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RESEARCH ARTICLE

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Risk factors and outcomes of delirium in hospitalized older Ghanaians

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Abstract

Objectives: Delirium has been rarely studied in older West Africans. We sought to investigate its correlates and outcomes in hospitalized older Ghanaians.

Methods: This was a one-month prospective observational study. Delirium prevalence was assessed within 24 h of admission using the Confusion Assessment Method (CAM). Incident delirium was determined with repeat CAM assessments on post-admission days 4, 7, 14, 21 and 28, after censoring participants with prevalent delirium. Multivariate logistic regression analyses were used to explore risk factors. Estimates of adjusted hazard ratios for mortality were derived with the discrete time version of the Cox regression model for time invariant explanatory variables.

Results: Among 483 participants, 250 (51.8%, 95% CI: 47.3–56.3) had prevalent delirium while 10 of the remaining 233 (4.3%, 95% CI: 2.1–7.8) developed incident delirium. Being older than 80 years (adjusted odds ratio (OR) = 2.1, 95% CI: 1.2–3.6), having no formal education (OR = 2.2, 95% CI: 1.4–3.4), stroke (OR = 1.8, 95% CI: 1.1–3.0), infection (OR = 1.9, 95% CI: 1.2–3.0), and high Triage Early Warning Score (OR = 6.9, 95% CI: 2.5–19.0) predicted delirium. Delirium (adjusted hazard ratio (HR) = 1.8, 95% CI: 1.0–3.3) and high TEWS (HR = 4.6 (95% CI: 1.7–12.7) at baseline predicted mortality. These factors also predicted longer hospital stay.

Conclusion: Over half of hospital-treated older Ghanaians in the present study had delirium on the first day of admission. The syndrome prolonged hospitalisation and increased mortality risk. Future studies in West Africa may investigate the epidemiology of delirium in primary care and community settings.

KEYWORDS
Africa, delirium, incident, length of stay, mortality, older adult, outcome

Key points

- Delirium is present on the day of admission in over half of hospitalized older adults in the study sample.
- Advanced age, lack of formal education and high Triage Early Warning Score are associated with higher risk of delirium.
- Delirium independently predicts higher mortality risk and prolonged hospital stay.

1 | INTRODUCTION

Delirium is an acute disorder characterized by deficits in attention, awareness, and global cognitive function, which represent a rapid change from baseline functioning.[1] The syndrome reflects the impact of a general medical condition or its treatment on the brain.[2] It is the most common and preventable complication of hospital admission in the elderly, with up to 56% of this population affected by delirium at some point during in-patient care.[3]

The common risk factors of delirium in older medical in-patients include age, sensory impairment, dementia, systemic infection, metabolic and endocrine syndromes, nutritional deficiencies, cardiovascular and respiratory disorders, alcohol and drug dependence.[4–7] Regardless of the risk factors leading to delirium in hospital treated elderly patients, the onset of the syndrome appears to result in increased length of hospital stay (LOS), as well as higher in-hospital and early post-discharge mortality.[3,8–11] However, several studies have found no association between delirium and hospital outcomes.[12,13]

As with the rest of the world, the population of older people is increasing rapidly in Africa, with over 212 million people in the sub-region projected to be 60 years or over by 2050.[14] To date, and as far as we know, there are no studies evaluating the prospective risk of new onset delirium or its outcomes in older populations of sub-Saharan Africa (SSA). Studies conducted in the sub-region are limited by cross-sectional nature of delirium data collection and analyses.[15–17] In the present study, we aimed to estimate prevalence and incidence of delirium and evaluate its risk factors and effects on hospital outcomes (LOS and mortality) in older adults admitted for in-patient medical care at a large Ghanaian teaching hospital.

2 | MATERIALS AND METHODS

The study was carried out from October 2020 to August 2021 at the Accident and Emergency (A&E) and medical wards of Komfo Anokye Teaching Hospital (KATH) in Kumasi. KATH is the 2nd largest tertiary hospital in Ghana and serves as the main referral centre for most of central and Northern Ghana, as well as neighbouring countries. Ethical approval was obtained from the KATH institutional review board (Ref no.: KATH IRB/AP/122/20).

2.1 | Subjects

Consecutive patients aged 60 years or older, admitted to the medical wards from the outpatient clinic or through the A&E were included. The exclusion criteria were deafness, inability to speak English or the local Akan-Twi language, planned or effected discharge/death before enrolment, and suspected or confirmed COVID-19 (admitted directly or transferred to secluded COVID-19 Unit after mandatory screening for all patients per hospital protocol). Written consent was obtained from all eligible patients and/or their spouses or adult children after the procedure of the study was explained to them either in English or the local Akan-Twi language. Figure 1 illustrates the study flow chart.

