



Emergency department visits by patients with an internal medicine specialist: understanding the role of specialists in reducing ED crowding

Emily L. Aaronson^{1,2} · Jungyeon Kim³ · Gregory A. Hard⁴ · Brian J. Yun¹ · Haytham M. A. Kaafarani⁵ · Sandhya K. Rao⁶ · Jeffery B. Weilburg⁷ · Jarone Lee^{1,5}

Received: 19 September 2018 / Accepted: 11 February 2019 / Published online: 22 February 2019

© Società Italiana di Medicina Interna (SIMI) 2019

Abstract

As emergency department (ED) crowding continues to worsen, many visits are at academic referral hospitals. As a result, engaging specialty services will be essential to decompressing the ED. To do this, it will be important to understand which specialties to focus interventions on for the greatest impact. To characterize the ED utilization of non-surgical adult patients with an ambulatory specialist who were seen and discharged from the ED. Retrospective cohort study of all consecutive patients currently under the care from a specialist presenting to an urban, university affiliated hospital between 01 January 2015 and 31 December 2016. The identification of ED visits attributable to specialists was based on the primary diagnosis of ED visits and the frequency of visit with specialists within a given timeframe. Only patients who were discharged directly from the ED were included in the analysis. There were 29,853 ED visits by patients currently under the care of a specialist during the study period. 17.76% of these visits were related to the medical specialty of the specialist. Of these visits, 41.73% occurred during office hours, and 24.81% occurred during weekends. The specialties with the largest proportion of ED visits related to their specialty was cardiology, gastroenterology, and pulmonary, respectively. Nearly 18% of all patients that have a specialist and are treated and discharged from the ED present with a diagnosis related to their specialist's practice. This may indicate that there is a role for specialty service to play in decreasing some ED utilization that may be appropriate for the out-patient clinical setting. By focusing attention on specific specialties and interventions targeted during office hours, there may be an opportunity to decrease ED utilization.

Keywords Utilization review · Crowding · Ambulatory care · Emergency medicine

✉ Jarone Lee
lee.jarone@mgh.harvard.edu

¹ Department of Emergency Medicine, Massachusetts General Hospital, Boston, MA, USA

² Lawrence Center for Quality and Safety, Massachusetts General Hospital, Boston, MA, USA

³ Department of Global Health and Population, Harvard T.H. Chan School of Public Health, Boston, MA, USA

⁴ Clinical Trials Network and Institute, Massachusetts General Hospital, Boston, MA, USA

⁵ Department of Trauma, Emergency Surgery and Surgical Critical Care, Massachusetts General Hospital, Boston, MA, USA

⁶ Department of Primary Care, Massachusetts General Hospital, Boston, MA, USA

⁷ Department of Psychiatry, Massachusetts General Hospital, Boston, MA, USA

Introduction

Emergency department (ED) crowding continues to affect hospitals nationwide. As capacity constraints mount, there is increasing evidence tying crowding to poor health outcomes and low-quality care [1–4]. In the setting of this, research has focused on efforts to decrease ED length of stay, principally focused on innovations in departmental design, improvements in ancillary service turn-around-times and throughput related to admitted patients [5–9]. As hospitals continue to navigate this complex issue, it is critical that solutions within the entire continuum of care are explored.

With complex chronic illness becoming more common, ambulatory specialty care now plays a prominent role in healthcare delivery [10, 11]. This is especially true in academic medical centers where there is robust access to specialist clinicians. The result is an increasing role for

out-patient specialty services in reducing avoidable ED presentations.

Prior study has shown that over a quarter of ED visits are attributable to patients with specialists and that by focusing on specific specialty practices, ED use can be reduced [12–15]. To more broadly engage specialty services, we need to understand which specialties represent the greatest opportunity for improvement. Additionally it will be critical to know, within each specialty, which patients are visiting the ED, why they present and at what times. To our knowledge, no study to date has looked at this. We hypothesize that patients who have a relationship with a specialist who present to the ED and are discharged represent potentially avoidable ED visits. As such, the objective of our study was to characterize the ED utilization of patients with an ambulatory medical specialist who were seen and discharged from the ED. Specific outcomes of this study were the: (1) top three medical specialties with highest proportion of ED use; (2) top three ED diagnoses related to the specialty; and (3) differences in diagnoses during business hours versus off hours.

