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Using the International Classification of Functioning, Disability and Health (ICF) to find out About Impairments Affecting Falls Self-efficacy in Community-Dwelling Older Adults in India

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Abstract

Physiological and psychological consequences of fear of falling and low falls self-efficacy are important, because they can substantially reduce quality of life. We investigated people aged 55 and over living in India. Fall-related self-efficacy was examined using the Modified Falls Efficacy Scale. Certain Categories from International Classification of Functioning (ICF) were selected as potential predictors of falls. The least absolute shrinkage and selection operator was used for multivariable covariate selection. Sixty-one percent (61%) participants reported low fall-related self-efficacy. Predictors found from ICF were pain in head and neck, increased blood pressure, maintenance of blood pressure, endurance of all muscles of the body, gait pattern functions, muscles of thigh, knee joint, and balance, depression. We identified a small but important spectrum of variables as predictors of low fall-related self-efficacy. Most of these variables identified as predictors of low fall-related self-efficacy might be amenable to exercise programs or medication review.

Keywords

International Classification of Functioning (ICF); Fall-related self-efficacy; Elderly; Balance; Depression; Cognitive decline

Introduction

In India, count of elderly persons above the age of 60 years is growing fast. India has largest number (76.6 million) of elderly population in the world at or over the age of 60, constituting above 8.6% of total population. Falls and recurrent falls are one of the major problems for the elderly and an important cause of morbidity and mortality [1].

About 7% of deaths in India are attributable to un-intentional injuries [2]. Accidental falls are among the leading causes of mortality, especially for the aged. While unintentional falls from higher levels, e.g. from ladders, buildings, or trees are a major cause of death in younger people, same-level falls such as slipping or tripping accounted for the largest number of deaths in those aged 60 and over [3].

Research from high resource settings show that risk factors for falls include muscle weakness, a history of falls, frailty, foot problems, use of four or more prescription medications, use of an assistive device, arthritis, depression, age older than 80 years, limitations in gait, balance, cognition, vision, and activities of daily living [4]. Fear of falling has been associated with de-conditioning, social isolation, more falls, greater frailty, decline in mobility and increased mortality.

Mostly falls happens from a complex interplay of predisposing and precipitating factors in a person's own environment. 1/2 to 2/3rd of falls occur in or around the patient's home especially bathroom. Fear of falling can be rather distressing and can be part of a vicious fall-associated cycle [5] leading to fear-induced activity restriction and further decline in physical functioning, thus increasing risk for falls. According to the World Health Organization (WHO) global report on falls prevention, about 28%–35% of people aged 65 years and above fall in each year and this proportion increases as age and frailty level increase. The prevalence of falls in the population above the age of 60 years in India is in the range 14%–53% [1].

Several interventions in successful fall prevention programs including exercise therapy (working on gait, balance, and lower limb muscle strengthening), medication management, modification of the home environment and multi-factorial interventions, which involved creating a customized plan based on individual risk assessment. Arguably, contextual factors such as the design of buildings, the availability of transport or electricity, or the geographical environment play a specific role for falls in low-income areas but these are less modifiable [4].

The objective of this study was to investigate factors affecting falls in persons aged 55 and over in India. Specifically, we wanted to examine the associations between aspects of functioning, depression, age, and sex on falls self-efficacy.

Methods

Study population and data collection procedures

Participants aged 55 and over were recruited from National Capital Territory- Delhi and Gurgaon, Haryana. Those who opted out of the study and those who were completely dependent in activities of daily living, those who were cognitively declined (HMSE≤19) were excluded from the study.

Participants were interviewed by health professionals (four physical therapists and three occupational therapists) trained in the application and principles of the International Classification of Functioning, Disability and Health (ICF). Data was gathered from patients' medical records and by interviewing the patients as well as the health professionals providing their care.

