EFFECT OF ACCESS BLOCK IN EMERGENCY DEPARTMENT IN INPATIENT UNIT LENGTH OF STAY IN A TERTIARY CARE HOSPITAL, USA

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By
Deepika Rehani

Under the guidance of
Dr. Brrun Kanjilal

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INSTITUTE OF HEALTH
MANAGEMENT RESEARCH
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Col. (Dr.) Ashok Kaushik
Dean, Academics and Student Affairs
IIHMR, Jaipur

Prof. Barun Kanjilal
Professor
IIHMR, Jaipur

1, Prabhu Dayal Marg, Near Sanganer Airport, Jaipur- 302029, Rajasthan, India.
Ph.: 0141- 3924700, 2791431- 32, Fax: 0141- 3924738, E-mail: iihmr@iihmr.org, Web.: www.iihmr.org

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Survey No: 123 & 132/2
Yemlur Post, Yemlur-Old Airport Road
Bengaluru Karnataka,
Pin Code – 560037, India
Tel: +91 80 6755 5000
Fax: +91 80 6755 3000
www.deloitte.com

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Deepika .

Signature

1, Prabhu Dayal Marg, Near Sanganer Airport, Jaipur- 302029, Rajasthan, India.
Ph.: 0141- 3924700, 2791431- 32, Fax: 0141- 3924738, E-mail: iihmr@iihmr.org, Web.: www.iihmr.org

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Title: The effect of access block in emergency department on inpatient unit length of stay in a tertiary care hospital, USA

ABSTRACT

Author Name: Dr. Deepika Rehani

Key words: Access block, Boarding of patients, Accident and Emergency department, Length of stay, Hospital outcome, Delay in admission

Background: Accident and emergency department (A&E) provides access to hospital services for urgent cases and 15-20% of patients arriving in A&E require admission to in patient wards but admission through the A&E accounts for a sizable portion of all admissions to surgery and inpatient wards. The spectacle of sick people whose condition merited admission as inpatients waiting overnight on trolleys, or even being treated in ambulances parked outside the unit has provoked widespread criticism. Access block" refers to the situation where patients requiring emergency hospital admission spend an unreasonable amount of time in an emergency department (ED) because they are unable to gain access to appropriate hospital inpatient beds. It is the proportion of A&E patients requiring admission whose total time within the A&E exceeds 8 hours. It is linked to increase A&E waiting time for medical care and leads to A&E overcrowding. This overcrowding is generally accepted to decrease efficiency and possibly quality of care and may impact hospital outcomes such as length of stay.

Objective: To investigate the relationship between access block in the emergency department (ED) (defined as total time from arrival to transfer from the ED over eight hours) and inpatient length of stay (LOS).

Methodology: Retrospective cohort study of all admissions through the ED to inpatient unit in a tertiary hospital in USA, during September 2014 till March 2015.Total time in the ED calculated in hours and LOS calculated in days from ED departure to hospital discharge.

Findings: 3535 admissions were included, and 911 experienced access block (25%). Mean LOS was 6 days 9 hours and mean ED LOS was 6 hours. Mean LOS in those who experienced access block was 7 days (95% CI, 7.28-6.72), compared with 6 days in the no-block group (95% CI, 6.49–5.51; $P < 0.0005$). Subgroup analysis showed that this "access block effect" occurred across different severities of illness and age groups.

Conclusions: Among patients admitted to the hospital from the ED, patients with ED LOS > 8 hours are associated with 16% longer IP LOS. The cumulative effect of delay on the 911 patients who experienced delay was an additional 1,176 hospital days. The major delay is likely due to the unavailability of vacant bed but further studies need to be conducted to find root cause of this delay and interventions need to be carried out that will improve ED flow and reduce admission delay

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DEFINITIONS

Access block: Patients staying for more than 8 hours in emergency department waiting to be admitted.

Length of stay (LOS): Total number of days a patient stays in inpatient unit after transfer from ED till discharge

ED length of stay: Total number of hours a patient stays in emergency department from arrival till transferred to inpatient.

Boarding: When a patient is pending for admission to inpatient unit and due to lack of beds in inpatient unit overstays in emergency department.

LIST OF ABBREVIATION

- A&E : Accident and emergency department
- LWBS: Left without being seen
- ED : Emergency department
- LOS : Inpatient length of stay
- IP: In Patient
- CAEP : Canadian Association of Emergency Physicians
- ACEP : American college of emergency physicians
- CTAS: Canadian triage and acuity scale
- HIS : Hospital information system

1. INTRODUCTION

Accident and emergency department (A&E) provides access to hospital services for urgent cases. The A&E (or casualty) department is used both by individuals brought by ambulance and by those presenting themselves for treatment. The later, in particular, include people whose medical conditions vary widely in severity. A&E therefore performs a sorting function, deals itself with a range of less seriously ill patients and assesses more serious cases for admission as inpatient. Only 15-20% of patients arriving in A&E require admission to in patient wards. [1] Though admission through the A&E accounts for a sizable portion of all admissions to surgery and inpatient wards [2].

Public concern has focused on excessively long waiting periods at A&E, particularly for those requiring admission. Official guidelines specify that patients requiring treatment as inpatients should be allocated to a bed within two hours. [3] Although these standards apply only to the time elapsed after a decision to admit, they are nevertheless routinely broken in many hospitals. The spectacle of sick people whose condition merited admission as inpatients waiting overnight on trolleys, or even being treated in ambulances parked outside the unit has provoked widespread criticism. At times A&E units have become so congested that they have been 'closed to blue lights' –even emergency ambulances are barred and diverted to other hospitals.

