

Clinical profiles and predictors of emergency department length of stay in super-elderly patients: A retrospective study of 1313 cases

Zhen Wu¹, Qiuping Lin¹, Guojie Gao¹, Yanjun Zhang¹, Zhixin Liao¹, Mengqi Duan² (✉)

¹Department of Emergency Medicine, The Third Affiliated Hospital of Sun Yat-sen University, Guangzhou 510630, China

²Nursing Department, The Third Affiliated Hospital of Sun Yat-sen University, Guangzhou 510630, China

Received: 26 March 2026 | Revised: 25 June 2026 | Accepted: 21 July 2026

ABSTRACT

This study aims to systematically describe the demographic profile, treatment characteristics, disease spectrum, illness severity, comorbidity burden, and clinical outcomes of emergency department (ED) in super-elderly patients and to identify independent factors influencing ED length of stay (LOS). A single-center retrospective cross-sectional study was conducted, enrolling 1313 patients aged ≥ 80 years who presented to the ED of a tertiary hospital in Guangzhou between January 2023 and December 2024. Data on demographics, triage levels, diagnoses, comorbidities, outcomes, and LOS were extracted from electronic medical records. Multiple linear regression analysis was used to identify independent predictors of ED LOS. The mean age of patients was (86.0 ± 4.5) years, with a male-to-female ratio of 1:1.07. The majority (78.8%) were triaged as Level II (acute and severe). Common diagnoses included dyspnea (12.8%), fever (11.7%), and chest pain (5.0%). The mean number of comorbidities was 3.8 ± 1.96 , and the mean Charlson Comorbidity Index (CCI) score was 5.6 ± 1.63 . Patients aged ≥ 90 years had a significantly higher rate of palliative care utilization than those aged 80–89 years (18.5% vs. 7.4%; $P < 0.01$). Multiple linear regression identified month of presentation ($\beta = -14.087$, $P = 0.01$), season of presentation ($\beta = -39.800$, $P = 0.02$), and number of comorbidities ($\beta = 87.876$, $P < 0.001$) as independent predictors of ED LOS. The model explained 21.4% of LOS variability (adjusted $R^2 = 0.214$). Super-elderly ED patients commonly present with nonspecific symptoms and substantial multimorbidity. Disease patterns and outcomes vary significantly by age and gender, while the longevity group (age ≥ 90 years) has a significantly higher palliative care utilization rate. ED LOS is substantially influenced by time factors and the burden of comorbidities. To enhance care efficiency, it is recommended that dynamic resource allocation strategies be adopted and comprehensive geriatric assessments be implemented.

KEYWORDS

super-elderly, emergency department (ED), length of stay (LOS), comorbidity burden, palliative care, geriatric care

1 Introduction

Global population aging is progressing at an accelerated pace. Projections indicate that by the mid-2030s, the number of individuals aged ≥ 80 years worldwide will reach approximately 265 million, surpassing the number of annual births [1]. In China, data from the Seventh National Census revealed that the population aged ≥ 80 years had reached 35.8 million, representing 2.54% of the total population [2], with a continuing upward trajectory. Consequently, super-elderly patients (age ≥ 80 years) have emerged as a clinically significant subgroup in emergency and critical care medicine. Epidemiological studies report that patients aged ≥ 80 years

constitute a substantial proportion of emergency department (ED) visits [3, 4], yet their rates of successful resuscitation are significantly lower than those observed in younger cohorts [5]. This population frequently presents with multisystem involvement, multiple comorbidities, cognitive impairment, and atypical clinical manifestations [6–8], which contribute to prolonged ED stays and increased healthcare expenditures [9]. Emergency department length of stay (LOS) has been associated with adverse patient outcomes [10], including elevated risks of complications and mortality in older adults [11, 12].

Despite these challenges, much of the existing literature has

focused on the general elderly population, with limited attention to the unique clinical characteristics and determinants of ED LOS in the super-elderly subgroup. Moreover, in daily emergency care practice, the presence of nonspecific symptoms and complex comorbidity patterns in very elderly patients complicates initial assessment and may further delay definitive management.

This study focused on 1313 patients aged ≥ 80 years who presented to the ED of a tertiary hospital in Guangzhou between January 2023 and December 2024. The aim was to systematically describe the demographic profile, treatment characteristics, disease spectrum, illness severity, comorbidity burden, and clinical outcomes of this population and to identify independent factors influencing ED LOS. The findings are intended to provide regionally relevant evidence to inform the optimization of emergency care processes for super-elderly patients, reduce unnecessary delays, and enhance the efficiency and quality of geriatric care. Additionally, the results may serve as a reference for developing clinical pathways and determining optimal timing for palliative care interventions in this vulnerable group.

2 Results

2.1 Basic characteristics

Among 1313 patients (mean age = 86.0 ± 4.5 years; 634 males (48.3%), and 679 females (51.7%); male-to-female ratio = 1:1.07), the majority were triaged as Level II (acute and severe) (78.8%). The most frequent outcome was discharge home (43.9%), followed by ED observation (30.5%), hospitalization (23.2%), and death (2.4%). Palliative care was provided to 9.7% of the included patients. Mean comorbidity count = 3.8 ± 1.96 ; mean CCI score = 5.6 ± 1.63 ; mean ED LOS = 530.4 ± 741.6 minutes (approximately 8.8 hours).