Measures

Modified Falls Efficacy Scale (MFES)

Tinetti et al. [6] developed the original Falls Efficacy Scale in 1990 as a 10-item self-rated survey assessing a person's confidence in performing activities on a scale of 0 to 10 (0 = not confident, 10

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= completely confident). We used the 14-item version of the MFES as proposed by Hill et al. [7]. This version includes four additional outdoor activities. The overall score is calculated by averaging the scores for all items. The 14-item version has been shown to be valid and reliable in Indian context. For a sample of healthy older women, a normative average score of 9.8 (range 9.2 to 10) was reported.

Because of the skewed distribution of the MFES, the MFES score was dichotomized such that scores of participants not reporting any problems in fall-related self-efficacy (MFES=10) were classified as 0, and scores of participants reporting any problems in fall-related self-efficacy (MFES<10) were classified as 1.

Comprehensive Geriatric ICF Core Set

The ICF is a multipurpose classification which belongs to the WHO family of international classifications. The ICF provides a comprehensive framework for quantifying and depicting functioning, health, and health-related domains. The classification is organized in a hierarchical structure comprising of two main parts, each with separate components.

The first part consists of functioning and disability with 3 components: Body Functions (coded b), Body Structures (s), and Activities and Participation (d). The second part of ICF encompasses contextual factors and has two components: Environmental Factors (e) and Personal Factors (not coded) [8].

Since we were interested in modifiable physical parameters as potential determinants of self- efficacy, we used categories from the Comprehensive Geriatric ICF Core Set components Body Functions and Body Structures for the assessment. Geriatric ICF Core Set is a selection of categories from the entire classification that can serve as a minimal standard for assessment and reporting on functioning and health [8,9]. ICF categories containing the terms "unspecified" and "other specified" in the description were excluded from the analysis, as well as categories with no obvious relationship to falls self-efficacy scale. In total, we used 25 categories from the component Body Functions and 12 categories from the component Body Structures.

We used the generic qualifier, which describes the extent of a problem in functioning. More precisely, the qualifier denotes the range from full functioning "0" (no problem) to "4" complete problem. If the level of functioning of a category was not specified, it was coded with "8"; if a category was inapplicable for an individual, it was coded with "9" [10].

Because all the properties of the qualifier are not sufficiently evaluated, we used, similar to Grill et al. [9], a simplified qualifier: each category of the components Body Functions and Body Structures was graded with "0" for "no impairment" and "1" for "impairment". The response option "9" was set to "0" because an inapplicable ICF category cannot be a problem, and the qualifier "8" was set to missing.

Depression

A Hindi version of the Geriatric Depression Scale (GDS-H) was used. The GDS-H is one of the most frequently used self-reported assessments of depression in Hindi speaking Indian older adults. GDS-H was validated in Indian Community by Ganguli et al. in 1999 [11]. It is a 30-item questionnaire with binary answers: a GDS-H score of 0 – 9 is regarded as no depression, 10 – 19 indicates mild depression, and 20 -30 denotes severe depression [12].

Cognitive function

The Hindi Mental State Examination (HMSE) is the Hindi Version of the Mini Mental State Examination (MMSE) [13]. The HMSE is a screening test for cognitive impairments, developed for the Hindi-speaking semi-literate and illiterate population of rural northern India. The maximum score is 31 which indicate perfect cognitive functioning. Cut-off score is 19 [13].

Balance

The Berg Balance Scale (BBS) is a commonly used tool to assess balance in elderly people. It consists of 14 items that are scored on a scale of 0 to 4, with 4 representing the most independence. The maximum total score is 56. The items include activities such as standing on one leg and transitioning from sitting to standing. BBS has shown high intrarater and interrater reliability (ICC =.98, 14, 15 ratio of variability among subjects to total = .96–1.0, 16 rs =.8817) in elderly population [14].

Additionally, age and sex were recorded.

Statistical methods

Descriptive data are presented as mean and standard deviation for continuous variables and as frequencies for categorical variables.

