

Ambulatory care by on-call teams in an Emergency Department

A. Kinsella¹, P. Gilligan^{1,2,3}.

1. UCD Intern Network, UCD School of Medicine, Belfield, Dublin 4, Ireland.
2. Emergency Department, Beaumont Hospital, Beaumont Rd., Beaumont, Dublin 9, Ireland.
3. Royal College of Surgeons in Ireland (RCSI), St. Stephen's Green, Dublin 2, Ireland.

Abstract

Aim

Admission rate is a key performance indicator for Emergency Departments (EDs). Senior hospital management advised that, if discharge by on-call teams was possible within 24 hours, a patient should be termed 'ambulatory' and remain in the ED under the care of the on-call team rather than being admitted to a ward. This study aimed to assess the impact of this initiative on ED admission rates and occupancy.

Methods

A pre- and post-intervention single site study over a seven-year period of the impact of this ambulatory care initiative on ED admission rates (number of patients admitted from ED/total attendances to ED) and occupancy (number of patients in the ED/number of clinical care spaces) was performed using Python and SPSS.

Results

Over the study period the admission rate increased. Statistically significant differences ($p < 0.05$) between the pre-intervention admission rate of $26 \pm 0.2\%$ (32,587 admissions; 123,662 attendances), the during intervention rate of $26 \pm 0.4\%$ (26,453 admissions; 102,048 attendances) and the post-intervention rate of $27 \pm 0.2\%$ (51,127 admissions; 188,430 attendances) were found. Of the 30-35 available clinical spaces in the ED, occupancy at 08:00 each day increased from $95 \pm 1\%$ (28.6 ± 0.4 patients) pre-intervention to $112 \pm 2\%$ (39.1 ± 0.5 patients) post-intervention ($p < 0.001$). The proportion of patients still in the 'referred' category at 08:00 each day increased three-fold.

Discussion

Ambulatory care in the ED by the on-call teams did not reduce ED admission rates. Occupancy increased significantly over the study period. On-call teams performing extended workups of 'referred' patients in the ED occupies clinical space required for the assessment of newly arriving patients by the emergency medicine team.

Introduction

Crowding of Emergency Departments (EDs) is associated with increased preventable death ^{1, 2, 3}. Anything that prolongs a patient's ED length of stay (EDLOS) will contribute to crowding ^{1, 4, 5}. Hospitals in Ireland report the number of admitted patients waiting on trolleys in their EDs and wards at 08:00 each day. This number is indicative of the degree of crowding of EDs nationally. The data is reported by the Health Service Executive and by the Irish Nurses and Midwives Organisation. Hospitals are expected to try to address this key performance metric by admitting patients to ward beds in a timely manner. The numbers waiting for assessment by the Emergency Medicine team or who have been referred to the on-call teams are not reported, but these patients form a significant part of the crowd in the ED.

Admission rate (total admitted / total attendances) is another key performance indicator. There was an increase in ED attendances to the hospital in which this research was performed over the study period (49,920 in 2017 to 63,280 in 2023). The senior management team promoted the concept that if a discharge by the on-call team within twenty-four hours, i.e. a short stay admission, was possible, the patient should be termed 'ambulatory' and remain in the ED rather than being transferred to a ward bed. Ambulatory care by the on-call teams in the ED was introduced with the goal of reducing ED admission rates and thereby increasing bed availability for those requiring longer admissions.

This study was motivated by a concern that, even if the number of admitted patients in the ED decreased, the numbers in the referral process under the care of the on-call teams would increase and that this would exacerbate crowding. There was a concern that ambulatory care by on-call teams in the ED would negatively impact on the timeliness of care in the ED, as those receiving care by on-call teams would still be occupying clinical space and require nursing care in an already crowded ED ⁶.

Methods

This pre- and post-intervention study was performed over a seven-year period and aimed to assess the impact of the delivery of ambulatory care by on call teams by testing four hypotheses. First, did ED admission rate differ when comparing pre-intervention, during intervention, and post-intervention groups? Second, did ED occupancy differ over the study period? Third, did the total proportion of patients under the care of on-call teams in the ED at 08:00 each morning differ over the study period? Fourth, did the proportion of patients in the ED in the 'referred' and 'admitted' categories at 08:00 each morning differ between pre, during, and post-intervention groups?

