# Does pride really come before a fall? Longitudinal analysis of older English adults

D McMinn,[1] S J Fergusson,[2] M Daly[3]

[1]Rowett Institute of Nutrition and Health, University of Aberdeen, Aberdeen AB25 2ZD, UK
[2]Royal Alexandra Hospital, Paisley PA2 9PN, UK
[3]Department of Management Work and Organisation, University of Stirling, Stirling, UK
Correspondence to: M Daly
michael.daly@stir.ac.uk

Additional material is published online only. To view please visit the journal online.

Cite this as: *BMJ* 2017;359:j5451
http://dx.doi.org/10.1136/bmj.j5451

Accepted: 20 November 2017

## ABSTRACT

### OBJECTIVE

To test whether high levels of reported pride are associated with subsequent falls.

### DESIGN

Secondary analysis of the English Longitudinal Study of Ageing (ELSA) dataset.

### SETTING

Multi-wave longitudinal sample of non-institutionalised older English adults.

### PARTICIPANTS

ELSA cohort of 6415 participants at wave 5 (baseline, 2010/11), of whom 4964 were available for follow-up at wave 7 (follow-up, 2014/15).

### MAIN OUTCOME MEASURES

Self reported pride at baseline (low/moderate/high) and whether the participant had reported having fallen during the two years before follow-up.

### RESULTS

The findings did not support the contention that "pride comes before a fall." Unadjusted estimates indicate that the odds of reported falls were significantly lower for people with high pride levels compared with those who had low pride (odds ratio 0.69, 95% confidence interval 0.58 to 0.81, P<0.001). This association remained after adjustment for age, sex, household wealth, and history of falls (odds ratio 0.81, 0.68 to 0.97, P<0.05). It was partially attenuated after further adjustment for mobility problems, eyesight problems, the presence of a limiting long term illness, a diagnosis of arthritis or osteoporosis, medication use, cognitive function, and pain and depression (odds ratio 0.86, 0.72 to 1.03, P<0.1). Because the confidence interval exceeded 1 in the final model, it remains possible that pride may not be an independent predictor of falls when known risk factors are considered. People with moderate pride did not have lower odds of having fallen than those with low pride in adjusted models. Participants lost to follow-up did not differ from those retained in terms of key variables, and weighting the analyses to account for selective attrition did not produce different results.

### CONCLUSIONS

Contrary to the well known saying "pride comes before a fall," these findings suggest that pride may actually be a protective factor against falling in older adults. Future studies may seek to investigate the mechanisms underpinning this relation.

## WHAT IS ALREADY KNOWN ON THIS TOPIC

Falls affect a large proportion of the older adult population, placing a burden on healthcare systems

Many established predictors of falls exist, including several psychological constructs such as fear of falling, pain, depression, and overconfidence

The literal validity of the statement "pride comes before a fall" has not previously been investigated empirically

## WHAT THIS STUDY ADDS

People with higher levels of pride seem to be at lower risk of falling

Pride may actually be a protective factor against falls, rather than an antecedent

## Introduction

Falls affect a large proportion of older adults,[1 2] often leading to injury and death.[3] The cost of falls to the UK government has been estimated at £1.1bn (€1.24bn; $1.46bn) annually.[4] For those affected, falls can lead to difficulties carrying out activities of daily living and fear of future falls.[5 6] This, in turn, may lead to social isolation and a decline in health.

Predictors of falls include impaired mobility and gait, polypharmacy, history of previous falls, sedentary behaviour, advancing age, female sex, visual impairments, impaired cognition, and environmental factors.[2] Some of these are modifiable and can be targeted by interventions to reduce the risk of falling.[7]

In addition to these well established predictors, certain psychological constructs have been shown to influence falling. For example, fear of falling, pain, depression, and overconfidence have all been implicated in the risk of falling.[8-11] The well known axiom "pride comes before a fall" (a paraphrase of Proverbs chapter 16 verse 18 from the Bible), purports pride as another possible psychological predictor of falling. However, no empirical evidence exists to show whether pride does, in fact, come before a fall. The aim of this study, therefore, was to interrogate whether this saying has literal validity, with the hypothesis that higher levels of pride would be associated with increased risk of future falls.