Observations with incomplete data were excluded in order to get complete cases. To analyze the factors associated with falls-efficacy, we used multivariable logistic regression models. Independent variables were the selected ICF categories from the Comprehensive Geriatric Core Set, BBS, GDSH, HMSE, age, and sex. ICF categories that showed a prevalence of problems in <=10% of the participants were not included in the analyses, because they did not vary sufficiently and could not explain the variability of the dependent variable [15]. The dependent variable was MFES.

Since simultaneous regression of large sets of independent and correlated variables often gives rise to co-linearity and hence variance inflation, we carried out the regression analysis in two steps. First, in order to improve prediction accuracy and to extract small subsets of independent variables which seemingly had the strongest effects on the dependent variable, we used the least absolute shrinkage and selection operator (LASSO) [16] to identify which of the variables were independently associated with falls efficacy. This procedure minimizes the residual sum of squared errors by minimizing the sum of the absolute values of the coefficients. To avoid a large or even inflated variance, as often occurs in least square regression, the LASSO sets some regression coefficients to zero and shrinks others based on a pre-set regularization parameter, the penalty. Thus, the method recursively selects valid subsets of variables with adequate discrimination. The number of included variables can be increased by decreasing penalty. Variables entering the model at a stage with high penalty can be interpreted as having a stronger effect than those entering later when the penalty is relaxed. However, the LASSO does not yield interpretable regression coefficients which denote the magnitude of the effect.

To estimate the magnitude of the effects of single variables, the variable set resulting from the LASSO procedure was then entered into a logistic model with MFES as the dichotomous dependent variable. Multi co-linearity was checked using the variance inflation factor (VIF). VIF values of <10 are considered as indicators for low multi co-linearity [17]. The Hosmer- Lemeshow statistic was used to assess goodness of fit; this statistic should be non-significant (p>0.05) to maintain the null hypothesis of adequate fit. The predictive power

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of the logistic model was determined using the Receiver Operating Characteristics (ROC) curve, which indicates how well a model is able to distinguish between events and non-events. The c-value is a measure for the area under the ROC curve and varies between 0.5 and 1; the higher the c- value, the better the model.

Results

A total of 260 participants (mean age 69 years, range 55 to 92, 50% women) were included. Average score on the fall-related self-efficacy scale was 9.1 (9.4 in men, 8.9 in women). Sixty-one percent of participants reported low fall-related self-efficacy. Demographic characteristics are shown in Table 1. Women more often had low falls self-efficacy (56% vs 40%), higher scores on the depression scale, and lower scores on the balance scale.

Table 1: Characteristics of the study population (stratified for MFES) and results of the LASSO selection, MFES = Modified Falls Efficacy Scale (binary coded: 0 = high falls self-efficacy (MFES=10), 1 = low falls self-efficacy (MFES<10)); BBS = Berg Balance Scale, GDS-H = Geriatric Depression Scale Hindi version; HMSE = Hindi Mental State Examination; LASSO = Least Absolute Shrinkage and Selection Operator; SD = Standard Deviation; CI = Confidence Interval; N =Number.

Variable N (%)	MFES=0 101 (38.8)	MFES=1 159 (61.2)	Total 260 (100.0)	LASSO Selection
Sex Female, N (%)	40 (39.6)	90 (56.6)	130 (50.0)	
Age Mean (SD) 95% CI	67.8 (7.3) 66.3 - 69.2	69.8 (7.9) 68.5 - 71.0	69.0 (7.7) 68.0 - 69.9	
BBS Mean (SD) 95% CI	53.8 (3.3) 53.1 - 54.4	46.1 (9.0) 44.7 - 47.6	49.1 (8.2) 48.1 - 50.1	X
GDS-H Mean(SD) 95% CI	1.5(2.7) 1.0 -2.0	3.8 (4.6) 3.0 - 4.5	2.9(4.1) 2.4 -3.4	X
HMSE Mean (SD) 95% CI	25.0 (2.7) 24.5 - 25.5	25.0 (2.8) 24.6 - 25.5	25.0 (2.8) 24.7 - 25.4	

The description and selection of the ICF categories is summarized in Table 2. The categories pain in stomach or abdomen (b28012), bones of thigh (s75000), hip joint (s75001), and ligaments and fasciae of thigh (s75003) were excluded because of low prevalence. All explanatory variables had VIF values of <4.5.

