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The FRAIL Questionnaire: A Useful Tool for Bedside Screening of Geriatric Trauma Patients

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ABSTRACT

Frailty screening is a priority in acute care. Using secondary data from our prior study, we derived a 5-item FRAIL Questionnaire (instrument) score for 188 geriatric trauma patients and aimed to examine the influence of preinjury physical frailty (as measured by FRAIL) on 1-year outcomes. The study used a secondary data analysis design. Patients were 65 years and older admitted through the emergency department (ED) between October 2013 and March 2014. The 5 items of the FRAIL instrument were identified within data sources of our prior study, and a preinjury FRAIL score was created for each patient. For data analysis, frequencies, measures of central tendency, and linear and logistic regression models were used. Median age of the patients was 77 years (interquartile range [IQR] = 69–86), and median Injury Severity Score = 10 (IQR = 9–17). Upon admission to the ED, 63 patients (34%) were screened as frail (FRAIL score ≥3), 71 (38%) as prefrail (score = 1–2), and 54 (29%) as nonfrail (score = 0). Frequencies for components of the FRAIL score were as follows: fatigue (N = 123; 65%), resistance (N = 61; 32%), ambulation (N = 76; 40%), illnesses (N = 51; 27%), and loss of weight (N = 11; 6%). After controlling for age, comorbidities, injury severity, and cognitive status, preinjury FRAIL scores explained 13% of the variability in function as measured by the Barthel Index (N = 129, β = .36, p < .001). Forty-seven patients died (26%) within 1 year. Logistic regression analysis revealed that the higher the preinjury FRAIL score, the greater the likelihood of mortality within 1 year (OR = 1.74, p = .001; 95% CI [1.27, 2.39]). The FRAIL Questionnaire predicts 1-year functional status and mortality and is a useful tool for bedside screening.

Key Words

Frailty, Geriatric trauma, 1-year outcomes, Older adults, Preinjury function

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Frailty in older adults is a state of vulnerability to internal and external stressors that increases the risk for negative outcomes. Frailty is an indicator of biological (vs. chronological) aging and has been established as a predictor of poor outcomes in various older populations and settings due to decline and deterioration of cellular, tissue, and organ properties (Mitnitski, Howlett, & Rockwood, 2017).

In recent years, the implication of frailty among the geriatric trauma population has gained significant attention. Physical frailty, as a contributor to falls, is increasingly recognized as a public health priority (Cesari et al., 2016; Morley, 2015), with experts recommending routine frailty screening in clinical settings (Morley et al., 2013). Cognitive frailty, defined as cognitive impairment combined with physical frailty, increases older adults' vulnerability to poor outcomes (Kelaiditi et al., 2013) and warrants additional screening. Older adults with cognitive frailty are more likely to decline, develop disabilities, and require hospitalization (Malmstrom & Morley, 2013). Our prior prospective cohort study (Maxwell et al., 2016) reported the influence of preinjury physical frailty and cognitive impairment on 1-year outcomes among geriatric trauma patients.

In response to a recognized need for frailty screening, clinicians at our Level 1 trauma center began using the five-item FRAIL Questionnaire (Morley, Malmstrom, & Miller, 2012) to screen patients 65 years and older admitted to the trauma service. We aimed to determine the extent to which the FRAIL instrument predicted geriatric trauma outcomes; thus, we retrospectively derived a five-item FRAIL score for patients in our prior study from separate data sources. We hypothesized that FRAIL score would predict 1-year functional status and mortality.

METHODS

After obtaining institutional review board approval (#130992), we conducted a secondary analysis of prospectively obtained data on patients who were 65 years or older, admitted through the emergency department with a primary injury diagnosis to three services (trauma, orthopedics, and geriatrics) within the hospital between October 2013 and March 2014. Detailed descriptions regarding recruitment and enrollment, procedures, instruments, and data collection are reported in prior

publications (Maxwell et al., 2015, 2016). In brief, we enrolled 188 older adult patients (age ≥65 years) admitted through the emergency department with a primary injury diagnosis. We interviewed surrogate respondents to determine preinjury physical frailty and cognitive status using the following validated screening instruments: Vulnerable Elders Survey (VES-13) (Saliba et al., 2001), Barthel Index (Collin, Wade, Davies, & Horne, 1988), Life Space Assessment (Lo, Brown, Sawyer, Kennedy, & Allman, 2014), Paffenbarger Physical Activity Questionnaire (Paffenbarger, Wing, & Hyde, 1978), and the AD8 Dementia Screen (Galvin et al., 2005). Demographic data were obtained from respondents, and additional variables (comorbidities, injury severity) were obtained from the medical record.