On-call teams were advised by hospital management that if a patient's admission requirement could be addressed within twenty-four hours of arrival to the ED that they should not be deemed 'admitted' but they should be defined as 'ambulatory' patients. An ambulatory screen was added to the Emergency Department Information System (EDIS) from May 2019 to March 2021.

Data was collected over a seven year period (January 2017 to December 2023) from the handover logbooks in which the number of patients in each of the ED categories – 'majors' patients i.e. those still under the care of the Emergency Medicine team, 'referred' to the on-call teams awaiting definitive decision regarding admission or discharge by these teams, 'admitted' by on-call teams and boarded in the ED whilst awaiting a ward bed, and 'ambulatory' patients seen by the on-call teams and undergoing further work up to inform the decision regarding admission or discharge - were recorded by the Emergency Medicine consultant on duty at 0800 every morning. Data relating to total Emergency Department attendances and admission rates were obtained from the hospital information system using the Diver software solution and from Management Information services. This data was exported to Excel, SPSS, and Python for analysis.

The monthly admission rates for patients attending the ED during the study period was obtained by dividing total monthly admissions by total monthly attendances to the ED. This was divided into pre-intervention (January 2017 - May 2019), during intervention (May 2019 - March 2021), and post-intervention (March 2021 – December 2023) groups for comparison.

The proportions in each group were obtained from days where a full data set (the number of patients in each of majors, referred, admitted, and ambulatory, if applicable) was recorded, incomplete days were excluded. The number of patients in the ED under the care of the on-call teams as a proportion of total patients in the ED was calculated for each day as follows:

$$\text{Proportion}_{\text{On-Call}} = \frac{\text{Referred} + \text{Admitted} \pm \text{Ambulatory}}{\text{Majors} + \text{Referred} + \text{Admitted} \pm \text{Ambulatory}} \quad (\text{Eq 1})$$

The proportions were again divided into three groups relating to the pre-intervention, during intervention, and post-intervention time periods

Similarly, the number of patients in the referred and admitted categories as a proportion of the total patients in the ED was calculated for each of the days a full data set was recorded, and divided into pre-, during, and post-intervention groups as follows:

$$\text{Proportion}_{\text{Referred}} = \frac{\text{Referred}}{\text{Majors} + \text{Referred} + \text{Admitted} \pm \text{Ambulatory}} \quad (\text{Eq 2})$$

$$\text{Proportion}_{\text{Admitted}} = \frac{\text{Admitted}}{\text{Majors} + \text{Referred} + \text{Admitted} \pm \text{Ambulatory}} \quad (\text{Eq 3})$$

Finally, the proportion of the patients in the ED under the care of on-call teams classified as 'referred' or 'admitted' were calculated, respectively, using the following equations:

$$\text{Proportion}_{\text{On-Call 'Referred'}} = \frac{\text{Referred}}{\text{Referred} + \text{Admitted} \pm \text{Ambulatory}} \quad (\text{Eq 4})$$

$$\text{Proportion}_{\text{On-Call 'Admitted'}} = \frac{\text{Admitted}}{\text{Referred} + \text{Admitted} \pm \text{Ambulatory}} \quad (\text{Eq 5})$$

Analysis was performed using the Kruskal-Wallis test. A p-value of <0.05 was taken as the significance level.

Results

The number of days for which a complete data set was recorded was 1,963 (76.7%).

The ambulatory care screen did not reduce ED admission rates (p-value < 0.05). Over the study period, the admission rate increased from 26±0.2% pre-intervention (32,587 admissions; 123,662 attendances), to 26±0.4% during intervention (26,453 admissions; 102,048 attendances), to 27±0.2% (51,127 admissions; 188,430 attendances) post-intervention. The total proportion of patients in the ED under the care of the on-call teams (referred, admitted ± ambulatory) remained the same in the pre-, during and post-intervention group (p = 0.051) (Fig 1). During the intervention, the average proportion of patients in the ED in the 'ambulatory' group was 0.12±0.9.