Methods

We conducted a retrospective cohort study of all consecutive patients currently under the care of a specialist presenting to a metropolitan, university affiliated hospital. We restricted our analysis to adult patients, aged 18 or older, who were seen and discharged from the ED. We hypothesized that patients that are seen and discharged represent potentially avoidable visits.

All ED visits attributed to a specialist by patients who were treated and discharged from 01 January 2015 to 31 December 2016 were included. Having a specialist was defined using prior described criteria derived from a multi-departmental hospital level committee to define a cohort for specialists [12].

Briefly, this was defined as one or more specialist visit in the prior 6 months OR two or more within the past two and a half years OR five or more ever with one within the last 5 years. Specialists were assigned a diagnostic group based on their most frequently billed diagnoses utilizing the Clinical Classifications Software (CCS) for International Classification of Diseases (ICD), 9th revision [16]. If the primary ED diagnosis was in the same CCS category as the specialist, then the ED visit was attributed to that clinician. Patients were excluded if they were under the age of 18. ED and demographic data were obtained using our department's ED Information System (Epic Systems Corporation, Verona, WI).

Data were summarized using descriptive statistics and 95% confidence intervals (CIs). A one-way ANOVA was

conducted to determine whether they are any statistically significant differences in practice patters between nine subspecialties. All analyses were conducted using Stata (Stata Corp. 2017. Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC.). This project was undertaken as a quality improvement and as such was not formally supervised by the IRB per their policies.

Results

There were nine specialties represented in the data set: allergy-immunology, cardiology, endocrinology, gastroenterology (GI), hematology-oncology, infectious disease, nephrology, palliative care, pulmonary. During the study period there were 195,695 ED visits, 109,755 by patients 18 years or older who were seen in and discharged from the ED; 29,853 of these visits were from 11,971 unique patients that had a specialist.

Over the 2-year study period, 29,853 out of the 109,755 ED visits (27.2%) were by patients currently receiving care from a specialist. Of these, 5301 out of the 109,755 (4.8%) visits were for a diagnosis that was related to their specialist's field (Fig. 1, Table 1). 41.73% (2212 out of the 5301 visits by patients currently receiving care from a specialist) occurred during office hours (9 am–5 pm Monday–Friday), and 24.80% (1315 out of the 5301 visits by patients currently receiving care from a specialist) occurred during weekends (Table 1). Patients characteristics are summarized in Table 2.

The specialties with the largest proportion of ED visits related to their clinical practice was among cardiology, gastroenterology and pulmonary respectively (Fig. 2). The largest volume of ED visits related to specialty services was in cardiology, hematology-oncology and gastroenterology (Table 1).

Among patients currently receiving care from a cardiologist, there were a total of 6665 visits and 28.46% (1897/6665)

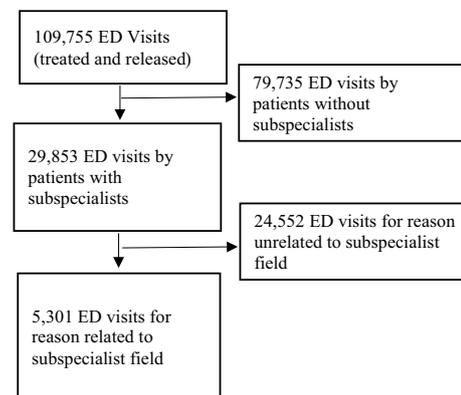


Figure 1 Study population

Table 1 ED visit description by subspecialty

Specialty	Total ED visits		ED visits related to specialty					
	n	Number of specialist	n	Number of specialist	During office hours (9 am–5 pm Mon–Fri)	During 2-h window before and after office hours		During weekends
						7–9 am	5–7 pm	
Allergy-Immunology	3176	40	517	35	216	19	31	157
Cardiology	6665	88	1897	81	845	62	159	440
Endocrine	4840	72	503	56	226	16	50	106
Gastroenterology	2913	45	633	37	231	30	50	171
Infectious disease	2283	52	317	36	119	11	26	86
Nephrology	1787	23	226	19	96	11	17	52
hematology-Oncology	5861	159	729	114	271	30	61	183
Palliative care	221	8	42	5	18	1	4	8
Pulmonary	2107	40	437	33	190	8	42	112
Total	29,853	527	5301	416	2212	188	440	1315