This overcrowding and delays in A&E throughput have several important consequences, such as boarding of admitted patients in the A&E, longer hospital stays, and the inability of patients to gain access to appropriate hospital beds, lost opportunities to treat patients due to ambulance diversion, and "left without being seen" (LWBS) patients [4-6]. The 2001

position statement on A&E overcrowding by the Canadian Association of Emergency Physicians stated that hospital overcrowding was the primary cause of A&E overcrowding [7]. That is, patients who should be admitted are held (boarded) in the A&E because there are no hospital beds available, and this in turn uses A&E resources and prevents other patients from being treated in a timely manner in the A&E. In addition to the potential health impact of admission delays, there may be an economic impact as well. This position has been echoed by professional bodies in Australia, the USA and the UK [8-10].

Inpatient bed "access block" has been regarded as the principle cause of A&E overcrowding. "Access block" refers to the situation where patients requiring emergency hospital admission spend an unreasonable amount of time in an emergency department (ED) because they are unable to gain access to appropriate hospital inpatient beds. [20, 21] It is the proportion of A&E patients requiring admission whose total time within the A&E exceeds 8 hours. [16] Access block is correlated with total hospital inpatient bed occupancy of 90% or more, as measured by a midnight bed census [16-18]. A target occupancy of 85% has been suggested as a balance between unused bed capacity and efficient inpatient flow. [18-19] ACEP believes a "boarded patient" is defined as a patient who remains in the emergency department after the patient has been admitted to the facility, but has not been transferred to an inpatient unit.

Access block is linked to increased A&E waiting time for medical care [22] and leads to A&E overcrowding. This overcrowding is generally accepted to decrease efficiency and possibly quality of care [23-25] and has also been linked to adverse events. [26] However, there have been not many published studies examining the relationship between access block and patient outcomes in hospital. Inpatient length of stay (LOS) is one of the simplest

measures of hospital outcome and resource use. This study aimed to investigate the impact of access block in the A&E on patient outcome measured in terms of inpatient LOS.

2. OBJECTIVES

2.1 General:

To determine the effect of access block in the emergency department (ED) (defined as total time from arrival to transfer from the ED over eight hours) on inpatient length of stay (LOS).

2.2 Specific:

- To study the workflow of admission of patient from ED to inpatient unit
- To determine the mean access block and mean inpatient LOS for patients coming from ED
- To determine the LOS and ED LOS of access block and non-block groups
- To analyze the department wise access block in the hospital
- To analyze the relationship between the mean ED LOS and mean IP LOS
- To give recommendations for the issues identified

2.3 Hypothesis:

There is no association between access block in emergency department and inpatient unit length of stay.

3. RATIONALE

Emergency department (ED) crowding has become a major barrier to receiving timely emergency care in the United States. Despite widespread recognition of the problem, the research and policy agendas needed to understand and address ED crowding are just beginning to unfold. In a recent study, 91% of hospital ED directors reported overcrowding as a problem. They described conditions such as patients in the hallways, full occupancy of ED beds, and long patient waits as occurring several times a week and daily. [27] Access block is linked to increase in ED waiting time for medical care and leads to ED overcrowding. This overcrowding is generally accepted to decrease efficiency and possibly quality of care and has also been linked to adverse events. However, there have been few published studies examining the relationship between access block and patient outcomes in hospital. Inpatient length of stay (LOS) is one of the simplest measures of hospital outcome and resource use. This study aims to investigate the presence of access block in a tertiary care setting in USA and analyze its effect on inpatient LOS.

4. LITERATURE REVIEW

Emergency department (ED) crowding and inadequate inpatient capacity are among the most important issues facing U.S. hospitals today and have been described by the Institute of Medicine as a public health crisis. [28] It is a prevalent health delivery problem and may adversely affect the outcomes of patients requiring admission [29]. EDs have become increasingly congested points of entry into the health care system, with many facilities routinely operating near or above their maximum capacity. Boarding inpatients consumes ED resources, prolongs the time all patients wait for medical attention, and reduces the number of ED treatment beds available to accommodate sudden surges in demand [30, 31].

ED crowding is caused by periodic mismatches in demand for care and supply of resources in the ED, including staffing and bed space. [32] It manifests as long waits for patients to be seen by providers, high LWBS rates, long ED lengths of stay (LOS), and long waiting times before inpatient bed placement (also known as ED boarding). [33]

Following studies conducted in USA, Canada and Australia give some evidence about how delay in admission to inpatient from ED affects the LOS keeping in mind different patient and system factors. In a study conducted in a Canadian hospitals, among patients admitted to the hospital from the ED, ED LOS > 12 hours is associated with 12.4% longer IP LOS and 11% greater IP cost. [34] In another study conducted at Canberra Hospital, Australian Capital Territory a strong relationship was found between longer LOS and arrival of access-block patients on the inpatient ward outside office hours (0800–1600 weekdays) [30] In Emergency Department, Canberra Hospital, Australian National University Medical School, Canberra, ACT ; presentation during high ED occupancy was associated with

increased in-hospital mortality at 10 days, after controlling for seasonal, shift, and day of the week effects.

