

ORIGINAL ARTICLE

Do elective surgical and medical admissions impact emergency department length of stay measurements?

Trevor S Langan MD, FRCPC

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Abstract

Background: Emergency department access block is a growing problem in emergency departments across Canada. Access block is defined as hospital occupancy >85% causing emergency department overcrowding. Hospital overcrowding leads to prolonged emergency department wait times, and delays in the transfer of admitted patients from the emergency department to inpatient beds. The relationship between elective admissions to hospital and emergency department wait times has not been adequately assessed. We undertook a simple linear regression analysis of the impact of elective admissions to hospital on emergency department length of stay.

Methods: Linear regression analysis of the number of daily elective admissions to adult acute care beds in the Calgary Health Region in the year 2004 and the daily median emergency department length of stay was done to establish the relationship between elective admissions and Emergency Department length of stay.

Results: 37,007 patients were admitted to adult acute care beds via the emergency department and 46,020 patients were admitted to adult acute care beds by all other routes. Regression analysis determined that there was no relationship between daily emergency department length of stay and the number of elective admissions per day.

Conclusion: For the year 2004, in the Calgary Health Region, elective acute care admissions to hospital had no relationship to emergency department length of stay for patients admitted via the emergency department. Further study is required to determine causative factors that prolong Emergency Department length of stay. Emergency departments across Canada continue to struggle with the demands of providing high quality care with diminishing resources.

Demographic data and epidemiologic evidence has shown that the number of emergency department visits have increased in the last ten years.^{1, 2} The resulting congestion in emergency departments leads to delays in patient assessments and in the treatment of the critically ill. Emergency care is compromised when the emergency department suffers access block¹⁻⁶. It has also been demonstrated that patients value timely access to quality emergency care and that prolonged wait times have been cited as a major reason for patients leaving the emergency room without being seen.^{1, 7}

Emergency department (ED) overcrowding, or access block, has many operating definitions; the most commonly cited definition refers to the state of the emergency department when hospital occupancy is greater than 85%. An observational study examining the association between hospital occupancy and daily emergency department length of stay (EDLOS) showed a strong association between the two variables⁸. In one analysis, for every 10% increase in hospital occupancy EDLOS increased 18 minutes.⁸ Another common definition of access block refers to the length of time patients who have been admitted are waiting for inpatient beds. Any patient with a time greater than 8 hours from 'decision to admit' to 'discharge from the ED' is termed a 'boarded patient'. The Canadian Association of Emergency Physicians' (CAEP) committee has committed to a position statement declaring: "patients requiring hospital admission should not be held in emergency department hallways

or waiting rooms for more than six hours”². Emergency department overcrowding has been declared a ‘systems’ issue and is not expected to have an easy solution.⁹

New evidence points to this as a patient safety issue, with data supporting the idea that emergency department overcrowding leads to increased patient mortality.¹⁰ Research in the field has focused on developing reliable and valid crowding measurement tools, and attempts to understand causes of emergency department overcrowding.⁹ A Canadian research group examined the impact of emergency department crowding on the empirical outcome of time to reperfusion for patients with acute myocardial infarction.¹¹ They concluded that emergency department overcrowding contributed to increased door-to-needle time, and could impact cardiac care¹¹. Further study by the same group demonstrated delays in the transport time of patients complaining of shortness of breath related to emergency department overcrowding.¹²

Other Canadian studies linking emergency department overcrowding to patient outcomes are scarce, however centers in other countries have published studies linking emergency department overcrowding with patient outcomes.^{6, 8, 10, 13} An Australian group has reported that emergency department length of stay (EDLOS) independently predicts inpatient length of stay (IPLOS). They concluded that EDLOS is an independent predictor of IPLOS when controlling for age, sex, and time of presentation. Further conclusions were that strategies to decrease EDLOS may subsequently decrease IPLOS and improve patient outcomes with decreased health care costs.⁶

