

Provided for non-commercial research and education use.  
Not for reproduction, distribution or commercial use.



This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

<http://www.elsevier.com/copyright>



Contents lists available at ScienceDirect

## Public Health

journal homepage: [www.elsevierhealth.com/journals/pubh](http://www.elsevierhealth.com/journals/pubh)

## Original Research

## Creation and piloting of a new hospital capacity assessment tool in a major urban area

B. Siegel\*, B.L. Norton, J.C. Blanchard, M. Regenstein, K.C. Jones

School of Public Health and Health Services, George Washington University, Washington, DC, USA

## ARTICLE INFO

## Article history:

Received 19 May 2009

Received in revised form

21 September 2009

Accepted 1 October 2009

Available online 14 November 2009

## Keywords:

Hospital

Capacity

Policy

Emergency department

Crowding

Patient flow

Community

Emergency care

## SUMMARY

**Objectives:** Crowded hospital emergency departments (EDs) can undermine the ability of a region's safety net to provide safe, timely care. However, data to measure hospital capacity community-wide is generally unavailable. This study aimed to assess hospital crowding, capacity and patient flow in an urban community using the newly developed hospital capacity assessment tool (HCAT).

**Study design:** A survey of the eight acute care hospitals in the District of Columbia (DC) with active EDs.

**Methods:** Existing emergency care assessment tools were reviewed. Eighteen of the 57 questions on the HCAT were adapted from existing hospital surveys, while the remaining 39 questions were constructed de novo for use in this assessment. Hospitals were provided with paper and electronic versions of the HCAT.

**Results:** All eight DC hospitals completed the HCAT; however, three hospitals were unable to answer many of the questions due to a lack of regular data collection. The HCAT data shows throughput times in DC hospitals that are substantially longer than national averages.

**Conclusions:** The HCAT is a promising tool for evaluating community-wide emergency care. Findings from the HCAT allowed for the introduction of new ED performance data into the local decision-making process.

© 2009 The Royal Society for Public Health. Published by Elsevier Ltd. All rights reserved.

## Introduction

Communities across the USA are struggling with hospital crowding, and its impact on emergency medical services and the delivery of high quality health care. Between 1996 and 2006, emergency department (ED) visits rose by 32% in the USA, while the number of visits per ED increased by 38%.<sup>1</sup> Not surprisingly, in 2006, 42% of all hospitals and 64% of urban hospitals reported going on ambulance diversion.<sup>2</sup> In another survey of hospital administrators, 90% reported that they had held or 'boarded' patients in the ED for 2 h or more awaiting an inpatient bed, and one in five hospitals reported average boarding times for patients in the ED of 8 h or more.<sup>3</sup>

Crowding is the result of multiple complex problems across the entire hospital, including staff and bed shortages, an inability to move patients promptly within the institution (e.g. from the ED to an inpatient unit), slow diagnostic processes and many other factors.<sup>4,5,6</sup> It has been viewed, at the very least, as an inconvenience for patients who may be forced to wait hours to

see a doctor, and even longer to be admitted to an inpatient bed. However, it may also have serious implications for patient safety and quality across an entire community, as treatment delays, chaotic conditions and understaffing can lead to an unsafe hospital environment and an inability to provide urgent care across a region in a timely fashion.<sup>7,8</sup> Over the past several years, a number of important studies have highlighted the need to better measure hospital and ED performance to improve flow and ensure a safer care environment.<sup>6,9,10</sup> In 2006, the Institute of Medicine (IOM) published three landmark reports on the nation's emergency services, and noted the lack of systematic quality measurement within this system and the resulting implications for a community's safety net.<sup>12</sup>

In the District of Columbia (DC), a high-profile tragedy involving the failure of prehospital and hospital emergency services renewed local interest in improving the system of emergency care in the city.<sup>11,12,13</sup> As a result, the local government requested a comprehensive, independent evaluation of emergency care. As part of this evaluation, a hospital capacity assessment tool (HCAT) was developed to identify factors related to ED crowding and the quality of emergency care at the eight acute care hospitals in DC with active EDs. The HCAT was intended to measure system capacity, ED utilization, availability of specialized services and quality

\* Corresponding author.

E-mail address: [bruce.siegel@gwumc.edu](mailto:bruce.siegel@gwumc.edu) (B. Siegel).

improvement activities, and to help to identify the root causes of hospital crowding across a region. It was not designed as a diagnostic instrument for a single hospital attempting to address crowding and delays. To the authors' knowledge, this is the first tool of its kind to solicit information from all of the hospitals in a metropolitan community. As such, this tool could provide an interesting window into the state of ED capacity and crowding in a single American city. If fielded successfully, it might also be useful to the many other US communities grappling with the need to improve emergency care.

