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Uncovering the boundary conditions of the association between concerns about falling and physical activity in adult populations: A scoping review protocol

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5	2	physical activity in adult populations: A scoping review protocol	
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1 2		
2 3 4	55	ABSTRACT
5 6	56	Introduction: Despite evidence of variation in how concerns about falling influence physical
7 8 9	57	activity, many of the currently available knowledge syntheses merely assume that this
10 11	58	relationship is uniform across populations and contexts. Therefore, we propose a scoping review
12 13	59	protocol to guide a summary of the body work that has examined the association between
14 15 16	60	concerns about falling and physical activity in adult populations, with an eye on the availability
17 18	61	of empirical evidence of moderation. <i>Methods and analyses</i> : Studies reporting on both the
19 20 21	62	concepts of concerns about falling and physical activity among samples with a mean age ≥ 18
21 22 23	63	years will be included. Five electronic databases will be searched. We will conduct a hand search
24 25	64	of the reference lists for all included studies and relevant knowledge syntheses and perform a
26 27	65	citing reference search for all included studies using Web of Science. A team of six reviewers
28 29 30	66	will single-screen titles and abstracts. Two reviewers will independently assess the eligibility of
31 32	67	each study based on a full-text examination. Results will be presented using a tree graph to
33 34 35 36 37	68	display the moderating factor(s) investigated and a ratio showing the number of time evidence
	69	for moderation was examined by the total number of investigations. <i>Ethics and dissemination</i> :
38 39	70	The university Human Research Protection Program determined that the proposed scoping
40 41	71	review does not qualify as Human Subjects Research under federal human subjects research
42 43 44	72	regulations (IRB-2023-1656). Results will be published in a peer-review journal and in the form
45 46	73	of a 1-page summary for Extension Program leaders, part of a nationwide Cooperative Extension
47 48	74	network.
49 50 51	75	Key words: accidental falls, effect modifier, exercise, fear, health behavior.
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2 3 4	78		STRENGTHS AND LIMITATIONS OF THIS STUDY
5 6 7	79	•	The proposed scoping review will include both qualitative and quantitative studies,
/ 8 9	80		providing a more complete picture of the availability of empirical evidence of
10 11	81		moderation.
12 13	82	٠	The electronic database search was designed and pilot tested to ensure high sensitivity
14 15 16	83		and reliability while balancing time and cost constraints.
17 18	84	٠	Data will be analyzed by mapping the empirical evidence of moderation to theory-
19 20	85		derived moderation hypotheses.
21 22 22	86	٠	Given that an assessment of risk of bias of the studies included in the proposed review
23 24 25	87		will not be conducted, the specific clinical and policy implications of the proposed review
26 27	88		may be limited.
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INTRODUCTION

90	Evaluation and reduction of concerns about falling and the promotion of physical activity
91	are two fundamental aspects of fall prevention and management [1]. Although regular
92	engagement in physical activity and adherence to multicomponent physical activity programs
93	can reduce concerns about falling and prevent falls, concerns about falling may represent for
94	many a barrier to physical activity participation [2–5]. This is an important public health issue
95	because both fallers and non-fallers in various adult populations are concerned about falling, and
96	such concerns can interfere with participation in various activities of daily living and reduce
97	quality of life. Ultimately, concerns about falling may increases the risk of future falls and care
98	dependency, which can both be further heightened by physical inactivity [1].
99	Concerns about falling tend to be negatively associated with physical activity
100	participation. However, concerns about falling may not uniformly influence physical activity
101	behavior across populations and contexts [6]. For instance, concerns about falling may have a
102	stronger negative influence on physical activity participation among older adults, people with
103	disease-specific symptoms and disabilities, or people with a history of falls [5,7,8]. Moreover,
104	theoretical [9–11] and qualitative [3] evidence indicate that concerns about falling could
105	positively influence physical activity in certain contexts. Despite evidence of variation in how
106	concerns about falling influences physical activity behavior, many of the currently available
107	knowledge syntheses assume this relationship is uniform across populations and contexts.
108	Consequently, practitioners and researchers may rely on a knowledge base with limited
109	information to determine with precision for whom or when concerns about falling should be
110	considered for promoting physical activity in the context of fall prevention and management.

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In this article, we propose a scoping review protocol to guide a summary of the body work that has examined the association between concerns about falling and physical activity in adult populations (age \geq 18 years), with an eye on the availability of empirical evidence of moderation, also known as effect modification. In the context of the proposed scoping review, moderation represents the variation in the degree to which concerns about falling relate to physical activity as a function of another factor, called a moderator variable. We expect the findings of the proposed scoping review to make a significant contribution to the literature by encouraging researchers to specify variables as moderators of the association between concerns about falling and physical activity behavior at the onset of their studies and make sampling and measurement related decisions that would enable them to perform more sensitive moderation analyses. It is also expected that these findings will help researchers to provide a more compelling rationale for the a priori planning and conduct of subgroup and meta-regression analyses of future meta-analyses. Ultimately, the proposed scoping review is expected to provide new insights that could help practitioners and researchers determine more precisely for whom and when concerns about falling should be a considered for promoting physical activity more effectively in the context of fall prevention and management. **Theoretical Rationale**

According to the social cognitive framework, concerns about falling could be linked to the construct of beliefs [12,13] or representations [14] about a health threat. Beliefs or representations about a health threat are thought to be linked to one's motivation to either adopt or avoid certain behaviors. Specifically, the construct of threat appraisal is theorized to capture one's held beliefs about a health threat (e.g., consequences of falling such as pain, and injury or loss of independence), and its association with negative emotions (e.g., concerns, worry, fear, or

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134	anxiety; [15]). The concept of concerns about falling has been explicitly linked to the construct
135	of threat appraisal in prior research in the context of physical activity in older adults [16,17].
136	Further, both the protection motivation theory [13] and common sense model [14] posit a
137	stronger and positive relationship between threat appraisal (e.g., concerns about falling) and
138	people's intention toward a given behavior (e.g., physical activity) for people who believe in the
139	effectiveness of that behavior in preventing the threat (e.g., engaging in balance and
140	strengthening exercise is an effective strategy to prevent injurious falls) and in their capabilities
141	in engaging in that behavior (e.g., self-efficacy for engaging in balance and strengthening
142	exercise). This perspective is also consistent with the conceptual framework describing the
143	origination and consequences of worries about falling by Ellmers et al. [18], which specifies
144	perception of control over one's concerns about falling as a key factor determining whether or
145	not concerns about falling motivate positive and protective changes in behavior.
146	According to the affect and health behavior framework, concerns about falling could be
147	linked to the concept of incidental affect [10]. Incidental affect refers to how one feels
148	throughout the day outside the context of the target behavior. According to this perspective,
149	concerns about falling can positively influence physical activity, but only if one expects that
150	engaging in physical activity will contribute to alleviating their concerns about falling.
151	Otherwise, concerns about falling will negatively influence physical activity. In contrast,
152	concerns about falling can lead to excessive physical activity avoidance if people anticipate
153	avoiding physical activity will help them cope with such concerns and protect them against
154	potential harms from future falls.
155	Drawing on this same theoretical framework, concerns about falling could also be linked
156	to the concept of affectively charged motives [10]. Affectively charged motives represent a