## Methods

The English Longitudinal Study of Ageing (ELSA) is a multi-wave longitudinal study of health and quality of life in a large sample of adults aged 50 years or older living in England (http://www.elsa-project.ac.uk/). We used data from participants aged 60 years or over in wave 5 (2010/11, referred to hereafter as baseline) and follow-up data collected in wave 7 (2014/15; referred to hereafter as follow-up) for the reported analyses. The wave 5 study assessment contained a question related to pride, and falls were assessed in wave 7. All wave 7 participants included were captured in the wave 5 cohort. All participants gave informed consent before data collection.

Levels of pride were measured as part of the ELSA wave 5 self completion questionnaire using the

following item: "During the past 30 days, to what degree did you feel proud?" Response options on a five point Likert-type scale were "not at all" (5.1% of participants), "a little" (12%), "moderately" (24.3%), "quite a bit" (32.6%), and "very much" (25.9%). For the analyses, we categorised participants as having low (not at all/a little), moderate (moderately), or high (quite a bit/very much) levels of pride. Falls were measured using the following item: "Have you fallen down in the last two years (for any reason)?" or, for those who took part in a previous wave (approximately two years earlier), whether they had fallen down since the date they were last interviewed. The response was a dichotomous yes/no. Only participants aged 60 years and over responded to this question.

### Statistical analysis

We calculated descriptive statistics to characterise the sample at baseline. Logistic regression assessed the association between pride level at baseline and odds of having fallen within the two years before follow-up. We treated pride as an ordered categorical variable, with "low pride" as the reference category, and estimated the association between "moderate" and "high" pride levels and subsequent falls in each model. We calculated unadjusted estimates first, before calculating adjusted estimates, firstly controlling for age, sex, household wealth, and history of falls (number of falls within the two years before baseline), and then adding a broad set of known risk factors for falls[2 12]: mobility problems (problems with activities of daily living; difficulty walking a quarter of a mile), eyesight problems (diagnosis of glaucoma, cataracts, macular degeneration, diabetic retinopathy, registered as sight impaired, eyesight reported as fair/poor/blind), the presence of a limiting long term illness, a diagnosis of arthritis or osteoporosis, medication usage (sum of drugs taken for high blood pressure, diabetes, cholesterol, chest pain, lung condition, asthma, and osteoporosis, and use of blood thinning agents), levels of cognitive function (combined score from executive function and memory tests),[13] and the presence of pain and depression.

Of 6638 participants aged 60 and over who completed the questionnaire at baseline, we excluded 223 because they did not complete the pride question. In the sample of 6415 participants who completed the pride question, 0.6% of all baseline covariate values were missing and 10.3% of participants were missing data on at least one covariate. We used multiple imputation (fully conditional specification using the iterative Markov chain Monte Carlo method to generate imputed datasets that we pooled using Rubin's combination rules) to account for non-response across these demographic, functional, and health confounders. From the sample of 6415 participants with baseline data, 4964 provided data at follow-up (77.4% retention rate). Alongside our regression models using imputed covariates, we did a complete case analysis including only participants with complete data on all covariates.

As the main source of missing data was attrition between waves, we also generated inverse probability weights to account for selection bias (for example, bias introduced if healthier or wealthier participants were more likely to be retained). Specifically, we used covariate data available for all participants with wave 5 data to account for the differential probability of retention in the study as a function of baseline characteristics. To do this, we did a logistic regression analysis predicting retention (non-missingness) using all baseline characteristics. We used the results of this analysis to determine whether participants retained in the sample at follow-up differed from those lost to follow-up across each of the study covariates. We then used the calculated probability of retention to generate the inverse probability weighting variable. This variable accounts for baseline differences between participants lost to follow-up and those retained in the analyses (for example, participants who possess characteristics associated with attrition will be weighted more heavily). We then applied the weighting variable to analyses of those with follow-up data. The inverse probability weighted adjustment provides a partial correction for selection bias in this group, so estimates from these analyses provide a more valid reflection of the association between pride and subsequent falls in English older adults. In a final sensitivity test, we tested the association between pride and falling in a sample of participants excluding those who had fallen at baseline. We used IBM SPSS Statistics version 21 for the analysis.

