Factors Associated with Fear of Falling and Associated Activity Restriction in Community-Dwelling Older Adults: A Systematic Review

Michael D. Denkinger, M.D., Albert Lukas, M.D., †Thorsten Nikolaus, M.D., Klaus Hauer, Ph.D.

Objective: *Fear of falling (FOF) is an important threat to autonomy. Current interventions to reduce FOF have yielded conflicting results. A possible reason for this discrepancy could be its multicausality. Some risk factors may not have been identified and addressed in recent studies. The last systematic review included studies until 2006.* **Methods:** *To identify additional risk factors for FOF and to test those mentioned previously, we conducted a systematic literature review. Studies examining FOF in community-dwelling older adults between 2006 and October 2013 were screened.* **Results:** *Outcomes are summarized with respect to different constructs such as FOF, fall-related self-efficacy/balance confidence, and FOF-related activity restriction. Odds ratios and p values are reported. There is no clear pattern with regard to the different FOF-related constructs studied. The only parameters robustly associated across all constructs were female gender, performance-based and questionnaire-based physical function, the use of a walking aid, and, less robust, a history of falls and poor self-rated health. Conflicting results were identified for depression and anxiety, multiple drugs, and psychotropic drugs. Other potentially modifiable risk factors were only mentioned in one or two studies and warrant further investigation. Parameters with mainly negative results are also presented.* **Conclusion:** *Only few risk factors identified were robustly associated across all FOF-related constructs and should be included in future studies on FOF. Some newer factors have to be tested again in different cohorts. The comprehensive overview might assist in the conceptualization of future studies.* (Am J Geriatr Psychiatry 2015; 23:72–86)

Key Words: Fear of falling, fall-related self-efficacy, balance confidence, community-dwelling older adults, systematic review

Received April 26, 2013; revised February 5, 2014; accepted March 6, 2014. From the Agaplesion Bethesda Clinic (MDD, AL, TN), Geriatric Chair of Ulm University, Ulm, Germany; and Agaplesion Bethanien Clinic (KH), Geriatric Centre of Heidelberg University, Heidelberg, Germany. Send correspondence and reprint requests to Michael D. Denkinger, M.D., Agaplesion Bethesda Clinic, Geriatric Center Ulm University, Zollernring 26, D-89073 Ulm, Germany. e-mail: michael.denkinger@bethesda-ulm.de

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INTRODUCTION

Fear of falling (FOF) is often used as an umbrella term that can be disentangled into distinct psychological concerns such as the specific fall-related fear, fall-related self-efficacy, balance confidence, and others.[1] Although these parameters are highly related, distinctions can be made when interpreting the results of different studies. In a review article, Hadjistavropoulos et al.[2] called for a clear distinction between the terms "falls efficacy" (fall-related self-efficacy) including balance confidence and "fear of falling." In their proposed model, supported by a focused literature review, FOF itself influenced activity avoidance, balance/functional performance, and subsequently falls indirectly through falls efficacy. This model is in line with findings that FOF can (directly or indirectly) have serious consequences for mobility and quality of life in older adults both in the community[3] and in nursing homes,[4] often through activity restriction and avoidance.[5,6] It was also predictive of delayed recovery from incident disability in geriatric rehabilitation.[7] Hence, in recent years, FOF has been clearly identified as one of the most important and potentially modifiable threats to autonomy in older individuals.

Interventional studies have mostly proven beneficial in reducing FOF and other endpoints, especially in frail, older, fall-prone populations, as demonstrated by different (systematic) reviews.[8–10] Interventions were typically based on Tai Chi, multicomponent interventions, or exercise. Tai Chi has been identified as the most consistent intervention, especially with regard to balance confidence.[8] However, in another meta-analysis, evidence on Tai Chi was considered insufficient, especially because of inconsistent effects when compared with different controls and missing long-term effects.[11] Multicomponent and exercise interventions have been considered positive, although significance of effects was rated low in a review.[8] In addition, another well-conducted study in community-dwelling older adults at risk[12] failed to show benefits of three different multicomponent exercise interventions on fall rates and FOF-related parameters. Thus, the ideal type of intervention and the individual components are still a subject of debate.[13] Another difficulty of many interventional trials and observational studies could be that psychological measures differentiating certain risk groups (people with objective risk as associated to motor status and subjective risk as associated to individual risk perception/ psychological status according to the study by Delbaere et al.[14]) were often not available.

To improve future interventional programs in older adults and to get a better picture of factors influencing FOF across different constructs, the search for further and potentially modifiable factors associated with FOF seems mandatory. In a review by Scheffer et al. in 2008,[3] a list of known risk factors from cross-sectional and longitudinal studies with publication dates until 2006 was reported. To identify additional predictors and analyze those previously mentioned, we performed an updated, comprehensive, and systematic literature search linked to and stratified according to the various aspects of FOF.