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157	category of motives that arise from the feelings experienced while performing a given behavior.
158	According to this perspective, concerns about falling can reflect a more intense emotion, such as
159	fear or anxiety, that would drive one to disengage from physical activity experiences that
160	previously have been associated with negative emotions. This perspective is also consistent with
161	the model of fear of falling, falls efficacy and anxiety [9], and the fear-avoidance model of
162	falling and functional disability [11]. One important implication of this perspective is that the
163	influence of concerns about falling on physical activity can be highly contextual. If past
164	experiences of physical activity have been unpleasant because one fell while doing an activity –
165	leading one to experience pain, an injury, or a loss of independence – concerns about falling can
166	prompt people to either avoid all kinds of physical activities, the specific activity associated with
167	the fall, or the performance of physical activity in the specific context in which the fall occurred
168	(e.g., avoiding the performance of physical activity under poor weather conditions, such as
169	walking on an icy sidewalks).
170	In summary, there is theoretical evidence in support of moderation, whereby the size or
171	sign of the association between concerns about falling and physical activity depend on another
172	factor, called a moderator variable. These potential moderators are specified in Table 1 below.
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Table 1. Hypothesized moderators of the of the relationship between concerns about falling and

physical activity behavior

	Moderator	Theoretical framework	Sign or
		Theoretical construct linked to the	size of
		concept of concerns about falling	effect ¹
	Beliefs about consequences	Social cognitive framework	Positive
	i.e., the belief that physical activity is an	Threat appraisal	
	effective strategy for preventing falls		
	Beliefs about capabilities	Social cognitive framework	Positive
	i.e., the belief that one can organize,	Threat appraisal	
	execute, and engage in physical activity		
	despite the presence of barriers		
	Beliefs about consequences	Affect and health behavior framework	Positive
	i.e, the belief that physical activity will	Incidental affect	
	help relieve concerns about falling		
	Beliefs about consequences	Affect and health behavior framework	Negative
	i.e., the belief that avoiding physical	Incidental affect	(stronger)
	activity will help relieve concerns about		
	falling and protect from future falls		
	History of falls within context	Affect and health behavior framework	Negative
	i.e., the experience of a fall while doing	Affectively charged motives	(stronger)
	physical activity and the context in		
	which that fall occurred		
182	¹ The association between concerns about f	alling and physical activity behavior is ty	pically
183	assumed to be negative.		
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Previous Knowledge Syntheses

Findings from prior knowledge syntheses provide converging evidence in support of a negative association between concerns about falling and physical activity behavior [2,3,5,7,19– 21]. Ramsey et al. [2] calculated the median Pearson correlation coefficient quantifying the strength of the association between fear of falling and daily steps (r = -0.21) and daily minutes of moderate-to-vigorous physical activity (r = -0.24) among older adults (≥ 60 years). Using benchmarking methods outlined by Wright et al. [22], these estimates indicate that older adults who are fearful of falling would typically take 321 fewer steps per day (or 2247 steps/week) and spent 12.6 minutes less in moderate-to-vigorous intensity physical activity per day (or 88.2 minutes/week) compared to those who are not fearful. Despite evidence that the size or sign of the association between concerns about falling and physical activity behavior can depend on another factor, most prior knowledge syntheses merely assumed that concerns about falling uniformly influence that behavior across populations and contexts. There are few notable exceptions, however. First, Beart et al. [7] hypothesized that the negative influence of concerns about falling on physical activity might be stronger as people age, especially among people aged 80 years and over. Second, Rider et al. [8] hypothesized that Parkinson's disease-specific symptoms and disabilities could moderate the impact of concerns

about falling on physical activity behavior such that the negative influence of concerns about
 falling on physical activity would be stronger when people have increased walking difficulties,

hyperkinesia, rigidity, freezing of gait, or impaired balance. Lastly, both systematic reviews of the qualitative literature by Franco et al. [5] and Meridith et al. [3] concluded that for many older adults (\geq 60 years), the influence of concerns about falling on physical activity participation was negative but depended on one's prior falls history or context. A history of falls could strengthen Page 11 of 32

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210	the negative influence of concerns about falling on physical activity [5], whereas concerns about
211	falling could promote engagement in certain types of exercise when performed with the overall
212	goal of improving physical functioning or reducing risk of future falls [3].
213	Moreover, most prior knowledge syntheses only included studies that sampled older
214	adults (\geq 60 years; [2–5,7,23,24]. Although insightful, the generalizability of their findings to
215	other populations for which concerns about falling and fall prevention and management have
216	important clinical implications cannot be inferred. Notably, one narrative knowledge synthesis
217	[21] concluded that there is a "probable negative association" between fear of falling and
218	physical activity behavior among people who had a transient ischemic attack or stroke (Table 1;
219	p. 62). Rider et al. [8] performed a scoping review of studies examining the association between
220	fear of falling and activity avoidance among people with Parkinson's disease and reported that
221	concerns about falling "emerged with a strong association with avoidance behavior" (p. 12).
222	Based on the findings from two studies, Streber et al. [20] performed a systematic review of
223	factors related to physical activity in persons with multiple sclerosis and concluded that falls-
224	related efficacy (higher levels of falls-related efficacy reflects lower levels of concerns about
225	falling) was "consistently positively associated with physical activity [in persons with multiple
226	sclerosis] but was less frequently examined" (Table 3, p. 639).

Finally, although some knowledge syntheses specifically focused on the concept of
physical activity [2,3,19–21], others were based on a broad conceptualization of the concepts
"activity restriction," "activity avoidance", or "activity level" [4,8,23,24]. These concepts
typically encompass a wide range of activity-related outcomes such as engagement in activities
of daily living, motor skills or mobility assessments, engagement in social activities, church

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> attendance, and physical activity. As a result, it is difficult to delineate the findings that pertain specifically to physical activity from other activities or behaviors.

Scoping Review Objectives

We propose to conduct a scoping review to map the research pertaining to the association between concerns about falling and physical activity behavior in adult populations, with an eye on the availability of empirical evidence of moderation. A preliminary search for existing scoping review reporting on evidence of moderation for the association between concerns about falling and physical activity behavior in adult populations (≥ 18 years) revealed that none exist [date of the search: May 11, 2023; electronic database searched: CINAHL (EBSCO interface). EMBASE (Elsevier interface), PubMed, PsycINFO (EBSCO interface), and SPORTDiscus (EBSCO interface)]. The main research questions that framed the proposed scoping review are: 1- What literature exists on evidence of moderation of the association between concerns about falling and physical activity in adult populations (specifically, how often studies have empirically examined moderators of this association)? 2- What range of evidence there is, with respect to research methodology and study design used, from empirical studies that have examined or reported on at least one moderator of the association between concerns about falling and physical activity in adult populations? 3- Which factors have been identified as a moderator of the association between concerns

about falling and physical activity in adult populations?

METHODS AND ANALYSIS

This scoping review protocol was developed following guidance of the scoping review framework proposed by the JBI Manual for Evidence Synthesis [25,26]. The reporting of this scoping review protocol follows the reporting guidelines for scoping review protocols [25], and

1 2		
3 4	255	is consistent with the Preferred Reporting Items for Systematic Review and Meta-Analysis
5 6 7 8 9 10 11 12 13	256	Protocols (PRISMA-P; [27]). An adapted version of the PRISMA-ScR checklist based on the
	257	reporting guidelines for scoping review protocols [25] is provided in online supplementary
	258	appendix 1.
	259	We will conduct the proposed scoping review in accordance with the scoping review
14 15	260	framework outlined by the JBI Manual for Evidence Synthesis [26,28]. The reporting of the
16 17 18	261	proposed scoping review will follow the Preferred Reporting Items for Systematic Reviews and
19 20	262	Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR; [29]). Any deviations to the
21 22	263	protocol, along with their respective justification, will be reported in the final scoping review
23 24 25	264	report.
25 26 27 28 29 30 31 32 33 34	265	Eligibility Criteria
	266	Participants
	267	Studies that report on samples with a mean age \geq 18 years will be included for review.
	268	Studies that have drawn on samples of either recreational or professional athletes, and people
35 36	269	who were unable to engage in physical activity will be excluded.
37 38	270	Concepts
39 40 41	271	Several facets closely related to the concept of concerns about falling were examined in
42 43	272	prior research [6], including fear of falling and falls efficacy [9,11,15]. Fear of falling refers to a
44 45 46 47 48 49 50	273	lasting concern about falling (e.g., feeling more anxious, fearful, or worried), whereas falls
	274	efficacy refers to the perceived capability in keeping balance or in preventing falls while
	275	performing various activities of daily living (e.g., going up or down stairs, walking up or down a
51 52	276	slope). While concerns about falling may arise because of a fall, such concerns can also exist
53 54 55	277	without a prior history of falling. Although there exists a variety of terms related to the dscription
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> of the psychological (anticipated or actual) effects of a fall, the 2022 World Falls Guidelines for falls prevention and management for older adults recommend the use of the term concerns about falling [1].

