Frailty and mortality among older patients in a tertiary hospital in Nigeria

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SUMMARY
Background: This study determined the frailty status and its association with mortality among older patients.
Design: A prospective cohort design.
Setting: Study was conducted at the medical wards of University College Hospital, Ibadan, Nigeria.
Participants and study tools: Four hundred and fifty older patients (>60 years) were followed up from the day of admission to death or discharge. Information obtained includes socio-demographic characteristics and clinical frailty was assessed using the Canadian Study of Health and Aging (CSHA) scale. Bivariate and multivariate analyses were carried out using SPSS version 21 at a p <0.05.
Results: Overall, frailty was identified in 285 (63.3%) respondents. Mortality was significantly higher among frail respondents (25.3%) than non-frail respondents (15.4%) p=0.028. Logistic regression analysis showed factors associated with frailty were: male sex (OR=1.946 [1.005–3.774], p=0.048), non-engagement in occupational activities (OR=2.642 [1.394–5.008], p=0.003), multiple morbidities (OR=4.411 [1.944–10.006], p<0.0001), functional disability (OR=2.114 [1.029–4.343), p=0.042], malnutrition (OR=9.258 [1.029–83.301], p=0.047) and being underweight (OR=7.462 [1.499–37.037], p=0.014).
Conclusion: The prevalence of frailty among medical in-hospital older patients is very high and calls for its prompt identification and management to improve their survival.

Keywords: Frailty, Mortality, Older patients, in-hospital, Nigeria

INTRODUCTION
Frailty is a biological syndrome defined as "a state of vulnerability resulting from progressive, cumulative physiological declines in reserve capacity and fitness across multiple body systems".[1, 2] Frailty is characterized by a loss of physiological reserves and, consequently, an inability to maintain homeostasis to combat a disease or injury with the common signs and symptoms which include fatigue, weight loss, weakness, low activity level, slow motor performance, and cognitive loss.[2, 3]

Research, however, suggests that frailty may be present in up to 50 – 80% of medical in-hospital older patients.[3, 4] Frail older persons have difficulty in coping with acute stressors such as hospitalization which often leads to poorer health outcomes.[2] Two major frailty models have been described in the literature.[5] First is the biologic syndrome model (frailty phenotype) described by Fried et al., which is suitable for the identification of non-disabled older persons at risk of negative events.[6, 7]

The measure is based on having three or more components of five phenotypic criteria namely; weakness, slowness, low level of physical activity, self-reported exhaustion, and unintentional weight loss.[5] Second is the burden model (the frailty index) which is cumulative of functional deficits identified in a comprehensive geriatric assessment.[5 - 7] The frailty index quantifies the functional, physiologic and psychologic conditions in addition to ascertaining the effectiveness of interventions and health status trajectories especially during hospitalization of older persons.[2]

Frailty is associated with mortality.[3,8] Although research in high-income countries abounds, there is limited information in low and middle-income countries (LMICs). Nigeria alongside many countries of the world is also experiencing the global phenomenon of population ageing. However, ageing in Nigeria is occurring alongside weak health systems and service provisions which ill-equipped

her to cope with the high burden of hospitalization among frail older persons.

This prospective cohort study aimed to determine the frailty status and mortality among older patients admitted to the medical wards of a tertiary hospital in Nigeria. Information thereby obtained would assist in developing interventions targeted at complementing the clinical management of older patients while improving their survival during hospitalization.

METHODS

Study site

This study which was part of a large project on the mortality among older patients and has been previously reported. [9] Briefly, data were collected from patients in the medical wards of the University College Hospital (UCH), Ibadan. UCH is the first tertiary hospital in Nigeria founded in 1957 and has 1000 beds. Medical outpatients' clinics, Emergency Department, and General outpatients' clinic are the gateways for the admission of older patients to the medical wards which have 150 beds covering the major specialties (gastroenterology, pulmonology, infectious diseases, neurology, cardiology, nephrology, dermatology, and endocrinology). Medical in-hospital older patients are managed by consultant physicians and resident doctors.

