



Factors associated with hospitalization from a geriatric short-stay unit (OBI-GER): a retrospective cohort study

Laura Orlandini¹ · Benedetta Maisano² · Alice Margherita Ornago³ · Elena Pinardi^{2,3} · Alberto Finazzi² · Andrea Bonini² · Maurizio Corsi¹ · Giacomo Mosca⁴ · Ernesto Contro⁴ · Andrea Staglianò¹ · Martina Manna² · Antonio Piscitelli⁵ · Aida Andreassi⁵ · Maria Cristina Ferrara² · Chukwuma Okoye^{1,2} · Giuseppe Bellelli^{1,2}

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Abstract

Background Geriatric Short-Stay Observation Units (G-SSU) are specialized units designed to improve care for older adults within the emergency department (ED). At our hospital, the Osservazione Breve Intensiva Geriatrica (OBI-GER) was established as a dedicated G-SSU.

Aims This study aims to characterize the clinical profile of older adults admitted to OBI-GER and identify factors associated with hospitalization within the first 24 h of admission.

Methods Retrospective, single-center study including individuals aged ≥ 75 years, admitted to OBI-GER between August 2023 and August 2024, with frailty and/or delirium during ED stay. Multivariable logistic regression model with stepwise selection was used to assess associations between hospitalization and clinical, functional, laboratory, and organizational variables.

Results Overall, 353 patients (mean age 86.8 ± 5.5 years, 47.9% male) were included, of whom 109 (30.8%) required hospitalization. The cohort exhibited moderate frailty (median Clinical Frailty Scale = 6, IQR 6–7) and a considerable comorbidity burden (median Charlson Comorbidity Index [CCI] = 6, IQR 5–8), along with a high prevalence of dementia (45%) and polypharmacy (mean 7.1 ± 3.4 medications). Independent risk factors for hospitalization included higher CCI (OR 1.19, 95% CI 1.05–1.35), delirium on the first day of OBI-GER (OR 2.03, 95% CI 1.13–3.64), frequent faller profile (OR 2.66; 95% CI 1.38–5.12), and lower hemoglobin levels at ED admission (OR 0.89, 95% CI 0.79–0.99).

Conclusions Despite their clinical complexity, only one-third of patients admitted to OBI-GER required hospitalization. CCI, delirium, fall history, and hemoglobin levels may serve to stratify hospitalization risk and optimize patient selection for G-SSU.

Keywords Geriatric emergency medicine · Older adults · Frailty · Short-stay unit · Comprehensive geriatric assessment

✉ Laura Orlandini
laura.orlandini@irccs-sangerardo.it;
laur.orlandini@gmail.com

¹ Acute Geriatric Unit, Fondazione IRCCS San Gerardo dei Tintori, Monza, Italy

² School of Medicine and Surgery, University of Milano-Bicocca, Milan, Italy

³ Aging Research Center, Department of Neurobiology, Care Sciences and Society, Karolinska Institutet and Stockholm University, Stockholm, Sweden

⁴ Emergency Medical Unit, Fondazione IRCCS San Gerardo dei Tintori, Monza, Italy

⁵ Medical Direction Unit, Fondazione IRCCS San Gerardo dei Tintori, Monza, Italy

Introduction

With a globally aging population, emergency departments (EDs) are facing significant challenges in managing frail older adults, who require individualized approaches and complex care [1, 2]. However, implementing such management in the busy and overcrowded ED setting has proven difficult, as these individuals often present with severe acute illness compounded by multimorbidity, polypharmacy, functional limitations, cognitive impairments and social vulnerability [3, 4]. Moreover, prolonged ED stays may further increase the risks of delirium, functional decline, and mortality in this population [2, 5].

To address these challenges, Geriatric Emergency Departments and Geriatric Short-Stay Units (G-SSUs) have been developed to improve care for frail older adults [6, 7]. These units aim to integrate Comprehensive Geriatric Assessment (CGA) into the acute care pathway, enabling early identification of geriatric syndromes, implementation of multidimensional interventions, and personalized discharge planning [8]. Emerging evidence suggests that G-SSUs may represent a viable alternative to hospitalization, potentially reducing related complications, enhancing patient outcomes, and promoting more efficient use of healthcare resources [9, 10]. However, despite advantages, G-SSUs cannot always prevent hospitalization, as some patients may require extended care due to clinical complications or logistical barriers preventing discharge. In this context, a deeper understanding of which patients can safely benefit from G-SSUs and which require standard hospitalization is crucial. To date, data on patient selection criteria and predictors of hospitalization from G-SSUs remain scarce, limiting the ability to refine admission protocols and enhance the effectiveness of this care model.