2.2 Comparison of different age groups

Patients were stratified into super-elderly (80–89 years; $n = 1053$) and longevity (age ≥ 90 years; $n = 260$) groups. Compared with the super-elderly group, the longevity group had a significantly higher proportion of females (56.9% vs. 50.4%; $P = 0.035$), higher Level II triage rates (81.9% vs. 78.1%; $P = 0.012$), and a markedly greater proportion receiving palliative care (18.5% vs. 7.4%; $P < 0.01$). No significant differences were observed in comorbidity counts or CCI scores (Table 1).

2.3 Gender-based differences.

Female patients were slightly older than males (86.3 ± 4.8 years vs. 85.7 ± 4.1 years; $P = 0.018$). Circulatory system diseases were more prevalent among females (17.8% vs. 12.5%; $P < 0.05$). Females also had higher rates of hospital discharge and lower rates of ED observation ($P < 0.05$). No significant differences were found in triage level, palliative care receipt, or ED LOS (Table 2).

2.4 Temporal distribution of visits

Presentation times exhibited a bimodal pattern: peaks occurred between 08:00–11:59 (311 cases, 23.7%) and 16:00–19:59 (302 cases, 23.0%). Monthly distributions showed the highest volumes in January (157 cases, 12.0%), December

(122 cases, 9.3%), and May (119 cases, 9.0%). Seasonally, most visits occurred in autumn (341 cases, 26.0%) and winter (368 cases, 28.0%) (Figs. 1–3)

2.5 Disease diagnosis distribution

The top three specific diagnoses were dyspnea (168 cases, 12.8%), fever (154 cases, 11.7%), and chest pain (66 cases, 5.0%). Males had higher rates of dyspnea, fever, chest pain, and pneumonia; females had higher rates of abdominal pain, hypertension, and chest tightness. (Table 3)

2.6 Comorbidity patterns

Comorbidities were prevalent in the study cohort. Two-disease combinations: diabetes and hypertension (162 cases, 45.0%), cerebral infarction and hypertension (87 cases, 24.2%), heart failure and hypertension (60 cases, 16.7%). Three-disease combinations: diabetes and cerebral infarction with hypertension (28 cases, 24.1%), heart failure and diabetes with hypertension (21 cases, 18.1%), atrial fibrillation and diabetes with hypertension (18 cases, 15.5%).

2.7 Factors influencing ED length of stay

Multiple linear regression analysis showed that all VIF values were less than 5, indicating no significant multicollinearity among the independent variables, and identified month of presentation ($\beta = -14.087$, $P = 0.01$), season of presentation ($\beta = -39.800$, $P = 0.02$), and number of comorbidities ($\beta = 87.876$, $P < 0.001$) as independent predictors of ED LOS. The model explained 21.4% of LOS variability (adjusted $R^2 = 0.214$). Other variables, including age, sex, triage level, CCI, and disease category, did not reach statistical significance (Table 4).

3 Discussion

3.1 Seasonal and temporal variation: Increased detention risk in autumn, winter, and peak hours

Our findings demonstrate that super-elderly patients most frequently presented during autumn (26.0%) and winter (28.0%), with peak attendance occurring between 08:00–11:59 and 16:00–19:59. The higher incidence in colder seasons may be attributable to increased respiratory infections caused by reduced mucociliary clearance and airway irritation from low temperatures, as well as heightened cardiovascular strain due to vasoconstriction and elevated blood pressure—factors particularly detrimental to immunocompromised older adults. These observations align with previous reports indicating a winter predominance of respiratory and cardiovascular events in elderly populations [13–15].

Beyond the direct effects of cold on the respiratory and circulatory systems, several factors may contribute to increased autumn and winter ED visits. First, dietary changes during colder months—including higher calorie, fat, and sodium intake—may exacerbate hypertension and cardiovascular risk [16]. Second, reduced physical activity in cold weather may increase thrombotic risk, as low temperature upregulates transferrin to induce hypercoagulability [17], and respiratory infections are independently associated with disseminated intravascular

Table 1 Comparison of different age groups

	Super-elderly group (80–89 years old), <i>n</i> = 1053	Longevity group (≥ 90 years old), <i>n</i> = 260	<i>X</i> ² / <i>t</i>	<i>P</i> value
Gender			3.523 ^a	0.03
Male	522 (49.6%)	112 (43.1%)		
Female	531 (50.4%)	148 (56.9%)		
Disease category by organ system			13.187 ^a	0.15
Symptoms, signs, and clinical and laboratory findings, not elsewhere classified	649 (61.6%)	170 (65.4%)		
Circulatory system	163 (15.5%)	37 (14.2%)		
Respiratory system	77 (7.3%)	11 (4.2%)		
Digestive system	61 (5.8%)	8 (3.1%)		
Injuries, poisonings, and certain other consequences of external causes	42 (4.0%)	17 (6.5%)		
Endocrine, nutritional, and metabolic diseases	18 (1.7%)	3 (1.2%)		
Genitourinary system	8 (0.8%)	4 (1.5%)		
Musculoskeletal system and connective tissue	9 (0.9%)	1 (0.4%)		
Neoplasms	6 (0.6%)	3 (1.2%)		
Others	20 (1.9%)	6 (2.3%)		
Triage level			10.996 ^a	0.01
Level I	24 (2.3%)	5 (1.9%)		
Level II	822 (78.1%)	213 (81.9%)		
Level III	183 (17.4%)	29 (11.2%)		
Level IV	24 (2.3%)	13 (5.0%)		
Patient outcome			10.231 ^a	0.01
Discharged home	478 (45.4%)	98 (37.7%)		
Observation in ED	301 (28.6%)	100 (38.5%)		
Admitted to hospital	250 (23.7%)	55 (21.2%)		
Death	24 (2.3%)	7 (2.7%)		
Palliative care			29.369 ^a	0.001
Yes	78 (7.4%)	48 (18.5%)		
No	975 (92.6%)	212 (81.5%)		
Number of comorbidities	3.76 ± 1.957	3.82 ± 1.961	−0.460	0.64
Charlson Comorbidity Index (CCI)	5.59 ± 1.659	5.67 ± 1.555	−0.625	0.53
LOS (minutes)	524.53 ± 781.573	554.38 ± 551.270	−0.581	0.56