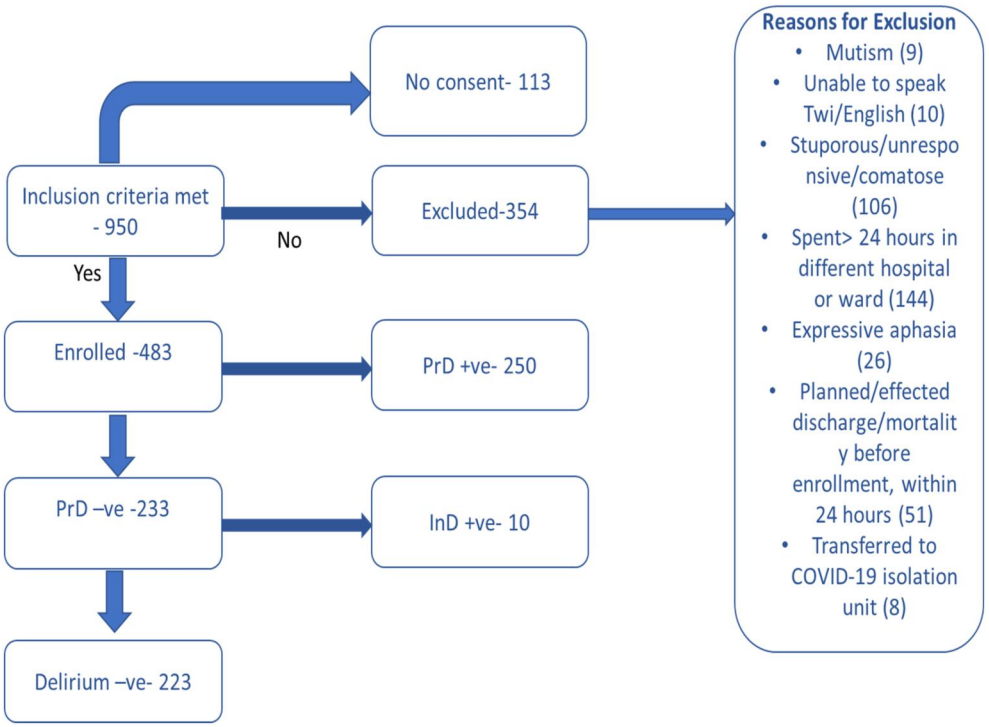

FIGURE 1 Study flow chart.

2.2 | Assessments

Assessments and data collection were performed by a research assistant (RA) under the supervision of a Specialist Psychiatrist. The RA, who has a degree in psychology, underwent a 3-day training on the study tools.

2.2.1 | Delirium

All participants were assessed for delirium within 24 h of admission using the Confusion Assessment Method (CAM).[18] CAM uses a 4-item algorithm developed for clinical diagnosis of delirium by non-specialists. It is the most widely used tool in the clinical assessment of delirium and has a sensitivity of 86% and a specificity of 93%.[19] Judgement was made about delirium status based on the CAM algorithm after an observation of patients' responses during an interview which included the Mini-Mental State Exam (MMSE).[20] Additional information was requested from their family caregivers or nursing staff assigned to the patient. A positive case of delirium must have had a recent onset of altered and fluctuating mental status, presence of inattention, and either disorganized thinking or altered level of arousal.[18] Those who tested positive for delirium at the first assessment (within 24 h of admission) were regarded as having *prevalent delirium* while those who initially tested negative for delirium were then followed up at pre-determined intervals with repeated CAM assessments on days 4, 7, 14, 21 and 28 until they developed *incident delirium*, died or were discharged. Those who survived on admission longer than 28 days and tested negative at all 6 delirium assessments were assumed to be delirium negative for the entire duration of their admission.

2.2.2 | Other data collection

A standardized questionnaire was used to obtain demographic data, educational status, occupation, marital status, diagnoses, date and time of admission, and date and time of discharge. Triage Early Warning Score (TEWS)[21] was calculated based on vital signs recorded in patients' files at admission.