## Methods

The authors aimed to create an HCAT that could be administered in a single urban or metropolitan area. The tool needed to be simple and sufficiently straightforward to be completed within a short period of time by a general acute care hospital to accommodate the timeline of the study. To construct the tool, the authors reviewed prior surveys and instruments that have been used in other settings to measure ED crowding, delays, hospital patient flow and related issues.<sup>9,14,15,16</sup> While these existing tools provide valuable information on factors that could potentially influence hospital patient flow and crowding in the ED, none of them include all of the elements necessary for a community-wide assessment of hospitals. One such tool, the National Hospital Ambulatory Medical Care Survey, uses an individual ED patient record form to collect data on throughput times; however, this data collection method is very labour and time intensive, and does not collect hospital-level and ED-level information related to patient flow and ED crowding, such as nurse staffing, specialty coverage and ambulance diversion. The hospital surveys created by the American Hospital Association and the US General Accounting Office do cover these ED and hospital-wide issues, but miss critical measures of patient flow (see [Box 1](#)),

### Box 1. Key measures of patient flow

- The length of time from registration in the ED to seeing a doctor.
- The length of time from registration in the ED to departure from the ED for patients admitted to the hospital.
- The length of time from registration in the ED to departure from the ED for patients discharged directly from the ED.
- The length of time spent in the ED after admission to an inpatient unit of the hospital ('boarding' time).
- The percentage of patients who leave the ED after registration, but before being seen by a doctor.

including length of time to doctor, length of time to ED departure for admitted and discharged patients, and average boarding time for admitted patients. In addition to these tools, measures from the Emergency Department Benchmarking Alliance and the Joint Commission were used to inform HCAT questions; however, these are not survey instruments.<sup>17,18</sup>

In constructing the assessment tool, 18 questions were adapted from the aforementioned sources, and an additional 39 questions were developed. Some of the additional items provided essential background on the characteristics of the patients at each hospital (e.g. percentage with primary or secondary psychiatric diagnoses). Other questions were designed to elicit information on potential future growth or constraints in capacity. The bulk of the items, however, were designed to serve one or more of the following functions:

- to measure key aspects of timeliness and delays, such as wait times;
- to identify what data are collected routinely by the institutions to gauge patient flow and crowding;
- to assess each hospital's perceptions of causes for ED crowding and hospital closure/diversion;
- to identify human capital issues that may influence flow (e.g. workforce shortages, specialty coverage challenges); and
- to determine institutional responses designed to alleviate crowding and/or reduce diversion.

To be included on the assessment tool, new and adapted questions had to meet two criteria: feasibility and relevance. Based on a review of the relevant literature and experience in prior improvement projects,<sup>19</sup> the authors determined whether each question could be answered by hospitals in a reasonable time period and could provide information that could be potentially actionable; i.e. that could give an outline of the dimensions and causes of crowding in DC, or point to potential areas of intervention for hospitals and policy makers in DC. The tool consisted of two sections. The first section, with primarily service capacity and organizational information, was clearly marked as being reportable in public documents by name of hospital. The second section, which included the majority of questions about throughput, quality and future capacity, was clearly marked as being blinded in any public reports. The study population of hospitals was relatively small (eight hospitals in one city), allowing for follow-up telephone calls after receipt of the assessment tool for clarifying questions between the staff administering the survey and the respondents.

These items were incorporated into an electronic Word form in order to obtain survey responses in a standard format. Prior to distribution of the HCAT, each hospital received a letter from the office of the City Administrator requesting the hospital's participation in the study. The HCAT was then provided to each of the eight surveyed hospitals in two ways. First, a paper copy was provided to the Chief Executive Officer (CEO) of each institution at the conclusion of interviews conducted as part of the overall study. An electronic copy was then e-mailed to the CEO and additional individuals suggested by the CEO, and generally included the Quality Improvement Director, ED Director or Administrator, and the Director of Planning. Respondents were asked to complete the HCAT within 14 days, and were provided with the contact information of a staff member who could answer any questions regarding the survey. Telephonic and e-mail follow-up were used to elicit responses from all eight hospitals that did not meet the 2-week response period. All hospitals completed the survey within 11 weeks of survey initiation. A full copy of the HCAT can be seen in [Appendix 1](#).

