Factors Associated with Emergency Department Length of Stay in Critically Ill Patients: A Single-Center Retrospective Study

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Background: Length of stay (LOS) in the emergency department (ED) should be measured and evaluated comprehensively as an important indicator of hospital emergency service. In this study, we aimed to analyze clinical characteristics of critically ill patients admitted to the ED and identify the factors associated with LOS.

Material/Methods: All patients with level 1 and level 2 of the Emergency Severity Index who were admitted to the ED from January 2018 to December 2019 were included in this retrospective study. The patients were divided into 2 groups: LOS ≥4 h and LOS <4 h. Variables were comprehensively analyzed and compared between the 2 groups.

Results: A total of 19,616 patients, including 7,269 patients in the LOS ≥4 h group and 12,347 patients in the LOS <4 group, were included. Advanced age, admission in winter and during the night shift, and diseases excluding nervous system diseases, cardiovascular diseases, and trauma were associated with higher risk of LOS. Nervous system diseases, cardiovascular diseases, trauma, and procedures including tracheal intubation, surgery, percutaneous coronary intervention, and thrombolysis were associated with lower risk of LOS.

Conclusions: Prolonged LOS in the ED was associated with increased age and admission in winter and during the night shift, while shortened LOS was associated with nervous system diseases, cardiovascular diseases, and trauma, as well as with procedures including tracheal intubation, surgery, percutaneous coronary intervention, and thrombolysis. Our findings can serve as a guide for ED physicians to individually evaluate patient condition and allocate medical resources more effectively.

Keywords: Critical Illness • Emergency Medical Services • Length of Stay

Abbreviations: ESI – Emergency Severity Index; CPR – cardiopulmonary resuscitation; PCI – percutaneous coronary intervention; LOS – length of stay; ED – Emergency Department; IQR – interquartile range; OR – odds ratio; CI – confidence interval

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Background

Overcrowding in the hospital Emergency Department (ED), which can decrease the efficiency of ED staff and lead to patient management delays and poor clinical outcomes, is considered a public health problem worldwide [1,2]. The imbalance of a rapid increase in the number of patients, especially critically ill patients, and insufficient medical resources exacerbates the problem [3]. A multicenter retrospective research study including 995 379 ED patients concluded that ED crowding is associated with increased in-hospital mortality and prolonged length of stay (LOS) [4]. Conversely, prolonged LOS in the ED was detrimental to quality of treatment, especially in time-sensitive disorders, including trauma [5], heart failure [6], and acute coronary syndrome [7]. Previous studies revealed that factors linked with LOS in the ED include patient-specific factors such as age, triage level, and severity of disorder and hospital-specific factors such as hospital size and specialist consultation [8,9]. A maximum length of ED stay of 4 h was confirmed to be associated with improved quality of medical care in the ED as well as with patient satisfaction [10]. Another retrospective study clarified that an LOS in the ED longer than 4 h could make the ED crowded. As ED volume increased, some ED patients did not receive treatment in a proper and timely manner [11].

Therefore, LOS in the ED is an important indicator of hospital emergency service, which should be comprehensively measured and evaluated so that medical management and resources can be implemented and allocated more effectively. It is critical for physicians to identify the essential factors needed to assess, at an early stage, the likelihood of a longer LOS after admission. In our study, we aimed to analyze clinical characteristics of patients with critical illness admitted to the ED and identify the factors associated with LOS.

