Predictors of Length of Hospital Stay in Children Presenting to the
Emergency Department of Saudi Arabia

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Article History:
Received on: 09 Nov 2020
Revised on: 12 Dec 2020
Accepted on: 16 Dec 2020

Keywords:
Children,
Emergency Department,
Length of Stay,
Predictors,
Saudi Arabia

ABSTRACT

Length-of-stay is an important quality measure for emergency departments. The study aimed to find predictors for prolonged LOS in children. A cross-sectional study was conducted from Jan 2017 to Mar 2018. Data were extracted from medical records of 5609 pediatric patients admitted to the King Abdullah Bin Abdulaziz University Hospital-ED, Riyadh, Saudi Arabia. Median LOS of the children was 74 mins. Multivariable analysis showed the difference in the expected LOS between patients DAMA and their non-DAMA counterparts was 72 mins. Difference in the expected LOS between patients at emergent and non-urgent triage was 89 mins, between urgent and non-urgent triage was 51 mins and difference between less urgent and non-urgent triage was 16 mins. Future studies should explore the contributing managerial and clinical factors that can explain such associations and might be the focus for future policy changes to reduce LOS in ED pediatric settings in Saudi Arabia.

INTRODUCTION

For the last two decades, Emergency Department overcrowding has been an alarming issue globally. These kinds of situations have become an important concern for children (Sprivulis et al., 2006). Visits of children in the ED have been growing; in the United States, about 30 million pediatric population receiving emergency care every year (Mccaig and Burt, 2005). More than 25% of all ED visits are by children. ED provides rapid access to emergency care facilities to pediatric patients admitted with
acute and severe conditions (Gilligan et al., 2008). Hence, it is neither equipped nor ready to deliver extended care for a longer time. Length of stay (LOS) is considered to be a significant factor impacting the quality of care for EDs, as it is an indicator of how efficient the medical services provided for the children are (Hughes et al., 2020). Often, EDs are mostly crowded and given the fact that most of the patients need assessments apart from simple history and physical examination. LOS can be simulated by many factors, including patient characteristics and problems, both internal and external, to the administration of EDs (Abri et al., 2020). Furthermore, there is a premise in the literature that different variables have a significant effect on the increased LOS, such as diagnostic or special investigations and procedures and waiting time for inpatient bed availability (Russ et al., 2010).

However, most of these studies investigated the associations between LOS and specific variables at the univariate level without adjusting for other potential confounders or covariates. Extensive studies also focused on adult patients rather than children. For example, Chalfin et al. (2007) found an association between prolonged ED-LOS and increased mortality, while Liew et al. (2003) found an association of access block with inpatient LOS. Other studies reported that crowded EDs and prolonged LOS contributed to ED waiting times (Naseer et al., 2020), often with patients left without being seen (Henneman et al., 2010). Moreover, it also results in diverting of ambulances and patients (i.e., declining to accept patients from other EDs or Emergency Medical Services) (Berger, 2006) and contracting nosocomial infections (Rodi et al., 2006) and decreased patient satisfaction (Taylor and Benger, 2004). These factors may be further deleterious for pediatric patients admitted in any tertiary care hospital, where they may come for treatment of more severe, chronic, or complex diseases (Reynolds et al., 1996) and require special healthcare (Kozer et al., 2002).

LOS has been determined as one of the contributing factors for pediatric ED overcrowding in numerous single-center studies and national datasets in developed nations (James et al., 2005). Findings from these studies have established that factors related to prolonged ED-LOS include higher acuity of a patient’s symptoms (Goldman et al., 2006), higher hospital occupancy (Forster et al., 2003), staffing shortages, volume visits (American Academy of Pediatrics Committee on Pediatric Emergency, 2004), higher ED, and care in a pediatric ED compared to a general ED (Bourgeois and Shannon, 2007). Specific factors that contribute to prolonged ED-LOS for admitted pediatric patients have not been studied in Saudi Arabia. Thus, the study’s objective was to identify factors that are independent with prolonged length of hospital stay in children presenting to the Emergency Department of Saudi Arabia.

MATERIALS AND METHODS

Our study had a cross-sectional study design conducted during one year period (from 2017 to 2018). All pediatric patients admitted to the ED of King Abdullah Bin Abdulaziz University Hospital (KAAUH) in Riyadh were included. The KAAUH provides medical care to all enrolled students, university and hospital employees, and their families. A total of 5609 pediatric patients medical records admitted to the KAAUH-ED were used. As per ED regulations and policies, all patient-related information is recorded in the Health Information Management System-TrakCare. These include general demographic information, triage category, all information related to admission, bed, and discharge classification.

