Ir Med J; November/December 2022; Vol 115; No. 10; P695

December 15th, 2022

The Six Hour Target and Total Daily Attendances Cohort Study

P. Gilligan[1,2,3], P. Fitzpatrick[3], E. Owens[1], S. Winder[1], M. Codd[3]

1. Beaumont Hospital, Beaumont Road, Dublin 9.
2. The Royal College of Surgeons in Ireland.
3. University College Dublin.

Abstract

Aims

In 2012 the Emergency Medicine Programme set a six hour time standard for 95% of patients attending Emergency Departments (ED) in Ireland to have their care completed. This study explores the impact of total daily attendances to an adult ED on the delivery of timely care.

Methods

A retrospective cohort study of 58,323 ED attendances was performed. The impacts of variables identified from the peer reviewed literature on the likelihood of a patient achieving timely care were examined. SPSS version 24 was used for analysis.

Results

The 6-hour target was achieved for 23,461 (40.2%) patients. Total daily attendances ranged from 99 to 222 attendances per day with a mean of 164 (sd 25.9) and a median of 170 patients. On days where the median daily attendance was surpassed the target was more likely to be achieved (OR 1.11; 95%CI 1.08 to 1.15). Referral for admission and requiring admission (OR 0.12; 95%CI 0.11 to 0.13) reduced the likelihood of completing the ED stay in a timely manner.

Conclusion

The challenge is not that too many patients are seeking Emergency Department care but that too many patients spend too long in the Emergency Department.

Introduction

This research examines the impact of total daily attendances on the timeliness of care delivery in an Emergency Department (ED). ED length of stay is not a direct measure of ED crowding, but it is widely used as an easily quantifiable surrogate marker and it is an important component of ED quality assurance monitoring[1].

It is readily calculated and understood, and is considered the "criterion standard" for the measurement of throughput and crowding [2]. ED length of stay (EDLOS) may be defined as either a continuous or a dichotomous variable, i.e., EDLOS in minutes/hours or EDLOS above or below a cut-off point e.g. the achievement of a target time for completion of ED based care.

One common focus of international healthcare policy response to ED crowding undertaken in a number of jurisdictions, including England in 2001, Ontario in 2008 and Australia in 2010, has been to specifically target reductions in EDLOS [3]. In Ireland in 2012 the Emergency Medicine Programme set a six hour time standard for 95% of patients attending the ED to have their care completed. This involves addressing the patients' care needs and being admitted to a ward bed or discharged home within 6 hours of arrival to the ED [4].

The crowding of EDs around the world is associated with increased preventable death[5,6,7]. It compromises the safe delivery of care and yet it remains an international reality more than forty years after it was first described[8,9,10]. One of the explanations given by some for the crowding of EDs is that too many people use the service. The term inappropriate use has been used whereby the service user or primary care are blamed for their accessing of the system[11].

Crowding is thought to relate to increased numbers of ED visits, prolongation of the ED evaluation and treatment process, and the lack of another care area to transfer or discharge the patient to after receiving emergency treatment[12]. It would seem logical to assume that if a patient attends on a day where there are large numbers of other patients attending that they will experience delays in their assessment and treatment. This research explores the hypothesis that there is an association between total attendances in a 24 hour period, i.e. the ED twenty four hour census, and the patients arriving in that timeframe having their ED visit completed in six hours or less. The research will also explore those variables that are associated with a prolonged stay in the ED with a view to informing how the perennial issue of ED crowding may be addressed.

Methods

The research was approved by Beaumont Hospital Research Ethics Committee. The research was performed in an ED with 28 clinical care spaces which receives in excess of 50,000 patients annually. The urban area teaching hospital has six hundred and eighty beds.

A retrospective cohort study of routinely gathered data on all patient attendances to the adult ED in the calendar year of 2019 was performed. All patients attending the ED have their data entered into the Emergency Department Information System (EDIS). Patients having laboratory based blood tests will have the details of requests captured on the laboratory information system and those having radiological investigations will be recorded on the radiology ordering and recording system, the Picture Archiving and Communication system (PACS) and the National Imaging Management Information System (NIMIS). The data from these systems were merged using the Diver software solution.

The data were entered by the Management Information Department into an Excel spreadsheet. The Excel dataset was subsequently imported into SPSS Version 24.

