

($\chi2$=10.38, p=0.006). A larger proportion of Hispanic men were in the older age groups relative to NHB men, although this was not statistically significant ($\chi2$=3.40, p=0.334). While the majority (51%) of Hispanic men had 4-year degree or higher, non-Hispanic Black men predominantly had high school or less, or some college (2-year degree) ($\chi2$=23.22, p<0.001). Between the two racial subgroups, fewer people were not partnered, but a larger proportion of NHB participants were not partnered relative to Hispanic men ($\chi2$=32.82, p<0.001). On average, NHB men in the study reported lower annual incomes than Hispanic men (t=3.30, p<0.001). On average, Hispanic participants reported significantly higher general health status compared to the NHB participants (t=0.01, p=0.02).

4.3.1.2 Sample characteristics by fall status.

When comparing sample characteristics by fall status, a significantly larger proportion of men in the 60 to 69 age groups reported 2+ falls ($\chi2$=17.34, p=0.008). On average, men reporting recurrent falls (i.e., 2+ falls) reported significantly more chronic conditions (f=9.57, p<0.001), less annual income (f=4.36, p=0.013), worse general health status (f=10.14, p<0.001), and higher number of medications taken daily (f=3.26, p=0.039). Relative to those reporting no falls or an incident fall, a smaller proportion of men reporting recurrent falls reported never/ rarely/occasionally getting help or support needed to improve their health and manage their health problems (f=16.14, p<0.001). A larger proportion of men reporting recurrent falls reported clinical depression (f=27.57, p<0.001), and lower reported disease self-management self-efficacy (f=5.23, p=0.006) compared to those reporting no falls or an incident fall.

Table 4.1 Sample characteristics by race/ethnicity and falls.

			Race/Ethnicity				Falls in the Past 12 Months				
	Frequency (n=779)	**Total (n=779)**	**NHB (n=458)**	**Hispanic (n=321)**	**X^2/t**	**P**	**0 Falls (n=569)**	**1 Fall (n=98)**	**≥2 Falls (n=112)**	**X^2/f**	**P**
Number of Falls (past 12 months)					10.38	0.006					
0 Falls	569	73.0%	77.3%	67.0%			--	--	--		
1 Fall	98	12.6%	10.3%	15.9%			--	--	--		
≥2 Falls	112	14.4%	12.4%	17.1%			--	--	--		
Race/Ethnicity										10.38	0.006
Non-Hispanic Black (NHB)	458	58.8%	--	--			62.2%	48.0%	50.9%		
Hispanic	321	41.2%	--	--			37.8%	52.0%	49.1%		
Age					3.40	0.334				17.34	0.008
60-64	309	39.7%	41.7%	36.8%			40.2%	30.6%	44.6%		
65-69	249	32.0%	31.2%	33.0%			34.1%	25.5%	26.8%		
70-74	146	18.7%	18.8%	18.7%			17.6%	28.6%	16.1%		
75+	75	9.6%	8.3%	11.5%			8.1%	15.3%	12.5%		
Education					23.22	<0.001				14.61	0.006
High School or Less	128	16.4%	18.3%	13.7%			18.3%	12.2%	10.7%		
Some College or 2-yr Degree	332	42.6%	47.8%	35.2%			43.4%	31.6%	48.2%		
4-yr Degree or More	319	40.9%	33.8%	51.1%			38.3%	56.1%	41.1%		
Relationship Status					32.82	<0.001				2.30	0.316
Never Married/Divorced/Separated/Widowed	312	40.1%	28.5%	11.6%			38.5%	42.9%	45.5%		

Married/Partnered	467	59.9%	51.5%	72.0%			61.5%	57.1%	54.5%		
Persons in Household (including self)	--	2.2(±1.2)	2.1(± 1.3)	2.3(±1.1)	0.974	0.047	2.2(±1.2)	2.2(±1.1)	2.2(±1.4)	0.40	0.961
Annual Household Income	--	6.2(±3.4)	5.8(±3.3)	6.9(±3.5)	3.30	<0.001	6.1(±3.3)	7.2(±3.6)	6.0(±3.6)	4.36	0.013
Residential Rurality					0.01	0.908				0.05	0.973
Metro	741	95.1%	95.2%	95.0%			95.1%	94.9%	95.5%		
Non-Metro	38	4.9%	4.8%	5.0%			4.9%	5.1%	4.5%		
Insurance Status					0.08	0.772				0.81	0.668
No	36	4.6%	4.8%	4.4%			4.4%	4.1%	6.3%		
Yes	743	95.4%	95.2%	95.6%			95.6%	95.9%	93.8%		
Number of Chronic Conditions	--	3.8(±2.7)	3.8(±2.5)	3.9(±2.9)	1.70	0.851	3.6(±2.5)	4.1(±2.8)	4.8(±2.9)	9.57	<0.001
Number of Medications Taken Daily	--	3.9(±1.9)	4.0(±1.9)	3.9(±1.9)	3.92	0.277	3.9(±1.9)	3.9(±1.9)	4.4(±1.9)	3.26	0.039
General Health Status	--	2.9(±0.8)	2.8(±0.8)	3.0(±0.9)	0.01	0.020	3.0(±0.8)	2.8(±0.8)	2.6(±0.9)	10.14	<0.001
Clinical Depression					0.05	0.820				27.57	<0.001
No(<3)	682	87.5%	87.8%	87.2%			90.9%	84.7%	73.2%		
Yes (3+)	97	12.5%	12.2%	12.8%			9.1%	15.3%	26.8%		
Routine Check-up Within Past Year					0.00	0.959				1.90	0.390
No	66	8.5%	8.5%	8.4%			7.7%	9.2%	11.6%		
Yes	713	91.5%	91.5%	91.6%			92.3%	90.8%	88.4%		