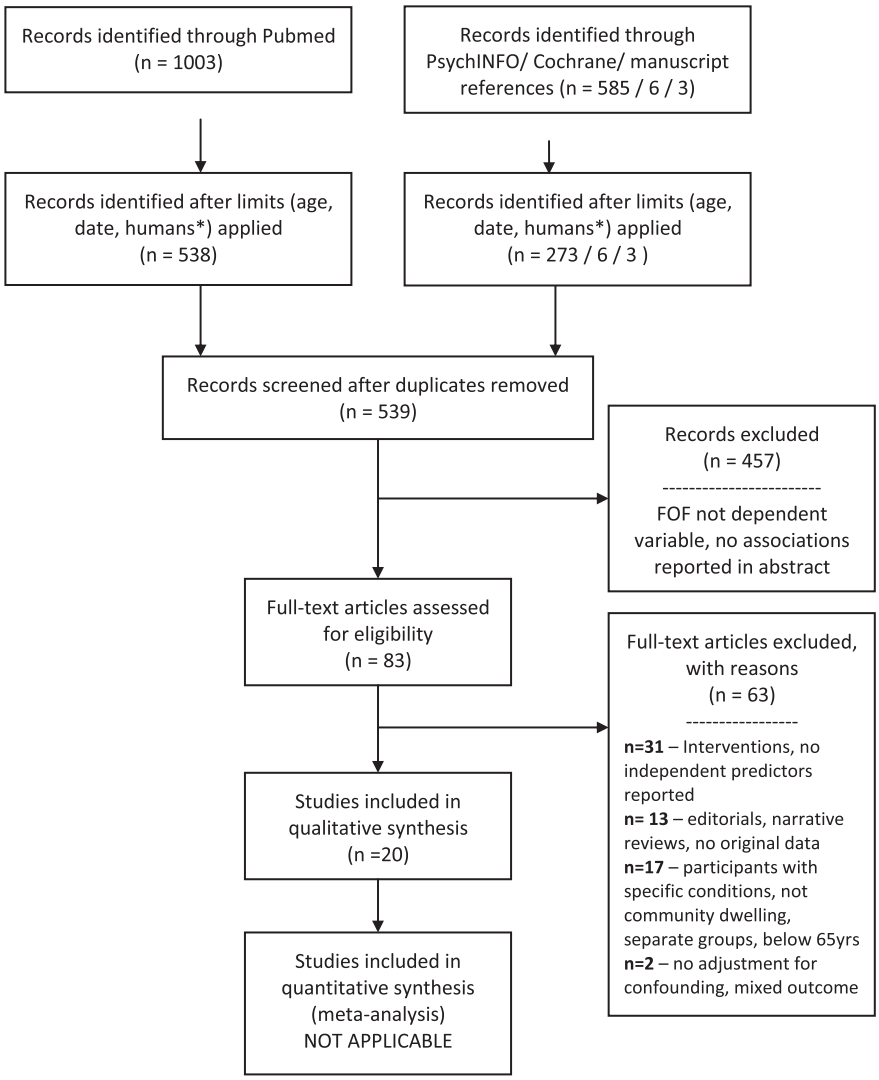
METHODS

The PubMed database was searched for the following terms: fear of falling, fall-related self-efficacy, balance confidence, and fear-associated/ related mobility restriction. No MeSH terms were used to not miss misclassified articles. Instead, the search was restricted to title and abstract, and 1,003 hits were retrieved. After inclusion of additional criteria (age 65 years and older, humans and publication date between January 2006 and October 2013), 538 hits remained. The search strategy was repeated in PsychINFO and the Cochrane Database of Systematic Reviews. After exclusion of duplicates, one additional article was identified.[15]

Titles were screened according to language, type of the study (observational cross-sectional or prospective), outcome (see above), and population of interest (community dwelling), if available. Articles where it was already obvious from the title that the study would not comply with the criteria mentioned were omitted (N = 457). In the remaining 83 publications, abstracts were again checked for the following criteria: language, type of the study (observational cross-sectional or prospective), outcome (see above), and population of interest (community-dwelling older adults, mean age above 65 years).

If it was not possible to clarify these criteria using abstracts, full text were obtained. Of all 83 articles, 31

FIGURE 1. Flow chart of the selection process according to PRISMA recommendations. Details are given in Methods. *Age was defined as 65 years and older, date as published between January 2006 and October 2013.



articles were excluded because they reported interventions related to FOF without reporting additional risk factors. Thirteen articles were either editorials, narrative reviews, or articles where FOF was handled as an independent variable and (mostly) falls were the outcome variable reported. Seventeen articles were excluded because the study population was defined according to a certain disease, a setting different from the community, or because participants were mostly below age 65 years. One article was excluded because controlling for potential cofounders could not be detected[16] and one article because outcome was not clearly defined (mixed outcome using falls and FOF together).[17] Thus, 20 articles remained and were thoroughly screened for factors associated with any of the above-named FOF constructs. A flow chart is shown in Figure 1. For logistic regression, odds ratios (ORs) and confidence intervals (CIs) were extracted, and for linear models, p values were extracted. If more than one model was available in the article, the results of the most complex model are presented here.

Constructs were operationalized into three main domains. The first domain was FOF, including single

TABLE 1. Association of Different Risk Factors with FOF, FAR, and FSE

Predictors	Construct	Studies	Sample Size, Gender[a]	Age (yr) Range, Mean/SD	Study Type	OR (95% CI)	p
Sociodemographic variables							
Age	FOF	Hull (4, CoF) 2012[1]	205	68–97	CS		NS
		Mendes da Costa 2012 (1)[6]	419	>65	CS	NS	
		Martinez 2010[46]	921	>65	CS	2.0 (1.5–2.8)	
		Van Haastregt 2008 (1)[47]	540	70–92	CS	1.05 (1.01–1.10)	
		Kempen 2009 (1)[26]	540	70–92	CS	1.04 (1.00–1.08)	
		Deshpande 2008 (1)[48]	848	65–101	CS		0.005
		Austin 2007[23]	1,282	70–85	Pro	NS	
		Rossat 2009[49]	1,189	74.7 ± 4.4	CS	NS	
		Reyes-Ortiz 2006[22]	1,341	>72	CS/Pro	NS	
		Oh-Park 2011[50]	380	>70	Pro	NS	
		Zijlstra 2007 (1)[28]	4,031	≥70	CS	1.79 (1.49–2.16)[b]	
	FAR	Mendes da Costa 2012 (2)[6]	419	>65	CS	2.83 (1.19-6.69)[b]	
		Van Haastregt 2008 (2)[47]	540	70–92	CS	1.07 (1.03–1.11)	
		Kempen 2009 (2)[26]	540	70–92	CS	1.04 (1.00–1.09)	
		Deshpande 2008 (2)[48]	848	65–101	CS		NS
		Guthrie 2012[24]	441	80.3 ± 7.1	CS/Pro	NS	
		Hull (1, mSAFFE) 2012[1]	205	68–97	CS		NS
		Zijlstra 2007 (2)[28]	4,031	≥70	CS	1.92 (1.59–2.32)[b]	
	FSE	Hull (2, FES-I) 2012[1]	205	68–97	CS		NS
		Hull (3, ABC) 2012[1]	205	68–97	CS		NS
		Ramulu 2012[27]	143	60–80	CS		NS
		Kumar 2013[25]	1,088	>65	CS	NS	
Female sex	FOF	Hull (4, CoF) 2012[1]	205	68–97	CS		<0.01
		Mendes da Costa 2012 (1)[6]	419	>65	CS	1.98 (1.27–3.08)	
		Reyes-Ortiz 2006[22]	1,341	>70	CS/Pro	2.50 (1.97–3.18)	
		Martinez 2010[46]	921	>65	CS	5.5 (3.9-7.6)	
		Rossat 2009[49]	1,189	74.7 ± 4.4	CS	2.90 (2.11–3.87)	
		Van Haastregt 2008 (1)[47]	540	70–92	CS	2.44 (1.55–3.86)	
		Oh-Park 2011[50]	380	>70	Pro	2.01 (1.12–3.60)	
		Filiatrault 2009[51]	286	75.4 ± 6.7	CS	3.44 (1.22–9.74)	
		Deshpande 2008 (1)[48]	848	65–101	CS		<0.001
		Kempen (1) 2009[26]	540	70–92	CS	2.28 (1.41–3.69)	
		Zijlstra 2007 (1)[28]	4,031	≥70	CS	3.23 (2.76–3.79)	
	FAR	Hull (1, mSAFFE) 2012[1]	205	68–97	CS		<0.05
		Mendes da Costa 2012 (2)[6]	419	>65	CS	1.92 (1.18–3.14)	
		Fletcher 2010[52]	560	81.0 ± 6.4	CS	3.55 (1.99–6.35)	
		Van Haastregt 2008 (2)[47]	540	70–92	CS	1.65 (1.05–2.58)	
		Deshpande 2008 (2)[48]	848	65–101	CS		NS
		Kempen (2) 2009[26]	540	70–92	CS	NS	
		Guthrie 2012[24]	441	80.3 ± 7.1	CS/Pro	NS	
		Zijlstra 2007 (2)[28]	4,031	≥70	CS	2.27 (1.92–2.69)	
	FSE	Hull (2, FES-I) 2012[1]	205	68–97	CS		<0.001
		Hull (3, ABC) 2012[1]	205	68–97	CS		<0.001
		Ramulu 2012[27]	143	60–80	CS		0.03
Marital status	FOF	Martinez 2010[46]	921	>65	CS	NS	
		Reyes-Ortiz 2006[22]	1,341	>72	CS/Pro	NS	
	FAR	Guthrie 2012[24]	441	80.3 ± 7.1	CS/Pro	NS	
Ethnicity	FOF	Oh-Park 2011[50] (Non-white)	380	>70	Pro	NS	
	FSE	Ramulu 2012[27] (African American)	143	60–80	CS		NS
		Kumar 2013[25] (African American/Minority)	1,088	>65	CS	3.06 (1.74–5.38)	
BMI	FOF	Deshpande (1) 2008[48]	848	65–101	CS		NS
		Rossat 2009[49]	1,189	74.7 ± 4.4	CS	NS	
	FAR	Austin 2007[23]	1,282	70–85	Pro	1.23 (1.10–1.38)	
		Deshpande (2) 2008[48]	848	65–101	CS		NS
	FSE	Ramulu 2012[27]	143	60–80	CS		0.02
		Kumar 2013[25]	1,088	>65	CS	NS	