Study population

A total of 450 older male and female older patients (≥ 60 years) admitted to the medical wards were enrolled during the study period (May 2013 and November 2014) consecutively. The sample size was derived using the prevalence value for the best estimate of mortality among older patients admitted to medical wards in Nigeria.[10] The ages of the respondents were determined by the direct recall and by the table of historical events if they could not recall their ages.[11, 12] Proxies who included the caregivers and close relations were interviewed in place of older patients who were too ill, unconscious or aphasic. Those who did not give their consent were excluded from the study.

Study design

This was a prospective cohort study. Patients aged 60 years and above who admitted in the medical wards were recruited and followed-up. Patients' recruitment was between May 12th, 2013 and November 30th, 2014. Subsequently, all patients who met the inclusion criteria were recruitment consecutively until the desired sample size was attained.

Respondents were observed from day of admission till discharged or death. At admission, each patient had baseline investigation such as full blood count, urinalysis and fasting plasma glucose. Frailty assessed within the first 24 hours of admission. Clinical parameters such as blood pressure, pulse rate and temperature were taken each day.

Instrument

A pretested, semi-structured, interviewer-administered questionnaire was utilized for the data collection. Information obtained included sociodemographic characteristics and clinical profile. In addition, the Canadian Study of Health and Aging (CSHA) clinical frailty scale was used to assess the frailty among the respondents.[13] The frailty scale is an effective measure of frailty index and provides predictive information similar to that of other established tools about mortality.[13] It is rated from 1= very fit to 7= severely frail based on the clinical profile of the patients.[13]

Furthermore, the ten-item Barthel's basic activities of daily living (BADL) tool was used to assess the functional disability.[14] Functional disability was defined as needing assistance in at least one of the basic activities of daily living.[15] The Short Form − 12 version 2 health survey (SF-12V2) was employed to measure the quality of life of the respondents.16 The physical component summary (PCS) and mental component summary (MCS) scores of the SF-12 were dichotomized at the mean scores (high vs. low) (PCS = 36.5; MCS = 42.5).[17] The 'six-item screener' which is a brief and reliable instrument with diagnostic properties comparable to the full Folstein's Mini-mental state examination (MMSE) was used for the assessment of cognition.18 Malnutrition was assessed using the 'Mini-nutritional assessment- short form' (MNA-SF). MNA-SF had been used previously among older Nigerians.[19, 20]

The level of generalized anxiety and depression was measured with the 'Hospital Anxiety and Depression Scale' (HADS), a 14-item tool (seven questions each for generalized anxiety and depression).[21, 22] The questionnaire was available in both English and the local language (Yoruba). The instrument was translated to Yoruba and back-translated to English to ensure the original meanings were maintained. Subsequently, the instrument was pretested in another facility apart from the study site. The questionnaire was administered in the patient's preferred language (English or Yoruba) by trained research assistants who were bilingual. Height was measured using a stadiometer (Seca, Hanover, USA) to the nearest 0.1 centimeters (cm) and weight with weighing scale (Hana, Shenzhen, China) to the nearest 0.1 kilograms (kg).

The body mass index (BMI) was calculated using weight (kg) divided by height (meter) squared. BMI was then categorized as underweight (< 18.4 kg/m2), normal

(18.5–24.9 kg/m2), overweight (25.0–29.9 kg/m2) and obesity (BMI ≥ 30.0 kg/m2).[23]

Ethical consideration
Approval for the study was obtained from the University of Ibadan/University College Hospital Institutional Review Board (UI/EC/12/0390). Each respondent/ proxy gave informed consent before the interview.

Statistics
Data entry, cleaning, and analysis were carried out using the Statistical Package for Social Sciences version 21 (SPSS 21). Descriptive analysis was carried out and appropriate charts were used to illustrate categorical variables. Chi-square statistics and student t-test were used to test associations between categorical variables and continuous variables respectively. The relationship between significant variables at bivariate analysis and the outcome measure, frailty were explored using the logistic regression analysis at $p < 0.05$.