The eight acute care hospitals in Washington, DC that completed the HCAT vary in terms of size, occupancy and ownership (see [Table 1](#)). The number of staffed hospital beds ranged from 184 to 817, and the annual number of ED visits ranged from almost 30,000 to over 77,000. Hospital occupancy rates ranged from 59.2% to 87.4%. Six of the hospitals are private not-for-profit, and two are investor-owned.

## Results

### Throughput times

The HCAT captures several throughput times that help to indicate the level of ED crowding in a hospital. For DC hospitals, the median wait time to see a doctor is 90 min, compared with the national median of 31 min (see [Table 2](#)).<sup>1</sup> The median length of time from ED triage to ED discharge in DC hospitals is 3.7 h. This length of stay (LOS) is 29.7% longer than the national median of 2.9 h for all patients.<sup>1</sup> Some EDs in DC have much longer LOS for patients

**Table 1**  
Hospital characteristics.

Hospital	Hospital beds <sup>a</sup>	ED visits <sup>a</sup>	Occupancy (%) <sup>a</sup>	Ownership <sup>b</sup>
Children's National Medical Center	234	73,466	87.4	Private, not-for-profit
George Washington University Hospital	339	63,049	68.3	Investor-owned
Georgetown University Hospital	402	33,316	79.4	Private, not-for-profit
Greater Southeast Community Hospital	184	33,488	59.2	Investor-owned
Howard University Hospital	291	47,575	66.8	Private, not-for-profit
Providence Hospital	266	49,258	77.7	Private, not-for-profit
Sibley Memorial Hospital	201	29,935	73.4	Private, not-for-profit
Washington Hospital Center	817	77,632	82.8	Private, not-for-profit

ED, emergency department.

<sup>a</sup> Data from the District of Columbia Hospital Association, 2007 Annual Utilization Report.

<sup>b</sup> Data from the 2005 American Hospital Association Survey.

discharged from the ED; at least one hospital reported LOS for discharged patients of 9 h.

The LOS in the ED for patients admitted to the hospital is much longer than that for discharged patients, both in DC and nationally, since admitted patients often wait long periods to be moved out of the ED and into an inpatient bed. In DC hospitals, the median LOS for these patients is 7 h; a full 1.5 h longer than the national average.<sup>20</sup>

Time spent by patients boarding in the ED accounts for much of the long LOS in the ED for admitted patients. Patients are considered boarders once they have been admitted to the hospital but have not been moved from the ED to an inpatient bed. The median boarding time of 4 h at DC hospitals, all of which reported that ED volume exceeded capacity, is slightly less than the average boarding time of 4.6 h reported at US hospitals exceeding their capacity.<sup>9</sup> The maximum number of patients boarding at any one time in DC hospitals ranges from 9 to 49, with a median of 20.5.

*Patients left without being seen*

Another indicator of ED crowding and overall quality of care in the ED is the percentage of patients who leave the ED without being seen (LWBS). The most common reason that patients give for LWBS is long wait times to see a doctor. Other factors include an improvement in the patient's condition, deciding that treatment can wait, transportation, safety concerns and difficulties with ED staff.<sup>21</sup> As shown in Table 2, the percentage of LWBS patients at seven DC hospitals ranges from 2.3% to 10.0%, and the median LWBS rate for these hospitals is 3.2%. The LWBS rate at all DC hospitals is higher than the reported national average of 2%.<sup>1</sup>

*Hospital staffing and workforce*

The median ED nurse vacancy rate in the study sample is 10%, which is lower than the median hospital-wide nurse vacancy rate of 13.6% but far higher than the median of 0.7% for EDs in the USA.<sup>22</sup>

**Table 2**  
Hospital capacity assessment tool results.

	DC minimum	DC maximum	DC median	US average
<b>Throughput times (h)</b>				
ED wait time to see a doctor	0.7	2.5	1.5	0.8
ED LOS for discharged patients <sup>a</sup>	3.2	9.0	3.7	2.9
ED LOS for admitted patients <sup>a</sup>	6.4	11.0	7.0	6.0
ED boarding time <sup>a</sup>	2.0	8.0	4.0	4.6
<b>LWBS patients</b>				
Patients left without being seen <sup>a</sup>	2.3%	10.0%	3.2%	1.3%
<b>Nurse vacancies</b>				
ED nurse vacancy rate <sup>a</sup>	4.1%	80.0%	10.0%	0.7%
Hospital-wide nurse vacancy rate <sup>b</sup>	3.5%	27.4%	13.6%	8.1%

DC, District of Columbia; ED, emergency department; LOS, length of stay; LWBS, left without being seen.

<sup>a</sup> Seven DC hospitals reported this data.

