A theoretical and empirical review of psychological factors associated with falls-related psychological concerns in community-dwelling older people

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Abstract

Background: Four constructs are encompassed by the term 'falls-related psychological concerns' (FrPC); 'fear of falling' (FOF), 'falls-related self-efficacy' (FSe), 'balance confidence' (BC) and 'outcome expectancy' (OE). FrPC are associated with negative consequences including physical, psychological and social. Identifying factors associated with FrPC could inform interventions to reduce these concerns.

Method: Sixty-two empirical papers relating to psychological factors associated with FrPC in community-dwelling older people were reviewed. Four levels of evidence were used when evaluating the literature: good, moderate, tentative and none.

Results: Evidence that anxiety predicted FOF, BC and OE was tentative. Moderate evidence was found for anxiety predicting FSe. Good evidence was found for depression predicting FSe. Moderate evidence was found for depression predicting both FOF and BC. No evidence was found for depression predicting OE. Tentative evidence was found for FSe predicting depression. Good and moderate evidence was found for quality of life (QoL) being predicted by FOF and BC respectively. Tentative evidence was found for FSe predicting QoL. Moderate evidence was found for QoL predicting both FSe and BC. No evidence was found for QoL predicting FOF. Good and moderate evidence was found for activity avoidance/restriction (AA/AR) being predicted by FOF and FSe respectively. Tentative evidence was found for BC and OE predicting AA/AR, as well as for AA/AR predicting FOF. Moderate evidence for activity level (AL) predicting FOF was identified, however the evidence of this predicting FSe and BC was tentative. Evidence for FOF, FSe, and BC predicting AL was tentative as was evidence to suggest FOF predicted coping.

Conclusions: Mixed evidence has been found for the association of psychological

factors in association with FrPCs. Future research should employ theoretically grounded concepts, use multivariate analysis and longitudinal designs.

Key words: falls, fear of falling, falls self-efficacy, balance confidence, outcome expectancy

Introduction

Falls-related psychological concerns (FrPC) is an umbrella term (Moore and Ellis, 2008) encompassing the concepts 'fear of falling' (FOF; Tinetti and Speechley, 1989), 'falls-related self-efficacy' (FSe; Tinetti *et al.,* 1990), 'balance confidence' (BC; Powell and Myers, 1995) and 'outcome expectancy' (OE; Yardley and Smith, 2002). These will be defined shortly in relation to their theoretical underpinnings.

Up to 83% of community-dwelling older people (CDOP) experience FrPC's (Zijlstra et al., 2007b). Whilst FrPC's may encourage caution, when disproportionate to falls risk they may be detrimental, leading to activity avoidance and social withdrawal (Fessel and Nevitt, 1997). This can result in muscle deconditioning and reduced quality of life (Delbaere *et al.,* 2004). Approximately 10% of CDOP have excessive FrPC when compared with their physiological falls risk (Delbaere et al., 2010a). FrPC have been highlighted as risk factors for institutional admission (Cumming *et al.,* 2000), and guidelines highlight the importance of addressing FrPC in routine screening (Department of Health, 2001). Identifying factors associated with FrPC could inform interventions to reduce these concerns.

A review in the area of psychological factors and their associations with FrPC is warranted for several reasons. Previous reviews have dominantly focused on physical (Scheffer *et al.,* 2008) or functional factors (Schepens, Sen, Painter and Murphy, 2012). Psychological factors associated with FOF among the elderly have been largely neglected (Li *et al.,* 2003). The most recent review (Denkinger, Lukas, Nikolaus and Hauer, 2014) presented a comprehensive list of physical, functional, social and psychological correlates of FOF. However, detailed discussion of the strength of evidence regarding FrPC and FOF was beyond the scope of their review. Further to

this, Denkinger *et al.* (2014) did not include all psychological factors (e.g. coping). The present review provides the first comprehensive examination of literature regarding FOF and FrPC. Further, this paper extends previous reviews by considering how psychological factors mediate the relationship between FrPC and falls.

The review begins by defining relevant terms and discussing theoretical understandings of each separate FrPC construct (i.e. FOF, FSe, BC, OE). The evidence pertaining to psychological factors associated with each construct (i.e. FOF, FSe, BC, OE) is then reviewed. This is done to provide clarity on the evidence base, as research is often conducted in relation to only one concept. This also reflects recommendations for researchers to clearly identify which particular FrPC concept they are considering (Moore and Ellis, 2008). The limited research exploring mediating effects of psychological factors on the FrPC-falls relationship is also considered.

Community-dwelling older people

CDOP are older persons living in their homes/communal setting without assistance with activities of daily living (ADL's; World Health Organisation, 2004). Whilst an older person is often defined as aged 65 years or older, much research into FrPC includes people aged 60 years or older. Therefore this cut-off will be used here, as recommended by Roebuck (1979). This equates to a sizeable number of people, for instance approximately 9.5million CDOP live in the UK (Dunnell, 2008).

Falls: Links with FrPC

A fall is "an unexpected event in which the individual comes to rest on the ground, floor, or lower level" (Lamb *et al.,* 2005; p.1619). Approximately 30% of CDOP fall annually (Tremblay and Barber, 2006), resulting in disability, morbidity,

mortality, and substantial annual costs (e.g. £1.5 billion -US$2.6 billion to UK health services) (Davis *et al.,* 2010). These factors have led to falls-reduction becoming a key government target (Department of Health, 2001).

Falls risk is multifactorial (Gillespie *et al.,* 2003), including extrinsic (e.g. environmental hazards) and intrinsic factors (e.g. psychological factors; Faulkner *et al.,* 2009). Physical factors such as increasing age (e.g. Rossat *et al.,* 2010), female gender (e.g. Cesari *et al.,* 2002) and poly-pharmacy (e.g. Riefkohl *et al.,* 2003) have been identified as risk factors.

There are mixed findings regarding the relationship between falls and FrPC. The relationship is considered bi-directional (Friedman *et al.,* 2002); with falls predicting FrPC (e.g. Boyd and Stevens, 2009; Delbaere *et al.,* 2010b), and FrPC predicting falls (e.g. Chou *et al.,* 2005; Rossat *et al.,* 2010). However, some studies failed to find significant associations between FrPC's and falls (e.g. Arnold *et al.,* 2005), and the relationship may not remain significant after adjusting for influences such as functional ability (Hadjistavropoulos *et al.,* 2011). It follows that additional variables may be influencing this relationship.

FrPC: Theoretical origins

'FrPC' incorporates four constructs: fear of falling (FOF; Tinetti and Speechley, 1989); falls-related self-efficacy (FSe; Tinetti *et al.,* 1990); balance confidence (BC; Powell and Myers, 1995); and outcome expectancy (OE; Yardley and Smith, 2002). FrPC have been reported by 3-85% of CDOP (Scheffer *et al.,* 2008; Zijlstra *et al.,* 2007a). Varying methodologies and FrPC constructs measured (i.e. FOF, FSe, BC, OE) contribute to this variance.

Distinguishing the FrPC constructs from each other has been problematic, as inter-changeable use of terminology leads to confusion in the literature. Whilst

significantly associated, the constructs are distinct (Lachman *et al.,* 1998). Researchers have been encouraged to specify which FrPC construct they are measuring (i.e. FOF, FSe, BC or OE) to develop clarity within the evidence base (Moore and Ellis, 2008).

Fear of Falling (FOF)

FOF is 'a lasting concern about falling that leads to an individual avoiding activities that he/she remains capable of performing' (Tinetti and Powell, 1993, p.36). Initially FOF was considered a phobia of walking or standing following a fall (Bhala *et al.,* 1982; Murphy and Issacs, 1982). However, as subsequent research identified FrPC in people who had never fallen (Arfken *et al.,* 1994), 'FOF' was expanded to include non-fallers.

The definition of FOF above acknowledges 'avoidance;' a behavioral element, as a dominant feature. This relates to avoidance of activities and community engagement. As 'FOF' includes emotional (i.e. anxiety) and behavioral (i.e. avoidance) elements, psychological factors associated with FOF may include emotional states (e.g. anxiety) and behavioral elements (e.g. activity avoidance). Unfortunately, 'FOF' is often used to refer to all FrPC, resulting in confusion in the literature (Hadjistavropoulos *et al.,* 2011).

Measures of FOF include single questions (Arfken *et al.,* 1994) which have been criticised for lacking sensitivity (Jørstad *et al.,* 2005), and comprehensive scales assessing fear and activity avoidance which have good psychometric properties (Lachman *et al.,* 1998). Measures are outlined in Appendix 1.

Fall-related self-efficacy (FSe)

With identification that some concerns about falling were not irrational or

disproportionate (defining characteristics of a 'phobia;' American Psychological Association, 2000), alternative ways of defining FrPC were considered, leading to understanding of FrPC within a self-efficacy deficit model (Tinetti *et al.,* 1990).

Falls-related self-efficacy (FSe) relates to someone's confidence in their ability to undertake activities of daily living (ADL's) without falling (Tinetti *et al.,* 1990). Whilst FOF and FSe are correlated, they measure differing constructs (Hotchkiss *et al.,* 2004; Li *et al.,* 2002). FSe has been shown to mediate between FOF and activity engagement (Li *et al.,* 2005).

FSe is based on self-efficacy theory (SET; Bandura, 1977; 1986). Self-efficacy (SE) is a cognitive mechanism that mediates between thoughts/emotions and actions (Bandura, 1986). It is made up of two components; efficacy expectations (EE) and outcome expectancy (OE). FSe draws on the EE component, relating to an individual's perception of their ability to undertake an action required to achieve a certain performance (i.e. not falling; Bandura, 1986). These expectancies develop via performance and vicarious experience, verbal persuasion, emotional and physical arousal, and feedback. These influence choices and motivations, from which activity-specific action emerges. OE refers to an individuals' perception that certain behavior will result in a specific outcome. Historically OE has received little attention in the FrPC literature (Yardley and Kempen, 2006) and will be covered later.

Empirical findings suggest SE plays a pivotal role in affective state regulation (e.g. anxiety; Bandura, 1992) and avoidance behavior (Myers *et al.,* 1996). Research suggests, as people perceive inefficacy in their ability to gain a desired outcome, depression may occur (Bandura, 1991; Olioff and Aboud, 1991). Empirically, higher SE has been associated with perseverance in problem-solving (Bandura,1992), leading to increased coping responses.

Various measures of FSe have been developed. The Falls-efficacy scale-International (FES-I; Yardley *et al.,* 2005) has been translated and internationally validated and is acknowledged as the 'gold standard' FSe measure, with good psychometric properties (Moore and Ellis, 2008). Measures are detailed in Appendix 1.

Balance confidence (BC)

BC also draws from the EE component of SET, referring to situation-specific self-efficacy (Powell and Myers, 1995). BC is an individual's belief about their ability to maintain balance whilst performing ADL's. As it relates to the same fundamental construct as FSe (Hotchkiss *et al.,* 2004), factors associated with BC may be anticipated to be similar to those hypothesised in relation to FSe, including emotional (e.g. depression) and behavioral (e.g. avoidance) factors. Measures of BC aimed to address criticisms of the original FSe measure, which was considered biased towards low-functioning CDOP due to items producing ceiling effects in those who were higher functioning (Powell and Myers, 1995). Measures of BC are reported to have good psychometric properties (Powell and Myers, 1995; Appendix 1).

Outcome expectancy (OE)

Outcome expectancy draws on the component of SET with the same name (i.e. OE), and considers beliefs about anticipated consequences of falling (e.g. social embarrassment; Yardley and Smith, 2002). Whilst this concept remains largely un-researched, it may be that OE could be associated with similar factors as FSe and BC, as it is also based on SET. The Consequences of Falling Scale (Yardley and Kempen, 2006), a measure of OE with good psychometric properties, is detailed in

Appendix 1.

Summary

This section outlined the four constructs of FrPC. Whilst FOF has been criticised for lacking theoretical underpinning, FSe built on this limitation, drawing on SET. This incorporated beliefs about one's ability to manage a perceived threat (i.e. falling). BC and OE also draw on SET. BC is considered to measure the same construct as FSe (Hotchkiss *et al.,* 2004). OE is a newly developing concept, having seen limited utilisation in research to date.

Relationships between the constructs are complex, and have generated confusion within the literature, with some researchers using terms interchangeably (Hadjistavropoulos *et al.,* 2011). Whilst FOF has been correlated with FSe and BC, they measure distinct constructs (Li *et al.,* 2002). It is recommended that researchers clarify terminology and ensure measures of FrPC are appropriately and consistently selected (Bower *et al.,* 2014; Jørstad *et al.,* 2005; Moore and Ellis, 2008). The FES-I, due to its international validation and theoretical grounding, may bring clarity if employed consistently (Yardley and Kempen, 2006).

The following section presents empirical evidence relating to psychological factors associated with FrPC. As researchers commonly only employ one concept of FrPC (e.g. FOF, *or*, FSE, *or* BC, *or* OE), the empirical evidence is presented in relation to individual concepts of FrPC (i.e. FOF, FSe, BC, OE). This reflects calls for empirical clarity by clearly specifying the individual construct from within the umbrella term 'FrPC' (Moore and Ellis, 2008).

Literature search

An advanced search identified relevant papers published up to November2014-Week 1 using PsycINFO, Ovid Medline, Web of Knowledge, ASSIA and Cochrane

Database of Systematic Reviews. Search terms included ‘older people,’ ‘fall,’ and derivatives of ‘concern’ (full search term list; Appendix 2). Cross- referencing of reference lists of all selected articles was under-taken to identify additional relevant papers. Inclusion and exclusion criteria were applied to abstracts (Appendix 2). Papers from previous reviews were included. Sixty-two relevant papers were identified.

Associated psychological factors

Due to considerable literature in the area, it was not possible to review each study in detail. However, studies are detailed in Supplementary Table 1. Studies were reviewed in relation to the FrPC concept measured by the researcher (i.e. FOF, FSe, BC, OE).

Research has not been conducted into relationships between each psychological factor and each FrPC construct (e.g. OE has not been researched in relation to quality of life). Four levels of evidence were used when evaluating the literature: good, moderate, tentative and none (see Table 1).

Table 1 about here

Designs and methods

Research into psychological factors associated with FrPC have utilised similar methodologies, and given space constraints, it is not possible to fully describe each study’s methodology. However, these are detailed in Supplementary Table 1. Studies have employed bivariate, multivariate and qualitative analysis, utilising cross-sectional and longitudinal designs.

Bivariate analysis considers associations between two variables, exploring

correlations between a measure of FrPC and a psychological factor (e.g. anxiety). Often they measure factors cross-sectionally. However, this analysis does not allow for inference of causality, or account for co-correlates potentially influencing relationships. Multivariate analysis is more robust, considering numerous independent and dependent variables (Tabachnick and Fidell, 2001). Whilst unable to prove causation, multivariate analysis provides greater clarity to relationships between variables as researchers can control for other factors, to see if a specific variable predicts another (e.g. if anxiety predicts FOF when controlling for depression).

Longitudinal studies allow researchers to develop understanding of sequential relationships between variables, and imply causation (e.g. if developing FOF is predicted by depression). These factors result in longitudinal designs being considered the most robust quantitative design (Field, 2009).

Due to the large literature and space constraints, the greatest focus in this review will be on the most methodologically robust studies. Where there are multivariate analyses and longitudinal designs, there will be greater focus on these studies. However, as noted, all studies are detailed in Supplementary Table 1. Relationships between each psychological factor and FrPC construct are summarised in Table 1 for clarity.