Physical activity is an umbrella term used to describe any human movement produced by the contraction of skeletal muscles that raises energy expenditure above resting metabolic rate (i.e., 1 Metabolic Equivalent of Task; MET [30]. Four main domains or types of activity have been identified: leisure-time physical activity, work- or school-related activity; household, domestic, or self-care activities; and activity for transport from place to place [31]. In addition to frequency and type of activity, physical activity behavior is also characterized by its duration (e.g., minutes/week), intensity (e.g., light, moderate, and vigorous), and mode (e.g., aerobic, muscle strengthening, and bone strengthening activities). The concept of physical activity is inclusive of the concepts of exercise and sport. Exercise refers to physical activity that is planned, structured, and repetitive for the purpose of enhancing or maintaining physical fitness and health [30]. Sport refers to physical activity that is rule governed, structured, competitive, and involves gross motor movement characterized by physical strategy, prowess, and chance [32]. However, the concept of physical activity does not encompass the concept of sedentary behavior [31]. Sedentary behaviors are defined as any waking behaviors characterized by an energy expenditure ≤ 1.5 METs, while in a sitting, reclining, or lying posture [33].

Types of evidence sources

The proposed scoping review will draw upon data from studies that have used a qualitative, quantitative, or mixed methodological approach. Irrespective of the methodological approach, we will include studies that have used cross-sectional, longitudinal, quasi-

experimental and experimental design. Knowledge synthesis of any types, conference abstracts,

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2 3	201	commentaries editorials study motocals thesis and discontation beaks and heals shortens and
4	301	commentaries, editorials, study protocols, thesis and dissertation, books and book chapters and
5 6 7	302	case studies will be excluded.
7 8 0	303	Search Strategy
9 10 11 12 13 14 15	304	The search strategy was developed was developed by the review team, which includes a
	305	database expert and health sciences information specialist. The health sciences information
	306	specialist and database expert implemented and executed an initial electronic databases
17 18	307	(coverage period) search strategy for CINAHL (EBSCO interface; 1976 – present), EMBASE
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34	308	(Elsevier interface; 1947 – present), PsycINFO (EBSCO interface; 1887 – present), PubMed
	309	(1946 – present), and SPORTDiscus (EBSCO interface; 1930 – present). For all databases,
	310	search terms taping on both the concept of concerns about falling and physical activity were
	311	used. Because the population of interest for this scoping review is the adult populations (≥ 18
	312	years), no age filters were used in any of the databases. Additionally, we used database-specific
	313	Index or Medical Subject Headings (MeSH) terms when available. The free text search terms
	314	remained constant across all databases, searching across title, abstract, and when available,
35 36	315	keyword fields. We updated the database-specific terms for each database, where available, but
37 38 39 40 41 42 43 44 45	316	used the same key concepts across all the databases. We used filters for resource types (i.e.,
	317	Academic Journals) in two of the EBSCO databases (SPORTDiscus and PsycINFO) because of
	318	the indexing of periodicals in EBSCO. We will not use this option for CINAHL because the
	319	filter was experiencing technical difficulties when pilot-test searches were run. No date or
46 47 48	320	language filters were used. Full details of an example electronic search for PubMed are presented
49 50	321	in Table 2.
51 52	322	
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. .	"Fear"[MeSH Terms] OR "Avoidance Learning"[MeSH Terms] OR "Self Efficacy"[MeS					
	Terms]					
2.	"fear"[Title/Abstract] OR "fears"[Title/Abstract] OR "concern"[Title/Abstract] OR					
	"concerns"[Title/Abstract] OR "confidence"[Title/Abstract] OR "accidental"[Title/Abstr					
	OR "efficacy"[Title/Abstract] OR "beliefs"[Title/Abstract] OR "avoidance"[Title/Abstra					
	OR "confident"[Title/Abstract] OR "threat"[Title/Abstract] OR "threats"[Title/Abstract]					
	"afraid"[Title/Abstract] OR "worry"[Title/Abstract] OR "worries"[Title/Abstract] OR					
	"worried"[Title/Abstract] OR "fearful"[Title/Abstract] OR "frightened"[Title/Abstract] O					
	"concerned"[Title/Abstract] OR "post fall syndrome"[Title/Abstract] OR					
	"ptophobia"[Title/Abstract] OR "scared"[Title/Abstract]					
3.	#1 OR #2					
4.	"Accidental Falls"[Mesh]					
5.	"falling"[Title/Abstract] OR "falls"[Title/Abstract] OR "fall"[Title/Abstract] OR					
	"balance"[Title/Abstract]					
6.	#4 OR #5					
7.	"Activities of Daily Living"[MeSH Terms] OR "Exercise"[MeSH Terms] OR					
	"Walking"[MeSH Terms] OR "Sports"[MeSH Terms]					
8.	"exercise"[Title/Abstract] OR "physical activity"[Title/Abstract] OR "physical					
	fitness"[Title/Abstract] OR "step count"[Title/Abstract] OR "walking"[Title/Abstract] O					
	"mobility"[Title/Abstract]					
9.	"Activity"[Title/Abstract] OR "activities"[Title/Abstract]					
10	"Daily living"[Title/Abstract] OR "level"[Title/Abstract] OR "levels"[Title/Abstract] OF					
11.	"avoidance"[Title/Abstract] OR "intensity"[Title/Abstract] OR "restricted"[Title/Abstract]					
	#9 AND #10					
12	#7 OR #8 OR #11					
	#3 AND #6 AND #12					

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- 3 4	328	5,7,8,19–21,23,24]. Lastly, we will perform a citing reference search for all included studies
5 6	329	using Web of Science. The results of the search will be reported in a PRISMA-ScR flow-chart
7 8	330	[29].
9 10 11	331	Studies written in any language will be included. Title and abstract of any potential
12 13	332	studies that are reported in a language other than English will be initially translated using Google
14 15	333	Translate. The full text will be translated by a qualified translator if it meets the inclusion criteria
16 17 18	334	at that stage. It is worth noting that at least one member of the review team has high proficiency
19 20	335	in English, French, and Korean. We will place no constraints on the publishing year of the
21 22	336	studies. We will use Covidence, a web-based software platform, to manage the retrieved citation
23 24 25	337	records (Covidence systematic review software, Veritas Health Innovation, Melbourne,
25 26 27	338	Australia).
28 29	339	Source of Evidence Selection
30 31	340	We ran an initial electronic databases search on May 23, 2022, which yield a total of
32 33 34	341	24,359 records (k). We will update the electronic databases search before formally implementing
35 36	342	our final, complete search strategy. We will not use any automation tools for study selection.
37 38	343	Screening of Titles and Abstracts
39 40	344	Given the high number of identified records through our initial electronic citation search
41 42 43	345	(k = 24,359) and the related time and cost constraints associated with their screening, we
44 45	346	assembled a team of six reviewers that will single-screen titles and abstracts using an over-
46 47	347	inclusive approach. Specifically, a given record will be retained and considered for full-text
48 49 50	348	examination if there is insufficient information to conclude with certainty its exclusion. The
50 51 52	349	specific exclusion criteria considered at this stage were: conference abstract, review article, case
53 54 55	350	report/series, not human research, ineligible age group (< 18 years), not reporting on either the
56 57		
58 59		
60		For peer review only - http://pmjopen.bmj.com/site/about/guidelines.xntml

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concept of physical activity or the concept of concern about falling. We used a two-step process for pilot-testing the titles and abstracts screening procedure. First, a random sample of 100 records from our initial search were selected and independently screened for eligibility by two review members. The decisions were compared, and discrepancies among the two reviewers were resolved by discussion. At the end of this first step, the reviewers disagreed on only two studies, and both reviewers agreed to exclude both after discussion. Second, another random sample of 100 records was selected and independently screened for eligibility by four reviewers. Then one of the reviewers involved in the first step described above met with the four reviewers to provide training and discuss screening decisions. Upon pilot-testing the process of screening titles and abstract and given the number or records to screen, the review team decided that all titles and abstracts would be screened by a single reviewer, one the six involved in pilot-testing titles and abstracts screening procedure. The single screening of the titles and abstracts can yield high sensitivity (98% - 100%) when certain exclusion criteria are used – such as conference abstract, review article, case report/series, not human research, ineligible age group (< 18 years) [34] – and is acceptable at this stage of the selection process [34,35].