Note: “a” indicates chi-square test; values without “a” indicate *t*-test.

coagulation [18]. Third, decreased outdoor activities and reduced sunlight exposure may exacerbate anxiety and depression, prompting ED visits among the elderly [19]. A European multicenter study confirmed that winter dyspnea patients were significantly older with higher rates of lower respiratory tract infections [20]. These multifactorial mechanisms suggest that promoting indoor physical activity, optimizing nutritional support, and addressing mental health needs may help reduce the burden of winter ED visits.

The temporal distribution mirrors general ED utilization patterns, suggesting that circadian rhythms and daytime access to healthcare resources remain influential even in the super-elderly subgroup. From a clinical operations perspective, these results support the need for dynamic staffing and resource allocation during high-demand seasons and time windows, with particular attention to older patients with multiple comorbidities, in order to minimize crowding and prevent care delays.

3.2 Comorbidity burden: A central driver of prolonged stay

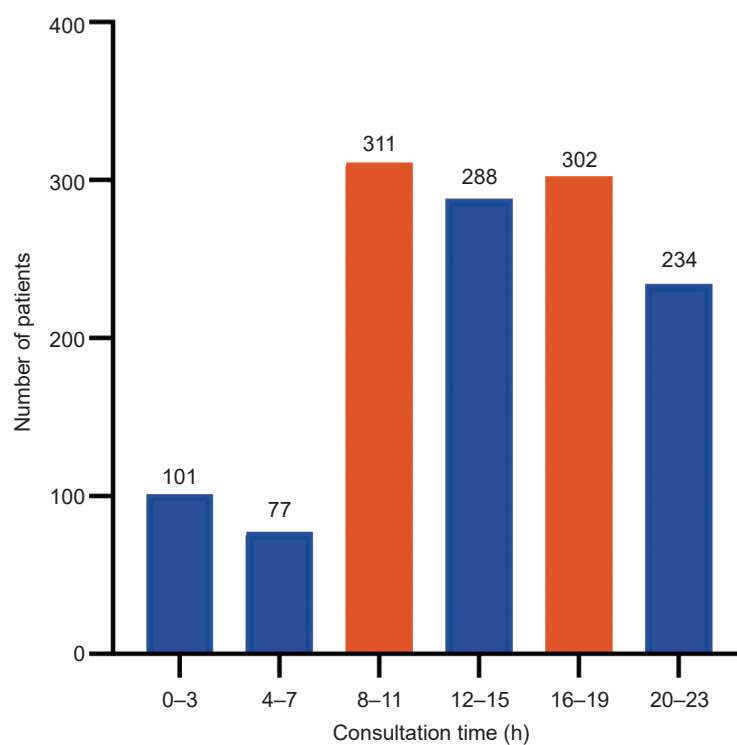
A defining characteristic of our cohort was the high comorbidity burden, with a mean of 3.8 conditions and a CCI of 5.6. The most frequent combination was diabetes mellitus with hypertension, confirming that multimorbidity is the norm rather than the exception in super-elderly patients [21]. Multiple linear regression analysis identified the number of comorbidities as an independent predictor, with each additional condition associated with an 87.876-minute increase in ED LOS ($P < 0.001$), consistent with findings by Charlson et al. [22, 23], linking comorbidity indices to greater medical complexity. Importantly, recent studies have shown that targeted interventions such as frailty alerts can significantly reduce ED waiting time and length of stay in older patients [24].