This study aims to characterize a cohort of patients admitted to our hospital G-SSU, the Osservazione Breve Intensiva Geriatrica (OBI-GER) during its first year of operation. Additionally, we compare the clinical profiles of patients who were discharged with those who required hospitalization, and we identify clinical and functional factors, detectable within the first 24 h of admission, that are associated with subsequent hospitalization.

Materials and methods

The OBI-GER model

The Istituto di Ricovero e Cura a Carattere Scientifico (IRCCS) San Gerardo dei Tintori, one of the largest tertiary care hospitals in Northern Italy, manages over 16,000 annual ED visits from patients aged ≥ 75 years, accounting for more than 15% of total admissions. To address this growing demand, the OBI-GER was established in August 2023 as a dedicated G-SSU to provide specialized care for frail older adults.

OBI-GER is a four-bed G-SSU, embedded within a broader general SSU. Admission to the general SSU is determined by the ED physician for patients with acute conditions deemed manageable within a 72-hour observation period, who are clinically stable (National Early Warning Score 2 [NEWS2] < 7) [11] and not terminally ill. Otherwise, direct admission to a standard inpatient ward is warranted. However, in cases of ED overcrowding or bed shortages, the ED physician may temporarily allocate patients to the

SSU, where the SSU team provides care until the patient is reassigned by the hospital bed manager to an inpatient ward.

Eligibility for OBI-GER is determined at SSU admission by the attending geriatrician and requires age ≥ 75 years along with the presence of frailty and/or delirium. These two conditions were selected as inclusion criteria based on a shared institutional protocol jointly developed and approved by the ED, the SSU, and the Geriatrics Unit. They were chosen for their high prevalence among older ED patients, their strong association with adverse outcomes and their suitability for early geriatric intervention in the ED setting [12–15].

Frailty is assessed using the Clinical Frailty Scale (CFS) [16] and the Primary Care Frailty Index (PC-FI) [17], with inclusion criteria set at CFS ≥ 5 and/or PC-FI ≥ 0.07 . Delirium is prospectively evaluated by the geriatrician at the time of SSU admission, using the 4AT tool [18]. To enhance case identification and ensure comprehensive phenotyping of delirium cases, a retrospective review of ED medical records is also conducted. This review involves searching for predefined keywords suggestive of acute cognitive disturbances (e.g., “acute confusional state,” “drowsiness,” “psychomotor agitation,” “psychomotor slowing,” “acute disorientation,” “sleep-wake cycle inversion”). This approach has been validated in previous studies, which have demonstrated its acceptable specificity and moderate sensitivity when compared with standardized assessment tools such as the CAM and the 4AT [19–21].

OBI-GER is staffed by a multidisciplinary team including a geriatrician, a geriatric resident, and an occupational therapist (OT), available from 8:00 AM to 2:00 PM on weekdays. Outside geriatrician service hours, medical care is provided by an Emergency Medicine physician. Nursing care is provided 24 h a day by a nurse shared with the non-geriatric SSU. The nursing staff receives geriatric training both before joining the unit and through ongoing education. Additional specialists, including a social worker, rehabilitation physician, and palliative care team, are available upon request.

Patients admitted to OBI-GER have access to radiological exams and specialist consultations with the same priority level as in the ED. Alongside routine clinical evaluation, they undergo a Comprehensive Geriatric Assessment (CGA) on weekdays, adapted to the care setting. This adaptation integrates the core elements of standard CGA while accounting for the constraints of limited time and resources [14, 22, 23]. Specifically, it includes delirium screening (4 ‘A’s Test, 4AT) [18], comorbidity assessment (Charlson Comorbidity Index, CCI) [24], frailty evaluation (CFS and PC-FI) [16, 17], functional status assessment (Activities of Daily Living, ADL; Instrumental Activities of Daily Living, IADL) [25], mobility evaluation by an OT, and a review of fall history and polypharmacy.

At the end of the observation period, patients may be discharged home, returned to their referring facility, or transferred to an appropriate care setting. Discharge eligibility is determined through a multidisciplinary process, informed by the results of CGA. Patients were discharged only if clinically stable, as judged by the attending physician and supported by a low-risk NEWS2 score (≤ 3) recorded on the day of discharge. Social and functional criteria were also taken into account, and discharge occurred only when adequate support systems and follow-up services were in place.