Anxiety

Fear of falling (FOF). All nine studies exploring FOF in relation to anxiety found significant positive bivariate associations (e.g. Hellstrom *et al.,* 2009; see Supplementary Table 1 for a full list of studies). However, evidence from more robust research designs is mixed. Van Haastregt, Zijlstra, van Rossum, van Eijk and Kempen (2008) found anxiety significantly predicted FOF in multivariate

analysis. However, when depression was included, anxiety was no longer a significant predictor. Hull, Kneebone and Farquharson (2012) found that both anxiety and depression made significant unique contributions to FOF, with depression predicting slightly more variance in FOF compared to anxiety. In contrast, Kempen, van Haastregt, McKee, Delbaere and Zijlstra (2009) found anxiety did not predict FOF. In the only longitudinal study, Murphy, Dubin and Gill (2003) found anxiety was not a significant predictor of FOF development.

Whilst anxiety was associated with FOF in bivariate analyses, multivariate analyses did not yield the same support. Positive findings in bivariate analysis may be explained by high co-morbidity between depression and anxiety in CDOP (Adamek and Slater, 2005), as when controlling for depression in multivariate analyses, the relationship between anxiety and FOF was less clear.

Falls related self-efficacy (FSe). FSe was significantly negatively correlated with anxiety in bivariate analysis (e.g. Miller and Pantel, 2003; Supplementary Table 1). The evidence from multivariate analyses is mixed. Two studies (Hull, Kneebone and Farquharson, 2012; Liu, 2014) found anxiety was a significant predictor of FSe. Two studies (Burker, et al., 1995; Ni Mihaolin *et al.*, 2012) failed to find anxiety predictive of FSe. Contrasting evidence from the few robust multivariate studies means further research is required. Longitudinal research designs may help to elucidate the relationship between anxiety and FSe. Whilst empirical evidence outside of the field of FrPC suggests anxiety may be negatively associated with self-efficacy (Bandura, 1992), evidence supporting this in relation to FSe was unclear.

Balance confidence (BC). In the only study examining the relationship between BC and anxiety, Hull, Kneebone and Farquharson (2012) found anxiety was a significant predictor of BC in multivariate analysis, such that greater anxiety predicted diminished BC. Further research utilising longitudinal methods is

warranted.

Outcome expectancy (OE). Hull, Kneebone and Farquharson (2012) found that anxiety made the largest significant unique contribution to OE in multivariate analysis. Increased anxiety was predictive of more negative beliefs about the anticipated consequences of a sustained fall. The dearth of research relating to OE limits firm conclusions, meaning further research is required.

Depression

FOF. Twelve cross-sectional studies reported significant positive bivariate associations between FOF and depression (e.g. Kim and So, 2013; Supplementary Table 1). Two studies failed to find significant bivariate associations (Drozdick and Edelstein, 2001; Miller and Pantel, 2003). However, their small samples may have limited detection of significant findings (Field, 2009).

Studies employing multivariate analysis have produced mixed results. Four of the seven studies conducting multivariate analysis found depression significantly predicted FOF (Chandler *et al.,* 1996; Deshpande *et al.,* 2009; Hull, Kneebone and Farquharson, 2012; van Haastregt *et al.,* 2008). However, Deshpande *et al.* (2009) only found this association with FOF whilst at home, and not with FOF whilst in the community. Chandler *et al.* (1996) only found this association in those with a falls history. Three studies found depression did not significantly predict FOF (Arfken *et al.,* 1994; Deshpande *et al.,* 2008b; Kempen *et al.,* 2009). Differing results may relate to Deshpande *et al.* (2009) splitting FOF with respect to different situations (i.e. home, community). FOF at home may be more severe, or have greater personal impact. Additionally, Chandler *et al.* (1996) only found significant results in those with a falls history. Failure of other studies to make these distinctions limits comparisons.

Five of six longitudinal studies failed to find depression predictive of FOF development (Austin *et al.,* 2007; Chou and Chi, 2008; Lach,2005; Murphy *et al.,* 2003; Reyes-Ortiz *et al.,* 2006). Whilst Chou and Chi (2008) found depression predicted FOF, when adjusted for social/independent functioning, this association did not remain significant. Austin *et al.* (2007) found depression was a significant predictor of persistent FOF. However, it was unclear if they adjusted for baseline levels of depression.

Oh-Park *et al.* (2011) found depression significantly predicted FOF, both transient and persistent. In this study, data was collected every two to three months over two years. As 'persistent FOF' was defined as reporting FOF on two or more occasions, the increased data collection points may have increased the likelihood of persistent FOF identification.

In summary, depression was not consistently associated with FOF. Depression did not predict FOF development in five of six longitudinal studies, but was more consistently associated with persistent FOF.

FSe. Significant negative bivariate associations between FSe and depression were identified by Liu (2014) and Tiernan *et al.* (2014). In multivariate analysis, six out of seven studies found depression negatively predicted FSe (Burker *et al.,* 1995; Delbaere *et al.,* 2010b; Kressig *et al.,* 2001; Miller and Pantel, 2003; Ni Mhaolain *et al,* 2012; Shin *et al.,* 2010). These findings support previous findings outside of the FrPC field relating perceived inefficacy to depression (Bandura, 1991; Olioff and Aboud, 1991). In contrast, one study (Hull, Kneebone and Farquharson, 2012) found depression did not significantly predict FSe.

Tiernan *et al.* (2014) found that FSe also significantly predicted depression scores among a sample of 44 African American CDOP. However, their small sample

limits the generalisability of their findings. Longitudinal research is required to clarify the association between FSe and depression and provide some evidence of causality.

BC. Significant negative bivariate associations between BC and depression were identified in four studies (e.g. Fortinsky *et al.,* 2009). In multivariate analysis, Kressig *et al.* (2001) and Klima, Newton, Keshner and Davey (2013) found depression was a significant predictor of BC. However, both studies were limited by the representativeness of their samples (Kressig *et al.'s* (2009) sample was primarily female; Klima *et al's.* (2013) sample was exclusively male). Hull, Kneebone and Farquharson (2012) found that depression did not significantly predict BC. Disagreement among findings as well as the dearth of methodologically robust studies means firm conclusions are limited. Further research is warranted.

OE. In the only multivariate analysis, Hull, Kneebone and Farquharson (2012) found that depression was not a significant predictor of OE. The lack of research relating to OE limits firm conclusions and means further research is required.

Quality of life (QoL)

FOF. All ten studies exploring FOF and QoL found negative bivariate associations (e.g. Chang *et al.,* 2010). Three studies found FOF negatively predicted QoL in multivariate analysis (Chang *et al.,* 2010; Lachman *et al.,* 1998; Li *et al.,* 2003). However, when FOF was utilised as the dependent variable in analyses, the findings were non-significant; two studies failed to find QoL predictive of FOF (Arfken *et al.,* 1994; Howland *et al.,* 1998) in multivariate analysis.

Using longitudinal designs, FOF was negatively predicted by QoL in individuals with persistent FOF (Austin *et al.,* 2007; Iglesias *et al.,* 2009), however, reduced QoL did not predict new FOF development (Austin *et al.,*

2007). It is unclear if these studies controlled for baseline levels of FOF. Iglesias *et al.'s* (2009) all female sample limits generalisation of these findings to men.

Evidence suggests, whilst reduced QoL does not predict FOF development, FOF predicts reduced QoL over time. This highlights the potentially detrimental effect of FOF on QoL for CDOP.

FSe. Four studies found FSe was significantly positively associated with QoL in bivariate analysis (Lachman *et al.,* 1998; Hsu, Alfermann, Lu and Lin, 2013; Huang and Wang, 2009; Patil, Uusi-Rasi, Kannus, Karinanta and Sievanen, 2013). Of the two studies that used more robust multivariate analysis, both found that FSe was a significant independent predictor of QoL (Hsu *et al.*, 2013; Patil *et al.,* 2013). Further research employing longitudinal designs would explore whether findings remain significant when controlling for additional variables, and allow an understanding of causality.

BC. Two studies found significant positive bivariate associations between QoL and BC (e.g. Talley *et al.,* 2008). Two studies employing multivariate analysis found significant relationships between BC and QoL; Brouwer *et al.* (2004) found physical QoL predicted BC, whilst Davis, Marra and Liu- Ambrose (2011) found BC significantly predicted physical and mental QoL.

The predictive effect of physical QoL on BC may relate to functional ability, with physical QoL relating to physical function and pain. These may impair balance ability, in turn affecting someone's BC. However, the lack of longitudinal designs once again limits the ability to infer causality. Further research may identify if these results are robust and explore possible mediating or moderating factors in the association.

Behavioral factors-Activity avoidance/restriction (AA/AR)

Behavioral factors associated with FrPC have been explored from two perspectives; activity avoidance/restriction (AA/AR) and activity levels (AL). Theoretical understandings of FrPC focus on AA/AR deeming 'avoidance' a key component to certain constructs (i.e. FOF).

FOF. Findings suggest 5-65% of respondents with FOF reported AA/AR due to this fear (e.g. Fletcher *et al.,* 2010; Supplementary Table 1). This wide range may, in part, be due to variation in measures of FOF (e.g. yes/no responses, Survey of Activities and Fear of Falling in the Elderly [SAFFE] subscale).

Six studies found significant positive bivariate associations between FOF and AA/AR (e.g. Bertera and Bertera, 2008). Chandler *et al.* (1996) only found this in fallers, with results approaching significance in non-fallers. Their small sample may have limited statistical power to detect significant findings (Field, 2009).

Betera and Betera (2008) found FOF was a significant predictor of AA/AR in multivariate analysis. Using longitudinal designs, Yardley and Smith (2002) found FOF was a significant predictor of AA/AR. However, Hadjistavropoulos *et al.* (2007) found FOF was only a significant predictor when combined in a step with FSe, BC, activity level and baseline AA/AR. Yardley and Smith (2002) used a self-administered version of the SAFFE, whilst Hadjistavropolous et al. (2007) used the interview-administered version. This may explain the different results.

Kempen *et al.* (2009) found AA/AR significantly predicted FOF. However, Howland *et al.* (1998) found AA/AR did not significantly predict FOF. Additionally, two longitudinal studies failed to find AA/AR predictive of FOF (Lach, 2005; Shimada *et al.,* 2007), suggesting AA/AR did not lead to FOF development. Two qualitative studies identified AA/AR in CDOP (Faes *et al.,* 2010; Lee *et al.,* 2008). However, respondents

did not relate this avoidance to FOF, rather to other factors (e.g. health status; Lee *et al.,* 2008).

Studies demonstrate, whilst FOF and AA/AR may be related, not all individuals experiencing FOF restrict activity. This raises questions about whether FOF 'leads to an individual avoiding activities that he/she remains capable of performing' (Tinetti and Powell, 1993, p.36), and suggests a more tentative expression of this link (i.e. 'may lead to').

FSe. Five studies found significant negative bivariate associations between FSe and AA/AR (e.g. Jellesmark, Forsyth Herling, Egerod and Beyer, 2012). Delbaere *et al.* (2009) found FSe had a direct effect on AA/AR in a structural equation model. However, Hadjistavropoulos *et al.* (2007) failed to identify FSe as a significant predictor of AA/AR at six-month follow-up. Differing measures of AA/AR may have contributed to contradictory findings. The inconsistent findings mean firm conclusions about associations between FSe and AA/AR cannot be made. Further exploration of this relationship is warranted.

BC. Three studies found significant negative bivariate correlations between BC and AA/AR (e.g. Hotchkiss *et al.,* 2004). However, Hadjistavropoulos *et al.* (2007) failed to identify BC as a significant predictor of AA/AR at six-month follow-up. This more robust longitudinal design suggests limited evidence that reduced BC leads to increased AA/AR. However, sparse research utilising the concept 'BC' in relation to AA/AR indicates further research is warranted.

OE. Delbaere *et al.* (2009) found a strong negative correlation between positive OE and AA/AR. However, in a structural equation model, OE did not have a direct effect on AA/AR. Rather, OE had an effect through FSe. Yardley and Smith (2002)

found AA/AR was significantly predicted by OE. However, unlike Delbaere *et al.* (2009) they did not control for FSe. Differing measures of AA/AR limits cross-study comparisons. The dearth of research relating to OE limits firm conclusions, meaning further research is required.

Behavioral factors - Activity levels (AL)

FOF. Eighteen studies explored AL in relation to FOF. Fourteen studies exploring this association found significant negative bivariate correlations (e.g. Doi *et al.,* 2012). Austin *et al.* (2007) and Reyes-Ortiz *et al.* (2006) found AL significantly predicted FOF in multivariate analysis, with lower AL predictive of higher FOF. Li, Fisher, Harmer, McAuley and Wilson, (2003) found membership to a high fear group as opposed to a low fear group, was significantly predicted by lower AL.

Bruce *et al.* (2002), Doi *et al.* (2012) and Wijlhuizen *et al.* (2007) found FOF significantly predicted AL, with increased activity being predicted by lower FOF. Four longitudinal studies found mixed results. Murphy *et al.* (2003) found sedentary lifestyle significantly predicted the development of FOF. Reyes-Ortiz *et al.* (2006) found increased church attendance significantly predicted FOF, with increased church attendance associated with lower levels of FOF. However, Austin *et al.* (2007) found reduced physical activity predicted persistent FOF, but not FOF development. Additionally, Hadjistavropoulos *et al.* (2007) found AL were significantly predicted by FOF.

With some studies failing to find significant associations at bivariate level (e.g. Filiatrault *et al.,* 2009), and mixed multivariate and longitudinal results, the variation may be explained by widely ranging measures of AL and FOF. This makes findings difficult to compare. Some defined activity in terms of much lower demand activities (e.g. going outside of the bedroom), with others relating this to higher demand activities (e.g. engagement in exercise) resulting in very different meaning of ‘low

activity.'

Church attendance in Reyes-Ortiz *et al.*'s (2006) study may relate to two concepts: AL (practice of attendance) or religion (purpose of attendance). Religion is a suggested coping response to physical and mental health issues in CDOP (Koenig *et al.,* 1992; Musick *et al.,* 2000). Therefore, Reyes-Ortiz *et al.,* (2006) may have assessed use of religion appose to physical activity.

Findings partially suggest lower AL were associated with increased FOF. However, differing measures of activity limits comparability of findings. AL was inconsistently associated with development of FOF, but again this may relate to the variance in measures of activity.

FSe. Of the six studies exploring FSe and AL, all found significant positive bivariate associations (e.g. Kumar, Carpenter, Morris, Iliffe and Kendrick, 2012). Only Tinetti *et al.* (1994) employed multivariate analysis, where AL remained a significant independent predictor of FSe. However, in longitudinal analysis, Hadjistavropoulos *et al.* (2007) found FSe did not independently predict AL. Lower AL were associated with reduced FSe. However, FSe failed to predict activity levels. Overall, results should be considered tentative.

BC. Three studies exploring BC in relation to AL found significant positive bivariate correlations (Hotchkiss *et al.,* 2004; Klima, Newton, Keshner and Davey, 2013; Myers *et al.,* 1996). Evidence from multivariate analyses is mixed. Klima *et al.* (1013) found that higher AL was significantly independently predicted by higher BC. Brouwer, *et al.* (2004) found BC was not significantly predicted by AL. Klima's *et al.*'s all male sample limits generalisation of their findings to females. Furthermore, a different measure of AL across studies limits the comparability of findings.