To achieve the six hour target a patient attendance had to be six hours or less from registration to admission to a ward bed or discharge from ED. Total daily attendances were taken to be the number of attendances between 00:00 and 23:59 in the time period that each patient attendance was registered.

Descriptive statistics were generated for demographic variables and Odds ratios (OR) with 95% Confidence Intervals (95%CI) for comparison of proportions. Total daily attendances were assessed against EDLOS as a continuous variable using Spearman's correlation, and against categorical variables for days above the mean, and days above the median of attendances with respect to achieving the 6 hour target using t tests or ANOVA, or Mann-Whitney U tests or Kruskal-Wallis tests as appropriate. A p value of < 0.05 was taken to represent statistical significance.

Results

In 2019 there were 58,323 attendances to the ED. Total daily attendance data were not normally distributed and ranged from 99 to 222. Table 1 describes the variables gathered for the research and their comparison between those achieving or failing to achieve the 6 Hour Target. The six hour target was achieved for 23,461 (40.2%) patients, 11,832 (50.4%) of whom were male. Of the 34,862 who did not achieve the six hour target, 18,618 (53.4%) were female. The mean age for all patients was 50.7 years (sd 21.3) ranging from 10 months old to 103 years of age. Those achieving the six hour target had a mean age of 46.6 years (sd 20.5) whilst those failing to achieve it had a mean age of 53.5 years (sd 21.4). The mean daily attendance was 164 (sd 25.9) with a median of 170 (IQR 146 to 182).

The mean length of stay was 9 hours, 12 minutes (SD 7 hours and 13 minutes). Those achieving the six hour target had a mean length of stay of 3h16m (SD 1h38m) compared with those not achieving at 13h11m (SD 6h45m). The median EDLOS for all attendances was 7 hours and 24 minutes, with those achieving the 6 Hour target having a median stay of 3 hours 20 minutes and those failing to achieve it spending a median of 11 hours and 9 minutes in the ED.

The median total daily attendance was 170 (IQR 149 – 181) for those achieving the six hour target and 169 (IQR 143 – 181) for those failing to achieve it. This was found to be statistically significant ($p<0.001$) using the Mann-Whitney U test.

With respect to the impact of total daily attendances on achieving the six hour target a bivariate correlation using Spearman's rho found a correlation of -0.02 (p value <0.001). Total daily attendances were a mean of 163.8 (sd 25.9) for those not achieving the 6 hour target and 165.0 (sd 25.0) for those achieving the target. The mean difference was an additional 1.2 patient attendances per day (95%CI 0.8 to 1.7) (p value <0.001) for patients who achieved the 6 hour target.

Table 1: The 6 Hr TDA cohort Study: Variables and their impact on achievement of the 6 Hour Target.

	All patient Attendances	**6 Hr Target Achieved**	**6 Hr Target Not Achieved**	**OR[**] / MD[***] (95% CI[f])**	**P value**
Total	58,323	23,461 (40.2%)	34,862 (59.8%)		
Age[j] (Mean (sd[*]))	50.7 yrs (22.0)	46.6 yrs (20.5)	53.5 yrs (21.4)	**MD (95%CI)**	<0.001[g]
				-6.9 (-7.3 to -6.6)	
Age >65 yrs[j]	17,653 (30.3%)	5,316 (30.1%)	12,337 (69.9%)	**OR (95%CI)**	<0.001[h]
				0.54 (0.52 to 0.56)	
Male (%)	28,065 (48.1%)	11,832 (42.2%)	16,233 (57.8%)	1.17 (1.13 to 1.21)	<0.001[h]
Female (%)	30,240 (51.8%)	11,622 (38.4%)	18,618 (61.6%)	0.86 (0.83 to 0.89)	
Admitted (%)	14,517 (24.9%)	1,561 (10.8%)	12,956 (89.2%)	0.12 (0.11 to 0.13)	
					<0.001[h]
Discharged (%)	43,806 (75.1%)	21,900 (50.0%)	21,906 (50.0%)	8.30 (7.85 to 8.77)	
Median (IQR) TDA[a]	170 (146- 182)	170 (149 – 183)	169 (143 –181)	**MD (95%CI)**	<0.001[g]
Mean TDA[a] (sd)	164.2 (25.9)	165 (25.9)	163.8 (25.9)	-1.2 (-1.7 to -0.8)	
Above mean TDA (%)	33,455 (57.4%)	13,785 (41.2%)	19,670 (58.8%)	**OR (95%CI)**	<0.001[g]
				1.10 (1.06 to1.14)	
Above Median TDA (%)		12,155 (41.5%)	17,135 (58.5%)	1.11 (1.08 to 1.15)	<0.001[h]
	29,290 (50.2%)				
Blood Testing Performed (%)	37,614 (64.5%)	9,046 (24.0%)	28,568 (76.0%)	0.14 (0.13 to 0.14)	<0.001[h]
Weekend	13,130 (22.5%)	4,887 (37.2%)	8,243(62.8%)	0.85 (0.82 – 0.88)	<0.001[h]
Weekday	45,193 (77.5%)	18,574 (41.1%)	26,619 (58.9%)	1.18 (1.13 to 1.32)	
EDLOS[b] Median	7hr 24 min	3 Hr 20 mins	11 hr 9 mins		
(IQR[K])	(4:01 to 12:27)	(1:54 to 4:41)	(8:12 to 16:11)		
EDLOS[b] Mean	9hr 12 mins	3 hr 16 mins	13 hr 11 mins		
(sd*)	(7hrs 13 mins)	(1hr 38 mins)	(6 hr 45 mins)		
	33 452 (57.4%)	10,553 (31.5%)	22,899 (68.5%)	**OR (95%CI**)	<0.001[h]
Radiology Performed (%)				0.43 (0.41 - 0.44)	

