ORIGINAL RESEARCH

The Effect of the Use of Frailty Scores and Hospital Score on 30-Day Hospital Readmissions in Geriatric Patients Admitted to the Emergency Department

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Abstract

Objective: Assessing the efficiency of healthcare systems is commonly done by analyzing the 30-day readmission rates. However, research on the effectiveness of readmission models, particularly in predicting 30-day unplanned readmissions in the older adult population with frailty, is insufficient.

Materials and Methods: This study analyzed 423 older patients who were admitted to the emergency department observation ward and evaluated their frailty scores and HOSPITAL scores. The HOSPITAL score's index admission criteria were modified to suit hospitalization. To assess the overall performance of each prediction model, the scaled Brier score was computed for the HOSPITAL score with and without the frailty scores.

Results: The analysis was performed on 320 of the patients, consisting of 188 (58.8%) females and 132 (41.3%) males, with ages ranging from 65 to 99 years, and a mean age of 79.05 years (standard deviation =10.76). The readmission rate was observed to be 43.17%. The models evaluated were (1) hospital only, (2) hospital + clinical frailty score (CFS), and (3) hospital + CFS + PRISMA-7. The scaled Brier scores for all models were computed, and it was found that the score was the same for all models, with a value of 0.02. This value indicates that the overall accuracy of the prediction of 30-day readmission is good.

Conclusion: While hospital readmissions can be prevented, relying solely on scoring systems may not be effective. Instead, case-based approaches using patient admissions may provide more meaningful results. Although the HOSPITAL score can predict 30-day readmissions, the frailty test may not to be a predictor.

Keywords: 30-day readmission, frailty, geriatrics, emergency department, HOSPITAL score

Introduction

In 2009, a significant number of emergency department (ED) visits in the United States, totaling over 19.8 million, were attributed to individuals aged 65 and above. Furthermore, this age group accounted for approximately 36% of all hospitalizations during that period. The healthcare requirements of this demographic group pose a significant burden on EDs, which are already grappling with high patient volumes. As such, effectively managing and meeting the healthcare demands of older adults within the ED setting necessitates careful planning, resource allocation, and strategic interventions (1).

The efficiency of healthcare systems is commonly assessed using 30-day readmission rates as a metric to direct budget allocation. They also act as the main indicator in research projects aiming at raising the standard of care. The majority of studies on 30-day readmission rates have been on patients who are referred from the community to the hospital and then discharged back to the community. Users of home care and long-term residential care, particularly frail older persons, who pose one of the biggest

difficulties to the current healthcare system, are not taken into consideration by this restricted focus (2).

Hospital readmissions have been associated with a range of factors, including socio-demographic factors, individual characteristics, multiple health conditions, and medical events. Elderly patients who receive treatment for various illnesses and undergo surgical procedures such as hip fracture, cancer, bypass, acute cardiovascular events, or complex surgery are particularly susceptible to being readmitted within 30-days. Although readmissions after surgery may not be directly linked to the surgical procedure, they can be influenced by underlying chronic health conditions. Therefore, chronic diseases can significantly increase the likelihood of readmission, regardless of the initial reason for hospitalization. Chronic diseases among older adults are interrelated, and treating one disease may negatively affect another, making patterns of 30-day hospital readmissions highly complex (3).

The HOSPITAL score is one of many readmission prediction models that have been created. Seven easily accessible clinical markers are included in the HOSPITAL score: serum sodium, hemoglobin, length of stay, procedure while hospitalized, prior admission numbers, index admission type, and discharge from oncology service. The utilization of these models in diverse clinical contexts worldwide has been driven by their user-friendly nature and consistent reproducibility. However, assessing the performance of these models has proven to be a challenging task due to the wide range of populations studied. Particularly, evaluating the accuracy of HOSPITAL ratings in predicting unplanned readmission within a 30-day period among older adults with compromised physical function and malnutrition has emerged as a crucial area of concern. This holds significant importance within the context of older individuals, who often present with interconnected and complex health conditions, as observed in acute geriatric units (4).

