Title

Fear of Falling after Hip Fracture: Prevalence, Course, and Relationship with One-Year Functional Recovery

Journal

American Journal of Geriatric Psychiatry, 24(12)

ISSN

1064-7481

Authors

Bower, Emily S
Wetherell, Julie Loebach
Petkus, Andrew J
et al.

Publication Date

2016-12-01

DOI

10.1016/j.jagp.2016.08.006

Peer reviewed

HHS Public Access
Author manuscript
Am J Geriatr Psychiatry. Author manuscript; available in PMC 2017 December 01.

Published in final edited form as:
Am J Geriatr Psychiatry. 2016 December ; 24(12): 1228–1236. doi:10.1016/j.jagp.2016.08.006.

Fear of Falling after Hip Fracture: Prevalence, Course, and Relationship with One-Year Functional Recovery

Emily S. Bower, MS[1], **Julie Loebach Wetherell, PhD**[2,3], **Andrew J. Petkus, PhD**[4], **Kerri S. Rawson, PhD**[5], and **and Eric J. Lenze, MD**[5]

[1]SDSU/UCSD Joint Doctoral Program in Clinical Psychology

[2]VA San Diego Healthcare System

[3]University of California, San Diego

[4]Department of Psychology, University of Southern California

[5]Healthy Mind Lab, Department of Psychiatry, Washington University School of Medicine, St. Louis

Abstract

OBJECTIVES—The effect of fear of falling (FoF) on recovery one year after hip fracture is not well known. Furthermore, the potential influence of premorbid function has not been explored. We aimed to describe rates of FoF after hip fracture, to assess the association of FoF with functional recovery one year post-fracture, and to evaluate the potential moderating effect of premorbid function on the relationship between FoF and functional recovery.

DESIGN—Secondary analysis of data from a prospective, longitudinal observational study to assess genetic factors influencing functional and psychological outcomes after hip fracture over 52 weeks.

SETTING—Eight area hospitals in St. Louis, MO.

PARTICIPANTS—241 cognitively intact individuals 60 years of age or older requiring surgical repair for hip fracture.

MEASUREMENTS—Fear of falling was measured by the short Falls Efficacy Scale-International 4 and 12 weeks post-fracture. The primary outcome was probability of full recovery 52 weeks post-fracture assessed with the Functional Recovery Score.

Corresponding Author: Julie Wetherell, Ph.D., University of California, San Diego, 9500 Gilman Drive, Dept. 9111N-1, La Jolla, CA 92093-9111, Tel: 858-552-8585 x2752, Fax: 858-552-4321, jwetherell@ucsd.edu.

Preliminary findings from this study were presented at the annual meeting of the Gerontological Society of America in San Diego, CA, November 14-18, 2012 and at the annual meeting of the American Association for Geriatric Psychiatry in Washington DC, March 17-20, 2016.

RESULTS—High rates of FoF were seen at 4 (60.5%) and 12 weeks (47.0%) post-fracture. Week 12 FoF was associated with lower odds of recovery for those with high function pre-fracture, OR = 0.82 [0.72, 0.93], but not for those with impaired ADL performance, OR = 1.04 [0.91, 1.19].

CONCLUSION—Fear of falling is common after hip fracture and is associated with poorer functional recovery one year after fracture, particularly in patients with high premorbid function. Fear of falling is a modifiable problem that represents a potential target for interventions to improve functional outcomes after hip fracture.

Keywords

fall-related self-efficacy; fear of falling; hip fracture; Falls Efficacy Scale International; Functional Recovery Score

OBJECTIVE

Hip fractures have a profound negative impact on quality of life, morbidity, and mortality in older adults. The worldwide incidence of hip fractures was 1.6 million in 2006, and is expected to reach 2.6 million by 2025 (1, 2). In spite of successful surgical methods, older adults with hip fracture often do not return to their prefracture functional status, necessitating additional assistance with mobility and activities of daily living or requiring transition to long-term care (3, 4). Thus, understanding predictors of poor recovery – particularly those amenable to intervention – is of great public health importance.

Fear of falling (FoF) may affect outcomes after hip fracture (5). Fear of falling is characterized by activity restriction (6), which in older adults with hip fracture could affect the rehabilitation process through reduced adherence to physical therapy. Approximately one in five community-dwelling older adults report FoF, which is associated with frailty, depression, and greater fall risk (7-9). In patients recovering from hip fracture, FoF is common and associated with impaired ADLs and walking ability (10, 11). To our knowledge, rates of FoF have not been reported prospectively in large samples using the gold standard assessment of FoF, the Falls Efficacy Scale International (FES-I; 12, 13).

The negative effect of FoF on health outcomes after hip fracture may not be evident until later in the rehabilitation process, when patients are transitioning back to their prefracture lifestyle. When measured concurrently, FoF is associated with greater postural sway and shorter forward reach 1 month after surgical hip repair (14) and with slower walking speed 4 months after hip fracture (15). Furthermore, FoF 1-2 weeks after fracture is not predictive of functional outcomes 2 or 6 months later (16, 17), whereas FoF 6 weeks after surgery predicts functional outcomes 6 months later (16). Thus, FoF occurring later in the recovery process may be more predictive of functional recovery than FoF directly after hip fracture.

