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Factors Associated With the Survival of Older Patients With Pneumonia in the Emergency Department: A Retrospective Observational Study

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ABSTRACT

Aims: To determine the clinical characteristics and identify not only the Korean Triage and Acuity Scale levels of older patients with pneumonia in the emergency department but also the factors associated with their survival.

Design: This study employed a retrospective observational design.

Methods: This study was conducted at the emergency department of a university hospital in Seoul, South Korea. It utilised medical data from January 1 to December 31, 2023. The study sample comprised 327 patients aged 65 years or older who received a pneumonia diagnosis (International Classification of Diseases: J10–J18). Binary logistic regression analysis was performed to identify independent factors associated with their survival.

Results: Survival was significantly associated with and influenced by sex (specifically, male sex), initial Korean Triage and Acuity Scale level, oxygen supplementation in the emergency department, consciousness level (specifically, painful response), body temperature (> 37.5°C) and a diagnosis of solid or hematologic malignancies.

Conclusions: The findings highlight the need for improved triage protocols, emphasising consciousness level, body temperature and malignancies. Incorporating geriatric-specific age thresholds and oncologic status into Korean Triage and Acuity Scale classifications may enhance risk stratification, timely intervention and resource allocation in emergency department settings.

Implications for the Profession and/or Patient Care: This study provides insight into triage accuracy for older pneumonia patients, emphasising early recognition of high-risk individuals and strengthening nursing assessment protocols. Improved Korean Triage and Acuity Scale classifications can optimise resource allocation and emergency care strategies, ultimately reducing mortality rates.

Impact: The study provides actionable insights for emergency nurses, triage clinicians and policymakers. The findings support the refinement of KTAS protocols to enhance risk stratification and guide resource allocation for older pneumonia patients, ultimately aiming to reduce mortality rates.

Reporting Method: Adhered to STROBE guidelines for observational studies.

Patient or Public Contributions: Although patients did not directly participate, the findings advocate for patient-centred triage improvements, enhancing early identification of high-risk older patients with pneumonia.

Keypoints

What does this paper contribute to the wider global clinical community?

- Highlights universally available, rapid triage predictors—consciousness level, fever response and oxygen requirement—that can improve early risk stratification of older patients with pneumonia in emergency departments
- Demonstrates the value of integrating geriatric-specific age thresholds and oncologic status into existing acuity scales (e.g., KTAS, CTAS and ESI), offering a template for global triage refinements tailored to ageing populations.
- Provides evidence to guide resource allocation and targeted interventions—such as prioritising febrile patients for aggressive care—to reduce mortality among older adults with pneumonia across diverse healthcare settings.

1 | Introduction

In 2025, the proportion of people aged 65 years or older in South Korea constituted 20.3% of the total population, marking the country's transition to a super-aged society (Korean Statistical Information Service 2025). According to the 2020 National Survey on the Elderly, 84% of the older adult population had at least one chronic disease, and those with multimorbidity (i.e., multiple chronic conditions) experienced a greater burden of medical expenses (Bae et al. 2022).

An analysis of healthcare service utilisation among older patients reveals that they constituted 29.4% of all emergency department (ED) visits in Korea (Seo 2021). One common reason for ED visits among older adults is respiratory symptoms, with patients who complain of dyspnea more likely to be hospitalised (Šteinmiller et al. 2015). Among respiratory tract diseases, pneumonia is a leading cause of mortality in older adults across the world. According to the 2021 Global Burden of Disease report, 2.1 million people died of pneumonia that year; adults over 70 years of age continued to be the most vulnerable, with more than 1 million pneumonia-related deaths (Bender et al. 2024). According to the Korean mortality statistics from 2022, pneumonia ranked as the third leading cause of death, with especially high mortality rates observed in those aged 70 or above (Vital Statistics Division Statistics Korea et al. 2023); if pneumonia cases associated with COVID-19 were considered, it would be ranked even higher. The high incidence of pneumonia in older adults is primarily because of an age-related decline in immune function that diminishes pathogen defence (Martín-Sánchez et al. 2013).

Therefore, to enhance the efficiency of pneumonia treatment and reduce mortality among older adult patients, objective indices that accurately assess patient severity and mortality risk should be adopted. Previous studies have revealed that older adult patients with respiratory symptoms who present to the ED had poor outcomes when they required high oxygen supplementation and had low systolic blood pressure, a rapid heart rate, and a body temperature below 36°C (Hong et al. 2024). Even among patients diagnosed with pneumonia, differences in severity, ED nurse staffing levels, and treatment times based on nurses' experience underscore the importance of rapid severity prediction (Lee and Cho 2018). Among the indices currently used to predict pneumonia prognosis, the Pneumonia Severity Index (PSI) and CURB-65 (Confusion, Uremia, Respiratory Rate, Blood Pressure, Age ≥ 65 years) are the most representative (Bradley et al. 2022; Wen et al. 2020). However, the former is complex owing to its consideration of multiple detailed items, making it less applicable in the ED than the latter (Kaal et al. 2023). Although CURB-65 is simple to calculate and easier to apply clinically, it exhibits relatively low sensitivity in prognostic prediction and does not incorporate complications into its scoring, thereby limiting its accuracy as a predictive factor (Baek et al. 2020; Ilg et al. 2019). Moreover, both PSI and CURB-65 have demonstrated reduced effectiveness in predicting outcomes in more advanced age groups (Baek et al. 2020).