Frail older adults are susceptible to physiological changes that hasten physical deterioration and functional decline, thereby raising the risk of unfavorable health outcomes. Frailty becomes more common as people age and is linked to greater mortality, morbidity, disability, health care utilization and costs. It is also a predictor of unfavorable outcomes from surgeries and interventions. In addition, frailty independently predicts hospital readmissions, including those occurring in less than 30-days after complex cardiovascular surgery and general admission to a medical ward (5).

In our study, we aimed to demonstrate the effectiveness of the Program of Research to Integrate the Services for the Maintenance of Autonomy-7 (PRISMA-7) and clinical frailty score (CFS) scores, which have been validated in Turkey, in conjunction with the hospital score, in predicting 30-day hospital readmission.

Materials and Methods

Study Setting

In the context of ED triage, the Manchester triage scale (MTS) utilizes a five-level system to prioritize patients, with level one indicating immediate attention and level five indicating non-urgent cases (6). Those deemed to be unstable, i.e., requiring management in the ED resuscitation, cardiac care or intensive care units with MTS score of one or two and who are deemed as non-urgent (T5), were excluded from the study as they are not subject to frailty assessments in our hospital. The study included 320 patients who were 65 years of age or older, had a T3-T4 triage score, and were under observation in our hospital's ED from January 1, 2022, to March 1, 2022, in weekdays morning shift was assessed retrospectively. Our ED covers an area with 460,000 inhabitants and has ~310,000 visits annually, Annually, there are ~10 ED geriatric observational unit patient presentations per weekday morning shift. Ethical approval was obtained from Ethics Committee of İstanbul Medeniyet University (21.12.2022).

The reason for choosing weekday working hours in our study is that 30-day readmission may also occur in outpatient clinic appointments during these time periods and patients have the ability to apply to outpatient hospital outpatient clinics.

Assessment Tools

Patient files, and retrospective hospital automation system scans, were used to assess the parameters of the HOSPITAL score, including the patient's hemoglobin level at discharge, diagnosis of cancer or discharge from the oncology department, sodium level at discharge, interventions with ICD 9 or ICD 10 codes, number of hospital admissions and length of stay in the last 12 months, emergency or outpatient visits in the first month after discharge, chronic illnesses, readmissions and length of stay in the first month, and the impact of HOSPITAL score, frailty score, and both on readmissions were analyzed. As our study involves only patients from ED we have modified the index admission criteria of HOSPITAL score with hospitalization from ED and scoring was performed according to original study by Donzé et al. (7). The Table 1 gives the information about the hospital score parameters and scoring system. A post hoc power analysis was conducted though G*Power 3 (8) to test the difference between two independent group means of modified HOSPITAL, scores by using a two-tailed test, alpha of 0.05. The results showed that the achieved power is 0.67 in mean differences of two groups observed readmission (n=132) and non-observed readmission (n=177). Thirty-day readmission data was obtained from hospital administration system. If the patient was hospitalized, 30-day readmission was assessed after the discharge date.

The PRISMA-7 assessment comprises seven questions with binary responses of "yes" or "no". It assesses a range of factors such as

age, gender, the existence of health issues that impede activities or require home care, need for assistance while walking, and the requirement for regular support. One point is assigned for each affirmative answer, and a score of three or higher is indicative of elevated frailty. In the study, the patient was considered frail if the patient scored 3 or more points on the PRISMA-7 score (9,10).

CFS is a useful tool with various domains that include Very Fit, well, Managing Well, Vulnerable, Mildly Frail, Moderately Frail, Severely Frail, Very Severely Frail, and Terminally Ill. It has demonstrated strong criterion validity through its ability to predict 5-year mortality and institutionalization and has displayed robust construct validity by accurately identifying poor health outcomes and validated in Turkish population (11). In our study, patients with a score of 5 or more points were considered frail.

Statistics

All statistical analyses were performed with SPSS Statistics Version 25.0 software (IBM, Chicago, IL). Descriptive statistics, were presented as proportions, means with standard deviation (SD), and as medians with interquartile ranges (IQR) as appropriate.