Elective surgical and medical admissions to hospitals make up approximately 50% of admissions to acute care beds. Some non-North American centers have instituted policies to cancel elective admissions on the basis of hospital occupancy. Two studies from Ireland detailed the effects of increasing emergency department admissions on elective surgery cancellations.^{13,14} One cited that 92% of elective surgery cancellations were attributable to bed usage by patients admitted via the emergency department.¹³

Social and economic analyses were not included in their reviews, however the authors theorized that the impact on the patients and their families was significant.¹³ The authors of both papers called for a separation of emergency and elective admissions to ensure mounting emergency department admissions did not increase elective surgery cancellation rates.¹⁴

Acute care inpatient beds are a finite resource over which elective and emergency services clash for bed allocation. The Calgary Health Region (CHR) has no policy to cancel elective admissions based on hospital occupancy rates. The Calgary Health Region (CHR) is one of the largest integrated health regions in Canada servicing over 1,160,000 people (2005 population statistics).¹⁵ The regionalized Emergency Department cares for over 260 000 patients annually, providing access to all general medicine and sub-specialty care providers including neurosurgery, cardiology, critical care, trauma, internal medicine and orthopedic surgery.

We undertook a research initiative to determine the relationship between medical and surgical elective admission rates and emergency department length of stay. We hypothesized that the daily number of elective admissions to hospital would demonstrate an interaction with the daily median emergency department length of stay when assessed by regression analysis.

Methods

This was a retrospective study design. The primary outcome was emergency department length of stay based on the boarding time of patients who were deemed to require admission to hospital. All elective admissions to the three adult hospitals between January 1, 2004 and December 31, 2004 in the Calgary Health Region were retrospectively reviewed and compared to a second regional database containing emergency department (ED) patient flow data. Data were acquired from the linkage of two health service databases that populate the Regional Emergency Department Information System (REDIS) and the Calgary Health Region (CHR) administrative database. The former contains all ED patient information including patient flow characteristics such as: triage

time, time to physician assessment, time of bed request, bed allocation and discharge from the ED. The latter has patient admission information including date and time, as well as route of admission (i.e. via the ED, via the operating room or direct admission). Dates on the two databases were formatted to ensure matching records for the datasets.

For patients admitted to hospital via the emergency room, the time from 'decision to admit' to 'bed allocation on ward' was stored in REDIS; this will be termed Emergency Department Length of Stay (EDLOS). The REDIS database for the calendar year of 2004 was sourced for this time period on all admitted patients from the ED.

The CHR database includes all data for patients admitted to beds in the health region. All admissions for the 2004 calendar year were analyzed for route of admission. The entire admitted population was examined, and the following sub-groups were excluded from the analysis: newborn births, still births and patients admitted via the emergency room. Admissions that were included were all admissions via outpatient medical clinics, day surgery, operating room, from home, and any other route of admission not via the emergency room.

Descriptive statistics (mean, median, range, standard deviation) were determined for the number of admissions per day via the ED and via other routes, and for EDLOS. Admission rate differences by day of week were compared using Student's *t*-test. Linear regression modeling with SPSS version 13.0 was used for statistical analysis of interaction between number of non-emergency room admissions (independent variable) and EDLOS (dependent variable). *P* values <0.05 were considered significant.

Results

Between January 1, 2004 and December 31, 2004, 83,027 patients were admitted to adult acute care beds in the CHR. 37,007 patients were admitted to hospitals via the ED, whereas 46,020 patients were admitted by routes other than the ED (direct from medical clinic or operating room, from home, from day surgery, inter-facility transfer).

For patients admitted via the ED 12,296 patients were excluded due to missing or incomplete patient records making time analysis impossible, leaving 24,711 records for interpretation. Admission bed requests via the ED appeared static over the course of the year, demonstrating a normal distribution with little day to day variability. There were non-significant differences between days of the week for mean volume of bed requests per day at each site. See Table 1 for distribution of bed requests via the ED over days of week and by site.