Table 2: Description and results of the selection of ICF variables (value = impairment, stratified for MFES), ICF = International Classification of Functioning, Disability and Health (ICF); MFES = Modified Falls Efficacy Scale (binary coded: 0 = high falls self-efficacy (MFES=10), 1 = low falls self-efficacy (MFES<10)); LASSO = Least Absolute Shrinkage and Selection Operator; N =Number

ICF Variable (Description) N (%)	MFES=0 101 (38.8)	MFES=1 159 (61.2)	Total 260 (100.0)	Prevalence > 10 %	LASSO Selection
b28010 pain in head and neck	11 (10.9)	63 (39.6)	74 (28.5)	X	X
b28011 pain in chest	6 (5.9)	24 (15.1)	30 (11.5)	X	
b28012 pain in stomach or abdomen	6 (5.9)	20 (12.6)	26 (10.0)		
b28013 pain in back	17 (16.8)	68 (42.8)	85 (32.7)	X	
b28014 pain in upper limb	13 (12.9)	45 (28.3)	58 (22.3)	X	
b28015 pain in lower limb	18 (17.8)	72 (45.3)	90 (34.6)	X	
b28016 pain in joints	32 (31.7)	91 (57.2)	123 (47.3)	X	
b4150 functions of arteries	12 (11.9)	59 (37.1)	71 (27.3)	X	
b4152 functions of veins	12 (11.9)	45 (28.3)	57 (21.9)	X	
b4200 increased blood pressure	30 (29.7)	88 (55.4)	118 (45.4)	X	X
b4202 maintenance of blood pressure	8 (7.9)	47 (29.6)	55 (21.2)	X	X
b7100 mobility of a single joint	27 (26.7)	65 (40.9)	92 (35.4)	X	
b7101 mobility of several joints	10 (9.9)	51 (32.1)	61 (23.5)	X	
b7102 mobility of joints generalized	6 (5.9)	26 (16.4)	32 (12.3)	X	
b7300 power of isolated muscles and muscles groups	10 (9.9)	30 (18.9)	40 (15.4)	X	
b7301 power of muscles of one limb	9 (8.9)	25 (15.7)	34 (13.1)	X	
b7302 power of muscles of one side of the body	5 (5.0)	22 (13.8)	27 (10.4)	X	
b7303 power of muscles in lower half of the body	8 (7.9)	39 (24.5)	47 (18.1)	X	
b7304 power of muscles of all limbs	5 (5.0)	29 (18.2)	34 (13.1)	X	
b7305 power of muscles of the trunk	5 (5.0)	24 (15.1)	29 (11.2)	X	
b7306 power of all muscles of the body	10 (9.9)	42 (26.4)	52 (20.0)	X	
b7400 endurance of isolated muscles	7 (6.9)	36 (22.6)	43 (16.5)	X	
b7401 endurance of muscle groups	7 (6.9)	41 (25.8)	48 (18.5)	X	
b7402 endurance of all muscles of the body	14 (13.9)	81 (50.9)	95 (36.5)	X	X
b770 gait pattern functions	7 (6.9)	69 (43.4)	76 (29.2)	X	X
s75000 bones of thigh	0 (0.0)	23 (14.5)	23 (8.9)		
s75001 hip joint	0 (0.0)	23 (14.5)	23 (8.9)		
s75002 muscles of thigh	1 (1.0)	37 (23.3)	38 (14.6)	X	X
s75003 ligaments and fasciae of thigh	1 (1.0)	17 (10.7)	18 (6.9)		
s75010 bones of lower leg	6 (5.9)	34 (21.4)	40 (15.4)	X	
s75011 knee joint	25 (24.8)	85 (53.5)	110 (42.3)	X	X
s75012 muscles of lower leg	12 (11.9)	64 (40.3)	76 (29.2)	X	
s75013 ligaments and fasciae of lower leg	6 (5.9)	31 (19.5)	37 (14.2)	X	
s75020 bones of ankle and foot	7 (6.9)	23 (14.5)	30 (11.5)	X	
s75021 ankle joint and joints of foot and toes	8 (7.9)	25 (15.7)	33 (12.7)	X	
s75022 muscles of ankle and foot	11 (10.9)	36 (22.6)	47 (18.1)	X	
s75023 ligaments and fasciae of ankle and foot	6 (5.9)	31 (19.5)	37 (14.2)	X	