The Korean Triage and Acuity Scale (KTAS) was developed in 2012 as a patient triage tool that encompasses both prehospital and hospital stages. It is based on the Canadian Triage and Acuity Scale but was modified based on a Delphi survey to align with Korea's healthcare environment. It aims to enhance the accuracy of patient severity assessment and optimise emergency response protocols (Park et al. 2014). In practice, nurses with varying levels of experience—from only 1 year to highly experienced practitioners—conduct severity classification. However, cases involving ambiguous or complex primary symptoms may require extended assessment time (Lee and Oh 2021). Patients presenting at the ED are classified as either adults or paediatric patients (using the cutoff of 15 years) and are evaluated for severity using KTAS prior to receiving emergency treatment (Park and Lim 2017). Data reveal that among ED patients, 79.4% were categorised as KTAS Level 4 (semi-urgent) (Lee and Oh 2021), while a larger proportion of older patients were categorised as KTAS Level 3 classification (emergency) (Shin and Kim 2018). Although the KTAS classification criteria are explicitly stated, over- and under-triage (assigning a higher or lower severity than warranted, respectively) can occur based on subjective judgements by the triaging nurse (Sim et al. 2012). Inaccurate classifications may result in delayed treatment (in cases of under-triage), thereby increasing the risk of emergencies, or in the unnecessary consumption of medical resources (in cases of over-triage), leading to economic losses and wasted time.

In the ED, prompt and accurate assessment of older patients' condition is critical for appropriate treatment. Older patients with chronic diseases are more likely to revisit the ED and present with a variety of symptoms than those without underlying conditions, underscoring the importance of early prognostic prediction. Accurate severity assessment in patients with pneumonia plays a crucial role in enhancing survival and reducing readmission rates (Davis et al. 2022). This not only alleviates ED congestion and reduces the burden on medical staff but also improves the quality of systematic patient care. Moreover, timely evaluation decreases readmission rates, thereby reducing overall medical expenses (Haynesworth et al. 2023; Hesselink et al. 2019). The consequent reduction in healthcare costs helps lower patients' financial burdens, improve their quality of life and ultimately diminish the

economic strain on the National Health Insurance System (Han et al. 2018). Thus, this study aims to identify the clinical characteristics and KTAS levels of older patients with pneumonia admitted to the ED and to determine the factors influencing their survival.

2 | Methods

2.1 | Study Design

This retrospective observational cohort study was performed at a University Hospital in Seoul—an academic tertiary hospital with an ED that treats 40,000 patients, on average, annually. The medical records of patients who visited the ED from January 1 to December 31, 2023, were retrieved.

2.2 | Participants

The inclusion criteria for study participants were: patients aged 65 years or older, and those diagnosed with pneumonia (International Classification of Diseases [ICD]: J10–J18) as a primary or secondary diagnosis upon admission. The pneumonia diagnosis was further verified through a comprehensive review of patients' medical records to ensure accuracy. Fever due to non-infectious diseases was not excluded from the study because triage nurses cannot determine all causes of fever at the triage stage. The exclusion criteria were: patients under 65 years of age, those who died in the ED prior to hospital admission, and those who were discharged from the ED without admission.

During the specified study period, 9007 older patients visited the ED. Among them, 432 received a pneumonia diagnosis and 327 were subsequently admitted for inpatient treatment, constituting the final study sample (Figure 1). The sample size of 327 patients was deemed sufficient, having exceeded the minimum requirement of 300 participants for a logistic regression analysis involving four or more independent variables, as recommended by Bujang (2021).

2.3 | Measures

The primary outcome was defined as in-hospital survival during index admission. Patients were classified as surviving if they were discharged from the hospital and as deceased if they died during the same hospitalisation. Independent variables included patient-related factors such as age, sex, medical history, vital signs (blood pressure, heart rate, respiratory rate, body temperature, oxygen saturation [SPO_2]), consciousness level, body mass index (BMI), oxygen supplementation in the ED, ED visit history and KTAS score at the ED. We assessed the length of ED stay, reflecting time spent in the ED before hospital admission, the treatment process, and the final KTAS score after reassessment.