The score comparison between two independent groups (with and without readmission) was analyzed conducting independent sample t-test for continuous variables and chi-square test for categorical variables. Binary logistic regression was used to calculate predicted outcomes for readmission. In order to test the overall performances of each predicted models, the scaled Brier score was computed and compared within the models. Also, error bar charts were used to visualize the mean difference between predicted outcomes of different models. ROC curve analysis was conducted for predicted models. The statistical significance level was determined as $p < 0.05$.

Table 1. HOSPITAL score for readmission

Attributes	Points if positive
Low hemoglobin at discharge (<12 g/dL)	1
Discharge from an oncology service	2
Low sodium level at discharge (<135 mEq/L)	1
Procedure during hospital stay (ICD10 coded)	1
Emergency hospitalisation	1
Number of hospital admissions during the previous year	
0-1	0
2-5	2
>5	5
Length of stay ≥5 days	2

Results

At our hospital, a total of 423 geriatric patients were admitted to the observation unit on the given dates. Out of these patients, 80 were initially evaluated in the T5 area and admitted to the observation unit without assessing their frailty score. None of the patients included in the study were transferred to other hospitals. Additionally, data was missing for 23 of these patients. As a result, analysis was performed on 320 of these patients. One hundred eighty eight (58.8%) female and 132 (41.3%) male patients ages from 65 to 99 (mean =79.05, SD =10.76) were screened. The readmission rate was observed as 43.17%.

The baseline characteristics of patients according to 30-day readmission were presented in Table 2. Table 3 demonstrates the details the prediction of HOSPITAL scores parameters and frailty scores on 30-day readmission.

Hospital Score * Readmission

The independent sample t-test was conducted to examine the difference between patients observed readmission and patient not observed readmission in the HOSPITAL score. The results show that there is a statistically significant difference between observed readmission, mean (SD) =3.70 (2.5) and median (IQR) =3.00 (3.00), not observed readmission groups, mean (SD) =3.02 (2.4) and median (IQR) =3.00 (3.00), according to HOSPITAL scores, t (307) =2.40, p<0.05, Cohen's d =0.28.

Table 2. The baseline characteristics of patients according to 30-day readmission with HOSPITAL and frailty scores

Characteristics	Patients' 30-day readmission rate frequency (%)		p
	No (n=184)	Yes (n=136)	
Sex			
Male	76 (41.3%)	56 (41.1%)	0.98
Female	108 (58.6%)	80 (58.8%)	
Age groups			
65-74	53 (28.8%)	47 (34.5%)	0.52
75-84	69 (37.5%)	45 (33%)	
≥85	62 (33.6%)	44 (23.3%)	
Comorbidities			
Diabetes mellitus	65 (36.3)	56 (41.2)	0.38
Hypertension	125 (69.8)	106 (77.9)	0.11
Coronary artery disease*	**30 (16.8)**	**40 (29.4)**	**<0.01**
Congestive heart failure	40 (22.3)	37 (27.2)	0.32
Dementia	16 (8.9)	9 (6.6)	0.45
Chronic kidney disease	15 (8.4)	14 (10.3)	0.57
Chronic obstructive pulmonary disease	15 (8.4)	16 (11.8)	0.32

*p<0.05

The independent sample t-test was conducted to examine the difference between patients observed readmission and patient not observed readmission in the CFS score. The results show that there is no statistically significant difference between observed readmission, mean (SD) =4.80 (1.75) and median (IQR) =5.00 (2.00), not observed readmission groups, mean (SD) =4.82 (1.95) and median (IQR) =5.00 (3.00), according to CFS scores, t (312) =0.10, p=0.92.

The chi-square test for independence was conducted to examine the association between patients observed readmission and patient not observed readmission with the PRISMA-7 score. The results show that there is no statistically significant association, χ^2 =0.001, p=0.97.