### Patient involvement

No patients were involved in setting the research question or the outcome measures, nor were they involved in developing plans for recruitment, design, or implementation of the study. No patients were asked to advise on interpretation or writing up of results. There are no plans to disseminate the results of the research to study participants or the relevant patient community.

### Results

Table 1 shows baseline characteristics. Participants were predominantly female (54.6%) with an average age of 69.3 years at baseline. More than half (58.5%) of participants reported having high levels of pride, and more than a quarter (27.9%) had fallen down in the two years before follow-up.

In the unadjusted model, both moderate and high levels of pride at baseline were associated with significantly lower odds of having reported falls in the two years before follow-up compared with low pride (moderate pride: odds ratio 0.82, 95% confidence interval 0.68 to 0.99, P<0.05; high pride: 0.69, 0.58 to 0.81, P<0.001). After control for demographic factors and falls history, moderate pride was unrelated to subsequent falls (odds ratio 0.97, 0.80 to 1.19, P=0.77). In contrast, high pride remained closely associated with a reduced risk of a reported fall (odds ratio 0.81, 0.68 to 0.97, P<0.05) such that high levels of baseline pride


doi: 10.1136/bmj.j5451 | *BMJ* 2017;359:j5451 | the bmj

**Table 1 | Baseline descriptive statistics for participants who did not fall and those who fell during the two years before follow-up (n=4964). Values are numbers (percentages) unless stated otherwise**

| Characteristic | No fall (n=3579) | Fall (n=1385) |
|---|---|---|
| Low pride | 567 (15.8) | 285 (20.6) |
| Moderate pride | 855 (23.9) | 353 (25.45 |
| High pride | 2157 (60.3) | 747 (53.9) |
| Age group, years: | | |
| 60-69 | 2115 (59.1) | 671 (48.4) |
| 70-79 | 1179 (32.9) | 511 (36.9) |
| 80-89 | 276 (7.7) | 186 (13.4) |
| ≥90 | 9 (0.3) | 17 (1.2) |
| Female sex | 1890 (52.8) | 821 (59.3) |
| Wealth*: | | |
| <£100 000 | 604 (16.9) | 300 (21.7) |
| £100 000 to £300 000 | 1465 (40.9) | 543 (39.2) |
| ≥£300 000 | 1510 (42.2) | 542 (39.1) |
| No of falls since previous wave: | | |
| 0 | 2860 (79.9) | 797 (57.5) |
| 1-2 | 644 (18.0) | 423 (30.5) |
| 2-3 | 49 (1.4) | 96 (6.9) |
| ≥4 | 26 (0.7) | 69 (5.0) |
| Activities of daily living, any problem | 469 (13.1) | 348 (25.1) |
| Mean difficulty walking quarter mile† | 1.38 | 1.77 |
| Eyesight problems: | | |
| Glaucoma | 261 (7.3) | 122 (8.8) |
| Cataracts | 914 (25.5) | 481 (34.7) |
| Macular degeneration | 140 (3.9) | 85 (6.1) |
| Diabetic retinopathy | 91 (2.5) | 38 (2.7) |
| Sight impaired (registered) | 20 (0.6) | 11 (0.8) |
| Reported eyesight as fair/poor/blind | 351 (9.8) | 199 (14.4) |
| Limiting long term illness | 1042 (29.1) | 586 (42.3) |
| Arthritis diagnosed | 1409 (39.4) | 718 (51.8) |
| Osteoporosis diagnosed | 308 (8.6) | 164 (11.8) |
| Mean drug use‡ | 0.94 | 1.04 |
| Troubled with pain | 1279 (35.7) | 680 (49.1) |
| Depression§ | 365 (10.2) | 223 (16.1) |
| Mean cognitive function score¶ | 30.40 | 29.53 |