The magnitude of the effect is about 13 deaths per year. [35] Mean hospital LOS also showed an increase with boarding time ($p < 0.001$), from 5.6 days (SD ± 11.4 days) for those who stayed in the ED for less than 2 hours to 8.7 days (SD ± 16.3 days) for those who boarded for more than 24 hours.[38]

Overcrowding in the emergency department can be attributed to a number of circumstances such as waiting longer than 90 minutes to see a provider, patients being placed in the hallway beds, more than 30% of department beds being filled with admitted patients, and having a full waiting room with no place to move new patients (Korn & Mansfield, 2008).

In a study conducted by Harris & Sharma (2010) quantified the determinants of the duration of time spent in an ED for patients who need admission to hospital. Reduced time in ED was associated with the number of nurses, the number of beds, and the number of doctors. Overall an increase in hospital resources, as measured by the number of nurses, doctors and physical beds, is associated with a significant reduction in patient care time in the ED. They also concluded that increasing hospital capacity is likely to reduce overcrowding in the average ED, but factors that determine congestion in individual hospitals, such as long holds for admitted patients and lack of movement from triage, are being investigated for improvement.

A third study by Bernstein et al. (2009) provides several reasons why overcrowding occurs in most emergency departments. Some of the main issues presented are an increase in volume and severity of illnesses, the nursing shortage, uninsured patients, difficulty in obtaining timely consultation, and availability of beds. ED crowding is associated with an

increased risk of in-hospital mortality, longer times to treatment for patients with pneumonia or acute pain, and a higher probability of leaving the ED against medical advice or without being seen. Results indicated that the inability to transfer in-patients into beds is one of the leading causes of crowding in the emergency department and increases mortality among critically ill patients.

In another retrospective study in acute care hospitals in California, periods of high ED crowding were associated with increased inpatient mortality and modest increases in length of stay and costs for admitted patients. [36] Mean IPLOS for the four categories of EDLOS were found to be </= 4 hours, 3.73 days; 4-8 hours, 5.65 days; 8-12 hours, 6.60 days; > 12 hours, 7.20 days ($P < 0.001$) in a study conducted in three metropolitan hospitals in Melbourne. In a study at the Northern Hospital, Victoria, EDLOS > 8 hours was significantly associated with longer IPLOS ($P < 0.001$) adjusting for medical comorbidities. [40]

Following the growing episodes of patient overcrowding in ED, in May 2012, the Joint Commission revised its patient flow standard. The standard requires several elements including that hospitals must have processes to support flow of patients throughout the hospital; and plan for the care of admitted patients in temporary bed locations or overflow locations, such as the ED. Three elements that will go into effect in January 2014, which specifically recommends hospitals set goals for managing the boarding of admitted patients in the ED. According to the standard, “it is recommended that boarding timeframes not exceed 4 hours in the interest of patient safety and quality of care.” In addition, results should be reported and reviewed by leadership to assure that goals are achieved, and actionable steps to improve processes are taken when they are not achieved. Finally, if the hospital has a population at risk for boarding due to behavioral health emergencies, leaders

must communicate with behavioral health providers or authorities in the community to foster care coordination.

5. METHODOLOGY

5.1 Key questions

- What is the average length of stay of patients in emergency department who are waiting to be admitted?
- What is the average IP length of stay of patients coming from emergency department?
- Whether patients with increased ED length of stay have increased IP length of stay?

5.2 Research design

5.2.1 Research Type: It is an analytical study conducted to determine the relationship between ED length of stay for patients waiting to be admitted and Inpatient length of stay for patients coming from ED. It is a retrospective cohort study of all the admissions through ED from September 2014 to March 2015 in a tertiary care hospital of USA.

5.2.2 Research Location: Emergency department and Inpatient Units of a tertiary hospital in USA. It is a 360 bedded medical center with a level III trauma center.

5.2.3 Research population: Cohort of admissions to inpatient units through emergency department.

5.2.4 Eligibility criteria: Only patients originating from ED who were subsequently admitted were included. Patients who were admitted only to the ED and subsequently discharged or transferred to other hospitals were excluded, as were those who were already inpatients at the time of ED presentation.

5.2.5 Type of data: Primary data of quantitative type was collected from the HIS of the hospital

5.2.6 Source of data: HIS of the hospital provided with the necessary reports from which relevant data was extracted.

5.3 Data extraction and analysis

A report was generated from HIS pertaining to emergency department which provided details related to length of stay, boarding time, patient characteristics, time of arrival, acuity and destination unit. There were a total of 5043 admissions from emergency department over a period of 6 months. Another report was generated to provide details regarding hospital LOS for patients who were admitted through emergency department only in the same time period. The two reports were matched which resulted in a total cohort size of 3535 as the patients with incomplete and unmatched data were eliminated. The analysis was performed on this final set of cohort comprising of 3535 patients. Hospital LOS was obtained as the number of hours stayed in the hospital which were converted to days for the

ease of analysis. Hospital LOS less than 12 hours was marked as 0. Whereas ED LOS was calculated as number of hours a patient stayed in emergency department starting from arrival to ED till transferred out. Access block was defined as ED LOS greater than 8 hours. Further the average LOS in emergency department and inpatient unit were calculated. Data was processed using excel

spreadsheet and LOS was compared between patients who experienced access block with patients who did not. The same was repeated with respect to different patient characteristics, acuity, and time of arrival.

5.4 Data analysis tool

MS excel 2013 was used for analysis of data.