Get Help/Support Needed					0.45	0.500				16.14	<0.001
Never/Rarely/Occasionally	230	29.5%	28.6%	30.8%			26.7%	27.6%	45.5%		
Frequently/Always	549	70.5%	71.4%	69.2%			73.3%	72.4%	54.5%		
Disease Self-Management Efficacy Scale	--	28.7(±2.6)	28.8(±2.2)	28.6(±3.1)	3.30	0.397	28.8(±2.4)	28.8(±2.6)	28.0(±3.4)	5.23	0.006

4.3.2 Factors associated with incident falls relative to no falls.

From the statistically significant associations shown in the bivariate analysis, Table 4.2 highlights the findings of the multinomial logistic regression examining factors associated with reporting incident and recurrent falls relative to reporting no falls in the past twelve months. Comparing men who reported an incident fall to those not reporting a fall, Hispanic men were more likely than NHB men to report an incident fall (OR=1.59, 95% CI=1.01-2.51). Men ages 70 to 74 (OR=2.19, 95% CI=1.19-4.03) as well as men 75 years and older (OR=2.64, 95% CI=1.25-5.57), were more likely to report an incident fall, respectively. Men who perceived themselves to have better general health status were less likely to report an incident fall (OR= 0.73, 95% CI= 0.54-0.99). Conversely, men with clinical depression were more likely to report an incident fall than those without depression (OR= 1.46, 95% CI= 1.05-2.05).

Comparing men who reported recurrent falls to those not reporting a fall, Hispanic men were more likely than NHB men to report recurrent falls (OR=1.59, 95% CI=1.02-2.47), and men with some college or a two-year degree were more likely than men with a high school education or less to report recurrent falls (OR=1.9, 95% CI=1.09-4.44). Each additional chronic condition reported increased the likelihood of reporting recurrent falls (OR= 1.10, 95% CI= 1.02-1.19). However, men who perceived themselves to have better general health status were

less likely to report recurrent falls (OR= 0.67, 95% CI= 0.50-0.91). Conversely, men who reported clinical depression were more likely to report recurrent falls than men without depression (OR=1.57, 95% CI=1.18-2.09). Men who got more frequent help or support needed to improve their health and manage their health problems were less likely to report recurrent falls (OR= 0.50, 95% CI= 0.32-0.79).

Table 4.2 Factors associated with incident and recurrent falls relative to not falling.

	1 FALL				**≥2 FALLS**			
		95% CI				**95% CI**		
	OR	**Lower**	**Upper**	**p**	**OR**	**Lower**	**Upper**	**p**
Non-Hispanic Black (NHB)	1.00	--	--	--	1.00	--	--	--
Hispanic	1.59	1.01	2.51	0.044	1.59	1.02	2.47	0.039
Age: 60-64 (referent)	1.00	--	--	--	1.00	--	--	--
Age: 65-69 (vs 60-64)	0.97	0.54	1.74	0.925	0.76	0.45	1.28	0.297
Age: 70-74 (vs 60-64)	2.19	1.19	4.03	0.012	1.05	0.55	1.99	0.889
Age: 75+ (vs 60-64)	2.64	1.25	5.57	0.011	1.80	0.85	3.81	0.123
Education: High school (HS) or less (referent)	1.00	--	--	--	1.00	--	--	--
Education: Some college or 2-year degree (vs HS or less)	1.19	0.57	2.46	0.641	2.20	1.09	4.44	0.028
Education: 4-year degree or more (vs HS or less)	1.76	0.84	3.69	0.136	2.00	0.94	4.25	0.071
Annual Household Income	1.07	1.00	1.16	0.062	1.03	0.95	1.10	0.509
Number of Chronic Conditions	1.05	0.97	1.14	0.234	1.10	1.02	1.19	0.012
Number of Daily Medications	0.94	0.82	1.07	0.324	1.06	0.93	1.20	0.409
General Health Status	0.73	0.54	0.99	0.040	0.67	0.50	0.91	0.010
Clinical Depression: No	1.00	--	--	--	1.00	--	--	--
Clinical Depression: Yes	1.46	1.05	2.05	0.026	1.57	1.18	2.09	0.002
Get Help/Support Needed: Never/Rarely/Occasionally	1.00	--	--	--	1.00	--	--	--
Get Help/Support Needed: Frequently/Always	0.88	0.53	1.48	0.636	0.50	0.32	0.79	0.003
Disease Self-Management Efficacy Scale	1.02	0.93	1.12	0.630	0.97	0.91	1.05	0.488