Table 2 Patient characteristics: ED visits related to specialty

Specialty	Age (years)	Sex
	Mean (SD)	Female (%)
Allergy-Immunology	58.63 (16.96)	381 (73.69%)
Cardiology	66.02 (15.80)	908 (47.87%)
Endocrinology	56.73 (17.70)	323 (64.21%)
Gastroenterology	53.69 (18.04)	421 (66.51%)
Infectious disease	54.49 (16.25)	191 (60.25%)
Nephrology	60.60 (17.46)	103 (45.58%)
Hematology-Oncology	57.30 (17.10)	367 (50.34%)
Palliative care	58.79 (14.97)	22 (52.38%)
Pulmonary	63.36 (15.75)	256 (58.58%)
Total	60.55 (17.30)	2972 (56.06%)

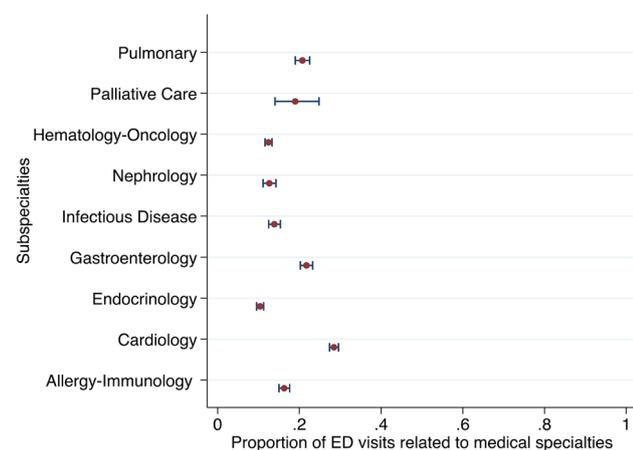


Figure 2 Proportion of ED visits related to specialties. One-way Anova ($F(8, 29,853) = 118.75$, $P < 0.05$)

of these were related to cardiac conditions (Table 1). Of visits related to cardiac conditions 44.54% (845/1897) occurred during office hours (9 am–5 pm Monday–Friday), with an additional 11.65% (221/1897) occurring during the 2-h window before (7 am–9 am) and after (5 pm–7 pm) working hours. 23.19% (440/1897) occurred during the weekend (Table 1). In this group, the top three cardiology-related primary diagnosis were chest pain not otherwise specified (NOS) (43.49%; 825/1897), arrhythmia (23.41%; 444/1897), and syncope (10.23%; 194/1897) (Table 3). These were also the three most common reasons for presentation during office hours and accounted for 78.20% of all visits during office hours. Off hours, although chest pain NOS (43.59%) and arrhythmia (24.03%) remained the two most common reasons for presentation to the ED, the third was related to blood pressure management (9.59%). These three diagnoses accounted for 77.21% of all visits during off hours (Table 3).

Among patients currently receiving care from a gastroenterologist, there were a total of 2913 visits and 21.73% (633/2913) of these were related to GI conditions (Table 1). Of visits related to GI conditions, 36.49% (231/633) occurred during office hours (9 am–5 pm Monday–Friday), with an additional 12.63% (80/633) occurring during 2-h window before (7 am–9 am) and after (5 pm–7 pm) office hours. 27.01% (171/633) occurred during weekends (Table 1). In this group, the top three GI-related primary diagnosis were abdominal pain (47.07%; 298/633), nausea/vomiting (8.53%; 54/633) and constipation (7.58%; 48/633) (Table 3). These three diagnoses did not change among ED visits during office hours and off hours. These diagnoses accounted for 59.31% of visits during office hours, and 65.42% of visits during off hours (Table 3).