Full-Text Examination

We will retrieve the full text of the records selected for inclusion at the titles and abstracts screening stage. Two reviewers will independently assess the eligibility of each article. Multiple articles reporting on the same study and written by the same authors group will be gathered and scrutinized to ensure that only unique study, rather than each article or duplication study, represents the unit of interest in the scoping review. When necessary for the making of a

selection decision, we will contact the authors of the articles for unpublished information. The decisions to include an article will be compared between the two reviewers, and discrepancies

between reviewers will be resolved by discussion. When no consensus can be reached, a third reviewer will help resolve the discrepancy. Moreover, any relevant retraction statements and errata for information for each included article will be examined to exclude data from studies that are fraudulent or studies that include errors. We will report reasons for exclusion of full-text articles that do not meet the eligibility criteria in a supplementary document in the scoping review.

380 Data extraction

Prior to data extraction, two reviewers will independently pilot-test a purpose-built data extraction sheet with three randomly selected records. An initial version of the purpose-built data extraction sheet is provided in online supplementary appendix 2. Reviewers will collect information about the characteristics of the study (i.e., authors, year of publication, origin/country of origin, aims/purposes), population and sample (i.e., sample size, mean age and range, percentage of women/female, race/ethnicity characteristics, health status, and settings -e.g., community, nursing home, medical facilities), the concept of concerns about falling (e.g., measurement instrument used and facet measured), and the concept of physical activity (e.g., measurement instrument used and facet measured). Reviewers will extract relevant information regarding all types of physical activity – all physical activity measurement metrics (e.g., frequency, duration, volume, number of steps, arbitrary activity units) will be considered, as well as the measurement by means of device-based (e.g., accelerometer) and self-report (e.g., questionnaires) instruments. For each study included, we will collect findings pertaining to evidence of moderation. Specifically, we will identify if a moderating factor was investigated (yes/no), specify the theoretical approach underlying the investigation (if any), and

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methodological approaches for investigating moderator effect (e.g., qualitative, quantitative, or mixed methods), the results pertaining to moderation, and the main conclusion of the study. It is expected that the data extraction sheet will be refined and revised following the pilot-testing of the data extraction process. After pilot-testing of the data extraction sheet, we will hold a meeting with all scoping review authors to discuss all aspect of the revised version of the data

extraction sheet and agree on its final version. Then, two reviewers will independently extract

data from all included studies, compare results, and resolve any discrepancies through

discussion. We will contact the study authors for clarification on unreported data item. When no consensus on reported data items can be reached, we will contact the study authors to help resolve the discrepancy. We will hold bi-weekly meetings throughout the data extraction process to discuss progress and monitor whether the data extraction sheet is capturing all the essential information to properly answer the research questions.

Data analysis and presentation of results

Primary study and sample characteristics will be reported for descriptive purposes in a summary table. We plan to use iconography to display the different types and number of samples drawn by the included studies. Moreover, we plan on using a waffle chart to illustrate the type of research methodology used within the included studies.

We will analyze the data descriptively, and report frequency count and percentage of studies investigating and reporting on evidence of moderation. Further, data will be charted, categorized, and summarized by mapping the data pertaining to the evidence for and against moderation to each of the hypothesized moderating factors outlined in Table 1. This will be applied to all studies, irrespective of the methodological approach or study design. Prior to mapping the evidence of moderation, the review authors will familiarize themselves with the Page 21 of 32

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2 3 4	419	data by reading and understanding all the included studies for review and understanding the
5 6	420	relevance of the data in relation to the main scoping review question. Result of this qualitative
7 8 9	421	synthesis will be presented using a tree graph to display the moderating factor(s) investigated by
10 11	422	the included studies, and a ratio showing the number of time evidence for moderation was
12 13	423	reported by the total number of investigations.
14 15 16	424	We will perform a narrative synthesis of the findings to highlight similarities and
17 18	425	differences both within and across studies by examining the convergence and divergence in
19 20	426	findings across qualitative and quantitative methodological approach, the concepts of concerns
21 22 23	427	about falling and physical activity behavior, and sample characteristics.
24 25	428	ETHICS AND DISSEMINATION PLAN
26 27	429	The Information withheld for peer-review] University Human Research
28 29 30	430	Protection Program determined that the proposed scoping review does not qualify as Human
31 32	431	Subjects Research under federal human subjects research regulations (IRB-2023-1656).
33 34	432	The results of this proposed scoping review will be disseminated through various means.
35 36 27	433	First, will disseminate the study findings through a peer-reviewed scientific journal and
37 38 39	434	presentation at a scientific conference. Second, will disseminate the findings in the form of a 1-
40 41	435	page summary, in plain language, via written briefs or e-newsletters to Extension Program
42 43	436	leaders, part of a nationwide Cooperative Extension network. We also plan to present posters or
44 45 46	437	e-posters at the national Health Extension annual conference. Extension Program and community
47 48	438	leaders attend training sessions during this conference. They represent an important group of
49 50	439	end-users as many of them deliver to members of their community evidence-based programs to
51 52 53	440	reduce concerns about falling and the promote of physical activity (e.g., A Matter of Balance,
53 54 55 56 57	441	Stepping On, Fit & Strong!) with the overall objective of preventing and managing falls.
58		21

 442 COMPETING INTERESTS 443 The authors declare that they have no known competing financial interests or 444 relationships that could have appeared to influence the work reported in this article. 445 AUTHOR CONTRIBUTIONS 446 All listed authors have contributed and will continue to contribute meaningful 447 conduct and reporting of proposed scoping review 	personal
 442 COMPETING INTERESTS 443 The authors declare that they have no known competing financial interests or 444 relationships that could have appeared to influence the work reported in this article. 445 AUTHOR CONTRIBUTIONS 446 All listed authors have contributed and will continue to contribute meaningful 447 conduct and reporting of proposed scoping review. Conceived the pro- 	personal
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446 All listed authors have contributed and will continue to contribute meaningful 447 conduct and reporting of proposed scoping review.	
447 conduct and reporting of proposed scoping review conceived the pro-	lly to the
conduct and reporting of proposed scoping review.	posed
448 review [Information withheld for peer-review]. developed the search	strategy,
and [Information withheld for peer-review] ran the initial electronic databases.	
450 [Information withheld for peer-review], are th	ie six title
and abstract reviewers. [Information withheld for peer-review] is an Extension	n Specialist,
452 with experience in delivering programs to reduce concerns about falling and promote	physical
activity to midlife and older adults, who will provide insights on the usefulness of the	escoping
454 review findings to practitioners. In addition, [Information withheld for peer-re	eview] will
help identify language barriers in the reporting of the scoping review results. All auth	ors read the
456 final protocol manuscript and revised it for content; all approved the final version.	ę
457 FUNDING STATEMENT	
458 This research received no specific grant from any funding agency in the public	с,
459 commercial, or not-for-profit sectors.	
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Online Supplementary File 1: Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist adapted for scoping review protocol¹

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	2
INTRODUCTION	N		
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	5-12
Objectives	4 Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.		12
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	Non applicable
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	13-15;17

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SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Information sources ¹	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	15-16
Search	8	Present the full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	15-16
Selection of sources of evidence ²	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	17-19
Data charting process ³	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	19-20; Appendix 2
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	19-20; Appendix 2
Critical appraisal of individual sources of evidence ⁴	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	Not applicable
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	20-21
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	22

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

¹Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

²A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote). ³The frameworks by Arkeny and O'Melley [1] and Layse et al. [2] and the JPL guidence [3, 5] refer to the process

³The frameworks by Arksey and O'Malley [1] and Levac et al. [2] and the JBI guidance [3-5] refer to the process of data extraction in a scoping review as data charting.

⁴The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

¹Adapted from Tricco et al. [6].