In 2004, there were 46,020 total patients admitted to CHR acute care beds by all routes other than the ED. Descriptive statistics revealed large variability in daily elective bed demand. There was variability within groups (i.e. Monday compared with Monday) and also between groups (i.e. Tuesday compared to Saturday). This result was expected as most elective admissions are weekday surgical admissions. See Table 1 for distribution of mean bed requests over days of week and by site.

EDLOS showed marked variability for each day, with a normally distributed wide range around the mean number of minutes. See Table 1 for the descriptive statistics of EDLOS.

Simple linear regression models using individual days to predict EDLOS as a function of the number of direct admissions were completed. For each day of the week, none of the associations between the number of admissions and the EDLOS were significant. Two sample plots are provided in Figures 1 and 2 demonstrating the actual and predicted median wait times plotted against the number of direct admissions for two of seven days of the week at one CHR hospital site. For all three adult ED sites and all seven days of the week there were no significant associations determined by linear regression analysis.

Discussion

Our data did not support a relationship between the volume of elective admissions and emergency department length of stay (EDLOS). We undertook this endeavour in an attempt to elicit potential factors impacting the growing problem of ED access block.

TABLE 1. Descriptive Statistics of Bed Demand and Emergency Department Length of Stay

CHR Site and Day of Week	Elective Bed Requests Mean per day In days (+/- SD)	ED Bed Requests Mean per day In days (+/- SD)	Mean EDLOS in minutes (+/- SD)
FMC			
Monday	71 (7.9)	36 (5.5)	117 (35)
Tuesday	69 (9.4)	37 (5.7)	141 (61)
Wednesday	65 (8.1)	38 (6.5)	139 (47)
Thursday	62 (6.7)	36 (6.1)	135 (62)
Friday	58 (7.8)	38 (5.2)	124 (41)
Saturday	20 (4.5)	37 (5.1)	101 (21)
Sunday	21 (3.9)	34 (4.5)	111 (39)
All days	52 (21.6)	36 (5.8)	124 (40)
PLC			
Monday	44 (7.4)	30 (5.3)	102 (45)
Tuesday	44 (6.8)	29 (4.9)	97 (41)
Wednesday	44 (8.0)	29 (6.4)	95 (48)
Thursday	40 (6.2)	28 (5.7)	107 (64)
Friday	37 (5.7)	28 (6.3)	92 (22)
Saturday	17 (3.9)	29 (4.4)	82 (29)
Sunday	16 (3.9)	26 (5.8)	90 (48)
All days	34 (13.3)	28 (5.6)	95 (44)
RGH			
Monday	50 (6.7)	28 (4.1)	106 (19)
Tuesday	53 (7.2)	29 (5.6)	98 (23)
Wednesday	48 (5.8)	28 (5.1)	95 (23)
Thursday	49 (8.5)	28 (4.5)	97 (25)
Friday	46 (6.3)	28 (3.8)	101 (22)
Saturday	17 (3.5)	28 (6.4)	101 (28)
Sunday	14 (5.5)	25 (5.1)	102 (20)
All days	39 (16.7)	28 (5.1)	100 (23)

Descriptive statistics of mean daily bed requests by Calgary Health Region site for all adult admissions via the Emergency Department (ED), elective adult admissions by all other routes, and mean Emergency Department Length of Stay (EDLOS) for admitted patients boarding in the ED. FMC = Foothills Medical Centre, PLC = Peter Lougheed Centre, RGH = Rockyview General Hospital, SD = standard deviation.

While our study does not demonstrate a relationship between the number of elective admissions and EDLOS, further causative factors of and solutions for access block must be sought. Examining correlations (be they positive, negative or non-significant) may lead to the discovery of factors not yet identified.