<sup>b</sup> Five DC hospitals reported this data. Sources of national data: 2006 National Hospital Ambulatory Medical Care Survey and 2007 American Health Association Survey of Hospital Leaders.

The ED nurse vacancy rate in one DC hospital was reported as 80%. The highest hospital-wide vacancy rate is approximately 27%. The median hospital-wide nurse vacancy rate in DC is well above the national average of 8.1%.<sup>2</sup>

DC hospitals reported that they have 24-h in-house or on-call coverage for most or all specialties. However, three hospitals reported no coverage for at least one specialty or less than 24-h coverage for multiple specialties. This may have important implications for patient wait times and overall access to specialty services. Five of the hospitals surveyed reported that they had difficulties obtaining specialty care in the ED. Hospitals cited neurosurgery, ophthalmic surgery and urology as the most difficult areas for obtaining ED coverage, while cardiothoracic surgery, neurology, otolaryngology, orthopaedics and plastic surgery also posed difficulties at some hospitals. Four hospitals in DC pay specialists to provide coverage in the ED.

*Factors contributing to ED ambulance closure/diversion*

Hospitals selected the top three factors that contribute to ambulance closure or diversion at their hospital. The factors selected by the most hospitals were a lack of critical care and general acute care beds and ED crowding. In addition, two hospitals ranked a shortage of nurses on inpatient floors as the most important contributing factor. ED nursing shortages and ancillary staff shortages were not selected as top factors by any of the hospitals.

*Hospital data collection and utilization*

Three hospitals were unable to answer multiple questions due to a lack of regular data collection. Other hospitals needed additional time to locate and calculate some of the requested data. Throughput times, hospital-wide nurse vacancy rates and daily hospital occupancy presented the most challenges for hospitals.

Six of the eight hospitals reported that they regularly collect time from ED triage to doctor, time from ED triage to discharge or

hospital admission, and percentage of LWBS patients. Five hospitals reported that they regularly collect patient boarding times. Three hospitals indicated that they use throughput times to track patient flow and ED crowding, while other hospitals use hospital occupancy, the number of patients in the ED, bed rounds, LWBS patients and patient satisfaction. Two hospitals indicated that they are currently in the process of developing and implementing internal ED performance measures. Only two hospitals reported that they regularly create forecasts of ED demand.

## Discussion

In its 2006 report on the future of emergency care, the IOM stated that 'performance data should be collected on a regular basis from all of the emergency care providers in a community'.<sup>6</sup> This perspective is important as EDs are a special community resource. They are providers of last resort operating under a unique federal mandate (the Emergency Medical Treatment and Active Labor Act of 1986) that sets broad expectations that they will serve almost all who come to them. No other part of the healthcare system has such obligations. However, existing surveys related to hospital and emergency care capacity, including the National Hospital Ambulatory Medical Care Survey, and the American Hospital Association and US Government Accountability Office surveys, do not permit the examination of data at the individual community level. This first deployment of the HCAT is thus a step in the direction of measuring the performance of this essential local safety net. However, this trial also illustrates some of the challenges in efforts to improve data reporting and accountability.

While all of the hospitals were eventually able to complete the bulk of the HCAT, the timeframes for doing so were longer than anticipated, and some data were never obtained. It is notable, for instance, that in a major US city, several hospitals (all with significant ED volumes) reported that they do not routinely collect indicators such as time from triage to discharge, LWBS rates or boarding times. Five hospitals do not use throughput times to monitor flow, and instead rely on much more distal effects such as patient satisfaction. Without such measurement, it is difficult to envisage how these organizations can mount robust interventions with measurable outcomes designed to improve timeliness or other measures of throughput and quality. While there are many potential strategies one can employ to improve flow or reduce crowding, it is impossible to assess the impact of any changes without a measurement framework.<sup>10</sup>

The paucity of forecasting may also block effective responses to crowding. Only two of the eight study hospitals forecast ED demand. Effective patient flow requires the ability to match resources, such as staff, to demand. Swings in activity can often be predicted (e.g. variation by time of day or season), allowing hospitals to anticipate periods of peak demand. Forecasting requires the analysis of historical trends, identification of demand drivers that could also affect trends (such as other hospitals going on diversion), and development of a forecast that is then tested against reality.<sup>23</sup> Without such tools, a hospital is forced to react to changes in workload rather than anticipating such fluctuation. This can lead to greater delays and diversion as resources are slowly adjusted to meet demand.<sup>10</sup> High nurse vacancy rates will exacerbate this situation.