(*Continued*)

TABLE 1. (*Continued*)

Predictors	Construct	Studies	Sample Size, Gender[a]	Age (yr) Range, Mean/SD	Study Type	OR (95% CI)	p
Hospitalization	FAR	Curcio 2009[29]	1,668	>60	CS	NS	
Institutionalization	FOF	Rossat 2009[49]	1,189	74.7 ± 4.4	CS	2.13 (1.07–4.3)	0.03
	FSE	Kumar 2013[25]	1,088	>65	CS	NS	
Low education/socioeconomic status	FOF	Martinez 2010[46]	921	>65	CS	1.5 (1.1–2.2)	
		Filiatrault 2009[51] (occupational status)	286	75.4 ± 6.7	CS	NS	
		Kempen (1) 2009[26]	540	70–92	CS	NS	
		Reyes-Ortiz 2006[22]	1,341	>72	CS/Pro	NS	
		Van Haastregt 2008 (1)[47]	540	70–92	CS	NS	
	FAR	Curcio 2009[29] (poverty)	1,668	>60	CS	1.32 (1.05–1.65)	
		Kempen (2) 2009[26]	540	70–92	CS	NS	
		Van Haastregt 2008 (2)[47]	540	70–92	CS	NS	
	FSE	Shin 2010[53]	213	73.4 ± 5.9	CS		NS
		Kumar 2013[25]	1088	>65	CS	2.14 (1.28–3.55)	
Fall-related history							
History of falls (any fall)	FOF	Mendes da Costa 2012 (1)[6]	419	>65	CS	3.45 (1.76–6.76)	
		Reyes-Ortiz 2006[22]	1,341	>72	Pro/CS	2.16 (1.73–2.69)	
		Rossat 2009[49]	1,189	74.7 ± 4.4	CS	2.56 (2.10–3.10)	
		Martinez 2010[46]	921	>65	CS	1.9 (1.3–3.5)	
		Van Haastregt 2008 (1)[47]	540	70–92	CS	1.65 (1.14–2.15)	
		Oh-Park 2011[50]	380	>70	Pro	2.21 (1.05–4.63)	
		Filiatrault 2009[51]	286	75.4 ± 6.7	CS	NS	
		Deshpande (1) 2008[48]	848	65–101	CS		NS
		Kempen (1) 2009[26]	540	70–92	CS	1.49 (1.01–2.20)	
		Hull (4, CoF) 2012[1]	205	68–97	Pro		NS
		Zijlstra 2007 (1)[28]	4,031	≥70	CS	2.28 (1.89–2.75)	
	FAR	Mendes da Costa 2012 (2)[6]	419	>65	CS	3.04 (1.70–5.42)[a]	
		Austin 2007[23]	1,282, f	70–85	Pro	2.65 (1.64–4.30)	
		Curcio 2009[29]	1,668	>60	CS	NS	
		Deshpande (2) 2008[48]	848	65–101	CS		NS
		Kempen (2) 2009[26]	540	70–92	CS	NS	
		Guthrie 2012[24]	441	80.3 ± 7.1	CS/Pro	NS	
		Hull (1, mSAFFE) 2012[1]	205	68–97	CS		NS
		Zijlstra 2007 (2)[28]	4,031	≥70	CS	5.72 (4.40–7.43)	
		Van Haastregt 2008 (2)[47]	540	70–92	CS	1.52 (1.05–2.19)	
	FSE	Hull (3, ABC) 2012[1]	205	68–97	Pro		<0.01
		Hull (2, FES-I) 2012[1]	205	68–97	Pro		NS
Injurious fall	FOF	Reyes-Ortiz 2006[22]	1,341	>72	Pro/CS	NS	
	FAR	Curcio 2009[29]	1,668	>60	CS	1.32 (1.00–1.74)	
Multiple falls	FOF	Zijlstra 2007 (1)[28]	4,031	≥70	CS	5.72 (4.40–7.43)	
	FAR	Austin 2007[23]	1,282, f	70–85	Pro	NS	
		Fletcher 2010[52]	560	81.0 ± 6.4	CS	2.15 (1.24–3.73)	
		Zijlstra 2007 (2)[28]	4,031	≥70	CS	4.64 (3.73–5.76)	
Physical function parameters							
Impaired function/mobility (performance-based)	FOF	Reyes-Ortiz 2006[22] (better performance)	1,341	>72	CS/Pro	0.92 (0.88–0.96)	
		Deshpande (1) 2008[48] (chair stand)	848	65–101	CS		0.001
		Rossat 2009[49]	1,189	74.7 ± 4.4	CS	1.05 (1.02–1.09)	
		Martinez 2010[46]	560	81.0 ± 6.4	CS	9.00 (5.24–15.44)	
	FAR	Austin 2007[23] (timed up and go)	1,282	70–85	Pro	1.34 (1.19–1.51)	
		Deshpande (2) 2008[48] (lower limb strength)	848	65–101	CS		0.001
		Guthrie 2012[24]	441	80.3 ± 7.1	CS/Pro	3.96 (2.04–7.72)	
		Curcio 2009[29] (gait, chair stand, grip strength)	1,668	>60	CS	NS	

(*Continued*)

TABLE 1. (*Continued*)

