Safety Literature 4th September 2022

A model for predicting fall risks of hospitalized elderly in Taiwan-a machine learning approach based on both electronic health records and comprehensive geriatric assessment

Chu WM, Kristiani E, Wang YC, Lin YR, Lin SY, Chan WC, Yang CT, Tsan YT. Front. Med. (Lausanne) 2022; 9: e937216.

Abstract

BACKGROUNDS: Falls are currently one of the important safety issues of elderly inpatients. Falls can lead to their injury, reduced mobility and comorbidity. In hospitals, it may cause medical disputes and staff guilty feelings and anxiety. We aimed to predict fall risks among hospitalized elderly patients using an approach of artificial intelligence.

MATERIALS AND METHODS: Our working hypothesis was that if hospitalized elderly patients have multiple risk factors, their incidence of falls is higher. Artificial intelligence was then used to predict the incidence of falls of these patients. We enrolled those elderly patients aged >65 years old and were admitted to the geriatric ward during 2018 and 2019, at a single medical center in central Taiwan. We collected 21 physiological and clinical data of these patients from their electronic health records (EHR) with their comprehensive geriatric assessment (CGA). Data included demographic information, vital signs, visual ability, hearing ability, previous medication, and activity of daily living. We separated data from a total of 1,101 patients into 3 datasets: (a) training dataset, (b) testing dataset and (c) validation dataset. To predict incidence of falls, we applied 6 models: (a) Deep neural network (DNN), (b) machine learning algorithm extreme Gradient Boosting (XGBoost), (c) Light Gradient Boosting Machine (LightGBM), (d) Random Forest, (e) Stochastic Gradient Descent (SGD) and (f) logistic regression.

RESULTS: From modeling data of 1,101 elderly patients, we found that machine learning algorithm XGBoost, LightGBM, Random forest, SGD and logistic regression were successfully trained. Finally, machine learning algorithm XGBoost achieved 73.2% accuracy.

CONCLUSION: This is the first machine-learning based study using both EHR and CGA to predict fall risks of elderly. Multiple risk factors of falls in hospitalized elderly patients can be put into a machine learning model to predict future falls for early planned actions. Future studies should be focused on the model fitting and accuracy of data analysis.

Language: en

Keywords
elderly; machine learning; prediction model; comprehensive geriatric assessment; fall accident

A systematic review of fall risk factors in stroke survivors: towards improved assessment platforms and protocols

Abdollahi M, Whitton N, Zand R, Dombovy M, Parnianpour M, Khalaf K, Rashedi E. Front. Bioeng. Biotechnol. 2022; 10: e910698.

Abstract

Background/Purpose: To prevent falling, a common incident with debilitating health consequences among stroke survivors, it is important to identify significant fall risk factors (FRFs) towards developing and implementing predictive and preventive strategies and guidelines. This review provides a systematic approach for identifying the relevant FRFs and shedding light on future directions of research.

METHODS: A systematic search was conducted in 5 popular research databases. Studies investigating the FRFs in the stroke community were evaluated to identify the commonality and trend of FRFs in the relevant literature.

RESULTS: twenty-seven relevant articles were reviewed and analyzed spanning the years 1995-2020. The results confirmed that the most common FRFs were age (21/27, i.e., considered in 21 out of 27 studies), gender (21/27), motion-related measures (19/27), motor function/impairment (17/27), balance-related measures (16/27), and cognitive impairment (11/27). Among these factors, motion-related measures had the highest rate of significance (i.e., 84% or 16/19). Due to the high commonality of balance/motion-related measures, we further analyzed these factors. We identified a trend reflecting that subjective tools are increasingly being replaced by simple objective measures (e.g., 10-m walk), and most recently by quantitative measures based on detailed motion analysis.

CONCLUSION: There remains a gap for a standardized systematic approach for selecting relevant FRFs in stroke fall risk literature. This study provides an evidence-based methodology to identify the relevant risk factors, as well as their commonalities and trends. Three significant areas for future research on post stroke fall risk assessment have been identified: 1) further exploration the efficacy of quantitative detailed motion analysis; 2) implementation of inertial measurement units as a cost-effective and accessible tool in clinics and beyond; and 3) investigation of the capability of cognitive-motor dual-task paradigms and their association with FRFs.

Language: en

Keywords

Body pain and functional disability predict falls in Chinese older adults: a population-based cohort study

Abstract

BACKGROUND: Falls are major health care concerns for older adults. Pain is associated with increased falls in older adults. However, the impact of pain on functional disability and how this might predispose Chinese older adults to fall is unclear.

AIM: The aim of the current study was to examine whether functional disability mediates the association of any pain, back and/or shoulder pain (B-S pain) and leg and/or knees pain (L-K pain) with falls and serious falls.