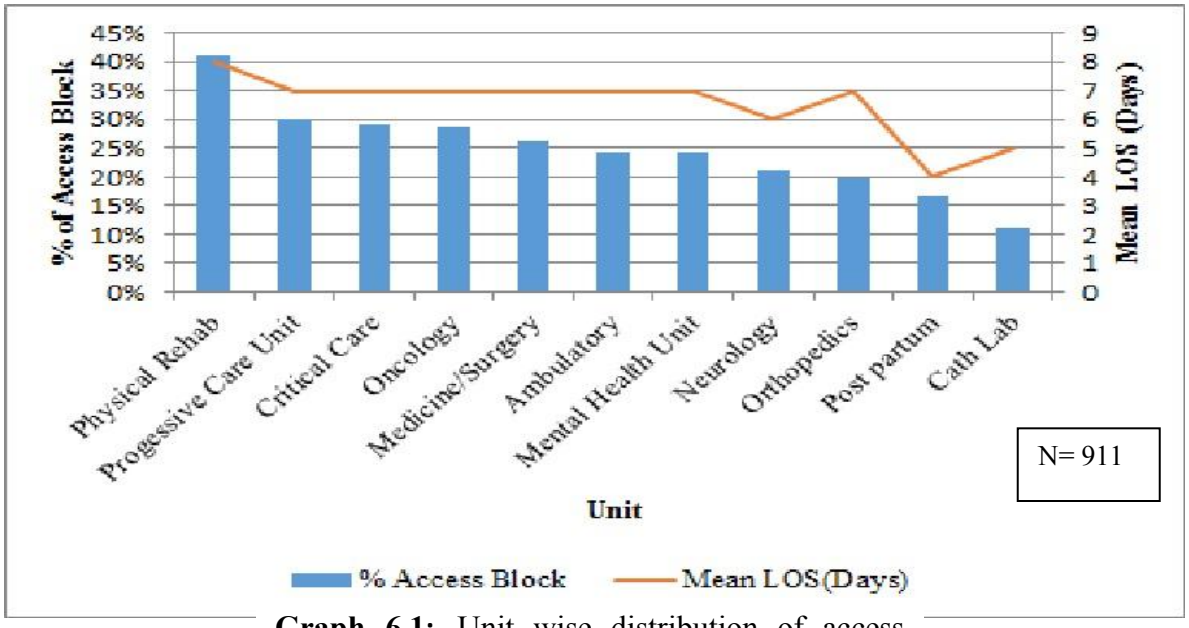
5.5 Statistical methods

For the purpose of comparing the mean LOS among access block group and non-access block group unpaired T test was applied.

6. RESULTS

During September 2014 to March 2015, duration of 6 months, there were total of 5043 admissions through emergency department. Out of this, 1508 patients were excluded due to unmatched ED or hospital stays, or negative time intervals. So the final data set comprised of 3535 patients. Out of this, 51% were females and the average age of cohort was 61.3 years.

The average length of stay in emergency department was 6 hours 30 min (median 6 hours) whereas the average inpatient length of stay was 6 days and 9 hours (median 4 days).Access block was seen in 911 patients (25 %) and the mean ED LOS in access block group was 12 hours 19 min and 5 hours in non-block group. As seen in graph 6.1, patients being admitted to Physical rehabilitation unit faced maximum access block (41%) with highest mean LOS as 8 days whereas catheterization lab had minimal access block (11%) with mean LOS as 5 days. Except orthopedics unit there was seen shorter LOS with lower access block.



Graph 6.1: Unit wise distribution of access block

As given in the table 6.1, mean LOS in the access-block group was 7 days (95% CI, 7.28-6.72), compared with 6 days in the no-block group (95% CI, 6.49–5.51; P < 0.0005, t test) considering the difference to be statistically significant. Hence the hypothesis is rejected and there is an association between access block in ED and inpatient LOS.

Table 6.1 T-Test to compare mean LOS between access block group and non-block group

Access Block	ED LOS(hours)	Mean LOS (Days)	N	Std Dev	CI at 95%
NO	<8	6	2624	7.24	0.49
YES	>8	7	911	7.49	0.28

The two-tailed P value equals 0.0004. By conventional criteria, this difference is considered to be extremely statistically significant.

Confidence interval:

The mean of Group One minus Group Two equals -1.0000

95% confidence interval of this difference: From -1.5519 to -0.4481

Intermediate values used in calculations:

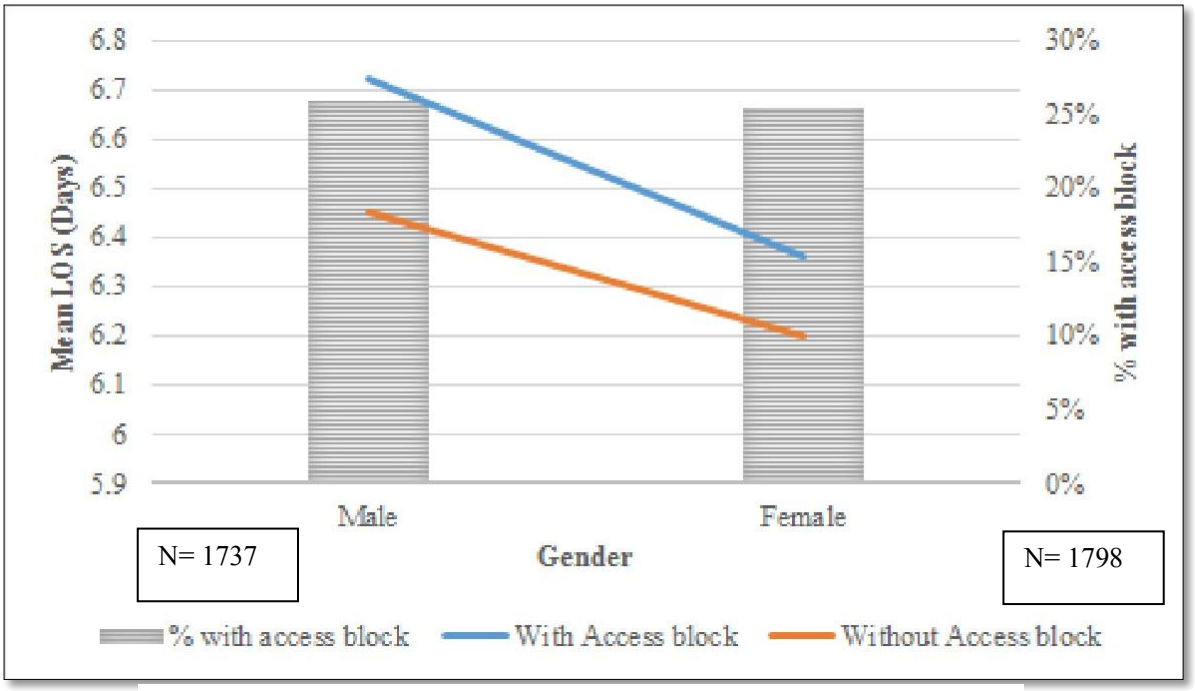
t = 3.5597

df = 3533

standard error of difference = 0.281

Hence we can say that there is an association between access block in ED and LOS.

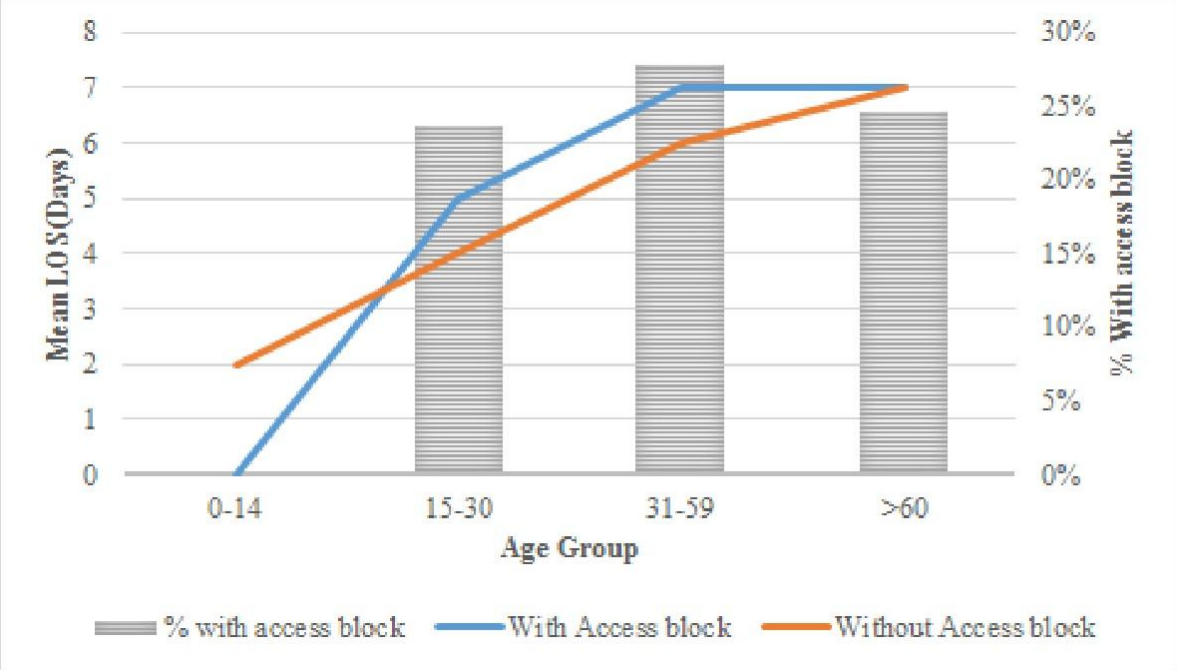
The mean LOS was further compared among access block group and non-access block group on the basis of patient characteristics, ED acuity and time of arrival. The number of