The KTAS classification is a symptom-oriented tool that can be used by qualified doctors and nurses. Level 1 emergency medical technicians who have worked in the ED for at least 12 months within the past 5 years will be eligible for KTAS classification for the following 3 years, provided they pass the test after undergoing training for a specified amount of time. Every patient who visits the ED undergoes a rapid initial assessment

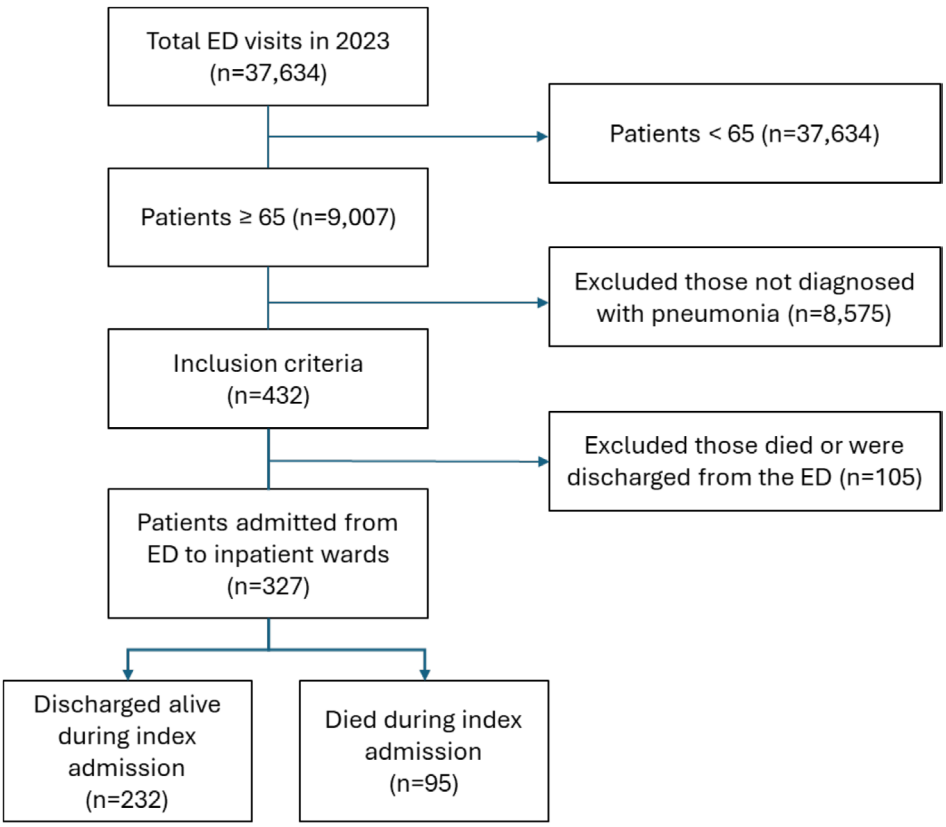

FIGURE 1 | Flowchart of participants. [Colour figure can be viewed at wileyonlinelibrary.com]

and infectious-disease screening by a KTAS-qualified person to determine critical signs upon first glance, such as shock status, cardiac arrest, altered mental status with a Glasgow Coma Scale (GCS) score of ≤13 points (3–8 points are classified as KTAS Level 1, and 9–13 points are classified as KTAS Level 2), or severe difficulties in breathing. Patients in a life-threatening condition and those requiring immediate medical care are classified as KTAS Level 1 and immediately admitted to the ED. Patients who do not meet Level 1 criteria are classified between Levels 2 and 5 based on their chief complaint and other variables. By integrating measures of both urgency and severity, the resulting KTAS levels determine the priority for patient care (Park and Lim 2017).

After the KTAS level is determined, the severity of patients is reevaluated during the waiting time or even during treatment. The guidelines recommend that Level 1 patients be treated without delay, while Levels 2, 3, 4, and 5 patients be reevaluated every 10, 30, 60 and 120 min, respectively. Thus, the KTAS level can change if new information is learned during treatment or if patients' symptoms and vital signs change. In addition, when patients leave the ED upon discharge or hospital admission, the KTAS level is recalculated to derive the final KTAS level (Chung et al. 2023).

2.4 | Data Collection

Medical records were reviewed using an electronic medical records system, with vital signs extracted from initial ED assessments. Consciousness levels were categorised according to the National Emergency Department Information System classification into: alert, verbal response, painful response and unresponsive. Patients were assigned a KTAS score, ranging from Level 1 (Resuscitation) to Level 5 (Non-urgent), by nurses trained in triage assessment protocols. Data on KTAS triage nurse experience (years of clinical practice) were collected from hospital personnel records and cross-checked with electronic health record assignment logs to identify the nurse who performed the initial KTAS assessment for each patient. The median experience of KTAS-performing nurses was 7 years. The median length of patients' ED stay before hospitalisation was 324 min. Among the participants, 70.6% ($n = 231$) received oxygen supplementation, while 29.4% ($n = 96$) did not.