The variable selection procedure yielded five categories from the component Body Functions: pain in head and neck (b28010), endurance of all muscles of the body (b7402), increased blood pressure (b4200), maintenance of blood pressure (b4202), and gait pattern functions (b770)); two categories from the component Body Structures: muscles of thigh (s750029) and knee joint (s75011); and the summary scores of the BBS and the GDS-H.

Table 3 explains the corresponding logistic regression between the factors of low fall related self-efficacy. Pain in head and neck, increased blood pressure, and impairments in maintenance of blood pressure, endurance of all muscles of the body, gait pattern functions, muscles of thigh, and knee joint were independent risk factors for low fall-related self-efficacy. Likewise, low balance and high scores on the depression scale indicated low fall-related self-efficacy.

Table 3: Shows the results of the corresponding logistic regression, CI = Confidence Interval, BBS- Berg Balance Scale, GDS- Geriatric Depression Scale

Variable (Description)	Odds ratio	95 % CI	p-value	Standardized Estimates
Intercept			0.0032	
b28010 pain in head and neck	3.36	1.45 – 7.79	0.0047	0.30
b4200 increased blood pressure	1.71	0.79 – 3.70	0.1717	0.15
b4202 maintenance of blood pressure	2.05	0.69 – 6.12	0.1971	0.16
b7402 endurance of all muscles of the body	2.62	1.16 – 5.89	0.0204	0.26
b770 gait pattern functions	1.70	0.60 – 4.82	0.3225	0.13
s75002 muscles of thigh	13.15	1.50 – 115.53	0.0201	0.50
s75011 knee joint	1.41	0.67 – 2.99	0.3663	0.09
BBS Berg Balance Scale	0.85	0.77 – 0.93	0.0003	-0.76
GDS-H Geriatric Depression Scale	1.12	1.01 – 1.24	0.0308	0.26

Discussion

To our knowledge, this is the first study to examine the relationship between fall-related self- efficacy (MFES) and impairments in older

adults in India. Interestingly, a high percentage of older adults had low perceived self-confidence at avoiding falls during normal daily activities. A number of specific risk factors from the components Body Functions and Body Structures were associated with low MFES.

We showed that pain in head and neck (b28010) was a relevant predictor for MFES. Kendall et al. [18] found that intense neck pain was associated with increased anterior-posterior body sway which is associated with significant changes in postural balance. Bishop et al. [19] found that even mild pain can be a predictor for changes in balance and mobility. Experience of neck pain was shown to be associated with an increased risk of fear of falling [20]. Migraine-associated vertigo and cervico-genic headache contributes to the fear of falling. Likewise, dizziness has been shown to lead to decreased falls self-efficacy [21].

Our study showed that endurance of all muscles of the body (b7402) was predictors for MFES. Literature showing this association is scarce. Duray et al. [22] found that physical fitness to improve the muscles strength and endurance had direct effect on falling risk and fear of falling. Physical inactivity, lower physical fitness, and the interaction between them directly lead to deterioration in the health status and functional capacity of the elderly.