Finally, the effect of FoF on functional outcomes after hip fracture may depend on whether fear is irrational given the patient's physical function. Delbaere et al. (18) reported disparities in the rate of falls over one year in community-dwelling older adults depending on whether FoF was commensurate with physiological fall risk. In older adults with low physiological fall risk (i.e., good physical ability), high FoF was associated with a greater injurious fall rate (39%) compared to those with low FoF (20%). Conversely, fall rate did not differ between those with high and low FoF in individuals with high physiological fall risk (41% vs. 34%). Thus, older adults with high FoF, despite relatively good physical function (i.e., irrational fear), experienced outcomes similar to older adults with poor physical function. In patients recovering from hip fracture, premorbid physical function may moderate the effect of FoF on recovery such that those with irrational fear (high function with high FoF) may experience worse outcomes than those with high function and low FoF. To our knowledge, the effect of irrational FoF on functional outcomes after hip fracture has not been reported.

In summary, FoF is a common and important health problem after hip fracture, yet published research on the association between FoF and recovery after hip fracture is limited. Prospective longitudinal studies are needed to evaluate the prevalence and effect of FoF on recovery in order to inform treatment and improve functional outcomes following hip fracture. Furthermore, factors that may moderate the relationship between FoF and recovery have not been explored.

The current study used data from a prospective, longitudinal study of participants with hip fracture (19, 20). The primary aim of the parent study was to examine genetic influences in the development of depression following a major medical event (i.e., hip fracture). The aims of the present study were (1) to describe rates of FoF at 4 and 12 weeks post-fracture, (2) to evaluate the effect of FoF on functional ability 52-weeks post-fracture, and (3) to examine the potential moderating effect of premorbid functional ability on the relationship between FoF and functional recovery. Per the recommendations of the Prevention of Falls Network Europe (ProFaNE) consensus group, we conceptualized FoF as low fall-related self-efficacy (12, 21). We hypothesized that higher FoF would be associated with poorer functional recovery. Based on the findings of Delbaere et al. (18), we further hypothesized that the effect of FoF on functional recovery would be greater for those with high baseline function compared to low baseline function.

METHODS

Procedures were approved by the Institutional Review Boards at Washington University School of Medicine in St. Louis and at the eight participating area hospitals. Participants provided written informed consent prior to undergoing study procedures. All procedures were in compliance with the ethical principles for human experimentation stated in the Declaration of Helsinki.

Participants

Participants in the parent study were recruited within one week of hip fracture from eight hospitals in the St. Louis, MO area between 2008-2012 (19, 20). All patients who were 60 years or older and had a primary diagnosis of hip fracture to be surgically repaired were consecutively screened. Exclusion criteria included no surgery for fracture, refracture through prosthesis, current major depression, living more than one hour away, metastatic cancer, current depressogenic medications (e.g., interferon), or inability to participate due to language, visual, or hearing barriers. These criteria were based on the requirements of the parent study (e.g., use of depressogenic medications could confound evaluation of genetic contributions to risk of depression). Additionally, individuals who were unable to provide informed consent or cooperate with the protocol due to dementia or severe cognitive impairment (i.e., Short Blessed Test >12) (22) that did not improve by the end of hospitalization were excluded both because cognitive impairment could interfere with the accurate assessment of depression as required by the parent study and because cognitive impairment could confound the relationship between genetic vulnerability and development of depression after a serious medical event.

For the current study, we included participants who had data on FoF from at least one time point, had data on physical function at week 52, and were community-dwelling.

The FES-I was introduced as a measure after recruitment had begun; therefore, of the 501 individuals enrolled in the parent study, 299 completed the FES-I at week 4 (n=275) or week 12 (n=277). Of those, 13 were residing in assisted living or a SNF at baseline and were excluded from the current analyses. An additional 45 did not have data for the FRS at week 52, resulting in a sample of 241 for the present investigation (see Figure 1).

Study Design

Data were drawn from a 52-week observational study of genetic predictors of psychological and functional outcomes following hip fracture in older adults. Baseline assessment for the parent study typically took place within 2 days after surgery to repair the hip fracture. Participants in the current study completed in-person follow-up assessments at 4 and 52 weeks post-surgery and were contacted for telephone assessments at weeks 12 and 26.

Measures

Fear of falling was measured with the short form of the Falls Efficacy Scale-International (FES-I 23), which is a 7-item self-report measure of concerns about falling in specific situations (e.g., taking a bath or shower). Items are rated on a 4-point scale from 1 (not at all concerned) to 4 (very concerned). Possible scores range from 7-28, with higher scores indicating greater concern about falling. In community-dwelling older adults, the short FES-I was highly correlated with the full FES-I (r=.97) and demonstrated excellent reliability and validity (23). In patients with hip fracture, the scale has demonstrated good reliability and structural validity (24). Internal consistency for this sample was good (α=.79). The FES-I was administered at weeks 4 and 12.