METHODS: The study included 7619 community-dwelling older adults aged 60 years and above from the China Health and Retirement Longitudinal Study. Baseline data were from Wave 3 and fall outcomes were from Wave 4. Functional disability was measured by the ADLs and IADLs scales. We used a logistic regression model to investigate associations between pain and fall outcomes and KHB method to estimate the mediating effects of ADL/IADL disability on pain-fall relationship.

RESULTS: After fully adjusting for covariates, the three pain measures (any pain, back and/or shoulder pain, leg and/or knees pain) were significantly associated with fall outcomes. When body pain was compared with no body pain, the proportion mediated by the ADL disability was 28.43% for falls, while the proportion mediated by IADL disability was 17.96% for falls. For associations between specific parts of body pain and falls, the proportions mediated by the ADL disability were 34.18% and 35.89% in back and/or shoulder pain and leg and/or knees pain, respectively, but the proportions reduced to 21.98% and 20.82% when mediated by the IADL disability. However, there were no significant contributions of ADL/IADL disability for the association between specific part of body pain and serious falls.

CONCLUSIONS: Pain in general and pain in specific body sites were significantly associated with an increased risk of fall among older adults living in community in China. Functional disability partially mediated the relationship of pain with falls.

Language: en

Keywords

Falls; Chinese older adults; Functional disability; Mediation analysis; Pain

Differences in fall-related emergency departments visits with and without an Injury, 2018

Abstract

BACKGROUND: Falls, with or without an injury, often affect the health of older adults (65+).

METHODS: We used the 2018 Healthcare Cost and Utilization Project to describe older adults' fall-related ED visits. We defined fall-related ED visits as those with a fall external cause of morbidity code and fall-injury related ED visits as those with an injury diagnosis code and a fall external cause of morbidity code. Percentages of fall-related and fall-injury related ED visits were analyzed by select characteristics.

RESULTS: Over 86% of fall-related ED visits were fall-injury related. A higher percentage of females (87%) and rural (88%) older adults' fall-related ED visits were fall-injury related compared to males (85%) and urban older adults (86%). A higher percentage of fall-related ED visits without a coded injury (33%) were hospitalized compared to those with a coded injury (29%).

CONCLUSION: The majority of fall-related ED visits included an injury diagnosis.

PRACTICAL APPLICATIONS: Researchers can consider which method of measuring ED visits related to falls is most appropriate for their study. Limiting fall-related ED visits to only those where an injury diagnosis is also present may underestimate the number of fall-related ED visits but may be appropriate for researchers specifically interested in fall injuries.

Language: en

Emergency readmissions following geriatric ground-level falls: how does frailty factor in?

Hosseinpour H, El-Qawaqzeh K, Stewart C, Akl MN, Anand T, Culbert MH, Nelson A, Bhogadi SK, Joseph B. Injury 2022; ePub(ePub): ePub.

Abstract

BACKGROUND: Ground-level falls (GLFs) in older adults are increasing as life expectancy increases, and more patients are being discharged to skilled nursing facilities (SNFs) for continuity of care. However, GLF patients are not a homogenous cohort, and the role of frailty remains to be assessed. Thus, the aim of this study is to examine the impact of frailty on the in-hospital and 30-day outcomes of GLF patients.

MATERIALS AND METHODS: This is a cohort analysis from the Nationwide Readmissions Database 2017. Geriatric (age ≥65 years) trauma patients presenting following GLFs were identified and grouped based on their frailty status. The associations between frailty and 30-day mortality and emergency readmission were examined by multivariate regression analyses adjusting for patient demographics and injury characteristics.

RESULTS: A total of 100,850 geriatric GLF patients were identified (frail: 41% vs. non-frail: 59%). Frail GLF patients were younger (81[74-87] vs. 83[76-89] years; p<0.001) and less severely injured-Injury Severity Score [ISS] (4[1-9] vs. 5[2-9]; p<0.001). Frail patients had a higher index mortality (2.9% vs. 1.9%; p<0.001) and higher 30-day readmissions (14.0% vs. 9.8%; p<0.001). Readmission mortality was also higher in the frail group (15.2% vs. 10.9%; p<0.001), with 75.2% of those patients readmitted from an SNF. On multivariate analysis, frailty was associated with 30-day mortality (OR 1.75; p<0.001) and 30-day readmission (OR 1.49; p<0.001).

CONCLUSION: Frail geriatric patients are at 75% higher odds of mortality and 49% higher odds of readmission following GLFs. Of those readmitted on an emergency basis, more than one in seven patients died, 75% of whom were readmitted from an SNF. This underscores the need for optimization plans that extend to the post-discharge period to reduce readmissions and subsequent high-impact consequences.