Table 3. Most common primary diagnosis of ED visits: related to specialty

Specialty	Visits during office hours			Visits during off hours		
	Diagnosis	<i>n</i>	Cum %	Diagnosis	<i>n</i>	Cum %
Allergy-Immunology	Pain	65	31.10	Pain	99	32.14
	Injury	42	51.20	Injury	59	51.30
	Back pain	29	65.07	Back pain	41	64.61
Cardiology	CP NOS	366	43.36	CP NOS	459	43.59
	Arrhythmia	191	66.00	Arrhythmia	253	67.62
	Syncope	103	78.20	Blood pressure	101	77.21
Endocrinology	Diabetes	57	25.22	Diabetes	68	24.55
	Injury	32	39.38	Injury	31	35.74
	CP NOS	18	47.35	Electrolytes	29	46.21
Gastroenterology	Abdominal pain	106	45.89	Abdominal pain	192	47.76
	Nausea/vomiting	17	53.25	Nausea/vomiting	37	56.97
	Constipation	14	59.31	Constipation	34	65.42
Infectious disease	Injury	17	14.29	Pain	29	14.65
	Abdominal pain	12	24.37	Injury	23	26.26
	Psychiatric	11	33.61	Psychiatric	21	36.87
Nephrology	UTI	20	20.83	UTI	27	20.77
	Renal	15	36.46	Renal	21	36.92
	AKI	9	45.83	Pain	10	44.62
Hematology-Oncology	Neoplasm	35	12.92	Neoplasm	76	16.59
	Abdominal pain	22	21.03	Abdominal pain	39	25.11
	Cellulitis	20	28.41	Seizure	33	32.31
Palliative care	Back pain	3	16.67	Nausea/vomiting	5	20.83
	Pain	3	33.33	Abdominal pain	4	37.50
	SOB	2	44.44	Colitis	3	50.00
Pulmonary	COPD	54	28.42	COPD	45	18.22
	SOB	36	47.37	URI	34	31.98
	Asthma	21	58.42	SOB	31	44.53

Among patients currently receiving care from a pulmonologist, there were a total of 2107 visits and 20.74% (437/2107) of these were related to pulmonary conditions (Table 1). Of these 437 visits related to pulmonary conditions, 43.47% (190/437) occurred during office hours (9 am–5 pm Monday–Friday) with an additional 11.44% (50/437) occurring during the 2-h window before and after office hours. 25.62% (112/437) occurred during weekends (Table 1). In this group, the most common pulmonary related diagnosis were COPD (22.65%; 99/437), shortness of breath (15.33%; 67/437), and asthma (11.44%; 50/437) (Table 3). These were also the three most common reasons for presentation during office hours and accounted for 58.42% of visits (Table 3). During off hours, although COPD (18.22 %) remained the most common reason for ED presentation, the second most frequent presentation was related to upper respiratory illnesses (13.76 %) with shortness of breath being the third most frequent (12.55%). These three diagnoses accounted for 44.53% of all visits during off hours (Table 3).

Discussion

Our study demonstrates that over a 24-month period there were 5301 ED visits treated and discharged from the ED that could potentially have been managed in an ambulatory setting by their specialist. We found that cardiology, GI and pulmonology were the specialties with the highest proportion of ED visits related to their practice. Focusing efforts and interventions on these three specialties could result in the greatest impact to reducing ED utilization.

We chose to focus on patients treated and discharged as they likely represent the patient population with the most opportunity to avoid ED presentation. While there are many reasons for patients to be admitted, including social determinants, we decided to exclude admitted patients as they were deemed by the ED not safe to discharge. As such the patients that were treated and discharged were considered safe for return to the community and potentially treatable in a non-ED setting.

We found that there were 2212 ED visits related to a specialist between 9 am and 5 pm. This represents an immediate opportunity to improve ambulatory access in the absence of extending office hours. Each specialty might need a unique intervention, whether it is reorganizing how urgent visits are handled or increasing the capacity and resources available in the out-patient setting. In terms of reducing ED visits during off hours, specialties could make an impact by extending office hours. Our data shows that extending coverage by 2 h at the end-of-the-day would have a potentially measurable impact, but not at the beginning of the day (Table 1).

For visits during the night and weekends, potential interventions include leveraging telemedicine resources, contracts with urgent care centers or healthcare plans and other groups (such as primary care), or internal discussions within the specialty groups to come up with novel ideas [14, 17].