sd[*]=standard deviation, OR[**]= odds ratio, MD[***] = Mean difference, Sig[****] = significance test, TDA[q] = Total Daily Attendance, EDLOS[b] = Emergency Department length of stay, CT[c] = Computed Tomography scan, US[d] = Ultrasound scan, MRI[e] = Magnetic resonance imaging, CI[f] = Confidence Interval, [g] = Mann-Whitney U Test [h] = Chi square, Mean Age[j] yrs = Mean age in years, Age>65 yrs [j]= Age over 65 years, IQR[K] = Interquartile Range. Note there were 18 patient attendances where the gender of the patient was not recorded.

Examination of EDLOS by Manchester triage category (Table 2) revealed that, apart from the highest

category, those of higher acuity spent longer in the ED (F test p<.001).

Table 2. The 6HrTDA study: Triage category and ED length of stay.

Triage category	Number	Median EDLOS*	IQR**
Red	332	5:26	2:19 to 11:26
Orange	14064	9:28	5:23 to 15:36
Yellow	30009	8:29	5:14 to 13:20
Green	11593	4:15	2:21 to 7:15
Blue	187	1:48	0:40 to 04:30
Not triaged	2138	0:59	0:35 to 1:44
Total	58323	7:24	4:01 to 12:27

EDLOS = Emergency Department length of stay, IQR** = Inter Quartile Range*

As compared to those discharged from the ED (mean EDLOS 7:12, sd 5:37) the requirement for referral (mean EDLOS 14:37, sd 8:07) to the on call services and for admission (mean EDLOS 15:13 sd 8:06) were each associated with a longer EDLOS and significant reduction in the likelihood of achieving the 6 hour target (OR 0.12, 95% CI 0.12 to 0.13; and OR 0.12, 95% CI 0.11 to 0.13).

On examining the correlation between total daily attendance and various elements of the total time spent in the ED the strongest correlation was with the Triage Time (Correlation coefficient 0.10). The time to First Medical was weakly negatively correlated with total daily attendance (Correlation coefficient -0.03). The entire duration of stay was weakly negatively correlated with total daily attendances (correlation coefficient -0.02).

Discussion

This research evidences that ED length of stay is only weakly correlated with total daily attendances and that there are other factors with far greater impact on the time a patient will spend in the ED. Patients requiring admission had the lowest likelihood of achieving the six hour target (OR 0.12, 95%CI 0.11 to 0.13) and this is because almost all patients requiring admission spent a period of time boarded in the ED pending the availability of a ward bed.

EDs worldwide are confronted with rising patient volumes causing significant strain on both

Emergency Medicine and entire healthcare systems[13]. ED crowding occurs when the demand for emergency services exceeds the ability of an ED to provide quality care within an appropriate time frame[14]. A Canadian multicentre retrospective cohort study over a 5 year time frame provided insight into the experiences of patients attending 16 high volume EDs in Alberta, Canada (attendances of over 50,000 patients per year) . The study included data from 3,925,457 presentations by 1,420,679 adults. As with this study longer EDLOS was noted for presentations requiring admission. In the Canadian study for discharged patients, the median length of stay was 3h21m whereas the median length of stay in the ED for admissions was 10h08m[14].