Material and Methods

Study Design and Patients

Initially, all patients admitted to the ED from January 2018 to December 2019 were included in this retrospective study. Only patients with a critical illness of level 1 and level 2 according to the Emergency Severity Index (ESI), which has a 5-level triage system [12], were enrolled in the study. Exclusion criteria were the following: age <14 years, pregnancy, and patients with data missing. The included patients were divided into 2 groups: LOS ≥4 h and LOS <4 h. Variables were comprehensively analyzed and compared between the 2 groups.
Factors associated with LOS in the ED

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Results

General Characteristics of Patients

At first, a total of 19,966 patients admitted to the ED were enrolled in this study. Based on the exclusion criteria, 350 patients were excluded and 19,616 patients with critical illness were finally included (Figure 1). The distribution of subgroups based on LOS is shown in Figure 2. The LOS proportions were ≤2 h (38.1%), 2 to 4 h (24.9%), 4 to 6 h (9.4%), 6 to 8 h (4.4%), 8 to 10 h (3.1%), and ≥10 h (20.1%). The mean patient age was 60.5 years and the in-hospital mortality was 1.9%. Male patients and elderly patients (≥60 years) accounted for 62.9% and 56.2% of patients, respectively. The proportion of ESI level 1 and level 2 were 11.7% and 88.3%, respectively. The mean time of LOS was 2.7 h. The top 5 disease categories ranked as follows: nervous system (25.6%), respiratory system (21.0%), cardiovascular system (14.3%), digestive system (11.6%), and trauma (9%). The incidence of tracheal intubation, mechanical ventilation, and CPR were 5.2%, 5%, and 2.4%, respectively. Surgery, PCI, and thrombolysis were performed in 377 (1.9%), 615 (3.1%), and 273 (1.4%) patients, respectively. More than 60% of patients were hospitalized (Table 1).

Comparison of Variables Between LOS ≥4 h and LOS <4 h Groups

The clinical characteristics of the 7,269 patients in the LOS ≥4 h group and the 12,347 patients in the LOS <4 h group are shown in Table 2. There were significant differences in sex between the 2 groups (P=0.038). Patients in the LOS ≥4 h group were older (P<0.001). Comparing 6 subgroups of age, the LOS ≥4 h group had more patients in the 4 subgroups ≥60 years. The number of patients in the LOS ≥4 h group admitted in winter (December to February) and spring (March to May) was significantly higher than patients in the LOS <4 h group admitted during those seasons. Moreover, significant differences were found between the 2 groups in admissions by all seasons (all P<0.001). The proportion of patients in the LOS ≥4 h group admitted to the ED during the night shift (midnight to 8:00 AM) was significantly higher than those in the LOS <4 h group (20.8% vs 15.1%, P<0.001), while the LOS ≥4 h group admissions were lower at the other times (day and afternoon shifts). Comparing the top 5 disease categories at presentation between the 2 groups, patients with respiratory diseases (32.1%) and digestive diseases (13.8%) were more likely to have longer stays in the ED, while those with nervous system diseases (31.7%), cardiovascular diseases (16.4%), and trauma (11.7%) had shorter stays in the ED (all P<0.001). The proportion of patients with tracheal intubation (3.0%), mechanical ventilation (3.4%), CPR (1.1%), surgery (0.2%), interventional therapy (1.8%), and thrombolysis (0.2%) was significantly lower in the LOS ≥4 h group than in the LOS <4 h group (all P<0.001). More patients were hospitalized (75.4%) or discharged home (16.6%) in the LOS ≥4 h group than in the LOS <4 h group (both P<0.001). The in-hospital mortality rates of the LOS ≥4 h and LOS <4 h groups were 1.1% and 2.5%, respectively (P<0.001).

Univariate and Multivariate Analyses for Factors Associated with LOS

Factors associated with LOS were determined by univariate and multivariate logistic regression analyses, as shown in Table 3. Age ≥60 years, admission in winter and during the night shift, and diseases excluding nervous system diseases, cardiovascular diseases, and trauma were associated with the higher risk of LOS. Nervous system diseases, cardiovascular diseases, trauma, and procedures including tracheal intubation, surgery, PCI, and thrombolysis were associated with the lower risk of LOS. In age subgroups, the OR increased with increasing age, and the OR in the group over 90 years old was the...
Table 1. General characteristics of total patients.