This lack of measurement and forecasting may reflect several realities of quality measurement in the area of emergency care and patient flow. First, only a few measures related to ED or hospital crowding are currently included in the data set that all US hospitals report to the public. These measures, such as time to percutaneous intervention for acute myocardial infarction or antibiotic treatment for pneumonia, apply to a modest subset of ED patients. More global measures of timeliness or crowding, such as time to treatment, boarding times or hours on diversion, are not currently included.

In the absence of such measures in the essentially mandated national data set, hospitals may either not implement any measurement, or are forced to rely on their own 'home grown' measures with varying specifications. This may result in hospitals being unable to provide all the data for the HCAT in a timely fashion. If so, the lack of such standard measures in a national set may be having a very deleterious effect on the ability of hospitals to address a serious quality-of-care problem.

Despite these challenges, most data on the HCAT were eventually provided by all hospitals. Thus, the HCAT does seem to provide a 'snapshot' of hospital and ED capacity and throughput in a given community at a point in time. The image here is of a city with crowding and delays that exceed the national average. These findings allowed for the introduction of new quantitative data into a local decision-making process, instead of the frequent use of anecdotes often found in such local discussions on hospital crowding, delays and diversion. Policy makers were able to craft renewed efforts at ED demand reduction, as well as a community-wide throughput and diversion measurement initiative.<sup>24</sup> Indeed, this information could also be of great interest to the public, which perceives the emergency care system as an essential resource open to all. One could anticipate a day when such information is routinely released, allowing individuals better insight into the performance of their community's safety net relative to national standards.

The HCAT was also useful in comparing and contrasting different institutions within the community. This, in turn, raised critical questions around relative performance. For example, this study found that the hospital routinely experiencing the highest occupancy never placed its ED on diversion. Naturally, this raised the question of whether diversion is really a function of occupancy, and in turn led the local government to consider restrictions on diversion. Such a community-wide policy response would not have been possible without this form of comparative instrument.

Several limitations are inherent in this study. The HCAT was only used in one city. While the authors have no reason to believe that it could not be used elsewhere, more work is needed to deploy the HCAT in other markets. The HCAT also relies on self-reported data that are difficult, if not impossible, to audit. This situation reflects the current state of hospital quality reporting, and until standard, auditable measures of crowding and flow are developed, this situation will not change. Finally, the hospitals responding to this instrument knew that this survey was being conducted as part of a well-publicized study commissioned by the local government. Thus, the 100% hospital response rate might not be replicable without such an obvious incentive to participate.

## Conclusion

To the authors' knowledge, the HCAT is the first tool developed to assess patient flow and crowding in a community. It allowed the development of recommendations for government in the nation's capital. It is hoped that it will be adopted for use in other communities and that it will continue to be refined.

### Ethical approval

None sought.

### Funding

Creation and implementation of the HCAT was funded under subcontract to the RAND Corporation as part of an assessment of health and health services in DC, commissioned by DC.

### Competing interests

None declared.