Referent: 0 falls

4.3.3 Factors associated with recurrent falls relative to incident falls.

Table 4.3 presents the findings of the binary logistic regression examining factors associated with experiencing recurrent falls relative to experiencing incident falls in the past

twelve months. Relative to men ages 60 to 64 years, men ages 70 to 74 years were less likely to report recurrent falls (OR= 0.40, 95% CI= 0.17-0.94). Men who got more frequent help or support needed to improve their health and manage their health problems were less likely to report recurrent falls (OR= 0.51, 95% CI= 0.27-0.97).

Table 4.3 Factors associated with recurrent falling relative to incident falls.

		95% CI		
	OR	**Lower**	**Upper**	**p**
Non-Hispanic Black (NHB)	1.00	--	--	--
Hispanic	1.08	0.58	2.00	0.804
Age: 60-64 (referent)	1.00	--	--	--
Age: 65-69 (vs 60-64)	0.84	0.39	1.78	0.640
Age: 70-74 (vs 60-64)	0.40	0.17	0.94	0.036
Age: 75+ (vs 60-64)	0.69	0.26	1.83	0.453
Education: High school (HS) or less (referent)	1.00	--	--	--
Education: Some college or 2-year degree vs (HS or less)	2.08	0.76	5.73	0.154
Education: 4-year degree or more (vs HS or less)	1.16	0.41	3.34	0.778
Annual Household Income	0.96	0.88	1.06	0.442
Number of Chronic Conditions	1.03	0.92	1.15	0.656
Number of Daily Medications	1.17	0.98	1.40	0.637
General Health Status	0.88	0.59	1.29	0.505
Clinical Depression: No	1.00	--	--	--
Clinical Depression: Yes	0.98	0.65	1.47	0.908
Get Help/Support Needed: Never/Rarely/Occasionally	1.00	--	--	--
Get Help/Support Needed: Frequently/Always	0.51	0.27	0.97	0.039
Disease Self-Management Efficacy Scale	0.93	0.84	1.04	0.193

Referent: 1 fall.

4.4 Discussion

This study identified factors associated with incident and recurrent falls among older NHB and Hispanic men with chronic conditions. Approximately 27% of participants reported an incident fall in the past 12 months, which is consistent with other studies and national averages that report at least 25% of older adults falling each year (Bergen et al., 2016; Moreland et al., 2020). Many of these samples however, contained both male and female participants, unlike the current study.

In this study, Hispanic men were approximately 1.6 times more likely to report an incident fall compared to their NHB counterparts, consistent with previous studies, which demonstrate similarity in rates between Hispanic and non-Hispanic White (NHW) adults, also suggesting that NHB has lower rates than both categories (Bergen et al., 2019). Additionally, Hispanic men were approximately 1.6 times more likely to report recurrent falls compared to their NHB counterparts, which is unique to the literature. A California Health Interview Survey found that both NHB and Hispanic older adults were more likely to have suffered recurrent falls in the previous year, where NHB adults had a slightly higher rate than Hispanic adults (14.2% and 13.8% respectively) (Kwon et al., 2018). The finding in this current study occurs against the background of Hispanics' better perception of general health status, a smaller number of chronic conditions reported, less polypharmacy, and reporting higher rates of being partnered, compared to NHB. Hispanic men in this study reported slightly lower rates of getting help or support, a factor that this study reveals to be consistently protective against recurrent falls.

Relative to incident falls, the risk for recurrent falling was similar across NHB and Hispanic men in this study. However, findings from this study highlight that study participants reported an average of 3.8 (±2.7) chronic conditions, and having more comorbidities was

associated with recurrent falls. This is consistent with previous studies where recurrent falls increased with comorbidities in a dose-response fashion (Immonen er al., 2020; Kwon et al., 2018). Comorbidities or multiple comorbid conditions, being higher in older adults of color (Kwon et al., 2018; Nicklett & Taylor, 2014; Sun et al., 2016), may increase the risk of not just an incident fall, but by causing secondary sarcopenia, a consequence of disease-related chronic inflammation (Cruz-Jentoft et al., 2019; Watson, 2012), also increase the risk of recurrent falls in this subpopulation of older adult males (Kwon et al., 2018). In addition, acting independently, comorbidities and previous episodes of at least one fall increases the risk of repeat, progressively more dangerous episodes of falls (Ek et al., 2019), especially among males (Vu et al., 2011).