We showed that gait pattern function (b770) was a relevant predictor for MFES. Nakakubo et al [23] found that Walk Ratio would enable the prediction of fall risk among community-dwelling elderly people. Smallest Walk Ratio was independently associated with falling in the elderly people. Short step length has chances of lower risk of fall. Rochat and colleagues [24] described a reciprocal relationship between mobility performance and falls self-efficacy. They found that both fall-related self-efficacy and gait could be improved by exercise. Maricarmen et al. [25] suggested reduced walking speed is consistent with age-related changes, and other contributors to an altered gait is impaired activity specific physical balance and stability, lower extremity muscles strength, and fear of falling.

Muscles of thigh (s75002) were relevant predictors of MFES. Borges et al. [26] found out that fall-related self-efficacy are associated with the reduction in knee extensor and plantar flexor strength which indicates the need for a preventive rehabilitation focused on strengthening lower extremity muscles, especially knee extensors and planter flexors muscle. Songvut et al. [27] says that both quadriceps torque and physical balance were positively correlated. Muscles strengthening based program was effective to improve postural balance and the levels fall- related health beliefs. Kachhwaha et al. [28] found that positive and large effect of strength training exercises in the management of fall related gait kinematics in elderly generate marked difference in improvement in cadence and fear of falling.

Impairment of the knee joint (s75011) is a relevant predictor of MFES. Tamura et al. [29] found that physical balance systems were impaired in older people with knee Osteoarthritis. This is in line with studies showing that lower extremity arthritis was associated with both low fall- related self-efficacy and fear of falling in older adults in long-term care. Lower extremity strength gain has also been associated with improvement in confidence in mobility and falls efficacy scale [30].

In our study, increased blood pressure (b4200) and maintenance of blood pressure (b4202) were associated with falls self-efficacy. A strong link between orthostatic hypotension and falls has not been documented, but taking medication for hypertension is known to be associated with fear of falling [31].

Balance (BBS) was the strongest predictor of MFES. This is concordant with the results of Gillespie et al [32], who reported that poor balance was associated with low falls efficacy. There is evidence that balance in older persons can be improved by Yoga, and Tai Chi to give promising interventions to manage fear of falling and improve balance [33,34].

Depression as operationalized with the GDS-H came up as another important predictor in our study. Low falls self-efficacy can lead to participation restrictions such as social isolation, which can then result in depression in older adults [35,36]. However, depression might also limit activities and lead to de-conditioning and increased frailty.

There was no evidence that age and sex were independent predictors of falls self-efficacy. It is reasonable to argue that functioning as indicated by impairment in Body Functions and Body Structures is a stronger risk factor for MFES than biological age and that the effects seen in women in bivariate analysis might be attributable to higher impairment.

Our study has some limitations. We are well aware that the present sample is a selection of people with high educational and economic status and not representative of the entire situation in India, e.g. rural areas. Moreover, because of the cross-sectional design, no conclusions can be made on the direction of causality. Finally, the dependent variable MFES was dichotomized, resulting in potential loss of information but making interpretation of the results more straightforward [37].

The main strength of this study lies in the description of impairments and in the selection of a restricted set of predictors of low falls self-efficacy. The ICF seems to be a helpful and universal framework to characterize impairments in an ageing population.

Conclusions

India is an ageing society where falls pose a major public health problem. Fear of falling and low falls efficacy can substantially reduce levels of activity, participation and quality of life even in the absence of falls. In this study, we identified a small but important spectrum of variables as predictors of low fall-related self-efficacy. Most of these variables might be amenable to exercise programs or medication review. These findings should be taken into account when developing effective interventions to break the vicious fall-associated cycle and to improve fall-related self-efficacy. Additional studies should be done to show the associations between levels of activity and participation and falls self-efficacy and the effects of environment. Repeated studies with a representative sample of rural community dwelling older people would also add to the knowledge contributing to falls prevention in India.