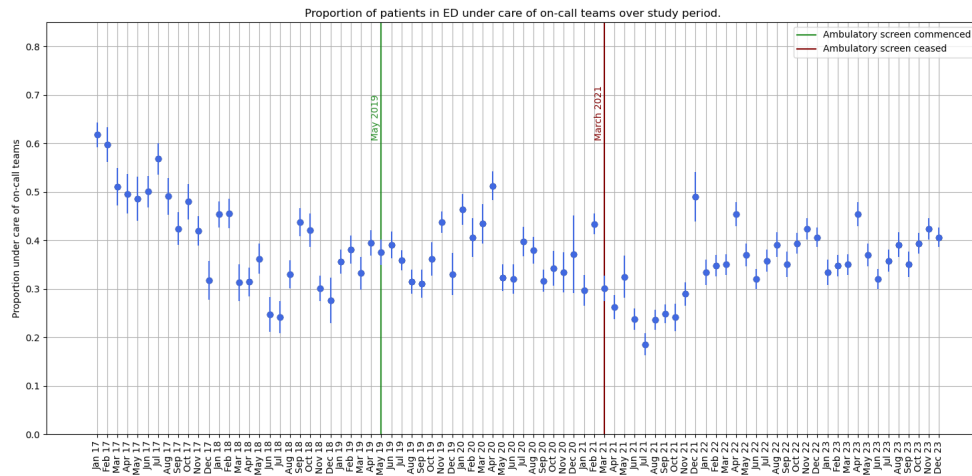


Figure 1: Proportion of patients in the ED under the care of on-call teams at 08:00, as calculated using Equation 1.

The proportion of patients in the ED in the ‘referred’ and ‘admitted’ categories were found to be significantly different when comparing the pre-, during, and post-intervention groups ($p < 0.001$) (Fig 2 & 3). The proportion of patients in the ED ‘referred’ category at 08:00 increased during the intervention period and remained consistently at a significantly higher level post-intervention (mean and standard deviation 0.25 ± 0.05) than pre-intervention (mean and standard deviation 0.08 ± 0.02) i.e. the number of patients still in the referred category at 08:00 tripled during the intervention, and remained elevated following its cessation. Conversely, the proportion of patients in the ED in the ‘admitted’ category at 08:00 reduced during the intervention period, and remained at a lower level post-intervention (mean and standard deviation 0.1 ± 0.07) than pre-intervention (mean and standard deviation 0.3 ± 0.1).

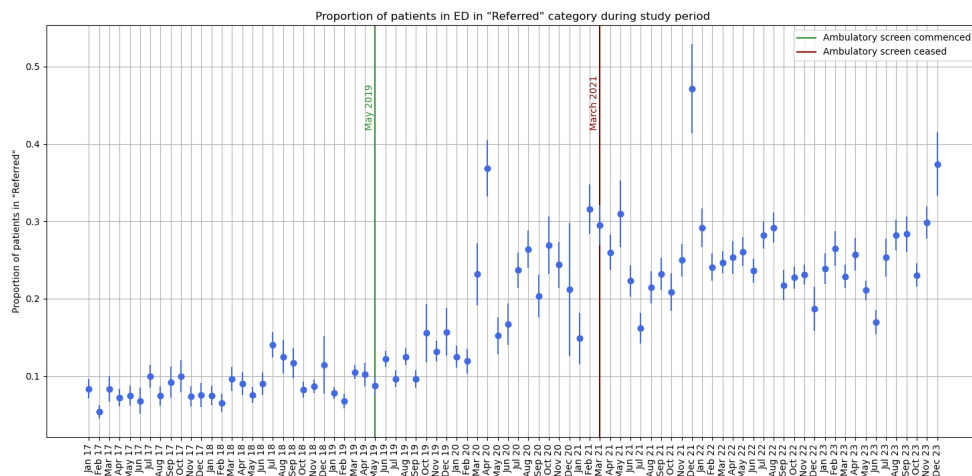


Figure 2: The proportion of patients in the ED in the ‘referred’ category at 08:00 during the study period, calculated using Equation 2.