Using BC as a predictor variable, Hadjistavropoulos *et al.* (2007) found AL were not predicted by BC. Significant associations were primarily found at bivariate level and the failure to conduct more stringent analysis using standardized measures means results should be interpreted with caution. AL were not consistently associated with, or predicted by, BC. Limited studies measuring BC means further exploration of BC in relation to psychological factors is warranted.

Coping

FOF. Coping has only been researched in relation to FOF. Drozdick and Edelstein (2001) found no significant differences in coping responses between fearful and non-fearful fallers. Filiatrault and Desrosiers (2011) found CDOP with FOF employed significantly more behavioral coping strategies than those without FOF. Whilst FOF predicted behavioral coping in multivariate analysis, FOF did not predict cognitive coping (Filiatrault and Desrosiers, 2011).

Whilst comparisons were made between fearful and non-fearful CDOP, researchers assessed coping with falls (Drozdick and Edlestein, 2001) or aging (Filiatrault and Desrosiers, 2011). Challenges to coping research are found if researchers do not specify what the respondents are coping with. If researchers want to understand coping with FrPC, it is important they clearly define the stressor as FrPC (Lazarus and Folkman, 1984). The small sample employed by Drozdick and Edlestein (2001) may have limited detection of significant between-group differences (Field, 2009).

The coping measure employed by Drozdick and Edelstein (2001) had not been validated on CDOP, and may have lacked sensitivity (Field, 2009). The measure employed by Filiatrault and Desrosiers (2011) only contained one scale of cognitive coping opposed to eight behavioral scales, potentially limiting sensitivity in

detecting cognitive coping. These limitations mean it is not yet possible to draw firm conclusions about coping with FrPC in CDOP.

Two qualitative studies reported CDOP attempted to cope with FOF by exercising caution, restricting activities and seeking social support (Huang, 2005; Ward-Griffin *et al.,* 2004). CDOP also assigned blame for, and changed their attitudes toward their FOF (Huang, 2005; Ward-Griffin *et al.,* 2004).

The limited participant and setting information in both qualitative studies restricts transferability of data (Williams and Morrow, 2009). It is important for future research to explore how representative these findings are.

Coping should be assessed in relation to specific events/situations (Lazarus and Folkman, 1984). Therefore, measuring coping in relation to other factors (e.g. falls) means inferences cannot be made about coping with FrPC. Further studies are required to explore these links employing other FrPC concepts (i.e. FSe, BC, OE)

Summary

Research regarding psychological factors associated with FrPC has been dominated by cross-sectional designs predominantly utilising the concept FOF. Wide use of bivariate analysis means, that in some relationships (e.g. FSe and QoL) the understanding of complex associations between factors is limited. The associations between FrPC constructs and psychological factors are summarised in Table 1. The strongest evidence was found for depression predicting FSe, FOF predicting QoL and FOF predicting AA/AR. Variability in findings limits firm conclusions.

Psychological factors mediating between FrPC and falls

Identifying a constellation of psychological factors does not reflect their impact on the relationship between FrPC and falls. Mediation analysis allows for this

relationship to be understood. Employing this analysis, Hsu *et al.* (2013) found activity level partially mediated the relationship between FOF and health-related quality of life, and Wijulhuzen *et al.* (2007) found physical activity mediated the relationship between FOF and falls. However, the latter study has been criticised for finding no main effect of FOF on falls incidence (Lacherez and Wood, 2008). In the absence of a main effect, there is no relationship to mediate (Hafeman and Schwartz, 2008). The limited research into mediation highlights further research is required in this area.

Hull and Kneebone (2007) describe a model of falls risk (Figure 1), which considers these relationships. This highlights factors associated with FrPC leading to increased falls risk, including those they deem to have empirical support (e.g. postural changes) and factors which have received limited empirical attention (e.g. coping).

Figure 1 about here

This review explored elements of this model, namely AA/AR and coping. Findings suggested inconsistent evidence of the association between AA/AR and FrPC. This review noted difficulties drawing firm conclusions regarding the relationship between coping and FrPC due to limited number of studies and their methodological limitations. This reflects the uncertainty expressed by the model. Qualitative findings suggested CDOP attempt to cope with FrPC (Huang, 2005; Ward-Griffin *et al.,* 2004). However, generalisability of these results is unclear.

Implications

Future research

Mixed evidence in relation to nearly every psychological factor means further research is required (Drozdick and Edelstein, 2001). This should seek to clarify

associations through consistent measurement of FrPC, with the FES-I being recommended due to its international translation, strong psychometric properties and theoretical underpinnings (Moore and Ellis, 2008; Yardley and Kempen, 2006). Research including other FrPC concepts is also warranted (e.g. OE).

Coping with FrPC has received limited attention and requires continued exploration (Drozdick and Edelstein, 2001). Gaining clarity on the role of coping, and how this influences outcomes seems pertinent, particularly with the increase in interventions including cognitive coping strategies (Zijlstra *et al.,* 2007b).

Not all CDOP experiencing FrPC have experienced falls, suggesting the two are not always linked. It would be important to understand which factors contribute to this variation. Factors mediating this relationship could be areas for intervention if adequately understood. Future research may also benefit from multivariate analysis to allow understanding of the complex relationships depicted in Hull and Kneebone's (2007) model. Longitudinal designs would also advance understanding regarding causation.

Clinical relevance

Identifying psychological factors associated with FrPC is important when considering CDOP needs. For example, if anxiety, depression and reduced QoL were associated with FrPC, clinicians may wish to be mindful of these factors during assessment, and when developing individuals' clinical formulations. The multiple factors associated with FrPC highlights the need for multidisciplinary working to ensure the physical, psychological and social needs of CDOP with FrPC are managed effectively.

In view of the emphasis FrPC has been given in the context of falls prevention (Department of Health, 2001), it is important to explore factors

potentially influencing the relationship between FrPC and falls. This may identify factors amenable to change in interventions, and could inform psychologists and other professionals working to reduce falls incidence and FrPC in their clinical work and consultation with other professionals.

In providing targeted, effective interventions to prevent falls and reduce FrPC, this may subsequently address the sequelae of potentially adverse outcomes resulting from falls, including disability, morbidity and mortality. In finding areas amenable to non-medical interventions, this may provide alternative approaches to reduce the large annual economic cost of falls.

The older adult population is the fastest growing sector of society (Dunnell, 2008). In order to maintain independence and autonomy in CDOP, it is important to ensure research focuses on factors which can support their continued community presence (Department of Health, 2001). With FrPC being highlighted as a risk factor for admission to an institution (Cumming *et al.,* 2000) it is important to address this issue in community populations to avoid admissions.

Theoretical relevance

With many terms used within the arena of FrPC, future research may assist in consolidating and agreeing appropriate constructs to employ. This may assist in identifying which construct is most theoretically relevant and therefore, best to focus on when exploring associated psychological factors. With FOF being criticised for its lack of theoretical underpinning, it may be helpful to consider more soundly based theoretical concepts (i.e. FSe, BC, OE).

Further research may provide clarity to a proposed model of falls risk (Hull and Kneebone, 2007), informing theoretical understanding and identifying aspects of these models that are most relevant to clinical practice. This may allow

insight into how interventions addressing FrPC and falls may correspond with suggestions in theoretical models. Research could attempt to bridge the gap between theory and practice, highlighting areas to consider in multi-factorial interventions aimed at reducing falls risk.

Conclusion

This review details the associations between FrPC and psychological factors. Whilst often research has been undertaken in relation to the concept FOF, this term lacks theoretical underpinning. Drawing on theoretically grounded terms (i.e. FSE, OE, BC) would allow a stronger, more consistent evidence-base to develop (Moore and Ellis, 2008).

Whilst many psychological factors have been explored, mixed evidence has been found in their associations with FrPC. Strongest evidence was shown for depression predicting FSe, and FOF predicting QoL and AA/AR. Coping with FrPC has received limited attention to date. Understanding this may inform interventions and clinicians seeking to support individuals reporting FrPC.

Whilst this review listed psychological factors associated with FrPC, future research may advance findings by exploring their mediating role in the relationship between FrPC and falls. Longitudinal designs and multivariate analysis would allow robust understanding to develop.

Conflict of Interest Declaration

None.

Declaration of Authors Roles

C. Hughes designed the study, collected the identified articles and wrote the initial draft of the paper. I. Kneebone advised on study design and assisted with writing the article. F. Jones also advised on design of the study and contributed to the writing of the final article. B. Brady assisted with the collection of the identified articles, checked the integrity of the literature search and contributed to the writing of the final article.

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Appendix 1: Summary table of measures of falls-related psychological concerns

Concept	Measure name	Number of item	Response scale	Reliability	Validity
Fear Of Falling (FOF)	Yes/no question	1	Yes/no	-	-
	Closed ended question	1	3 point scale Not at all, somewhat, very much	Test-retest (at two weeks)=0.66	Convergent Concurrent
	Has fear of falling made you avoid any activities?	1	Yes/no	Test-retest (at 4-7 days)=0.36	
	Survey of activities and fear of falling in the elderly (SAFFE)	33	4 point likert scale (range 0-3)	Cronbach's α=0.91	Concurrent Convergent Criterion
	Modified SAFFE (m SAFFE)	17	3 point likert scale (range 1-3)	Cronbachs α=0.91-0.92 Test retest (at 6 months)=0.75	Concurrent Construct
	University of Illinois at Chicago Fear of Falling measure	16	3 point likert (range 1-3)	Cronbach's α=0.93	
	Geriatric Fear of Falling measure	41	Range 1-5	Cronbach's α=0.86-0.88 Test retest at two weeks) = 0.88	Concurrent Construct

Falls-related Self Efficacy (FSe)	Falls Efficacy Scale (FES)	10	10 point numerical rating (range=1-10)	Cronbach's α=0.90 Test retest (at 4-7 days)=0.71	Concurrent Convergent Construct
	Amended FES (amFES)	10	4 point likert scale (range 1-4)		Convergent
	Revised FES (rFES)	10	11 point numerical rating (range=0-10)	Cronbach's α=0.95 Test retest=0.88	Discriminant
	Modified FES (mFES)	14	11 point numerical rating (range=0-10)	Cronbach's α=0.95 Test retest=0.95	Discriminant
	FES-international (FES-I)	16	4 point likert scale (range 1-4)	Cronbach's α=0.96 Test-retest=0.96	Discriminant
Balance Confidence	Activities-specific Balance Confidence Scale (ABC)	16	101 point numerical rating (range 0-100)	Cronbach's α=0.96 Test retest=0.95	Concurrent Convergent Discriminant Construct
	ABC-6	6	101 point Numerical rating (range 0-100)	Cronbach's α=0.90-0.91	Discriminant

	Modified ABC (mABC)	16	21 point scales (range 0-100)	Cronbach's α=0.95	Discriminant
	Balance Self-Perceptions Test	12	5 point rating scale (range 1-5)		Convergent
Outcome Expectancy (OE)	Consequences of falling scale	12	4-point likert scale (range 1-4)	Cronbach's α=0.86-0.94 Test re-test (at 6 months) r=0.61-0.64	

Appendix 2: Literature search strategy

Search strategy

An advanced search was conducted to identify relevant papers that were published between no start date and November 2014-Week 1 using PsycINFO, Ovid Medline, Web of Knowledge, ASSIA and Cochrane Database of Systematic Reviews (CSDR). They were searched using the same strategy. Additionally the reference lists of all selected articles were reviewed to identify any additional relevant papers. Key search terms were chosen by reviewing MeSH headings, and also identifying key words from previous reviews (e.g. Scheffer et al., 2008). These included words relating to 'older people' in order to define the population and 'fall,' 'fear' and additional related terms (e.g. 'efficacy'). Studies were limited to those published in the English language.

MeSH terms and words used to search electronic databases

1	2	3	4
Elderly	Fall	Anxiety	'falls self-efficacy'
Frail	Falls	Fear	'falls-related efficacy'
Aged	Accidental fall	Concern	'fear of falling'
Older person/s		Worry	'FOF'
Older adults		Anxious	'Balance-confidence'
		Efficacy	
		Self-efficacy	
		Confidence	
		Balance confidence	

Columns two and three were combine with 'and,' and the results if this were combined with column for with 'or.' The results of this search were then combined with column one with 'and.'

Search	Number of studies generated
Column 1	9931286
Column 2	815421
Column 3	5609755
Column 4	24284
Column 4 combined using ‘or’ with Column 3	5605832
Column 1, 2, combined 3 and 4 combined using ‘and’	3934

When limited to those studies published in English and removing duplicates, this reduced the total search to 2376 papers, of which 62 papers were selected for review of the empirical factors associated with FrPC.

Inclusion/exclusion criteria

Abstracts were read and inclusion and exclusion criteria applied. Papers were included where the authors measured or explored the psychological correlates or themes associated with FrPC in CDOP. These included anxiety, depression, quality of life, activity avoidance/restriction and coping. As behavior is considered related to psychological constructs, this is included for the basis of this review. Papers were excluded if they did not address psychological factors, or only addressed physical factors (e.g. balance, gait, age, gender). Papers were also excluded if participants were aged under 60 years, they were not CDOP (e.g. they were inpatients or resided in a supported care facility such as a nursing home) or the papers were not published in the English language. Intervention studies were also excluded.

Table 1: Empirical evidence for associations between FrPC constructs and psychological factors

	FOF	FSe	BC	OE
Anxiety	Anxiety predicting FOF=**Tentative** FOF predicting anxiety= --	Anxiety predicting FSe= **Moderate** FSe predicting anxiety= --	Anxiety predicting BC=**Tentative** BC predicting anxiety= --	Anxiety predicting OE=**Tentative** OE predicting anxiety= --
Depression	Depression predicting FOF=**Moderate** FOF predicting depression= --	Depression predicting FSe= **Good** FSe predicting depression= **Tentative**	Depression predicting BC=**Moderate** BC predicting depression= --	Depression predicting OE=**No evidence** OE predicting Depression= --
QoL	QoL predicting FOF=**No evidence** FOF predicting QoL=**Good**	QoL predicting FSe=**Moderate** FSe predicting QoL=**Tentative**	QoL predicting BC=**Moderate** BC predicting QoL=**Moderate**	--
AA/AR	AA/AR predicting FOF=**Tentative** FOF predicting AA/AR=**Good**	AA/AR predicting FSe= -- FSe predicting AA/AR=**Moderate**	AA/AR predicting BC= -- BC predicting AA/AR=**Tentative**	AA/AR predicting OE= -- OE predicting AA/AR=**Tentative**
Activity Levels (AL)	AL predicting FOF=**Moderate** FOF predicting AL=**Tentative**	AL predicting FSe=**Tentative** FSe predicting AL=**Tentative**	AL predicting BC=**Tentative** BC predicting AL=**Tentative**	--
Coping	Coping predicting FOF= -- FOF predicting coping=**Tentative**	--	--	--

-- = relationship not explored in any studies **Good evidence**=two or more studies show same findings with methodologically strong designs. This includes consideration of power, multivariate analysis and longitudinal designs **Moderate evidence**=one or more studies show evidence but measures employed were not psychometrically robust, or if only one study was methodologically strong (e.g. well-powered, multivariate analysis, longitudinal designs) **Tentative evidence**=studies have methodological limitations (e.g. inadequate power, only bivariate analysis conducted) **No evidence**=no study confirming the association between these variables (Harvey, Watkins, Mansell & Shafran, 2004).