## References

- Pitts SR, Niska RW, Xu J, Burt C. *National Hospital Ambulatory Medical Care Survey: 2006 emergency department summary*. NHR v7. Hyattsville: National Center for Health Statistics; 2008.
- American Hospital Association. *The state of America's hospitals – taking the pulse: findings from the 2006 American Hospital Association Survey of Hospital Leaders*. Falls Church: American Hospital Association. Available from: <http://www.aha.org/aha/content/2006/PowerPoint/StateHospitalsChartPack2006.PPT>; 2007 [last accessed 02.09.2008].
- United States General Accounting Office. *Hospital emergency departments: crowded conditions vary among hospitals and communities*. Washington, D.C.: GAO-03-460; 2003.
- Derlet RW, Richards JR. Overcrowding in the nation's emergency departments: complex causes and disturbing effects. *Ann Emerg Med* 2000;**35**:63–8.
- Olshaker JS, Rathlev NK. Emergency department overcrowding and ambulance diversion: the impact and potential solutions of extended boarding of admitted patients in the emergency department. *J Emerg Med* 2006;**30**:351–6.
- Institute of Medicine. *Future of emergency care – hospital-based emergency care: at the breaking point*. Washington, DC: National Academy Press; 2006.
- Rivers E, Nguyen B, Havstad S, Ressler J, Muzzin A, Knoblich B, et al. Early goal-directed therapy in the treatment of severe sepsis and septic shock. *N Engl J Med* 2001;**345**:1368–77.
- Chalfin DB, Trzeciak S, Likourezos A, Baumann BM, Dellinger RP, DELAY-ED study group. Impact of delayed transfer of critically ill patients from the emergency department to the intensive care unit. *Crit Care Med* 2007;**35**:1477–83.
- Lewin Group. *Emergency department overload: a growing crisis: the results of the American Hospital Association Survey of Emergency Department (ED) and Hospital Capacity*. Falls Church, VA: American Hospital Association; 2002.
- Wilson MJ, Siegel B, Sickler D. Coping with crowding: enhancing work flow to reduce crowding. *Jt Comm J Qual Patient Saf* 2007;**33**:57–67.
- Wilbur DQ. City defends response in fatal NW beating. *The Washington Post*; 12/01/2006. B.02.
- Wilbur DQ. Sources cite delay in aid to reporter; EMTs thought Rosenbaum was drunk. *The Washington Post*; 11/01/2006. B.02.
- Office of the Inspector General. *Summary of special report: emergency response to the assault on David E. Rosenbaum*. Washington, D.C.: Government of the District of Columbia; 2006.
- United States General Accounting Office. *Hospital emergency departments: crowded conditions vary among hospitals and communities*. Washington, D.C.: GAO-03-460; 2003.
- Siegel B, Nguyen K. *Unpublished letter of Intent for urgent matters ED collaborative*. Washington, D.C.: George Washington University School of Public Health and Health Services; 2002.
- National Center for Health Statistics. *National Hospital Ambulatory Medical Care Survey: 2007 emergency department patient record*. Available from: <http://www.cdc.gov/nchs/data/ahcd/nhamcs100-ED-PRF-web.pdf> [last accessed 08.09.2008].
- Welch S, Augustine J, Camargo C, Reese C. Emergency department performance measures and benchmarking summit. *Acad Emerg Med* 2006;**13**:1074–80.
- Joint Commission on the Accreditation of Healthcare Organizations. *Managing patient flow: strategies and solutions for addressing hospital overcrowding*. Oakbrook Terrace: Joint Commission Resources; 2004.
- Wilson MJ, Nguyen K. *Bursting at the seams: improving patient flow to help America's emergency departments*. Washington, D.C: George Washington University School of Public Health and Health Services; 2004.
- McCaig L, Burt C. *National Hospital Ambulatory Medical Care Survey: 2001 emergency department summary*. AD 335. Hyattsville: National Center for Health Statistics; 2003.
- Brand C, Kennedy M, MacBean C, Sundararajan V, Taylor D. *Patients who 'leave without being seen' (LWBS) from an emergency department: literature review commissioned by the Department of Human Services Victoria*. Victoria, Australia: Department of Human Services; 2005.
- Burt CW, McCaig LF. *Staffing, capacity, and ambulance diversion in emergency departments: United States, 2003–04*. AD 376. Hyattsville: National Center for Health Statistics; 2006.
- Finarelli Jr HJ, Johnson T. Effective demand forecasting in 9 steps. *Healthc Financ Manage* 2004;**58**:52–6. 58.
- Lurie N, Gresenz CR, Blanchard J, Ruder T, Chandra A, et al. *Assessing health and health care in the District of Columbia: phase 2 report*. RAND DRR-4386. Washington, D.C.: The RAND Corp; 2008.

**Appendix 1. Hospital capacity assessment tool assessing the state of emergency care in the District of Columbia**

Hospital Data Collection Tool

We are working with the RAND Corporation on a study of emergent and urgent care commissioned by the District of Columbia. This tool is designed to help us collect accurate data to assess the state of this care in the District of Columbia. Your assistance in helping us create an accurate and objective portrait of this system is critical. Please answer all questions to the best of your ability, using your best estimates whenever necessary. If you have questions, please contact \_\_\_\_\_ by \_\_\_\_\_. The completed tool should be returned to \_\_\_\_\_ by \_\_\_\_\_. We may contact you if we have questions about your responses.

Most data collected in this tool will be reported without hospital identifiers. Any data that may be reported with hospital identifiers is indicated below.

Thank you very much for your help.

**Questions highlighted in yellow are questions that may be reported with hospital identifiers.**

**Name of hospital responding** \_\_\_\_\_  
 Name of individual completing tool \_\_\_\_\_  
 Title \_\_\_\_\_  
 Phone number \_\_\_\_\_  
 Email address \_\_\_\_\_  
 Date tool completed \_\_\_\_\_