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Source or e	vidence (Authors, year)
Country	
Methodolog	gy : qualitative, quantitative, or mixed methods
Study desig	n: cross-sectional, longitudinal, quasi-experimental, or experimental
Sample	
Age: Samj	ple mean age and/or age range (years)
Biological	sex: Percentage of female
Race/ethni	icity: Percentage of White
Health stat	tus and/or setting
Theory: Na	me of the theory (if any)
Concept of	concerns about falling
Facet mea	sured: Fear of falling or fall efficacy
I doot inted	
Measurem	ent instrument used: Name of the instrument (if any)
Measurem	nent instrument used: Name of the instrument (if any) physical activity
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Moderation investigation:

Yes/no

Theoretical rationale for the investigation and hypotheses (if any)

Description of how evidence of moderation was examined

to mode. Main findings pertaining to moderation

Uncovering the boundary conditions of the association between concerns about falling and physical activity in adult populations: A scoping review protocol

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3 4	55	ABSTRACT
5 6	56	Introduction: Despite evidence of variation in how concerns about falling influence physical
/ 8 9	57	activity, many of the currently available knowledge syntheses merely assume that this
10 11	58	relationship is uniform across populations and contexts. Therefore, we propose a scoping review
12 13	59	protocol to guide a summary of the body work that has examined the association between
14 15	60	concerns about falling and physical activity in adult populations, with an eye on the availability
16 17 18	61	of empirical evidence of moderation. Methods and analyses: Studies reporting on both the
19 20	62	concepts of concerns about falling and physical activity among samples with a mean age ≥ 18
21 22	63	years will be included. Five electronic databases will be searched. We will conduct a hand search
23 24 25	64	of the reference lists for all included studies and relevant knowledge syntheses and perform a
25 26 27	65	citing reference search for all included studies using Web of Science. A team of six reviewers
28 29	66	will single-screen titles and abstracts. Two reviewers will independently assess the eligibility of
30 31	67	each study based on a full-text examination. Results will be presented using a tree graph to
32 33 34	68	display the moderating factor(s) investigated and a ratio showing the number of time evidence
35 36	69	for moderation was examined by the total number of investigations. Ethics and dissemination:
37 38	70	The university Human Research Protection Program determined that the proposed scoping
39 40 41	71	review does not qualify as Human Subjects Research under federal human subjects research
41 42 43	72	regulations (IRB-2023-1656). Results will be published in a peer-review journal and in the form
44 45	73	of a 1-page summary for Extension Program leaders, part of a nationwide Cooperative Extension
46 47	74	network.
48 49 50	75	Key words: accidental falls, effect modifier, exercise, fear, health behavior.
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2 3 4	78		STRENGTHS AND LIMITATIONS OF THIS STUDY	n: first
5 6	79	•	The proposed scoping review will include both qualitative and quantitative studies,	publis
7 8 9	80		providing a more complete picture of the availability of empirical evidence of	ned as
10 11	81		moderation.	10.113 Prote
12 13	82	•	The electronic database search was designed and pilot-tested to ensure high sensitivity	6/bmjo ected b
14 15 16	83		and reliability while balancing time and cost constraints.	pen-20 y copy
17 18	84	•	We will analyze data by mapping the empirical evidence of moderation to theory-derived	23-083 rright, i
19 20 21	85		moderation hypotheses.	234 on ncludii
21 22 23	86	•	Given that an assessment of risk of bias of the studies included in the proposed review	20 De
24 25	87		will not be conducted, the specific clinical and policy implications of the proposed review	cembe Ensei uses re
27 228 29 30 31 32 33 34 35 37 38 30 41 42 43 44 50 51 52 53 45 55 55 55 55 55 55 55 55	88		may be limited.	2024. Downloaded from http://bmjopen.bmj.com/ on June 12, 2025 at Agence Bibliogra nement Superieur (ABES) . ated to text and data mining, Al training, and similar technologies.
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INTRODUCTION

90	Evaluation and reduction of concerns about falling and the promotion of physical activity
91	are two fundamental aspects of fall prevention and management [1]. Although regular
92	engagement in physical activity and adherence to multicomponent physical activity programs
93	can reduce concerns about falling and prevent falls, concerns about falling may represent for
94	many a barrier to physical activity participation [2–5]. This is an important public health issue
95	because both fallers and non-fallers in various adult populations are concerned about falling, and
96	such concerns can interfere with participation in various activities of daily living and reduce
97	quality of life. Ultimately, concerns about falling may increases the risk of future falls and care
98	dependency, which can both be further heightened by physical inactivity [1].
99	Concerns about falling tend to be negatively associated with physical activity
100	participation. However, concerns about falling may not uniformly influence physical activity
101	behavior across populations and contexts [6]. For instance, concerns about falling may have a
102	stronger negative influence on physical activity participation among older adults, people with
103	disease-specific symptoms and disabilities, or people with a history of falls [5,7,8]. Moreover,
104	theoretical [9–11] and qualitative [3] evidence indicate that concerns about falling could
105	positively influence physical activity in certain contexts.
106	In this article, we propose a scoping review protocol to guide a summary of the body
107	work that has avantined the association between concerns about falling and abusical activity in

work that has examined the association between concerns about falling and physical activity in adult populations (age \geq 18 years), with an eye on the availability of empirical evidence of moderation, also known as effect modification. In the context of the proposed scoping review, moderation represents the variation in the degree to which concerns about falling relate to physical activity as a function of another factor, called a moderator variable. Specifically, a

moderator is a variable that changes the direction (sign) or magnitude (size) of the relation between concerns about falling and physical activity behavior. We expect the findings of the proposed scoping review to make a significant contribution to the literature by encouraging researchers to specify variables as moderators of the relation between concerns about falling and physical activity behavior at the onset of their studies and make sampling and measurement related decisions that would enable them to perform more sensitive moderation analyses. It is also expected that these findings will help researchers to provide a more compelling rationale for the a priori planning and conduct of subgroup and meta-regression analyses of future meta-analyses. Ultimately, the proposed scoping review is expected to provide new insights that could help practitioners and researchers determine more precisely for whom and when concerns about falling should be a considered for promoting physical activity more effectively in the context of fall prevention and management.

124 Rationale

According to the social cognitive framework, concerns about falling could be linked to the construct of beliefs [12,13] or representations [14] about a health threat. Beliefs or representations about a health threat are thought to be linked to one's motivation to either adopt or avoid certain behaviors. Specifically, the construct of threat appraisal is theorized to capture one's held beliefs about a health threat (e.g., consequences of falling such as pain, injury or loss of independence), and its association with negative emotions (e.g., concerns, worry, fear, or anxiety; [15]). The concept of concerns about falling has been explicitly linked to the construct of threat appraisal in prior research in the context of physical activity in older adults [16,17]. Further, both the protection motivation theory [13] and common sense model [14] posit a stronger and positive relationship between threat appraisal (e.g., concerns about falling) and

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3 4	135	people's intention toward a given behavior (e.g., physical activity) for people who believe in the
5 6	136	effectiveness of that behavior in preventing the threat (e.g., engaging in balance and
7 8 0	137	strengthening exercise is an effective strategy to prevent injurious falls) and in their capabilities
9 10 11	138	in engaging in that behavior (e.g., self-efficacy for engaging in balance and strengthening
12 13	139	exercise). This perspective is also consistent with the conceptual framework describing the
14 15	140	origination and consequences of worries about falling by Ellmers et al. [18], which specifies
16 17 18	141	perception of control over one's concerns about falling as a key factor determining whether
19 20	142	concerns about falling motivate positive and protective changes in behavior.
21 22	143	According to the affect and health behavior framework, concerns about falling could be
23 24 25	144	linked to the concept of incidental affect [10]. Incidental affect refers to how one feels
23 26 27	145	throughout the day outside the context of the target behavior. According to this perspective,
28 29	146	concerns about falling can positively influence physical activity, but only if one expects that
30 31	147	engaging in physical activity will contribute to alleviating their concerns about falling.
32 33 34	148	Otherwise, concerns about falling will negatively influence physical activity. In contrast,
35 36	149	concerns about falling can lead to excessive physical activity avoidance if people anticipate
37 38	150	avoiding physical activity will help them cope with such concerns and protect them against
39 40	151	potential harms from future falls.
41 42 43	152	Drawing on this same theoretical framework, concerns about falling could also be linked
44 45	153	to the concept of affectively charged motives [10]. Affectively charged motives represent a
46 47	154	category of motives that arise from the feelings experienced while performing a given behavior.
48 49 50	155	According to this perspective, concerns about falling can reflect a more intense emotion, such as
50 51		

fear or anxiety, that would drive one to disengage from physical activity experiences that