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Competing interests

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References

1. Ministry of Social Justice and Empowerment, Government of India. National Policy for Senior Citizens; March 2011.
2. Jagnoor J, Suraweera W, Keay L, Ivers RQ, Thakur J et al. (2012) Unintentional injury mortality in India, 2005: nationally representative mortality survey of 1.1 million homes. BMC public health 12: 487.
3. Jagnoor J, Suraweera W, Keay L, Ivers RQ, Thakur JS et al. (2011) Childhood and adult mortality from unintentional falls in India. Bulletin of the World Health Organization 89: 733-40.
4. Deandrea S, Lucenteforte E, Bravi F, Foschi R, La Vecchia C, et al. (2010) Risk factors for falls in community-dwelling older people: a systematic review and meta-analysis. Epidemiology 21: 658-68.
5. Waleed Al-Faisal. Falls Prevention for Older Persons.
6. Tinetti ME, Richman D, Powell L (1990) Falls efficacy as a measure of fear of falling. Journal of gerontology 45: P239-43.
7. Hill KD, Schwarz JA, Kalogeropoulos AJ, Gibson SJ (1996) Fear of falling revisited. Archives of physical medicine and rehabilitation 77: 1025-9.
8. Grill E, Stucki G (2011) Criteria for validating comprehensive ICF Core Sets and developing brief ICF Core Set versions. Journal of rehabilitation medicine: official journal of the UEMS European Board of Physical and Rehabilitation Medicine 43: 87-91.
9. Grill E, Joisten S, Swoboda W, Stucki G (2007) Early-stage impairments and limitations of functioning from the geriatric ICF core set as determinants of independent living in older patients after discharge from post-acute rehabilitation. Journal of rehabilitation medicine: official journal of the UEMS European Board of Physical and Rehabilitation Medicine 39: 591-7.
10. Bickenbach J CA, Rauch A, Stucki G (2012) Die ICF Core Sets - Manual for Clinical Practice. Bern: Hogrefe.
11. Grill E, Muller M, Quittan M, Strobl R, Kostanjsek N, et al. (2011) Brief ICF Core Set for patients in geriatric post-acute rehabilitation facilities. Journal of rehabilitation medicine: official journal of the UEMS European Board of Physical and Rehabilitation Medicine 43: 139-44.
12. Yesavage JA, Brink TL, Rose TL, Lum O, Huang V, et al. (1982) Development and validation of a geriatric depression screening scale: a preliminary report. Journal of psychiatric research 17: 37-49.
13. Ganguli M, Ratcliff G, Chandra V, Sharma S, Gilby J, et al. (1995) A Hindi version of the MMSE: the development of a cognitive screening instrument for a largely illiterate rural elderly population in India. International journal of geriatric psychiatry 10: 367-77.
14. Berg KO, Wood-Dauphinee SL, Williams JI, Maki B (1992) Measuring balance in the elderly: validation of an instrument. Canadian journal of public health 83: S7-11.
15. Kus S, Oberhauser C, Cieza A (2012) Validation of the brief International Classification of Functioning, Disability, and Health (ICF) core set for hand conditions. Journal of hand therapy: official journal of the American Society of Hand Therapists 25: 274-86.
16. Tibshirani R (1996) Regression shrinkage and selection via the lasso. J Roy Statist Soc 58: 267-88.
17. Der G, Everitt BS (2012) Applied Medical Statistics Using SAS: CRC Press.
18. Kendall JC, Hvid LG, Hartvigsen J et al. (2018) Impact of musculoskeletal pain on balance and concerns of falling in mobility-limited, community-dwelling Danes over 75 years of age: a cross-sectional study. Aging Clin Exp Res 30: 969–975.
19. Bishop MD, Meuleman J, Robinson M, Light KE (2007) Influence of pain and depression on fear of falling, mobility, and balance in older male veterans. Journal of rehabilitation research and development 44: 675-83.