1. **Number of ED visits/year (calendar year 2006):** \_\_\_\_\_
2. **Based on your response above, please provide the percentage of ED visits/year classified as: Medical \_\_\_\_\_% Surgical \_\_\_\_\_% Trauma \_\_\_\_\_% (This does not have to add up to 100%).**
3. **What is your ED's current designed capacity (visits per year)?** \_\_\_\_\_
4. **What do you expect to be your ED's designed capacity in 5 years (visits per year)?** \_\_\_\_\_
5. **Are you planning to physically expand the size of your ED within the next 5 years?**  
 Yes  No
6. **How many treatment stations do you currently have in the ED (do not include fast track, observation or clinical decision unit stations)?** \_\_\_\_\_
7. **How many treatment stations do you expect to have in the ED in 5 years?** \_\_\_\_\_
8. **Do you have a fast track?**  Yes  No
9. **Do you have an observation or clinical decision unit?**  Yes  No
10. **Do you have a separate dedicated psychiatric ED?**  Yes  No  
 a. **If so, how many beds does it contain?** \_\_\_\_\_
11. **If you do not have a separate dedicated psychiatric ED, do you have a dedicated psychiatric unit in the ED?**  Yes  No  
 a. **If so, how many beds does it contain?** \_\_\_\_\_
12. **Do you have an inpatient detoxification unit?**  Yes  No
13. **Do you admit patients solely for detoxification for alcohol without any other acute psychiatric diagnosis?**  Yes  No
14. **Do you admit patients solely for other substance abuse without any other acute psychiatric diagnosis?**  Yes  No
15. **Do you have a dedicated stroke team with defined members that can be emergently activated to respond to a stroke?**  Yes  No
16. **Do you have a written protocol for administration of thrombolytics for stroke?**  Yes  No

**Questions 17–30 are for the month of May 2007:**

17. Average time from ED triage until physician contact, in minutes \_\_\_\_\_
18. Do you routinely (at least monthly) collect the data in Question 17?  
 Yes  No
19. Average time from ED triage until discharge or physical departure to inpatient bed (ED LOS), in hours \_\_\_\_\_
- a. Average time from ED triage until *discharge* for patients not being admitted to the hospital, in hours \_\_\_\_\_
- b. Average time from ED triage until *physical departure to inpatient bed*, in hours \_\_\_\_\_
20. Do you routinely (at least monthly) collect the data in Question 19?  
 Yes  No
21. Percentage of patients with average time from ED triage until discharge or physical departure to inpatient bed (ED LOS), greater than 6 hours \_\_\_\_\_%
22. Do you routinely (at least monthly) collect the data in Question 21?  
 Yes  No
23. Average time from decision to admit patient to physical departure to inpatient bed (ED boarding time), in hours \_\_\_\_\_
24. Do you routinely (at least monthly) collect the data in Question 23?  
 Yes  No
25. Percentage of admitted patients with a time from decision to admit patient to physical departure to inpatient bed (ED boarding time) greater than 4 hours \_\_\_\_\_%
26. Do you routinely (at least monthly) collect the data in Question 25?  
 Yes  No
27. Percentage of patients leaving the ED without being seen (includes patients that left before screening exam, before completing treatment, or against medical advice) \_\_\_\_\_%
28. Do you routinely (at least monthly) collect the data in Question 27?  
 Yes  No
29. Number of visits from patients in police custody or jailed inmates (currently not imprisoned):  
 \_\_\_\_\_
30. Number of visits from prison inmates: \_\_\_\_\_

**Questions 31 and 32 are for the latest 12-month period:**

31. Average time from ED triage until discharge or physical departure to inpatient bed (ED LOS), **over the past 12 months**, in hours \_\_\_\_\_
- a. Average time from ED triage until *discharge* for patients not being admitted to the hospital over the past 12 months, in hours \_\_\_\_\_
- b. Average time from ED triage until *physical departure to inpatient bed*, over the last 12 months, in hours \_\_\_\_\_
32. What was the maximum number of patients you had boarding in the ED (patients awaiting transfer to inpatient bed) at any one time **in the past 12 months?** \_\_\_\_\_
33. Briefly describe any other indicators the hospital uses to measure and track ED crowding and/or patient flow. Please limit your response to 250 words:  
 \_\_\_\_\_