| Characteristic                        | Number of patients |
|---------------------------------------|--------------------|
| Number of patients                   | 19616              |
| Sex (n, %)                            |                    |
| Male                                  | 12330 (62.9)       |
| Female                                | 7286 (37.1)        |
| ESI level (n, %)                      |                    |
| Level 1                               | 2292 (11.7)        |
| Level 2                               | 17324 (88.3)       |
| Age (years)                           | 60.5±18.9          |
| <18 (n, %)                            | 179 (0.9)          |
| 18-45                                 | 3981 (20.3)        |
| 46-59                                 | 4424 (22.6)        |
| 60-69                                 | 3928 (20.0)        |
| 70-79                                 | 3671 (18.7)        |
| 80-89                                 | 2890 (14.7)        |
| ≥90                                   | 543 (2.8)          |
| Admission season (n, %)               |                    |
| Winter (Dec-Feb)                      | 5072 (25.9)        |
| Spring (Mar-May)                      | 4755 (24.2)        |
| Summer (Jun-Aug)                      | 4753 (24.2)        |
| Fall (Sep-Nov)                        | 5036 (25.7)        |
| Admission time (n, %)                 |                    |
| Midnight-8:00 AM                      | 3376 (17.2)        |
| 8:00 AM-4:00 PM                       | 7940 (40.5)        |
| 4:00 PM-Midnight                      | 8300 (42.3)        |
| Diagnosis (n, %)                      |                    |
| Nervous system diseases               | 5029 (25.6)        |
| Respiratory diseases                  | 4120 (21.0)        |
| Cardiovascular diseases               | 2806 (14.3)        |
| Digestive system diseases             | 2270 (11.6)        |
| Trauma                                | 1756 (9.0)         |
| Tuberculosis                          | 726 (3.7)          |
| Acute poisoning                       | 616 (3.1)          |
| Urinary system diseases               | 334 (1.7)          |
| Endocrine system diseases             | 291 (1.5)          |
| Respiratory and cardiac arrest        | 226 (1.2)          |
| Tumor diseases                        | 223 (1.1)          |
| Blood system diseases                 | 161 (0.8)          |
| Other diseases                        | 1058 (5.4)         |
| Procedures (n, %)                     |                    |
| Tracheal intubation                   | 1027 (5.2)         |
| Mechanical ventilation                | 990 (5.0)          |
| Invasive ventilation                  | 903 (4.6)          |
| Noninvasive ventilation               | 87 (0.4)           |
| CPR                                   | 466 (2.4)          |
| Surgery                               | 377 (1.9)          |
| Interventional therapy                | 819 (4.2)          |
| PCI                                   | 615 (3.1)          |
| Others                                | 204 (1.0)          |
| Thrombolysis                          | 273 (1.4)          |
| Clinical outcomes (n, %)              |                    |
| Hospitalization                       | 13514 (68.9)       |
| Observation in ED                     | 3310 (16.9)        |
| Discharged home                       | 2070 (10.6)        |
| Transferred                           | 339 (1.7)          |
| In-hospital mortality (n, %)          | 382 (1.9)          |
| LOS in ED (h)                         | 2.7 (1.4-7.1)      |

ESI – Emergency Severity Index; CPR – cardiopulmonary resuscitation; PCI – percutaneous coronary intervention; LOS – length of stay; ED – emergency department.

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highest (OR 2.320, 95% CI 1.426-3.776). For time of admission, patients admitted in the winter (December to February) and during the night shift (midnight to 8:00 AM) were more likely to stay longer in the ED (OR 1.602, 95% CI 1.459-1.759 and OR 1.642, 95% CI 1.493-1.806, respectively). Three categories of diseases were negatively associated with LOS, including cardiovascular diseases (OR 0.188, 95% CI 0.104-0.341), nervous system diseases (OR 0.612, 95% CI 0.544-0.689), and trauma (OR 0.541, 95% CI 0.456-0.640). Patients with tracheal intubation (OR 0.564, 95% CI 0.329-0.967), surgery (OR 0.097, 95% CI 0.054-0.174), PCI (OR 0.046, 95% CI 0.028-0.077), and thrombolysis (OR 0.170, 95% CI 0.103-0.281) had a significantly lower risk of longer LOS.
Table 2. Comparison of variables between LOS ≥4 h and LOS <4 h groups.