The aim of the study is to compare the models that predict patients' readmissions to hospital according to HOSPITAL, frailty, and PRISMA-7 scores. The models are (1) HOSPITAL only, (2) HOSPITAL + CFS and (3) HOSPITAL + CFS + PRISMA-7. The scaled Brier scores of models were computed. For all models the scaled Brier score is the same and 0.02 and this value

shows that the overall accuracy for the prediction of 30-day readmission is good. There is no statistically significant association between HOSPITAL score groups (low, intermediate & high) and PRISMA-7 score and frailty score. There is a very weak positive correlation between hospital score and frailty score (r=0.12, p<0.05). There is a strong positive association between PRISMA and frailty scores (r=0.79, p<0.001). There is no statistically significant difference in frailty scores & PRISMA-7 scores between patients who readmitted to hospital and who not. Figure 1 demonstrates the prediction models of the study.

Discussion

In our research findings indicate that the HOSPITAL score is a reliable predictor of hospital admissions within a 30-day timeframe for elderly patients. However, when considering frailty scores such as CFS and PRISMA-7, whether used independently or in conjunction with the HOSPITAL score, they do not exhibit dependable predictive capabilities in this context.

| Table 3. m-HOSPITAL score and frailty scores			
m-HOSPITAL score			
Low hemoglobin at discharge (<12 g/dL)*	**126 (71.2)**	**77 (57.5)**	**<0.05**
Discharge from an oncology service	5 (2.8)	5 (3.7)	0.66
Low sodium level at discharge (<135 mEq/L)	43 (24.3)	35 (26.3)	0.69
Procedure during hospital stay (ICD10 coded)	28 (15.6)	15 (11.0)	0.24
Hospitalization urgent or emergent *	**23 (12.8)**	**57 (41.9)**	**<0.01**
Number of hospital admissions during the previous year*			<0.05
0-1	92 (51.4)	50 (36.8)	
2-5	56 (31.3)	51 (37.5)	
>5	31 (17.3)	35 (25.7)	
Length of stay ≥5 days	35 (19.6)	16 (11.8)	0.06
m-HOSPITAL TOTAL* (n=177/132)	**3.02 (2.44)**	**3.70 (2.50)**	**<0.05**
PRISMA-7			0.97
No risk	74 (56.9)	56 (43.1)	
At risk	105 (56.8)	80 (43.2)	
CFS	4.82 (1.95)	4.80 (1.75)	0.92
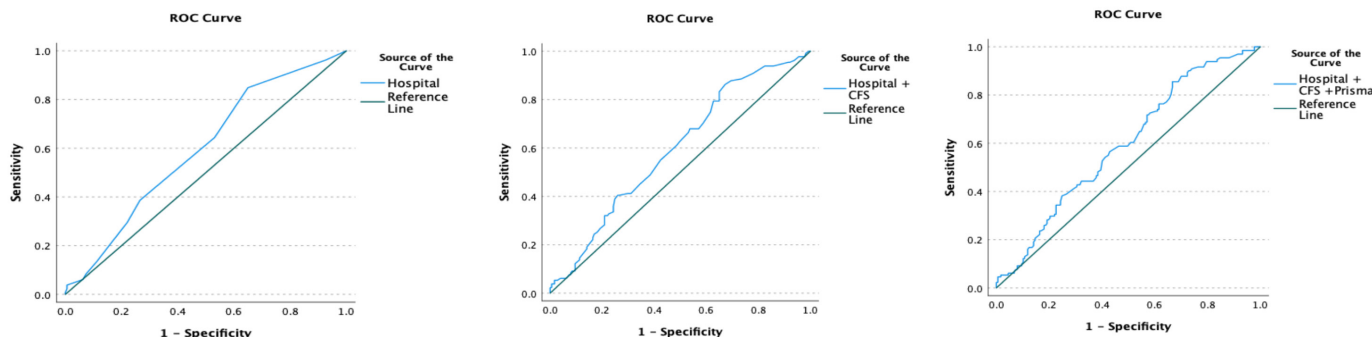
Figure 1. Prediction models of the frailty and hospital score

Older age, male gender, non-white race, medicaid eligibility, recent physician interactions, prior ED visits, and prior hospitalizations are just a few of the patient characteristics that have been connected to greater return rates to an ED or hospital. The fact that these results diverge from those of other worldwide studies could be attributed to differences in patient populations and healthcare infrastructure. These findings emphasize the significance of strengthening care transitions for patients at high risk and adjusting solutions to the particular requirements of each patient population (1).