Study design and population

This is a retrospective analysis of prospectively collected data from all patients consecutively admitted to OBI-GER during its first year of operation (August 15, 2023, and August 15, 2024). Figure 1 illustrates the study population flowchart. During the study period, 461 patients were admitted to OBI-GER. Of these, 108 patients were excluded as they did not meet the admission criteria for the OBI-GER model. This group included patients temporarily placed in OBI-GER while awaiting transfer to an inpatient ward ($n=98$), clinically unstable patients requiring intensive monitoring (NEWS2 ≥ 7 , $n=23$), and patients admitted for palliative care who died during their stay ($n=9$).

The local Ethics Committee (deliberation no. 1205, December 14, 2022) authorized data collection and its use as part of a clinical registry. Written informed consent was obtained from all participants or their next of kin, when patients were not able to provide consent. The study adheres to the principles of the Declaration of Helsinki.

Data collection and study outcome

Collected data included sociodemographic characteristics, medical history, laboratory results, clinical and vital parameters. Sociodemographic data included age, sex, marital status, and source of admission. ED-related data included date and time of admission, triage code (five-level color scale, increasing severity from white to red), NEWS2 score, presenting symptoms, and serum laboratory parameters. Due to the short length of stay in the ED and the availability of ED blood test results at the time of admission to OBI-GER, only blood tests performed in the ED were included in the analysis, while those conducted during the OBI-GER stay were excluded. These included hemoglobin (Hb), white blood cell count (WBC), sodium, potassium, creatinine, and C-reactive protein (CRP). Electrolyte imbalance was defined as an abnormal sodium and/or potassium level based on laboratory reference ranges (sodium: 136–145 mmol/L; potassium: 3.5–5.1 mmol/L). Date and time of admission to OBI-GER were also recorded, along with the CGA parameters. Early CGA was defined as the completion of a geriatrician-led CGA within 24 h of SSU admission. Patients were classified as frequent fallers if they had a history of falls within the preceding six months and presented to the emergency department as a result of a fall. Additionally, delirium and NEWS2 score on the first and last day of OBI-GER stay were collected. The presence of a documented dementia diagnosis was assessed through a review of medical records and, when possible, confirmed via caregiver interviews. NEWS2 worsening was defined as an increase in NEWS2 score from the ED to OBI-GER admission. Finally, the length of stay in both the ED and OBI-GER were calculated.

The primary outcome of the study was hospital admission to an inpatient ward following the OBI-GER stay.

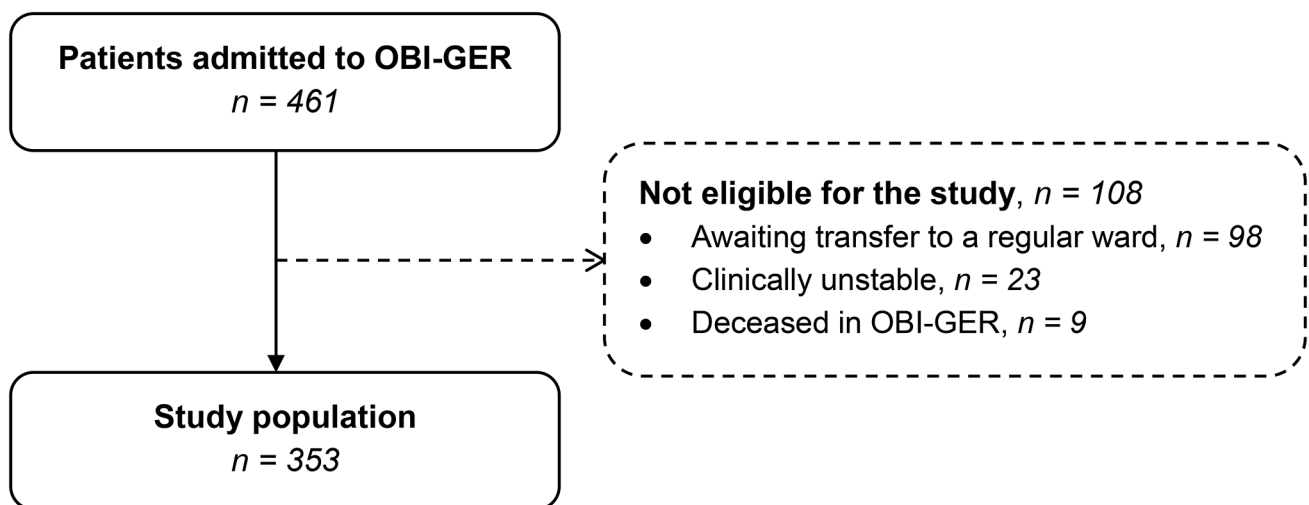


Fig. 1 Study Flowchart. Legend: Multiple exclusion criteria may apply to the same individual

Statistical analysis

Categorical variables were reported as frequencies and percentages, whereas continuous variables were presented as means and standard deviations (SD) or medians and interquartile ranges (IQR), as appropriate. Comparisons between discharged and hospitalized patients were performed using the Student's *t*-test or Mann-Whitney *U* test for continuous variables and the Chi-square test for categorical variables.