The need for extended diagnostic workup, medication

Table 2 Gender-based differences

	Male (<i>n</i> = 634)	Female (<i>n</i> = 679)	χ^2/t	<i>P</i> value
Age (mean $\pm$ SD) (years)	85.72 $\pm$ 4.136	86.31 $\pm$ 4.773	-2.373	0.01
Disease category by organ system			27.660 ^a	0.001
Symptoms, signs, and clinical and laboratory findings, not elsewhere classified	408 (64.4%)	411 (60.5%)		
Circulatory system	79 (12.5%)	121 (17.8%)		
Respiratory system	58 (9.1%)	30 (4.4%)		
Digestive system	35 (5.5%)	34 (5.0%)		
Injuries, poisonings, and certain other consequences of external causes	21 (3.3%)	38 (5.6%)		
Endocrine, nutritional, and metabolic diseases	8 (1.3%)	13 (1.9%)		
Genitourinary system	3 (0.5%)	9 (1.3%)		
Musculoskeletal system and connective tissue	3 (0.5%)	7 (1.0%)		
Neoplasms	4 (0.6%)	5 (0.7%)		
Others	15 (2.4%)	11 (1.6%)		
Triage level			0.607 ^a	0.89
Level I	13 (2.1%)	16 (2.4%)		
Level II	505 (79.7%)	530 (78.1%)		
Level III	98 (15.5%)	114 (16.8%)		
Level IV	18 (2.8%)	19 (2.8%)		
Patient outcome			17.151 ^a	0.001
Discharged home	246 (38.8%)	330 (48.6%)		
Observation in ED	219 (34.5%)	182 (26.8%)		
Admitted to hospital	158 (24.9%)	147 (21.6%)		
Death	11 (1.7%)	20 (2.9%)		
Palliative care			0.608 ^a	0.45
Yes	65 (10.3%)	61 (9.0%)		
No	569 (89.7%)	618 (91.0%)		
Number of comorbidities	3.84 $\pm$ 1.969	3.73 $\pm$ 1.946	0.872	0.38
Charlson Comorbidity Index (CCI)	5.68 $\pm$ 1.706	5.54 $\pm$ 1.572	1.558	0.12
LOS (minutes)	553.22 $\pm$ 914.023	509.16 $\pm$ 532.218	1.076	0.28

Note: "a" indicates chi-square test; values without "a" indicate *t*-test.

**Figure 1** Distribution of consultation time.

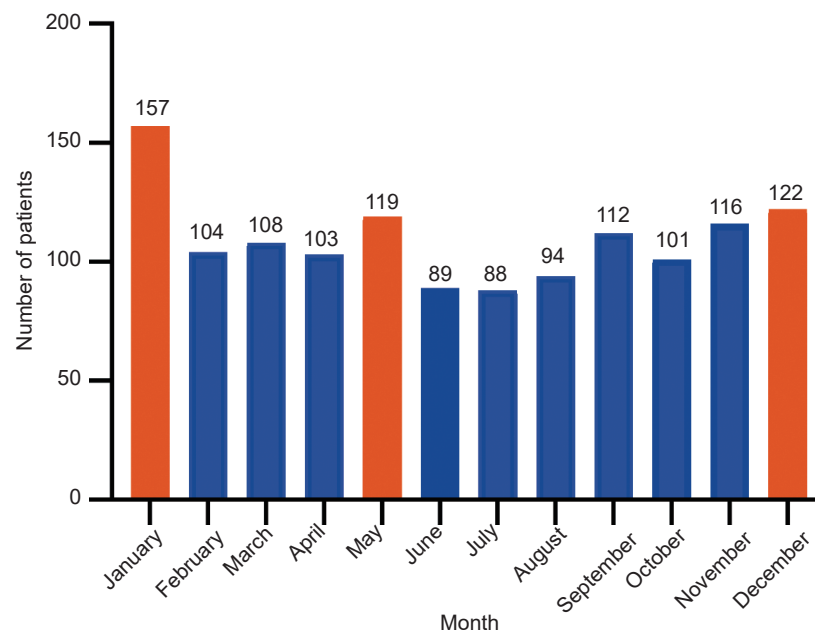


Figure 2 Monthly distribution of ED visits.

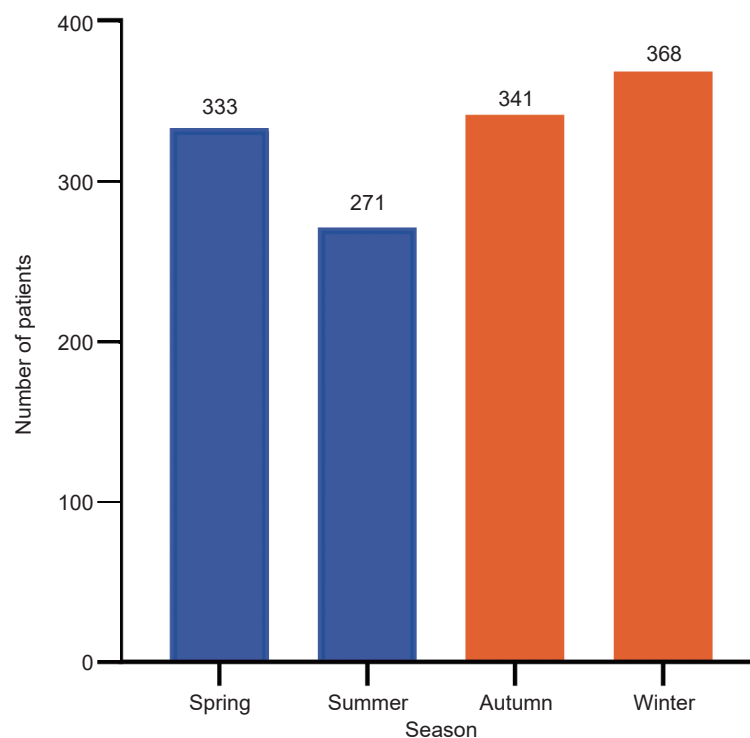


Figure 3 Seasonal distribution of ED visits.

reconciliation, and multidisciplinary input in patients with multiple chronic illnesses contributes to longer ED stays. This underscores the potential utility of comorbidity burden as a real-time triage and risk-stratification tool. Early identification of high-burden patients could enable targeted activation of specialized assessment pathways, reducing redundant testing and process delays.