previously have been associated with negative emotions. This perspective is also consistent with

the model of fear of falling, falls efficacy and anxiety [9], and the fear-avoidance model of falling and functional disability [11]. One important implication of this perspective is that the influence of concerns about falling on physical activity can be highly contextual. If past experiences of physical activity have been unpleasant because one fell while doing an activity -leading one to experience pain, an injury, or a loss of independence – concerns about falling can prompt people to either avoid all kinds of physical activities, the specific activity associated with the fall, or the performance of physical activity in the specific context in which the fall occurred (e.g., avoiding the performance of physical activity under poor weather conditions, such as walking on an icy sidewalk). Findings from prior knowledge syntheses provide converging evidence in support of a negative association between concerns about falling and physical activity behavior [2,3,5,7,19-21]. Ramsey et al. [2] calculated the median Pearson correlation coefficient quantifying the strength of the association between fear of falling and daily steps (r = -0.21) and daily minutes of moderate-to-vigorous physical activity (r = -0.24) among older adults (≥ 60 years). Using benchmarking methods outlined by Wright et al. [22], these estimates indicate that older adults who are fearful of falling would typically take 321 fewer steps per day (or 2247 steps/week) and spent 12.6 minutes less in moderate-to-vigorous intensity physical activity per day (or 88.2 minutes/week) compared to those who are not fearful. Despite evidence that the size or sign of the association between concerns about falling

176 Despite evidence that the size or sign of the association between concerns about falling 177 and physical activity behavior can depend on another factor, most prior knowledge syntheses 178 merely assumed that concerns about falling uniformly influence that behavior across populations 179 and contexts. There are few notable exceptions, however. First, Beart et al. [7] hypothesized that 180 the negative influence of concerns about falling on physical activity might be stronger as people

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181	age, especially among people aged 80 years and over. Second, Rider et al. [8] hypothesized that
182	Parkinson's disease-specific symptoms and disabilities could moderate the impact of concerns
183	about falling on physical activity behavior such that the negative influence of concerns about
184	falling on physical activity would be stronger when people have increased walking difficulties,
185	hyperkinesia, rigidity, freezing of gait, or impaired balance. Lastly, both systematic reviews of
186	the qualitative literature by Franco et al. [5] and Meridith et al. [3] concluded that for many older
187	adults (\geq 60 years), the influence of concerns about falling on physical activity participation was
188	negative but depended on one's prior falls history or context. A history of falls could strengthen
189	the negative influence of concerns about falling on physical activity [5], whereas concerns about
190	falling could promote engagement in certain types of exercise when performed with the overall
191	goal of improving physical functioning or reducing risk of future falls [3]. Lastly, there is
192	empirical evidence indicating that women (compared to men) may show a greater tendency to
193	restrict their activities to protect themself against potential harms from future falls [23,24].
194	In summary, there is theoretical evidence and hypotheses in support of moderation,
195	whereby the direction (sign) or magnitude (size) of the association between concerns about
196	falling and physical activity may depend on another factor, called a moderator variable. These
197	potential moderators are specified in Table 1 below.
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205 physical activity behavior

Moderator	Sign and size of th
	effect modification
Age	
• For people who are older (relative to younger people), especially for those	Sign: Negative
aged 80 years and over.	Size: Larger
Beliefs about capabilities	
• When people hold the belief that they can organize, execute, and engage	Sign: Positive
in physical activity despite the presence of barriers.	
Beliefs about consequences	
• When people hold the belief that physical activity is an effective strategy	Sign: Positive
for preventing falls.	
 When people hold the belief that physical activity will help them relieve 	Sign: Positive
their concerns about falling.	
• When people hold the belief that avoiding physical activity will help them	Sign: Negative
reduce their concerns about falling and protect them from future falls.	Size: Larger
Biological sex / gender	
• For women (compared to men)	Sign: Negative
	Size: Larger
Disease-specific symptoms and disabilities	•
• For people with disease-specific symptoms or a disability	Sign: Negative
	Size: Larger
History of falls (within context)	
 When past experiences of physical activity have been unpleasant because 	Sign: Negative
one fell while doing an activity.	Size: Larger

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Prior Knowledge Syntheses Most prior knowledge syntheses only included studies that sampled older adults (≥ 60 years; [2–5,7,25,26]. Although insightful, the generalizability of their findings to other populations for which concerns about falling and fall prevention and management have important clinical implications cannot be inferred. Notably, one narrative knowledge synthesis [21] concluded that there is a "probable negative association" between fear of falling and physical activity behavior among people who had a transient ischemic attack or stroke (Table 1; p. 62). Rider et al. [8] performed a scoping review of studies examining the association between fear of falling and activity avoidance among people with Parkinson's disease and reported that concerns about falling "emerged with a strong association with avoidance behavior" (p. 12). Based on the findings from two studies, Streber et al. [20] performed a systematic review of factors related to physical activity in persons with multiple sclerosis and concluded that fallsrelated efficacy (higher levels of falls-related efficacy reflects lower levels of concerns about falling) was "consistently positively associated with physical activity [in persons with multiple sclerosis] but was less frequently examined" (p. 639). Moreover, although some knowledge syntheses specifically focused on the concept of physical activity [2,3,19–21], others were based on a broad conceptualization of the concepts

"activity restriction," "activity avoidance", or "activity level" [4,8,25,26]. These concepts
typically encompass a wide range of activity-related outcomes such as engagement in activities
of daily living, motor skills or mobility assessments, engagement in social activities, church
attendance, and physical activity. As a result, it is difficult to delineate the findings that pertain
specifically to physical activity from other activities or behaviors.

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> 232 **Scoping Review Objectives**

We propose to conduct a scoping review to map the research pertaining to the association 233 between concerns about falling and physical activity behavior in adult populations, with an eve 234 on the availability of empirical evidence of moderation. A preliminary search for existing 235 236 scoping review reporting on evidence of moderation for the association between concerns about 237 falling and physical activity behavior in adult populations (≥ 18 years) revealed that none exist [date of the search: May 11, 2023; electronic database searched: CINAHL (EBSCO interface). 238 EMBASE (Elsevier interface), PubMed, PsycINFO (EBSCO interface), and SPORTDiscus 239 240 (EBSCO interface)]. The primary research question of the proposed scoping review is: What literature exists on evidence of moderation of the association between concerns about falling and 241 physical activity in adult populations (age ≥ 18 years)? We propose two sub questions: 242 1- What range of evidence there is within the sources of evidence identified for the primary 243 research question with respect to research methodology and selected attributes of the 244 245 research design? 2- Which factors have been identified as a moderator within the sources of evidence 246 identified for the primary research question? 247 **METHODS AND ANALYSIS** 248 This scoping review protocol was developed following guidance of the scoping review 249 250 framework proposed by the JBI Manual for Evidence Synthesis [27,28]. The reporting of this 251 scoping review protocol follows the reporting guidelines for scoping review protocols [27], and 252 is consistent with the Preferred Reporting Items for Systematic Review and Meta-Analysis 253 Protocols (PRISMA-P; [29]). An adapted version of the PRISMA-ScR checklist based on the reporting guidelines for scoping review protocols [27] is provided in online supplementary 254 255 appendix 1. 12

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We will conduct the proposed scoping review in accordance with the scoping review framework outlined by the JBI Manual for Evidence Synthesis [28,30]. The reporting of the proposed scoping review will follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR; [31]). Any deviations to the protocol, along with their respective justification, will be reported in the final scoping review report.

Eligibility Criteria

Participants

Studies that report on samples with a mean age ≥ 18 years will be included for review. Studies that have drawn on samples of either recreational or professional athletes, and people who were unable to engage in physical activity will be excluded.

Concepts

Concerns about falling. Several facets closely related to the concept of concerns about falling were examined in prior research [6], including fear of falling and falls efficacy [9,11,15]. Fear of falling refers to a more intense, lasting concern about falling (e.g., feeling more anxious, fearful, or worried), whereas falls efficacy refers to the perceived capability in keeping balance or in preventing falls while performing various activities of daily living (e.g., going up or down stairs, walking up or down a slope). While concerns about falling may arise because of a fall, such concerns can also exist without a prior history of falling. Although there exists a variety of terms related to the description of the psychological (anticipated or actual) effects of a fall, the 2022 World Falls Guidelines for falls prevention and management for older adults recommend the use of the term concerns about falling [1].