20. Kim S, So WY (2013) Prevalence and correlates of fear of falling in Korean community-dwelling elderly subjects. Experimental gerontology 48: 1323-8.
21. Menant JC, Wong A, Sturnieks DL, Close JC, Delbaere K, et al. (2013) Pain and anxiety mediate the relationship between dizziness and falls in older people. Journal of the American Geriatrics Society 61: 423-8.
22. Mehmet D, Arzu G (2017) The relationship between physical fitness and falling risk and fear of falling in community-dwelling elderly people with different physical activity levels. Turk J Med Sci 47: 455-462.
23. Sho N, Takehiko D (2018) Association of walk ratio during normal gait speed and fall in community-dwelling elderly people. Gait & Posture 66: 151-154.
24. Rochat S, Martin E, Piot-Ziegler C, Najafi B, Aminian K, et al. (2008) Falls self-efficacy and gait performance after gait and balance training in older people. Journal of the American Geriatrics Society 56: 1154-6.
25. Maricarmen CJ (2017) Normal Changes in Gait and Mobility Problems in the Elderly. Physical medicine and rehabilitation 28: 713–725.
26. Viviane SB, Nayara SS, Ariana CM, Nathália CX, Lorene Elka SB (2017) Falls, muscle strength, and functional abilities in community-dwelling elderly women; Fisioter. Mov., Curitiba, v. 30, n. 2, p. 357-366.
27. Punlomso S, Srimuang P, Tudpor K (2020) Fall Prevention by Otago Exercise Program based on Health Belief Model in Community-Dwelling Older Persons. Indian Journal of Physiotherapy & Occupational Therapy 14: p245-252.
28. Kachhwaha R, Sriraghunath S, Arun k, Arun kumar D; Vyas I (2018) A Study to Analyze the Efficacy of Strength Training Exercise for Fall Related Gait Kinematics in Elderly-An Experimental Study. Indian Journal of Physiotherapy & Occupational Therapy 12: p101-106.
29. Takayuki T, Yohei O, Syunsuke K, Kento S, TaisukeTomatsu,Satoshi Machida (2016) The Impaired Balance Systems Identified by the BESTest in Older Patients With Knee Osteoarthritis. PM&R 8: 869-875.
30. Chandler JM, Duncan PW, Kochersberger G, Studenski S (1998) Is lower extremity strength gain associated with improvement in physical performance and disability in frail, community-dwelling elders? Archives of physical medicine and rehabilitation 79: 24-30.
31. Austin N, Devine A, Dick I, Prince R, Bruce D (2007) Fear of falling in older women: a longitudinal study of incidence, persistence, and predictors. Journal of the American Geriatrics Society 55: 1598-603.
32. Gillespie SM, Friedman SM (2007) Fear of falling in new long-term care enrollees. Journal of the American Medical Directors Association 8: 307-13.
33. Schmid AA, Van Puymbroeck M, Koceja DM (2010) Effect of a 12-week yoga intervention on fear of falling and balance in older adults: a pilot study. Archives of physical medicine and rehabilitation 91: 576-83.
34. Van Haastregt JC, Zijlstra GA, Van Rossum E, van Eijk JT, Kempen GI (2008) Feelings of anxiety and symptoms of depression in community-living older persons who avoid activity for fear of falling. The American journal of geriatric psychiatry: official journal of the American Association for Geriatric Psychiatry 16: 186-93.
35. Gagnon N, Flint AJ, Naglie G, Devins GM (2005) Affective correlates of fear of falling in elderly persons. The American journal of geriatric psychiatry: official journal of the American Association for Geriatric Psychiatry 13: 7-14.
36. Ganguli M, Dube S, Johnston JM, Pandav R, Chandra V, et al. (1999) Depressive symptoms, cognitive impairment and functional impairment in a rural elderly population in India: a Hindi version of the geriatric depression scale (GDS-H). Int J Geriatr Psychiatry 14: 807-20.
37. Strawberry KG, Marjorie HW (2007) How Tai Chi improves balance: Biomechanics of recovery to a walking slip in impaired seniors. Gait & Posture 25: 205-214.

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