Functional ability was measured with the Functional Recovery Score (FRS) (25), which is an 11-item, clinician-administered interview that measures the amount of assistance needed for basic activities of daily living (BADL), instrumental activities of daily living (IADL), and mobility. A total score ranging from 0-100 provides a measure of overall functional ability. Lower scores indicate poorer function and more assistance required. The scale is reliable and valid in older patients after surgery for hip fracture (26). The FRS was administered at baseline and weeks 4, 12, 26, and 52. Baseline scores represent prefracture functional ability assessed retrospectively. The baseline FRS was also used as a proxy for assessing irrational FoF (i.e., high functional ability coupled with high FoF).

Medical co-morbidity was measured with the Cumulative Illness Rating Scale for Geriatrics (CIRS-G; 27). Each of the 14 items represents an organ system (e.g., vascular) that the clinician rates on a scale from 0-4, with higher scores indicating greater severity of medical illness. Total scores range from 0-56. The CIRS-G was scored at baseline by a physician (EJL) based on medical records and medical history data collected by trained research assistants.

The Montgomery-Åsberg Depression Rating Scale (MADRS) is a physician-administered measure of depression symptoms (28). The scale consists of 10 items rated from 0- 6 (total score 0-60), with higher scores indicating a greater degree of depressive symptoms. The MADRS was assessed by trained raters. Test-retest reliability was ICC = .84, CI = 0.51-0.95 (19).

Statistical Analyses

To calculate rates of FoF, we used a brief FES-I score ≥11 to classify high FoF (13). To evaluate the relationship between FoF and functional recovery, we used multiple logistic regression analyses with continuous FES-I scores at week 4 or 12, unadjusted and adjusted for covariates. The outcome was functional recovery one year after fracture operationally defined as 100% return to baseline FRS. Weeks 4 and 12 FES-I scores were evaluated in separate models. Covariates included age, concurrent (week 4 or12) depression, medical co-morbidity, premorbid functional ability, and concurrent (week 4 or 12) functional ability. Three participants were missing a single item on the FES-I, which was replaced using person-mean substitution. Models were assessed for goodness-of-fit using the Hosmer and Lemeshow test, and plots of leverage and residuals were evaluated to identify observations with influence. One case was both an extreme outlier on the FES-I at week 12 and demonstrated significant leverage, thus it was removed from regression analyses (all cases were included when calculating rates of FoF). The distribution of scores for the FRS were highly negatively skewed, suggesting a natural division between high and low functioning participants, so the variables were dichotomized using a median split. Finally, to evaluate whether the effect of FoF was different for those with high or low baseline function, we reran the models including baseline FRS and the interaction term between baseline FRS and the FES-I as predictors. A Bonferroni correction was used to correct for multiple tests (α=.05/3). All models were assessed with the LOGISTIC procedure in SAS version 9.3 (SAS Institute, Inc., Cary, NC). A plot of the adjusted predicted values was generated with the SGPLOT procedure using the methods described by the UCLA Statistical Consulting Group (29).

RESULTS

Participant Characteristics

Participants were majority female, Caucasian, and independent with BADLs (see Table 1). The most common reason for hip fracture was from a fall, and the majority were femoral neck fractures. Hemiarthroplasty, internal fixation with screws, and IM nail were the most common treatment methods. Participants with missing FRS data at week 52 (n=45) had higher baseline depression scores, higher levels of FoF at weeks 4 and 12, and lower FRS scores at all timepoints. Participants with no FES data (n=52) were older and had fewer years of education than those with FES data.

Rates of fear of falling after fracture

High FoF was reported by over half of participants at week 4 and just under half of participants at week 12 (see Table 2). Of those reporting high FoF at week 4, 60.7% reported high FoF at week 12. Overall, persistently high FoF (high FoF at weeks 4 and 12) was reported by 34.0% of participants.

On average, patients reported high functional ability prior to fracture (see Table 2). Approximately half of participants had not recovered baseline functional ability by week 52.

Association of fear of falling with functional recovery

In unadjusted models, week 4 FES-I scores were related to recovery at week 52, such that higher FoF was associated with lower odds of recovery (OR=.90, 95% CI [0.84, 0.96], $\chi^2(1)=8.95$, $p=.003$). Week 4 FES-I scores were not related to recovery after adjusting for age, depression, medical co-morbidity, premorbid functional ability, and functional ability at 4 weeks, OR=.94, 95% CI [0.86, 1.04], $\chi^2(1)=1.97$, $p=.16$. Thus, FoF at week 4 did not appear to be a significant predictor of recovery in this sample and was not evaluated further.

In unadjusted models, Week 12 FES-I scores were related to recovery such that higher FoF was associated with lower odds of recovery (OR=0.84, 95% CI [0.78, 0.92], $\chi^2(1)=15.07$, $p<.001$). This relationship remained significant after controlling for covariates (OR=0.90, 95% CI [0.82, 0.99], $\chi^2(1)=5.23$, $p=.02$), but was qualified by an interaction with premorbid function (see Table 3). The interaction revealed an inverse relationship between FES-I scores and probability of recovery in patients with high premorbid function (see Figure 2). When premorbid function was high, higher FoF was associated with lower probability of recovery (see Table 4). Conversely, FES-I scores were not related to probability of recovery when premorbid function was low (see Table 5). Thus, FoF was a significant predictor of functional recovery after hip fracture in those who were high functioning prior to fracture, whereas it was not predictive of recovery in those with low prior function.