An important chronic condition found in this study was depression, which increased the risk of both falls and recurrent falls. This is consistent with the findings of earlier studies (Hung et al., 2017); one Korean study found that the risk of an incident fall is higher among adults who experience depressive illness, and the association is stronger with recurrent falls (Jo et al., 2020). Recurrent falls were found to also be strongly associated with poor personal perception of mental health; study found participants' descriptions of feelings of stress to be strongly associated with recurrent falls (Jo et al., 2020). In multiple studies, depression more than doubled the risk of falling among older adults (Atlas et al., 2017; Paliwal et al., 2017; Stuart et al., 2018), and this association was unexplained by medication use or age, in a study conducted in an Australian sample of older adults (Stuart et al., 2018). However, a US study found some partial association with medication (Quach et al., 2013).

Further, consistent with the findings of the current study, a longitudinal study of a sample of Medicare beneficiaries revealed a strong association between depression and falls, even after adjusting for health-related variables (Li et al., 2020). Although the mechanism by which

depressive illness increases the risk of falls is not very clear (Kvelde et al., 2013), depression is associated with impairments in the cognitive (Rock et al., 2014; Quach et al., 2014) and physical functioning (Kvelde et al., 2013) of older adults which, when combined in an individual, may potentially increase the risk of recurrent falls (Yoo, 2011). Treated depression associated with frailty increased the risk of falling in a prospective cohort study (Lin et al., 2021). Frailty independently affects cognition and is associated with poorer health outcomes, as well as poor perception of general health, all of which are predictors of falls in this subpopulation (Kvelde et al., 2013). Further, depressive illness and subjective stress are common mental health issues that older adults of color experience, often arising from multiple social stressors, such as poverty and racial injustice among NHB adults (Chae et al., 2011; Mouzon et al., 2017; Nadimpalli et al., 2015; Qin et al., 2020; Shim et al., 2012), and immigration, as well as housing issues, among Hispanic adults (Alegría et al., 2014; Wassertheil-Smoller et al., 2014).

These associations are relevant to the participants in the current study because frailty is more common among older adults of color (Cawthon et al., 2007; Usher et al., 2021), who also suffer from depressive illness (Chae et al., 2011; Lerman Ginzburg et al., 2021). In addition, as depression increases the risk of recurrent falls, this tends to create a cycle of persistent emotional issues, such as fear of falling, which in turn, predisposes them to more falls (Kvelde et al., 2013; Yoo, 2011), further complicating the depressive illness (Gambaro et al., 2022). The findings of this current study show that there is need to prioritize older adults of color in decreasing depression-associated falls, possibly through combined mental health and physical functioning promotion programs. Additionally, the limited knowledge of the exact mechanisms of risk of falling from depression requires further investigation.

Participants who perceived themselves as healthy were less likely to report an incident or recurrent fall. This is consistent with the results of an earlier study which assessed the relationship between general health and falls among older adults who were 85 years and older; participants who reported poor general health had a threefold increase in their risk of falling (Grundstrom et al., 2012). Health status is proportional to the number of chronic diseases that older adults suffer from and sometimes exerts a mediating effect between chronic diseases and falls (Tang et al., 2022).

These indicators of poor health have consistently increased among older adults of color and have particularly contributed to the growing health disparities between NHB and non-Hispanic White (NHW) older adults, although improvements appear to be observed between NHW and Hispanic adults, except in healthcare access (Odlum et al., 2020). Specifically, a previous study showed that disparities were more pronounced among older adults who were asked to rate their own health (Shippee et al., 2020). Based on self-reporting as in the current study, a cross-sectional study found significant associations between poor general health and risk factors of falls among older adults with falls (Byun et al., 2021), and the results of this current study confirm these findings (Kim et al., 2020).

Although some authors have demonstrated the limited reliability of self-rated health reports in defining racial health disparities, because of racial variations (Assari et al., 2016; Woo & Zajacova, 2017), and the gradual reduction of the disparity gap appears to be significant for NHB adults in one behavioral domain and in access to health insurance, NHB adults still experience the worst trends of comorbidities (Odlum et al., 2020). Hence, the association between general health status and falls in this study indicate that regular assessments of the

health status of older adult males of color will benefit any effort to reduce poor health-related falls.

Participants who reported frequently getting the help or support that they needed were less likely to experience recurrent falls. This is in contradiction to an earlier cross-sectional analysis of older adults in a New York City survey, which found no statistically significant association between social support and falls, after adjusting for covariates (Durbin et al., 2016). Another study found that spousal support decreased the risk of falls among Hong Kong residents with stroke, who were also ambulatory like in the current study (Chan & Fong, 2013).