Whilst this study found a weak correlation -0.02 (p value<0.001) with numbers attending daily and achieving timely care a multicentre cohort study from the United States of America by Lucas et al, involving five hospitals and the experiences of 27,325 patients found a correlation coefficient of 0.13 (p value 0.048) between the numbers attending the ED each 24 hours and the time spent in the ED[15]. Similarly Casalino et al in their one year prospective observational cohort study involving 67,307 patient attendances with between 130 and 238 visits per day (median 184) found that input had little or no impact on achieving their four hour target for timely care completion[16].

The impact of requiring investigations, referral and admission has been quantified by this study and as noted by Kreindler et al, in their rapid review of the literature, admitted patients, older patients, those requiring investigations or procedures and those needing other specialty input spend longer in EDs[17]. Similar findings to this study were noted in a retrospective study over 10 years with data on over 7 million patient attendances in Australia from the Victorian Emergency Minimum Dataset. As with this research data from the EDs of Metropolitan Melbourne, using fixed effects modelling found that an Emergency Department length of stay of more than 4 hours was associated with older age, being female, emergency ambulance arrival, being classified as triage category 2 or 3, and requiring hospital admission[18].

Chan et al in their retrospective single centre cohort study in America of an ED with 55,000 attendances found that total daily census, which included their Urgent Care centre and the Emergency Department, did not significantly affect throughput time[19].

Kawano et al, in Japan, have found that an increase of one in the number of walk-in patients and ambulance arrivals prolonged patient stay in ED by only 1.8 and 2.6 minutes respectively; however, the execution of laboratory blood tests added another 74 minutes to the stay of discharged patients[20]. A positive correlation between laboratory turnaround times i.e. from receiving a sample to issuing a result, and ED LOS was observed in a broad patient population and across distinct acuity levels in a retrospective analysis of real-world patient data from 486 US hospitals. Their finding indicated a thirty second decrease in ED LOS with every one minute decrease in laboratory processing time [21].

Limitations of this research include that this was a single centre retrospective study. In other Emergency Departments with large numbers of boarded admitted patients occupying the available

clinical care spaces there may be a threshold for total daily attendances that has a greater impact on EDLOS. The data was drawn from an Emergency Department Information system and as observed by Lowthian et al, data quality and consistency are reliant on clinicians and clerical staff who work in an environment fraught with multiple distractions[18]. The use of 24 hours attendance, as indicative of the level of busyness, may have missed the impact of hourly attendances on the length of stay in the ED[22].

The use of data analysis and not just assumptions is important to determine which variables significantly affect ED throughput time so that incorrect conclusions are prevented[11,19]. Patients who are entirely appropriate to having care provided in an ED are likely to have the longest stays as a result of needing investigations, interventions, referral and admission. Being able to improve turnaround times for bloods tests to be performed and results made available would help in achieving timely care. Having more timely availability of radiology would reduce ED length of stay. Having acute hospital beds available for those needing them would facilitate timely care in the ED. The problem is not that too many patients are seeking ED care it is that too many patients spend too long in the Emergency Department. The timely delivery of care requires the timely delivery of every element of that care.

Declaration of Conflicts of Interest:
None declared.

Corresponding Author:
Peadar Gilligan
Emergency Department,
Beaumont Hospital,
Beaumont Road,
Dublin 9.
E-Mail: peadargilligan@beaumont.ie

References:

1. Herring A, Wilper A, Himmelstein DU, Woolhandler S, Espinola JA, Brown DFM, et al. Increasing Length of Stay Among Adult Visits to U.S. Emergency Departments, 2001–2005. Academic emergency medicine. 2009;16(7):609-16.
2. Guttmann A, Schull MJ, Vermeulen MJ, Stukel TA. Association between waiting times and short term mortality and hospital admission after departure from emergency department: population based cohort study from Ontario, Canada. BMJ. 2011;342(jun01 1):d2983-d.
3. Vermeulen MJ, Guttmann A, Stukel TA, Kachra A, Sivilotti MLA, Rowe BH, et al. Are reductions in emergency department length of stay associated with improvements in quality of care? A difference-in-differences analysis. BMJ Quality & Safety. 2016;25(7):489-98.
4. HSE. Health Service Executive. The national emergency medicine programme: A strategy to improve safety, quality, access and value in emergency medicine in Ireland. 2012. 2012.