Data were analyzed using STATA version 22. Descriptive statistics were reported by computing their frequencies and percentages for categorical variables. Median (IQR) was reported for quantitative variables such as age and LOS. The relationship of LOS with different variables was measured by the Mann Whitney U test/Kruskal Wallis test. Robust regression modeling, an unadjusted and adjusted beta coefficient with 95% CI, was reported, and all plausible interactions and confounders were assessed. A p-value of < 0.5 was considered significant. The ethical exemption was taken from the Ethical Review Committee at Princess Nourah University, along with approval from King Abdullah bin Abdulaziz University Hospital to retrieve the needed data from patients medical records.

RESULTS

Description of the population

A total of 5609 pediatric patients presented to the emergency department as shown in Table 1. The median age of the admitted participants was three years. A more significant proportion of patients presenting to ED were less than or equal to 5 years old (59.3%). A higher proportion of patients (52.6%) were sent home, followed by those (24.4%) admitted to the hospital. Almost 0.3% were discharged against medical advice (DAMA), 0.3% were discharged with an outpatient appointment and 0.1% were transferred to another healthcare setup.
Table 1: Description of the study participants.

| Variables                              | Frequency (n=5609) | Percent (%) |
|----------------------------------------|--------------------|-------------|
| **Age (Median (IQR))**                 |                    |             |
| In years                               | 3(6)               |             |
| Age                                    |                    |             |
| ≤5 years                               | 3326               | 59.3        |
| >5 years                               | 2283               | 40.7        |
| **Gender**                             |                    |             |
| Male                                   | 3102               | 55.3        |
| Female                                 | 2507               | 44.7        |
| **Discharge classification**           |                    |             |
| Admission to hospital                  | 133                | 2.4         |
| Discharged with outpatient appointment | 18                 | 0.3         |
| Home                                   | 2953               | 52.6        |
| Discharge against medical advice       | 19                 | 0.3         |
| Transfer to another health care facility | 8              | 0.1         |
| **Triage**                             |                    |             |
| Non-Urgent                             | 658                | 11.7        |
| Less Urgent                            | 3736               | 66.6        |
| Urgent                                 | 1055               | 18.8        |
| Emergent                               | 27                 | 0.5         |
| **Length of Hospital stay (Median (IQR))** |                |             |
| In minutes                             | 74 (72)            |             |

Table 2: Length of hospital stay (LOS) and its related factors in children at the Emergency department.

| Variables                              | Length of Hospital Stay (in minutes) | p-value |
|----------------------------------------|-------------------------------------|---------|
|                                        | Median (IQR)                        |         |
| **Age**                                |                                     |         |
| ≤5 years                               | 68(81)                              | 0.445   |
| >5 years                               | 77(114)                             |         |
| **Gender**                             |                                     |         |
| Females                                | 75 (72)                             | 0.788   |
| Males                                  | 73 (71)                             |         |
| **Discharge classification**           |                                     |         |
| Admission to Hospital                  | 292(145)                            | <0.001* |
| Discharged with outpatient appointment | 127(49)                            |         |
| Home                                   | 69 (61)                             |         |
| Discharge against medical advice       | 159(168)                            |         |
| Transfer to another healthcare facility | 95 (128)                            |         |
| **Discharge against medical advice**   |                                     |         |
| Yes                                    | 159 (168)                           | <0.001* |
| No                                     | 71 (69)                             |         |
| **Triage category**                    |                                     |         |
| Non-Urgent                             | 59 (58)                             | <0.001* |
| Less Urgent                            | 70 (59)                             |         |
| Urgent                                 | 120(128)                            |         |
| Emergent                               | 236(212)                            |         |

*significant at p-value < 0.05 by Mann Whitney U test/Kruskal Wallis test.
Moreover, a higher proportion (66.6%) of patients presented to the less urgent triage, followed by other categories Table 1. The median length of hospital stays of the children was 74 (76) minutes.

Length of hospital stay and its related factors

Table 2 shows the length of hospital stay and its related factors in children in the emergency department. The overall median LOS of the children was 74 (72) mins. The median LOS among patients who were discharged against medical advice was significantly higher (159 (168) mins) versus their non-DAMA counterparts (71 (69) mins) (p-value <0.001). Moreover, median LOS in patients presenting to emergent triage was significantly higher (236 (212) mins) followed by urgent (120 (128) mins), less urgent (70 (59) mins) and with least in the non-urgent (59 (58) mins) (p-value <0.001). However, we observed no significant relationship between age and gender with LOS at p-value <0.05.