Predictors	Construct	Studies	Sample Size, Gender[a]	Age (yr) Range, Mean/SD	Study Type	OR (95% CI)	p
		Fletcher 2010[52] ("unsteady gait")	921	>65	CS	2.2 (1.5–3.1)	
	FSE	Kumar 2013[25] (timed up and go)	1,088	>65	CS	2.50 (1.41–4.45)	
		Kumar 2013[25] (sit to stands >11)	1,088	>65	CS	0.48 (0.30–0.77)	
		Kumar 2013[25] (functional reach)	1,088	>65	CS	0.96 (0.93–0.99)	
(I)ADL disability (questionnaire-based)	FOF	Kempen (1) 2009[26]	540	70–92	CS	1.17 (1.11–1.23)	
		Reyes-Ortiz 2006[22]	1,341	>72	CS/Pro	NS	
	FAR	Kempen (2) 2009[26]	560	81.0 ± 6.4	CS	1.41 (1.21–1.64)	
		Curcio 2009[29] (ADL)	540	70–92	CS	1.20 (1.14–1.27)	
		Fletcher 2010[52]	1,668	>60	CS	1.65 (1.16–2.32)	
	FSE	Shin 2010[53]	213	73.4 ± 5.9	CS		<0.001
		Kumar 2013[25] (unable to rise from a chair)	1,088	>65	CS	4.50 (1.53—13.24)	
Impaired balance	FOF	Guthrie 2012[24] (better balance)	441	80.3 ± 7.1	CS/Pro	0.71 (0.63–0.82)	
		Deshpande (1) 2008[48]	848	65–101	CS		NS
	FAR	Austin 2007[23] (eyes open)	1,282, f	70–85	Pro	1.56 (1.10–2.20)	
		Austin 2007[23] (eyes closed)	1,282, f	70–85	Pro	NS	
	FSE	Deshpande (2) 2008[48]	848	65–101	CS		<0.001
		Kumar 2013[25]	1,088	>65	CS	1.93 (1.23–3.03)	
Specific clinical gait abnormality	FOF	Oh-Park 2011[50]	380	>70	Pro	2.29 (1.21–4.32)	
		Rochat (1) 2010[45]	860	65–70	CS		NS
		Rochat (2) 2010[45]	860	65–70	CS		<0.001[c]
Walking aid	FOF	Hull (4, CoF) 2012[1]	205	68–97	CS		<0.001
		Rossat 2009[49]	1,189	74.7 ± 4.4	CS	NS	
		Reyes-Ortiz 2006[22]	1,341	>72	CS/Pro	NS	
	FAR	Hull (1, mSAFFE) 2012[1]	205	68–97	CS		<0.001
		Austin 2007[23]	1,282, f	70–85	Pro	5.71 (2.64–12.34)	
	FSE	Hull (2, FES-I) 2012[1]	205	68–97	CS		<0.001
		Hull (3, ABC) 2012[1]	205	68–97	CS		<0.001
		Kumar 2013[25]	1,088	>65	CS	3.31 (1.81–6.04)	
Grip strength	FOF	Deshpande (1) 2008[48] (handgrip)	848	65–101	CS		NS
		Rossat 2009[49] (handgrip)	1,189	74.7 ± 4.4	CS	NS	
	FAR	Deshpande (2) 2008[48] (handgrip)	848	65–101	CS		NS
	FSE	Ramulu 2012[27] (handgrip)	143	60–80	CS		NS
Psychological parameters							
Depressive symptoms/ depression	FOF	Hull (4, CoF) 2012[1]	205	68–97	CS		NS
		Painter 2012 (1)[15]	99	73.1 (55–91)	CS		NS
		Van Haastregt 2008 (1)[47]	540	70–92	CS	2.43 (1.44–4.13)	
		Deshpande (1) 2008[48]	848	65–101	CS		NS
		Kempen (1) 2009[26]	540	70–92	CS	NS	
		Oh-Park 2011[50]	380	>70	Pro	1.45 (1.21–1.74)	
	FAR	Austin 2007[23]	1,282	70–85	CS	2.58 (1.56–4.28)	
		Hull (1, mSAFFE) 2012[1]	205	68–97	Pro		<0.01
		Curcio 2009[29]	1,668	>60	CS	1.76 (1.38–2.24)	
		Deshpande (2) 2008[48]	848	65–101	CS		<0.001
		Kempen (2) 2009[26]	540	70–92	CS	NS	
		Van Haastregt 2008 (2)[47]	540	70–92	CS	NS	
		Painter 2012 (2)[15]	99	73.1 (55–91)	CS		NS
	FSE	Hull (2, FES-I) 2012[1]	205	68–97	CS		NS
		Hull (3, ABC) 2012[1]	205	68–97	CS		NS
		Shin 2010[53]	213	73.4 ± 5.9	CS		<0.001

(*Continued*)

TABLE 1. (*Continued*)

Predictors	Construct	Studies	Sample Size, Gender[a]	Age (yr) Range, Mean/SD	Study Type	OR (95% CI)	p
Anxiety	FOF	Hull (4, CoF) 2012[1]	205	68–97	CS		<0.001
		Kempen (1) 2009[26]	540	70–92	CS	NS	
		Painter 2012 (1)[15]	99	73.1 (55–91)	CS		NS
	FAR	Hull (1, mSAFFE) 2012[1]	205	68–97	CS		<0.05
		Kempen (2) 2009[26]	540	70–92	CS	NS	
		Painter 2012 (2)[15]	99	73.1 (55–91)	CS		0.003
	FSE	Hull (2, FES-I) 2012[1]	205	68–97	CS		<0.001
		Hull (3, ABC) 2012[1]	205	68–97	CS		<0.001
Loneliness	FOF	Kempen (1) 2009[26]	540	70–92	CS	NS	
		Kempen (2) 2009[26]	540	70–92	CS	NS	
Cognitive impairment	FOF	Deshpande (1) 2008[48]	848	65–101	CS		NS
		Kempen (1) 2009[26]	540	70–92	CS	NS	
		Oh-Park 2011[50]	380	>70	Pro	NS	
		Rossat 2009[49]	1,189	74.7 ± 4.4	CS	NS	
		Reyes-Ortiz 2006[22]	1,341	>72	CS/Pro	NS	
	FAR	Fletcher 2010[52]	560	81.0 ± 6.4	CS	1.63 (1.11–2.39)	
		Austin 2007[23]	1,282	70–85	Pro	1.88 (1.11–3.21)	
		Deshpande (2) 2008[48]	848	65–101	CS		NS
		Kempen (2) 2009[26]	540	70–92	CS	NS	
Mastery	FOF	Deshpande (1) 2008[48]	848	65–101	CS		0.001
		Kempen (1) 2009[26]	540	70–92	CS	NS	
	FAR	Desphande (2) 2008[48]	848	65–101	CS		<0.001
		Kempen (2) 2009[26]	540	70–92	CS	NS	
General self-efficacy	FOF	Kempen (1) 2009[26]	540	70–92	CS	NS	
	FAR	Kempen (2) 2009[26]	540	70–92	CS	NS	
Clinical examination and history							
Poor self-rated health	FOF	Hull (4, CoF) 2012[1]	205	68–97	CS		NS
		Curcio 2009[29]	1,668	>60	CS	1.38 (1.06–1.79)	
		Kempen (1) 2009[26]	540	70–92	CS	NS	
		Van Haastregt 2008 (1)[47]	540	≥70	CS	1.75 (1.16–2.65)	
		Zijlstra 2007 (1)[28] (highest vs. lowest tertile)	4,031		CS	11.91 (8.38–16.95)	
	FAR	Filiatrault 2009[51]	286	75.4 ± 6.7	CS	NS	
		Van Haastregt 2008 (2)[47]	540	70–92	CS	2.60 (1.70–3.99)	
		Kempen (2) 2009[26]	540	70–92	CS	NS	
		Hull (1, mSAFFE) 2012[1]	205	68–97	CS		NS
		Zijlstra 2007 (2)[28] (highest vs. lowest tertile)	4,031	≥70		6.93 (4.70–10.21)	
	FSE	Hull (2, FES-I) 2012[1]	205	68–97	CS		<0.01
		Hull (3, ABC) 2012[1]	205	68–97	CS		NS
		Kumar 2013[25] (lowest vs. highest tertile)	1,088	>65	CS	2.74 (1.31–5.73)	
Heart disease (any)	FOF	Martinez 2010[46]	921	>65	CS	1.5 (1.1–2.2)	
		Reyes-Ortiz 2006[22]	1,341	>72	CS/Pro	NS	
	FAR	Curcio 2009[29]	1,668	>60	CS	NS	
Diabetes	FOF	Reyes-Ortiz 2006[22]	1,341	>72	CS/Pro	NS	
Stroke	FOF	Reyes-Ortiz 2006[22]	1,341	>72	CS/Pro	NS	
Impaired vision	FOF	Deshpande (1) 2008[48] (acuity, contrast)	848	65–101	CS	2.04 (1.11–3.76)	
		Kempen (1) 2009[26]	540	70–92	CS	NS	
		Oh-Park 2011[50]	380	>70	Pro		NS
		Rossat 2009[49]	1,189	74.7 ± 4.4	CS		NS
	FAR	Guthrie 2012[24]	441	80.3 ± 7.1	CS/Pro	NS	
		Curcio 2009[29]	1,668	>60	CS	NS	
		Deshpande (2) 2008[48] (acuity, contrast)	848	65–101	CS	NS	
		Kempen (2) 2009[26]	540	70–92	CS	NS	
	FSE	Ramulu 2012[27] (diff. domains, glaucoma-assoc.)	143	60–80	CS		<0.001