2.3 | Definition of risk factors

The risk factors investigated in this study were selected based on their theoretical relationship with delirium in older adults. Participants with at least 1 year of formal education were categorised as educated. TEWS was analysed as a categorical variable with 4 ordinal groups namely, 'green' (routine, 0–2), 'yellow' (urgent, 3–4), 'orange' (very urgent, 5–6) and 'red' (emergency, ≥7). Multimorbidity was defined as having ≥3 medical conditions. Participants who were engaged in occupational activity within the last 3 months were classified as 'currently working'.

2.4 | Outcomes

2.4.1 | Mortality

Information on mortality was collected after the completion of baseline assessment, and at each follow-up time point (Days 4, 7, 14, 21 and 28). This information was recorded when hospital notes indicated the date and time of death, and the research assistant and their supervisor (JO) had been reliably informed, usually by the nursing staff, about the death of a participant who was not available for follow-up assessments.

2.4.2 | Length of hospital stay

LOS was calculated as the number of in-patient full days (to a maximum of 28 days) between participants enrolment and their discharge or death. Information about discharge was collected from patients' hospital records.

2.5 | Statistical analyses

Data was collected using paper questionnaires, collated in Epidata Manager (v.4.6.02),[22] cleaned and analysed with STATA (v14.1).[23] We summarized prevalent delirium, socio-demographic and clinical risk factor variables using frequency and percentage while mean/median and standard deviation (S.D.) were calculated for age and other continuous variables. Participants were considered to have reached an endpoint if they were available for outcome assessments at day 28 of follow-up, or when the RA had been reliably informed of their death or discharge. We examined the association of prevalent delirium with demographic and clinical risk factor variables. We first conducted bivariate analyses using simple logistic regression, after which variables that were significantly associated with prevalent delirium at an alpha value of 5% were entered into multivariate logistic regression models. We estimated adjusted odds ratios (OR) of associations withing 95% confidence intervals (CI).

Incidence was calculated as the ratio of new cases of delirium (New onset cases) to the number at risk (excluding those with prevalent delirium and losses to follow-up). We also estimated the cumulative incidence of new onset delirium (within 95% CI) according to demographic, and clinical risk factors variable using the Kaplan-Meier method. To achieve this, we calculated person time for those who developed new onset delirium or were censored using the interval from the date of first enrolment into the study to the last assessment time-point in which the person was followed up.

To investigate the baseline predictors of mortality over the 28-day period, we fitted Cox proportional hazards regression models and estimated unadjusted hazards ratios (with 95% CI) as measures of effect. Prevalent delirium, socio-demographic, and clinical risk factors variables were included as time invariant factors. Variables

TABLE 1 Sociodemographic and clinical characteristics of study population ($N = 483$).

Variable	*n* (%)
Age (years)	
60 to 69	228 (47.2)
70 to 79	126 (26.1)
80 and above	129 (26.7)
Sex	
Male	211 (43.7)
Female	272 (56.3)
Living alone	
Yes	28 (5.9)
No	450 (94.1)
Occupation	
Active work	18 (3.73)
Retired	58 (12.01)
No work	407 (84.27)
Marital status	
Single	4 (0.9)
Married	208 (44.3)
Divorced	30 (6.4)
Widowed	188 (40.1)
Separated	39 (8.3)
Education	
None	166 (35.3)
Primary	70 (14.9)
Secondary	172 (36.6)
Tertiary	62 (13.2)
TEWs	
Green (routine)	77 (16.1)
Yellow (urgent)	211 (44.2)
Orange (very urgent)	150 (31.5)
Red (emergency)	39 (8.2)
Delirium	
Yes	260 (53.8)
No	223 (46.2)
Multimorbidity (>2conditions)	
Yes	92 (19.0)
No	391 (81.0)
Diagnoses	
Cerebrovascular accident	
Yes	123 (25.5)
No	360 (74.5)
Diabetes	
Yes	101 (20.9)
No	382 (79.1)
Primary respiratory condition	
Yes	71 (14.7)
No	412 (85.3)
Infection	
Yes	172 (35.6)
No	311 (64.4)
Uro-nephrological condition	
Yes	127 (26.3)
No	355 (73.7)
Cardiovascular illness	
Yes	182 (37.7)
No	301 (62.3)
GI conditions	
Yes	51 (10.6)
No	431 (89.4)

Abbreviation: TEWS, Triage Early Warning Score.

with p-value <0.05 were entered in a multivariable model to obtain adjusted hazards ratios.

We next investigated the relationship between delirium and LOS over 28 days of follow-up. For this objective, we compared the mean LOS between participants with and without prevalent delirium using linear regression models adjusting for variables which were significantly associated with LOS in unadjusted analyses.