To further clarify the interaction, we divided the sample into four groups based on whether they reported high or low function prior to fracture and whether they reported high or low FoF at week 12. Of individuals who were high functioning prior to fracture, 25% (n=16/64) with high FoF recovered to a baseline level of functioning, compared to 58% (n=51/88) with low FoF. In individuals with prior ADL impairment, 23% (n=11/47) with high FoF recovered compared to 22% (n=8/37) with low FoF.

CONCLUSIONS

The present investigation examined rates of FoF following a hip fracture and the association of FoF with functional recovery over one year in a parent longitudinal study designed to examine genetic influences on psychological and functional outcomes after hip fracture. Our study had three key findings. First, we found that FoF after hip fracture is common, with rates of 61% and 47% at 4 and 12 weeks post-fracture, respectively, and with 34% of participants reporting high fear at both timepoints. Second, we found that FoF at 12 weeks predicted poorer functional outcomes 52 weeks post-fracture. Finally, we found that this effect was moderated by baseline function, such that higher FoF was associated with poorer functional outcomes in those with high premorbid function, whereas FoF was not predictive of functional outcomes in those with low premorbid function. In fact, FoF appeared to cancel out the benefits of high baseline function in achieving successful recovery. FoF is a potentially modifiable factor (see 30) that, if treated, could reduce the burden of care for older adults after hip fracture. This may be particularly important for older adults whose functional ability was high prior to their fracture.

Prevalence rates from the current study are similar to rates reported in other studies. In our sample, the rate of FoF reported at 12 weeks was slightly lower than rates reported by Jellesmark et al (11), who found that 58% endorsed high FoF 3-6 months after hip fracture. The difference may be due to the wider time range for reporting in the study by Jellesmark et al (i.e., over 3 months vs. one timepoint in the current study). Visschedijk et al (31) found that 59% reported FoF 8-16 weeks after fracture using a single-item assessment and had an average full FES-I score of 29.4 (approximately 12.9 on the short FES-I). These rates were slightly higher than the rates reported in the current study (mean FES-I at week 12 = 11.5). Visschedijk et al focused on a sample of patients admitted to inpatient rehabilitation, whereas the sample in the current study included patients receiving either inpatient or outpatient rehabilitation. This may account for the differences in rates of FoF, as patients receiving inpatient rehabilitation may experience higher levels of FoF.

Findings from the current study expand upon previously published findings that FES-I scores 6 weeks, but not 2 weeks, post-fracture were predictive of functional outcomes 6 months after hip fracture (16). Our findings extend those of Oude Voshaar et al by measuring FoF at 4 and 12 weeks after fracture and assessing the effect of FoF on functional outcomes one year after fracture. Overall, results from the current study support previous findings that FoF is an important factor affecting functional recovery and suggest that FoF is common up to 3 months after hip fracture in older adults. The current findings also suggest that the best time to assess and provide intervention for FoF may be several months after hip fracture. In some patients, high FoF within a month after fracture may be transient and adaptive. Conversely, high FoF three months post-fracture may be indicative of maladaptive processes that warrant intervention, particularly among older adults with high baseline function. Interventions that may reduce FoF include exercise, tai chi, and multicomponent interventions that address psychological, physical, and environmental factors (32). Although some exercise-based interventions have been effective at reducing fall-related psychological outcomes (e.g., 33), others have not (e.g., 34). Multicomponent interventions that include a cognitive behavioral component show promise for reducing FoF in community-dwelling older adults (35, 36). Thus, multicomponent interventions that target psychosocial factors in addition to physical function are recommended, although research with patients recovering from hip fracture is needed.

The current findings add to the literature by showing that FoF at 12 but not 4 weeks post-fracture predicted one-year functional outcomes, and that this effect was moderated by premorbid function. The moderating effect was such that higher FoF at 12 weeks was predictive of poorer functional recovery in those with high premorbid function (i.e., irrational fear, defined as high FoF despite relatively good physical function), but not in those with lower premorbid functioning (i.e., rational fear, defined as high FoF coupled with relatively poor physical function). This could suggest that FoF is more salient to previously high functioning patients later in the recovery period when they are trying to re-establish prior activities. Furthermore, older adults with FoF often restrict activities, which could reduce adherence to exercise regimens and lead to functional decline (37). It is also plausible that patients with low baseline functional ability were more likely to have high FoF at baseline. If this were the case, high FoF at week 12 could represent a relatively stable condition that might be less likely to be associated with functional change in those with low baseline functional ability. We attempted to control for the concurrent effect of functional ability in our analyses; however, it is possible that patients who perceived their functional recovery as worse than expected would be more likely to report FoF. Indeed, the relationship between FoF and functional ability is likely complex and bidirectional.