RESULTS
A total of 450 older patients were recruited with a mean age of 71.5 (±8.0) years and female to male ratio of 1.08. Two hundred and eighty-five (63.3%) respondents had frailty and 14% were rated as having severe frailty. As shown in Figure 1, a higher proportion of males (30.5%) had mild frailty, while a higher proportion of females (25.8%) was apparently vulnerable to frailty.
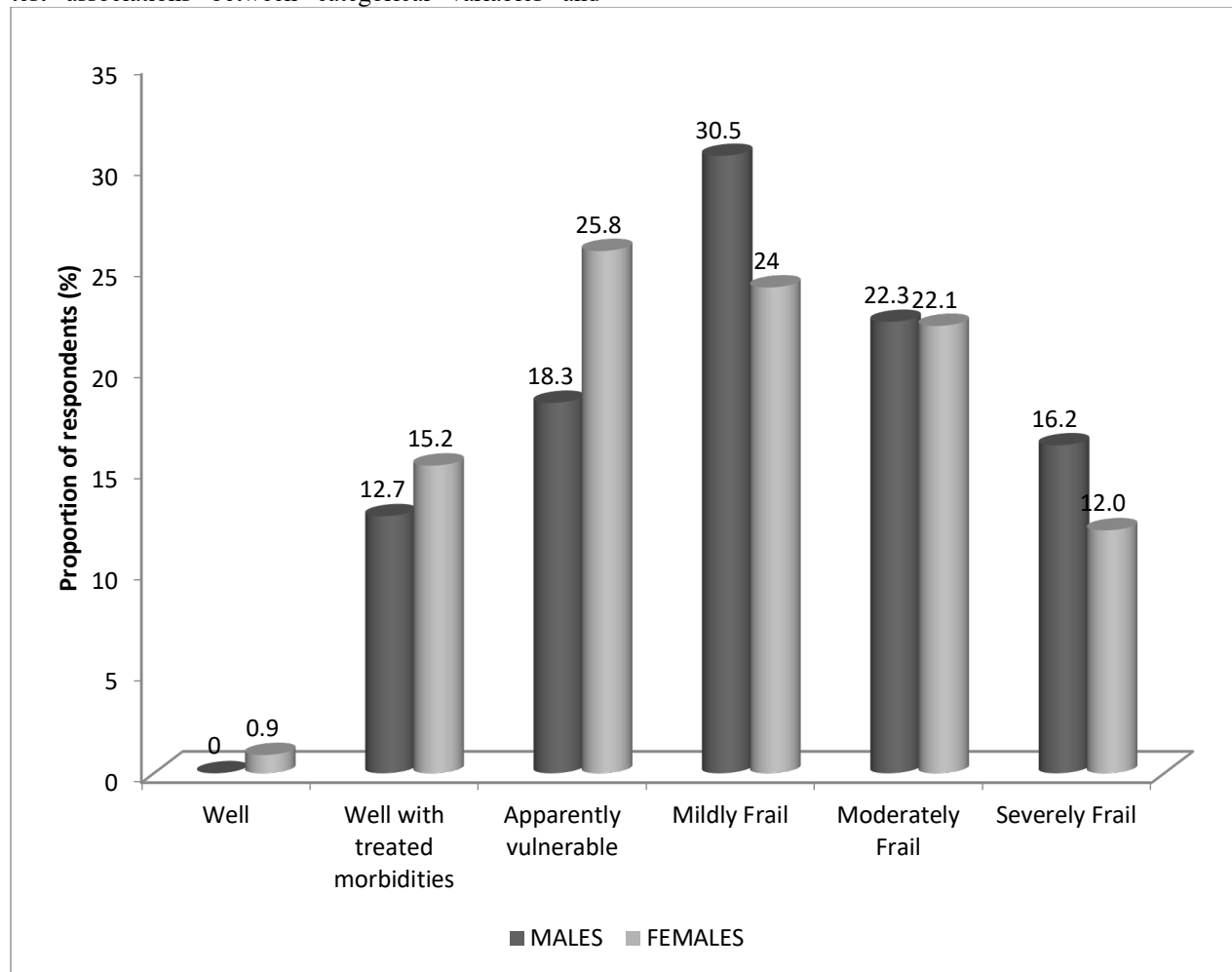

Figure 1 The frailty status of the respondents by sex

Other sociodemographic characteristic factors which were significantly associated with frailty included increasing age ($p = 0.006$), male sex ($p = 0.017$), higher educational status ($p = 0.036$), non-engagement in occupational activities ($p = 0.002$) and lower social classes ($p = 0.013$). See Table 1.