Frailty is a recognized geriatric syndrome that is marked by comorbidity, diminished muscle strength, and malnutrition in addition to the loss of function and physiologic reserve. Frail persons had more than 40 times the likelihood of having four or more comorbid conditions compared to robust ones, according to nationwide longitudinal research in the United States. In frail older persons, asthenia and cognitive impairment frequently coexist, which may help to explain why fragile patients are more likely to suffer negative health consequences (12). As it objectively represents their chronic health issues and medical requirements, frailty in older people is a substantial risk factor for adverse clinical events (13). Furthermore, academics and policymakers are becoming more interested in determining how vulnerable older people are to negative health outcomes as a result of the demographic trend in many industrialized countries towards an aging population. Such measurement and its association with adverse health outcomes are essential for healthcare planning and resource allocation (14).

In studies conducted at a university hospital in Ireland has demonstrated the efficacy of various screening measures in identifying frailty among patients in the ED. Notably, CFS and the PRISMA-7 screening instrument exhibited higher levels of accuracy, suggesting their preferential consideration for identifying frailty in ED settings (15,16). Therefore, we chose these two frailty instruments in our study. In addition, we preferred to use the PRISMA-7 score parameters for functional assessment and the CFS score parameters for clinical evaluation, which allowed us to compare two different frailty assessments. Our study revealed that the two scores were strongly correlated, indicating that frailty is a significant issue for patients in both clinical and functional contexts. There are also studies in the literature that have been conducted with a variety of different frailty assessment tools, for example a study confirms the ability of hospital frailty risk score (HFRS) to identify older, frail people at higher risk of prolonged hospital length of stay and increased mortality risk. However, in that study it was not observed a significant association between HFRS and 28-day unplanned readmission or repeated hospital admission (17). In other study with HFRS form shows that frailty was a powerful predictor of long length of stay and in-hospital mortality, but less so of emergency readmissions (18). The Identifying seniors at risk (ISAR) tool can be used to identify people who are more likely to need readmission through risk stratification. It is appropriate for rapid patient screening to determine who needs to be reviewed by a clinical geriatric team due to its high sensitivity and negative predictive value at a cut-point of 2+. The clinical geriatric team can then determine whether patients have geriatric conditions that necessitate further attention, instruction, and supervision in order to lower the risk of readmission (19).

In a study that utilized the PRISMA-7 and ER2 frailty assessment tools, their association with short-term adverse outcomes such as increased hospitalization and prolonged ED stay was established. However, conflicting results exist regarding the evaluation of frailty in the ED and its association with long-term outcomes (20). In a study conducted by Shang et al. (21) to compare the predictive abilities of the FRAIL scale (FS), frailty screening questionnaire (FSQ), and CFS for adverse outcomes in older adults in the ED, the three tools were found to have a low predictive ability for readmission. In another study comparing CFS, ISAR, and PRISMA-7 scores, it was found that the PRISMA-7 score was able to predict the 30-day admission (22).

Given the prevalence of numerous other conditions that necessitate ongoing outpatient appointments and are associated with negative consequences in fragile patients, we investigated the impacts of the HOSPITAL score, the PRISMA-7 score, and the CFS score on 30-day hospital admission in our study. Additionally, we expected that combining frailty scores with the HOSPITAL score would produce a better prediction of 30-day hospital admission because the HOSPITAL score does not offer a separate evaluation for individuals over the age of 65. Surprisingly, we discovered that frailty ratings had no bearing on this result. The contradictions in predicting 30-day readmissions with frailty scores can be explained in the following ways:

Frailty is not a static condition and patients may become frailer during the 30-day follow-up period. To prevent frailty from progressing, follow-up policies in the ED, involvement of departments in discharge recommendations, and widespread implementation of home healthcare services may be necessary.

Frail patients tend to be more dependent on others in their daily activities due to disabilities, dementia, CKD, CVD, and COPD. Additionally, in countries like Turkey where appointment systems are web-based, these patients may be less familiar with new technologies (23), potentially leading to a reduction in hospital admissions. Moreover, in our country, the emergency system may only bring patients to hospital EDs, and they may not be able to attend outpatient clinic appointments. Another factor could be the widespread family medicine system, which may allow patients to benefit from home healthcare services instead of hospitals.