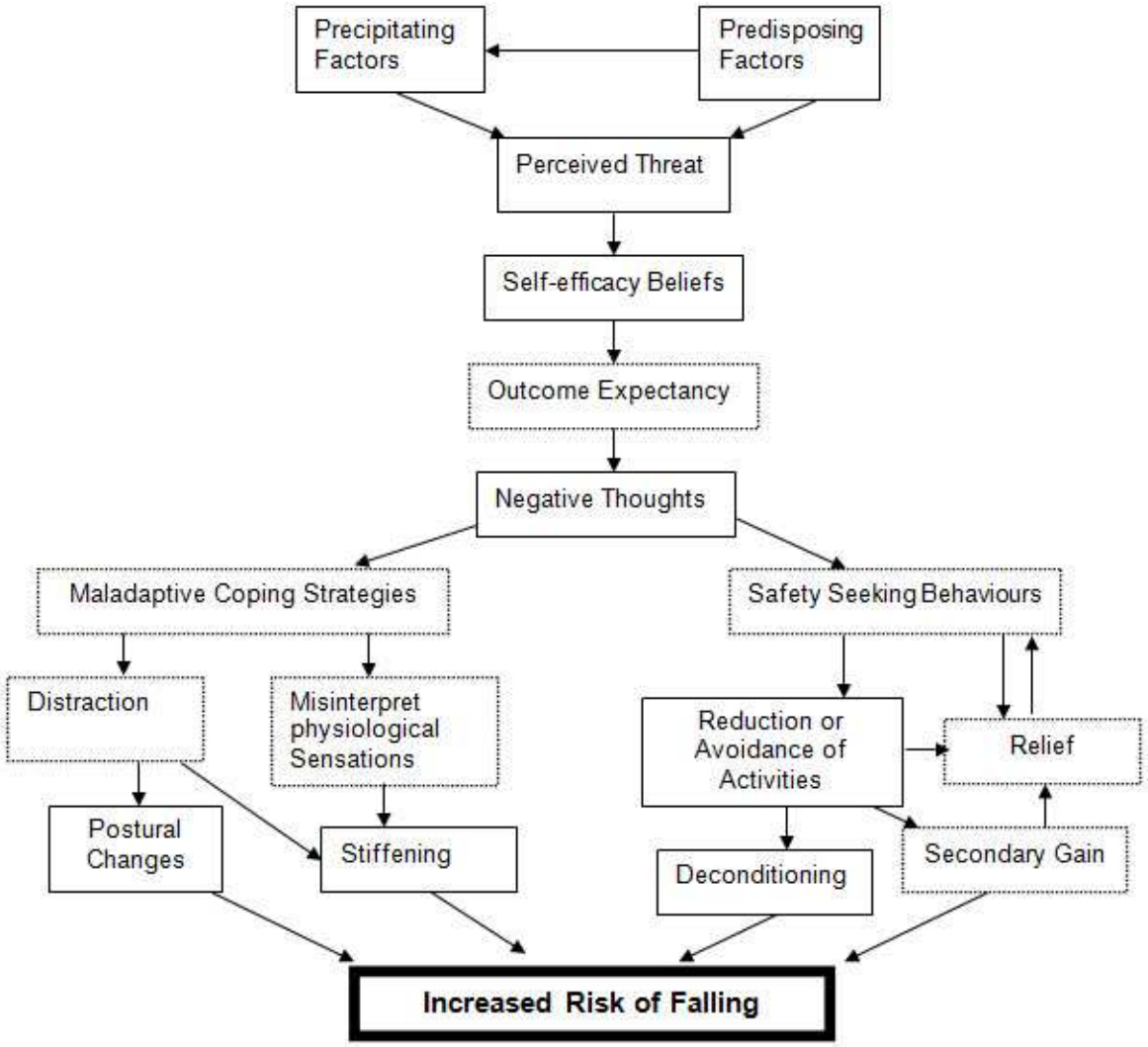

Figure 1: Hull and Kneebone's (2007) model of falls risk. Dotted lines indicate limited evidence.

Supplementary Table 1. Summary of the studies critiqued

Variable	Study	Population	Study design	How variable measured	FrPC construct measured	Method of analysis	Association
Depression	Arfken, Lach, Birge and Miller, 1994	N=890 CDOP Fell into four age groups 66-70 years: N=243 71-75 years: N=240 76-80 years: N=203 81+ years: N=204	Cross-sectional	GDS	FOF: at the present time are you very fearful, somewhat fearful or not fearful that you may fall?	Chi-squared or Kruskal-Wallis Rank Test, multivariate logistic regression	Those who were very fearful of falling significantly likely to have increased levels of depression (p<0.0001) at bivariate level. Still true after adjusted for age and gender. However, depression was not a significant predictor of FOF in multivariate analysis.
Depression	Austin, Devine, Dick, Prince and Bruce, 2007	1282 community dwelling older women aged 70 years and over	longitudinal 3 year follow-up	SF-36 mental component summary used to assess depression	FOF=single questions: are you afraid of falling (yes/no) Do you limit any household activities because you are frightened you may fall? (yes/no) Do you limit any outside activity because you are frightened you may fall? (yes/no)	Chi-squared, ANOVA, Kruskall-Wallis H test, logistic regression	Cross sectional: At bivariate level, FOF associated with depression (with FOF MCS score: 51.6 ± 9.4, without FOF: 54.4 ± 8.0, p<0.01). Depression significantly predicted FOF in multivariate analysis. Longitudinal: those with persistent FOF (reported at time one and at follow up) FOF associated with higher frequency of depression (Never FOF MCS=6.2, Persistent FOF MCS=16.9, p<0.05) in univariate analysis. For persistent FOF, MCS score (depression) was significant independent predictor of FOF (OR=2.58, 95% CI=1.56-4.28). Depression did not predict new-onset FOF (p>0.05) in bivariate or multivariate analysis.
Depression	Burker, Wong, Sloane, Mattingly, Preisser and Mitchell, 1995	N=126 CDOP Dizzy N=60 Non dizzy N=66 Mean age 75.5 years (SD=7.4)	Cross-sectional	Depression subscale of SCL-90-R	FSe: three questions from FES: Indicate how confident they were they could complete the following tasks without falling: cleaning house, getting dressed/un	Stepwise multiple regression	SCL-90-R depression score significantly independently predicted FSe in multiple regression in dizzy participants (p=0.008) Higher depression scores were predictive of higher FSe scores and there individual affect remained consistent across groups (dizzy v non-dizzy).

					dressed and preparing meals (6 point likert scale: extremely [1], not at all [6])		
Depression	Chandler, Duncan, Sanders and Studenski, 1996	N=149 male CDOP aged 70-104 years	Cross-sectional	GDS	FOF: would you say that you are somewhat afraid, not afraid or very afraid of falling?	Independent t-test, logistic regression	Data spilt between previous fallers and those without a falls history. Non-fallers: Depression significantly greater in those who were very FOF (p=0.03) in bivariate analysis. Fallers: Depression was significantly associated with FOF in bivariate analysis (p=0.002). In logistic regression analysis, depression was a significant predictor of FOF (OR=1.4, 95% CI=1.2-1.7, p=not reported).
Depression	Chou and Chi, 2008	N=321 community dwelling older people aged 65 years or older. Mean age=72.6 years (SD=5.5)	Longitudinal 12 month follow-up	MDS depression rating scale assessed at baseline and 12 month follow up	FOF: 'do you limit going outdoors due to fear of falling?' (0=does not limit, 1=limits activity). Assessed at baseline and 12 month follow up	Multiple regression	FOF at baseline predicted depression at 12 month follow up (b=0.10; p<0.05) in multiple regression analysis, but this disappeared if adjusted for IADL limitation or social functioning Depression at baseline predicted FOF at 12 month follow up (b=0.25, p<0.01) in multiple regression analysis but when adjusted for baseline depression level, no longer significant.
Depression	Delbaere, Close, Brodaty, Sachdev and Lord, 2010a	N=500 aged 70-90 years CDOP	Cross-sectional	GDS	FES-I to measure perceived risk of falling	Logistic regression	Depression significantly and independently predicted FES-I scores (p<0.001) in multivariate analysis.
Depression	Deshpande, Metter, Bandinelli, Laurentani, Windham and Ferrucci, 2008b	N=926 CDOP aged 65 years or over Stratified into four age groups: 65-70, 71-80, 81-90, 90 years+	Cross-sectional	CES-D	FOF: SAFFE	'Correlation analysis,' multiple linear regression	Participants with higher levels of FOF had significantly more depressive symptoms (p<0.001) in bivariate analysis. However, in multivariate regression analysis it was found that depression did not significantly predict FOF.
Depression	Deshpande Metter, Lauretani, Bandinelli and Ferrucci,	342 CDOP aged 65 years and older	Cross sectional	CES-D	FOF: SAFFE Categorise to FOF related to	'general linear model multivariate analysis'	In multivariate analysis, higher depressive symptoms were independently predicted FOF exclusively for activities within the home

	2009				activities in the home environ-ment, FOF related to activities in the community environ-ment.		environment (p<0.01).
Depression	Downton and Andrews, 1990	N=203 CDOP aged 75-84 years	Cross-sectional	Schwab Depression Inventory	Do you limit your activity due to FOF? (yes/no)	Mann-Whitney U-Wilcoxon rank sum test	FOF was significantly associated with higher depression scores (5.57 v 9.34, p<0.0001) in bivariate
Depression	Drozdick and Edelstein, 2001	34 CDOP mean age 74.35, (SD=8.88) all fallers	Cross-sectional	GDS-15	FOF: three item question-naire scored on 5 point likert scale. Measured frequency, severity and impact of FOF. Severity was used as one measure and the other two questions	ANOVA	No significant difference between high and low fear fallers on the GDS-15 F(1,32)=0.775, p>0.05).
Depression	Fortinsky, Panzer, Wakefield and Into,	N=329 CDOP mean age	Cross-sectional	CES-D	BC: ABC	Pearsons correlation	ABC score negatively correlated with DES-D score (p<0.0001) at bivariate level.
Depression	Hellstrom, Vahlberg, Urell and Emtner, 2009	N=80 CDOP aged 65 years with COPD	Cross-sectional	Hospital Anxiety and Depression Scale-Depression subscale (HADS-HAD- D)	FOF: single question 'are you afraid of falling?' (yes/no) Categories: FOF or no FOF	Unpaired t-test	Those with FOF as measured by single question had significantly higher levels of depression (p=0.012) at bivariate level.
Depression	Hull, Kneebone and Farquharson, 2012	N=205 CDOP mean age 81 years, SD 7.5	Cross-sectional	Geriatric Depression Scale – 15 (GDS)	FOF: Modified Survey of Activities and Fear of Falling (MSAFFE)	Hierarchical multiple regression	FOF: GDS scores made a significant unique contribution to mSAFFE scores (B = 0.23, p < 0.05). BC: GDS scores did not make a significant unique contribution to ABC scores. OE: GDS scores did not make a significant unique

Depression	Kempen, van Haastregt, McKee, Delbaere and Zijlstra, 2009	N=540 CDOP aged 70 years or over with 'at least mild FOF'	Cross-sectional	HADS-HAD- D	FOF: are you afraid of falling? (never, almost never, sometimes, often, very	t-test/chi-squared, logistic regression	In bivariate analysis, depression was significantly correlated with increased FOF level (6.1 v 7.7, p<0.05). However, depression did not predict FOF in logistic regression analysis
Depression	Kim and So, 2013	N=9033 CDOP aged 65 years and older, 76.6% experienc ed FOF	Cross-sectional	Korean version of the Short Form Geriatric Depression Scale	FOF: Do you have a fear of falling (falling down, slipping, and falling when sitting down)? (no fear, some fear, dread)	Logistic regression	Older people with depression had a 1.82-times increased risk of FOF, (95% CI = 1.561-2-124, p < 0.001.
Depression	Klima, Newton, Keshner and Davey, 2013	N=131 Communit y dwelling priests, aged 60 years or older. Two age groups formed: 60-74 year olds, aged 75+.	Cross-sectional	Geriatric Depression Scale	FOF: Do you experience FOF? Yes/No. BC: ABC	ANOVA, independe nt t tests, chi square, stepwise multiple regression	More men over the age of 75 reported FOF compared to the younger group (41% versus 14%, p < 0.001). Depression was negatively correlated with Balance confidence (-.39, p < 0.01). Multiple regression revealed that balance, mood, assistive device use
Depression	Kressig, Wolf, Sattin, O'Grady, Greenspan, Curns and Kutner, 2001	N=287 communit y dwelling older people aged 70 years and over	Cross-sectional	Center for Epidemiolog ical Studies Depression Scale (CES-D)	FSE: FES BC: ABC	Pearson or Spearmans rank correlation, logistic regression	Significant association between depression and FES score (p=0.007) and ABC score (p<0.001) at bivariate level. Depressed individual twice as likely to be fearful of falling compared to those who were not depressed (FES: OR:2.1, 95% CI=1.2- 3.6; ABC: OR:2.6, 95% CI=1.5-4.4) in bivariate analysis. For ABC, depression remained significant predictor in multivariable logistic regression (OR: 1.6, 95% CI=1.3-2.3, p=0.012) For FES, OR = 'comparable' (p1460) with OR for ABC, suggesting

Depression	Lach, 2005	N= 1358 time one N=890 time 2 N=842 at time three N=600 at	Longitudinal -follow up after 4 years	GDS-30	FOF: At the present time are you very fearful, somewhat fearful, or not fearful that you might fall	t-test	At time two in cross-sectional analysis, GDS score was significantly positively correlated with level of FOF (12.21 v 13.6, p=0.000) in bivariate analysis. Not explored in
Depression	Lee, MacKenzie and James, 2008	N=9 CDOP who were high or moderately fearful of falling	Cross-sectional	NA-semi-structured interviews comprising open ended questions: Would you describe yourself as depressed?	FOF: how afraid are you that you will fall and hurt yourself in the next year? (very, fairly, a little, not at all). Very and fairly responses were classified as having a high or	Phenomen - ological analysis	Only two participants acknowledged extended periods of felling low and depressed. All were satisfied with their lives and had positive views of the future. Those who reported depression stated it was a short-term effect
Depression	Liu, 2014	N=445 CDOP aged 65 years or older	Cross-sectional	Chinese Geriatric Depression Scale – Short Form	FSe but referred to as FOF: Chinese Falls Efficacy Scale (CFES-I)	Chi squares and independent t tests, bivariate logistic analyses, stepwise multivariate analysis	Univariate analysis indicated that individuals with FOF had higher depression scores compared to their non-FOF peers, p = 0.000. Multivariate analysis indicated that likelihood of FOF increased 1.38-times per 1-point increase in
Depression	Miller and Pantel, 2003	58 CDOP (M=79.2, range 71-96 years)	Cross-sectional	Geriatric Depression Scale (GDS)	FSe: mFES FOF: worry about falling scale of Modified falls interview schedule-worry (MFIS-W)	Pearson correlation	mFES significantly positively correlated with depression (p<0.01) at bivariate level. MFIS-W was not significantly correlated with depression at bivariate level.
Depression	Murphy, Dubin and Gill, 2003	N=313 female CDOP aged 72 years and older	Longitudinal –1 year follow up	CES-D	FOF: are you afraid of falling? yes/no	Chi-squared	Depression was not significantly associated with the development of FOF at follow up (p=0.19) in bivariate analysis.