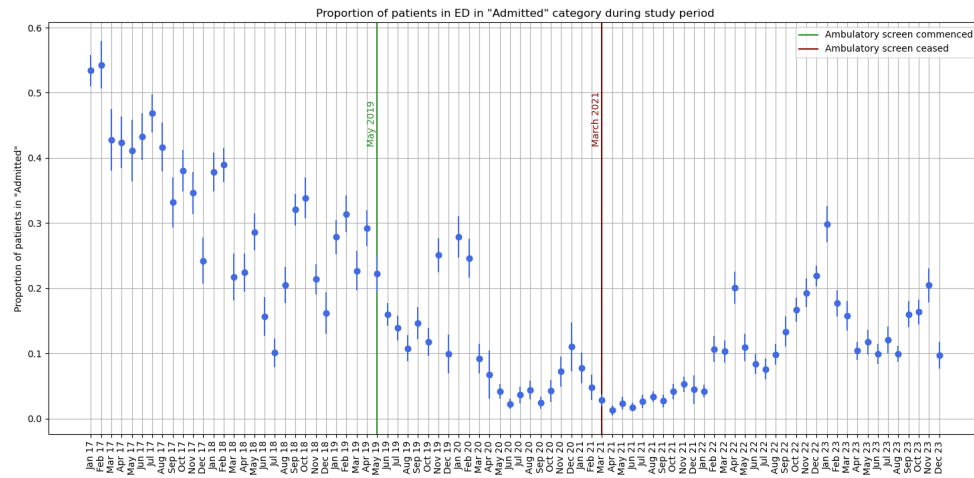


Figure 3: The proportion of patients in the ED in the ‘admitted’, category at 08:00 calculated using Equation 3.

Pre-intervention, of the patients in the ED under the care of on-call teams, the proportion in the ‘referred’ category was 0.3 ± 0.1 . Following the intervention, this proportion rose to 0.7 ± 0.1 , a statistically significant increase ($p < 0.001$, Fig 4). When viewed in combination with our previous result that the total proportion of patients in the ED under the care of on-call teams did not differ pre, during, and post-intervention, this analysis shows a shift in patient categorization from the majority of patients under the care of on-call teams being in the ‘admitted’ category to the majority being in the ‘referred’ category.

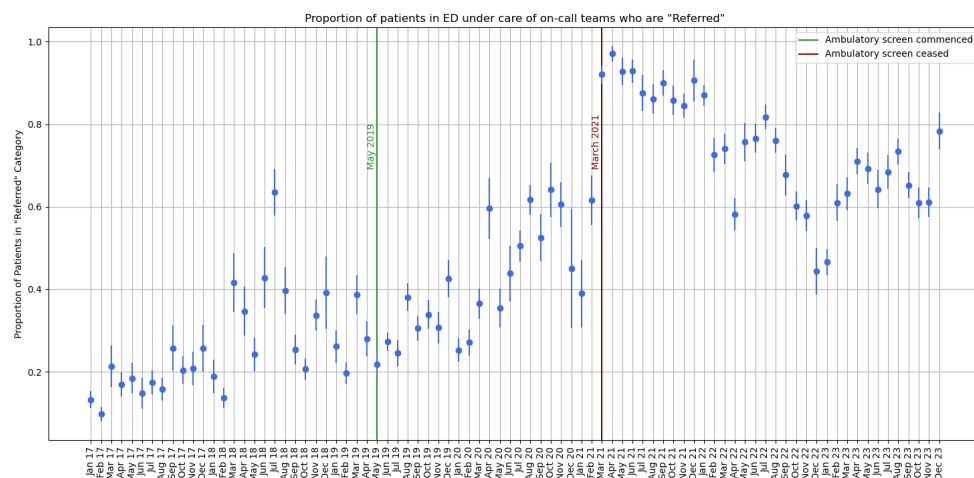


Figure 4: Proportion of patients in the ED under the care of the on-call teams who are classified as ‘referred’.

ED occupancy (number of patients in the ED/number of clinical care spaces) varied over the study period from $95 \pm 1\%$ pre-intervention (representing a mean and standard error of 28.6 ± 0.4 patients), $91 \pm 2\%$ during intervention (representing a mean and standard error of 27.2 ± 0.7 patients), to $112 \pm 2\%$ post-intervention (representing a mean and standard error of 39.1 ± 0.5 patients). Of note, ED occupancy during the intervention prior to the declaration of the Covid-19 pandemic (i.e. May 2019 to March 2020) rose to $125 \pm 3\%$ (representing a mean and standard error of 37.4 ± 0.9 patients), and subsequently fell to an average of $57 \pm 2\%$ (representing a mean and standard error of 17.0 ± 0.5 patients) from March 2020 to cessation of the intervention in March 2021. This reduced occupancy is in keeping with a period of reduced ED attendances due to the pandemic.