5. Richardson DB. Increase in patient mortality at 10 days associated with emergency department overcrowding. Medical journal of Australia. 2006;184(5):213-6.
6. af Ugglas B, Djärv T, Ljungman PLS, Holzmann MJ. Emergency department crowding associated with increased 30-day mortality: a cohort study in Stockholm Region, Sweden, 2012 to 2016. Journal of the American College of Emergency Physicians Open. 2020;1(6):1312-9.
7. Jo SMD, Jin YHMDP, Lee JBMDP, Jeong TMD, Yoon JMD, Park BMD. Emergency Department Occupancy Ratio is Associated With Increased Early Mortality. Journal of Emergency Medicine. 2014;46(2):241-9.
8. Stang AS, Crotts J, Johnson DW, Hartling L, Guttmann A, Zehtabchi S. Crowding Measures Associated With the Quality of Emergency Department Care: A Systematic Review. Academic emergency medicine. 2015;22(6):643-56.
9. Boyle A, Abel G, Raut P, Austin R, Dhakshinamoorthy V, Ayyamuthu R, et al. Comparison of the International Crowding Measure in Emergency Departments (ICMED) and the National Emergency Department Overcrowding Score (NEDOCS) to measure emergency department crowding: pilot study. Emergency medicine journal : EMJ. 2016;33(5):307-12.
10. Di Somma S, Di Somma S, Paladino L, Paladino L, Vaughan L, Vaughan L, et al. Overcrowding in emergency department: an international issue. Internal and emergency medicine. 2015;10(2):171-5.
11. Richardson DB, Mountain D. Myths versus facts in emergency department overcrowding and hospital access block. Medical journal of Australia. 2009;190(7):369-74.
12. Bradley VM. Placing Emergency Department Crowding on the Decision Agenda. Journal of emergency nursing. 2005;31(3):247-58.
13. Ansah JP, Ahmad S, Lee LH, Shen Y, Ong MEH, Matchar DB, et al. Modeling Emergency Department crowding: Restoring the balance between demand for and supply of emergency medicine. PloS one. 2021;16(1):e0244097-e.
14. Rowe BH, McRae A, Rosychuk RJ. Temporal trends in emergency department volumes and crowding metrics in a western Canadian province: a population-based, administrative data study. BMC health services research. 2020;20(1):356-.
15. Lucas R, Farley H, Twanmoh J, Urumov A, Olsen N, Evans B, et al. Emergency Department Patient Flow: The Influence of Hospital Census Variables on Emergency Department Length of Stay. Academic emergency medicine. 2009;16(7):597-602.
16. Casalino E, Choquet C, Bernard J, Debit A, Doumenc B, Berthoumieu A, et al. Predictive variables of an emergency department quality and performance indicator: a 1-year prospective, observational, cohort study evaluating hospital and emergency census variables and emergency department time interval measurements. Emergency medicine journal : EMJ. 2013;30(8):638-147.
17. Kreindler SA, Cui Y, Metge CJ, Raynard M. Patient characteristics associated with longer emergency department stay: a rapid review. Emergency Medicine Journal. 2016;33(3):194-9.
18. Lowthian JA, Curtis AJ, Jolley DJ, Stoelwinder JU, McNeil JJ, Cameron PA. Demand at the emergency department front door: 10-year trends in presentations. Medical journal of Australia. 2012;196(2):128-32.

19. Chan L, Reilly KM, Salluzzo RF. Variables That Affect Patient Throughput Times in an Academic Emergency Department. American journal of medical quality. 1997;12(4):183-6.
20. Kawano T, Nishiyama K, Hayashi H. Execution of diagnostic testing has a stronger effect on emergency department crowding than other common factors: A cross-sectional study. PloS one. 2014;9(10):e108447-e.
21. Kaushik N, Khangulov VS, O'Hara M, Arnaout R. Reduction in laboratory turnaround time decreases emergency room length of stay. Open access emergency medicine. 2018;10:37-45.
22. Fatovich DM, Nagree Y, Sprivulis P. Access block causes emergency department overcrowding and ambulance diversion in Perth, Western Australia. Emergency Medicine Journal. 2005;22(5):351-4.