Language: en

Keywords

Factors associated with reporting of the Prevention of Falls Network Europe (ProFaNE) core outcome set domains in randomized trials on falls in older people: a citation analysis and correlational study

Abstract

BACKGROUND: Core outcome sets are advocated as a means to standardize outcome reporting across randomized controlled trials (RCTs) and reduce selective outcome reporting. In 2005, the Prevention of Falls Network Europe (ProFaNE) published a core outcome set identifying five domains that should be measured and reported, at a minimum, in RCTs or meta-analysis on falls in older people. As reporting of all five domains of the ProFaNE core outcome set has been minimal, we set out to investigate factors associated with reporting of the ProFaNE core outcome set domains in a purposeful sample of RCTs on falls in older people.

METHODS: We conducted a systematic citation analysis to identify all reports of RCTs focused on falls in older people that cited the ProFaNE core outcome set between October 2005 and July 2021. We abstracted author-level, study-level, and manuscript-level data and whether each domain of the ProFaNE core outcome set was reported. We used penalized LASSO regression to identify factors associated with the mean percentage of ProFaNE core outcome set domains reported.

RESULTS: We identified 85 eligible reports of RCTs. Articles were published between 2007 and 2021, described 75 unique RCTs, and were authored by 76 unique corresponding authors. The percentage of ProFaNE core outcome set domains reported ranged from 0 to 100%, with a median of 40% and mean (standard deviation, SD) of 52.2% (25.1). RCTs funded by a non-industry source reported a higher mean percentage of domains than RCTs without a non-industry funding source (estimated mean difference = 17.5%; 95% confidence interval (CI) 1.8-33.2). RCTs examining exercise (15.4%; 95% CI 1.9-28.9) or multi-component/factorial (17.4%; 95% CI 4.7-30.1) interventions each reported a higher mean percentage of domains than RCTs examining other intervention types.

CONCLUSIONS: We found that RCTs funded by at least one non-industry source, examining exercise or multi-component/factorial interventions, reported the highest percentages of ProFaNE core outcome set domains.

FINDINGS may help inform strategies to increase the impact of the ProFaNE core outcome set. Ultimately, this may lead to enhanced knowledge of the effectiveness and safety of interventions to prevent and/or manage falls in older people.

Language: en

Falls in senior adults: demographics, cost, risk stratification, and evaluation

Abstract

Falls occur at staggering rates across the country, with 25% of Americans over 65 reporting annual falls. The fall rate in Missourian older adults is 27.3%. Eighty-six percent of fall-related deaths happen over the age of 65. There are many intrinsic and extrinsic factors that contribute to falls, with some factors that can be targeted and optimized by physicians. There are nuances to the history and physical that can help physicians identify these risk factors.

Language: en

Falls in senior adults part II: management, treatment, prevention, and therapy plans

Abstract

In this follow up to our Falls in Senior Adults Part I article,1 we address further management of falls after fall risk has been identified. This review will focus on the current literature on the treatment, therapy plans, and prevention of falls in senior adults.

Language: en

Is dual-task training clinically beneficial to improve balance and executive function in community-dwelling older adults with a history of falls?

Abstract

PURPOSE: To date, the effects of dual-task training on balance underlying cognitive function remain unclear. Therefore, this study was to verify the effects of cognitive-physical dual-task training on balance and executive function in community-dwelling older adults with a history of falls.

METHOD: Fifty-eight participants were randomly allocated to the experimental group (EG) receiving cognitive-physical dual-task training (n = 29) or to the control group (CG) receiving functional balance training (n = 29). After 12 sessions for 6 weeks, the One Leg Standing Test (OLST), the Timed UP and Go (TUG), and part B of the Trail-Making Test (TMT-B) were implemented to examine static and dynamic balance and executive function.

RESULTS: After the 12 sessions, the EG showed a greater improvement in the OLST ($p < 0.001$; $\eta(2) = 0.332$), the TUG ($p < 0.001$; $\eta(2) = 0.375$), and the TMT-B ($p < 0.001$; $\eta(2) = 0.224$) compared to the CG.

CONCLUSION: These results indicate that dual-task training is clinically beneficial to improving static and dynamic balance as well as executive function in older adults with a history of falls. These findings shed new light on a clinical implication that executive function should be considered in balance training for older adults.

Language: en

Keywords

Otago exercise program plus cognitive dual-task can reduce fall risk, improve cognition and functioning in older adults

Santos PC, Machado DRL, Abdalla PP, Santos CV, Lopes S, Martins AC, Mota J, Mesquita C. Curr. Aging Sci. 2022; ePub(ePub): ePub.

Abstract

BACKGROUND: The risk of falling increases with neuromusculoskeletal and cognitive changes resulting from aging. Physical exercise shows beneficial effects on the risk of falling, but the results are unknown when associated with cognitive activity dual-task (DT) Objective: The objective of the study was to evaluate the impacts of the Otago Exercise Program (OEP) plus DT cognitive activity on the risk of falling in older adults.