FRAIL Questionnaire

The validated FRAIL Questionnaire has been utilized with diverse older populations and is predictive of disability and mortality (Chao et al., 2015; Malmstrom, Miller, & Morley, 2014; Morley et al., 2012; Woo et al., 2015). The FRAIL Questionnaire assesses five components: **F**atigue, **R**esistance, **A**mbulation, **I**llnesses, and **L**oss of weight and creates an acronym to facilitate utilization (FRAIL). In the following text and in Table 1 are summaries of the five items from the FRAIL Questionnaire, the sources (instruments) from which we obtained information/data, and the specific questions that we used to assign positive scores for each item.

- *Fatigue*: To assess *fatigue* (Does the patient fatigue easily?), we utilized two questions from the VES-13 (Saliba et al., 2001) (Does the patient have difficulty walking a quarter of a mile? AND Does the patient have difficulty performing housework such as washing windows or scrubbing floors?). If the patient reported to have "a lot of difficulty" or was "unable to do" the tasks, we assigned a score of 1. We then checked the Paffenbarger Physical Activity Questionnaire (Paffenbarger et al., 1978) to confirm that the patient had a low activity level and did not engage in moderate- or high-level activity.
- *Resistance*: To assess *resistance* (Is the patient unable to walk up one flight of stairs?), we utilized the Barthel Index (Collin et al., 1988) item for level of activity in climbing stairs. If the patient was unable to climb stairs, we assigned a score of 1.
- *Ambulation*: To assess *ambulation* (Is the patient unable to walk one block?), we utilized the VES-13 question about walking (Does the patient have difficulty walking a quarter of a mile?). If the patient reported "a lot of difficulty" or "unable to do," we assigned a score of 1.

- *Illnesses*: To assess *illnesses* (Does the patient have more than five illnesses?), we obtained *ICD-9* (*International Classification of Diseases, Ninth Revision*) codes for Elixhauser comorbidities (Elixhauser, Steiner, Harris, & Coffey, 1998). If the patient had more than five comorbidities, we assigned a score of 1.
- *Loss of weight*: To assess *loss of weight* (Has the patient lost more than 5% of his or her weight in the past 6 months?), we reviewed the Nursing Admission History (Has the patient has lost five pounds or more in the last 3 months without trying?) and the Nutrition Screening Evaluation (Has the patient had unintended weight loss?). If the patient reported "yes" to either question, we assigned a score of 1.

Data Analysis

Data were entered into SPSS 23.0 for analysis. Frequency distributions were used to summarize nominal and ordinal categorical variables. Because of skewness, median and interquartile range (IQR) were used to summarize continuous variables. Comparisons among the three frailty categories were conducted using the Kruskal–Wallis (continuous data) and χ^2 tests of independence (nominal, ordinal data). Post hoc pairwise comparisons of statistically significant overall tests used a Bonferroni-corrected alpha of $p = .017$. Simple and multiple linear regression analyses were used to generate the unadjusted and adjusted associations of preinjury variables with 1-year functional status (Barthel Index scores; Collin et al., 1988). Simple and multiple logistic regressions were used to test associations of those same variables with 1-year mortality. Other than the Bonferroni-corrected post hoc alpha values, an α of .05 ($p < .05$) was used for determining statistical significance.

RESULTS

Summaries of the patient characteristics overall, as well as within each of the three frailty categories, are displayed in Table 2. The median age of the patients was 77 years (IQR = 69–86 years). The median Comorbidity Index value was 3.0 (IQR = 0–9), median injury severity score was 10 (IQR = 9–17), and the median score of the AD8 Dementia Screen was 1 (IQR = 0–4).

Among the five items of the FRAIL Questionnaire, the most prevalent positive finding was for preinjury fatigue, with 123 patients (65%) scoring positive. In descending order, the positive findings for the remaining FRAIL items were ambulation (*N* = 76; 40%), resistance (*N* = 61; 32%), illnesses (*N* = 51; 27%), and loss of weight (*N* = 11; 6%). Overall, 37.8% (*N* = 71) patients were in the prefrail category and 33.5% (*N* = 63) in the frail category.