| Variable                        | LOS ≥4 h (n, %) | LOS <4 h (n, %) | P value |
|---------------------------------|----------------|-----------------|---------|
| Number of patients              | 7269 (37.1)    | 12347 (62.9)    |         |
| Sex (n, %)                      |                |                 | 0.038*  |
| Male                            | 4679 (64.4)    | 7651 (62.0)     |         |
| Female                          | 2590 (35.6)    | 4696 (38.0)     |         |
| Age, years (n, %)               |                |                 | <0.001* |
| <18                             | 30 (0.4)       | 149 (1.2)       | <0.001* |
| 18-45                           | 1499 (20.6)    | 2925 (23.7)     | 0.034*  |
| 46-59                           | 1527 (21.0)    | 2401 (19.4)     | 0.008*  |
| 60-79                           | 1541 (21.2)    | 2360 (19.0)     | 0.045*  |
| 80-89                           | 1207 (16.6)    | 1683 (13.6)     | 0.193   |
| ≥90                             | 257 (3.5)      | 285 (2.3)       | <0.001* |
| Admission by season (n,% )      |                |                 |         |
| Winter (Dec-Feb)                | 2154 (29.6)    | 2918 (23.6)     | <0.001* |
| Spring (Mar-May)                | 1922 (26.4)    | 2833 (22.9)     | <0.001* |
| Summer (Jun-Aug)                | 1569 (21.6)    | 3184 (25.8)     | <0.001* |
| Fall (Sep-Nov)                  | 1624 (22.3)    | 3412 (27.6)     | <0.001* |
| Admission time (n, %)           |                |                 |         |
| Midnight-00 AM                  | 1514 (20.8)    | 1862 (15.1)     | <0.001* |
| 8:00 AM-4:00 PM                 | 2784 (38.3)    | 5153 (41.7)     | 0.031*  |
| 4:00 PM-Midnight                | 2968 (40.8)    | 5332 (43.2)     | 0.040*  |
| Diagnosis (n, %)                |                |                 |         |
| Respiratory diseases            | 2336 (32.1)    | 1784 (14.4)     | <0.001* |
| Nervous system diseases         | 1112 (15.3)    | 3917 (31.7)     | <0.001* |
| Cardiovascular diseases         | 775 (10.7)     | 2031 (16.4)     | <0.001* |
| Digestive system diseases       | 1008 (13.8)    | 1773 (13.0)     | <0.001* |
| Trauma                          | 307 (4.2)      | 1449 (11.7)     | <0.001* |
| Endocrine system diseases       | 141 (1.9)      | 150 (1.2)       | <0.001* |
| Blood system diseases           | 100 (1.4)      | 61 (0.5)        | <0.001* |
| Acute poisoning                 | 175 (2.4)      | 441 (3.6)       | <0.001* |
| Tumor diseases                  | 152 (2.1)      | 71 (0.6)        | <0.001* |
| Tuberculosis                    | 529 (7.3)      | 197 (1.6)       | <0.001* |
| Respiratory and cardiac arrest  | 17 (0.2)       | 209 (1.7)       | <0.001* |
| Other                           | 415 (5.7)      | 643 (5.2)       | 0.133   |
Discussion

In this retrospective cohort study of critically ill patients admitted to the ED in 2018 and 2019, patient clinical characteristics were analyzed and factors associated with LOS were identified. Prolonged LOS was associated with increased age and admission in winter and during the night shift, whereas shortened LOS was associated with nervous system diseases, cardiovascular diseases, and trauma as well as with procedures including tracheal intubation, surgery, PCI, and thrombolysis.