3.3 Nonspecific symptoms and assessment challenges: Impact on triage and management

In 62.4% of cases, the primary diagnosis fell under the ICD-11

category “symptoms, signs, and clinical or laboratory findings not elsewhere classified,” with common presentations including dyspnea, fever, and chest pain. This predominance of nonspecific symptoms reflects the phenomenon of “symptom masking” in older adults, wherein classic disease markers are diminished or absent [25–27]. Despite this, 78.8% of patients were triaged as Level II (acute but not immediately life-threatening), indicating that a significant proportion of patients require careful but non-emergent evaluation. Recent evidence further demonstrates that elderly patients presenting with nonspecific complaints have a significantly higher risk of

Table 3 Diagnostic distribution of specific diseases (top 10)

Disease diagnosis	Male	Female	Total
Dyspnea	92 (14.51%)	76 (11.19%)	168 (12.8%)
Fever	85 (13.41%)	69 (10.16%)	154 (11.73%)
Chest pain	38 (5.99%)	28 (4.12%)	66 (5.03%)
Abdominal pain	22 (3.47%)	34 (5.01%)	56 (4.27%)
Pneumonia	32 (5.05%)	20 (2.95%)	52 (3.96%)
Hypertension	10 (1.58%)	34 (5.01%)	44 (3.35%)
Chest tightness	14 (2.21%)	29 (4.27%)	43 (3.27%)
Cough	18 (2.84%)	24 (3.53%)	42 (3.2%)
Dizziness	18 (2.84%)	23 (3.39%)	41 (3.12%)
Coma	11 (1.74%)	18 (2.65%)	29 (2.21%)
In total	634	679	1313

Table 4 Multivariable regression results

Variable	Regression coefficient (β)	Standard error (SE)	VIF	<i>t</i> value	<i>P</i> value
Constant	756.466	418.960		1.806	0.07
Consultation month	-14.087	5.616	1.043	-2.508	0.01
Consultation time	-1.249	13.784	1.004	-0.091	0.92
Consultation season	-39.800	17.912	1.057	-2.222	0.02
Gender	-33.064	40.188	1.012	-0.823	0.41
Age	-1.460	4.554	1.046	-0.321	0.74
Disease category by organ system	2.132	10.543	1.022	0.202	0.84
Number of comorbidities	87.876	13.540	1.761	6.490	<0.001
Charlson Comorbidity Index (CCI)	-12.577	16.018	1.727	-0.785	0.43
Emergency triage level	-54.496	40.012	1.036	-1.362	0.17
Palliative care	-22.235	70.693	1.088	-0.315	0.75
Patient outcome	1.586	23.814	1.053	0.067	0.94

hospital admission and 30-day mortality, as well as prolonged ED length of stay [28].

These findings highlight the importance of incorporating comprehensive geriatric assessment components into ED triage, including functional status, nutritional risk, and cognitive screening. Such measures could improve diagnostic precision, reduce repeated investigations, and mitigate unnecessary prolongation of ED stay in patients with unclear presenting complaints.

3.4 Age stratification and end-of-life care needs: Higher palliative care utilization in the longevity group

The longevity subgroup (age ≥ 90 years) had a significantly higher proportion of palliative care utilization (18.5%) compared with the 80–89-year-old group (7.4%; $P < 0.01$), indicating that advancing age is a strong predictor of end-stage care initiation during emergency encounters [29]. This finding suggests that in the oldest-old, irreversible disease trajectories are more common, necessitating earlier discussions about care goals.

Additionally, circulatory system diseases were more prevalent in female patients (17.8% vs. 12.5%; $P = 0.001$), potentially reflecting longer life expectancy, prolonged atherosclerotic processes, and hormonal influences on cardiovascular risk accumulation [30]. For patients aged ≥ 90

years with declining functional status and limited therapeutic options, integrating palliative care teams into the ED workflow can enhance the quality of end-of-life care, facilitate family communication, and reduce unnecessary prolonged LOS, thereby optimizing resource use.

4 Conclusions

This study delineates the clinical profile of super-elderly ED patients: nonspecific symptoms predominate, multimorbidity is ubiquitous, and disease patterns and outcomes vary by age and sex. ED LOS is significantly influenced by seasonal and temporal factors, as well as comorbidity burden. The oldest-old (age ≥ 90 years) demonstrate a substantially higher need for palliative care. It is recommended to proactively identify the end-of-life care needs of long-lived individuals, adopt dynamic resource allocation strategies, and conduct comprehensive geriatric assessments, with the aim of reducing emergency department stay times for elderly patients and improving the quality and efficiency of healthcare services for this vulnerable population.

5 Methods

5.1 Study design and population

A retrospective cross-sectional study was conducted using a

convenience sampling approach. All patients aged ≥ 80 years who attended the ED of a tertiary hospital in Guangzhou between January 1, 2023, and December 31, 2024, were screened for eligibility. Inclusion criteria were: (1) age ≥ 80 years; (2) admission to the emergency resuscitation room, as determined by the attending emergency physician based on vital sign abnormalities, altered mental status, or hemodynamic instability indicating an acute, severe, or life-threatening condition requiring immediate monitoring and resuscitation; and (3) availability of complete clinical data. Exclusion criteria were: (1) significant missing data; and (2) death on arrival. A total of 1313 eligible super-elderly patients were included. This study was conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies.