The current study has some limitations, chief among which is the fact that it is a secondary analysis of data that were collected for a different purpose. A study specifically designed to evaluate long-term effects of FoF on recovery from hip fracture may benefit from different inclusion and exclusion criteria than those of the parent study here, such as by including individuals with cognitive impairment. Cognitively impaired patients were excluded to avoid possible confounds in the parent study; thus, we cannot draw conclusions about the relationship between FoF and functional recovery in patients with cognitive impairment, despite the fact that patients with dementia may have a higher risk of falls, and outcomes may be worse than in cognitively healthy older adults (38, 39). Thus, the current findings should be considered preliminary pending replication in other samples. Finally, the current results do not rule out the possibility that changes in functional ability precede and cause changes in FoF. One could hypothesize that there are multiple pathways through which FoF could affect functional recovery, with functional ability and FoF interacting over time. Analysis of these complex relationships is beyond the scope of the current study but warrants future consideration.

There are many strengths of the current study. Foremost, this was a large longitudinal study examining psychological factors following hip fracture. Comorbid disorders that could confound psychological outcomes were excluded, most notably dementia, persistent delirium, depression (at baseline), and terminal illness. Additionally, FoF was measured at multiple time points using a gold-standard assessment instrument. These findings represent important contributions to the literature, as they extend findings from previously published research while adding new information about the moderating effect of premorbid function on the relationship between FoF and functional recovery.

In conclusion, the current study found that high FoF is common 4-12 weeks after hip fracture. Importantly, high FoF is predictive of poorer functional recovery in older adults with high levels of physical function prior to hip fracture. Fear of falling is a potentially treatable psychological factor, and these findings suggest that targeting high FoF for treatment three months post-fracture, especially among high functioning older adults, could have positive, long-term effects on functional outcomes after hip fracture.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Conflicts of Interest and Source of Funding: Research supported by NIMH R01 MH074596 and the Taylor Family Institute.

Dr. Lenze receives research support from Takeda, Lundbeck, the McKnight Brain Research Foundation, the Taylor Family Institute for Innovative Psychiatric Research, and the Barnes Jewish Foundation.

REFERENCES

1. Gullberg B, Johnell O, Kanis JA. World-wide projections for hip fracture. Osteoporos Int. 1997; 7:407–413. [PubMed: 9425497]
2. Johnell O, Kanis JA. An estimate of the worldwide prevalence and disability associated with osteoporotic fractures. Osteoporos Int. 2006; 17:1726–1733. [PubMed: 16983459]
3. Marks R, Allegrante JP, MacKenzie CR, et al. Hip fractures among the elderly: causes, consequences and control. Ageing Res Rev. 2003; 2:57–93. [PubMed: 12437996]
4. Alarcon T, Gonzalez-Montalvo JI, Gotor P, et al. Activities of daily living after hip fracture: profile and rate of recovery during 2 years of follow-up. Osteoporos Int. 2011; 22:1609–1613. [PubMed: 20521027]
5. Visschedijk J, Achterberg W, Van Balen R, et al. Fear of falling after hip fracture: a systematic review of measurement instruments, prevalence, interventions, and related factors. J Am Geriatr Soc. 2010; 58:1739–1748. [PubMed: 20863333]
6. Tinetti ME, Mendes de Leon CF, Doucette JT, et al. Fear of falling and fall-related efficacy in relationship to functioning among community-living elders. Journal of Gerontology: Medical Sciences. 1994; 49:M140–147.
7. Arfken CL, Lach HW, Birge SJ, et al. The prevalence and correlates of fear of falling in elderly persons living in the community. Am J Public Health. 1994; 84:565–570. [PubMed: 8154557]
8. Friedman SM, Munoz B, West SK, et al. Falls and fear of falling: which comes first? A longitudinal prediction model suggests strategies for primary and secondary prevention. J Am Geriatr Soc. 2002; 50:1329–1335. [PubMed: 12164987]
9. Austin N, Devine A, Dick I, et al. Fear of falling in older women: a longitudinal study of incidence, persistence, and predictors. J Am Geriatr Soc. 2007; 55:1598–1603. [PubMed: 17908062]
10. Visschedijk JH, Caljouw MA, van Balen R, et al. Fear of falling after hip fracture in vulnerable older persons rehabilitating in a skilled nursing facility. J Rehabil Med. 2014; 46:258–263. [PubMed: 24284784]
11. Jellesmark A, Herling SF, Egerod I, et al. Fear of falling and changed functional ability following hip fracture among community-dwelling elderly people: an explanatory sequential mixed method study. Disabil Rehabil. 2012; 34:2124–2131. [PubMed: 22536796]
12. Yardley L, Beyer N, Hauer K, et al. Development and initial validation of the Falls Efficacy Scale-International (FES-I). Age Ageing. 2005; 34:614–619. [PubMed: 16267188]
13. Delbaere K, Close JC, Mikolaizak AS, et al. The Falls Efficacy Scale International (FES-I). A comprehensive longitudinal validation study. Age Ageing. 2010; 39:210–216. [PubMed: 20061508]
14. Ingemarsson AH, Frandin K, Hellstrom K, et al. Balance function and fall-related efficacy in patients with newly operated hip fracture. Clin Rehabil. 2000; 14:497–505. [PubMed: 11043875]
15. Whitehead C, Miller M, Crotty M. Falls in community-dwelling older persons following hip fracture: impact on self-efficacy, balance and handicap. Clin Rehabil. 2003; 17:899–906. [PubMed: 14682563]