Variables that showed a significant difference between study groups ($p < 0.05$) and those considered clinically relevant within the first 24 h of OBI-GER admission were included in a multivariable logistic regression model to assess their associations with hospitalization. Age, sex, source of admission, CFS, CCI, frequent faller, dementia, length of ED stay, delirium, early CGA, NEWS2 worsening, electrolyte imbalance, Hb, WBC, CRP and creatinine serum levels were considered potential covariates. CCI was included in the model without the age component to avoid collinearity. A backward stepwise multivariate logistic regression was subsequently performed. Covariates were iteratively removed based on the Akaike Information Criterion (AIC), with the process continuing automatically until no further reduction in AIC was observed. Statistical significance was set at $p < 0.05$. All statistical analyses were conducted using R software (version 4.3.2).

Results

The main characteristics of the study population, categorized by referral destination from OBI-GER (hospitalized vs. discharged), are presented in Table 1.

The mean age of the overall cohort was 86.8 ± 5.47 years, with 47.9% of the patients being male. More than half (53%) of the patients received a yellow triage code, and only 3% presented asymptotically to the ED. The majority exhibited multiple presenting symptoms, with respiratory symptoms (30%), altered mental status (21.2%) and falls (16.4%) being the most common (Fig. 2). The median length of ED stay was 7.52 h (IQR = 5.3–11.5).

At the time of OBI-GER admission the median NEWS2 score was 1 [IQR = 0–3], and 78 patients (22.1%) experienced delirium on the first day of their stay. Early CGA was performed in 77.6% of cases. Patients exhibited a functional dependence profile (median ADL = 4 [IQR 1–6], median IADL = 1 [IQR 0–4]) and a median CCI score of 6 [IQR 5–8], with 14.7% identified as frequent fallers. Cognitive impairment and polypharmacy were common, with 45% of patients having a pre-existing dementia diagnosis and an average of 7.1 ± 3.4 medications taken chronically before admission. The CFS showed a median score of 6 [IQR 6–7],

and the PC-FI had a median value of 0.2 (IQR 0.12–0.28), indicating moderate frailty. The median length of OBI-GER stay was 59.7 h (IQR = 40.1, 70.5). At the end of the observation period, 244 patients (69%) were discharged from OBI-GER, primarily to their homes (87.3%), followed by nursing homes (9.8%) and hospices (1.6%).

Hospitalized patients ($n = 109$, 30.8%) exhibited a higher comorbidity burden (median CCI: 6 [IQR 5–8] vs. 5 [IQR 5–8], $p = 0.042$), lower hemoglobin levels at ED admission (11.6 g/dL vs. 12.5 g/dL, $p = 0.027$), and were more likely to be frequent fallers (21.1% vs. 11.9%, $p = 0.024$), compared to those discharged. No significant differences in presenting symptoms were observed between groups (Fig. 2). Additionally, hospitalized patients had a significantly shorter stay in OBI-GER (45.7 vs. 61.7 h, $p = 0.004$) and exhibited higher NEWS2 scores at discharge (2 [IQR 0–3] vs. 0 [IQR 0–2], $p < 0.001$), compared to those discharged from OBI-GER.

Multivariable logistic regression analyses (Fig. 3) identified higher CCI score (OR 1.19, 95% CI 1.05–1.35, $p = 0.007$), the presence of delirium on the first day of OBI-GER stay (OR 2.03, 95% CI 1.13–3.64, $p = 0.017$), and being a frequent faller (OR 2.66, 95% CI 1.38–5.12, $p = 0.003$) as independent predictors of hospitalization. Conversely, higher hemoglobin levels at ED admission were inversely associated with hospitalization risk (OR 0.89, 95% CI 0.79–0.99, $p = 0.037$).

Discussion

This study describes the clinical profile of a cohort of patients admitted to OBI-GER during its first year of operation and identifies variables associated with hospitalization risk. Delirium on the first day of admission, comorbidity (CCI), and the frequent faller profile were independently associated with an increased risk of hospitalization. Conversely, higher hemoglobin levels at ED admission were inversely associated with hospitalization risk.