5.2 Data collection

Data were extracted from the hospital's electronic medical record system and included:

- (1) Demographic: Age and gender.
- (2) Clinic characteristics: Time of initial physician evaluation, categorized into six 4-hour intervals: 00:00–03:59, 04:00–07:59, 08:00–11:59, 12:00–15:59, 16:00–19:59, and 20:00–23:59; month of presentation (January–December); season (spring: March–May; summer: June–August; autumn: September–November; winter: December–February).
- (3) Disease category by organ system: Based on ICD-11 coding [31]; patients without a definitive diagnosis were classified according to the chief complaint.
- (4) Triage level: Assigned per institutional pre-examination triage criteria into four levels [32]: Level I (critical), Level II

(acute and severe), Level III (urgent), Level IV (non-urgent).

(5) Comorbidity profile: Number of comorbidities and the CCI [33], calculated by summing weighted chronic disease scores plus age-adjusted points (+1 per decade ≥ 50 years).

(6) ED LOS: Defined as the total time (minutes) from ED entry to departure (including admission, transfer, or death).

(7) Outcome: Discharge home (or community follow-up), ED observation without admission, inpatient admission, or death (in-ED or ED observation).

(8) Palliative care: Receipt of end-of-life care targeting symptom relief and quality of life improvement.

5.3 Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics version 26.0. Continuous variables were expressed as the mean $\pm$ standard deviation (SD); categorical variables as frequencies (n) and percentages. Between-group comparisons were performed using Student's t -test or one-way ANOVA for normally distributed continuous data, and chi-square (X^2) or Fisher's exact tests for categorical variables. Multiple linear regression analysis was conducted with ED LOS as the dependent variable. Independent variables included sex, age, time of presentation, month, season, triage level, disease category, outcome, palliative care status, CCI, and number of comorbidities (forced entry method). Regression coefficients (β), standard errors (SE), variance inflation factors (VIF), t values, and P values were reported. All VIF values were below 5, indicating no significant multicollinearity, and adjusted R^2 was used to quantify the explanatory power of the model. Statistically significant associations were defined as $P < 0.05$. Variable assignments were presented in Table 5.

Table 5 Variable assignments

Variable	Variable type	Coding scheme
LOS	Dependent variable	Actual value (minutes)
Gender	Independent variable	Male = 1, female = 2
Consultation time	Independent variable	0–3 h = 1, 4–7 h = 2, 8–11 h = 3, 12–15 h = 4, 16–19 h = 5, 20–23 h = 6
Season	Independent variable	Spring = 1, summer = 2, autumn = 3, winter = 4
Triage level	Independent variable	Level I = 1, Level II = 2, Level III = 3, Level IV = 4
Palliative care	Independent variable	Yes = 1, No = 0
Patient outcome	Independent variable	Discharged = 1, under observation = 2, admitted = 3, death = 4
Disease category by organ system	Independent variable	Symptoms, signs, and clinical/lab findings, not elsewhere classified = 1, circulatory system = 2, respiratory system = 3, digestive system = 4, injuries, poisonings, and external cause consequences = 5, endocrine, nutritional, and metabolic diseases = 6, genitourinary system = 7, musculoskeletal system and connective tissue = 8, neoplasms = 9, other = 10

Ethical approval

This study was approved by the Medical Ethics Committee of the Third Affiliated Hospital of Sun Yat-sen University (Medical Ethics II 2025-146-01), The Third Affiliated Hospital of Sun Yat-sen University).

Consent to participate

Informed consent was obtained from all participants or their legal guardians prior to enrollment.

Data availability

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

Author contributions

Mengqi Duan was responsible for the conception and overall design of the study, whereas Mengqi Duan, Zhen Wu and Qiuping Lin collaborated on conceptualization, data management, and methodology and contributed to the

writing. In addition, Guojie Gao, Yanjun Zhang and Zhixin Liao performed the formal analysis and participated in the review and editing process of the manuscript.

Acknowledgments

This research was supported by the Nursing Innovation Development Research Project (No. GDHLYJYM202413) of the Guangdong Nursing Association and the Lingnan Nightingale Nursing Research Institute.

Conflict of interests

No potential conflict of interest relevant to this article is reported.