Additionally, longitudinal study of nationally representative sample of older adults in the United States found that loneliness increased the risk of falls in this sample, over five years of follow-up (Zeytinoglu et al., 2021). However, none of these studies assessed recurrent falls independently (Chan & Fong, 2013; Durbin et al., 2016; Zeytinoglu et al., 2021).

The findings of Zeytinoglu et al. (2021) are relevant to the current study because loneliness, regardless of actual social isolation, is closely associated with the perception of a lack of social support (Masi et al., 2011; Zeytinoglu et al., 2021), and the availability of support is a protective factor for the wellbeing of older adults of color, especially NHB adults, which may serve to decrease stress and depression (Assari & Moghani Lankarani, 2018; Shim et al., 2012). Conversely, projections show that NHB adults may potentially lose family network and social support over the next four decades (Verdery & Margolis, 2017). Therefore, the findings of this current study and the very limited information about the effects of social support suggest the need for more research. Additionally, since the lack of social support can serve as a barrier to older adults participating in fall prevention interventions (Sandlund et al., 2017), prospective or

experimental studies, respectively, can be done to identify the temporality between social support and recurrent falls, and its role in fall prevention in this subpopulation of older adult males.

4.4.1 Limitations

As with most studies, this study is not without limitations. Data were self-reported, so it is possible that falls were underreported; recall bias may underestimate risk among much older adults (Fleming et al., 2008; Hoffman et al., 2018). Further, older adults may have difficulty remembering incident non-injurious falls that did not require hospitalization, and recurrent falls are less likely to be easily recalled by adults of advanced ages (Fleming et al., 2008; Sanders et al., 2015). In addition to recall issues, there may be cultural, family, or personal factors or perceived stigmata that prevent older adults from admitting to incident or recurrent falls. Some of these include fear of loss of independence or employment, or fear of being perceived as weak (Stevens et al., 2017). Further, perceptions about what constitutes a fall (Hughes et al., 2008) may underestimate risk among older adults (Hoffman et al., 2018).

The data collected using a Qualtrics Panel and online questionnaires may have introduced sampling bias, which may indicate the non-Hispanic Black and Hispanic men in this study are not representative of the larger respective populations. For example, this data collection method may not have easily reached potential participants who tend not to have ready access to the internet, because older age, lower socioeconomic status, and those living in rural areas (Tappen et al., 2022; Yoon et al., 2020). To minimize fall recurrence underreporting, objective methods of collection of fall data (e.g., electronic medical records and wearable technology) should be utilized in future studies, either alone or in combination with subjective fall reporting approaches (Ferreira et el., 2022; Kelly et al., 2022; Teister et al., 2018). However, all data collection methods should consider issues regarding access, usability, sensitivity, and specificity for fall

ascertainment (Kelly et al., 2022), as well as attempt to minimize misclassification bias (Baus et al., 2017)

As a cross-sectional study, causal inference cannot be established in the absence of clear incidence and temporal associations between the risk factors in this study. However, this provides a foundation for the development of a risk factor model that considers a set of fall-associated risk factors, which may inform a multidimensional evidence-based fall prevention program. Such a program will incorporate the cultural and psychosocial contexts of falls among older adult males of color.

4.5 Conclusion

There are only a handful of primary studies focusing on incident and recurring falls among older males of color. The recent trends in mortality from falls suggest the need to prioritize the fall-related issues in these subpopulations of older adults, with careful consideration for specific characteristics of likely heterogenous groups, immigration, and culture. The findings of this current study underscore the fact that interventions that strengthen the social network of older men of color may be of potential benefit, and these should be developed or incorporated into existing evidence-based strategies.

5. CONCLUSION

5.1 Introduction restatement

Among the most common causes of injury-related deaths around the world, falls are the most clinically important cause of injury, especially among adults ages 60 and older (WHO, 2021; Ye et al., 2021). Even when not fatal, falls frequently lead to serious disabilities (GBD 2019 Diseases and Injuries Collaborators [GBD], 2020).

More than one-quarter of older adults (i.e., individuals 65 years and older) in the United States experience a fall (Bergen et al., 2016; Moreland et al., 2020), and the annual incidence has increased by about 1.5% nationally (Hoffman et al., 2012), especially as older adults advance in age (Bergen et al., 2019; Moreland et al., 2020; Moreland & Lee, 2021). Recent data show that mortality has also increased by 30% (Centers for Disease Control and Prevention [CDC], 2020).