Descriptive results based on imputed datasets.
*Total benefit unit net non-pension wealth in pounds (derived from set of wealth sources including current and savings account balances, shares, national savings, and premium bonds and value of primary and secondary housing, private debt (eg, credit card debt, outstanding loans) and housing debt). Variable was treated as continuous and log transformed for main analyses to reduce skewness.
†Scores range from 1=no difficulty to 4=unable to walk distance.
‡Sum of whether drug was taken for each of high blood pressure, diabetes, cholesterol, chest pain, lung condition, asthma, and osteoporosis and whether blood thinning agents were taken.
§Score of ≥4 on eight item Center for Epidemiological Studies Depression Scale.[14]
¶Combined score from executive function and memory tests[13] (higher scores indicate greater cognitive ability).

reduced the odds of having had a reported fall in the two years before follow-up by 19%. Further adjustment for a large set of known predictors of falls partially attenuated the strength of the association between high pride and risk of falling (odds ratio 0.86, 0.72 to 1.03, P<0.1). Notably, the confidence interval exceeded 1 in this model, so it remains possible that pride may not be an independent predictor of falls when known risk factors are considered. Table 2 shows the estimates for the unadjusted and adjusted analyses.

The complete case analyses (n=4522) supported these findings. Both moderate and high pride were associated with a reduced risk of a reported fall in the two years before follow-up in the unadjusted model (moderate pride: odds ratio 0.79, 0.65 to 0.96, P<0.05; high pride: 0.64, 0.53 to 0.76, P<0.001). High pride remained a key predictor after adjustment for demographic factors and falls history (odds ratio 0.76, 0.63 to 0.91, P<0.005) and in a fully adjusted model (0.80, 0.66 to 0.96, P<0.05).

Findings from our analyses examining predictors of retention from baseline to follow-up showed that participants retained in the sample did not differ from those with missing data with regards to their levels of baseline pride or their falls history. Older participants, those taking more drugs, and those with difficulties walking a quarter of a mile were more likely to drop out of the sample. In contrast, participants with higher levels of cognitive functioning were substantially more likely to be retained, as were those with cataracts or arthritis. We used findings from our retention analysis (see supplementary table) to calculate inverse probability weights to account for each participant's probability of non-response in the follow-up wave given the baseline covariates observed.[15] Weighting the primary analyses to account for bias due to selective attrition did not produce different results in the unadjusted model, in which the regression point estimate was minimally affected (unadjusted logistic regression association between high pride and falls:

**Table 2 | Logistic regression analysis of baseline factors associated with falls occurring in two years before follow-up. Values are odds ratios (95% confidence intervals)**

| | Unadjusted model | +Demographic factors and recent falls | +Physical function and health covariates |
|---|---|---|---|
| Moderate pride* | 0.82 (0.68 to 0.99) | 0.97 (0.80 to 1.19) | 1.01 (0.82 to 1.24) |
| High pride* | 0.69 (0.58 to 0.81) | 0.81 (0.68 to 0.97) | 0.86 (0.72 to 1.03) |
| Age (years) | – | 1.04 (1.03 to 1.05) | 1.03 (1.02 to 1.04) |
| Female sex | – | 1.23 (1.07 to 1.40) | 1.15 (1.00 to 1.32) |
| Wealth (log)† | – | 0.98 (0.94 to 1.02) | 1.02 (0.97 to 1.06) |
| No of recent falls, measured at baseline (0 is base category): | | | |
| 1-2 recent falls | – | 2.17 (1.87 to 2.52) | 2.01 (1.72 to 2.33) |
| 3-4 recent falls | – | 6.64 (4.64 to 9.49) | 5.33 (4.82 to 5.90) |
| ≥4 recent falls | – | 9.67 (6.0 to 15.55) | 7.21 (4.44 to 11.72) |
| Activities of daily living, any problem | – | – | 1.15 (0.94 to 1.40) |
| Difficulty walking quarter mile‡ | – | – | 1.20 (1.10 to 1.32) |
| Eyesight problems: | | | |
| Glaucoma | – | – | 1.06 (0.83 to 1.35) |
| Cataracts | – | – | 1.11 (0.95 to 1.30) |
| Macular degeneration | – | – | 1.10 (0.81 to 1.49) |
| Diabetic retinopathy | – | – | 0.88 (0.58 to 1.35) |
| Sight impaired (registered) | – | – | 0.74 (0.33 to 1.70) |
| Eyesight fair/poor/blind | – | – | 1.07 (0.86 to 1.33) |
| Limiting long term illness | – | – | 0.99 (0.83 to 1.18) |
| Arthritis | – | – | 1.19 (1.03 to 1.37) |
| Osteoporosis | – | – | 0.92 (0.74 to 1.16) |
| Drug use§ | – | – | 0.96 (0.90 to 1.03) |
| Troubled with pain | – | – | 1.16 (1.00 to 1.36) |
| Depression¶ | – | – | 1.10 (0.90 to 1.35) |
| Cognitive function (z score)** | – | – | 1.00 (0.92 to 1.08) |