METHOD: 36 older adults (83.5±5.7 years) participated in a quasi-experimental study, distributed in two experimental groups and a control group: 1) OEP (OEPG; n=12), 2) OEP plus DT (OEPDTG; n=12), and a control group (CG; n=12). Older adults were evaluated at pre- and post-12 weeks of intervention-. The thresholds for the risk of falling were considered as multiparameter scores of the 10 Meter Walking Test (10MWT), evocative 10MWT, Timed Up and Go (TUG), Sit to Stand Test (STS), and The Four-Stage Balance Test (Four-Stage), and the Montreal Cognitive Assessment (MoCA), to test the cognitive impairment.

RESULTS: At baseline, all groups were homogeneous. Post-intervention, the experimental groups presented significant functional differences, in comparison to the CG, for 10MWT (OEPDTG: p=0.002; OEPG: p=0.002); evocative 10MWT (OEPDTG: p=0.001; OEPG: p=0.001); TUG (OEPDTG: p=0.034); STS (OEPDTG: p<0.001; OEPG: p<0.001) and cognitive for MoCA (OEPDTG: p<0.019). Significant intra-group differences (pre-post) were observed in all intervention groups, but none in CG. The risk of falling (Four-Stage) in experimental groups (OEPDTG: 33.3%; OEPG: 41.7%) was considerably lower than CG (83.3%).

CONCLUSION: Otago Exercise Program alone can reduce the risk of falling due to improved functionality, but adding the dual task also improves cognitive capacity in older adults. The clinical significance of these interventions goes beyond statistics.

Language: en

Keywords

Prevalence and risk factors for falls and fall-related injuries in the 2018 National Post-acute and Long-term Care Study

Marcum ZA, Dai Z, Tan ECK. J. Am. Geriatr. Soc. 2022; ePub(ePub): ePub.

Abstract

Falls and related injuries are common and cause significant morbidity and mortality in older adults living in long-term care settings.1 However, prior epidemiological estimates of falls in this setting are nearly 30 years old and not nationally representative.2 Contemporary representative data are needed to inform research and policy related to falls. Thus, we evaluated the prevalence and characteristics associated with falls and fall-related injuries using a nationally representative sample of residential care community (RCC) residents in the United States.

The prevalence of falls during the past 90 days at the RCC was 26.4%. The occurrence of falls did not differ by sex, race, use of Medicaid, visual impairment, or number of comorbidities. However, a greater proportion of those with falls were prescribed polypharmacy ≥9 medications, dependent per the Katz Index of Independence in Activities of Daily Living (Katz ADL score), requiring a walking aid, or having impaired cognitive function.

Language: en

Perceptions of facilitators and barriers to implementation of falls prevention programs in primary health care settings in China

Abstract

IMPORTANCE: Falls have become a major public health issue in China with population aging. Although falls prevention for older community-dwelling people has been included in the National Essential Public Health Service Package since 2009, there is limited understanding of the implementation of this program.

OBJECTIVE: To identify the associated factors and provide recommendations to inform the better implementation of falls prevention in the Chinese primary health care system. DESIGN, SETTING, AND PARTICIPANTS: This qualitative study was conducted in 3 purposively selected cities in China from March 1 to June 7, 2021. Health administrators from the local health commission or bureau, staff members from local Centers for Disease Control and Prevention and primary health care facilities and community-dwelling older people were recruited, using a combination of purposive sampling and snowball sampling. MAIN OUTCOMES AND MEASURES: In-depth interviews were conducted with health administrators and focus groups with other participants. Data analysis followed the guidance of the Consolidated Framework for Implementation Research. Study outcomes included facilitators and barriers of implementing falls prevention for older people in the Chinese primary health care settings. A framework with recommendations was developed to inform the future intervention implementation.

RESULTS: Among a total of 130 participants interviewed, 77 (59.2%) were female and the mean (SD) age was 47.4 (16.7) years. Clear recognition of the challenges and benefits of falls prevention, adaptive regionally tailored guidance plans, and continuous governmental policy and financial support were the major facilitators, whereas the major barriers consisted of insufficient confidence in delivering interventions and poor understanding of the falls burden, low recognition of the importance of falls prevention, limited multisectoral collaboration, and weak financial incentives. A 7-strategy embedded framework-including data-driven surveillance, audit and feedback, implementation strategy, workforce strengthening, community empowerment, internal services integration, and external enabling environment-was developed to foster successful implementation.

CONCLUSIONS AND RELEVANCE: This qualitative study identified major facilitators and barriers to the implementation of falls prevention for older people at the primary care level, which have the potential to contribute to better implementation of falls prevention for older people in the Chinese primary health care system.

Language: en