Despite the high clinical complexity of our cohort—characterized by a high prevalence of frailty, cognitive impairment, and comorbidity—only 31% of patients required hospitalization after transitioning from OBI-GER. This finding suggests the potential of this model in managing frail older adults outside traditional wards. Moreover, it aligns with existing evidence on the role of specialized geriatric ED assessment units in reducing hospital admissions and improving outcomes in this vulnerable population [26, 27].

In our study, delirium on the first day in OBI-GER was associated with a twofold increase in hospitalization risk, likely reflecting the greater clinical complexity and the challenges of managing delirium within OBI-GER time constraints. As a marker of acute clinical instability, delirium

Table 1 Baseline characteristics of the study cohort, overall and by referral destination from the OBI-GER unit (discharged versus hospitalized)

	Overall (n=353)	Discharged (n=244)	Hospitalized (n=109)	p-value
Socio-demographic characteristics				
Age, mean (SD)	86.8 (5.5)	87.1 (5.8)	86.1 (4.6)	0.135
Male, n (%)	169 (47.9)	118 (48.4)	51 (46.8)	0.875
Partnered, n (%)	127 (36.7)	90 (37.5)	37 (34.9)	0.902
Living alone, n (%)	90 (25.5)	62 (25.4)	28 (25.7)	1.000
Source of admission, n (%)				
Community	335 (94.9)	230 (94.3)	105 (96.3)	0.553
Nursing Home	12 (3.4)	10 (4.1)	2 (1.8)	
Other	6 (1.7)	4 (1.6)	2 (1.8)	
ED admission data				
Triage code, n (%)				
White	1 (0.3)	0 (0.0)	1 (0.9)	0.199
Green	0 (0.0)	0 (0.0)	0 (0.0)	
Blue	138 (39.1)	102 (41.8)	36 (33.0)	
Yellow	187 (53.0)	125 (51.2)	62 (56.9)	
Red	27 (7.6)	17 (7)	10 (9.2)	
NEWS2, median [IQR]	1 [0, 3]	1 [0, 3]	1 [0, 3]	0.740
Serum Hb (g/dL), median [IQR]	12.2 [10.7, 13.7]	12.5 [11, 13.7]	11.6 [10, 13.8]	0.027
Serum WBC (x10 ⁶ /L), median [IQR]	8900 [6760, 12260]	8915 [7017.5, 12372.5]	8800 [6340, 11580]	0.363
Serum CRP (mg/dL), median [IQR]	1.8 [0.5, 6.1]	1.7 [0.5, 6.1]	2.4 [0.5, 6.1]	0.582
Serum creatinine (mg/dL), median [IQR]	1.1 [0.9, 1.7]	1.1 [0.9, 1.6]	1.3 [0.8, 1.9]	0.216
Electrolyte imbalance, n (%)	113 (32.3)	71 (29.5)	42 (38.5)	0.119
LOS (h), median [IQR]	7.5 [5.3, 11.5]	7.5 [5.3, 11.2]	8 [5.2, 12.1]	0.462
OBI-GER data				
NEWS2 at admission, median [IQR]	1 [0, 3]	1 [0, 2]	1 [0, 3]	0.288
Delirium on first day, n (%)	78 (22.1)	47 (19.3)	31 (28.4)	0.075
LOS (h), median [IQR]	59.7 [40.1, 70.5]	61.7 [41.3, 71.8]	45.7 [24.5, 68.7]	0.004
CGA				
ADL, median [IQR]	4 [1, 6]	3 [1, 6]	4 [1, 6]	0.201
IADL, median [IQR]	1 [0, 4]	1 [0, 4]	1 [0, 4]	0.499
Walking autonomy, n (%)				
Independent	144 (40.8)	99 (40.6)	45 (41.3)	0.624
With help/aid	168 (47.6)	114 (46.7)	54 (49.5)	
Bedridden	41 (11.6)	31 (12.7)	10 (9.2)	
Frequent faller, n (%)	52 (14.7)	29 (11.9)	23 (21.1)	0.024
CCI, median, [IQR]	6 [5, 8]	6 [5, 7]	6 [5, 8]	0.042
Dementia, n (%)	159 (45)	113 (46.3)	46 (42.2)	0.548
Number of medications, mean (SD)	7.1 (3.4)	7 (3.3)	7.2 (3.7)	0.623
CFS, median [IQR]	6.00 [6, 7]	6 [6, 7]	6 [5, 7]	0.319
PC-FI, median [IQR]	0.2 [0.12, 0.28]	0.2 [0.12, 0.24]	0.2 [0.12, 0.28]	0.083
Early CGA, n (%)	274 (77.6)	190 (77.9)	84 (77.1)	0.977