3 | RESULTS

3.1 | Study sample

Demographic and clinical characteristics of the study sample are presented in Table 1. Out of 950 older adult medical admissions, 483 eligible patients consented to participate in this study. The median age of participants was 70 years (range: 60–98 years). Almost half of the respondents were aged between 60 and 69 years (228, 47.2%). Approximately 56.3% (272) of the respondents were female.

3.2 | Prevalence

Of the total of 483 participants, delirium was present in 250 on the first day of hospital admission (51.8%, 95% CI: 47.3%–56.3%). Prevalent delirium was higher in participants who were retired or

otherwise not engaged in occupational activity within the last 3 months (Supplementary Table S1).

In logistic regression analyses (Table 2) adjusting for the effect of age, education, marital status, occupation, multimorbidity and TEWS, being older than 80 years (Adjusted Odds ratio (OR) = 2.1, 95% CI = 1.2–3.6) and having no formal education (OR = 2.2, 95% CI = 1.4–3.4), stroke (OR = 1.8, 95% CI = 1.1–3.0), infection (OR = 1.9, 95% CI = 1.2–3.0), and high Triage early warning (TEWS) (OR = 6.9, 95% CI = 2.5–19.0) were independent predictors of prevalent delirium.

3.3 | New onset

A total of 10 new onset delirium cases were identified in the 28 days of follow-up. These cases produced an incidence proportion of 4.3%

TABLE 2 Multivariable associations with prevalent delirium.

Variable	Unadjusted OR (95% CI)	*p*-value	Adjusted[a] OR (95% CI)	*p*-value
Age (years)				
60 to 69	Ref		Ref	
70 to 79	0.90 (0.58,1.39)	0.627	0.80 (0.48,1.32)	0.274
80 and above	3.45 (2.16,5.53)	<0.001	2.06 (1.18,3.57)*	0.011
Marital status				
Unmarried	Ref	0.003	Ref	0.315
Married	1.75 (1.21,2.53)		0.80 (0.52,1.23)	
Occupation				
Retired/No active work	Ref	0.017	Ref	0.241
Active work	3.93 (1.28,12.12)		0.49 (0.15,1.62)	
Formal education				
Yes	Ref	<0.001	Ref	0.001
No	2.63 (1.77,3.90)		2.18 (1.37,3.48)*	
Cerebrovascular accident				
No	Ref	0.010	Ref	0.020
Yes	1.73 (1.14,2.63)		1.81 (1.09,2.99)*	
Infection				
No	Ref	<0.001	Ref	0.005
Yes	2.53 (1.72,3.73)		1.90 (1.21,2.98)*	
Uro-nephrological condition				
No	Ref	0.019	Ref	0.136
Yes	1.64 (1.08,2.47)		1.45 (0.89,2.36)	
Cardiovascular illness				
No	Ref	0.004	Ref	0.090
Yes	0.58 (0.40,0.85)		0.69 (0.45,1.06)	
TEWs				
Green (routine)	Ref		Ref	
Yellow (urgent)	1.38 (0.80,2.38)	0.252	1.12 (0.62,2.02)	0.717
Orange (very urgent)	4.04 (2.26,7.24)	<0.001	2.59 (1.38,4.89)*	0.003
Red (emergency)	8.97 (3.49,23.06)	<0.001	6.93 (2.53,18.99)*	<0.001

Abbreviations: 95% CI, 95% Confidence Interval; OR, Odds Ratio; TEWS, Triage Early Warning Score.

[a]adjusted diagnoses, occupation and marital status.

*$p < 0.005$.

(95% CI = 2.1–7.8) and an overall incidence rate of 0.3% (95% CI = 0.2–0.6). The incident rate was 0.1% (95% CI = 0.04–0.6) for men and 0.5% (95% CI = 0.2 1.0) for women. The highest incident rate, 1.0% (95% CI = 0.3–3.1), was recorded in participants admitted for gastrointestinal conditions.

3.4 | Mortality

In Table 3, 62 of the 483 participants enrolled in this study died within 28 days of admission. This produced an overall mortality rate of 2.1% (95% CI = 1.6–2.6). The rates for participants with delirium was 2.7% (95% CI = 2.0–3.5). In Cox regression analyses adjusting for the effect of age, education, marital status, occupation, multimorbidity and TEWS, delirium (HR = 2.3, 95% CI = 1.2–4.4) and high TEWS (HR = 4.6, 95% CI = 1.7–12.8) were independent predictors of mortality.