*Reference category for comparison is "low pride" (ie, those who reported feeling proud "not at all" or "a little" in previous month).
†Natural logarithm of total benefit unit net non-pension wealth measured in pounds.
‡Scores range from 1=no difficulty to 4=unable to walk distance.
§Sum of whether drug was taken for each of high blood pressure, diabetes, cholesterol, chest pain, lung condition, asthma, and osteoporosis and whether blood thinning agents were taken.
¶Score of ≥4 on eight item Center for Epidemiological Studies Depression Scale.[14]
**Combined score from executive function and memory tests[13] (higher scores indicate greater cognitive ability).

odds ratio 0.71, 0.60 to 0.83, P<0.001). Adjusted estimates showed some evidence of attenuation, particularly in the fully adjusted model (adjusted for demographic factors and falls history: odds ratio 0.85, 0.72 to 1.01, P=0.07; fully adjusted: 0.91, 0.76 to 1.08, P=0.27).

Finally, sensitivity analyses showed that exclusion of participants who had fallen within two years of baseline had minimal effect on the results (n=3652; unadjusted logistic regression: odds ratio 0.73, 0.59 to 0.91, P<0.005; adjusted for demographic factors: 0.76, 0.61 to 0.95, P<0.05; fully adjusted model: 0.81, 0.65 to 1.01, P=0.06). This finding was replicated in the complete case analysis (n=3347; unadjusted logistic regression: odds ratio 0.70, 0.57 to 0.87, P<0.005; adjusted for demographic factors: 0.71, 0.56 to 0.89, P<0.005; fully adjusted model: 0.74, 0.59 to 0.94, P<0.05), showing that pride prospectively predicted a reduced risk of falling among participants without a recent history of falls.

## Discussion

Unsurprisingly, this is the first study to investigate temporal associations between pride and subsequent reported falls in a large sample of English older adults. Contrary to the proverb, our findings suggest that pride may actually be protective against falls rather than being a contributing factor. In this study population, high levels of pride were associated with a 31% reduction (unadjusted) in the odds of having had a reported fall within the two years before follow-up. This association remained after control for demographic factors and falls history, such that the odds of having had a reported fall within the two years before follow-up was 19% lower for people with high levels of pride compared with those who had low levels. The strength of this association was only partially attenuated by adjustment for a large set of established predictors of falls. However, we note that the confidence interval exceeded 1 in this model, so it remains possible that pride may not be an independent predictor of falls when known risk factors are considered. In contrast, high pride was robustly associated with a reduced risk of falling in a fully adjusted complete case analyses and also in participants without a recent history of falls. Adjustment for potential bias arising from selective loss to follow-up minimally affected our unadjusted estimate of the link between pride and falls, although this adjustment did attenuate the relation in our most stringently adjusted model.

### Strengths and limitations

The study is not without limitations. Firstly, pride was conceptualised as being a potential antecedent to physical falls in older adults. However, the saying "pride comes before a fall" more likely refers to metaphorical moral or ethical falls, not literal ones. Consequently, the findings against the hypothesis may

not be as peculiar as they first seemed. Secondly, no precise definition of a fall was provided to participants, falls were self reported (possibly introducing recall bias), and there was no external verification that participants had fallen. Finally, although we could investigate the temporal association between baseline pride and subsequent odds of having had a reported fall, the possibility exists that reverse causality may play a role in this relation—that is, that falling may influence subsequent levels of pride. Unfortunately, pride was not measured at wave 7 (follow-up) in the ELSA study, so the possibility of reverse causality could not be robustly examined. That said, our sensitivity analyses showed that the relation between pride and falls was observed among participants without a recent history of falls, providing some evidence against the reverse causality hypothesis. Strengths of the study include the large sample, adjustment for multiple confounders, and the rigorous well controlled data collection protocol implemented by ELSA ensuring data quality.