CGA=Comprehensive Geriatric Assessment; ADL=Activities of Daily Living; IADL=Instrumental Activities of Daily Living; CFS=Clinical Frailty Scale; PC-FI=Primary Care Frailty Index; CCI=Charlson Comorbidity Index; NEWS2=National Early Warning Score 2; Hb=Hemoglobin; WBC=White Blood Count; CRP=C Reactive Protein; LOS=length of stay

Note: early CGA refers to CGA completion within 24 h from OBI-GER admission

often requires extensive diagnostic procedures and prolonged care to address its multifactorial causes [28, 29]. Additionally, delirious patients are frequently frail and multimorbid [30, 31], making safe discharge difficult without full resolution and adequate family support.

Delirium was included among the OBI GER admission criteria based on a shared institutional protocol, reflecting both its clinical relevance and high frequency in the ED

setting [2, 13, 32]. As delirium is often underdiagnosed in acute care, many older adults arrive in SSUs without formal recognition of the syndrome [33, 34]. In this real-world context, OBI-GER enables timely identification and initial management by a dedicated geriatric team. Nonetheless, our findings demonstrate that delirium often exceeds the scope of short-stay care and frequently leads to hospitalization. Future research should investigate whether implementing

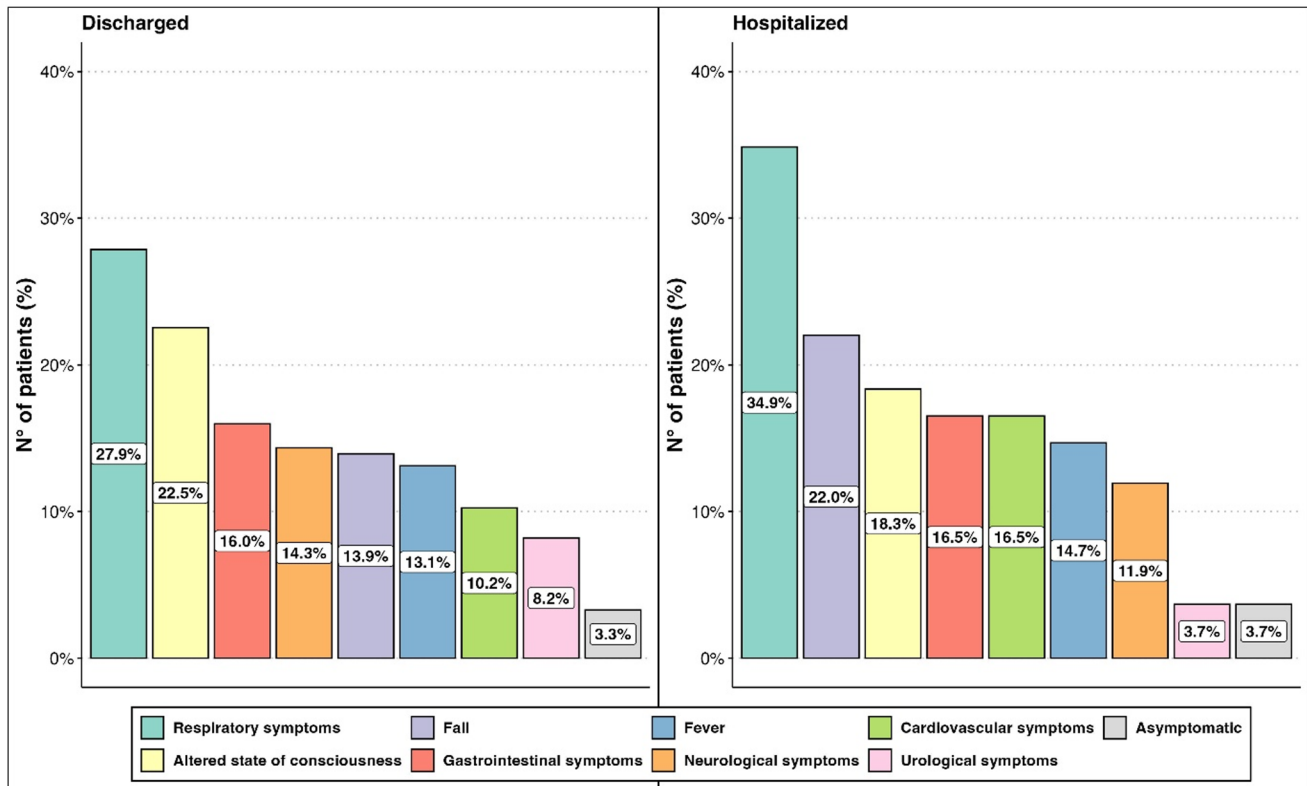


Fig. 2 Presenting symptoms at ED admission, ordered by frequency within patients discharged or hospitalized from OBI-GER

delirium screening upon ED admission could help appropriately identify patients who should be directly admitted to inpatient wards versus those who could be managed in the G-SSUs.