3.5 | Length of hospital stay

The overall mean LOS was 6.6 (±0.3) days. The mean LOS for participants with delirium at baseline was 7.6 (±0.4) days. In

TABLE 3 Association between delirium and mortality- multivariate analysis.

	Overall mortality rate (95% CI) per '000 persons years				
	20.65 (16.10,26.49)				
Variable	Mortality cases (n = 62)	Mortality rate per 1000 person-years (95% CI)	Unadjusted HR (95% CI)	Adjusted[a] HR (95% CI)	*p*-value
Prevalent delirium					
No	16	12.76 (7.82,20.83)	Ref	Ref	0.047
Yes	46	26.32 (19.71,35.13)	2.05 (1.16,3.63)*	1.84 (1.01,3.34)	
All delirium					
No	12	10.53 (5.98,18.54)	Ref	Ref	0.013
Yes	50	26.85 (20.35,35.43)	2.56 (1.36,4.81)*	2.31 (1.19,4.45)	
Age (years)					
60 to 69	28	20.02 (13.82,29.00)	Ref	Ref	
70 to 79	10	11.77 (6.33,21.88)	0.61 (0.30,1.26)	0.62 (0.29,1.29)	0.197
80 and above	24	31.83 (21.33,47.49)	1.56 (0.90,2.69)	1.58 (0.87,2.87)	0.135
Marital status					
Others	40	24.39 (17.89,33.25)	Ref	Ref	0.171
Married	19	14.81 (9.45,23.22)	0.60 (0.35,1.04)	0.67 (0.38,1.18)	
Occupation					
Others	61	20.92 (16.27,26.88)	Ref	Ref	0.809
Active work	1	11.70 (1.65,83.03)	0.54 (0.07,3.88)	0.78 (0.10,5.84)	
Primary respiratory condition					
No	45	18.13 (13.53,24.28)	Ref	Ref	0.074
Yes	17	32.72 (20.34,52.64)	1.79 (1.02,3.13)*	1.69 (0.95,3.01)	
Infection					
No	29	15.93 (11.07,22.92)	Ref	Ref	0.137
Yes	33	27.94 (19.87,39.30)	1.76 (1.06,2.89)*	1.49 (0.88,2.53)	
TEWs					
Green (routine)	6	15.60 (7.01,34.73)	Ref	Ref	
Yellow (urgent)	21	16.36 (10.67,25.09)	1.07 (0.43,2.66)	1.09 (0.44,2.75)	0.843
Orange (very urgent)	21	19.27 (12.56,29.55)	1.28 (0.51,3.20)	1.25 (0.49,3.18)	0.633
Red (emergency)	12	53.33 (30.29,93.91)	3.43 (1.28,9.14)*	4.65 (1.71,12.68)	0.003

Abbreviations: 95% CI, 95% Confidence Interval; HR, Hazard Ratio; TEWS, Triage Early Warning Score.

[a]adjusted for age, education, occupation and marital status.

*$p < 0.005$.

linear regression analyses adjusting for age, education, occupational status, marital status, multimorbidity and TEWS (Table 4), delirium was associated with LOS (Coefficient 2.2, 95% CI: 1.1–3.3). The other covariates of this association are presented in Table 4.

TABLE 4 Association between delirium and length of hospital stay.

Characteristics	Coef. (95% CI)	Adjusted[a] Coef. (95% C. I)	*p*-value
Prevalent delirium			
No	Ref	Ref	<0.001
Yes	2.03 (1.04,3.02)	2.23 (1.12,3.34)	
Age (years)			
60 to 69	Ref	Ref	
70 to 79	1.10 (−0.32,2.52)	0.93 (−0.58,2.44)	0.225
80 and above	0.11 (−0.97,1.20)	−0.31 (−1.55,0.93)	0.621
Marital status			
Others	Ref	Ref	0.712
Married	0.08 (−0.97,1.12)	0.21 (−0.90,1.31)	
Occupation			
Retired/None	Ref	Ref	0.375
Active work	−1.24 (−3.49,1.02)	−0.89 (−2.86,1.08)	
Education			
None	Ref	Ref	0.592
≥ Primary education	−0.25 (−1.34,0.84)	−0.33 (−1.55,0.89)	
Infection			
No	Ref	Ref	0.011
Yes	1.29 (0.17,2.40)*	1.55 (0.36,2.73)	
Uro-nephrological condition			
No	Ref	Ref	0.001
Yes	2.13 (0.87,3.40)*	2.21 (0.88,3.54)	
Multimorbidity (>2conditions)			
No	Ref	Ref	0.003
Yes	2.37 (0.81,3.93)*	2.48 (0.85,4.11)	
TEWs			
Green (routine)	Ref	Ref	
Yellow (urgent)	1.02 (−0.44,2.48)	0.80 (−0.26,1.85)	0.138
Orange (very urgent)	2.35 (0.82,3.89)*	2.16 (0.58,3.74)	0.007
Red (emergency)	1.14 (−1.02,3.30)	0.70 (−0.95,2.35)	0.404