Our research does support a common theme in Emergency Medicine that, despite the perception of

unpredictability, the ED demand for acute care beds was stable over time and by day of week. The fluctuation in acute care bed demand was at the level of the elective admissions, with statistically significant differences between weekdays and weekends. Inpatient resources should be staffed accordingly, with beds allocated to the anticipated (and predictable) ED admissions.

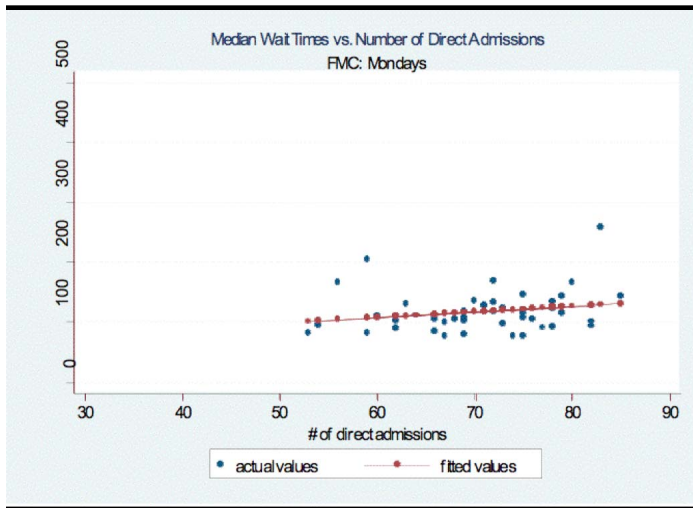


FIGURE 1. Monday plot of median wait time and number of direct admissions. Non-significant prediction of EDLOS by number of admissions (P :NS). $R^2 = 0.0445$

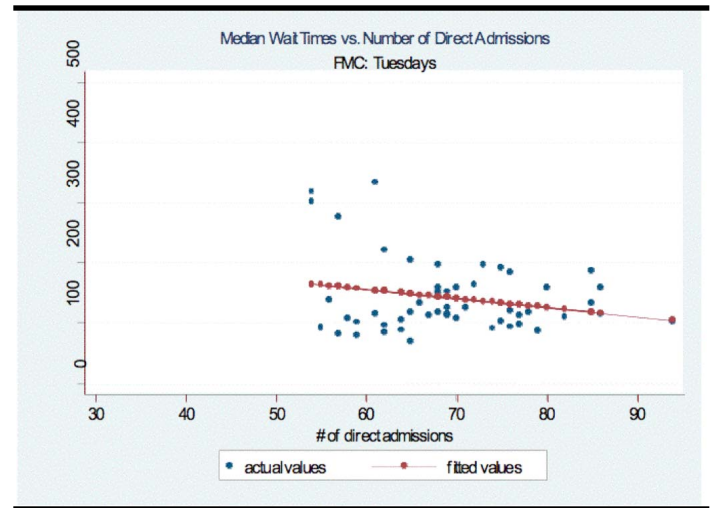


FIGURE 2. Tuesday plot of median wait time and number of direct admissions. Non-significant prediction of EDLOS by number of admissions. $R^2 = 0.0539$

Future study of ED patient flow characteristics should include the development of a more complex multiple regression model with an increasing number of potential variables to better determine factors influencing EDLOS. We anticipate that including such variables as: allied health workers shift scheduling, inpatient nursing shift volumes and the daily number of patient discharges from inpatient wards to the regression model would help to describe the complexity of ED access block.

Limitations

Our study has a number of limitations. The external validity of our study is in question as it was conducted in only one metropolitan Canadian health region. The generalizability to other centers is unknown. The methodology was a retrospective database review which has potential errors of data entry and incomplete data sets. There are also multiple other confounding variables affecting EDLOS including but not limited to: nursing staff, hospital occupancy, discharge rates from hospital, access to long-term care beds, and seasonal variability of illness patterns.

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Correspondence to:

Dr. T.S. Langhan
Emergency Medicine Resident,
Room C231-1403 29th street NW,
Calgary, Alberta,
Canada, T2N 2T9