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Physical activity. Physical activity is an umbrella term used to describe any human movement produced by the contraction of skeletal muscles that raises energy expenditure above resting metabolic rate (i.e., 1 Metabolic Equivalent of Task; MET [32]. Four main domains or types of activity have been identified: leisure-time physical activity, work- or school-related activity; household, domestic, or self-care activities; and activity for transport from place to place [33]. In addition to frequency and type of activity, physical activity behavior is also characterized by its duration (e.g., minutes/week), intensity (e.g., light, moderate, and vigorous), and mode (e.g., aerobic, muscle strengthening, and bone strengthening activities). The concept of physical activity is inclusive of the concepts of exercise and sport. Exercise refers to physical activity that is planned, structured, and repetitive for the purpose of enhancing or maintaining physical fitness and health [32]. Sport refers to physical activity that is rule governed, structured, competitive, and involves gross motor movement characterized by physical strategy, prowess, and chance [34]. However, the concept of physical activity does not encompass the concept of sedentary behavior [33]. Sedentary behaviors are defined as any waking behaviors characterized by an energy expenditure ≤ 1.5 METs, while in a sitting, reclining, or lying posture [35]. Types of evidence sources The proposed scoping review will draw upon data from studies that have used a qualitative, quantitative, or mixed methodological approach. Irrespective of the methodological

approach, we will include studies that have used cross-sectional, longitudinal, quasi-

experimental and experimental design. Knowledge synthesis of any types, conference abstracts,

commentaries, editorials, study protocols, thesis and dissertation, books and book chapters and

case studies will be excluded.

Search Strategy

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301	The search strategy was developed was developed by the review team, which includes a
302	database expert and health sciences information specialist. The health sciences information
303	specialist and database expert implemented and executed an initial electronic databases
304	(coverage period) search strategy for CINAHL (EBSCO interface; 1976 - present), EMBASE
305	(Elsevier interface; 1947 – present), PsycINFO (EBSCO interface; 1887 – present), PubMed
306	(1946 – present), and SPORTDiscus (EBSCO interface; 1930 – present). For all databases,
307	search terms taping on both the concept of concerns about falling and physical activity were
308	used. Because the population of interest for this scoping review is the adult populations (≥ 18
309	years), no age filters were used in any of the databases. Additionally, we used database-specific
310	Index or Medical Subject Headings (MeSH) terms when available. The free text search terms
311	remained constant across all databases, searching across title, abstract, and when available,
312	keyword fields. We updated the database-specific terms for each database, where available, but
313	used the same key concepts across all the databases. We used filters for resource types (i.e.,
314	Academic Journals) in two of the EBSCO databases (SPORTDiscus and PsycINFO) because of
315	the indexing of periodicals in EBSCO. We will not use this option for CINAHL because the
316	filter was experiencing technical difficulties when pilot-test searches were run. No date or
317	language filters were used. Full details of an example electronic search for PubMed are presented
318	in Table 2.
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. .	"Fear"[MeSH Terms] OR "Avoidance Learning"[MeSH Terms] OR "Self Efficacy"[MeS
	Terms]
2.	"fear"[Title/Abstract] OR "fears"[Title/Abstract] OR "concern"[Title/Abstract] OR
	"concerns"[Title/Abstract] OR "confidence"[Title/Abstract] OR "accidental"[Title/Abstr
	OR "efficacy"[Title/Abstract] OR "beliefs"[Title/Abstract] OR "avoidance"[Title/Abstra
	OR "confident"[Title/Abstract] OR "threat"[Title/Abstract] OR "threats"[Title/Abstract]
	"afraid"[Title/Abstract] OR "worry"[Title/Abstract] OR "worries"[Title/Abstract] OR
	"worried"[Title/Abstract] OR "fearful"[Title/Abstract] OR "frightened"[Title/Abstract] O
	"concerned"[Title/Abstract] OR "post fall syndrome"[Title/Abstract] OR
	"ptophobia"[Title/Abstract] OR "scared"[Title/Abstract]
3.	#1 OR #2
4.	"Accidental Falls"[Mesh]
5.	"falling"[Title/Abstract] OR "falls"[Title/Abstract] OR "fall"[Title/Abstract] OR
	"balance"[Title/Abstract]
6.	#4 OR #5
7.	"Activities of Daily Living"[MeSH Terms] OR "Exercise"[MeSH Terms] OR
	"Walking"[MeSH Terms] OR "Sports"[MeSH Terms]
8.	"exercise"[Title/Abstract] OR "physical activity"[Title/Abstract] OR "physical
	fitness"[Title/Abstract] OR "step count"[Title/Abstract] OR "walking"[Title/Abstract] O
	"mobility"[Title/Abstract]
9.	"Activity"[Title/Abstract] OR "activities"[Title/Abstract]
10	"Daily living"[Title/Abstract] OR "level"[Title/Abstract] OR "levels"[Title/Abstract] OF
	"avoidance"[Title/Abstract] OR "intensity"[Title/Abstract] OR "restricted"[Title/Abstract]
11	#9 AND #10
12	#7 OR #8 OR #11
	#3 AND #6 AND #12

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- 3 4	328	5,7,8,19–21,25,26]. Lastly, we will perform a citing reference search for all included studies
5 6	329	using Web of Science. The results of the search will be reported in a PRISMA-ScR flow-chart
7 8	330	[31].
9 10 11	331	Studies written in any language will be included. Title and abstract of any potential
12 13	332	studies that are reported in a language other than English will be initially translated using Google
14 15	333	Translate. The full text will be translated by a qualified translator if it meets the inclusion criteria
16 17 18	334	at that stage. It is worth noting that at least one member of the review team has high proficiency
19 20	335	in English, French, and Korean. We will place no constraints on the publishing year of the
21 22	336	studies. We will use Covidence, a web-based software platform, to manage the retrieved citation
23 24 25	337	records (Covidence systematic review software, Veritas Health Innovation, Melbourne,
23 26 27	338	Australia).
28 29	339	Source of Evidence Selection
30 31	340	We ran an initial electronic databases search on May 23, 2022, which yield a total of
32 33 34	341	24,359 records (k). We will update the electronic databases search before formally implementing
35 36	342	our final, complete search strategy. We will not use any automation tools for study selection.
37 38	343	Screening of Titles and Abstracts
39 40 41	344	Given the high number of identified records through our initial electronic citation search
42 43	345	(k = 24,359) and the related time and cost constraints associated with their screening, we
44 45	346	assembled a team of six reviewers that will single-screen titles and abstracts using an over-
46 47 48	347	inclusive approach. Specifically, a given record will be retained and considered for full-text
49 50	348	examination if there is insufficient information to conclude with certainty its exclusion. The
51 52	349	specific exclusion criteria considered at this stage were: conference abstract, review article, case
53 54 55	350	report/series, not human research, ineligible age group (< 18 years), not reporting on either the
56 57		
58 59		17

concept of physical activity or the concept of concern about falling. We used a two-step process for pilot-testing the titles and abstracts screening procedure. First, a random sample of 100 records from our initial search were selected and independently screened for eligibility by two review members. The decisions were compared, and discrepancies among the two reviewers were resolved by discussion. At the end of this first step, the reviewers disagreed on only two studies, and both reviewers agreed to exclude both after discussion. Second, another random sample of 100 records was selected and independently screened for eligibility by four reviewers. Then one of the reviewers involved in the first step described above met with the four reviewers to provide training and discuss screening decisions. Upon pilot-testing the process of screening titles and abstract and given the number or records to screen, the review team decided that all titles and abstracts would be screened by a single reviewer, one the six involved in pilot-testing titles and abstracts screening procedure. The single screening of the titles and abstracts can yield high sensitivity (98% - 100%) when certain exclusion criteria are used – such as conference abstract, review article, case report/series, not human research, ineligible age group (< 18 years) [36] – and is acceptable at this stage of the selection process [36,37]. **Full-Text Examination**

We will retrieve the full text of the records selected for inclusion at the titles and abstracts screening stage. Two reviewers will independently assess the eligibility of each article. Multiple articles reporting on the same study and written by the same authors group will be gathered and scrutinized to ensure that only unique study, rather than each article or duplication study, represents the unit of interest in the scoping review. When necessary for the making of a selection decision, we will contact the authors of the articles for unpublished information. The

decisions to include an article will be compared between the two reviewers, and discrepancies

between reviewers will be resolved by discussion. When no consensus can be reached, a third reviewer will help resolve the discrepancy. Moreover, any relevant retraction statements and errata for information for each included article will be examined to exclude data from studies that are fraudulent or studies that include errors. We will report reasons for exclusion of full-text articles that do not meet the eligibility criteria in a supplementary document in the scoping review.