Our study showed that with increasing age, the risk of prolonged LOS increased, and the group of patients aged 90 years or older had the highest risk. A study with 5025 elderly patients in the ED indicated that prolonged LOS is best predicted by several indicators, which include being aged 90 years or older [13]. Another study revealed that of 16 791 ED presentations made by older patients, 4192 experienced a longer LOS, and increased age was associated with an increasing LOS in the ED [14]. Elderly patients are likely to stay in the ED longer because of poor communication with physicians, multiple chronic disorders, an atypical presentation with delayed symptoms, and unstable vital signs. Compared with younger patients, older patients admitted in the ED have multiple and complex presenting symptoms and conditions, which lead to more diagnostic tests and procedures as well as consultation services [15].

In the present study, patients admitted in winter and during the night shift had a higher risk of staying longer in the ED. One study investigated the relationship between the relative risk of ED visitation and seasonal temperature and concluded that in cold weather, the total number of patients in the hospital declined by 15%, but ED visits increased by 4% [16]. A study of 17 298 ED visits for respiratory infection indicated that significantly fewer visits were recorded in warm months than in cold months (OR 0.23; 95% CI 0.29-0.18; P<0.001) [17].

Increasing evidence indicates that winter is associated with the higher risk of morbidity in many disorders, including stroke, acute coronary syndrome, heart failure, and asthma [6,18-21], which also contributes to more ED visits and a longer LOS in the ED. Moreover, many studies have focused on the relationship between admission time and clinical outcomes. A retrospective cohort study in acute aortic dissection demonstrated

| Variable                  | LOS ≥4 h (n, %) | LOS <4 h (n, %) | P value |
|---------------------------|-----------------|-----------------|---------|
| Procedures                |                 |                 |         |
| Tracheal intubation       | 216 (3.0)       | 811 (6.6)       | <0.001* |
| Mechanical ventilation    | 245 (3.4)       | 745 (6.0)       | <0.001* |
| Invasive ventilation      | 199 (2.8)       | 704 (5.7)       | <0.001* |
| Noninvasive ventilation   | 46 (0.6)        | 41 (0.3)        | 0.002*  |
| CPR                       | 81 (1.1)        | 385 (3.1)       | <0.001* |
| Surgery                   | 12 (0.2)        | 365 (3.0)       | <0.001* |
| Intervventional therapy   | 131 (1.8)       | 688 (5.6)       | <0.001* |
| PCI                       | 16 (0.2)        | 599 (4.9)       | <0.001* |
| Other                     | 115 (1.6)       | 89 (0.7)        | <0.001* |
| Thrombolysis              | 17 (0.2)        | 256 (2.1)       | <0.001* |
| Clinical outcomes         |                 |                 |         |
| Hospitalization           | 5484 (75.4)     | 8030 (65.0)     | <0.001* |
| Observation in ED         | 318 (4.4)       | 2992 (24.2)     | <0.001* |
| Discharged home           | 1209 (16.6)     | 861 (7.0)       | <0.001* |
| Transferred               | 179 (2.5)       | 160 (1.3)       | <0.001* |
| In-hospital mortality     | 78 (1.1)        | 304 (2.5)       | <0.001* |

LOS – length of stay; CPR – cardiopulmonary resuscitation; PCI – percutaneous coronary intervention; ED – Emergency Department. (* P<0.05).
Table 3. Univariate and multivariate analyses for factors associated with LOS.