A single episode of falls may be dangerous to the frail older adult, but multiple episodes pose even greater risk of morbidity and mortality (Sun et al., 2016), and because of certain risk factors, older adults, especially older adult males (Gale et al., 2018), who have experienced a fall are highly likely to experience repeat falls (Nicklett & Taylor, 2014). These factors and their effects on single (incident) and recurrent falls were the focus of this project. This dissertation study, consisting of a scoping review and secondary data analyses, highlighted fall-related risk factors and subsequently, the differences between non-Hispanic White (NHW), Hispanic, and non-Hispanic Black (NHB) male populations, in terms of the distributions of these fall-related risk factors.

5.2 Summary

The purpose of the scoping review was to highlight the multifactorial etiology of falls and recurrent falls among older adult males ages 60 years and older, with at least one comorbidity.

Multiple databases were searched, and a set of strict inclusion and exclusion criteria were applied. Each manuscript was assessed for the risk of bias, using a standardized toolkit specifically tailored to each study design.

Thirty-eight studies (16 cohort studies, 15 cross-sectional studies, six longitudinal studies, and one case-control study) were included in the review. One of the studies had a weighted sample size, while the remaining 37 studies had a total sample size of 606,397. The incidence of falls and recurrent falls ranged from 6.2% (Ek et al., 2019) to 55.8% (Torres et al., 2015), and 7.7% (Karlsson et al., 2012) to 27% (Khalatbari-Soltani et al., 2021), respectively. The prevalence of falls and recurrent falls ranged from 2.4% (Mochida et al., 2018) to 39.4% (Hammarlund et al., 2016) and 7.7% (Karlsson et al., 2012) to 12% (Jefferis et al., 2014), respectively.

All studies included some specific type of chronic disease and/or symptom/complaints. Among these, pain, depression, musculoskeletal disease, poor physical fitness, and chronic hypoxemia were found to be positively correlated with the risk of recurrent falls. A previous fall predisposed to recurrent, injurious falls. Pain, frailty, nocturia, and nocturnal, sleep-related hypoxemia consistently showed a dose-response increase with falls. Two studies found that NHW males had higher risk of falls than other racial subgroups (Chang & Do, 2015; Karlsson et al., 2014), but after adjusting for covariates, there were no differences in risk based on ethnicity (Karlsson et al., 2014).

Study 2 utilized a large sample of male participants to identify the prevalence of incident and recurrent falls within a national sample of men ages 60 and older, with at least one chronic condition. The study also aimed to identify the risk factors associated with incident and recurrent falls among these men in the past 3 months.

All analyses were performed using SPSS version 28. Descriptive statistics and bivariate analyses were performed, and a multinomial logistic regression model was fitted to identify factors associated with incident and recurrent falling relative to men who reported no fall (referent category).

This sample contained 7,207 men ages 60 to 101 (mean age= 77.8 (±8.0)) years with 2.0 (±1.1) chronic conditions). Of these men, 19.1% reported one fall, and 18.9% reported two or more falls, in the past 3 months. Compared to NHW men, NHB (OR 0.55, 95% CI 0.40-0.76) and Hispanic (OR 0.69, 95% CI 0.52-0.93) men were less likely to report an incident fall, or recurrent falls (NHB (OR 0.41, 95% CI 0.29-0.59) and Hispanic (OR 0.58, 95% CI 0.42-0.79) respectively). Men who perceived better general personal health status were less likely to report an incident fall (OR 0.89, 95% CI 0.82-0.96) or recurrent falls (OR 0.81, 95% CI 0.75-0.89). Men who were more fearful of falling (OR 1.17, 95% CI 1.07-1.26) and reported more activity limitations because of concerns about falls (OR 1.32, 95% CI 1.24-1.42) were more likely to report an incident fall, as well as recurrent falls (more fearful of falling (OR 1.46, 95% CI 1.341.58), reported more activity limitations because of concerns about falls (OR 1.71, 95% CI 1.60-1.83)). Men ages 70 to 74 years (OR 0.62, 95% CI 0.45-0.86) and 80+ years (OR 0.63, 95% CI 0.47-0.85) were less likely to report recurrent falls than men ages 60-64. The likelihood of reporting recurrent falls increased with increasing number of comorbid conditions reported (OR 1.10, 95% CI 1.04-1.16). For the binary regression comparing recurrent falls to an incident fall, men 80+ years were less likely to report recurrent falls (OR 0.69, 95% CI 0.48-0.99) than men 60-64 years. Also, men who were more fearful of falling (OR 1.27, 95% CI 1.15-1.41) and reported more activity limitations because of concerns about falls were more likely to report recurrent falls (OR 1.31, 955 CI 1.21-1.42).

The purposes of study 3 were to identify the prevalence of incident and recurrent falls among NHB and Hispanic men with chronic conditions and identify factors associated with incident and recurrent falls among these two racial/ethnic subgroups.

All analyses were performed using SPSS version 28. Descriptive statistics and bivariate analyses were performed, and a multinomial logistic regression model was fitted to identify factors associated with incident and recurrent falling.