2.5 | Statistical Analysis

Data were analysed using the IBM SPSS Statistics for Windows, version 27.0. Descriptive statistics, including frequency distributions and percentages, were used for categorical variables. Means and standard deviations (or medians and interquartile ranges for non-normally distributed data) described continuous variables related to participants' general and disease-specific characteristics. For group comparisons, independent *t*-tests were employed to compare continuous variables between the surviving and deceased groups. Chi-square tests, or Fisher's exact tests where cell counts were small, were used to analyse differences in categorical variables between these two groups. Binary logistic regression analysis was performed to identify independent factors influencing survival, calculating their odds ratios (ORs) and 95% confidence intervals (CIs). Prior to conducting logistic regression, multicollinearity among independent variables was assessed using linear regression. The 'Initial KTAS level' and 'Final KTAS level' were found to exhibit a variance inflation factor (VIF) greater than 10, indicating significant multicollinearity (Menard 2002). Consequently, the 'Final KTAS level' variable was excluded from the logistic regression model to ensure the validity of the analysis. The KTAS triage nurse experience was summarised descriptively; no nurse-level or causal analyses linking nurse experience to KTAS accuracy or patient survival were performed.

2.6 | Ethical Considerations

The study was reviewed and exempted by the Institutional Review Board of K University Medical Centre (Approval No. KUMC 2024-08-020). All personal identifiers were encrypted or removed to ensure patient confidentiality. In cases where sensitive information may have been inadvertently collected, it was immediately encrypted to prevent patient identification. All collected data were used strictly for the purposes of this research. Data will be securely stored for a period of 3 years following the study's completion—in accordance with Article 15 of the Bioethics Act Enforcement Rule—after which they will be permanently deleted.

3 | Results

3.1 | Participant Characteristics

Table 1 summarises the participant characteristics. Among 327 hospitalised older patients with pneumonia, the median age was 81 years and the majority were male. Although most patients were alert on ED arrival, the remaining showed reduced responsiveness. BMI distribution revealed notable proportions of both underweight and overweight patients. Median vital signs at presentation were within expected ranges, and overall in-hospital survival was 70.9%. Initial KTAS triage clustered in Levels 2–3, primarily Level 3; KTAS remained unchanged for 98.5% of patients.

3.2 | Comparison of Participants' Characteristics Between Surviving and Deceased Groups

Participant characteristics were compared between the surviving and deceased groups (Table 2). SPO_2 upon ED arrival was missing for 2 patients and height was unrecorded for 17, weight for 2, and BMI for 14; these values were treated as missing. Statistically significant differences between the surviving and deceased groups were observed in systolic blood pressure ($t = -2.734$, $p = 0.003$), body temperature ($t = -3.447$, $p < 0.001$), consciousness level ($\chi^2 = 20.438$, $p < 0.001$), initial KTAS level ($\chi^2 = 26.043$, $p < 0.001$), and oxygen supplementation in the ED ($\chi^2 = 22.896$, $p < 0.001$).

Patients classified with lower KTAS levels had higher survival rates, while oxygen supplementation in the ED was associated with increased mortality (Table 2).

TABLE 1 | General characteristics of participants ($N = 327$).

Variables	*n* (%)	Median (IQR)
Sex		
Male	190 (58.1)	
Female	137 (41.9)	
Age (years)		
< 70	36 (11.0)	81.0 (11)
70 ~ 79	104 (31.8)	
80 ~ 89	144 (44.0)	
≥ 90	43 (13.1)	
Consciousness level		
Alert	234 (71.6)	
Verbal response	41 (12.5)	
Painful response	51 (15.6)	
Unresponsive	1 (0.3)	
Height (cm)		160 (14)
Body weight (kg)		54.5 (19)
BMI[a] (kg/m^2)		
< 18.5	77 (24.6)	21.3 (5)
18.5 ~ 22.9	121 (38.7)	
≥ 23	115 (36.7)	
SPO_2[a] (%)		95 (5)
Systolic blood pressure (mmHg)		132 (38)
Diastolic blood pressure (mmHg)		69 (15)
Heart rate (bpm)		99 (30)
Respiratory rate (breaths/min)		20 (2)
Body temperature (°C)		37.1 (1)
Survival status after ED		
Surviving	232 (70.9)	
Deceased	95 (29.1)	
Initial KTAS level		
Level 1	9 (2.8)	
Level 2	90 (27.5)	
Level 3	179 (54.7)	
Level 4	49 (15.0)	
Change to initial and final KTAS level		
No	322 (98.5)	
Yes	5 (1.5)	
Length of ED stay (mins)		324.0 (118.0)
Return visit to ED		
No	323 (98.8)	
Yes	4 (1.2)	
Oxygen supplementation in the ED (nasally)		
No	96 (29.4)	
Yes	231 (70.6)	
Comorbidity[b]		
Hypertension	191 (20.9)	
Diabetes mellitus	110 (12.0)	
Cardiovascular disease	108 (11.8)	
Renal disease	47 (5.1)	
Respiratory disease	112 (12.3)	
Solid malignancy	58 (6.4)	
Hematologic malignancy	7 (0.8)	
Hepatobiliary and pancreatic disease	19 (2.1)	
Urinary tract infection	5 (0.5)	
Mental health disorder	8 (0.9)	