Depression	Murphy, Williams and Gill, 2002	N=1064 CDOP aged 72 years and older	Population based cross-sectional	CES-D	FOF: are you afraid falling (yes/no)	Chi-squared	Significantly different scores on CES-D in no fear v fear of falling v fear with activity restriction with those with FOF and activity restriction significantly higher scores (17.0 v 24.8 v 39.6, p=0.001) in
Depression	Ni Mhaolain, Fan, Romero-Ortuno, Cogan, Cunningham, Lawlor and Kenny, 2012	N=301 CDOP aged 60 years or older, separated into robust and frail faller categories. All experienced a fall within the	Cross-sectional	8-item short form of CES-D	FSe: Modified Falls Efficacy Scale (MFES)	ANOVA, sequential linear regression	Among pre-frail or frail fallers, higher depression scores was the only variable that predicted lower MFES scores and higher FOF. The odds ratio of meeting case level depressive disorder was significantly higher for frail fallers compared to robust fallers (OR – 2.6, CI 1.3-5.2, p = 0.006)
Depression	Oh-Park, Xue, Holtzer and Verghese, 2011	N=380 CDOP without FOF at baseline aged 70 years or older	Longitudinal	GDS	FOF: did you have any FOF in the last two months since our last interview? (yes/no) FOF incident=reporting of FOF Transient FOF= only reporting FOF during one interview for the minimum two years Persistent FOF= reporting two or more times	'correlation methods' and Cox proportional hazards regression, polytomous logistic regression	Developing FOF was associated with increased depression (p<0.01) in bivariate analysis. Depression was an independent risk factor for incident FOF (p<0.01) in multivariate analysis. 20.6% reported transient FOF, 30.9% reported persistent FOF. Depression was associated with increased risk of transient and persistent FOF (p<0.01) in multivariate analysis. Depression predicted transient and persistent FOF.

Depression	Reyes-Ortiz, Ayele, Mulligan, Espino, Berges and Markides, 2006	1341 CDOP aged 70 years and older	Longitudinal with two year follow up	CES-D	FOF: How afraid of you of falling? (not at all, somewhat, fairly or very	Chi-squared, logistic regression	FOF was associated with high depressive symptoms in bivariate analysis (p<0.001). However, depression was not a significant independent predictor of FOF in a logistic
Depression	Shin, Kang, Kim, Jung, Kim, Hong, Yun and Ma, 2010	N=213 CDOP aged 60 years or older	Cross-sectional	K-GDS (Korean version of GDS)	FSE but referred to as FOF: FES	'correlation and hierarchical regression analyses'	Depression significantly correlated with FES scores (r=0.501, p<0.001) in bivariate analysis. In hierarchical multiple regression analysis, when depression was added to the model, the variance explained increased. Additionally depression remained a statistically significant influence on FOF
Depression	Talley, Wyman and Gross, 2008	N=272 CDOP females aged 70-98 (M=78.7, SD=4.9)	Cross-sectional	GDS	FOF=SAFF E BC=ABC	Pearson or point-biserial correlation coefficients	FOF was significantly positively associated with depression in bivariate analysis BC was significantly negatively correlated with depression in
Depression	Tiernan, Lysack, Neufeld, Goldberg and Lichtenberg, 2014	N = 44 CDOP African Americans from a neighourhood in Detroit (M age = 72.3 years)	Community-based cross-sectional	Single item: "feeling down or blue" (none of the time, a little of the time, some of the time, a good bit of the time, most of the time, all of the time).	FSe = FES altered so that 'light housekeeping' and 'simple shopping' replaced with 'personal grooming' and 'getting on and off the toilet'.	Bivariate analysis. Non-parametric tests (Mann Whitney U or gamma statistics tests).Kruskill Wallis test with post hoc comparison, logicstic regression.	Ps reported very high FSe (M = 94.9/100). 29.4% of Ps reported feeling down or blue at least some of the time. Correlation between FSe and Depression = -.204 (p <0.001). FSe explained significant proportion of variance in Depression ratings (B = 0.971, p = 0.001).
Depression	van Haastregt, Zijlstra, van Rossum, van Eijk and Kempen, 2008	N=540 CDOP aged 70-92 years (mean=77. 6, SD=4.8)	Cross-sectional	HADS HAD- D scale	FOF: single question 'are you afraid of falling?' (yes/no) 'Do you avoid certain	Independent samples t- test, logistic regression	Symptoms of depression occurred 'considerably more' (p189) in persons with severe FOF compared to those with mild FOF (26.1% v 12.2%) and was depression was a significant independent predictor of FOF (OR=2.74, 95%

					due to fear of falling?' (yes/no)		CI=1.69-4.47, p=<0.001) in multivariate analysis (increased depression associated with increased severity of FOF). When anxiety and depression were included in the multivariate analysis, only depression remained independently associated with FOF
Anxiety	Burker *et al.,* 1995	N=126 CDOP Dizzy N=60 Non-dizzy N=66 Mean age 75.5 years (SD=7.4)	Cross-sectional	Anxiety subscale of SCL-90-R	FSe: three questions from FES: Indicate how confident they were they could complete the following tasks without falling: cleaning house, getting dressed/un dressed and preparing meals (6 point likert scale: extremely [1], not at all [6])	ANOVA and two sample t-test, Stepwise multiple regression	SCL-90-R anxiety score were significantly associated with FSe in bivariate analysis (p=not stated). However, anxiety did not significantly predict FSe for dizzy participants in multivariate analysis.
Anxiety	Downton and Andrews, 1990	N=203 CDOP aged 75-84 years	Cross-sectional	Anxiety subscale of General Health Question - naire	FOF: Do you limit your activity due to FOF? (yes/no)	Mann-Whitney U-Wilcoxon rank sum test	FOF was significantly associated with higher anxiety scores (2.65 v 4.39, p=0.0007) in bivariate analysis.
Anxiety	Drozdick and Edelstein, 2001	34 CDOP mean age 74.35, SD=8.88) all fallers	Cross-sectional	State-trait anxiety index (STAI)	FOF: three item question-naire scored on 5 point likert scale. Measured frequency, severity and	ANOVA	General anxiety differed significantly between those with high and low fear (F(1,32)=6.95, p<0.01).

					Severity was used as one measure and the other two questions combined as a composite score		
Anxiety	Hellstrom *et al.,* 2009	N=80 CDOP aged 65 years with COPD	Cross sectional	Hospital Anxiety and Depression Scale: Anxiety subscale (HADS-HAD-A)	FOF: single question 'are you afraid of falling?' (yes/no) Categories: with FOF or no FOF	Unpaired t-test	Those with FOF as measured by single question had significantly higher levels of anxiety (p=0.008) at bivariate level Did not compare FOF scores with
Anxiety	Hull, Kneebone and Farquharson, 2012	N=205 CDOP mean age 81 years, SD 7.5	Cross-sectional	Geriatric Anxiety Inventory (GAI)	FOF: Modified Survey of Activities and Fear of Falling (MSAFFE) BC: ABC Outcome expectancy: Consequences of Falling Scale (CoF)	Hierarchical multiple regression	FOF: GAI scores made a significant unique contribution to mSAFFE scores (B = 0.15, p < 0.01). BC: GAI scores made a significant unique contribution to ABC scores (B = 0.34, p < 0.001). OE: Of all contributing variables, GAI scores
Anxiety	Kempen et al., 2009	N=540 CDOP aged 70 years or over with at least mild 'FOF	Cross-sectional	HADS-HAD-A	FOF: are you afraid of falling? (never, almost never, sometimes, often, very	Chi- squared/ independent t-tests, logistic regression	In univariate analysis, anxiety was significantly correlated with increased FOF level (6.5 v 8.4, p<0.05). However, anxiety did not predict FOF in a logistic regression analysis
Anxiety	Lui, 2014	N=445 CDOP aged 65 years or older. 64.73% had FOF.	Cross-sectional	Chinese General Anxiety Disorder Questionnaire-7 (CGAD-7)	FSe but referred to as FOF: Chinese Falls Efficacy Scale (CFES-I)	Chi squares and independent t tests, bivariate logistic analyses, stepwise multivariate analysis	Univariate analysis indicated that individuals with FOF had higher mean CGAD-7 scores compared totheir non-FOF peers (5.52 V 2.42, p = 0.000). Multivariate analysis indicated that likelihood of FOF increased 1.16-times per 1-point increase in CGAD-7 score (95% CI = 1.09 -

Anxiety	Miller and Pantel, 2003	58 CDOP (M=79.2, range 71- 96 years)	Cross-sectional	Beck Anxiety Inventory (BAI)	FSe: mFES FOF: worry about falling scale of Modified falls interview	Pearson correlation	mFES significantly positively correlated with anxiety in bivariate analysis (p<0.01) MFIS-W was significantly correlated with anxiety in bivariate analysis (p<0.01)
Anxiety	Murphy, *et al.,* 2003	N=313 female CDOP aged 72 years and older	Longitudinal baseline and 1 year follow up	STAI	FOF: are you afraid of falling? (yes/no)	Chi-squared, binominal regression	Anxiety was significantly associated with developing FOF at follow up in bivariate analysis (p=0.02). However, anxiety did not predict FOF in multivariate analysis (RR=1.41, 95% CI=1.35- 2.84, p>0.05).
Anxiety	Murphy, *et al.,* 2002	N=1064 CDOP aged 72 years and older	Cross-sectional	STAI	FOF: are you afraid falling (yes/no)	Chi-squared	Significantly different scores on STAI in no fear v fear of falling v fear with activity restriction with those with FOF and activity restriction significantly higher scores (38.4 v 59.7 v 70.2, p=0.001) However, all scored over the clinical cut of (32) for anxiety. They did not explore anxiety in relation to FOF in multivariate analysis, rather anxiety in relation to activity restriction
Anxiety	Ni Mhaolain, Fan, Romero-Ortuno, Cogan, Cunningham, Lawlor and Kenny, 2012	N=301 CDOP aged 60 years or older, separated into robust and frail faller categories. All experienced a fall within the past 12 months. 32.6% of fallers classified as robust, 54.2% pre-frail, 13.3% frail.	Cross-sectional	Hospital Anxiety and Depression Scale	FSe: Modified Falls Efficacy Scale (MFES)	ANOVA, stepwise MR	Anxiety was not found to be a significant psychological contributor to MFES scores for frail or robust fallers.

Anxiety	van Haastregt et al., 2008	N=540 CDOP aged 70-92 years (mean=77. 6, SD=4.8)	Cross-sectional	HADS HAD- A scale	FOF: single question 'are you afraid of falling?' 'Do you avoid certain activities due to fear of falling?' Responses to both questions: never, almost never, sometimes, often,	Independent samples t- test, logistic regression	Symptoms of anxiety occurred 'considerably more' (p189) in persons with severe FOF compared to those with mild FOF (28.2% v 16.6%) and anxiety significantly independently predicted FOF (OR=1.84, 95% CI=1.18-2.87, p=0.007) in multivariate analysis. When anxiety and depression were included in the analysis, anxiety was no longer
QoL	Arfken *et al.,* 1994	N=890 CDOP Fell into four age groups 66-70 years: N=243 71-75 years: N=240 76-80 years: N=203	Cohort study	QoL measure focusing on frequency of leaving home building but not yard, frequency of leaving home and yard and satisfaction with life ('very,' 'somewhat' or 'not at all'	FOF: at the present time are you very fearful, somewhat fearful or not fearful that you may fall?	Chi-squared, multiple logistic regression	Those who were very fearful were most likely to have decreased QoL at bivariate level: Infrequently leave building but not yard (p<0.0001) Infrequently leave building and yard (p<0.0001) Less than very satisfied with life (p<0.0001) Still true after adjusted for age and gender. However, QoL did not significantly predict FOF
QoL	Austin, *et al.,* 2007	1282 community dwelling older women aged 70 years and over	longitudinal 3 year follow up	SF-36 MCS scores	FOF: single questions: are you afraid of falling (yes/no) Do you limit any household activities because you are frightened you may fall? (yes/no) Do you limit any outside activity because you are frightened you may fall?	Chi-squared/AN OVA/ Kruskal Wallis H Tests, forward-step logistic regression	In bivariate analysis at baseline, FOF was associated with reduced QoL (p<0.01). MCS score (which was related to depression presence by the authors), remained a significant predictor of FOF in multivariate analysis for those with persistent FOF compared to those who never reported FOF (p<0.05). However MCS scores did not predict new FOF development.

QoL	Brouwer *et al.,* 2004	N=25 CDOP who reported being FOF of falling aged 65 years or older Control group who did not report FOF N=25 CDOP mean age 76.3 (SD=5	Cross-sectional	SF-36 Physical summary compone nt (PCS) Mental summary compone nt (MCS)	BC: ABC	Independe nt t-test, stepwise multiple regression	Significant differences were found between those with FOF and those without with regard physical summary scores ($p<0.001$) in bivariate analysis. However, scores on the mental component summary were not significantly different ($p=0.538$) in bivariate analysis. In stepwise multiple regression, the strongest indicator of ABC scores was the physical
QoL	Chang, Chi, Yang and Chu, 2010	N=4056 CDOP aged 65 years and over	Cross-sectional	SF-36 PCS and MCS	FOF: are you afraid of falling? (yes/no)	Chi-squared, ANOVA, multiple linear regression	FOF had significant negative affect on HrQoL on both subscales (PCS and MCS) ($p<0.001$) at bivariate level. Subjects with FOF had lower PCS scores, secondary only to falls history Subjects with FOF had lower MCS scores In multiple linear regressions, FOF was an independent risk factor for PCS after adjustment for confounders ($p<0.001$). Also FOF was an
QoL	Davis, Marra and Liu-Ambrose, 2011	N=135 female CDOP aged 65-75 years	Cross-sectional	EuroQol-5D	BC: ABC	Pearson product moment correlation co-efficient, multiple linear regression	Bivariate: ABC scores were significantly correlated with HrQoL ($p<0.01$) In multivariate linear regression, ABC scale scores was a significant and independent predictor for HrQoL ($p<0.01$).