Graph 6.2: Mean LOS with gender of the patients arriving in ED

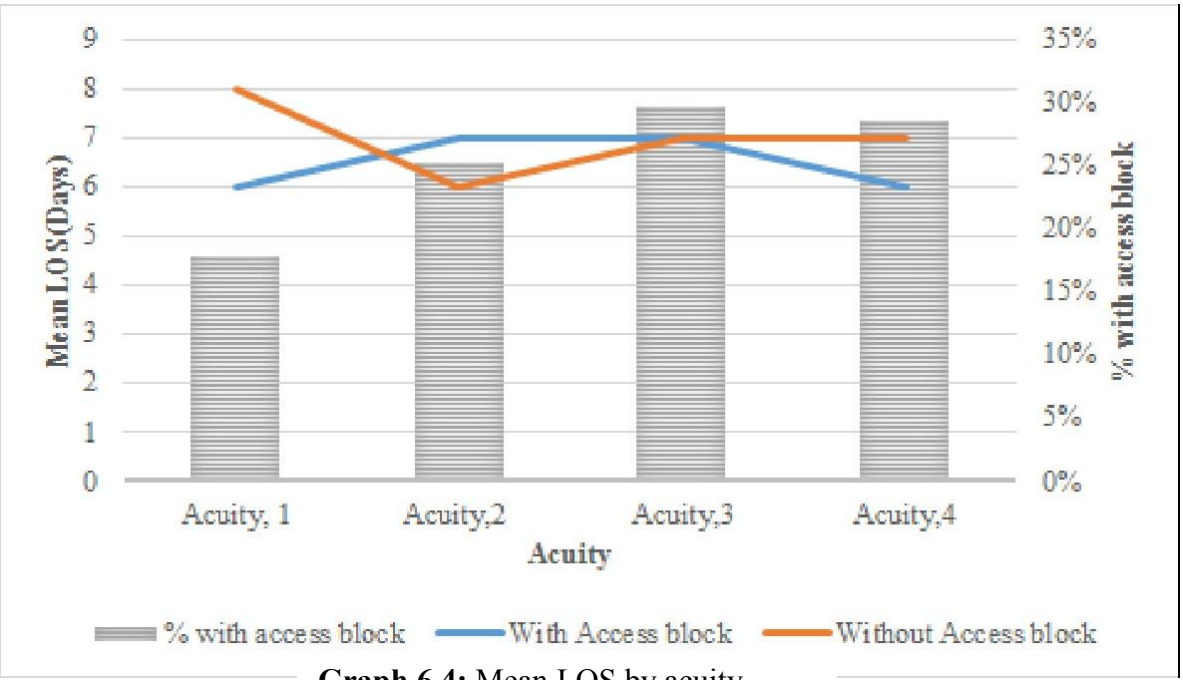
male patients (26%) facing access block was almost equal to that of females (25%) as seen in graph 6.2. It was also seen that the mean LOS was higher among access block group than non-block group for both males and females.

All the age groups had almost equal percentage of access block with age group, 31-59 years facing highest access block (28%) and no access block was seen among age group 15 years and below. The mean LOS was seen to be higher among access block group across all the age groups except age group 60 and above where the mean LOS was equal among access block and non-block group as shown in graph 6.3.



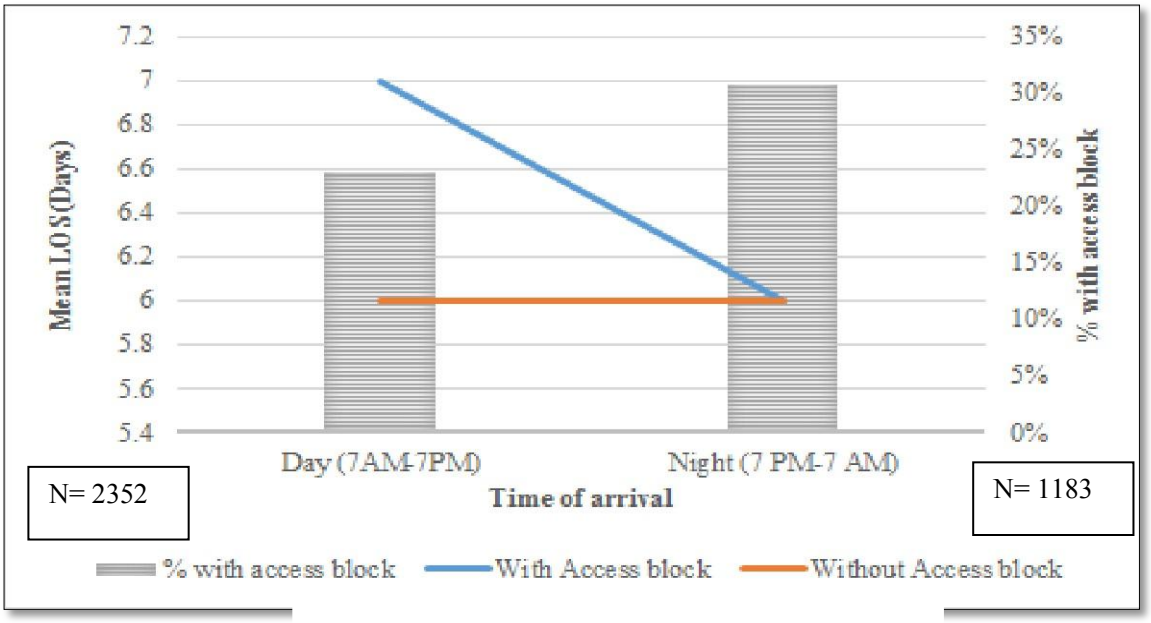
Graph 6.3: Mean LOS by age groups

With respect to acuity, access block was observed in all the categories with maximum access block in category 3 –Urgent (30%) and least in category 1-Resuscitation (18%). The effect of access block was observed only in category 2- emergent as shown in graph 6.4.



Graph 6.4: Mean LOS by acuity

As for the time of arrival, more access block was seen during the night visit (31%) as compared to day visit (23%). Further, access block effect was observed only for day arrival.



Graph 6.5: Mean LOS by time of arrival

Figure 6.1 describes the workflow for admission to inpatient unit through emergency department till discharge. On the basis of data made available through HIS, the average time taken after the disposition is decided by doctor till admission to inpatient unit is 4 hours with almost 90 percent of time taken post the bed request is raised.