The PRISMA-7 score includes parameters such as social support and advanced age. In a previous study, the relationship between patients' socio-demographic characteristics and 30-day readmissions was compared (24). The addition of social determinants of health variables did not improve the performance of the hospital readmission risk score as frailty markers in our study. In our study The HOSPITAL score had good overall performance in this setting with a Brier score of 0.02. However, when we also included frailty scores in the HOSPITAL score, the Brier score did not change (25). In our study, no relationship was found between the HOSPITAL score and frailty scores, and this is likely due to the fact that the parameters of the HOSPITAL score are generally derived from hospital data, which may not capture the difficulties that frail patients face in accessing hospital care.

Study Limitations

Although it is one of the forerunner studies on frailty and hospital score assessment in older patients admitting to Turkish emergency medicine departments, the study has some limitations. First as all the patients have index emergency admission, we had to modify the hospital score to emergency hospitalizations as our intervention should decrease the HOSPITAL score, but HOSPITAL score still predicts 30-day readmission, we believe this has minimum effect on analysis and interpretation of results. Second as our hospital is a tertiary hospital the healthcare standards might be high and may lead to decreased number of readmissions. Third it is a single-center study and standards of care might change in the other institutions and multicentered studies should be performed in the future to replicate and validate our results.

Conclusion

Our research findings demonstrate that the HOSPITAL score successfully predicts hospital admissions within a 30-day period for older patients. However, the frailty scores, either alone or in conjunction with the HOSPITAL score, fail to provide reliable prediction in this regard. Hospital readmissions can be prevented, but rather than relying solely on scoring systems, case-based approaches using patient admissions may be more meaningful. Another point of discussion is that patients may be frailer, resulting in decreased hospital readmissions.

Ethics

Ethics Committee Approval: Ethical approval was obtained from Ethics Committee of İstanbul Medeniyet University (21.12.2022).

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

References

1. Biese K, Massing M, Platts-Mills TF, Young J, McArdle J, Dayaa JA, Simpson R Jr. Predictors of 30-Day Return Following an Emergency Department Visit for Older Adults. N C Med J 2019;80:12-18.

2. Gruneir A, Fung K, Fischer HD, Bronskill SE, Panjwani D, Bell CM, Dhalla I, Rochon PA, Anderson G. Care setting and 30-day hospital readmissions among older adults: a population-based cohort study. CMAJ 2018;190:E1124-E1133.

3. Pereira F, Verloo H, Zhivko T, Di Giovanni S, Meyer-Massetti C, von Gunten A, Martins MM, Wernli B. Risk of 30-day hospital readmission associated with medical conditions and drug regimens of polymedicated, older inpatients discharged home: a registry-based cohort study. BMJ Open 2021;11:e052755.

4. Sun CH, Chou YY, Lee YS, Weng SC, Lin CF, Kuo FH, Hsu PS, Lin SY. Prediction of 30-Day Readmission in Hospitalized Older Adults Using Comprehensive Geriatric Assessment and LACE Index and HOSPITAL Score. Int J Environ Res Public Health 2022;20:348.

5. Davis-Ajami ML, Chang PS, Wu J. Hospital readmission and mortality associations to frailty in hospitalized patients with coronary heart disease. Aging and Health Research 2021;1:100042.

6. Mackway-Jones K, Marsden J, Windle J. eds. Emergency triage: Manchester triage group. John Wiley & Sons; 2014.

7. Donzé JD, Williams MV, Robinson EJ, Zimlichman E, Aujesky D, Vasilevskis EE, Kripalani S, Metlay JP, Wallington T, Fletcher GS, Auerbach AD, Schnipper JL. International Validity of the HOSPITAL Score to Predict 30-Day Potentially Avoidable Hospital Readmissions. JAMA Intern Med 2016;176:496-502.