Univariate and Multivariable analysis

Table 3 indicates univariable and multi variable robust regression analysis to assess the relationship between hospital stay length and its related factors among children in the Emergency Department. On univariate analysis Table 3a, we observed that the difference of the expected LOS between patients who discharged against medical advice (DAMA) and their counterpart was 83 minutes. Moreover, the difference in the expected LOS between patients at emergent and non-urgent triage was 124 minutes, urgent and non-urgent triage was 44 minutes, and less urgent and non-urgent triage was 12 minutes. However, there was no significant association between age and gender with LOS. On multivariable analysis Table 3b, after adjusting for the other covariates, we observed that the difference in the expected LOS between patients discharged against medical advice and their non-DAMA counterparts was 72 minutes. Moreover, the difference in the expected LOS between patients at emergent and non-urgent triage was 89 minutes, urgent and non-urgent triage was 51 minutes, and less urgent and non-urgent triage was 16 minutes.

DISCUSSION

In our study population, few factors were associated with LOS, including discharge against medical advice and triage category characterized by urgent and emergent needs while adjusting for the other variables in the final model. Although our study found minimal factors associated with prolonged LOS among the pediatric population, the results are consistent with most other studies across the globe (Hoffenberg et al., 2001). These results indicate the various interconnected factors contribute to prolonged ED-LOS. Triage acuity was related to LOS.
among the pediatric population in our study. When adjusted for other risk factors, the higher acuity assignment (emergent or urgent) was comparatively found to be more associated with extended LOS as compare to the lowest acuity category (non-urgent). A study carried out at a larger tertiary care teaching hospital observed that higher triage acuity was independently related to the extended LOS (Kusumawati et al., 2019). A fact which explains this finding is that patients categorized in urgent and emergent triage care needed more time for treatment and stabilization in the ED before being transferred to appropriate units. Researchers have experienced that in most Saudi settings, actual treatments for critical patients are conducted in EDs themselves, which tends to increase ED LOS. Moreover, children required ventilator stays longer in the ED due to the intensive treatment. Furthermore, physicians need more time for deciding appropriate places (whether ICU or another ward) for high acuity patients (Rose et al., 2012). These findings are comparable to other published studies. For instance, a study conducted in France reported that shorter ED LOS was associated with lower triage acuity (non-urgent care) (Capuano et al., 2015).

In another study, a longer ED LOS was associated with higher triage acuity (Mahmoud et al., 2013). Concerning DAMA as a factor for a prolonged stay, we found that those who left against medical advice had an extended length of stay in the ED when they came back and got admitted to the ED. It is a fascinating and unique finding of our study and lacks support from the literature. A fact which concurs with this finding is that patients who leave against medical advice had often not adequately recovered during their previous hospital stay and end up having more complicated conditions, requiring readmission to the ED. This readmission with more complicated conditions, in turn, might have resulted in more investigations, more consultations from different medical teams and more rigorous treatment requiring longer stays in the ED. Studies have shown that DAMA can have other deleterious effects and prolong the length of stay after readmission. More specifically, DAMA outcomes can include the deterioration of the patient’s condition, incurring long-term incurable side effects, and rendering unsatisfactory medicinal outcomes (Gardner et al., 2007) that could result in death. Furthermore, readmission of the patient with severe conditions enforces extra costs on the healthcare system, which is worth observing and discussing.

**Strengths and Limitations**

Our study’s strength is that it is the first study conducted in Saudi Arabia evaluating the factors of prolonged length of stay in the emergency department among pediatric patients. We can safely assume that our study results can be generalizable to all tertiary care hospitals EDs in Saudi Arabia, as the hospital at which we conducted this study provides healthcare facilities to people of multiple demographics. Nevertheless, this study did have some limitations. The data were abstracted from medical records and, therefore, limited by the availability and legibility of the available documentation. Furthermore, we did not have data available on the record on socioeconomic factors like education, occupation and income or reasons for signing DAMA that might be important predictors that may aid in reducing LOS at the emergency department. However, these findings may assist in informing EDs of what they need to develop screening tools to enable the prioritization of pediatric patients who are likely to be admitted to or discharged from ED.

**CONCLUSIONS**

In conclusion, our study demonstrated the risk factors for LOS to be leaving against medical advice and triage category (urgent and emergent care). For further exploration of issues related to prolonged LOS among the Saudi pediatric population, factors highlighted in this study present a sharp and concise starting point. These aspects of ED care must be studied further, and all possible factors associated with these variables, such as both the institutional and broad patient-related factors, are thoroughly analyzed. These findings can prove to be invaluable for quality improvement initiatives at other Saudi institutions as well.

**Funding Support**

The authors declare that they have no funding support for this study.

**Conflict of Interest**

The authors declare that they have no conflict of interest for this study.

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