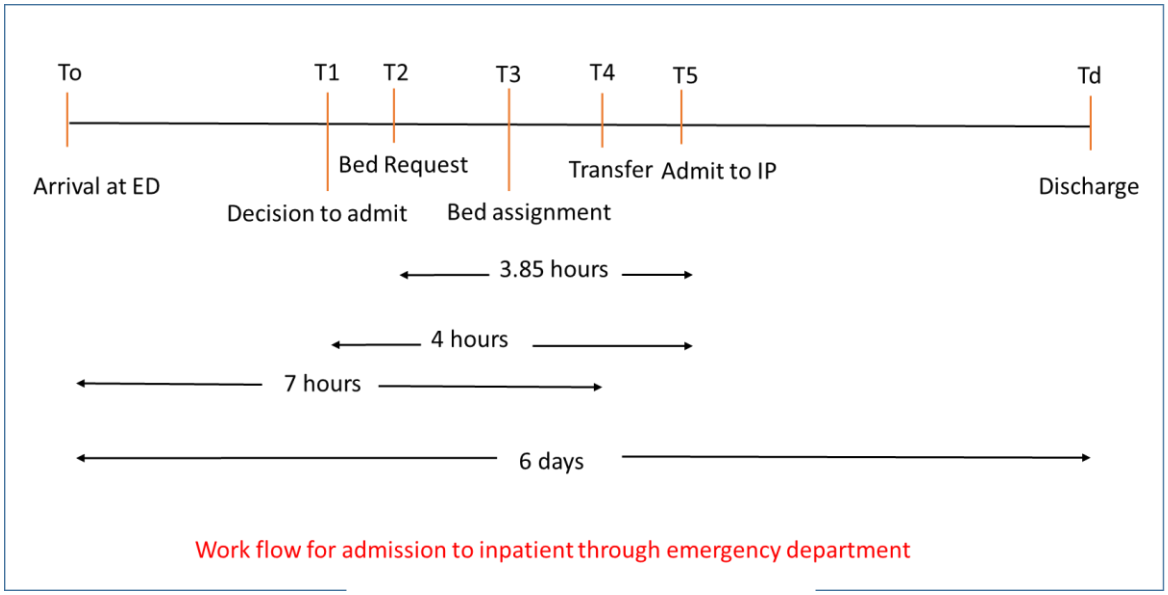


Figure 6.1

7. DISCUSSION

The study was conducted to demonstrate the effect of access block in emergency department on mean inpatient LOS. Patients experiencing access block had mean inpatient LOS 1 day (16.6 percent) more than the non- block patients. This amounts to almost 16 percent of average LOS after ED presentation. Out of all the admissions about 25 percent (911) of patients faced access block and on an average spent 7 hours extra in ED and 1 day extra of hospital stay leading to 1176 extra hospital days in six month duration. This can have a substantial effect on the patient care and revenues of the hospital thereby requiring further investigations.

Comparison of access block with LOS in presence of different factors was conducted and revealed that the access block effect on LOS was found to be independent of gender of the patients. With respect to the age group, it was observed that access block was observed in all the age groups except age group 15 and below likely because the number of patients pending admission in this age group was almost nil (2). But there was no effect of access block in age group 60 and above, likely because this group comprised of patients with chronic and geriatric diseases who tend to stay for longer time in inpatient unit irrespective of stay in ED.

The effect of access block on LOS was found only in patients admitted with acuity 2-emergent group, though access block was seen in all the age groups irrespective of condition of the patient, this refutes the possibility that the access block effect patients were “sicker”, requiring longer “work-up” in the ED and then longer duration of care on the ward. Due to the variation in access block effect with respect to different levels of acuity no definite conclusion can be drawn and requires further investigation.

With respect to the time of arrival in ED, percent of patients facing access block was more in night (30%) likely because investigations take longer time in night due to lack of staff and limited lab functioning. The LOS for patients with access block was observed to be more in the day shift only and no effect was seen at night which suggests there is no impact of time of arrival on access block effect.

The association between ED LOS and hospital LOS has been studied by others as well. Richardson also used ED LOS > 8 hours to define admission delay and found that on average, delayed patients stayed 6.5 hours longer in the ED and 0.8 days longer as inpatients than non-delayed patients compared to 7 hours longer in ED and 1 day longer in inpatient unit in my study. The estimated cumulative impact at the study site was 700 bed-days per year [5]. Liew et al studied 17,954 admissions from the ED in three Australian hospitals from July 2000 to June 2001 [6]. They found that prolonged ED LOS was associated with excess inpatient LOS in a "dose-dependent" relationship. Compared to patients with ED LOS < 8 hours, patients with ED LOS of 8-12 hours were approximately 20% more likely to have longer inpatient LOS, and patients with ED LOS > 12 hours were 50% more likely to have longer inpatient LOS.