(*Continued*)

TABLE 1. (*Continued*)

Predictors	Construct	Studies	Sample Size, Gender[a]	Age (yr) Range, Mean/SD	Study Type	OR (95% CI)	p
Glasses (nonspecific)	FOF	Hull (4, CoF) 2012[1]	205	68–97	CS		<0.05
	FAR	Hull (1, mSAFFE) 2012[1]	205	68–97	CS		NS
	FSE	Hull (2, FES-I) 2012[1]	205	68–97	CS		NS
		Hull (3, ABC) 2012[1]	205	68–97	CS		<0.05
Impaired hearing	FOF	Kempen (1) 2009[26]	540	70–92	CS	NS	
	FAR	Curcio 2009[29]	1,668	>60	CS	NS	
		Kempen (2) 2009[26]	540	70–92	CS	NS	
Hearing aid	FOF	Hull (4, CoF) 2012[1]	205	68–97	CS		NS
	FAR	Hull (1, mSAFFE) 2012[1]	205	68–97	CS		NS
	FSE	Hull (2, FES-I) 2012[1]	205	68–97	CS		<0.001
		Hull (3, ABC) 2012[1]	205	68–97	CS		NS
Vibration sensitivity/ proprioception	FOF	Deshpande (1) 2008[48]	848	65–101	CS		NS
		Rossat 2009[49]	1,189	74.7 ± 4.4	CS	NS	
	FAR	Deshpande (2) 2008[48]	848	65–101	CS		NS
Pain	FAR	Fletcher 2010[52]	560	81.0 ± 6.4	CS	1.78 (1.41–2.24)	
		Curcio 2009[29]	1,668	>60	CS	NS	
Comorbidity/multiple chronic conditions	FOF	Kempen (1) 2009[26]	540	70–92	CS	NS	
		Martinez 2010[46]	921	>65	CS	NS	
		Oh-Park 2011[50]	380	>70	Pro	NS	
	FAR	Guthrie 2012[24]	441	80.3 ± 7.1	CS/Pro	2.09 (1.22–3.59)	
		Kempen (2) 2009[26]	540	70–92	CS	NS	
	FSE	Ramulu 2012[27]	143	60–80	CS		<0.001
Urinary incontinence	FOF	Reyes-Ortiz 2006[22]	1,341	>72	Pro/CS	1.34 (1.04–1.71)	
Osteoarthritis	FOF	Reyes-Ortiz 2006[22]	1,341	>72	Pro/CS	1.49 (1.20–1.84)	
	FAR	Curcio 2009[29]	1,668	>60	CS	NS	
Sleep quality	FSE	Shin 2010[53]	213	73.4 ± 5.9	CS		NS
Hypertension	FOF	Reyes-Ortiz 2006[22]	1,341	>72	Pro/CS	1.25 (1.01–1.55)	
	FAR	Curcio 2009[29]	1,668	>60	CS	NS	
Medication							
Medication: multiple drugs	FOF	Hull (4, CoF) 2012[1]	205	68–97	CS		NS
		Rossat 2009[49]	1,189	74.7	CS	1.05 (1.00–1.1)	
	FAR	Hull (1, mSAFFE) 2012[1]	205	68–97	CS		NS
		Curcio 2009[29]	1,668	>60	CS	1.56 (1.14–2.14)	
	FSE	Hull (2, FES-I) 2012[1]	205	68–97	CS		<0.001
		Hull (3, ABC) 2012[1]	205	68–97	CS		<0.05
		Shin 2010[53]	213	73.4 ± 5.9	CS		NS
Medication: psychotropic/CNS	FOF	Martinez 2010[46]	921	>65	CS	1.6 (1.1–2.2)	
		Rossat 2009[49]	1,189	74.7 ± 4.4	CS	1.45 (1.03–2.02)	
		Oh-Park 2011[50]	380	>70	Pro	NS	
	FAR	Austin 2007[23]	1,282, f	70–85	Pro	2.83 (1.44–5.59)	
		Guthrie 2012[24] (CNS medication)	441	80.3 ± 7.1	CS/Pro	NS	
Medication: hypertension	FAR	Austin 2007[23]	1,282, f	70–85	Pro	NS	
Medication: cardiovascular	FAR	Guthrie 2012[24]	441	80.3 ± 7.1	CS/Pro	NS	
Medication: diuretics	FAR	Guthrie 2012[24]	441	80.3 ± 7.1	CS/Pro	NS	
Medication: analgesic/pain	FAR	Guthrie 2012[24]	441	80.3 ± 7.1	CS/Pro	NS	
Environment/Participation							
Accommodation	FOF	Hull (4, CoF) 2012[1]	205	68–97	CS		NS
	FAR	Hull (1, mSAFFE) 2012[1]	205	68–97	CS		NS
	FSE	Hull (2, FES-I) 2012[1]	205	68–97	CS		NS
		Hull (3, ABC) 2012[1]	205	68–97	CS		NS
Environment	FOF	Filiatrault 2009[51] (smaller cities)	286	75.4 ± 6.7	CS	3.91 (1.95–7.83)[d]	
		Filiatrault 2009[51] (rural area)	286	75.4 ± 6.7	CS	2.66 (1.09–6.49)[d]	
Living alone	FOF	Mendes da Costa 2012 (1)[6]	419	>65	CS	2.15 (1.31–3.54)	
		Van Haastregt 2008 (1)[47]	540	70–92	CS	NS	
		Zijlstra 2007 (1)[28]	4,031	≥70	CS	NS	