This sample contained 779 non-Hispanic Black (n=458) and Hispanic (n=321) men, ages 60 to 93 years (mean age=66.8 (±5.4)) with an average of 3.8(±2.7) chronic conditions. In this sample, 12.6% reported one fall and 14.4% reported two or more falls in the past 12 months. Results of the multinomial analysis showed that Hispanic men were more likely than NHB men to report an incident fall (OR=1.60, 95% CI=1.02-2.52). Men ages 70 to 74 (OR=2.21, 95% CI=1.20-4.06) as well as men 75 years and older (OR=2.68, 95% CI=1.28-5.63), were more likely than men ages 60-64, to report an incident fall, respectively. Men who perceived better general personal health status were less likely to report an incident fall (OR= 0.72, 95% CI= 0.53-0.98) and recurrent falls (OR= 0.69, 95% CI= 0.51-0.93). The likelihood of reporting recurrent falls increased with higher numbers of chronic diseases reported (OR= 1.10, 95% CI= 1.02-1.19). Men with clinical depression were more likely to report an incident fall (OR= 1.17, 95% CI= 1.08-1.26) and recurrent falls (OR=1.46, 95% CI=1.34-1.58) than men without depression. For the binary regression comparing recurrent falls to an incident fall, men ages 70 to 74 years were less likely to report recurrent falls (OR= 0.40, 95% CI= 0.17-0.94) than men ages 60-64. Men who got more frequent help or support needed to improve their health and manage their health problems also reported less recurrent falls than men who did not (OR= 0.51, 95% CI= 0.27-0.97).

5.3 Discussion of relevance to overall dissertation

The scoping review answered the question: “what are the risk factors for falls and recurrent falls among older male adults aged 65 and older in the United States?”. Further, this study highlighted the prevalence of these risk factors, and identified potential gaps in the literature regarding recurrent falls. This review identified that studies have mixed results in terms of the differences in fall-related risk based on race/ethnicity. In addition to this, the studies examining this subject among older adult males with at least one chronic disease are very limited. The paucity of literature on this subpopulation of older adults suggests the need for more primary studies to compare risk, not just among men, but with consideration for race/ethnicity in future analyses, because of its relevance to other upstream risk factors for health in any racially diverse society (Campos & Kim, 2017; Flanagin et al., 2021; Menkin et al., 2017).

Study 2 showed that the rates of reporting a fall in this sample of older adult males remained high, when compared to some earlier studies. This may be a feature of the short recall period (i.e., three months) (Fujimoto et al., 2000). However, when these rates are considered against a background of increasing annual incidence rates (Hoffman et al., 2022), it appears that the risk of falls among different samples of older adult males in the United States remains high, despite efforts to reduce the burden. Also, this study aligns with the current literature that race/ethnicity may be a significant predictor of recurrent falls among older men (Geng et al., 2017; Nicklett & Taylor, 2014; Wehner-Hewson et al., 2022). This study also found that higher comorbidities increased the rates of reporting both incident and recurrent falls, and comorbid diseases tend to have serious effects in older adults, especially in men at advanced ages (Ek et al., 2019). This study highlights the problem in two areas: first, older adult males with comorbid conditions experience multiple falls (Kwon et al., 2018; Okoye et al., 2021), and second, the

limited evidence about risk across the racial/ethnic groups suggest the need to explore comorbid diseases as risk factors for recurrent falls among older adult men of color.

Study 3 contained a sample of older NHB and Hispanic men with chronic conditions showed that the prevalence of falls is high in this subpopulation. This study showed some similarities in the rates of reporting incident falls between Hispanic and NHB men, namely that Hispanic men reported higher incident falls than NHB men, when compared with a previous study's findings (Bergen et al., 2019), but contradicts the findings of another earlier study (Kwon et al., 2018) in the reporting of recurrent falls between these two racial/ethnic categories of older adult men. In this study, participants who perceived themselves as healthy were less likely to report an incident or recurrent fall, and since the perception of health status is positively correlated with well-being and symptom management of chronic diseases (Benyamini & Burns, 2019; Pawlikowska-Łagód & Suchodolska, 2022), this study helps to identify important areas that need attention among older adult males of color. This study also showed that depression is associated with both incident and recurrent falls. People of color tend to experience depression often brought on by multiple factors, added to a layer of social/systemic stressors (Chae et al., 2011; Lerman Ginzburg et al., 2021). This study found that this sample of men had the necessary social support, and this reduced their risk of reporting a fall. Because of the effects of social support in reducing depression and stress (Assari & Moghani Lankarani, 2018; Shim et al., 2012), this is an area that may need to be further explored in intervention efforts or further studies, because projections show that NHB adults may potentially lose family network and social support over the next four decades (Verdery & Margolis, 2017). Further, since the lack of social support can serve as a barrier to older adults participating in fall prevention interventions (Sandlund et al., 2017), prospective or experimental studies, respectively, can be done to identify

the temporality between social support and recurrent falls, and its role in fall prevention in this subpopulation of older adult males.