Although proving an association does not prove cause and effect and the available data do not allow the reasons for the access-block effect on LOS to be identified, they allow some possible explanations to be examined. Analysis of the work flow of admissions through ED reveals that on an average a patient waits for almost 4 hours after a bed request has been raised till he/she gets admitted. In depth analysis is required to find the root cause of the

possible delay in admission to inpatient which is beyond the scope of the study due to physical constraints. A prospective case–control study would allow better identification of the factors that contribute to the access-block effect. Though there can be numerous speculations to explain the same .Few of the possible explanations are as follows:

- **Unavailability of Inpatient beds**: Lack of vacant beds in inpatient units or less number of licensed beds with respect to the patient inflow can be one of the major reasons for increased boarding of ED by patients waiting to be admitted. Queuing theory given by Erlang, tells us that a system is most efficient when it operates at 85% capacity. So if the hospital is functioning at 90-95% capacity it is in a crisis mode with little or no surge capacity. Moreover the increase in demand is not proportionate to increase in number of beds in hospital which leads to a gap resulting in overcrowding and boarding of patients in ED.
- **Workforce:** Shortage of workforce is another possible reason which delays the treatment to patient and accentuates bed shortage.
- **Aging population:** Major chunk of ED visits is comprised of elderly population who are likely to stay for longer in inpatient units and visit ED more often.
- **Crowding in emergency department:** Crowding in emergency delays the work up required for deciding the disposition of patient thereby increasing the LOS.

8. POSSIBLE SOLUTIONS:

In order to overcome the issue of delayed admissions through ED which impacts patient care, length of stay as well as the revenue of the hospital there needs to be further research conducted to identify the root cause of delay. With healthcare so unpredictable it is important to propose solutions that may help in solving some of the issues in the ED. Although the solutions may not fix the problems right away, it is a step in the right direction and promotes movement in the ED.

As stated by Hoot and Aronsky, (2008) the proposed solutions should be long-term approaches and are considered to be better than the short-term options that have only masked the problems for a short time in the past, delaying the crisis and need for long-term solutions. Short-term and long-term solutions will be provided to support in the ED's movement of patients in regards to overcrowding, delay of transfer to the ICU, and medical errors.

Short-term solutions have been used in the past and continue to be used by several state hospitals.

- The first high impact solutions includes moving emergency patients who have been admitted to the hospital out of the ED to inpatient areas, such as hallways, conference rooms, and solariums. Moving patients out of the ED beds can open areas for emergencies and alleviate the ED nurses of those patients.
- A second high impact solution includes coordinating the discharge of admitted patients in the hospital before noon, or in the case of ICU patients, assessing for downgrades prior to noon. Timely discharges and downgrades of patients can significantly improve the flow of patients through the ED by making more inpatient

beds available to emergency patients (ACEP, 2008). In order for this solution to work, there must be leadership from all aspects of the hospital and the process must include physicians, nurses, pharmacy, radiology, lab, and housekeeping.

- A third solution is to coordinate the schedule of elective patients and surgical patients and if necessary cancel those appointments at times when the hospital has reached high volume of inpatients and admissions Other short-term high impact solutions included bedside registration, fast-track units, and physician triage.

Long-term solutions are highly regarded as the solutions that will have the most impact on an organization .Although the time frame is lengthier than short term solutions, they provide long lasting results. There are two major long-term solutions; increased resources and demand management.

- **Increase resources**: Additional personnel, observation units, and hospital bed access are the most common solutions for crowding in the ED.
    - Additional personnel may include a permanent increase in the number of physicians during a busy shift, which can reduce the outpatient length of stay by 35 minutes.
    - A second option for additional personnel is to reserve employees as needed during the viral season. A rural hospital activated the reserve personnel strategy and reduced waiting times by 15 minutes and the rate of patients leaving without being seen by 37%
    - Increasing resources can also mean adding observations units to decrease the number of admitted patients holding in the ED. The addition of an ED-managed acute care unit decreases ambulance diversion by 40% and halves the rate of patients leaving without being seen.

- A third resource included hospital bed access. After increasing the number of critical care beds from 47 to 67, ambulance diversion decreased by 66% at one hospital. Over a period of time, when more beds were added to hospital units, there were significant decreases in occupancy levels and waiting times in the ED .

- **Demand management**: It focuses on non-urgent referrals, ambulance diversion, and destination control. In a survey conducted by Hoot & Aronsky (2008) 38% of ED patients said that they would swap their ED visit for a primary care appointment within 72 hours. When following up non-urgent patients who were triaged to receive care elsewhere it was found that 42% of the patients received the same care and there were no adverse outcomes. In proposing non-urgent referrals, the ED can continue to focus on the patients who need consistent monitoring (ICU patients) and keep the ED beds open for future emergencies.

9. LIMITATIONS

I was unable to capture the actual time that patients were sent to inpatient units as this information was not captured in the data bases used for the analysis. Thus, the analysis may underestimate the true impact on ED resources. I used a retrospective study design that does not allow us to isolate the cause of admission delays. Thus, I can only speculate as to whether or not the delay was due to lack of availability of hospital beds or other barriers to treatment or assessment. Prolonged IP LOS may also be caused by downstream problems including discharge difficulties, such as lack of rehabilitation beds or difficulties coordinating outpatient care. I was not able to assess whether this was a contributing factor to longer hospital LOS or not. Finally, my analysis is based on a single academic hospital and the results may not be generalizable to other settings.

9. CONCLUSION

My study shows that among patients admitted to the hospital from the ED, patients with ED LOS > 8 hours are associated with 16% longer IP LOS. The cumulative effect of delay on the 911 patients who experienced delay was an additional 1,176 hospital days. The major delay is likely due to the unavailability of vacant bed but further studies need to be conducted to find root cause of this delay and interventions need to be carried out that will improve ED flow and reduce admission delay.

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