By better understanding the types of diagnoses that result in these patients ED presentation, groups may be able to create alternative care pathways to help care for these patients in other settings. For the Endocrine population for example, in which a quarter of their patients were seen for diabetes related complaints, creating an alternative pathway with a focus on hyperglycemia and diabetes could impact ED use. Similarly for the COPD population, which represented 22.65% of the pulmonology visits, there could be a clinical pathway that allows these patients to get the assessment and symptomatic treatment needed outside of the ED.

It also becomes clear based on this data, that some specialties have a more heterogenous list of reasons that their patients present to the ED and thus likely less opportunity to identify alternative treatment pathways. For example, although the three most frequent diagnoses in allergy-immunology, cardiology and GI make up greater than 60% of all ED visits related to each of their specialties, the three most common diagnoses in hematology-oncology account for only a third of their visits.

Ultimately, if even 10% of the patients that have a specialist who visited the ED and were discharged with a complaint related to their specialty could have been treated in a different setting, based on our data and the national median for the average length of stay of discharged patients, this would represent 455,202 bed hours saved over a year.

Although our data set did not provide the ability to calculate variation in practice, further work with a focus on understanding provider-level variation may represent an opportunity for standardization, accountability, and transparency. Previous studies have shown that feedback to providers on their variation in practice can be an effective tool in changing practice [14, 17, 15]. To that end, a better understanding of if individuals within a group are more likely to send patients to the ED when on call, may be helpful in spreading education, changing culture, and standardizing care.

As our healthcare system continues to experiment with global payment models and accountable care organizations, better coordination of resources and care will become even more important. Our results suggest that engaging specialty services in reducing ED use is not only good for the ED, but also could have many downstream effects on reducing cost of care by optimizing the location of care.

Limitations

Our study has several limitations. It is a retrospective review and as such, we were unable to prospectively capture more data about this patient population, such as the clinicians' assessment of if the ED visit was avoidable. Furthermore, we used hospital-based billing data. This lends to inherent flaws with the dataset including: (1) potentially modified diagnoses based on a non-clinical assessment; (2) errors in attribution to specific clinical departments and clinicians; (3) loss of granular clinical decision making data; (4) minimal adjudication of the data besides payment and claims; and (5) no correlation with outcomes. However administrative and billing datasets in research have been shown to have a high correlation with medical records as compared to self-reported conditions [18–20].

Other limitations include that this was a single center study at a large academic medical center in a metropolitan area with a large number of affiliated specialty services. The percentage of patients followed by specialists is likely higher than it would be in a community hospital. We also chose to focus on patients who were seen and discharged from the ED as a group that may represent patients that could have been cared for in the ambulatory space. We do not however, based on our data, know patient-level information about this group and if they would, in fact, have been appropriately cared for in the ambulatory space. In addition, we do have information on the specifics of the patient's medical care related to the visit, such as if they attempted to contact their specialist, were referred to the ED by the specialist, or had already failed outpatient management for the same complaint.

Conclusions

Over a quarter of patients seen in the ED are currently receiving care from a specialist. Of these, nearly 18% of the patients that are seen and discharged presented with a diagnosis related to their specialist's practice. Understanding this, there is an important role for specialty services to play in decreasing ED crowding. By focusing attention on specific specialties, such as cardiology, GI and pulmonology, there may be an opportunity to decrease ED utilization

beyond current interventions focused on primary care practices.

Compliance with ethical standards

Conflict of interest Jarone Lee has two unrelated disclosures to the present work. Dr. Lee is a consultant for both Butterfly Network, Inc. and Felis Medical, Inc.

Statements on human and animal rights All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent For this study, formal consent was not required.