16. Oude Voshaar RC, Banerjee S, Horan M, et al. Fear of falling more important than pain and depression for functional recovery after surgery for hip fracture in older people. Psychol Med. 2006; 36:1635–1645. [PubMed: 16863598]
17. McKee KJ, Orbell S, Austin CA, et al. Fear of falling, falls efficacy, and health outcomes in older people following hip fracture. Disabil Rehabil. 2002; 24:327–333. [PubMed: 12017466]
18. Delbaere K, Close JC, Brodaty H, et al. Determinants of disparities between perceived and physiological risk of falling among elderly people: cohort study. BMJ. 2010; 341:c4165. [PubMed: 20724399]
19. Rawson KS, Dixon D, Nowotny P, et al. Association of functional polymorphisms from brain-derived neurotrophic factor and serotonin-related genes with depressive symptoms after a medical stressor in older adults. PLoS One. 2015; 10:e0120685. [PubMed: 25781924]
20. Cristancho P, Lenze EJ, Avidan MS, et al. Trajectories of depressive symptoms after hip fracture. Psychol Med. 2016; 46:1413–1425. [PubMed: 27032698]
21. Lamb SE, Jorstad-Stein EC, Hauer K, et al. Development of a common outcome data set for fall injury prevention trials: the Prevention of Falls Network Europe consensus. J Am Geriatr Soc. 2005; 53:1618–1622. [PubMed: 16137297]
22. Katzman R, Brown T, Fuld P, et al. Validation of a short Orientation-Memory-Concentration Test of cognitive impairment. Am J Psychiatry. 1983; 140:734–739. [PubMed: 6846631]
23. Kempen GIJM, Yardley L, Van Haastregt JCM, et al. The Short FES-I: a shortened version of the falls efficacy scale-international to assess fear of falling. Age Ageing. 2008; 37:45–50. [PubMed: 18032400]
24. Visschedijk JH, Terwee CB, Caljouw MA, et al. Reliability and validity of the Falls Efficacy Scale-International after hip fracture in patients aged ≥65 years. Disabil Rehabil. 2015:1–8.
25. Zuckerman JD, Koval KJ, Aharonoff GB, et al. A functional recovery score for elderly hip fracture patients: I. Development. J Orthop Trauma. 2000; 14:20–25. [PubMed: 10630798]
26. Zuckerman JD, Koval KJ, Aharonoff GB, et al. A functional recovery score for elderly hip fracture patients: II. Validity and reliability. J Orthop Trauma. 2000; 14:26–30. [PubMed: 10630799]
27. Miller MD, Paradis CF, Houck PR, et al. Rating chronic medical illness burden in geropsychiatric practice and research: application of the Cumulative Illness Rating Scale. Psychiatry Res. 1992; 41:237–248. [PubMed: 1594710]
28. Montgomery SA, Asberg M. A new depression scale designed to be sensitive to change. Br J Psychiatry. 1979; 134:382–389. [PubMed: 444788]
29. SAS FAQ. UCLA. Statistical Consulting Group website http://www.ats.ucla.edu/stat/sas/faq/sas_adjust.htm (accessed February 6, 2016)
30. Kendrick D, Kumar A, Carpenter H, et al. Exercise for reducing fear of falling in older people living in the community. Cochrane Database Syst Rev. 2014; 11:CD009848.
31. Visschedijk J, van Balen R, Hertogh C, et al. Fear of falling in patients with hip fractures: prevalence and related psychological factors. J Am Med Dir Assoc. 2013; 14:218–220. [PubMed: 23218746]
32. Zijlstra GA, van Haastregt JC, van Rossum E, et al. Interventions to reduce fear of falling in community-living older people: a systematic review. J Am Geriatr Soc. 2007; 55:603–615. [PubMed: 17397441]
33. Li F, Harmer P, Fisher KJ, et al. Tai Chi and fall reductions in older adults: a randomized controlled trial. J Gerontol A Biol Sci Med Sci. 2005; 60:187–194. [PubMed: 15814861]
34. Freiberger E, Haberle L, Spirduso WW, et al. Long-term effects of three multicomponent exercise interventions on physical performance and fall-related psychological outcomes in community-dwelling older adults: a randomized controlled trial. J Am Geriatr Soc. 2012; 60:437–446. [PubMed: 22324753]
35. Wetherell JL, Johnson K, Chang D, et al. Activity, balance, learning, and exposure (ABLE): a new intervention for fear of falling. Int J Geriatr Psychiatry. in press.
36. Zijlstra GA, van Haastregt JC, Ambergen T, et al. Effects of a multicomponent cognitive behavioral group intervention on fear of falling and activity avoidance in community-dwelling older adults: results of a randomized controlled trial. J Am Geriatr Soc. 2009; 57:2020–2028. [PubMed: 19793161]

37. Resnick B, D'Adamo C, Shardell M, et al. Adherence to an Exercise Intervention Among Older Women Post Hip Fracture. J Clin Sport Psychol. 2008; 2:41–56. [PubMed: 20428489]
38. van Doorn C, Gruber-Baldini AL, Zimmerman S, et al. Dementia as a risk factor for falls and fall injuries among nursing home residents. J Am Geriatr Soc. 2003; 51:1213–1218. [PubMed: 12919232]
39. Mitchell R, Harvey L, Brodaty H, et al. Hip fracture and the influence of dementia on health outcomes and access to hospital-based rehabilitation for older individuals. Disabil Rehabil. 2016:1–10.