| Variable                      | Unadjusted results | Multivariate results |
|-------------------------------|--------------------|----------------------|
|                               | OR (95% CI)        | P value              | OR (95% CI)        | P value              |
| Sex, Male                     | 1.109 (1.044-1.178)| 0.001                | 0.991 (0.924-1.063)| 0.802                |
| Age, years                    | <0.001             | 0.002*               |
| <18                           | Ref                | Ref                  |
| 18-45                         | 2.164 (1.453-3.221)| <0.001               | 1.678 (1.066-2.641)| 0.025*               |
| 46-59                         | 2.545 (1.711-3.786)| <0.001               | 1.798 (1.143-2.829)| 0.011*               |
| 60-69                         | 3.159 (2.123-4.700)| <0.001               | 1.955 (1.241-3.079)| 0.004*               |
| 70-79                         | 3.593 (2.414-5.348)| <0.001               | 1.880 (1.192-2.964)| 0.007                |
| 80-89                         | 3.626 (2.390-5.309)| <0.001               | 1.963 (1.243-3.099)| 0.004*               |
| ≥90                           | 4.463 (2.912-6.839)| <0.001               | 2.320 (1.426-3.776)| 0.001*               |
| Admission season              | <0.001             | <0.001               |
| Winter (Dec-Feb)              | 1.551 (1.430-1.682)| <0.001               | 1.602 (1.459-1.759)| <0.001*              |
| Spring (Mar-May)             | 1.452 (1.312-1.618)| <0.001               | 1.412 (1.283-1.553)| <0.001*              |
| Summer (Jun-Aug)             | 1.035 (0.951-1.127)| 0.421                | 0.998 (0.906-1.099)| 0.964                |
| Fall (Sep-Nov)               | Ref                | Ref                  |
| Admission time               | <0.001             | <0.001               |
| Midnight-8: 00 AM            | 1.461 (1.347-1.585)| <0.001               | 1.642 (1.493-1.806)| <0.001*              |
| 8: 00 AM-4: 00 PM            | 0.972 (0.911-1.036)| 0.381                | 0.850 (0.789-0.915)| <0.001*              |
| 4: 00 PM-Midnight            | Ref                | Ref                  |
| Diagnosis                    | Ref                | Ref                  |
| Respiratory and cardiac arrest| Ref                | Ref                  |
| Nervous system diseases      | 0.753 (0.677-0.838)| <0.001               | 0.612 (0.544-0.689)| <0.001*              |
| Respiratory diseases         | 3.484 (3.142-3.864)| <0.001               | 2.647 (2.356-2.975)| <0.001*              |
| Digestive system diseases    | 2.071 (1.841-2.328)| <0.001               | 1.746 (1.531-1.991)| <0.001*              |
| Trauma                       | 0.557 (0.480-0.646)| <0.001               | 0.541 (0.456-0.640)| <0.001*              |
| Cardiovascular diseases      | 0.214 (0.129-0.353)| <0.001               | 0.188 (0.104-0.341)| <0.001*              |
| Endocrine system diseases    | 2.462 (1.928-3.145)| <0.001               | 2.325 (1.770-3.053)| <0.001*              |
| Blood system diseases        | 4.480 (3.222-6.230)| <0.001               | 4.080 (2.825-5.894)| <0.001*              |
| Acute poisoning              | 1.011 (0.833-1.227)| 0.912                | 1.358 (1.082-1.704)| 0.008*               |
| Tumor diseases               | 5.777 (4.305-7.753)| <0.001               | 4.840 (3.505-6.684)| <0.001*              |
| Tuberculosis                 | 7.040 (5.860-8.459)| <0.001               | 4.986 (4.102-6.061)| <0.001*              |
| Other                        | 1.692 (1.458-1.964)| <0.001               | 1.786 (1.508-2.115)| <0.001*              |
| Procedures                   | 0.436 (0.374-0.508)| <0.001               | 0.564 (0.329-0.967)| 0.038*               |
| Mechanical ventilation      | Ref                | Ref                  |
Table 3 continued. Univariate and multivariate analyses for factors associated with LOS.