References

- Bernstein SL, Aronsky D, Duseja R et al (2009) The effect of emergency department crowding on clinically oriented outcomes. *Acad Emerg Med* 16(1):1–10. <https://doi.org/10.1111/j.1553-2712.2008.00295.x>
- Trzeciak S, Rivers EP (2003) Emergency department overcrowding in the United States: an emerging threat to patient safety and public health. *Emerg Med J* 20(5):402–405. <https://doi.org/10.1136/emj.20.5.402>
- Hoot NR, Aronsky D (2008) Systematic review of emergency department crowding: causes, effects, and solutions. *Ann Emerg Med* 52(2):126–136. <https://doi.org/10.1016/j.annemergmed.2008.03.014>
- Carter EJ, Pouch SM, Larson EL (2014) The relationship between emergency department crowding and patient outcomes: a systematic review. *J Nurs Scholarsh* 46(2):106–115. <https://doi.org/10.1111/jnu.12055>
- Rodi SW, Grau M, Orsini CM (2006) Evaluation of a fast track unit: alignment of resources and demand results in improved satisfaction and decreased length of stay for emergency department patients. *Qual Manag Health Care* 15(3):163–170. <https://doi.org/10.1097/00019514-200607000-00006>
- Considine J, Kropman M, Kelly E, Winter C (2008) Effect of emergency department fast track on emergency department length of stay: a case-control study. *Emerg Med J* 25(12):815–819. <https://doi.org/10.1136/emj.2008.057919>
- Goodacre SW (2013) Point-of-care testing may reduce length of stay but not Emergency Department crowding. *Ann Emerg Med* 61(2):153–154. <https://doi.org/10.1016/j.annemergmed.2012.09.001>
- Jang JY, Do SS, Lee EJ, Park CB, Song KJ (2013) Singer AJ Use of a comprehensive metabolic panel point-of-care test to reduce length of stay in the Emergency Department: a randomized controlled trial. *Ann Emerg Med* 61(2):145–151. <https://doi.org/10.1016/j.annemergmed.2012.07.021>
- Honigman LS, Schuur JD, Chambers JG, Pines JM (2014) Adoption of interventions to reduce emergency department crowding from 2007 to 2010. *Ann Emerg Med* 64(4):S74–S75. <https://doi.org/10.1016/j.annemergmed.2014.07.233>
- Pitts SR, Carrier ER, Rich EC, Kellermann AL (2010) Where Americans get acute care: increasingly, it's not at their doctor's office. *Health Aff* 29(9):1620–1629. <https://doi.org/10.1377/hlthaff.2009.1026>
- Freid V, Bernstein A (2010) Health Care utilization among adults aged 55–64 years: how has it changed over the past 10 years? *NCHS data brief* 32:1–8
- Kim J, Yun B, Aaronson E, Kaafarani H, Linov P, Rao S (2018) Weilburg J LJ (2018) The next step to reducing Emergency Department (ED) crowding: engaging specialist physicians. *PLoS One* 13:e0201393
- Patel AD, Wood EG, Cohen DM (2017) Reduced Emergency Department utilization by patients with epilepsy using QI methodology. *Pediatrics* 139(2):e20152358. <https://doi.org/10.1542/peds.2015-2358>
- Lee J, Greenspan PT, Israel E et al (2016) Emergency Department utilization report to decrease visits by pediatric gastroenterology patients. *Pediatrics* 138(1):e20153586–e20153586. <https://doi.org/10.1542/peds.2015-3586>
- Yun BJ, Aaronson EL, Israel E, Greenspan P, Rao S, Lee J (2017) Cost savings associated with decreased emergency department utilization by reporting emergency department visits to specialists. *Am J Emerg Med*. <https://doi.org/10.1016/j.ajem.2017.04.050>
- HCUP Clinical Classifications Software (CCS) for ICD-9-CM. Healthcare cost and utilization project (HCUP), 2006–2009. Agency for Healthcare Research and Quality, Rockville, MD. www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp
- Lee J, Israel E, Weinstein H et al (2017) Using physician-level Emergency Department utilization reports to address avoidable visits by patients managed by pediatric specialists. *Hosp Pediatr* 7(11):686–691. <https://doi.org/10.1542/hpeds.2017-0054>
- Fowles JB, Fowler EJ, Craft C (1998) Validation of claims diagnoses and self-reported conditions compared with medical records for selected chronic diseases. *J Ambul Care Manag*. <https://doi.org/10.1097/00004479-199801000-00004>
- Fowles JB, Fowler E, Craft C, McCoy CE (1997) Comparing claims data and self-reported data with the medical record for pap smear rates. *Eval Health Prof*. <https://doi.org/10.1177/016327879702000305>
- Tyree PT, Lind BK, Lafferty WE (2006) Challenges of using medical insurance claims data for utilization analysis. *Am J Med Qual*. <https://doi.org/10.1177/1062860606288774>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.