TABLE 1	Summary of FRAIL Questionnaire Items and Sources Utilized for Secondary Analysis	
FRAIL Questionnaire Item	**Source**	**Question/Criteria for Positive Score**
F (Fatigue): Is the patient easily fatigued?	Vulnerable Elders Survey (VES-13) Paffenbarger Physical Activity Questionnaire	Does the patient have *difficulty walking* a quarter of a mile? • Some, a lot, unable to do AND Does the patient have *difficulty performing housework* such as washing windows or scrubbing floors? • Some, a lot, unable to do AND Activity in a typical 24-hour day • *No moderate or vigorous activity*
R (Resistance): Is the patient unable to walk up one flight of stairs?	Barthel Index	Preinjury level of activity for *climbing stairs* • Unable to do
A (Ambulation): Is the patient unable to walk one block?	Vulnerable Elders Survey (VES-13)	Does the patient have *difficulty walking a quarter of a mile*? • A lot, unable to do
I (Illnesses): Does the patient have more than five illnesses?	Medical record (*ICD-9* codes)	Number of comorbidities (Elixhauser comorbidities)
L (Loss of weight): Has the patient lost more than 5% of weight in the past 6 months?	Nursing Admission History Nutrition Screening Evaluation	Lost five pounds or more in the last 3 months without trying? • Yes AND/OR Unintended weight loss? • Yes
Note. ICD-9 = International Classification of Diseases, Ninth Revision.		

Demographic and preinjury characteristics of the patients in each of the FRAIL categories (nonfrail, prefrail, and frail) are also summarized in Table 2. Statistically significant differences among groups were observed for each of those characteristics ($p < .05$). Frail and prefrail patients were older than the nonfrail patients (medians = 78–79 vs. median = 73). The Comorbidity Index and AD8 Dementia Screen (cognitive impairment) values were higher for the frail group than for the prefrail group, which were, in turn, higher than those for the nonfrail group (Bonferroni-adjusted $p < .017$). The injury severity scores were statistically significantly lower for the patients in the frail group than for those in the nonfrail group (median = 9 vs. median = 13).

One-year postdischarge function: One-year post-hospital discharge functional status as measured by the Barthel Index (Collin et al., 1988) was obtained for 176 patients (94% [12; 6%] lost to follow-up). Table 3 summarizes the unadjusted and adjusted associations of preinjury variables (age, comorbidity, injury severity, AD8 Dementia Screen score, FRAIL score) with the 1-year Barthel Index (Collin et al., 1988) scores. All of the simple correlations of the preinjury variables with the 1-year Barthel scores were statistically significant ($p < .05$). The overall multiple regression model accounted for 33% of the variability in Barthel Index (Collin et al., 1988) scores (multiple $R = .58$, adjusted $R^2 = .30$, $p < .001$). After controlling for the other variables in the analysis, statistically significant associations were observed for age ($\beta = -.16$, $p = .049$) and the preinjury FRAIL score ($\beta = -.36$, $p < .001$) (see Table 3).

One-year postdischarge mortality: One-year post-hospital discharge mortality status was obtained for 184 patients (98%, [4; 2%] lost to follow-up). Forty-seven patients (25.5%) died within 1 year of hospital

TABLE 2 — Characteristics of Geriatric Trauma Study Sample by FRAIL Category

Preinjury Characteristics	TOTAL (N = 188)	Nonfrail Score = 0 (n = 54)	Prefrail Score = 1–2 (n = 71)	Frail Score ≥3 (n = 63)	p
Age (median, IQR)	77 (69–86)	73 (66–79)[a]	78 (70–86)[b]	79 (71–88)[b]	.001
Comorbidity Index (median, IQR)	3 (0–9)	0 (0–3)[a]	3 (0–8)[b]	7 (3–13)[c]	<.001
Injury Severity Score (median, IQR)	10 (9–17)	13 (9–18)[a]	12 (9–18)[a,b]	9 (4–16)[b]	.024
AD8 score (median, IQR)	1 (0–4)	0 (0–2)[a]	1 (0–4)[b]	4 (2–7)[c]	<.001
FRAIL score (median, IQR)	1 (0–3)	0 (0–0)[a]	1 (1–2)[b]	3 (3–4)[c]	<.001
Easily fatigued? (n, %)	123 (65)	0 (0)[a]	60 (85)[b]	63 (100)[c]	<.001
Unable to walk up one flight of stairs? (n, %)	61 (32)	0 (0)[a]	6 (9)[b]	55 (87)[b]	<.001
Unable to walk one block? (n, %)	76 (40)	0 (0)[a]	17 (24)[b]	59 (94)[c]	<.001
More than five illnesses? (n, %)	51 (27)	0 (0)[a]	15 (21)[b]	36 (57)[c]	<.001
Weight loss? (n, %)	11 (6)	0 (0)[a]	3 (4)[a,b]	8 (13)[b]	.011

Note. IQR = interquartile range. Superscripts indicate statistically significant differences between specific frailty groups (Bonferroni-adjusted $p < .017$).

admission. Unadjusted and adjusted associations of the same set of preinjury variables with mortality are shown in Table 4. With the exception of injury severity, each of the other four preinjury variables increased the likelihood of 1-year post-hospital mortality ($p < .05$). After controlling for other variables in the analyses, however, injury severity became statistically significant ($p = .004$) and comorbidity was not ($p = .431$). In the adjusted model, the likelihood of mortality within 1-year post-hospital discharge increased 7% with each year of increasing age (OR = 1.07, 95% CI [1.03, 1.13], $p = .002$), increased 68% for each point increase in the injury severity score (OR = 1.68, 95% CI [1.18, 2.40], $p = .004$), and increased 74% for each point increase in the FRAIL score (OR = 1.74, 95% CI [1.27, 2.39], $p = .001$) (see Table 4).