380 Data extraction

Prior to data extraction, two reviewers will independently pilot-test a purpose-built data extraction sheet with three randomly selected records. An initial version of the purpose-built data extraction sheet is provided in online supplementary appendix 2. Reviewers will collect information about the characteristics of the study (i.e., authors, year of publication, origin/country of origin, aims/purposes), population and sample (i.e., sample size, mean age and range, percentage of women/female, race/ethnicity characteristics, health status, and settings -e.g., community, nursing home, medical facilities), the concept of concerns about falling (e.g., measurement instrument used and facet measured), and the concept of physical activity (e.g., measurement instrument used and facet measured). Reviewers will extract relevant information regarding all types of physical activity – all physical activity measurement metrics (e.g., frequency, duration, volume, number of steps, arbitrary activity units) will be considered, as well as the measurement by means of device-based (e.g., accelerometer) and self-report (e.g., questionnaires) instruments. For each study included, we will collect findings pertaining to evidence of moderation. Specifically, we will identify if a moderating factor was investigated (yes/no), specify the theoretical approach underlying the investigation (if any), and

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methodological approaches for investigating moderator effect (e.g., qualitative, quantitative, or
mixed methods), the results pertaining to moderation, and the main conclusion of the study.

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It is expected that the data extraction sheet will be refined and revised following the pilot-testing of the data extraction process. After pilot-testing of the data extraction sheet, we will hold a meeting with all scoping review authors to discuss all aspect of the revised version of the data extraction sheet and agree on its final version. Then, two reviewers will independently extract data from all included studies, compare results, and resolve any discrepancies through discussion. We will contact the study authors for clarification on unreported data item. When no consensus on reported data items can be reached, we will contact the study authors to help resolve the discrepancy. We will hold bi-weekly meetings throughout the data extraction process to discuss progress and monitor whether the data extraction sheet is capturing all the essential information to properly answer the research questions.

8 Data analysis and presentation of results

409 Primary study and sample characteristics will be reported for descriptive purposes in a summary
410 table. We plan to use iconography to display the different types and number of samples drawn by the
411 included studies. Moreover, we plan on using a waffle chart to illustrate the type of research
412 methodology used within the included studies (i.e., qualitative, quantitative, and mixed
413 methods).

We will analyze the data descriptively, and report frequency count and percentage of studies investigating and reporting on evidence of moderation. Further, data will be charted, categorized, and summarized by mapping the data pertaining to the evidence for and against moderation to each of the hypothesized moderators outlined in Table 1. This will be applied to all studies, irrespective of the methodological approach or research design. Prior to mapping the evidence of moderation, the review authors will familiarize themselves with the data by reading Page 21 of 33

and understanding all the included studies for review and understanding the relevance of the data
in relation to the main scoping review question. Result of this qualitative synthesis will be
presented using a tree graph to display the moderating factor(s) investigated by the included
studies, and a ratio showing the number of time evidence for moderation was reported by the
total number of investigations.
We will perform a narrative synthesis of the findings to highlight similarities and
differences both within and across studies by examining the convergence and divergence in
findings across methodological approach, the concepts of concerns about falling and physical
activity behavior, and sample characteristics.
Patient and public involvement
Patients or the public were not involved in the design, or conduct, or reporting, or
dissemination plans of our research.
ETHICS AND DISSEMINATION PLAN
The Purdue University Human Research Protection Program determined that the
proposed scoping review does not qualify as Human Subjects Research under federal human
subjects research regulations (IRB-2023-1656).
The results of this proposed scoping review will be disseminated through various means.
First, will disseminate the study findings through a peer-reviewed scientific journal and
presentation at a scientific conference. Second, will disseminate the findings in the form of a 1-
page summary, in plain language, via written briefs or e-newsletters to Extension Program
leaders, part of a nationwide Cooperative Extension network. We also plan to present posters or
e-posters at the national Health Extension annual conference. Extension Program and community
leaders attend training sessions during this conference. They represent an important group of
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443	end-users as many of them deliver to members of their community evidence-based programs to
444	reduce concerns about falling and the promote of physical activity (e.g., A Matter of Balance,
445	Stepping On, Fit & Strong!) with the overall objective of preventing and managing falls.
446	COMPETING INTERESTS
447	The authors declare that they have no known competing financial interests or personal
448	relationships that could have appeared to influence the work reported in this article.
449	AUTHOR CONTRIBUTIONS
450	All listed authors have contributed and will continue to contribute meaningfully to the
451	conduct and reporting of proposed scoping review. S.A. and J.B.R. conceived the proposed
452	review. S.A. and J.B.R. developed the search strategy, and J.B.R. ran the initial electronic
453	databases. S.A., E.A.C, E.R.J, H.R., R.C.K., and J.B.R., are the six title and abstract reviewers.
454	K.J.M. is an Extension Specialist, with experience in delivering programs to reduce concerns
455	about falling and promote physical activity to midlife and older adults, who will provide insights
456	on the usefulness of the scoping review findings to practitioners. In addition, K.J.M. will help
457	identify language barriers in the reporting of the scoping review results. All authors read the final
458	protocol manuscript and revised it for content; all approved the final version. S.A. is responsible
459	for the overall content as guarantor.
460	FUNDING STATEMENT
461	This research received no specific grant from any funding agency in the public,
462	commercial, or not-for-profit sectors.
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Online Supplementary File 1: Preferred Reporting Items for Systematic reviews and Meta-

Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist adapted for scoping review

 $protocol^1$

SECTION	ITEM	REPORTED ON PAGE #	
TITLE			
Title	1	Identify the report as a scoping review.	1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	2
INTRODUCTIO	N		
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	5-12
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	12
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	Non applicable
Eligibility criteria		Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	13-15;17

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SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Information sources ¹	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	15-16
Search 8		Present the full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	15-16
Selection of sources of evidence ²	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	17-19
Data charting process ³ 10		Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	19-20; Appendix 2
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	19-20; Appendix 2
Critical appraisal of individual 12 sources of evidence ⁴		If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	Not applicable
Synthesis of results 13		Describe the methods of handling and summarizing the data that were charted.	20-21
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	22

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

¹Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

²A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

³The frameworks by Arksey and O'Malley [1] and Levac et al. [2] and the JBI guidance [3-5] refer to the process of data extraction in a scoping review as data charting.

⁴The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

¹Adapted from Tricco et al. [6].

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Country

Methodology: qualitative, quantitative, or mixed methods

Study design: cross-sectional, longitudinal, quasi-experimental, or experimental

BMJ Open

Sample

$\Delta \sigma e^{\cdot}$	Sample	mean	age	and/or	age	range	(vears)	
Age.	Sample	mean	age	and/or	age	range	(years)	

Biological sex: Percentage of female

Race/ethnicity: Percentage of White

Health status and/or setting

Theory: Name of the theory (if any)

Concept of concerns about falling

Facet measured: Fear of falling or fall efficacy

Measurement instrument used: Name of the instrument (if any)

Concept of physical activity

Domain or type of physical activity measured: Leisure-time physical activity, work- or schoolrelated activity, household, domestic, or self-care activities, activity for transport from place to place

Characteristics of physical activity: Frequency, Intensity, Mode

Mode of assessment: Self-report or device-based

Measurement instrument used: Name of the instrument (if any)

Main findings pertaining to the relationship between concerns about falling and physical activity

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Moderation investigation:

Yes/no

Theoretical rationale for the investigation and hypotheses (if any)

Description of how evidence of moderation was examined

Main findings pertaining to moderation

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