QoL	Howland, Lachman, Walker-Peterson, Cote, Kasten and Jette, 1998	N=266 CDOP aged 62-93 years	Cross-sectional	Mental Component Scale (MCS) of SF-36	FOF: how afraid are you that you will fall and hurt yourself in the next year? (very to not at all on 4 point scale) Perceived control over the likelihood of falling asked to rate the validity of the following statements: I can reduce my risk of falling, I can overcome my worry about falling, there are things I can do to keep myself from falling, falling is something I can control (definitely true	t-tests, logistic regression	In bivariate analysis, reduced SF-36 MCS significantly associated with FOF v those who denied FOF (mean score=66.9 v 77.5, p=0.000) In logistic regression analysis QoL did not predict FOF (OR=0.990, 95% CI=0.975-1.005, p=0.181)
QoL	Hsu, Alfermann, Lu and Lin, 2013	N=193 from Taiwan, 182 from Germany. CDOP aged 65 and older	Cross-sectional	QoL: Short form 12-item Health Survey (SF-12) Physical activity: Goder's Leisure-Time	FSe but referred to as FOF: FES-I	Multiple Regression, Sobel test	FOF and QoL significantly negatively correlated, -0.63 and -0.59, p<.05. The effect of FOF on QoL remained significant after controlling for physical activity level for both Taiwanese (B from -0.59 to -0.49; Sobel test Z = -4.86, p<0.05) and German participants (B from -0.63 to -0.59; Sobel test Z = -3.70, p<0.05). Physical

				Questionnaire Self-concept: Physical Self-concept Scale for Older Adults (PSCS-O)			activity partially mediates the relationship between FOF and QOL. Self-concept partially mediated relationship between FOF and QoL for Taiwanese (B from -0.59 to -0.33; Sobel Z = -7.66, p<0.05) and Germans (B
QoL	Huang and Wang, 2009	N=168 CDOP aged 60 years or older	Cross-sectional (Baseline data from longitudinal measure validation study)	World health organization QOL-BREF Subscale score: Physical health (PH) Psychological (P) Social relationships (SR) Environment (E) Total (T)	FSE: FES BC: ABC FOF: geriatric fear of falling measurement (GFFM)	Pearson correlation	The FES scores were significantly correlated with all WHOQOL subscale scores, except social relationships (PH r=0.58, p<0.001; P r=0.45, p<0.001; SR r=0.15, p>0.05; E r=0.29, p<0.01; T r=0.46, p<0.001) in bivariate analysis. The ABC scores were significantly correlated with all WHOQOL subscale scores (PH r=0.61, p<0.001; P r=0.48, p<0.001; SR r=0.23, p<0.01; E r=0.25, p<-0.01; T r=0.48, p<0.001) in bivariate analysis. The GFFM scores were significantly correlated with
QoL	Iglesias, Manca and Torgerson, 2009	Female CDOP	Paper combining data from two randomised controlled trials and one cohort study- Longitudinal designs Calcium and vitamin d study: N=3314 women mean age 76.8. data collected	Subscales of EuroQol-5D	FOF: 6 point likert scale: worried about falling all the time- worried none of the time	Hierarchical 'multilevel' regression or ANCOVA	In hip protector trial: Significant association between reduced QoL and increased FOF in bivariate analysis. FOF was a significant predictor of reduced QoL in multivariate analysis. Calcium and vitamin D prevention trial: Higher fear of falling was significantly associated with lower EQ-5D score at bivariate level. Anxiety/depression dimension had strongest impact. FOF predicted reduced QoL in multivariate analysis. Epidemiological risk

			between two years and 42 months (mean follow up 24 months) Hip protector study: N=4196 women mean age 77.8 Follow up between two years and 42 months (median 28 months). Data collected at 6 monthly intervals. Epidemiological risk factor study: prospective comprehend-sive, cohort study N=4292 women, mean age 76.9 years. Data collected at baseline and 12 months				for FOF when compared with falls and fractures
QoL	Lachman, Howland, Tennstedt, Jette, Assmann, and Peterson, 1998	N=270 CDOP aged 62-93 (M=76.16 SD=7.91)	Cross-sectional	MOS SF-36	FSe= FES FOF= SAFFE FOF=single questions: Are you afraid of falling? (very-not at all, 4 point likert scale), Are there things you don't do because you are afraid you might fall? (yes/no) Are there things you have stopped doing because you are worried you might fall? (yes/no)	'correlation' analysis, multiple regression analysis	All QoL subscales were significantly correlated with SAFFE FOF subscale scores and FES scores in bivariate analysis. All but 'inactive leisure' QoL subscale was significantly correlated with FOF as assessed using single question in bivariate analysis. SAFFE subscales (FOF) were significant independent risk factor for poor quality of life in multiple regression analysis.

QoL	Li, Fisher, Harmer, McAuley and Wilson, 2003	N=256 CDOP aged 70-92 years (mean=77. 5 years, SD=5.0)	Cross-sectional	SF-12 mental and physical component scores reported	FOF: SAFFE which looked at FOF level and associated activity restriction	ANOVA, MANOVA	Significant differences found between high fear and low fear groups on QoL measures In an ANOVA: High fear of falling group had significantly poorer QoL as measured on both physical and mental component subscales (MCS: p=0.0003; PCS: p=0.0001). In a MANOVA: Significant difference between low and high fear groups with
QoL	Patil, Uusi-Rasi, Kannus, Karinkanta and Sievanen, 2014	N=409 Community dwelling older women aged between 70 and 80 years	Cross-sectional	QoL: LEIPAD Questionnaire Wellbeing: WHO-5 wellbeing index	FSe but referred to as FOF: FES-I	Univariate multinomial logistic regression, multivariate regression	ADL and IADL: Women with difficulties in ADL and IADL were significantly more likely to have both moderate and high FOF. Low QoL scores (<20) were associated with increased likelihood of both moderate FOF (OR 3.5, 95% CI 1.2 – 10.3) and high FOF (OR 19.7, 95% CI 409 – 78.8). Poor WHO-5 wellbeing scores were also
QoL	Suzuki, Ohyama, Yamada and Kanamori, 2002	N=49 CDOP aged 60 and older	Cross-sectional	SF-36 (Japanese version)	FOF: at the present time are you very fearful, somewhat fearful or not fearful that you may fall?	The Dunnet test	Males: For role limitations and social functioning subscales, those with no FOF had higher scores than those who were moderately fearful (p<0.05) in bivariate analysis. Females: Physical functioning, role limitations, general health perceptions, vitality were significantly higher scores for those with no fear of falling v those moderately or very fearful (p<0.05).

QoL	Talley, Wyman and Gross, 2008	N=272 CDOP females aged 70-98 (M=78.7, SD=4.9)	Cross-sectional (Baseline data from randomised control trial)	SF-36	FOF= SAFFE BC=ABC	Pearson or point-biserial correlation coefficient	FOF was significantly negatively associated with all domains of QoL in bivariate analysis. BC was significantly positively correlated with all domains of QoL in bivariate analysis
Coping	Drozdick and Edelstein, 2001	34 CDOP mean age 74.35, SD=8.88) all fallers	Cross-sectional	Ways of Coping Checklist-Revised	FOF: three item question-naire scored on 5 point likert scale. Measured frequency, severity and impact of FOF. Severity was used as one measure and the other two questions combined	ANOVA	No difference in coping styles used by low or high fear group
Coping	Filiatrault and Desrosiers, 2011	N=288 CDOP aged 65 years or older	Cross-sectional	Inventory of coping strategies used by the elderly 69 behavioural strategies 25 cognitive strategies	FOF: are you afraid of falling? (never, occasionally, often, very often)	Student t-test, linear regression, multivariate regression	Those with FOF use more behavioural coping strategies than those who are not afraid of falling, including avoidance and restriction strategies (e.g. I no longer go upstairs, I reduce the amount of time I move around). The percentage of individuals with FOF was higher for 83% (58) of the coping strategies from the ICSUE. Mean number of cognitive and behavioural strategies was also significantly higher among participants who were afraid of falling (behavioural: 18.6 v 21.5, $p<0.001$; cognitive: 14.4 v 15.3, $p=0.03$) in bivariate analysis. Mean frequency scores for behavioural coping strategies was significantly higher in those with FOF compared to those without FOF (0.47 v 0.56, $p<0.001$) in bivariate analysis. However, the mean frequency score for cognitive strategies was not significantly different for those with and without FOF (0.95 v

							In multiple linear regression, FOF was an independent predictor of coping strategies in two performance domains (mobility and movement: r=0.52, p=0.001; and transportation and driving: r=0.19, p=0.007), meaning those with FOF use a larger range of behavioural coping strategies than those without FOF in these two domains. FOF did not significantly predict global diversity scores relating to the use of cognitive coping strategies (r=0.57, p=0.19) in multivariate analysis, meaning those with FOF did not employ a wider range of cognitive strategies than those without FOF. FOF significantly predicted global frequency of use scores for behavioural strategies (r=0.05, p=0.006) this was also significant for the frequency of use of three performance domains: mobility and movement (r=0.12, p<0.001); transportation and driving (r=0.23, p=0.004) and elimination (r=0.07, p=0.05) in multivariate analysis. FOF did not significantly predict global frequency of use of cognitive coping strategies in multivariate analysis (r=0.04, p=0.22).
Coping	Huang, 2005	N=25 CDOP aged 65-82 years	Cross-sectional	What kind of strategies did you choose to deal with FOF? Did you change to other kinds of strategies? Why? How did you adjust your life in order to deal with FOF? What are your comments about dealing with FOF for CDOP?	FOF: Are you fearful of falling? (only those who answered yes entered the study)	Grounded theory	Engaged in a dynamic process called 'managing FOF' Developed four strategies: 1. Develop psychosomatic symptoms: physical (shaking, sweating, goose bumps, palpitations, heightened awareness of surroundings, sleeping disturbance, headaches and appetite disturbance): emotional (frequent worry about falling, increased psychological pressure, insecurity, irritability, inability to concentrate) 2. Adopting attitude of risk prevention: increased vigilance (taking precautions such as arriving places earlier, take smaller, slower steps, pay more attention when walking); readiness for emergencies (better late

							than never attitude, using support from others). 3. Paying attention to environmental safety: environmental modification (eliminating dangerous factors such as slippery floors); use of safety devices (e.g. handrails). 4. Modifying behaviour: adjustment of behaviour (change habits to minimise hazardous factors, self restraint or avoiding activities that they felt would lead to a fall); limiting social activities (significantly reduced and changed their pattern of interacting with the outside world, less dynamic and more static, reduced exercise, reduced visits to friends, encourage others to visit then rather than they go to their friends). Dealing with FOF v suffering with FOF was drawn out. Dealing with FOF related to minimising the impact of FOF and trying to manage this FOF 'to the best of the individual's ability,' and that individuals are satisfied with the methods they use to manage. Suffering with FOF related to low satisfaction for the individual with regards the management strategy, negative consequences to the individual and physical or mental 'torment' related to FOF.
Coping	Ward-Griffin, Hobson, Melles, Kloseck, VanderVoort and Critty, 2004	N=9 CDOP aged 72-92 years	Cross-sectional	N/A-open ended, semi-structured interviews	FOF: How worried are you about falling? (open ended responses)	Phenomenological study-interpretative analysis	Exercising precaution: Depended on help from others (relying on others to undertake activities of daily living or to monitor activities), resisted activities (avoiding certain social activities and/or physical environments), eliminated hazards (removal of dangerous objects such as throw rugs), selected safe spaces (avoiding unsafe environments) and assigned blame (self-blame, blame of health conditions or blame of external conditions such as the weather). Striving for independence: Self confidence encouraged them to be active-minimized impact of the fall (calling falls slips or trips because

							this made falls appear less severe), used assistive devices (introduced devices within and outside of the home allowing increased mobility and safety), resisted confinement (put aside or live with FOF-not letting FOF control them), 'ran the risk' (acknowledging that an activity held a certain level of risk but, after considering advantages and disadvantages, decided the risk was worth taking) and accessed resources (securing and using the supports that were put in place by self, family or the community).
Activity avoidance/ restriction	Austin *et al.,* 2007	1282 community dwelling older women aged 70 years and over	Longitudinal 3 year follow up	Activity restriction: Do you limit any household activities because you are frightened you may fall? (yes/no) Do you limit any outside activities because you are frightened you may fall? (yes/no)	FOF=single questions: are you afraid of falling (yes/no) Do you limit any household activities because you are frightened you may fall? (yes/no) Do you limit any outside activity because you are frightened you may fall? (yes/no)	Descriptive statistics	51% of those with FOF reported activity restriction in the household and 45% limited outside activities
Activity avoidance/ restriction	Bertera and Bertera, 2008	N=3474 CDOP aged 65 years and older	Cross-sectional	Do you do things less often or more slowly? Do you avoid lifting heavy objects? Do you avoid bending or stooping? Do you avoid walking? Do you avoid using stairs? Do you avoid reaching overhead? Do you avoid going	FOF: 'did you fear falling in the last year?' (everyday, once/twice per week, one/twice per month, a few times, never)	Linear regression model.	In multivariate analysis (regression) FOF in the past year predicted avoidance of common activities (β0.37, $p<0.001$). However, there was significant interaction between FOF and falls history ($F[19, 1976]=53.8$, $p<0.001$) and a stepwise interaction between the number of falls and FOF such that activity avoidance was lowest for those with no falls at each level of fear.

				outside? Do you avoid gripping and opening things? Do you avoid taking medications that make you dizzy? (yes/no)			
Activity avoidance/ restriction	Chandler, Duncan, Sanders and Studenski, 1996	N=149 male CDOP aged 70-104 years	Cross-sectional (Baseline data from longitudinal study)	Restriction of activity: Asked if been out of his bedroom without help, outside of house/apartment without help, outside neighbour-hood without help 'In the past two years, have you cut back on any of the things you do inside your house? (yes/no)	FOF: would you say that you are somewhat afraid, not afraid or very afraid of falling? FOF was dichotomised to very or not FOF (very= positive response as very, not= positive response to somewhat or not)	Chi-squared	Data spilt between previous fallers and those without a falls history. Non-fallers: Restricted activity level and those who were very FOF were significantly associated in bivariate analysis (p=0.045) Decreased activity level within the home and FOF showed a trend towards significance (p=0.09), with those with higher FOF having decreased activity levels less. Fallers: Restricted activity level and those who were very FOF were significantly associated in bivariate analysis (p=0.03). Decreased activity level within the home and FOF was significantly correlated (p=0.02), with those with higher FOF having decreased activity levels less.
Activity avoidance/ restriction	Curcio *et al.*, 2009	N=1668 CDOP mean age 70.9 (SD 7.4)	Cross-sectional	If yes to FOF question: Do you think this fear has made you cut down on any activities that you used to do?' (yes/no) to assess fear related activity restriction. Also: How is your physical activity compared with one year before? (increased/ equal/ less/ much less) less or much less	FOF: are you afraid of falling? (not at all, a little, quite a bit, very much) followed up with: 'do you think this fear has made you cut down on any activities that you used to do?' (yes/no) to assess fear related activity restriction.	Descriptive statistics	Activity restriction related to FOF was reported in 52.2%. Increasing activity restriction was associated with increasing severity of FOF (36.4% v 43.6% v 56.9%).

				combined as decreased physical activity.	Then dichoto-mised into fear of falling with activity restriction and fear of falling without activity restriction		
Activity avoidance/ restriction	Delbaere, Crombez, van Haastregt and Vlaeyen, 2009	N=896 CDOP aged 70 years and older mean age 76.2 (SD=4.7)	Cross-sectional	Mobility range subscale from SIP-68	FSe: mFES OE: catastro-phizing about falls scale	Pearson's or Spearman's rho, structural equational modelling using AMOS	mFES and CFS scores were strongly correlated with mobility restrictions during daily activities (mFES/mobility range inter-correlation=0.54, $p<0.01$; CAF/mobility range inter-correlation=0.35, $p<0.01$) in bivariate analysis. In a structural equation model, found that concerns about falls (mFES scores) had a direct effect on mobility restrictions ($p<0.001$). However catatrophizing about falls (CFS scores) only affected mobility restrictions through concern about falling, and did not have direct effect on mobility restrictions.
Activity avoidance/ restriction	Deshpande Metter, Bandinelli, Lauretam, Windham and Ferruci, 2008b	N=926 CDOP aged 65 years or over Stratified into four age groups: 65-70, 71-80, 81-90, 90 years+	Cross-sectional (follow-up data from a wider epidemiologi cal study).	Activity subscale of SAFFE	FOF: SAFFE	Descriptive statistics	65% of those reported FOF also reported fear-related activity restriction.
Activity avoidance/ restriction	Deshpande Metter, Laurentani, Bradinelli, Guralinik and Ferrucci., 2008a	N=673 CDOP aged 65 years and over	Cross-sectional	Activity restrictions subscale of SAFFE	FOF: SAFFE	Descriptive statistics	Of those with FOF, 25% did not restrict activity, 59.6% reported moderate activity restriction, 14% reported severe activity restriction

Activity Avoidance/restriction	Dias, Freire, Santos, Vieira, Dias and Perracini, 2011	N=113 CDOP (M age 74.5)	Cross-sectional	Activity restrictions subscale of Brazilian version of SAFFE	FOF: Brazilian version of SAFFE FSE: FES-I Brazil Depression: GDS-15	Chi Ssquare, ANOVA, Kruskil Wallis tests, path analysis	Highest FOF reported for activities 'to walk on slippery surfaces' and 'to take a shower'. Activities restricted due to FOF: 'walk on slippery surfaces', 'walk outside for several blocks', and 'reach for something overhead'. Of those with FOF, those who reported AR showed greater self-reported depression (p = 0.038) and lower FSE (p = 0.000) compared to those who did not restrict their activities. Those with depressive symptoms showed 90% chance of
Activity avoidance/ restriction	Faes, Reelick, Banningh, de Gier, Esselink and Rikkert, 2010	N=10 CDOP aged 70-80 and 10 carers aged 40-	Cross-sectional	NA	FOF	Grounded theory	Described constant fear of falling and fear of the consequences of falling Described social withdrawal which was attributed to their FOF
Activity avoidance/ restriction	Fletcher *et al.*, 2010	N=559 CDOP mean age 81.0 (SD=6.4)	Cross-sectional	FOF: do you limit going outdoors due to FOF? (dichotomised to limited /restricted activity due to FOF or did not limit/ restrict activity due	FOF: do you limit going outdoors due to FOF? (dichotomised to limited/ restricted activity due to FOF or did not limit/ restrict activity	Descriptive statistics	35% responded positively to FOF question regarding limiting their activities due to fear of falling
Activity avoidance/ restriction	Friedman, Munoz, West, Rubin and Fried, 2002	2212 CDOP aged 65-84 years	Longitudinal 20 months follow-up	If responded positively to FOF question asked: 'do you ever limit your activities, for example, what you do or where you go, because you are	FOF: 'apart from being in a high place, in the past 12 months, have you been worried or afraid you might fall?' (yes/no)	Descriptive statistics	Of those who reported FOF at baseline (20.8%), 46.2% (N=212) reported activity restriction due to this fear.