Abbreviations: Coef, Coefficient; TEWS, Triage Early Warning Score.

[a]adjusted for age, education, occupation and marital status.

*$p < 0.005$.

4 | DISCUSSION

We found a prevalence of 51.8% for delirium on the first day of hospital admission in this sample of older Ghanaians. Approximately 4.3% developed new onset delirium within 28 days of in-patient care producing an incident rate of 0.3%. Being older than 80 years and having no formal education, stroke, infectious disease, and high TEWS were independent predictors of delirium. The overall mortality rate estimated over 28 days was 2.1%. Delirium and high TEWS at baseline predicted mortality and LOS.

The delirium prevalence of 51.8% observed in the present study is higher than the range of 18%–35% reported in a recent systematic review including older in-patient studies drawn mostly from the High Income Countries (HIC).[24] Prior studies from Tanzania[17] and Nigeria[16,25] also found delirium prevalence rates that were below the range of what has been found in the present study. There are several possible reasons for the high prevalence of delirium in the present study. Several studies have observed pandemic-related barriers to health-seeking and access during the study period. These include anxiety, increased financial constraints, limited hospital space and higher threshold for hospital admission.[26–28] It is feasible that covid-19 related factors operating during the period of our study data collection may have led to longer delays in health seeking for many patients, with an attendant cumulative illness burden including severity and complications, such as delirium, at presentation. A previous study from Nigeria,[29] identified illness severity as an important driver of higher prevalence of delirium.

Another plausible reason for the high delirium prevalence observed in the present study is the limited intensive care unit (ICU) capacity at KATH, Ghana, as in many sub-Saharan African settings.[30] This factor ensures that patients who would otherwise be admitted to the ICU remain at the A&E or on the medical ward.[30,31]

The correlates of prevalent delirium found in the present study are well documented in studies conducted all over the world.[10,17,24] The effects of advanced age and stroke on delirium risk are already known to be exerted through gradual and more sudden neurodegeneration respectively. In this study, TEWS was used as physiological proxy for severity of acute illness; this has been shown to correlate with delirium in previous studies. In sub-Saharan Africa and many other settings globally, higher education is known to be protective against the pathological changes underlying neurocognitive disorders[32] and represents a modifiable risk factors for these disorders.

We found the incidence proportion and rate of new-onset delirium in the present study to be 4.3% and 0.3%. The incidence established in the present study falls below the range of 5%–38% reported in a 2014 metanalysis[33] of 11 studies of delirium with a total of 2338 medical in-patients aged 55 years and older, from mostly HIC. There are several possible reasons for the lower incidence of delirium estimated in the present study. For example, the low incidence of delirium and other neurocognitive disorders in sub-Saharan Africa may be due to higher mortality.[32] We found a mortality rate of 2.1% in the present study wherein participants

with delirium had approximately 2 times the risk of dying within 28 days. In turn, higher mortality risk may be due to the often-reported lower standard of healthcare care in the setting of the present study.[34]

To the best of our knowledge, this is the first prospective study of delirium in older medical in-patients from sub-Saharan Africa. Similar to many previous studies in the global literature, we found in the present study that delirium was associated with longer LOS.[10,24,35,36] The main limitation of the present study is that it only used a hospital sample, and as such, results may not be generalizable to other populations. The findings of this study cannot be generalized to people with deafness and suspected or confirmed COVID-19 as they were excluded from the study.

In conclusion, delirium is very common among older medical in-patients with approximately half of older adults having prevalent delirium in this tertiary medical setting. The syndrome is associated with longer hospital stay and higher mortality risk in older medical in-patients. Further studies need to be done to explore the epidemiology of delirium in primary and community settings, and feasible pharmacological and non-pharmacological preventive and remedial interventions for delirium, in West Africa.

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CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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