Note: Vital signs are the initial values recorded upon arrival at the emergency department. As the data did not follow a normal distribution, results are expressed as median and interquartile range (IQR).
Abbreviations: BMI, body mass index; KTAS, Korea Triage and Acuity Scale; SPO, saturation pulse oxygen.
[a]Missing data.
[b]Multiple responses.

3.3 | Factors Influencing Survival in Older Patients With Pneumonia

As shown in Table 3, logistic regression analysis identified sex, oxygen supplementation, initial KTAS score, consciousness level, body temperature and malignancies as significant predictors of survival. Prior to the logistic regression analysis, 1 patient with an 'unresponsive' consciousness level and 14 with missing BMI values were excluded owing to missing data.

The logistic regression model was built in three sequential steps. Model 1, which included only sex and age, revealed no significant factors for survival. After adjusting for BMI, oxygen supplementation, initial KTAS level, consciousness level and body temperature (> 37.5°C), Model 2 identified male sex ($B = -0.82$, $p = 0.01$), oxygen supplementation ($B = -1.43$, $p < 0.001$), a 'painful response' consciousness level ($B = -0.97$, $p = 0.02$) and body temperature (> 37.5°C) ($B = 0.89$, $p = 0.004$) as significant factors. The final Model 3, which included all variables from Model 2 along with comorbidities and past medical history, showed a statistically significant fit over the previous model (χ^2 (10) = 20.819, $p < 0.001$) and accounted for

TABLE 2 | Comparison of participants' characteristics between surviving and deceased groups.

Variables	Deceased group ($n = 95$)	Surviving group ($n = 232$)	t or χ^2 (p)
Systolic blood pressure (mmHg), mean ± SD	125.49 ± 30.63	135.18 ± 28.42	−2.734 (0.003)
Body temperature (°C), mean ± SD	36.94 ± 0.89	37.31 ± 0.89	−3.447 (< 0.001)
Consciousness level, *n* (%)			
Alert	55 (57.9)	179 (77.2)	20.438 (< 0.001)
Verbal response	12 (12.6)	29 (12.5)	
Painful response	28 (29.5)	23 (9.9)	
Unresponsive	—	1 (0.4)	
Initial KTAS level, *n* (%)			
Level 1 Resuscitation	5 (5.3)	4 (1.7)	26.043 (< 0.001)
Level 2 Emergency	42 (44.2)	48 (20.7)	
Level 3 Urgent	42 (44.2)	137 (59.1)	
Level 4 Semi-urgent	6 (6.3)	43 (18.5)	
Oxygen supplementation in the ED (nasally), *n* (%)			
No	10 (10.5)	86 (37.1)	22.896 (< 0.001)
Yes	85 (89.5)	146 (62.9)	

Note: Continuous variables were analysed using independent two-sample *t*-tests, and categorical variables were assessed using chi-square tests.
Abbreviations: ED, emergency department; KTAS, Korean Triage and Acuity Scale.

33.3% of the variance in survival. In this model, male patients exhibited lower odds of survival than did female patients (OR = 0.490, $p = 0.030$). Oxygen supplementation in the ED was associated with an approximately five-fold increase in the odds of mortality (OR for survival = 0.203, $p < 0.001$). Patients with higher initial KTAS scores (indicating lower severity) had higher odds of survival (OR = 1.690, $p = 0.044$). The odds of survival for patients with a 'painful response' consciousness level were about one-third the odds of those who were 'alert' (OR = 0.326, $p = 0.011$). Patients with body temperatures exceeding 37.5°C had higher odds of survival (OR = 1.798, $p = 0.001$). Those diagnosed with solid malignancies had significantly lower odds of survival (OR = 0.445, $p = 0.026$), while those diagnosed with hematologic malignancies showed even lower odds (OR = 0.081, $p = 0.011$).

4 | Discussion

The rapid demographic shift toward a super-aged society in South Korea, coupled with the increasing number of older patients seeking emergency care, underscores the critical importance of effective assessment and management in EDs. Pneumonia, a leading cause of mortality in older adults, necessitates a nuanced understanding of patient characteristics to improve outcomes.