Activity avoidance/ restriction	Hadjistavro -poulos, Martin, Sharpe, Lints, McCreary and Asmund- son, 2007	N=571 CDOP aged 69 years and over (mean= 76. 6 years, SD=5.4)	Longitudinal 6 month follow-up	Avoidance subscale of SAFFE	FOF: SAFFE BC: ABC FSe: FES	Hierarchical multiple regression	In hierarchical multiple regression analysis SAFFE FOF scale, FES and ABC scores were entered in same step as SAFFE activity level and activity restriction subscales of SAFFE. This step was significant (F[14, 541]=21.00, p<0.001) in predicting activity restriction at time two but all were not significant independent predictors. Only SAFFE activity restriction at time one from this block was predictive of activity
Activity avoidance/ restriction	Hellstrom *et al.,* 2009	N=80 CDOP aged 65 years with COPD	Cross-sectional	If you are afraid of falling, does it prevent you from doing activities you would like to do?	FOF: single question 'are you afraid of falling?' (yes/no)	Chi-squared	50% of those who reported FOF reported restricting their activity. This was 0% in those without FOF (p=0.001) in bivariate analysis.
Activity avoidance/ restriction	Hotchkiss, Fisher, Robertson , Rutten-cutter, Schuffert and Barker, 2004	N=118 CDOP 60-99 (M=75. 8)	Cross-sectional	How many of the following places do you not go to because you are afraid of falling? Church, mall, movie theatre	FOF= SAFFE FSe=FES BC=ABC	Pearson product moment correlation	Activity restriction was significantly correlated with SAFE, FES and ABC scores in bivariate analysis (p<0.01).
Activity avoidance/ restriction	Howland *et al.,* 1998	N=266 CDOP aged 62-93 years	Cross-sectional	Are there things you don't do because you might fall? (yes/no) Are there things you have stopped doing because you are worried you might fall? (yes/no)	FOF: how afraid are you that you will fall and hurt yourself in the next year? (very to not at all on 4 point scale) Perceived control over the	Chi-squared , logistic regression	55% reported FOF (very=9%, somewhat=17%, slightly=29%). 56% of these people reported activity restriction due to this fear. Those who curtailed activity differed significantly from those who did not curtail activity with regards intensity of FOF (very afraid=20.7% v 9.4%; somewhat afraid=36.6% v

					asked to rate the validity of the following statements: I can reduce my risk of falling, I can overcome my worry about falling, there are things I can do to keep myself from falling, falling is something I can control (definitely true, mostly true, unsure, mostly false, definitely false)		in bivariate analysis. However, FOF did not predict activity curtailment.
Activity avoidance/ restriction	Jang, Cho, Oh, Lee and Baik, 2007	N=732 CDOP aged 60 years or older Range=60- 99 M=70.2, SD=5.8	Cross-sectional	Do you ever limit your activities- either what you used to do or what you wish to do- because you are afraid of falling? (yes/no)	FOF: How much are you afraid of falling? (not at all, slightly, somewhat, very much)	Descriptive statistics	39.7% of those reporting FOF restricted their activity because of this
Activity avoidance/restriction	Jellesmark, Forsyth Herling, Egerod and Beyer, 2012	N=33 CDOP, 3-6 months post hip fracture. Aged 65 years or older.	Sequential explanatory mixed methods: survey and in-depth interviews	Activity avoidance – mSAFFE Functional ability: ADL, IADL Mobility: NMS	FSe but referred to as FOF: FES-I	QUANT: Spearman's Rho, Mann Whitney U test, Kruskil Wallis test, chi square, Fisher exact test QUAL: In-depth interviews analysed using systematic text condensation (STC)	58% of participants reported high FOF. The most feared activities were: walking on slippery surfaces, walking on an uneven surface, walking up or down a slope. Activities most avoided due to FOF were: going outside when it is slippery, using public transportation and going for a walk. 68% of variation in m SAFFE scores was explained by differences in FES-I scores. Ps with high FOF avoided more activities, needed more assistance with ADL and were less mobile compared to low FOF participants.

							QUAL: 4 main themes emerged: FOF, keeping fit vs risk avoidance, injury/pain, and inability to rise after falling. Of the 4 participants interviewed, 2 felt concerned about FOF, 2 felt incapacitated by FOF. The most worrying concerns were injury/pain and inability to rise after falling.
Activity avoidance/ restriction	Kempen, van Haastregt, McKee, Delbaere and Zijlstra, 2009	N=540 CDOP aged 70 years or over with at least mild 'FOF	Cross-sectional	Groningen activity restriction scale Do you avoid certain activities due to fear of falling?	FOF: are you afraid of falling? (never, almost never, sometimes , often, very often)	Chi-squared/ independent t-tests, logistic regression	42% reported 'severe activity avoidance in response to single item avoidance question Activity restriction scores were significantly correlated with increased FOF (15.9 v 19.0, p<0.05) In logistic regression analysis, activity restriction remained a
Activity avoidance/ restriction	Lach 2005	N= 1358 time one N=890 time 2 N=842 at time three N=600 at time four CDOP aged 65-80 years	Longitudinal -follow-up after 4 years	Do you participate in social activities more, the same, or less than you used to a year ago? During the past 12 months have you cut down on things you would like to do because	FOF: At the present time are you very fearful, somewhat fearful, or not fearful that you might fall (again)?	Chi-squared, binary logistic regression analysis	At time two in cross-sectional analysis, cutting down on activities was significantly positively correlated with FOF level (11.1 v 25.1, p=0.000). Cutting down activities was not significant in predicting the development of FOF in the longitudinal analysis (OR=0.53, 95% CI 0.24- 1.17, p>0.05)
Activity avoidance/ restriction	Lachman, Howland, Tennstedt, Jette, Assmann, and Peterson., 1998	N=270 CDOP aged 62-93 (M=76.16 SD=7.91)	Cross-sectional	SAFFE subscale FOF assessment questions: Are there things you don't do because you are afraid you might fall?	FSe=FES FOF= SAFFE FOF=single questions: Are you afraid of falling? (very - not at all, 4 point likert scale), Are	'correlation analysis'	Higher fear scores were related to increased activity restriction in bivariate analysis. Greatest amount of fear was found in the group who reported restricting their activities due to fear of falling in bivariate analysis.

				you have stopped doing because you are worried you might fall? (yes/no)	don't do because you are afraid you might fall? (yes/no) Are there things you have stopped doing because you are worried you might fall?		
Activity avoidance/ restriction	Lee, Mackenzie and James, 2008	N=9 CDOP who were high or moderately fearful of falling	Cross-sectional	NA-semi-structured interviews comprising open ended questions: Did your levels of activity decrease before you realised you were afraid of falling? Have you decreased your occupations since you began to fear falling? Were you encouraged to decrease you activity by family or friends? Do you participate in any	FOF: how afraid are you that you will fall and hurt yourself in the next year? (very, fairly, a little, not at all). Very and fairly responses were classified as having a high or moderate level of FOF	Phenomen-ological approach	Activities they engaged in had changed over time All had begun to limit their activity levels but this did not relate to FOF, rather other factors relating to aging Participants reported phasing out activities that made participants feel they might fall Moderated the speed to which they completed activities which made them feel concerned they would fall Non-essential activities were initially avoided while more essential activities tend to be undertaken at a slower pace and with care if there is a risk of falling
Activity avoidance/ restriction	Lim, Jang, Park, Kyun, Kang and Paik, 2011	N=828 CDOP aged 65 years or older	Cross-sectional	Do you ever limit your activities either in terms of what you used to do or what you would like to do because you are afraid of	FOF: to what extent are you afraid of falling? (not at all, slightly, somewhat, very much)	Descriptive statistics	31% of subjects with FOF reported restricting their activities due to FOF

Activity avoidance/ restriction	Murphy, Williams and Gill, 2002	N=1064 CDOP aged 72 years and older	Cross-sectional	If positive to FOF question, asked: has this fear caused you to cut down on your activities (yes/no)	FOF: are you afraid falling (yes/no)	Descriptive statistics	44% of individuals reporting FOF restricted their activities
Activity avoidance/ restriction	Myers, *et al.,* 1996	N=60 CDOP aged 65-95 years	Cross-sectional	Activity restriction: Has fear of falling made you avoid any activities? (yes/no) Extent of avoidance of activities on ABC (0%=never, 100%=always)	FOF: Are you afraid of falling? (yes/no) FSE: FES BC: ABC	t-test	29% of fallers reporting FOF reported activity avoidance due to this fear. 31% of non-fallers reporting FOF reported activity avoidance due to this fear. Subjects who avoided activities due to FOF had significantly lower ABC scores compared with non-avoiders (M=30.8 v 71.0, t=7.19, p<0.001) in bivariate analysis. Significant relationships were also found between FES scores and activity avoidance versus non-avoidance (M=43.4 v 19.9, t=5.46, p<0.001) in bivariate analysis. Total balance confidence scores were highly related to total avoidance ratings (r=-0.92, p=not stated) in bivariate analysis.
Activity avoidance/ restriction	Rochat, Bula, Martin, Seematter-Bagnoud, Karmaniola Aminian, Piot-Ziegler and Santos-Eggimanin, 2010	N=860 CDOP aged 65-70 years	Cross-sectional	If yes to FOF question: Because of your FOF, have you restricted any activities? (yes/no)	FOF: are you afraid of falling? (no fear, moderately fearful, very fearful) FSE: FES-I	Kruskal-Wallis test	24.4% of the whole sample reported FOF without activity restriction, 5.2 % (N=45) reported FOF with activity restriction FES-I scores significantly decreased as FOF severity increased, with FOF with activity restriction deemed to be most severe (p<0.001) in bivariate analysis.
Activity avoidance/ restriction	Shimada, Lord, Yoshida, Kim and Suzuki, 2007	N=582 CDOP aged 70 years or over	Baseline survey and two year follow up survey on activity levels	Do you carry out physical activity (yes/no), frequency of activities (times per week) and nature of activities undertaken (golf, ball games, hiking, home-based or group exercise,	FOF; fear of falling (yes/no)	Chi-squared/ independent sample t-test, multiple logistic regression	Those who had ceased regular activity were more likely to report FOF at baseline. In bivariate analysis, those who reported FOF at baseline were more likely to cease regular activity (p=0.033) but in multivariate analysis (multiple logistic regression), FOF did not significantly and independently predict activity restriction.

				dancing, swimming, martial arts, jogging, walking, other exercise). Regular physical activity defined as carrying out any type of physical activity 5 times or more per week.			
Activity avoidance/ restriction	Talley, Wyman and Gross, 2008	N=272 CDOP females aged 70-98 (M=78.7, SD=4.9)	Cross-sectional (Baseline data from randomised control trial)	SAFFE activity restriction subscale	FOF= SAFFE BC=ABC	Pearson or point biserial correlation	FOF was significantly positively associated with activity restriction in bivariate analysis. BC was significantly negatively correlated with activity restriction in bivariate analysis.
Activity avoidance/ restriction	Tinetti *et al.,* 1994	N=1103 CDOP aged 72 years or over	Cross-sectional	If responded yes to 'are you afraid of falling?' then asked if this fear had made them cut down on activities	FOF; are you afraid of falling (yes/no) FSe: FES	Contingency table analysis	Of those who reported FOF, 24% of fallers reported restricting activity, amongst non-fallers this was 15% (x^2=13.1, p<0.001). Mean FES score for those who acknowledged activity restriction due to FOF was 69.3(SD=25.1). Compared to those who denied FOF, or reported FOF but denied activity restriction, this was significantly lower (f=101.17(2,1005, p<0.0001) in bivariate analysis.
Activity avoidance/ restriction	Yardley and Smith, 2002	CDOP aged 75 years and older. Initially 224 (mean age: 80.7, SD=4.25), at 6 month follow up N=166 (mean age: 80.7, SD=4.16)	Longitudinal 6 month follow-up	Activity avoidance subscale of the SAFFE	FOF: In general, are you afraid of falling over? (not at all, a little, quite a bit, very much) OE: cones-quences of falling scale	ANOVA, multiple regression,	To single question (FOF) positively related to activity avoidance (f=2-209=43.67, p<0.001). Increased FOF related to substantial increase in activity avoidance in ANOVA In cross-sectional regression analyses, FOF explained significant additional variance in activity restriction scores at Time one (R^2 change=0.072, F=21.79, P<0.001) in multivariate analysis. In longitudinal analyses, significant variance in SAFFE scores (level of activity avoidance) was predicted by FOF score (R^2change=0.019, F=6.70, P<0.05) and both subscales on COF scale (Damage to identity=R^2change=0.19, F=7.27, p<0.01; Loss of

							functional independence=R^2change=0.036, F=13.92, p<0.001) in multivariate analysis.
Activity avoidance/ restriction	Zijlstra, van Haastregt, van Eijk, van	N=4031 CDOP aged 70 years or older.	Cross-sectional	Do you avoid certain activities due to FOF	FOF: Are you afraid of falling? (never,	Descriptive statistics	For those experiencing FOF (54.3% of total sample), 65.5% reported avoiding their activities due to this fear.
Activity level	Arfken *et al.,* 1994	N=890 CDOP Fell into four age groups 66-70 years: N=243 71-75 years: N=240 76-80 years: N=203 81+ years: N=204	Cross-sectional	Subscale of wider question-naire addressing QoL that recorded: frequency of participating in social activities (religious or club meeting, visiting family or friends, eating with other people, going to a social event, having friends in) Infrequent= less than three times a week.	FOF: at the present time are you very fearful, somewhat fearful or not fearful that you may fall?	Chi-squared, multivariate logistic regression	Infrequent social activities was not associated to changes in FOF level in bivariate analysis (p=0.11, NS). Level of social activities did not predict level of FOF (OR=0.90, 95% CI=0.62-1.31, p=not stated) in multivariate analysis.
Activity level	Austin *et al.,* 2007	1282 community dwelling older women aged 70 years and over	Longitudinal 3 year follow-up	Activity level: Do you participate in any sports recreation or regular physical activity? (yes/no)	FOF=single questions: are you afraid of falling (yes/no) Do you limit any household activities because you are frightened you may fall? (yes/no) Do you limit any outside activity because you are frightened you may fall? (yes/no)	Chi-squared/ANOVA/ Kruskall-Wallis H Tests, forward step logistic regression	In univariate analysis lack of participation in physical activity was associated with FOF at baseline (OR=1.95, 95% CI=1.50-2.55, p=not stated). Activity level significantly predicted FOF in multivariate analysis (OR1.48, 95% CI=1.09-2.02, p=not stated). When analysing longitudinal relationships, those with persistent FOF undertook significantly less physical activity compared to those who had never reported FOF (never FOF M=19.4 v persistent FOF M=34.0, p<0.05) in bivariate analysis. However, level of physical activity was not associated with the development of FOF at bivariate level, and did not predict new FOF development in multivariate analysis (p>0.05).