8. Faul F, Erdfelder E, Lang AG, Buchner A. G*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods 2007;39:175-191.

9. Yaman H, Ünal Z. The validation of the PRISMA-7 questionnaire in community-dwelling elderly people living in Antalya, Turkey. Electron Physician 2018;10:726672.

10. Raîche M, Hébert R, Dubois MF. PRISMA-7: A case-finding tool to identify older adults with moderate to severe disabilities. Archives of Gerontology and Geriatrics 2008;47:918.

11. Rockwood K. A global clinical measure of fitness and frailty in elderly people. Canadian Medical Association Journal 2005;173:48995.

12. Jiao J, Guo N, Xie L, Ying Q, Zhu C, Guo X, Wen X, Jin J, Wang H, Lv D, Zhao S, Wu X, Xu T. Association between Frailty and 90-Day Outcomes amongst the Chinese Population: A Hospital-Based Multicentre Cohort Study. Gerontology 2022;68:8-16.

13. Clegg A, Young J, Iliffe S, Rikkert MO, Rockwood K. Frailty in elderly people. Lancet 2013;381:752-762.

14. Nghiem S, Afoakwah C, Scuffham P, Byrnes J. Hospital frailty risk score and adverse health outcomes: evidence from longitudinal record linkage cardiac data. Age Ageing 2021;50:1778-1784.

15. O'Caoimh R, Costello M, Small C, Spooner L, Flannery A, O'Reilly L, Heffernan L, Mannion E, Maughan A, Joyce A, Molloy DW, O'Donnell J. Comparison of Frailty Screening Instruments in the Emergency Department. Int J Environ Res Public Health 2019;16:3626.

16. O'Caoimh R, McGauran J, O'Donovan MR, Gillman C, O'Hea A, Hayes M, O'Connor K, Moloney E, Alcock M. Frailty Screening in the Emergency Department: Comparing the Variable Indicative of Placement Risk, Clinical Frailty Scale and PRISMA-7. Int J Environ Res Public Health 2022;20:290.

17. Shebeshi DS, Dolja-Gore X, Byles J. Validation of hospital frailty risk score to predict hospital use in older people: Evidence from the Australian Longitudinal Study on Women's Health. Arch Gerontol Geriatr 2021;92:104282.

18. Street A, Maynou L, Gilbert T, Stone T, Mason S, Conroy S. The use of linked routine data to optimise calculation of the Hospital Frailty Risk Score on the basis of previous hospital admissions: a retrospective observational cohort study. Lancet Healthy Longev 2021;2:e154-e162.

19. McCusker J, Warburton RN, Lambert SD, Belzile E, de Raad M. The Revised Identification of Seniors At Risk screening tool predicts readmission in older hospitalized patients: a cohort study. BMC Geriatr 2022;22:888.

20. Launay CP, Lubov J, Galery K, Vilcocq C, Maubert É, Afilalo M, Beauchet O. Prognosis tools for short-term adverse events in older emergency department users: result of a Québec observational prospective cohort. BMC Geriatr 2021;21:73.

21. Shang N, Liu H, Wang N, Guo S, Ma L. Comparison of three frailty screening instruments for prediction of adverse outcomes among older adults in the emergency department. Geriatr Gerontol Int 2022;22:851-856.

22. Solakoglu GA, Aciksari K, Adak NA. Can Frailty Tools Predict the Mortality, Readmission, and Hospitalization of Geriatric Emergency Attenders? International Journal of Gerontology 2021;15:145-149.

23. Harris MT, Blocker KA, Rogers WA. Older Adults and Smart Technology: Facilitators and Barriers to Use. Front Comput Sci 2022;4:835927.

24. Obuobi S, Chua RFM, Besser SA, Tabit CE. Social determinants of health and hospital readmissions: can the HOSPITAL risk score be improved by the inclusion of social factors? BMC Health Serv Res 2021;21:5.

25. Aubert CE, Rodondi N, Terman SW, Feller M, Schneider C, Oberle J, Dalleur O, Knol W, O'Mahony D, Aujesky D, Donzé J. HOSPITAL Score and LACE Index to Predict Mortality in Multimorbid Older Patients. Drugs Aging 2022;39:223-234.