Consistent with previous research [35–37], our finding that being a frequent faller nearly triples the risk of hospitalization suggests that falls are not merely a mobility issue but a marker of a broader physiological decline affecting the neurological, musculoskeletal, and cardiovascular systems [38–40]. As such, frequent falls should be recognized as a critical marker of underlying health decline, warranting proactive, multidisciplinary interventions [41–43].

A key finding of this study is the association between higher hemoglobin levels and a reduced risk of hospitalization, in line with previous studies linking hemoglobin decline to acute clinical deterioration in older adults [44–46]. This relationship likely reflects increased biological vulnerability, given that hemoglobin reduction is a common feature of chronic diseases in older adults [47, 48]. However, our findings do not support the use of hemoglobin as an independent biomarker for hospitalization risk stratification [49], emphasizing that clinical decision-making should remain multifactorial, incorporating functional, clinical, and laboratory parameters.

In our study, we found an association between comorbidity, measured by the CCI [24], and hospitalization.

Conversely, no association was observed between frailty and hospitalization. This finding contrasts with the results reported by Nouvenne et al. [10], who found that the CFS and cancer, among individual conditions, independently predicted hospitalization in a cohort of 452 patients admitted to a G-SSU. However, their study cohort had lower and more variable CFS scores (median=4, IQR 3–6) compared to our cohort (median=6, IQR 5–6), suggesting that a ceiling effect in frailty scores may have limited our ability to detect an association. Moreover, whereas Nouvenne et al. focused on individual diseases, our analysis included a composite measure of comorbidity, as well as key geriatric syndromes such as delirium and falls. This multidimensional approach may more accurately reflect the complexity of hospitalization risk in frail older adults [10].

This study has several limitations. Its observational, retrospective, and single-center design, along with the underrepresentation of specific populations (e.g., long-term care residents), limits the generalizability of the findings. Finally, unmeasured confounders may have influenced hospitalization decisions and could not be fully accounted for.

Despite these limitations, this study offers valuable real-world evidence on the role of G-SSUs in managing frail older adults—a setting that remains understudied—and may help promote the implementation of such services in medium- to large-sized hospitals. Investing in the development of such