References

- [1] United Nations. Ageing. Available at <https://www.un.org/zh/global-issues/ageing> (accessed 8 February 2026)
- [2] Du, P. The status quo of population aging and development of the social security system in China. *Chinese Social Security Review*, **2023**, 7(2): 31–47. (in Chinese)
- [3] Stillman, K., Dahlke, L., Aharonyan, L., Lauzon, M., Lawton, A., Stang, C., Geiderman, J., Rosen, S., Torbati, S. Social risks of geriatric patients presenting to the emergency department. *BMC Geriatrics*, **2026**, 26: 409. <https://doi.org/10.1186/s12877-026-07186-3>
- [4] Fuentes, E., Jacob, J., del Castillo, J. G., Montero-Pérez, F. J., Alquezar-Arbé, A., García-Lamberechts, E. J., Aguiló, S., Fernández-Alonso, C., Burillo-Putze, G., Piñera, P. et al. Use of resources in elderly patients consulting the emergency department: Analysis of the Emergency Department and Elder Needs Cohort (EDEN-21). *Internal and Emergency Medicine*, **2025**, 20(1): 247–256. <https://doi.org/10.1007/s11739-024-03638-z>
- [5] Ong, C. A., Nadarajan, G. D., Fook-Chong, S., Shahidah, N., Arulanandam, S., Ng, Y. Y., Chia, M. Y., Tiah, L., Mao, D. R., Ng, W. M. et al. Increasing neurologically intact survival after out-of-hospital cardiac arrest among elderly: Singapore Experience. *Resuscitation Plus*, **2024**, 17: 100573. <https://doi.org/10.1016/j.resplu.2024.100573>
- [6] Wang, S. M., Li, Q. Y., Hu, J. Z., Chen, Q. R., Wang, S. S., Xue, Q. L., Huang, C. M., Sun, H. Y., Liu, M. H. Association of multimorbidity patterns and order of physical frailty and cognitive impairment occurrence: A prospective cohort study. *Age and Ageing*, **2025**, 54(4): afaf101. <https://doi.org/10.1093/ageing/afaf101>
- [7] Nicholson, K., Liu, W., Fitzpatrick, D., Hardacre, K. A., Roberts, S., Salerno, J., Stranges, S., Fortin, M., Mangin, D. Prevalence of multimorbidity and polypharmacy among adults and older adults: A systematic review. *The Lancet Healthy Longevity*, **2024**, 5(4): e287–e296. [https://doi.org/10.1016/S2666-7568\(24\)00007-2](https://doi.org/10.1016/S2666-7568(24)00007-2)
- [8] Li, Z. H., Zhou, X. T., Zhou, T. T., Mei, T. S., Fang, M., Huang, P. Cross-cultural adaptation and validation of the Chinese version of the six-item screener for cognitive impairment in older patients in the emergency department. *Journal of Emergency Nursing*, **2026**, 52(4): 960–970.e1. <https://doi.org/10.1016/j.jen.2026.01.004>
- [9] Merchant, R. A., Chan, Y. H., Ling, N. M. W., Chen, M. Z. X., Ho, V. W. T., Wong, B. L. L., Lim, Z., Ng, S. E., Anantharaman, V. Admission of older patients to geriatric inpatient care from the emergency department compared with admission through acute medical unit: Cost and length of stay outcomes. *The Journal of Frailty & Aging*, **2024**, 13(4): 507–513. <https://doi.org/10.14283/jfa.2024.58>
- [10] Eidstø, A., Ylä-Mattila, J., Tuominen, J., Huhtala, H., Palomäki, A., Koivisto, T. Emergency department crowding increases 10-day mortality for non-critical patients: A retrospective observational study. *Internal and Emergency Medicine*, **2024**, 19(1): 175–181. <https://doi.org/10.1007/s11739-023-03392-8>
- [11] Elder, N., Tyler, K., Mumma, B., Maeda, M., Tancredi, D. Emergency department length of stay is associated with delirium in older adults. *Western Journal of Emergency Medicine*, **2023**, 24(3): 532–537. <https://doi.org/10.5811/westjem.59383>
- [12] Sheng, L. Challenges and coping strategies in diagnosis and treatment of comorbidities in elderly patients with cardiovascular diseases. *Chinese Journal of Geriatric Heart Brain and Vessel Diseases*, **2025**, 27(3): 257–259. (in Chinese)
- [13] Wang, Y., Ye, D. X., Cheng, Y. B., Liu, Y., Li, N., Wang, Y., Bi, P., Tong, S. L., Li, Y. H., Yao, X. Y. Seasonal variation in association between temperature change and emergency department visits: A multi-site study in China. *Environmental Research*, **2022**, 214: 113963. <https://doi.org/10.1016/j.envres.2022.113963>
- [14] Enhörning, S., Melander, O., Engström, G., Elmstahl, S., Lind, L., Nilsson, P. M., Pihlgård, M., Timpka, S. Seasonal variation of vasopressin and its relevance for the winter peak of cardiometabolic disease: A pooled analysis of five cohorts. *Journal of Internal Medicine*, **2022**, 292(2): 365–376. <https://doi.org/10.1111/joim.13489>
- [15] Jung, C. C., Hsia, Y. F., Hsu, N. Y., Wang, Y. C., Su, H. J. Cumulative effect of indoor temperature on cardiovascular disease-related emergency department visits among older adults in Taiwan. *Science of the Total Environment*, **2020**, 731: 138958. <https://doi.org/10.1016/j.scitotenv.2020.138958>
- [16] Fan, J. F., Xiao, Y. C., Feng, Y. F., Niu, L. Y., Tan, X., Sun, J. C., Leng, Y. Q., Li, W. Y., Wang, W. Z., Wang, Y. K. A systematic review and meta-analysis of cold exposure and cardiovascular disease outcomes. *Frontiers in Cardiovascular Medicine*, **2023**, 10: 1084611. <https://doi.org/10.3389/fcvm.2023.1084611>
- [17] Li, M. Q., Tang, X. P., Liao, Z. Y., Shen, C. B., Cheng, R. M., Fang, M. Q., Wang, G., Li, Y., Tang, S. Z., Xie, L. et al. Hypoxia and low temperature upregulate transferrin to induce hypercoagulability at high altitude. *Blood*, **2022**, 140(19): 2063–2075. <https://doi.org/10.1182/blood.2022016410>
- [18] Rinaldi, I., Sudaryo, M. K., Prihartono, N. A. Disseminated intravascular coagulation in sepsis and associated factors. *Journal of Clinical Medicine*, **2022**, 11(21): 6480. <https://doi.org/10.3390/jcm11216480>
- [19] Huang, X. F., Kong, Q. Y., Huang, Y. T., Wang, X. X., Wang, R. R., Li, Y. Y., Wu, Y. Q., Guan, C. Y., Wan, X. W., Zhang, Y. Y. Relationship between Sun exposure and seasonal affective disorder symptoms in rural older people with different personalities: A cross-sectional study. *BMC Public Health*, **2024**, 24: 2568. <https://doi.org/10.1186/s12889-024-20074-y>
- [20] Karamercan, M. A., Dündar, Z. D., Ergin, M., Van Meer, O., Body, R., Harjola, V. P., Verschuren, F., Christ, M., Golea, A., Capsec, J. et al. Seasonal variations of patients presenting dyspnea to emergency departments in Europe: Results from the EURODEM Study. *Turkish Journal of Medical Sciences*, **2020**, 50(8): 1879–1886. <https://doi.org/10.3906/sag-2002-221>
- [21] Yang, J., Li, H. R., Chen, Y. L., Chen, T., Xiao, Q. H., Zhao, H. L., Wang, J. X., Li, S. Y., Xie, Y., Oliver, B. et al. Quality and recommendations of guidelines for multimorbidity and polypharmacy in older adults: A systematic review. *Ageing Research Reviews*, **2026**, 117: 103060. <https://doi.org/10.1016/j.arr.2026.103060>
- [22] Charlson, M. E., Wells, M. T. Comorbidity: From a confounder in longitudinal clinical research to the main issue in population management. *Psychotherapy and Psychosomatics*, **2022**, 91(3): 145–151. <https://doi.org/10.1159/000521952>
- [23] Solakoglu, G. A. Evaluation of factors affecting the length of stay of geriatric patients in the emergency department. *Northern Clinics of Istanbul*, **2023**, 10(4): 444–450. <https://doi.org/10.14744/nci.2023.59319>
- [24] Ehrlington, S. M., Wretborn, J., Wilhelms, D. Frailty alerts reduce waiting time and length of stay in the emergency department. *Academic Emergency Medicine*, **2026**, 33(2): e70239. <https://doi.org/10.1111/acem.70239>
- [25] McQuown, C. M., Tsivitse, E. K. Nonspecific complaints in older emergency department patients. *Clinics in Geriatric Medicine*, **2023**,