34. Would you say that your hospital ED is currently at or over capacity?  
 Yes  No
35. Briefly describe overall capacity challenges in the ED and inpatient at your hospital. Please limit your response to 250 words:  
 \_\_\_\_\_
36. Which would you pick as the most important factors causing closure/diversion in your hospital? (Please select up to three factors causing closure/diversion in hospital, ranked in order of importance with one being the most important.)
- \_\_\_\_\_ Lack of monitored and/or critical care beds
  - \_\_\_\_\_ Lack of general acute care beds
  - \_\_\_\_\_ Overcrowded ED
  - \_\_\_\_\_ Shortage of nursing staff on floor
  - \_\_\_\_\_ Shortage of nursing staff in the ED
  - \_\_\_\_\_ Shortage of ancillary staff in the ED
  - \_\_\_\_\_ Other (Please identify) \_\_\_\_\_
37. For calendar year 2006, please estimate the number of days you experienced
- Hospital occupancy above 90% \_\_\_\_\_ days
  - Hospital occupancy above 95% \_\_\_\_\_ days
  - Hospital occupancy above 100% \_\_\_\_\_ days
  - Hospital occupancy above 105% \_\_\_\_\_ days
38. Do you have a written hospital policy for when you request closure/diversion?  
 Yes  No
39. Who makes the decision for your hospital to request closure/diversion? (title) \_\_\_\_\_
40. What was your average hospital-wide vacancy rate for RNs
- In May 2007? \_\_\_\_\_%
  - Over the past 12 months? \_\_\_\_\_%
41. What was your average ED vacancy rate for RNs
- In May 2007? \_\_\_\_\_%
  - Over the past 12 months? \_\_\_\_\_%
42. Please pick the statement below that most reflects your hospital's experience obtaining on-call specialty care for the ED (pick one):
- Obtaining specialty coverage for our ED is *not* a problem
  - Obtaining specialty coverage for our ED is a *minor* problem
  - Obtaining specialty coverage for our ED is a *major* problem
43. From the following list of specialties, pick **up to five** that are most difficult to fill for ED coverage. Please rank them with numbers 1 through 5, with 1 being the most difficult to fill.
- |                                  |  |
|----------------------------------|--|
| a. _____ Cardio/thoracic surgery | m. _____ Emergency medicine            |
| b. _____ Neurology               | n. _____ Trauma surgery                |
| c. _____ Neurosurgery            | o. _____ Cardiology                    |
| d. _____ General surgery         | p. _____ Psychiatry and psychology     |
| e. _____ Ophthalmic surgery      | q. _____ Paediatrics                   |
| f. _____ Oral/max surgery        | r. _____ Radiology                     |
| g. _____ Anaesthesiology         | s. _____ Urology                       |
| h. _____ Otolaryngology          | t. _____ Pulmonary medicine            |
| i. _____ Orthopaedics            | u. _____ Dermatology                   |
| j. _____ Neonatology             | v. _____ Neurointerventional radiology |
| k. _____ Ob/gyn                  | w. _____ Other (please specify) _____  |
| l. _____ Plastic surgery         |  |

44. Please describe the availability of specialty care in the ED. Indicate the degree of coverage, as of today. Please check only one box for each specialty.

	24-h coverage (in-house)	24-h coverage (combination in-house and on-call)	24-h coverage (on-call)	Part-time coverage (less than 24 h)	No coverage
Cardiology					
Cardio/thoracic Surgery					
Neurology					
Neurosurgery					
Ophthalmic surgery					
Oral/max surgery					
Otolaryngology					
Orthopaedics					
Ob/gyn					
Plastic surgery					
Trauma surgery					
Neurointerventional radiology					

45. Do you pay specialists for providing coverage in your ED?  Yes  No

46. For calendar year 2006, what percentage of your ED visits had a **primary** psychiatric diagnosis? \_\_\_\_\_%

47. For calendar year 2006, what percentage of your ED visits had **any** psychiatric diagnosis? \_\_\_\_\_%

48. Please pick the statement below that most reflects your hospital's experience in obtaining psychiatric care for your ED patients (pick one):

- a.  Obtaining inpatient psychiatric care for our ED patients is *not* a problem
- b.  Obtaining inpatient psychiatric care for our ED patients is a *minor* problem
- c.  Obtaining inpatient psychiatric care for our ED patients is a *major* problem

49. Do you have a triage nurse solely to receive EMS transports?  Yes  No

50. Do you maintain a dedicated space for the use of EMS crews?  Yes  No

51. Does your ED have an electronic patient tracking system?  Yes  No

52. Does your hospital have an electronic bed tracking system?  Yes  No

53. Do you regularly create any formal forecasts of ED demand (e.g. estimate ED volume for following day)?  Yes  No

54. Briefly describe any initiatives the hospital has undertaken in the last 24 months to reduce ED crowding, and the results. Please limit your response to 500 words:  
\_\_\_\_\_

55. Please describe any formal case management, disease management or other programmes you have implemented designed to reduce non-emergent preventable ED use. Please limit your response to 500 words: \_\_\_\_\_

56. Please describe any formal primary care linkages, referral programs or other programmes you have implemented designed to reduce non-emergent ED use. Please limit your response to 500 words: \_\_\_\_\_

57. Is there anything else you would like us to know? \_\_\_\_\_