| Variable                  | Unadjusted results | Multivariate results |
|---------------------------|--------------------|---------------------|
|                           | OR (95% CI)        | P value             | OR (95% CI)        | P value             |
| Invasive ventilator       | 0.467 (0.398-0.548) | <0.001              | 1.015 (0.566-1.820) | 0.960               |
| Noninvasive ventilator    | 1.853 (1.215-2.826) | 0.004               | 0.818 (0.523-1.279) | 0.379               |
| None                      | Ref                |                     | Ref                |                     |
| CPR                       | 0.350 (0.275-0.446) | <0.001              | 0.874 (0.578-1.323) | 0.525               |
| Surgery                   | 0.054 (0.031-0.097) | <0.001              | 0.097 (0.054-0.174) | <0.001*             |
| Interventional therapy    |                    |                     |                    |                     |
| PCI                       | 0.044 (0.027-0.072) | <0.001              | 0.046 (0.028-0.077) | <0.001*             |
| Other                     | 2.111 (1.598-2.788) | <0.001              | 1.912 (1.359-2.690) | <0.001*             |
| None                      | Ref                |                     | Ref                |                     |
| Thrombolysis              | 0.111 (0.068-0.181) | <0.001              | 0.170 (0.103-0.281) | <0.001*             |

LOS – length of stay; OR – odds ratio; CI – confidential interval; CPR – cardiopulmonary resuscitation; PCI – percutaneous coronary intervention (* P<0.05).

that nighttime admission was associated with a higher risk of longer stays in the intensive care unit and in-hospital mortality [22]. A recent study identified that ED patients who presented during the evening (OR 4.25, 95% CI 1.742-10.417) or nighttime (OR 14.93, 95% CI 4.22-52.63) were significantly more likely to have a prolonged LOS than those with a morning presentation [23]. A possible explanation could be that it was necessary for night shift arrivals to wait until the daytime to be hospitalized or discharged, leading to increased LOS in the ED. Additionally, consultations with specialists and some special imaging or laboratory tests for diagnosis and therapy are less available at night than during the day [24].

In the present study, among the most common categories of disorders presenting in the ED, nervous system diseases, cardiovascular diseases, and trauma were negatively associated with LOS. Moreover, tracheal intubation, surgery, PCI, and thrombolysis showed the same relationship with LOS. Our hospital is a tertiary hospital as well as a stroke, chest pain, and trauma center. For several years, effective and convenient emergency medicine processes have been constructed for time-sensitive disorders including stroke, acute coronary syndrome, acute heart failure, and trauma. For those patients, multidisciplinary consultation and management are implemented quickly as are hospitalizations and transfers, which could explain why patients with mechanical intubation, surgery, PCI, and thrombolysis had a comparatively lower risk of prolonged LOS. In a study on stroke, evidence showed that endovascular stroke therapy and thrombolysis were inversely associated with the LOS in the ED [25]. In a mature trauma center with standardized activation protocols, trauma activation and subsequent management and procedures, including surgery, could mitigate the negative effects of prolonged LOS in the ED [26].

Overall, factors associated with LOS in the ED in a large sample of critically ill patients were analyzed. Our findings can serve as a guide for ED physicians to individually evaluate patients’ condition and allocate medical resources more effectively. There were several limitations in our study. First, it was a single-center retrospective study, so caution should be exercised when applying the results to other centers with different situations and policies. Second, only categories of diseases were included and analyzed in this study, with subgroups of diseases not divided and compared, which to a certain extent might have affected our results. Third, because of some missing data, not all factors associated with LOS in the ED of patients were mentioned in this study, including marital status, medical insurance, socioeconomical status, and educational background. Further research with more clinical variables should be considered.

Conclusions

Prolonged LOS in the ED was associated with increased age and admission in winter and during the night shift, while shortened LOS was linked with nervous system diseases, cardiovascular diseases, and trauma as well as with procedures including tracheal intubation, surgery, PCI, and thrombolysis. Our findings can serve as a guide for ED physicians to individually evaluate patients’ conditions and allocate medical resources more effectively.
Ethics Statement

Ethics approval was provided by the Medical Ethics Committee of Changsha Central Hospital.

Availability of Data and Materials

Datasets used and/or analyzed in the present study are availed by the corresponding author on reasonable request.

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Conflicts of Interest

None.