### Implications

Contrary to the biblical proverb that "pride comes before a fall," these findings suggest the opposite—that pride may actually be protective against falling. Do these findings undermine the validity of biblical wisdom in its application to contemporary health outcomes? The keen biblical scholar will have noted that "pride comes before a fall" is, in fact, an inaccurate paraphrase of Proverbs chapter 16 verse 18, which reads "pride goes before destruction, and a haughty spirit before a fall." The original source material, making use of typical Hebraic parallelism, is more clearly describing an arrogance of attitude rather than a healthy self respect. In the absence of ELSA variables measuring destruction and a haughty spirit, the validity of biblical wisdom in relation to health outcomes remains empirically unchallenged.

The overall incidence of falling was relatively low in this sample (27.9% fell in the two years before follow-up), compared with previously reported falls rates of around 40% per year in older adults.[16 17] Also of note is the apparent low rate of medication use for an older population of adults, as well as the finding that those with fewer mobility problems and higher levels of cognitive function were more likely to be retained at follow-up. Taken together, these findings perhaps suggest that the sample at follow-up was healthier than those not retained, although levels of pride and incidence of falls did not differ between these groups.

Falls in older adults place a considerable burden on the healthcare system. Recommended multifactorial falls prevention strategies include elements of strength and balance training, home hazard assessment and intervention, vision assessment and referral, and medication review with modification or withdrawal.[12] Such strategies target physical and environmental factors but do not address potentially important psychological elements. Although promoting pride-boosting interventions on the basis of this study alone would be a leap too far, these findings raise questions around the importance of promoting positive psychological states as a means of falls prevention. The first step in answering these questions may be to better understand the possible mechanisms driving such an association. In the case of pride, higher levels are likely to be reflective of, or a driver of, higher levels of general subjective wellbeing, which has been shown to have close associations with physical health.[18] Physical manifestations of pride may also make people with high levels of pride less likely to fall—for example, having a more upright and confident posture, walking with the head raised high giving better sight of oncoming obstacles, and walking with a purposeful gait. Such phenomena may be linked to the role of a person's level of self efficacy or confidence in their physical abilities, resulting in the completion of daily activities in a more assured manner. In this sense, by including several controls for daily physical functioning, our most stringently controlled models may have been over-adjusted. This notion is supported by an established literature in the area of fear of falling and falls efficacy,[19] which has shown interesting findings in terms of disparities between psychological (perceived) versus physiological risk factors for falling,[20] lending further credence to the importance of psychological constructs as risk factors for falls.

### Conclusions

In this longitudinal analysis of the association between baseline levels of pride and subsequent reported falls, data did not support the received wisdom that "pride comes before a fall." Conversely, higher levels of pride may actually be protective against falls in older adults. Future studies may seek to explore the drivers of this association.

Contributions: DM had the idea for the study. MD analysed the data. DM, SJF, and MD each made important contributions to interpreting the results and writing the manuscript. MD is the guarantor.

Funding: No funding was provided to conduct this secondary analysis.

Competing interests: All authors have completed the ICMJE uniform disclosure form at http://www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Ethical approval: Ethical approval for all the ELSA waves was granted from the National Research and Ethics Committee, and all procedures adhered to the Helsinki Declaration. Informed consent was obtained from participants before data collection.

Transparency declaration: The lead author (the manuscript's guarantor) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Data sharing: No additional data available.