5.4 Methodological and conceptual concerns

In the scoping review, variabilities in study methods and the large variabilities in sample sizes, effect sizes of measures of association, and statistical significance may limit the generalizability of the findings of this study. However, this study also acknowledged these variabilities to occur sometimes because of cultural differences in the perception of frailty and falling among older adult males, globally. Most of the retrospective studies used a recall period of 12 months, while only one used 3 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). However, more objective methods of measuring falls, such as electronic medical records, need to be identified and utilized during data collection. Many of the international studies and some United States-focused studies 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. Further, the studies which included race/ethnicity as a variable in their analyses were predominantly Caucasian in their sample (Chang & Do, 2015; Karlsson et al., 2014), and the distribution and effects of these risk factors among older men of color may remain unclear.

Studies 2 and 3 relied on self-reported data, which may have introduced recall bias and inaccurate reporting. However, because this study utilized a relatively short recall period, the effects of recall bias may not have been significant. Also, because all participants in the dataset voluntarily enrolled in an evidence-based fall prevention program, this sample likely contained

less frail and/or more ambulatory participants, excluding more frail adults who were unable to participate. It is also possible that the participants in this sample previously had a fall or had been fearful of falling. As such, this means that these men may not have been representative of the larger male population. In addition, the proportions in this sample do not completely reflect the racial distribution of older adult males in the United States (United States Census Bureau, 2022), suggesting that the findings of this study may not be generalizable to the larger, national male population. This study had a substantially larger proportion of NHW compared to NHB and Hispanic men, hence, additional studies are needed that focus on older men of color. Additionally, the cross-sectional nature of the study prevents the determination of any causal relationship between these risk factors and the outcome variables. Also, it is possible that important variables from the broader risk factor model were excluded because of the restricted number of variables in this study, largely because these were secondary data. The collection of primary data and the utilization of sampling methods that potentially help to reduce sampling bias may allow for a more representative sample. Further, the researcher's inability to understand and correct problems arising from survey questions or low response rates among men (especially men of color) would have been prevented in a primary data-driven study.

Recall bias from self-reporting may underestimate risk among much older adults (Fleming et al., 2008; Hoffman et al., 2018). In addition to recall issues, there may be cultural, family, or personal factors or perceived stigmata that prevent older adults from admitting to incident or recurrent falls. Some of these include fear of loss of independence or employment, or fear of being perceived as weak (Stevens et al., 2017). Further, perceptions about what constitutes a fall (Hughes et al., 2008) may underestimate risk among older adults (Hoffman et al., 2018). The data for study 3 collected using a Qualtrics Panel and online questionnaires may

have introduced sampling bias, which may indicate the non-Hispanic Black and Hispanic men in this study are not representative of the larger respective populations. Additionally, as cross-sectional studies, causal inference could not be established in the absence of clear incidence and temporal associations between the risk factors in this study. While study 3 had sufficient sample size, a much larger sample size may be desirable in this study, to understand the true effect sizes of the measures of association.

5.5 Recommendations and future research

Study 1 provides a background for the understanding of a risk model for recurrent falls among older adult males. The inconsistencies in prevalence and incidence across included studies demonstrate the need to conduct more primary studies, to address additional research questions, ranging from sample composition to the specific association of each risk factor with recurrent falls.

Data collection approaches that potentially maximize sample size for men and men of color need to be considered, to ensure greater study power and potentially stronger effect sizes. This will also ensure the generalizability of study findings from a more representative study sample. Prospective studies, including experimental or quasi-experimental studies will provide information about temporality and causation.

Further, there are only a handful of primary studies focusing on recurrent falls among older males of color with comorbidities. The recent trends in mortality from falls suggest the need to prioritize the fall-related issues in these subpopulations of older adults, with careful consideration for specific characteristics of likely heterogenous groups, immigration, and culture.

This project identifies NHW and Hispanic older adult males as being more at risk of reporting falls than NHB men. In addition, it also shows certain risk factors that are significant

and associated with frailty among older males of color, such as depression, chronic pain, lack of physical fitness, and multimorbidity. From these two main findings, this study helps to identify an important subpopulation of older adults requiring interventions that address chronic disease and pain, improves physical fitness and slows frailty, and promotes mental wellness, to decrease recurrent falls. The implementation of such programs will rest on the background of data provided in the publishable studies of this project, and other research questions that will be answered, stemming from it. Experimental studies to evaluate the roles of some factors, such as chronic disease management, mental health wellness programs, and programs that strengthen social networks for older adults of color, will help to understand how these factors can contribute to the reduction of recurrent falls among older adult males.

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