This study's findings regarding the KTAS classification of older patients with pneumonia, align with previous research. The majority of patients (55.5%) were classified as KTAS Level 3 (urgent), with a significant proportion (85.9%) falling into the more severe Levels 1–3. This is consistent with not only national emergency medical statistics from 2023, which reported high proportions of older patients in KTAS Levels 1 and 2 (63.3% and 49.8%, respectively), but also prior studies indicating a higher prevalence of KTAS Level 3 among older patients visiting EDs (National Emergency Medical Center 2024). This suggests that older patients visiting EDs are generally in a more critical condition than those in other age groups, highlighting their inherent vulnerability and need for urgent initial assessment (Huh et al. 2021; Shin and Kim 2018).

The median experience of KTAS-performing nurses in this study was 7 years. While not directly comparable to all prior studies, this figure indicates that nurses with a substantial level of experience are responsible for triage classification at the study hospital, which is generally considered beneficial for accurate assessment (Kim et al. 2019). The median length of ED stay for admitted patients was 324 min, comparable to findings from other studies on critically ill patients (e.g., 353.2 min for intensive care unit admissions; Kim et al. 2019).

Age is a critical prognostic indicator in older patients with pneumonia. Established tools for assessing pneumonia severity, such as the PSI and CURB-65, incorporate age as one of their parameters. The A-DROP scoring system, proposed by the Japanese Respiratory Society, further refines this criterion by stratifying it by sex—men aged 70 years or older and women aged 75 years or older (Shindo et al. 2008). A-DROP is an acronym for Age (men ≥ 70 years, women ≥ 75 years), Dehydration (blood urea nitrogen ≥ 21 mg/dL), Respiratory failure (SaO_2 ≤ 90% or PaO_2 ≤ 60 mmHg), Orientation disturbance (confusion), and low blood pressure (systolic blood pressure ≤ 90 mmHg). Each positive criterion is assigned one

TABLE 3 | Factors influencing participants' survival ($N = 327$).

Variables		*B*	SE	Wald	*p*	Exp (*B*)	95% CI
Age		−0.016	0.020	0.81	0.416	0.984	0.947–1.023
Sex (male)		−0.713	0.329	4.73	0.030	0.490	0.257–0.934
Level of consciousness[a]				7.78	0.016		
Verbal response		0.292	0.479	0.31	0.541	1.340	0.524–3.423
Painful response		−1.121	0.440	6.11	0.011	0.326	0.138–0.772
Initial KTAS level		0.532	0.259	4.171	0.044	1.690	1.021–2.664
Oxygen supplementation in the ED		−1.594	0.455	11.98	< 0.001	0.203	0.083–0.495
Body mass index (kg/m^2)		0.010	0.039	0.066	0.798	0.990	0.918–1.068
Body temperature (> 37.5) (°C)		0.587	0.184	10.197	0.001	1.798	1.254–2.577
Comorbidity	Hypertension	0.533	0.313	2.902	0.088	1.704	0.923–3.145
	Diabetes mellitus	0.189	0.335	0.319	0.572	1.208	0.627–2.328
	Cardiovascular disease	0.220	0.340	0.417	0.518	1.246	0.640–2.426
	Respiratory disease	0.074	0.318	0.054	0.816	1.077	0.578–2.007
	Renal disease	−0.735	0.418	3.087	0.079	0.480	0.211–1.089
	Solid malignancy	−0.810	0.364	4.944	0.026	0.445	0.218–0.908
	Hematologic malignancy	−2.511	0.987	6.464	0.011	0.081	0.012–0.563
	Hepatobiliary and pancreatic disease	−0.299	0.653	0.210	0.647	0.741	0.206–2.666
	Urinary tract infection	−0.859	1.001	0.736	0.391	0.424	0.060–3.015
	Mental health disorder	−0.086	0.931	0.008	0.927	0.918	0.148–5.688
(Constant)		−18.88	6.903	7.483	0.006	< 0.001	

Note: Model 1 = Age, sex; Model 2 = Age, sex, body mass index, oxygen supplementation in the ED, Initial KTAS level, level of consciousness, body temperature. −2Log likelihood = 293.702; Cox & Snell R Square = 0.234, Nagelkerke $R^2 = 0.333$.
Abbreviations: ED, emergency department; KTAS, Korean Triage and Acuity Scale; SE, standard error.
[a]Unresponsive is not included in the analysis.

point, yielding a total score ranging from 0 to 6. Previous research found that the age component of A-DROP did not differ significantly between survivors and non-survivors. However, when female subjects were further subdivided into age thresholds of 65, 70 and 75 years, a significant association with mortality emerged at the 70-year cutoff, underscoring the need for more granular age-level stratification when evaluating prognoses in older patients with pneumonia.