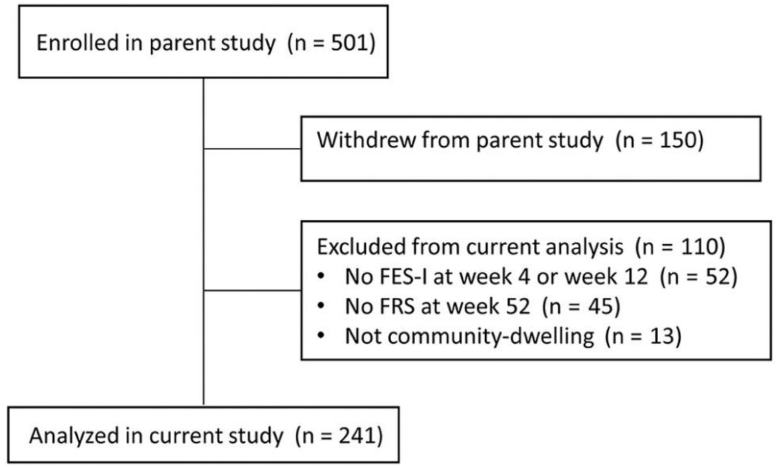

Figure 1.

Flowchart of participants through the study.

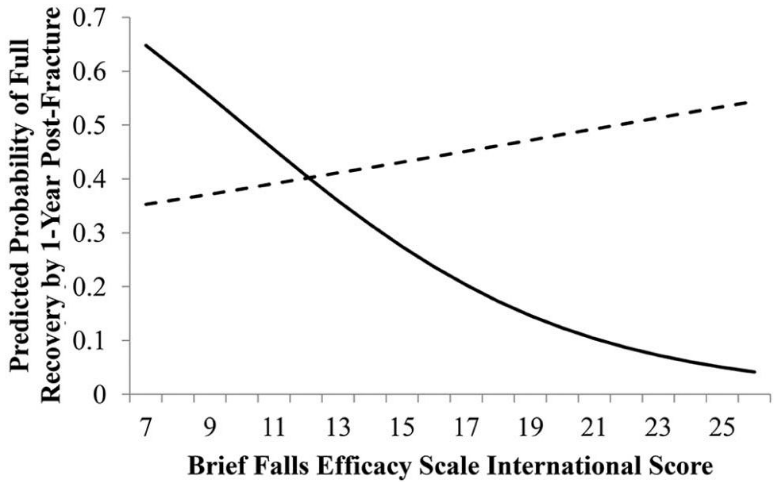

Figure 2.

Estimated probability of recovery for a person with mean age, mean MADRS score, mean CIRS-G score, and high week 12 FRS. Dashed line = low week 0 FRS, solid line = high week 0 FRS. CIRS-G = Cumulative Illness Rating Scale – Geriatric; FRS = Functional Recovery Score, high scores are those above the median, low scores are those below the median, week 0 indicates premorbid function assessed retrospectively after surgery to repair hip fracture; MADRS = Montgomery Asberg Depression Rating Score.

Table 1

Participant Characteristics (n = 241)

	Pre-Fracture, except where indicated
Age in years, *M* (*SD*; range)	77.2 (8.5; 60-95)
Female, %	74.3
Education in years, *M* (*SD*; range)	13.3 (2.9; 6-26)[a]
Race, %	
Asian	0.4
Black or African American	7.9
White, non-Hispanic	91.7
Marital status, %	
Never married	8.3
Married	41.9
Divorced/Separated	12.8
Widowed	36.9
Living status, %	
Home, no supervision	84.2
Home, part-time supervision	5.4
Home, full-time supervision	7.9
Other	2.5
Mechanism of injury, %	
Fall	92.1
Motor Vehicle Accident	2.1
Other/Data not available	5.8
Fracture Type, %	
Femoral Neck	48.5
Intertrochanteric	41.5
Subtrochanteric	5.0
Other/Data not available	5.0
Implant Type, %	
Total hip arthroplasty	9.1
Hemiarthroplasty	29.1
Internal Fixation with screws	25.7
Sliding hip screw	2.1
IM nail	27.4
Other/Data not available	6.6
CIRS-G, *M* (*SD*; range)	12.5 (3.7; 5-25)
MADRS, *median* (*IQR*)	2.0 (0-4)
MADRS week 4, *median* (*IQR*)	4.0 (1-8)[b]
MADRS week 12, *median* (*IQR*)	3.0 (1-6)[c]
SBT, *M* (*SD*; range)	4.3 (3.2; 0-12)

	Pre-Fracture, except where indicated
Independent BADL, %	95.0
Independent IADL, %	58.5
Walks without assistance, %	74.7

Note. All values are pre-fracture, except where indicated. Higher scores indicate greater symptom severity for all scales. BADL = Basic Activities of Daily Living; CIRS-G = Cumulative Illness Rating Scale - Geriatric; IADL = Instrumental Activities of Daily Living; MADRS = Montgomery Åsberg Depression Rating Scale; SBT = Short Blessed Test.