(*Continued*)

TABLE 1. (*Continued*)

Predictors	Construct	Studies	Sample Size, Gender[a]	Age (yr) Range, Mean/SD	Study Type	OR (95% CI)	p
		Filiatrault 2009[51] (no support from partner)	286	75.4 ± 6.7	CS	2.66 (1.06–6.72)	
		Filiatrault 2009[51] (living alone)	286	75.4 ± 6.7	CS	NS	
		Kempen (1) 2009[26]	540	70–92	CS	NS	
		Martinez 2010[46]	921	>65	CS	NS	
	FAR	Austin 2007[23]	1,282, f	70–85	Pro	1.54 (1.13–2.08)	
		Kempen (2) 2009[26]	540	70–92	CS	NS	
		Mendes da Costa 2012 (2)[6]	419	>65	CS	NS	
		Van Haastregt 2008 (2)[47]	540	70–92	CS	NS	
		Zijlstra 2007 (2)[28]	4,031	≥70	CS	NS	
	FSE	Ramulu 2012[27]	143	60–80	CS		0.006
		Kumar 2013[25]	1,088	>65	CS	1.93 (1.12–3.35)	
Physical activity	FOF	Filiatrault 2009[51]	286	75.4 ± 6.7	CS	NS	
	FAR	Curcio 2009[29]	1,668	>60	CS	1.35 (1.06–1.70)	
Sedentary behavior	FAR	Austin 2007[23]	1,282, f	70–85	Pro	NS	
Social support	FOF	Deshpande (1) 2008[48]	848	65–101	CS		NS
		Kempen (1) 2009[26]	540	70–92	CS	NS	
		Filiatrault 2009[51] (Support from friends)	286	75.4 ± 6.7	CS	NS	
	FAR	Deshpande (2) 2008[48]	848	65–101	CS		NS
		Kempen (2) 2009[26]	540	70–92	CS	NS	
	FSE	Kumar 2013[25]	1,088	>65	CS	NS	
Use of public transport	FOF	Filiatrault 2009[51]	286	75.4 ± 6.7	CS	NS	
Church attendance	FOF	Reyes-Ortiz 2006[22]	1,341	>72	CS/Pro	0.73 (0.58–0.92)	

Notes: For logistic regression odds ratios (OR) and confidence intervals (CI) and for linear models p values were extracted. If more than one model is presented, the results of the most complex model is presented. If FOF and fear-related activity restriction were both tested independently, both are shown with the addendum (1) for FOF and (2) for FAR. If incident or persistent fear of falling has been tested (prospective cohorts), results are shown for persistent fear to allow for a better comparison with the other studies (see below for details). Details and instruments used:

Austin: Any positively rated item of a three-item questionnaire on FOF and FOF-related activity restriction as published before.[54] Differentiates between developed and persistent fear. Curcio: One question: are you afraid of falling? If yes, additional question on associated activity restriction. Multivariate results only reported on FOF-related activity restriction in the population that previously indicated fear of falling (N = 1,390).

Deshpande: (1) FOF according to SAFE summary score; fear-related activity restriction according to SAFE summary score.

Filiatrault: One question: Are you afraid of falling? Four-category response scale (never, occasionally, often, very often). FOF dichotomized into never vs. the other three categories.

Fletcher: One question on FOF-related activity restriction (Did you limit walking outdoors because of fear of falling?).

Guthrie: Any person limits going outdoors due to a fear of falling according to Inter-RAI CHA.

Hull (1–4): Different FOF-associated outcomes: fear by the mSAFFE (1), self-efficacy by the FES-I (2), balance confidence by the ABC-scale (3), outcome expectancy by the CoF scale (4).

Kempen: (1) One question: Are you afraid of falling? If yes, additional question on (2) associated activity restriction.

Kumar: FES-I short version (7 items).

Martinez: One question on FOF, rated according to three options: much, little, none.

Mendes da Costa: (1) One question: Are you afraid of falling? If yes, additional question on (2) associated activity restriction.

Oh-Park: One question: Did you have fear of falling in the last 2 months or since the last interview? Yes/no. Separate analysis of transient and persistent falling.

Painter: SAFE − FOF item.

Ramulu: UIC FFM, a 16-item instrument similar to FES-I that focuses on fear related to ADLs.

Reyes-Ortiz: One question: How afraid are you of falling? Rated according to four-point scale (no, somewhat, fairly, high).

Rochat: (1) One question: Are you afraid of falling? If yes, (2) additional question on associated activity restriction. For details on results reported see[c] below.

Rossat: One question: Are you afraid to fall? Answered yes/no. some individuals institutionalized, most community-dwelling, recruited via health centers for free medical examination.

Shin: Korean version of Tinetti's FES.

Van Haastregt: See Kempen. Same population, different variables. (1) FOF, (2) fear-related activity restriction.

Zijlstra: (1) One question on FOF: Are you afraid of falling? and (2) associated avoidance of activity: Do you avoid certain activities due to fear of falling? Five-point Likert scale from never to very often. For analysis dichotomized into never/almost never and sometimes/often/very often.

ABC: Activities-specific Balance Confidence; BMI: Body Mass Index; CoF: Consequences of Falling; CS: cross-sectional; FES-I: Falls Efficacy Scale–International; mSAFFE: modified Survey of Activities and Fear of Falling; Pro: Prospective; SAFE/SAFFE: Survey of Activities and Fear of Falling in the Elderly; UIC-FFM: University of Illinois at Chicago Fear of Falling Measure; m: men; w: women.

[a]If the population was not mixed, gender is given: f: females.
[b]Significant for highest vs. (reference) tertile not for the intermediate vs. reference tertile.
[c]Only significant for FOF-related activity restriction, not for FOF alone. Highest significance for step cadence, stride velocity, and step length (<0.01), still significant for variation in stride velocity and total double support (<0.05).
[d]Reference: metropolitan area, large city; higher odds for cities below 150,000, lower for rural areas.

questions ("are you afraid of falling" and others) and the Consequence of falling Scale, which was only used in one study.[1] The Consequence of falling Scale does not include questions about self-efficacy during everyday tasks and does not ask about activity avoidance. It represents a more detailed assessment of feared consequences and therefore mainly relates to the classic fear of falling construct. The second domain was the FOF-related activity restriction (FAR), either operationalized as single questions ("Have you restricted your activity because of…") up to three questions or using a subscale of the Survey of Activities and Fear of Falling.[18] Fall-related self-efficacy (FSE) was identified as the third construct, represented by both the FES(-I) or the ABC-scale. Of all three, activity restriction due to FOF has previously been considered the outcome that is mostly related to disability and loss of autonomy in older adults.[19] A flow chart according to the PRISMA statement[20] is presented in Figure 1.