Table 1 Sociodemographic characteristics by the frequency of frailty

Variable	Frail=285 n (%)	Not frail =165 n (%)	Total=450 N (%)	χ²	p
Age (years)					
60 – 64	48 (50.5)	47 (49.5)	95 (100.0)	12.593	0.006*
65 – 69	60 (58.8)	42 (41.2)	102 (100.0)		
70 – 74	62 (68.1)	29 (31.9)	91 (100.0)		
≥ 75	115 (71.0)	47 (29.0)	162 (100.0)		
Sex					
Male	149 (69.0)	67 (31.0)	216 (100.0)	5.706	0.017*
Female	136 (58.1)	98 (41.9)	234 (100.0)		
Marital status					
Currently married	199 (69.8)	110 (30.2)	309 (100.0)	0.484	0.487
Not currently married	86 (61.0)	55 (39.0)	141 (100.0)		
Highest educational attainment					
None	68 (64.2)	38 (35.8)	106 (100.0)	8.538	0.036*
Primary	57 (54.8)	47 (45.2)	104 (100.0)		
Secondary	82 (61.7)	51 (38.3)	133 (100.0)		
Tertiary	79 (73.8)	28 (26.2)	107 (100.0)		
Number of Children alive (N = 436) †					
≤ 2	22 (55.0)	18 (45.0)	40 (100.0)	3.899	0.142
3 – 4	73 (58.4)	52 (41.6)	125 (100.0)		
≥ 5	181 (66.8)	90 (33.2)	271 (100.0)		
Occupational status					
Still engaged in occupational activities	66 (52.8)	59 (47.2)	125 (100.0)	9.827	0.002*
Not engaged in occupational activities	223 (68.6)	102 (31.4)	325 (100.0)		
Social class (N = 125)					
Upper (classes I – III)	15 (37.5)	25 (62.5)	40 (100.0)	6.131	0.013*
Lower (classes IV – V)	52 (61.2)	33 (38.8)	85 (100.0)		

* Significant at 5% level of significance
† Could not be assessed in all the respondents

Overall, there were 99 (22.0%) in-hospital deaths. The 30-day all-cause mortality rate was significantly higher among frail respondents [18.8 deaths per 1000 patient-days (95% CI 14.0 – 24.2)] compared with non-frail respondents [11.3 deaths per 1000 patient-days (95% CI 7.1 – 17.1)]. The mortality rate ratio (MRR) was 1.648 (95% CI 1.008 – 2.837), p = 0.048.

Table 2 depicts the frailty status by the proportion of in-hospital deaths. A significantly higher proportion of frail respondents 72 (25.3%) died on hospital admission compared to respondents who were not frail 27 (15.4%), p = 0.028.

Table 2 The frailty status by the proportion of in-hospital deaths

	DEAD =99 n (%)	DISCHARGED = 351 n (%)	TOTAL N (%)
Well	0 (0.0)	2 (100.0)	2 (100.0)
Well with Comorbidities	11 (17.5)	52 (82.5)	63 (100.0)
Apparently vulnerable	16 (16.0)	84 (84.0)	100 (100.0)
Mildly frail	26 (21.3)	96 (78.7)	122 (100.0)
Moderately frail	21 (21.0)	79 (79.0)	100 (100.0)
Severely frail	25 (39.7)	38 (60.3)	63 (100.0)
χ² = 14.490 df = 5 p = 0.010*			

*Significant at 5% level of significance

The relative risk for mortality among frail respondents was 1.76 (95% CI 1.05 – 2.96). There was a significant increase in the proportion of in-hospital deaths with the frailty status (p = 0.010)

Table 3 shows the clinical parameters associated with frailty. These include: BMI (p = 0.028), malnutrition (p = 0.022), cognitive impairment (p <0.0001), functional disability (p <0.0001), self-reported physical inactivity (p = 0.010), depression (p = 0.007) and having ≥5 morbidities (p <0.0001) were statistically associated with frailty.