[a] *n*=234.

[b] *n*=227.

[c] *n*=237.

Table 2

Functional Ability and Fear of Falling at Baseline, and 4, 12, 26, and 52 Weeks After Hip Fracture Repair, Median (Interquartile Range), n = 241

	Baseline	**Week 4**	**Week 12**	**Week 26**	**Week 52**
FRS	100 (92-100)	80 (61-86)	88 (82-95)	91 (85-100)	91 (84-100)
% full recovery	--	5%	22%	37%	48%
FES-I	--	12 (9-16)	10 (8-14)	--	--
High FOF, %	--	60.5	47.0	--	--

Note. FES-I = Falls Efficacy Scale International, scores range from 7-28 with higher scores indicating lower fall-related self-efficacy (i.e., greater psychopathology); FOF = Fear of falling, dichotomized at a score of 11; FRS = Functional Recovery Score, scores range from 0-100 with lower scores indicating greater impairment.

Table 3

Logistic Regression Evaluating the Moderating Effect of Week 0 Functional Ability on the Relationship Between FES-I Scores at Week 12 and Full Recovery One Year Post-Fracture (n = 240)

	OR	95% CI	Wald χ^2	*p*
FES-I Week 12 * FRS Week 0			6.97	.008
FES-I Week 12 (at High FRS)	0.82	[0.72, 0.93]		
FES-I Week 12 (at Low FRS)	1.04	[0.91, 1.19]		
FRS Week 0 (at mean FES)	1.17	[0.56, 2.46]		
FRS Week 12 (High vs Low)	3.14	[1.48, 6.66]	8.93	.003
Age	0.92	[0.89, 0.96]	15.25	< .001
CIRSG	0.93	[0.85, 1.02]	2.19	.14
MADRS Week 12	0.95	[0.88, 1.02]	1.94	.16

Note. Global Wald chi-square was significant, $\chi^2(7) = 47.48$, $p < .001$. Degrees of freedom are 1 for all tests listed in the table. For FRS, higher scores indicate better functioning whereas for all other scales, higher scores indicate greater symptomology; CIRS-G = Cumulative Illness Rating Scale - Geriatric, assessed at week 0; FES-I = Falls Efficacy Scale International; FRS = Functional Recovery Scale, week 0 indicates premorbid function assessed retrospectively after surgery to repair hip fracture; MADRS = Montgomery Asberg Depression Rating Scale.

Table 4

Logistic Regression Model Predicting Full Recovery One Year Post-Fracture from FES-I Scores at Week 12 in Participants with High Baseline Functional Ability, Controlling for Covariates, n = 152

	OR	95% CI	Wald χ^2	*p*
FES-I Week 12	0.82	[0.72, 0.94]	8.87	.003
FRS Week 12 (High vs Low)	4.23	[1.65, 10.83]	9.06	.003
Age	0.93	[0.88, 0.97]	10.08	.002
CIRS-G	0.90	[0.80, 1.01]	3.05	.08
MADRS Week 12	0.97	[0.88, 1.07]	0.46	.50

Note. Global Wald chi-square was significant, $\chi^2(5) = 31.29$, $p < .001$. Degrees of freedom are 1 for all tests listed in the table. For FRS, higher scores indicate better functioning whereas for all other scales, higher scores indicate greater symptomology; CIRS-G = Cumulative Illness Rating Scale - Geriatric, assessed at week 0; FES-I = Falls Efficacy Scale International; FRS = Functional Recovery Scale, week 0 indicates premorbid function assessed retrospectively after surgery to repair hip fracture; MADRS = Montgomery Asberg Depression Rating Scale.

Table 5

Logistic Regression Model Predicting Full Recovery One Year Post-Fracture from FES-I Scores at Week 12 in Participants with Low Baseline Functional Ability, Controlling for Covariates, n = 83

	OR	95% CI	Wald χ^2	*p*
FES-I Week 12	1.02	[0.87, 1.18]	0.05	.83
FRS Week 12 (High vs Low)	1.78	[0.43, 7.27]	0.62	.43
Age	0.91	[0.84, 0.98]	5.70	.02
CIRS-G	0.97	[0.83, 1.13]	0.16	.69
MADRS Week 12	0.91	[0.79, 1.04]	1.99	.16

Note. Global Wald chi-square was not significant, $\chi^2(5) = 7.76$, p = .17. Degrees of freedom are 1 for all tests listed in the table. For FRS, higher scores indicate better functioning whereas for all other scales, higher scores indicate greater symptomology; CIRS-G = Cumulative Illness Rating Scale - Geriatric, assessed at week 0; FES-I = Falls Efficacy Scale International; FRS = Functional Recovery Scale, week 0 indicates premorbid function assessed retrospectively after surgery to repair hip fracture; MADRS = Montgomery Asberg Depression Rating Scale.