Activity levels	Bruce, Devine and Prince, 2002	N=1500 female CDOP aged 70-85 years	Cross-sectional	Activity levels: 'do you participate in any sports recreation or regular physical activity, including walking, that you undertook in the last three months?' (yes/no) If yes, asked to list up to four activities and the duration (hours/week) that they engaged in these activities. Calculated activity level based on kcal/day taking into account body weight and published energy costs of the activities reported. Classified to sedentary, active with energy expenditure <200 kcal/day and active >200 kcal/day	FOF: 'are you afraid of falling?' (yes/no) 'Do you limit any household activities' because you are frightened you might fall?' (yes/no) 'Do you limit any outside activities because you are frightened you may fall?' (yes/no) If positive to all three classified as FOF	Chi-squared, multiple logistic regression, multiple linear regression	Significant differences in activity level in those reporting FOF. Those with highest activity levels were less likely to have FOF (sedentary v active<200 v active>200: 45.2% v 33.3% v 27.0%, p=0.001) in bivariate analysis. In multiple logistic regression, when comparing those who were sedentary and those who were active (both<200 and >200 kcal/day), FOF significantly predicted activity levels, with increased FOF negatively associated with being active (OR=0.70, 95% CI=0.53-0.90, p=0.006). FOF significantly predicted sedentary lifestyle. In multiple linear regression, FOF significantly predicted lower energy expenditure (activity level) in the two 'active' groups (β0.09, p=0.003). Mean energy expenditure in those with FOF=183 (SD=87-386) kcal/day v 216 (SD=106-442) kcal/day in active women who did not report FOF (p=0.001). These results remained significant when explored in those without disability.
Activity levels	Brouwer, Musselman and Culham, 2004	N=25 CDOP who reported being FOF of falling aged 65 years or older Control group who did not report FOF N=25 CDOP mean age 76.3 (SD=5.2 years)	Cross-sectional	Human activity profile	BC: ABC	Independent t-test	Those with FOF (experimental group) showed greater activity curtailment than those without. However, this was not significant (p=0.109) in bivariate analysis.

Activity level	Deshpande Metter, Bandinelli, Lauretam, Windham and Ferruci, 2008b	N=926 CDOP aged 65 years or over Stratified into four age groups: 65-70, 71-80, 81-90, 90 years+	Cross-sectional (follow-up data from a wider epidemiological study).	Affirmative responses on SAFFE regarding if the activity was performed	FOF: SAFFE	'Correlation analysis,' multiple linear regression	Those who reported higher levels of FOF performed fewer activities (p=0.001). However activity level did not predict FOF in multivariate analysis.
Activity levels	Doi, Ono, Ono, Yamaguchi, Makiura and Hirata, 2012	N=262 Community dwelling older women aged 65-95 years.	Cross-sectional	Steps per day recorded for 7 days using a pedometer including an accelerometer	FOF: Do you have a fear of falling? Yes/no. IADL checklist	Independent t tests, Chi square, linear regression	62.2% of women reported FOF. IADL limitations did not differ between FOF and non-FOF women. Women without FOF had higher levels of physical activity compared to women with FOF (FOF 4670 +/- 2787 steps/day, nonFOF 5819 +/- 3170 steps/day, p = 0.0025). After controlling for covariates, FOF had a significant association with lower physical activity (p = 0.0275). R2 = 0.263.
Activity levels	Downton and Andrews, 1990	N=203 CDOP aged 75-84 years	Cross-sectional	Frequency of trips outside the house	FOF: Do you limit your activity due to FOF? (yes/no)	Chi-squared	FOF was significantly associated with mobility levels (0.73 v 1.15, p=0.011) in bivariate analysis.
Activity levels	Filiatrault, Desrosiers and Trottier, 2009	N=288 CDOP aged 65 years or older	Cross-sectional	Perceived activity levels Unclear of how questioned	FOF: are you afraid of falling? (never, occasion-ally, often, very often)	Chi- squared, logistic regression	Perceived activity level was not significantly different between fearful and non-fearful participants at any level of activity (p=0.16) in bivariate analysis. Perceived activity level did not predict FOF in multivariate analysis (logistic regression).
Activity level	Hadjistavro-poulos *et al.,* 2007	N=571 CDOP aged 69 years and over (mean=76.6 years, SD=5.4)	Longitudinal 6 month follow-up	Activity level subscale of SAFFE	FOF: SAFFE BC: ABC FSE: FES	Hierarchical multiple regression	In hierarchical multiple regression analysis SAFFE FOF scale, FES and ABC scores were entered in same step as SAFFE activity level and activity restriction subscales of SAFFE. This step was significant in predicting activity level at time 2 (F[14, 541]=4.94, p<0.001). From this block, SAFFE FOF subscale and SAFFE activity level subscales scores were significant predictors of activity level at time two (FOF p<0.05, activity level p<0.01).

Activity levels	Hotchkiss, Fisher, Robertson, Rutten-cutter, Schuffert and Barker, 2004	N=118 CDOP 60-99 (M=75.8)	Cross-sectional	How often did you leave your home last week?	FOF= SAFFE FSe=FES BC=ABC	Pearson correlation	Activity level was significantly correlated with FES ($p<0.01$) and ABC ($p<0.05$) scores in bivariate analysis. Activity level was not significantly correlated
Activity levels	Klima, Newton, Keshner and Davey, 2013	N=131 Community dwelling priests, aged 60 years or older. Two age groups formed: 60-74 year olds, aged 75+.	Cross-sectional	Physical Activity Scale for the Elderly	FOF: Do you experience FOF? Yes/No. BC: ABC	ANOVA, independent t tests, chi square, stepwise multiple regression	More men over the age of 75 reported FOF compared to the younger group (41% versus 14%, $p < 0.001$). Balance confidence was lower for the older age group compared to the younger men (78.4 vs 89.1, $p < 0.001$). Physical activity was positively correlated with BC (.57, $p<0.01$). Multiple regression revealed that balance.
Activity levels	Kumar, Carpenter, Morris, Iliffe and Kendrick, 2014	N=1088 CDOP aged 65 years and older	Cross-sectional	CHAMPS physical activity questionnaire for older adults	FSe but referred to as FOF: Short form FES-I	T tests, Mann Whitney U tests, ANOVA, multivariate regression	Participating in moderate intensity physical activity for >150 minutes per week was associated with significantly lower odds of FOF (OR 0.01, 95% CI 0.13 – 0.28, $p < 0.001$).
Activity levels	Lachman, Howland, Tennstedt, Jette, Assmann, and Peterson, 1998	N=270 CDOP aged 62-93 (M=76.16 SD=7.91)	Cross-sectional	Leisure instrument developed from Kansas City Studies of Aging & Normative Aging Study with three indexes: active, inactive and social activities.	FSe=FES FOF= SAFFE FOF=single questions: Are you afraid of falling? (very- not at all, 4 point likert scale), Are there things you don't do because you are afraid you might fall? (yes/no)	'correlation'	Those with higher fear scores engaged in fewer activities. SAFEE FOF subscale correlated with SAFFE number of activities subscale (significance not reported) in bivariate analysis. FES correlated with SAFFE number of activities subscale (significance not reported) in bivariate analysis.

					stopped doing because you are worried you might fall? (yes/no)		
Activity level	Li *et al.,* 2003	N=256 CDOP aged 70-92 years (mean=77.5 years, SD=5.0)	Cross-sectional (Baseline assessments reported for a wider scale physical activity trial)	Activity level subscale of SAFFE	FOF: SAFFE which looked at FOF level and associated activity restriction	Pearson's correlation, ANOVA,	Correlation between SAFFE activity level and FOF score was negatively statistically significant (r=-0.20, p<0.001). Individuals with higher fear engaged in fewer activities. In an ANOVA, significant group differences in activity level between the high-fear and low-fear groups were reported (f[1,254)=5.26, p<0.02) showing participants in high fear group had significantly lower activity levels compared with the
Activity level	Lim, Jang, Park, Kyun, Kang and Park, 2011	N=828 CDOP aged 65 years or older	Cross-sectional	International physical activity question-naire	FOF: to what extent are you afraid of falling? (not at all, slightly, somewhat, very much)	Logistic regression, multiple linear regression	Physical activity level was not associated with FOF in bivariate analysis.
Activity levels	Lim and Taylor, 2005	8881 CDOP aged 65 years or older (M=72.9 in active group, M=74.7 in inactive group)	Cross-sectional	Number of days in the last week that spent exercising for at lease 30 minutes in each of the following: Walking, moderate activity (golf, dancing, lawn bowls) or vigorous activity (gardening, yard work). Dichotom-ised into adequate and inadequate activity level. Adequate is at least 30	FOF: are you afraid of falling? (yes/no)	'Descriptive statistics,' Cox's proportional hazards regression	In bivariate analysis, adequate physical activity was significantly more common in those who denied FOF (p<0.001). However, FOF did not significantly predict activity levels in multivariate analysis.

				activity at least five out of seven days			
Activity levels	Maki, 1997	N=75 CDOP aged 62-96 years	Cross-sectional (baseline data from longitudinal study)	Those who walk outside (in good weather) less than once per week. Not reported how this was questioned	FOF: are you afraid of falling? (not at all, somewhat, very much)	Fisher exact test	The difference between fearful and fearless participants was not significant with regards those responding to walking outside less than once per week (p=0.68) in bivariate analysis.
Activity level	Murphy, *et al.,* 2003	N=313 female CDOP aged 72 years and older	Longitudinal 1 year follow-up	Frequency of participation in IADL's: How often do you undertake light housework, heavy housework, light yard work, heavy yard work, heavy home repair and driving? (dichotom-ised to participate or do not participate; response options not reported) Considered sedentary if did not participate in any stretching exercises/ calisthenics or any sports within the previous month, and in an average day, reported walking less than one city block and no stair climbing	FOF: are you afraid of falling? (yes/no)	Chi-squared, binomial regression	Developing FOF at follow up was significantly associated with sedentary lifestyle in bivariate analysis (no FOF 23.9%, FOF 42.3%, p=0.01). Sedentary lifestyle predicted FOF development, with sedentary lifestyle found to be predisposing to developing FOF at follow up in multivariate analysis (OR=1.96, 95% CI=1.35-2.84, p<0.05)
Activity level	Myers, Powell, Maki, Holliday, Brawley and Sherk, 1996	N=60 CDOP aged 65-95 years with two groups: high and low mobility	Cross-sectional	High mobility: those recruited from senior centres and a walking club. Did not require assistance	FOF: Are you afraid of falling? (yes/no) FSE: FES BC: ABC	Spearmans correlation, chi-squared	BC (ABC scores) was related to frequency of doing various activities. When looking at two selected activities (sweeping the floor, shopping), those who reported these activities more regularly had higher balance confidence scores (sweeping floor: r=0.70,

				when leaving the home. Low mobility: those at home-care and day care services. Did not leave home without assistance or used			p<0.001; shopping: r=0.54, p<0.001) in bivariate analysis. When groups dichotomised to low/high mobility, those with low mobility were more likely to report FOF (67% v 47%) however, this was not significant in bivariate analysis. High mobility groups had
Activity levels	Patil, Uusi-Rasi, Kannus, Karinkanta and Sievanen, 2014	N=409 Community dwelling older women aged between 70 and 80 years	Cross-sectional	The Community Health Activities Model Program for Seniors (CHAMPS) physical activity questionnaire	FSe but referred to as FOF: FES-I	Univariate multinomial logistic regression, multivariate regression	Women who engaged in less than 2.5 hours of physical activity per week were almost 3 times as likely to have a high FOF compared to women who engaged in more than 6 hours of physical activity per week.
Activity levels	Reyes-Ortiz, Ayele, Mulligan, Espino, Berges and Markides, 2006	1341 CDOP aged 70 years and older	Longitudinal two year follow-up	How often do you attend church or a religious service? (never or almost never, several times a year, once or twice a month, almost every week, more than once a week)	FOF: How afraid of you of falling? (not at all, somewhat, fairly or very afraid)	Chi-squared, logistic regression	Frequency of church attendance was associated with an increase in the percentage of subjects that were not afraid of falling, and a decrease in the percentage of subjects who were very afraid of falling at a univariate level. In bivariate analysis, lower FOF was associated with frequent church attendance (p=0.005). In a logistic regression analysis, frequent church attendance was a significant independent predictor of lower FOF (OR=0.73, 95% CI=0.58-0.92, p=0.008).

Activity level	Tinetti *et al.,* 1994	N=1103 CDOP aged 72 years or over	Cross-sectional	Physical and social activity assessed: Physical= Yale physical activity survey (light and heavy yard work, light and heavy housework, heavy home repair, sports, number of flights of stairs climbed per day and distance walked per day) Social: Frequency of participation in eight events (attending events, paid work, volunteering, visiting friends, attending religious services, participating in groups, going to museums/ shows; not at all/ 1-4 times	FOF; are you afraid of falling (yes/no) FSE: FES	Contingency table analysis/ ANOVA, backward-selected multiple linear regression	Correlation between FES score and social activity was significant in bivariate analysis (b=0.34, p=not reported). Correlation between FES score and physical activity was significant in bivariate analysis (b=0.49, p=not reported). FES significantly predicted social functioning in a multiple linear regression (partial correlation=0.088, p<0.01, model R^2=0.302). However, FOF did not significantly predict social functioning in multivariate analysis. FES independently predicted physical functioning in a multiple linear regression (p<0.001). However, data was not provided to support this. FOF did not significantly predict physical functioning in multivariate analysis
Activity level	Wijhuizen, de Jong and Hopman-Rock, 2007	1752 CDOP mean age 73.0 years all aged 65 years and older	Cross-sectional (Prospective follow-up study over 10 months. Data relating to activity level was only explored cross-sectionally).	Asked 'how often you walk outside for at least half an hour' and 'how often you bicycled during the winter and summer months' (both questions responded to on scale: each day, once or twice a week, once or twice a month,	FOF: how often are you afraid of falling? (never, seldom, regular, very often)	Polytomous logistic regression,	FOF significantly predicted physical activity levels: Individuals with higher FOF were more often active (OR=1.5, 95% CI=1.1-2.2, p=0.02) or low to moderately active (OR=2.9, 95% CI=2.1-4.2, p=0.00) than those with low FOF, appose to being very active. Those with low FOF were more likely to be very active.