DISCUSSION

Our findings demonstrated that the five-item FRAIL Questionnaire was associated with reported functional status (as a measure of disability) 1-year post-hospital discharge and with mortality within that same time frame among geriatric trauma patients. The FRAIL score was found to be a predictor among the five preinjury characteristics included in our analysis. The FRAIL Questionnaire is a useful tool for clinicians, as it is short and has minimal provider and response burden. Furthermore, a FRAIL score provides a simple but useful method for obtaining information about older adults' preinjury frailty status

TABLE 3 — Associations of Preinjury Variables With Barthel Index Scores at 1 Year Postinjury[a] (N = 129)

Characteristic	Unadjusted β	Unadjusted p	Adjusted β	Adjusted p
Age	−.29	.001	−.16	.049
Injury severity	.22	.014	.02	.803
Comorbidity index	−.33	<.001	−.12	.144
Cognition (AD8 score)	−.37	<.001	−.15	.089
FRAIL score	−.51	<.001	−.36	<.001

[a]Multiple R = .58, R^2 = .33, adjusted R^2 = .30, $p < .001$.

TABLE 4	Associations of Preinjury Variables With 1-Year Mortality (*N* = 184)				
	Unadjusted		**Adjusted**[a]		
Characteristic	**OR**	***p***	**OR**	***p***	**95% CI**
Age	1.08	<.001	1.07	.002	1.026, 1.125
Injury severity	1.23	.164	1.68	.004	1.175, 2.400
Comorbidity Index	1.50	.031	1.20	.431	0.758, 1.913
Cognition (AD8 score)	1.60	.005	1.10	.659	0.728, 1.651
FRAIL score	1.76	<.001	1.74	.001	1.266, 2.391
[a]*Model* χ^2 *(df = 5) = 41.30, p < .001.*					

that can be incorporated into trauma registries. Frailty measures are important for risk adjustment for both research and quality improvement efforts and can facilitate individualized care and goal setting. Of note, the FRAIL Questionnaire is a screening instrument and should be utilized to trigger further additional geriatric or palliative care assessments.

Our study has limitations. Clearly, the use of secondary data to create a FRAIL score may not accurately represent actual FRAIL scores. However, as noted in the introduction, our trauma service clinicians have screened older patients using the FRAIL Scale since March 2015. We compared the frequencies assigned to FRAIL items in this secondary analysis with actual FRAIL scores collected from geriatric trauma patients over the past year, and we found similar frequencies for the overall FRAIL scores and for each of the five items. Additional limitations include the relatively small sample size and conduction of the study at a single site.

Frailty screening in the acute care setting has several implications. Identification of injured older adults in nonfrail, prefrail, and frail categories can target patients for specific interventions aimed at individual needs. Among nonfrail patients, education is needed to inform patients and families about the trajectory of frailty inherent with aging and to help mitigate advancement to prefrail and frail states. Among prefrail patients, interventions aimed at aggressive rehabilitation, resistance and endurance training, and the need for habitual physical activity are needed. Among frail patients, early interventions aimed at increasing the understanding of frailty and the association with poor outcomes may pave the way for behavior change related to physical activity, fall prevention, environmental modifications, and advance care planning. Future research is needed to explore the influence of these approaches on outcomes such as health care utilization, readmissions to acute care, documentation of advance care planning, and overall survival.

CONCLUSION

The prevalence of frailty among geriatric trauma patients is high and represents a public health crisis. Change is needed in how trauma care providers address this issue so that models of care are more responsive to the unmet needs of aging adults. Action is needed now to maximize frailty prevention efforts with the realization that these efforts must be more focused and must start at younger ages.

KEY POINTS

- Frailty is an indicator of biological aging and is a predominant predictor of poor outcomes in aging adults.
- The incidence of frailty and prefrailty is high among geriatric trauma patients.
- FRAIL Questionnaire scores are associated with 2-year outcomes.
- The FRAIL Questionnaire is a useful tool for bedside frailty screening to trigger additional patient assessment.

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