Table 4 shows the logistic regression analysis which was carried out on significant variables associated with frailty. The logistic model was statistically significant, χ2 (17) = 77.051, p < 0.0001. The model explained 29.6% Nagelkerke (R2) of the variance in frailty and correctly classified 72.3% of cases. The most significant factors associated with frailty were male sex (OR = 1.946 [95% CI 1.005 – 3.774], p = 0.048), not engaged in occupational activities (OR = 2.642 [95% CI 1.394 – 5.008], p = 0.003), multiple morbidities ≥ 5 (OR = 4.411 [95% CI 1.944 – 10.006], p < 0.0001), functional disability (OR = 2.114 [95% CI 1.029 – 4.343], p = 0.042, malnutrition (OR = 9.258 [95% CI 1.029 – 83.301], p = 0.047 and being underweight (OR = 7.462 [95% CI 1.499 – 37.037], p = 0.014.

Table 3 Clinical parameters by the frequency of frailty

Variable	Frail = 285 n (%)	Not frail =165 n (%)	Total = 450 N (%)	χ^2	p
Body Mass Index (n = 424)					
Underweight	5 (41.7)	7 (58.3)	12 (100.0)	9.119	0.028*
Normal	104 (64.6)	57 (35.4)	161 (100.0)		
Overweight	88 (59.5)	60 (40.5)	148 (100.0)		
Obese	77 (74.8)	26 (25.2)	103 (100.0)		
Nutritional status (n = 350)					
Malnourished	15 (93.8)	1 (6.2)	16 (100.0)	5.289	0.022*
No malnutrition	221 (66.2)	113 (33.8)	334 (100.0)		
Cognitive function (n = 387)					
Impaired	69 (86.3)	11 (13.7)	80 (100.0)	24.676	<0.0001*
Not impaired	172 (56.0)	135 (44.0)	307 (100.0)		
Functional disability					
Independent	29 (39.2)	45 (60.8)	74 (100.0)	22.701	<0.0001*
Dependent	257 (68.4)	119 (31.6)	376 (100.0)		
Self-reported physical activity level					
Active	252 (61.3)	159 (38.7)	411 (100.0)	6.580	0.010*
Not active	32 (82.1)	7 (17.9)	39 (100.0)		
Anxiety (n = 436)					
Yes	232 (64.3)	129 (35.7)	361 (100.0)	1.817	0.178
No	42 (56.0)	33 (44.0)	75 (100.0)		
Depression (n = 436)					
Yes	33 (82.5)	7 (17.5)	40 (100.0)	7.287	0.007*
No	241 (60.9)	155 (39.1)	396 (100.0)		
Quality of life (physical domain)					
Low	132 (68.4)	61 (31.4)	193 (100.0)	3.727	0.054
High	153 (59.5)	104 (40.5)	257 (100.0)		
Quality of life (mental domain)					
Low	141 (63.5)	81 (36.5)	222 (100.0)	0.006	0.938
High	144 (63.2)	84 (36.8)	228 (100.0)		
Multiple morbidities					
1 – 4	207 (58.0)	150 (42.0)	357 (100.0)	21.292	<0.0001*
≥ 5	78 (83.9)	15 (16.1)	93 (100.0)		

* Significant at 5% level of significance   ✝ Could not be assessed in all the respondents

Table 4 Logistic regression analysis of factors which were significantly associated with frailty