- 39(4): 491–501. <https://doi.org/10.1016/j.cger.2023.04.007>
- [26] Kłosiewicz, T., Rozmarynowska, M., Konieczka, P., Mazur, M. Impact of geriatric admissions on workload in the emergency department. *Healthcare*, **2023**, 11(4): 593. <https://doi.org/10.3390/healthcare11040593>
- [27] van Dam, C. S., Peters, M. J. L., Hoogendijk, E. O., Nanayakkara, P. W. B., Muller, M., Trappenburg, M. C. Older patients with nonspecific complaints at the Emergency Department are at risk of adverse health outcomes. *European Journal of Internal Medicine*, **2023**, 112: 86–92. <https://doi.org/10.1016/j.ejim.2023.03.018>
- [28] Erwander, K., Ivarsson, K., Olsson, M. L., Agvall, B. Elderly patients with non-specific complaints at the emergency department have a high risk for admission and 30-days mortality. *BMC Geriatrics*, **2024**, 24: 5. <https://doi.org/10.1186/s12877-023-04621-7>
- [29] Mojtahedi, Z., Yoo, J. W., Callahan, K., Bhandari, N., Lou, D. H., Ghodsi, K., Shen, J. J. Inpatient palliative care is less utilized in rare, fatal extrahepatic cholangiocarcinoma: A ten-year national perspective. *International Journal of Environmental Research and Public Health*, **2021**, 18(19): 10004. <https://doi.org/10.3390/ijerph181910004>
- [30] Rajendran, A., Minhas, A. S., Kazzi, B., Varma, B., Choi, E., Thakkar, A., Michos, E. D. Sex-specific differences in cardiovascular risk factors and implications for cardiovascular disease prevention in women. *Atherosclerosis*, **2023**, 384: 117269. <https://doi.org/10.1016/j.atherosclerosis.2023.117269>
- [31] Feinstein, J. A., Gill, P. J., Anderson, B. R. Preparing for the *International Classification of Diseases, 11th Revision (ICD-11)* in the US Healthcare System. *JAMA Health Forum*, **2023**, 4(7): e232253. <https://doi.org/10.1001/jamahealthforum.2023.2253>
- [32] Li, B. Y., Zhang, Z. F., Li, K. Y., Deng, Y. Y. The effectiveness of a modified Manchester Triage System for geriatric patients: A retrospective quantitative study. *Nursing Open*, **2024**, 11(9): e70024. <https://doi.org/10.1002/nop2.70024>
- [33] Charlson, M. E., Charlson, R. E., Peterson, J. C., Marinopoulos, S. S., Briggs, W. M., Hollenberg, J. P. The Charlson comorbidity index is adapted to predict costs of chronic disease in primary care patients. *Journal of Clinical Epidemiology*, **2008**, 61(12): 1234–1240. <https://doi.org/10.1016/j.jclinepi.2008.01.006>