RESULTS

Twenty articles were identified. Extraction of risk factors was difficult because in some articles multiple dependent variables were studied, several models were presented, or two or more groups were compared. For details with regard to what parameters have been chosen for this review, see Table 1, including the comprehensive legend. Table 2 was constructed to provide an overview of all parameters studied in at least two studies with regard to the same construct. A comprehensive summary is given on how often variables were found to be significantly associated with the outcome or how often they were found to be nonsignificant.

Comparing parameters with regard to different constructs reveal few discrepancies. The most obvious differences account for activity restriction as compared with the other two constructs. Ratios (number of significant studies divided by number of insignificant studies with regard to the parameter of interest) were inconsistent with regard to age, depression (both FAR positive and FSE/FOF negative) and history of one fall, and poor self-rated health (FAR negative and FSE/FOF positive). Living alone is only positively associated with FSE and anxiety only negatively associated with FOF.

Across all domains, robust associations can be found only for impaired function and balance, female gender, and the use of a walking aid. Less clear associations account for history of falls and poor self-rated health. Conflicting results have been identified for depression and anxiety, multiple and psychotropic drugs, mastery, and others. Impaired vision, living alone (social integration), low socioeconomic status, cognitive impairment including dementia in its various entities, comorbidity/multiple disease counts, social support, and others have been reported as insignificant in most studies (see ratios provided in Table 2).

Several risk factors were only analyzed in one or two studies, including variables such as chronic pain, urinary incontinence, heart disease (not specifically disentangled in the studies cited, therefore including heart failure, coronary heart disease, and maybe others), and specific diseases such as visual field loss due to glaucoma, hypertension, osteoarthritis, a history of stroke, diabetes, clinical gait abnormalities (depends on the underlying disease which is not clearly stated in the articles mentioned), mastery, environmental circumstances, the use of a hearing aid (not hearing difficulties), and not attending church on a regular basis.

DISCUSSION

Clear Association with Physical Function

In this update of the most recent review on risk factors for FOF in community-dwelling older adults,[3] we evaluated many different factors from sociodemographic, clinical, physiologic, and psychological domains and stratified analysis according to three FOF-related constructs. Interestingly, only very few risk factors were robustly associated with any

TABLE 2. Significant/Insignificant Association Ratios of Parameters Tested in Multivariable Analyses in the Studies Identified (Only Shown If at Least Included in Two Studies with Same Outcome)

	Significant/Insignificant Association Ratio Only Studies Since 2006				Significant/Insignificant Association Ratio Including Studies Before 2006[3]				Modifiability
Parameters	**FOF**	**FAR**	**FSE**	**All**	**FOF**	**FAR**	**FSE**	**All**	**(+) (+/−) (−)**
Sociodemographic									
Age	4/6	4/3	0/4	8/13	6/10	5/3	2/5	13/17	(−)
Female sex	11/0	5/3	3/0	19/3	15/2	6/4	4/0	25/6	(−)
Marital status	0/2	0/1		0/3					(−)
Ethnicity	0/1		1/1	1/2					(−)
BMI	0/2	1/1	1/1	2/4					(+)
Low education	1/4	1/2	1/1	3/7					(+)
Fall-related									
History of one fall	8/3	4/5	1/1	13/9	15/3	5/5	2/1	22/9	(−)
History of multiple falls		1/1		1/1					(−)
Physiologic									
Impaired function	4/0	4/1	1/0	9/1					(+)
ADL/IADL disability	1/1	3/0	2/0	6/1					(+)
Impaired balance	1/1	1/1	2/0	4/2					(+)
Clinical gait abnormality	1/1	1/0		2/1					(+/−)
Walking aid	1/2	2/0	3/0	6/2	3/3	3/0	3/1	9/4	(+/−)
Grip strength	0/2	0/1	0/1	0/4					(+)
Psychological									
Depressive symptoms/depression	2/4	4/3	1/2	7/9	(3/4)	(5/3)	(3/2)	(11/9)	(+)
Anxiety	1/2	2/1	2/0	5/3	2/4	2/1	2/0	6/5	(+)
Cognitive impairment	0/5	2/2		2/7					(+/−)
Mastery	1/1	1/1		2/2					(+/−)
Disease-/health-related									
Poor self-rated health	3/2	2/3	2/1	7/6	6/2	3/3	2/1	11/6	(+/−)
Heart disease	1/1	0/1		1/2					(+)
Impaired vision	1/3	0/4	1/0	2/7	2/4	1/4	1/0	4/8	(+/−)
Impaired hearing	0/1	0/2		0/3					(+/−)
Vibration sensitivity	0/2	0/1		0/3					(−)
Pain		1/1		1/1					(+)
Comorbidity	0/3	1/1	1/0	2/4					(+/−)
Medication-related									
Multiple drugs	1/1	1/1	2/1	4/3					(+)
Psychotropic drugs	2/1	1/1		3/2					(+)
Environment/participation									
Living alone	2/4	1/4	2/0	5/8					(+/−)
Activity/sedentary behavior	0/1	1/1		1/2					(+)
Social support	0/3	0/2	0/1	0/6	1/3	0/2	0/1	1/6	(+/−)

Notes: Modifiability: subjective evaluation by authors: (+) = modifiable, (+/−) = yes and no, difficult trade off situations, (−) = not or hardly modifiable; Empty cell = not available. Numbers in brackets (variable: depression) = information only available from the text, not included in the table available as supplement by Scheffer et al[3] (therefore, it was not clear whether parameters were insignificant or not available).

FOF-related construct. These variables are female gender, impaired physical function (either questionnaire- or performance-based and mostly involving mobility tasks), and the use of a walking aid.

The most clearly associated risk factor for FOF is what can be summarized under impaired physical function, including terms such as walking (dis)ability, mobility disability, and instrumental activity of daily living (IADL) and activity of daily living (ADL) difficulties. Although IADL/ADL impairments have been included in the previous review because it has been mentioned in two studies before 2006, performance-based impaired mobility (gait speed, timed up and go, or other lower extremity measures) has not been in the focus before 2006. A reason might be that in cross-sectional studies it was impossible to disentangle causal relationships: FOF can both influence further mobility as a useful adaption to FOF to maintain balance and prevent falls[21] and can be influenced by a functional deficit itself. Until now, three studies have even prospectively identified functional deficits as an important predictor for the

development of FOF.[22–24] In these articles and others where sufficient controlling for different aspects of physical function can be identified (Kumar[25] or Kempen et al.[26]), these measures remain clearly significant, whereas age, comorbidity, and so on are no longer or only weakly associated. In other studies, measures of comorbidity,[27] self-rated health,[28] multiple medications,[29] or even age[6,28] seem to have been used. Therefore, a measure of physical function should always be included in future studies.