In our study, the initial KTAS score was significantly associated with survival, suggesting that triage nurses at the studied hospital accurately assessed patient severity at presentation. Length of ED stay likewise did not differ significantly: non-survivors spent an average of 328.25 min in the ED compared with 344.37 min for survivors, a negligible difference in the approximately 5-h stay. These results contrast with prior reports linking prolonged ED stays in older patients to increased mortality (Wu et al. 2023). In our cohort, time to admission from the ED did not differ significantly between survivors and non-survivors. This may reflect the impact of post-arrival workflows—such as the interval to laboratory confirmation and interdepartmental admission decisions—as well as variability in consultation and treatment planning between emergency medicine physicians and consultants from other specialties.

The logistic regression analysis identified several independent factors influencing survival in older patients with pneumonia: male sex, oxygen supplementation in the ED, initial KTAS level, consciousness level, body temperature and a diagnosis of solid or hematologic malignancies. Male patients exhibited a 0.5 times lower survival rate, meaning their mortality rate was twice that of female patients. This aligns with previous research identifying male sex as a significant factor associated with increased mortality in older patients with pneumonia (Osman et al. 2021).

Oxygen supplementation in the ED was associated with an approximately 0.2 times reduced survival rate. This finding is consistent with other studies showing that higher oxygen requirements correlate with increased severity and mortality in ED patients (Hong et al. 2024). This suggests that the need for oxygen supplementation is a critical indicator of disease severity and a strong predictor of adverse outcomes.

Initial KTAS level was identified as a significant survival factor. A higher initial KTAS level (indicating a less severe condition)

was associated with a 1.69 times higher survival rate (Jung et al. 2023). This means that patients triaged with lower acuity levels (e.g., KTAS 3 compared to KTAS 2) had a greater chance of survival. This finding underscores the profound importance of accurate initial triage in the ED, as it directly impacts patient care trajectory and survival outcomes. Moreover, it implies that the nurses at the study hospital effectively classified patient severity using KTAS.

Consciousness level was a crucial predictor, with patients exhibiting a 'painful response' having odds of survival that were 0.326 times lower than those of 'alert' patients. This reinforces the findings of previous studies that lower GCS scores and altered consciousness are associated with increased mortality (Kim et al. 2015). This also highlights the critical need for intensive monitoring of consciousness in older patients visiting the ED, who often present with atypical symptoms. A decline in consciousness may be a subtle yet significant sign of respiratory distress or other severe underlying issues that could be overlooked if only classic pneumonia symptoms are sought. Comprehensive assessment, including vital signs such as systolic blood pressure, body temperature, oxygen supplementation status and consciousness level, is essential for a holistic evaluation of patients' conditions (Kim et al. 2015; Lucke et al. 2022).

Conversely, patients presenting with a body temperature exceeding 37.5°C exhibited approximately a 1.8-fold higher odds of survival (OR = 1.798), reflecting findings among older patients with respiratory issues that reveal poorer outcomes in those with lower temperatures (Hong et al. 2024). This observation may reflect the possibility that febrile patients received more intensive treatment and vigilant monitoring. In a study of older patients with community-acquired pneumonia, those admitted without fever or leukocytosis had a seven-fold greater risk of death than did patients exhibiting these signs (Ahkee et al. 1997). Such results indicate that fever in older adults is a positive prognostic marker, signalling an adequate immune response to infection, although its absence may denote impaired immunity. Thus, in older patients, fever suggests both an increased susceptibility to infection and the preservation of host defense mechanisms (El-Solh et al. 2001). A large-scale study of patients with acute respiratory distress syndrome and pneumonia further demonstrated that higher initial temperatures (mean 37.5°C; fever defined as ≥ 38.3°C) were significantly associated with lower 90-day mortality rates. Mortality rates were lower in the febrile (23%) and hyperthermic (19%) groups than in the normothermic (29%) or hypothermic groups (≥ 36%) (Schell-Chaple et al. 2015). Therefore, among pneumonia patients aged 65 years and older, body temperatures ≥ 37.5°C likely reflect a relatively preserved immune response and are associated with lower mortality and better prognosis compared with their normothermic or hypothermic counterparts.

Finally, a diagnosis of solid or hematologic malignancy significantly reduces survival rates. This is consistent with previous research indicating that cancer diagnosis is a significant risk factor for mortality in older patients with pneumonia (Jung et al. 2020). Patients with cancer often have compromised immune systems owing to the disease itself or its treatment (e.g., chemotherapy), making them highly vulnerable to severe infections such as pneumonia. This increased vulnerability leads to a higher risk of fatal outcomes when pneumonia occurs (Tanaka et al. 2023). Implementing infection prevention education and vaccination programmes specifically for patients with cancer could help mitigate this risk.

This study provides valuable insights into the factors influencing survival in older patients with pneumonia presenting to the ED. The identified factors—male sex, oxygen supplementation, consciousness level, initial KTAS level, body temperature and malignancies—are all critical elements assessed by triage nurses during initial patient evaluation.