Discussion

Emergency department crowding is an issue of significant national and international concern^{7,8}. The practice of on-call teams performing ambulatory care of patients in the ED does not reduce ED admission rates and contributes to ED crowding through increased occupancy.

The total proportion of patients in the ED under the care of on-call teams did not differ significantly between the pre-, during, and post-intervention groups, with patients being cared for by on-call teams continuing to occupy a significant proportion of the available clinical space in the ED. However, with the introduction of the ambulatory screen, the proportion of patients in the ED who remained in the 'referred' category increased significantly whilst the proportion of patients in the ED at 08:00 deemed to be 'admitted' decreased. This suggests patients who would historically have been admitted and moved to a ward bed experienced more of their workup in the ED. The persistence of this trend following cessation of the ambulatory screen points to the establishment of a new norm of extended workups prior to admission. This is concerning as time to admission is an independent risk factor for all-cause mortality and morbidity^{3, 9, 10}.

ED crowding is strongly correlated with increased EDLOS and overall patient morbidity^{11,12} and mortality^{1, 2, 3, 13, 14}. It is well-established that the boarding of patients in the ED negatively impacts on crowding and EDLOS^{15, 16, 17, 18}. Similarly, the practice of performing extended patients work-ups in the ED pre-admission reduces the clinical space available for those patients needing assessment by the EM team. Such work ups ought to be performed in dedicated ambulatory care units / acute medical assessment units, which have been demonstrated to reduce ED crowding and LOS^{19, 20, 21}.

Limitations of the study include this being a single centre study and as such the findings may not be generalisable to other centres. The study period included the impact of the Covid -19 (May 2019 to March 2021) pandemic on the Emergency Department. The study design attempted to mitigate the effect of the pandemic by performing both a three-way comparison of the pre-, during, and post-intervention groups as well as a direct two-way comparison of the pre- and post-intervention groups (January 2017 – May 2019 and March 2021 – December 2023).

The study explored the impact of increasing ED attendances over the study period, a possible confounding variable, by looking at the different ED patient categories as proportions of total attendances rather than analysing category numbers alone. A moderate negative correlation between total ED attendances and proportion of patients under the care of on-call teams (correlation coefficient = -0.392, p-value = < 0.001) was found. This may be due to the lack of available clinical space in the ED for the assessment of patients still under the care of the Emergency Medicine (EM) team resulting in more patients still waiting to be seen or to have their care completed by the EM team at 08:00 each day. This bottleneck effect may account for the relative increase in the number of patients under the care of EM teams observed with increased attendances.

Emergency Departments have limited clinical space and staff for the provision of care to patients arriving to the hospital with unscheduled care needs. When the Emergency Medicine team refer patients to the on-call teams it is important that decisions are made in an expedited manner. If further work up or senior decision making is required, the patient should be moved to a ward bed in a timely manner. Failure to do this results in prolonging the patient's stay in the Emergency Department, increasing crowding and the likelihood of adverse outcomes for patients by depleting available clinical space, nursing care and resources, as well as denying admitted patients the ward-level care they require²². Ambulatory care by on call teams needs to be provided in a dedicated unit outside the Emergency Department rather than prolonging patients' Emergency Department length of stay.

Declaration of Conflicts of Interest:

None declared.

Corresponding Author:

Aishling Kinsella,
UCD Intern Network,
UCD School of Medicine,
Belfield,
Dublin 4,
Ireland.