Unclear Association with Previous Falls and Others

Less robust evidence can be found for some items previously thought to be clearly associated with FOF, such as the history of falls, self-rated health, multiple medications, psychotropic drugs, depression, and anxiety. Other variables had a negative ratio of significant to insignificant associations across different FOF-related constructs, such as social support, living alone, grip strength, heart disease, or reduced vibration sensitivity/proprioception.

Mixed Patterns Across Different Constructs

Disentangling differences between FOF-related constructs, at that stage, did not provide much additional information. However, when getting into detail and including the results from the review by Scheffer et al.[3] (Table 2), relevant differences often seem to be associated with FOF-related activity restriction. For example, depression and age have mostly been related to activity restriction but not so much to the other two constructs. Other variables, such as history of falls and poor self-rated health, seemed to influence self-efficacy and FOF more than fear-related activity restriction. This could mean that independent of former falls and bad health status, obligatory activity tasks have to be followed.

When looking at anxiety, FAR and FSE were related but FOF was not. This might relate to the direct influence of anxiety on gait and balance as shown in experimental settings before[30] or to a generally high level of fear ("anxious and aware groups" according to Delbaere et al.[14]). This higher anxiety level does not seem to be driven by FOF but might itself directly affect activity and self-efficacy during everyday life, comparable with the model proposed by Hadjistavropoulos et al.[2] In this regard, disentangling individual risk groups according to their psychological and motor status[14] could help to interpret these diverse results. In addition, depressive symptoms, prevalent depression, and anxiety always have to be interpreted with caution because they are highly related or even part of the outcome itself. Reduced self-efficacy, fear, and reduced confidence are all considered symptoms of a depressive disorder with or without fall-related difficulties or diagnosable anxiety disorders.

Clinical Significance and Recommendations Regarding Intervention/Treatment

Several risk factors have only been mentioned once or twice and therefore require further evidence before recommendations can be given. Three of them have been positively associated with FOF (in one study) while at the same time being potentially modifiable: incontinence, environmental issues (smaller cities and rural areas versus urbanity), and church attendance. Some other rarely reported factors show mixed evidence but would also have the potential for future interventions if more studies confirmed them as risk factors, such as mastery, pain, and physical activity. Two variables, previously reported by Scheffer et al.,[3] dizziness and knowing someone who had fallen, have not been reported again in recent literature in community-dwelling older adults.

With the identification of more risk factors, more treatment options evolve. However, not all parameters identified in one study hold true for another one. Modifiable and positively associated factors such as incontinence or mastery should be followed further, whereas others such as social support, proprioception, or grip strength are not very promising (Table 2). Other parameters with mixed evidence such as multiple (psychotropic) medications offer potential for straightforward interventions such as clinical drug reviews, for example. However, some potentially modifiable factors such as pain or hypertension often resemble difficult trade-off situations in older adults: Initiation of drug treatment could even increase disability, because of adverse events (i.e., dizziness) and polymedication (i.e., drug interaction) issues.[31] For another parameter, physical activity, little trade-off is necessary because of its well-documented positive effect on different health parameters. With regard to FOF, it has rarely been mentioned in the articles screened,[29,32] although it has been identified as an important factor when

interpreting the differential results of certain interventional studies on falling.[13,33] Most often, activity restriction due to FOF was used as the outcome variable and was therefore no longer included as an independent predictor. Physical activity levels have to be included in observational studies on FOF and falls to adequately control for different risk exposures.

Apart from community-dwelling older adults, FOF has also been examined in other settings (patients presenting in emergency departments,[34,35] residents of veterans homes,[36] or even priests[32]) or different populations with a unique disease as the main selection criteria, such as chronic obstructive pulmonary disease,[37] rheumatoid arthritis,[38] osteoarthritis,[39] osteoporosis,[40] stroke,[41,42] Parkinson disease,[43] and vertigo.[44] Although it is difficult to compare these heterogeneous studies with the summarized results from community-dwelling older adults presented here, in general, predictors were largely comparable and very few additional factors are presented. The most important difference is the greater detail of clinical symptoms associated with FOF with respect to the underlying disease. As an example, festination, shuffling, turning, and start hesitation have been reported in patients with Parkinson disease,[43] all symptoms that are part of the above-mentioned functional deficit category. Is the future of FOF research lying in more detailed research projects involving well-specified (sub)populations? Then, umbrella terms such as functional or mobility deficits should be better specified to stratify appropriate treatments. Rochat et al.,[45] for example, used gait analyses to study mobility disability. They identified step cadence, stride velocity, and step length as being most significantly associated with FOF-related activity restriction,[45] which makes them possible targets for new treatment options. The same rationale accounts for terms such as dizziness, balance problems, urinary incontinence, or vision; the latter is represented by a detailed study on glaucoma.[27]

The complex relationships with an ever-increasing number of associated parameters might, on the one hand, call for the conception of different RCTs in certain subpopulations, stratified according to different diseases/morbidities or according to different personality traits.[14] On the other hand, the large comparability of predictors across different populations might also argue for a more uniform but comprehensive approach. For that purpose most available epidemiologic datasets will not suffice because more detailed assessments on individual items are usually not available.

Limitations

Because of many different instruments used to measure FOF with and without activity restriction and further great heterogeneity of studies included, a meta-analysis was not appropriate. Still, for the purpose of the identification of additional risk factors, all suitable studies should have been identified. Some risk factors identified have only been reported in single studies. Thus, confirmation of these findings is surely warranted before including them in future multifactorial and multicomponent interventions. Also, because of very heterogeneous consideration of confounders in different studies, odds ratios with confidence intervals or p values do not always represent comparable levels of significance. However, these variables can still provide an idea of the strength of correlation and are therefore reported. We are aware that the ratios provided in Table 2 do not represent the last level of evidence, but we regarded this as the most conclusive demonstration of what factors are more or less conflicting with regard to the outcomes. Conceptualization of the three different constructs as represented was considered the most useful for the current study, although this can also be discussed contrarily. It has to be mentioned that both the old (here only represented by the study of Shin et al.[53]) and modified FES and the FES-I were put into the "efficacy" category, although discussions are ongoing as to which of the assessments represent more of a FOF than a falls-efficacy measure.

CONCLUSION

We identified several more or less well-known risk factors for FOF between 2006 and 2013 and compared them with a previous review. Because of its robust associations across studies, future studies on FOF-related outcomes always have to include at least one aspect of performance-based and questionnaire-based physical function and female gender. History of falls, comorbidity, self-perceived health, and depression/anxiety should also be included. Despite mixed evidence for depression and anxiety (and

maybe also self-perceived awareness of a person's own risk) these disorders should remain in the focus of psychiatrists, neurologists and geriatricians alike, because of their importance for disentangling certain risk groups and because successful interventions do exist. The comprehensive overview presented here might assist in the conception of future observational and interventional studies.

Thorsten Nikolaus, Director of the Agaplesion Bethesda Clinic Ulm, passed away on September 26, 2013. He will be warmly remembered and dearly missed by all.

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