4.1 | Limitations

This study has several limitations. First, as a single-centre retrospective analysis, the findings may not be entirely generalisable to broader populations. Second, confounding factors, such as do-not-resuscitate orders, underlying disease severity, pre-hospital care and concurrent respiratory infections, were not fully controlled. Third, the exclusion of patients who died in the ED restricts the study's survival analysis to those who survived the initial ED phase and were admitted, inherently biassing the sample toward patients who were less critically ill at presentation or received immediate, effective resuscitation. Consequently, the reported mortality rates and identified survival factors may not fully represent the entire spectrum of older patients with pneumonia presenting to the ED, particularly the most severely affected patients who succumb rapidly. This suggests that the true mortality burden for older patients with pneumonia presenting to the ED may be higher than that reflected in this study's findings. Thus, future research should explore the factors associated with ED mortality in this population. Fourth, variability in triage nurse decision making may have led to inconsistencies in KTAS classification, affecting overall data interpretation. In addition, KTAS triage nurse experience was available only as aggregate descriptive data and individual nurse identifiers were not linked to patient records; therefore, whether nurse experience influenced KTAS classification accuracy or patient outcomes could not be assessed. Future studies should link nurse identifiers to patient data and use multilevel or nurse-level regression to evaluate the effect of triage nurse experience on triage accuracy and survival. Finally, because this study focused specifically on pneumonia, patients with COVID-19 pneumonia (ICD code U07) or acute respiratory distress syndrome (ICD code J80) were not included, thereby limiting insights into viral pneumonia outcomes (Bradley et al. 2022). Future research should validate these findings through multi-centre studies incorporating additional clinical variables to refine pneumonia severity assessment tools for older patients.

4.2 | Implications for Nursing Practice

This study highlights the critical role of ED nurses in the initial evaluation and triage of older patients with pneumonia. Accurate KTAS classification ensures appropriate resource allocation, early intervention and optimised patient outcomes (Chung et al. 2023). The findings suggest that age-specific classifications and oncologic history should be incorporated into

KTAS scoring to improve severity assessments. Additionally, ED nurses should closely monitor neurological status, body temperature and oxygen dependency as early indicators of prognosis in patients with pneumonia (Kim et al. 2022).

Moreover, given the significant association between oxygen supplementation and mortality, nurses must carefully evaluate respiratory function and oxygen requirements to ensure targeted care. Education programmes focusing on triaging older patients with pneumonia, along with interdisciplinary collaboration between ED nurses and physicians will be crucial to improve patient assessments and treatment protocols. Lastly, as South Korea continues to experience a rise in ED admissions among older patients, continuous refinement of triage criteria tailored to ageing populations will be essential for enhancing emergency care strategies.

5 | Conclusion

As South Korea transitions into a super-aged society, the proportion of older patients visiting EDs is significantly increasing, leading to a higher burden of healthcare utilisation. Pneumonia remains a leading cause of mortality among older adults, emphasising the need for accurate severity assessment and timely intervention.

This study identified key factors influencing survival in older patients with pneumonia admitted to the ED. The findings demonstrate that KTAS severity classification, oxygen supplementation, consciousness level, body temperature, and malignancy history are significant predictors of survival. Patients classified into higher KTAS scores (indicating lower severity) exhibited higher survival rates, highlighting the importance of proper triage assessment. Oxygen supplementation was associated with increased mortality, likely indicating greater respiratory impairment. Additionally, patients with impaired consciousness and lower body temperature had poorer prognoses, while those with malignancies had significantly reduced survival rates.

The results suggest that existing pneumonia severity indices, such as PSI and CURB-65, may not adequately predict prognoses in older patients, underscoring the necessity of refining KTAS classifications to incorporate age-specific criteria and oncologic history, thereby improving triage accuracy and facilitating early risk stratification.

For effective clinical application, emergency nurses must recognise the prognostic significance of consciousness levels, body temperature, and oxygen dependency. Enhancing triage education and interdisciplinary collaboration can optimise care for older patients with pneumonia, ultimately reducing mortality rates and improving patient outcomes. As South Korea faces increasing ED admissions of older patients, further refinement of triage protocols tailored to ageing populations will be essential in enhancing emergency care strategies.

Author Contributions

Seon Myeong Lee: conceptualisation, data curation, investigation, methodology, resources, validation, visualisation and writing – original draft. **Eunjung Ryu:** conceptualisation, data curation, formal analysis, methodology, project administration, software, supervision, validation and manuscript writing. We confirm that all authors meet the authorship criteria and are in agreement with the content of the manuscript.

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Ethics Statement

The study was approved by the Institutional Review Board (IRB) at the Konkuk University Hospital (Approval No.: KUMC 202408-020). Informed consent was waived from all subjects and/or their legal representatives by the IRB as per the retrospective nature of the study. The study was performed in accordance with the Good Clinical Practice guidelines. This study is a part of the first author's thesis at Chung-Ang University.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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