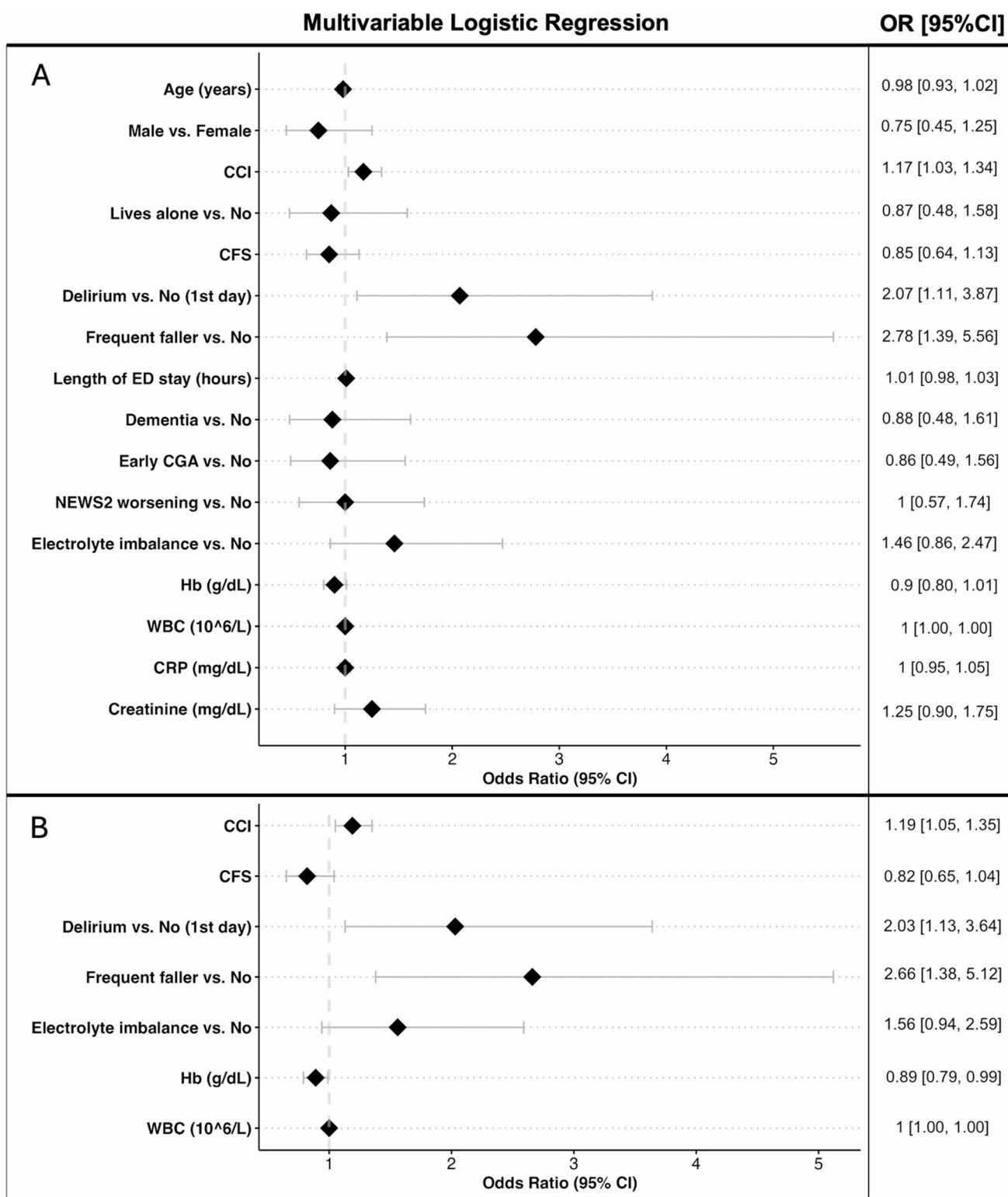


Fig. 3 Multivariable Logistic Regression Analysis: Full Model (panel A) and Stepwise Selection Model (panel B). OR=Odds Ratio; CI=confidence interval; CCI=Charlson Comorbidity Index, without age CFS=Clinical Frailty Scale; G-SSU=Geriatric Short Stay Unit;

CGA=Comprehensive Geriatric Assessment; NEWS2=national early warning score 2; Hb=Hemoglobin; WBC=White Blood Count; CRP=C Reactive Protein. Note: early CGA refers to CGA completion within 24 h from OBI-GER admission

care models designed to reduce potentially avoidable hospital admissions among older adults could represent a key strategy for enhancing the quality, efficiency, and sustainability of care for this vulnerable population. Furthermore, this study paves the way for future research to design risk stratification tools that integrate delirium, comorbidity, previous falls, and hemoglobin levels to guide G-SSU admission decisions. These tools could help optimize patient selection and care efficiency in geriatric emergency settings.

Conclusions

This study identifies key factors associated with hospitalization from OBI-GER, a Geriatric Short-Stay Unit (G-SSU) specifically designed for frail older adults in the emergency setting. Given the growing adoption of G-SSUs, our results provide valuable real-world evidence to help define patient selection criteria and refine admission protocols in similar units.

Despite the high clinical complexity of the study cohort, only 31% of patients required hospitalization, reinforcing the potential effectiveness of OBI-GER in preventing unnecessary admissions while ensuring appropriate care for frail older patients.

Further, multicenter studies are needed to validate these findings, ensuring that OBI-GER and comparable G-SSUs are used efficiently to balance hospitalization needs and optimize outcomes for frail older adults in the ED.

Author contributions Conceptualization and design: LO, AMO, EP, BM, CO; Material preparation and data collection: BM, AB, MM. Data analysis: AMO; Writing - original draft preparation: LO; Writing - review and editing: all authors; Supervision: GB.

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Data availability All data relevant to the study are included in the article. The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval This study was performed in line with the principles of the Declaration of Helsinki. The local Ethics Committee (deliberation no. 1205, December 14, 2022) authorized data collection and its use as part of a clinical registry.

Informed consent Informed consent was obtained from all individual participants or their next of kin when patients were not able to provide consent.

Conflict of interest The authors have no competing interests to declare that are relevant to the content of this article.

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