1 Bandeen-Roche K, Seplaki CL, Huang J. Frailty in Older Adults: A Nationally Representative Profile in the United States. *J Gerontol A Biol Sci Med Sci* 2015;70:1427-34. doi:10.1093/gerona/glv133
2 Ambrose AF, Paul G, Hausdorff JM. Risk factors for falls among older adults: a review of the literature. *Maturitas* 2013;75:51-61. doi:10.1016/j.maturitas.2013.02.009
3 Ayoung-Chee P, McIntyre L, Ebel BE, Mack CD, McCormick W, Maier RV. Long-term outcomes of ground-level falls in the elderly. *J Trauma Acute Care Surg* 2014;76:498-503, discussion 503. doi:10.1097/TA.0000000000000102
4 Davis JC, Robertson MC, Ashe MC, Liu-Ambrose T, Khan KM, Marra CA. International comparison of cost of falls in older adults living in the community: a systematic review. *Osteoporos Int* 2010;21:1295-306. doi:10.1007/s00198-009-1162-0
5 Sekaran NK, Choi H, Hayward RA, Langa KM. Fall-associated difficulty with activities of daily living in functionally independent individuals aged 65 to 69 in the United States: a cohort study. *J Am Geriatr Soc* 2013;61:96-100. doi:10.1111/jgs.12071
6 Visschedijk JH, Caljouw MA, Bakkers E, van Balen R, Achterberg WP. Longitudinal follow-up study on fear of falling during and after rehabilitation in skilled nursing facilities. *BMC Geriatr* 2015;15:161. doi:10.1186/s12877-015-0158-1
7 Karlsson MK, Magnusson H, von Schewelov T, Rosengren BE. Prevention of falls in the elderly--a review. *Osteoporos Int* 2013;24:747-62. doi:10.1007/s00198-012-2256-7
8 Friedman SM, Munoz B, West SK, Rubin GS, Fried LP. Falls and fear of falling: which comes first? A longitudinal prediction model suggests strategies for primary and secondary prevention. *J Am Geriatr Soc* 2002;50:1329-35. doi:10.1046/j.1532-5415.2002.50352.x
9 Gale CR, Cooper C, Aihie Sayer A. Prevalence and risk factors for falls in older men and women: The English Longitudinal Study of Ageing. *Age Ageing* 2016;45:789-94. doi:10.1093/ageing/afw129
10 Wang YC, Lin FG, Yu CP. Depression as a predictor of falls amongst institutionalized elders. *Aging Ment Health* 2012;16:763-70. doi:10.1080/13607863.2012.678479
11 Fortinsky RH, Panzer V, Wakefield D. Alignment between balance confidence and fall risk in later life: Has over-confidence been overlooked? *Health Risk Soc* 2009;11:341-52. doi:10.1080/13698570903015735
12 National Institute for Health and Care Excellence. *Falls in older people: assessing risk and prevention.* NICE, 2013.
13 Steptoe A, Breeze E, Banks J, Nazroo J. Cohort profile: the English longitudinal study of ageing. *Int J Epidemiol* 2013;42:1640-8. doi:10.1093/ije/dys168
14 Radloff LS. The CES-D Scale. *Appl Psychol Meas* 1977;1:385-401. doi:10.1177/014662167700100306
15 Mansournia MA, Altman DG. Inverse probability weighting. *BMJ* 2016;352:i189. doi:10.1136/bmj.i189
16 Hawk C, Hyland JK, Rupert R, Colonvega M, Hall S. Assessment of balance and risk for falls in a sample of community-dwelling adults aged 65 and older. *Chiropr Osteopat* 2006;14:3. doi:10.1186/1746-1340-14-3
17 Rubenstein LZ. Falls in older people: epidemiology, risk factors and strategies for prevention. *Age Ageing* 2006;35(Suppl 2):ii37-41. doi:10.1093/ageing/afl084
18 Steptoe A, Deaton A, Stone AA. Subjective wellbeing, health, and ageing. *Lancet* 2015;385:640-8. doi:10.1016/S0140-6736(13)61489-0
19 Hadjistavropoulos T, Delbaere K, Fitzgerald TD. Reconceptualizing the role of fear of falling and balance confidence in fall risk. *J Aging Health* 2011;23:3-23. doi:10.1177/0898264310378039
20 Delbaere K, Close JC, Brodaty H, Sachdev P, Lord SR. Determinants of disparities between perceived and physiological risk of falling among elderly people: cohort study. *BMJ* 2010;341:c4165. doi:10.1136/bmj.c4165


## Supplementary table