	β	p	Odds Ratio (OR)	95% CI for OR Lower	95% CI for OR Upper
Sex (Male)	0.666	0.048*	1.946	1.005	3.774
Lower social classes	-0.034	0.768	0.967	0.773	1.210
Not engaged in occupational activities	0.972	0.003*	2.642	1.394	5.008
Age groups (years)					
60 – 64		0.320			
65 – 69	0.045	0.910	1.046	0.476	2.298
70 – 74	0.507	0.225	1.660	0.732	3.765
≥ 75	0.587	0.136	1.798	0.831	3.891
Multiple morbidities (≥ 5)	1.484	<0.0001*	4.411	1.944	10.006
Depression	-0.660	0.214	0.517	0.182	1.464
Functional disability	0.749	0.042*	2.114	1.029	4.343
Malnutrition	2.225	0.047*	9.258	1.029	83.301
Body Mass Index					
Normal		0.002*			
Underweight	2.010	0.014*	7.462	1.499	37.037
Overweight	0.666	0.056	1.946	0.982	3.861
Obese	0.405	0.330	1.499	0.664	3.385
Self-reported physical inactivity	0.913	0.133	2.491	0.758	8.187
Educational attainment					
None		0.208			
Primary	-0.579	0.157	0.561	0.252	1.249
Secondary	-0.743	0.074	0.476	0.211	1.074
Tertiary	-0.147	0.751	0.864	0.349	2.136
Constant	-0.935	0.410	0.392		

* Significant at 5% level of significance

DISCUSSION

This study provides much-needed information about the prevalence of frailty and associated factors among older persons on hospital admission in a tertiary institution in Nigeria. The prevalence of frailty among elderly varies across different settings. For instance, studies have shown that frailty is higher in the hospital than in the community[5], among people of African descent compared to the Caucasians and geographical location (lowest prevalence obtained among the Europeans).[5] However, documented variability in the findings of frailty may be due to differences in the definition and tools used for the surveys.[5]

Our reported prevalence of frailty (63.3%) was similar to those from other low and medium income countries (LMICs) but was lower than the European reports.[4, 24, 25] This finding may be attributable to the differences in the age definition of the elderly where the European studies used 65 years and the LMICs used 60 years.[5]Most studies reported a higher prevalence of frailty among the older women which would appear different from our observations.[5, 6] However, our finding was in tandem with studies from other LMICs where a higher prevalence of frailty was reported among hospitalized older men than women.[4, 24] A possible reason for these observations is that older men have higher hospitalization rates with more severe and disabling conditions as some other authors have observed.[4, 24]

Furthermore, in this study, age was observed to be significantly associated with frailty. This finding is supported by other research which highlights the significant decline in the physiology of the body system (homeostenosis) with age.[26] In addition, old age is associated with increased prevalence of disability and the cumulative burden of diseases.[7] The relative risk for mortality of 1.76 among the frail respondents in this study is comparable to the range of 1.36 to 5.52 documented among frail in-hospital older patients in a recent systematic review.[2] However, this finding is not surprising as frailty is characterized by multisystem dysregulations, leading to a loss of dynamic homeostasis, decreased physiologic reserve, and increased vulnerability for subsequent morbidity and mortality.[5] Our report showed that despite differences in the settings, there is a similarity in the risk borne by the older patients on hospital admission if the similar frailty measure was used. These include the presence of multiple morbidities, male sex functional disability, malnutrition and sedentary lifestyle (OR = 2.6) were the predictors of frailty. Though frailty is a distinct entity, this finding further reinforced the belief that there is significant overlap between the aforementioned factors and frailty.[7] Frailty leads to significant physical and functional decline, and it is difficult to reverse.

There is, therefore, a need for healthcare workers to appreciate the challenges faced in managing acutely ill older patients. This necessitates holistic management in order to identify vulnerable older patients needing prompt medical attention during hospitalization.

Strength and limitations
This was a prospective cohort study which spanned all the major medical specialties. To our knowledge, this study is the first to document frailty and associated findings among hospitalized older patients in Nigeria. The hospital-based setting may account for the high prevalence of frailty in comparison to the findings among community-dwelling older persons.

CONCLUSION
The high prevalence of frailty among medical in-hospital older patients is a medical challenge. The finding of modifiable predictors such as multiple morbidities, malnutrition, functional disability and sedentary lifestyle calls for a concerted public health action to address these factors which could lead to or worsen hospitalization outcomes.

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