E-Mail: aishlingkinsella@gmail.com

References:

1. Boyle A, Higginson I, Sarsfield K, Kumari P. RCEM Acute Insight Series: Crowding and its Consequences. London (UK). 2021 Nov. 18 p.
2. Roussel M, Teissandier D, Yordanov Y, Balen F, Noizet M, Tazarourte K et al. Overnight Stay in the Emergency Department and Mortality in Older Patients. *JAMA Intern Med.* 2023 Dec;183(12):1378-1385.
3. Jones S, Moulton C, Swift S, Molyneux P, Black S, Mason N et al. Association between delays to patient admission from the emergency department and all-cause 30-day mortality. *Emergency Medicine Journal.* 2022;39:168-173.
4. Savioli G, Ceresa IF, Gri N, Piccini GB, Longhitano Y, Zanza C et al. Emergency Department Overcrowding: Understanding the Factors to Find Corresponding Solutions. *J Pers Med.* 2022 Feb; 12(2): 279.
5. Morley G, Unwin M, Peterson G, Stankovich J, Kinsman L. Emergency department crowding: A systematic review of causes, consequences and solutions. *PLOS One.* 2018; 13(8): e0203316. <https://doi.org/10.1371/journal.pone.0203316>
6. Gilligan P. Improving Timeliness of Care in Ireland's Emergency Departments. *Ir Med J.* 2022; 113(10): 200.
7. Health Information and Quality Authority. Overview Report: Monitoring and Regulation of Healthcare Services 2021-2023.
8. Di Somma S, Paladino L, Vaughan L, Lalle I, Magrini L, Magnanti M. Overcrowding in emergency departments: an international issue. *Intern Emerg Med.* 2015;10:171-175.
9. Guttman A, Schull M J, Vermeulen M J, Stukel T A. 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:d2983.
10. Cardoso L, Grion C, Matuso T, Anami E, Kauss I, Seko L et al. Impact of delayed admission to intensive care units on mortality of critically ill patients: a cohort study. *Crit Care.* 2011; 15. <https://doi.org/10.1186/cc9975>
11. Hong KJ, Shin SD, Song KJ, Cha WC, Cho JS. Association between ED crowding and delay in resuscitation effort. *Am Journ Emerg Med.* 2013; 31(3):509-515.

12. McCusker J, Vadeboncoeur A, Levesque JF, Ciampi A, Belzile E. Increases in Emergency Department Occupancy Are Associated with Adverse 30-day Outcomes. *Academic Emergency Medicine*. 2014; 21(10):1092-1100.
13. Plunkett P, Byrne D, Breslin T, Bennett K, Silke B. Increasing wait times predict increasing mortality for emergency medical admissions. *Eur J Emerg Med*. 2011 Aug;18(4).
14. Sprivulis P, Da Silva J, Jacobs I, Jelinek G, Frazer A. The association between hospital overcrowding and mortality among patients admitted via Western Australian emergency departments. *MJA*. 2006;184:208-212.
15. Kenny J, Chang B, Hemmert K. Factors Affecting Emergency Department Crowding. *Emerg Med Clin N Am*. 2020 Aug; 38(3): 573-587.
16. Laam LA, Wary AA, Strony RS, Fitzpatrick MH, Kraus CK. Quantifying the impact of patient boarding on emergency department length of stay: all admitted patients are negatively affected by boarding. *JACEP Open*. 2021; 2:e12401.
17. White B, Biddinger P, Chang Y, Grabowski B, Carignan S, Brown D. Boarding Inpatients in the Emergency Department Increases Discharged Patients Length of Stay. *J Emerg Med*. 2013 Jan; 44(1): 230-235.
18. Singer A, Thode H, Vicellio P, Pines J. The Association Between Length of Emergency Department Boarding and Mortality. *Acad Emerg Med*. 2011 December; 18(12):1324-1329.
19. Scott I, Vaughan L, Bell D. Effectiveness of acute medical units in hospitals: a systematic review. *IJQHC*. 2009 Dec; 21(6): p397-407.
20. McGovern E. *Acute medical assessment units: a literature review*. Health Services Executive: Dublin; 2013
21. Sartini M, Carbone A, Demartini A, Giribone L, Oliva M, Spagnolo M et al. Overcrowding in Emergency Department: Causes, Consequences, and Solutions – A Narrative Review. *Healthcare (Basel)*. 2022 Aug; 10(9):1625.
22. Eriksson J, Gellerstedt L, Hilleras P, Craftman A. Registered nurses' perceptions of safe care in overcrowded emergency departments. *J Clin Nurs*. 2017 Oct 27; 27(5-6):p1061-e1067.