Study objective: Emergency departments (EDs) provide round-the-clock emergency care but also serve as a health care “safety net.” We seek to determine the number, distribution, and characteristics of US EDs, with a long-term goal of improving access to emergency care.

Methods: We created an inventory of nonfederal nonspecialty US hospitals using 2001 data from 2 independent sources. Hospitals that did not report ED visit data, or with large changes in visit volume by 2003, were contacted to obtain or verify visit volume (n=437; 9% of all hospitals). EDs were divided into 2 groups: those with at least 1 patient per hour, 24 hours per day, 7 days per week (≥ 8,760 visits/year) and those with fewer visits.

Results: Of 4,917 hospitals, 4,862 (99%) reported an ED. These EDs collectively received 101.6 million visits. One in 3 EDs (n=1,535) received less than 8,760 visits per year; the national median was 15,711 visits per year. Excluding the low-volume EDs, the remaining 3,327 reported 95.2 million annual visits. The typical higher-volume ED received approximately 28,000 visits per year; 28% (n=922) were in a nonurban setting. Among all EDs, per-capita visits varied by state, with the highest ED visit rates in Washington, DC; West Virginia; and Mississippi.

Conclusion: Significant variation exists in the distribution and use of US EDs. One third of EDs have an annual visit volume less than 8,760 and, together, they account for 6% of all visits. The United States should consider classifying EDs, as it does trauma centers, to clarify the type of care available in this heterogeneous clinical setting and the distribution of different types of EDs. [Ann Emerg Med. 2006;48:694-701.]

INTRODUCTION

Background
The emergency department (ED) provides round-the-clock emergency care and also serves a “safety net” function for many individuals in the United States.\(^1\) Given this dual role, the ED has become the focus of a growing number of public health initiatives. Despite this attention, a great deal of basic information about EDs remains unknown. The number, distribution, and basic usage patterns of US EDs have not been well characterized. Previous studies have focused on emergency services within a localized area\(^2,3\) or have had national scope but lacked geographic specificity.\(^4-6\)

Despite the importance of answering essential questions about the current status of US EDs, the task has largely been overlooked.

Importance
The need for a more rigorous study of emergency care in the United States was formally stated in a 1995 Josiah Macy Jr. Foundation report titled “The Role of Emergency Medicine in the Future of American Medical Care.”\(^7\) In particular, the report suggested the adoption of a classification system with which to categorize, and thus assess, emergency care in the United States. Since 1995, several recommendations from the
Editor’s Capsule Summary

**What is already known on this topic**
Two large federally sponsored surveys estimate the annual number of emergency department (ED) visits in the United States (the National Hospital Ambulatory Medical Care Survey and the Medical Expenditure Panel Survey), but there is no national classification system for EDs.

**What question this study addressed**
The authors created a national inventory of EDs. This inventory estimates the number, distribution, and patient volume characteristics of all US EDs.

**What this study adds to our knowledge**
This study supports the National Hospital Ambulatory Medical Care Survey estimate of the annual number of US ED visits, which differs significantly from the Medical Expenditure Panel Survey estimate. Significant variation exists in the volume received, with one third of all US EDs having an annual volume less than 8,760.

**How this might change clinical practice**
The Institute of Medicine has called for an evidence-based categorization system for emergency medical services systems, EDs, and trauma centers according to adult and pediatric service capabilities. The National Emergency Department Inventory may be an important tool for accomplishing this goal.

**Goals of This Investigation**
To address this information gap, the Emergency Medicine Network (EMNet) at Massachusetts General Hospital created a comprehensive database of US EDs. The database, called the National Emergency Department Inventory, accounts for every hospital in the nation, as of 2001. Similar inventories have been created for trauma centers but, to our knowledge, never for EDs. We created the National Emergency Department Inventory to determine the number, distribution, and other basic characteristics of US EDs, with a long-term goal of determining the general capabilities of all US EDs and improving access to emergency care.

**MATERIALS AND METHODS**

**Data Collection and Processing**
The National Emergency Department Inventory was developed by integrating data from 3 sources: the SMG Marketing Group’s Hospital Market Profiling Solution Database Fourth Quarter 2001 Release (referred to hereafter as the SMG Database), the 2001 American Hospital Association Annual Survey of Hospitals (referred to as the AHA Annual Survey), and information collected independently by EMNet staff.

The SMG Database is a commercially available data set widely used for health care research in both the public and private sectors. The SMG Database is assembled and updated annually by Verispan (Yardley, PA), a health care marketing research group. Information is gathered by survey from the federal and state agencies that license hospitals, the Centers for Medicare and Medicaid, and through direct contact with hospitals. The SMG Database contains more than 300 data elements for greater than 6,800 US health care facilities, including address and annual ED visit volume when applicable.

The AHA Annual Survey (Chicago, IL) contains more than 600 data elements collected directly from more than 6,100 US health care facilities by survey. Data are estimated for nonreporting hospitals and for incomplete responses according to the missing hospital’s most recent information, statistical models, or data obtained from similar hospitals. The AHA Annual Survey includes data elements such as facility address and annual ED visit volume.

The SMG Database and AHA Annual Survey were compared line by line and merged into a single data set. Two data sets were used, rather than 1, to minimize omission of any hospitals from the National Emergency Department Inventory and to verify hospital address. Although both data sets provided information on annual ED visits, the SMG Database’s ED visit volume data were used preferentially over AHA Annual Survey data to better match the methodology used by the National Hospital Ambulatory Medical Care Survey. Of the 4,917 hospitals listed in the combined data set, approximately 146 (3%) lacked ED visit volume data from the SMG Database. In these cases, when the facility was determined to have an ED, visit volume data were obtained through a combination of Internet searches, faxes, and telephone interviews conducted by EMNet staff between June 2002 and December 2003.

In 2005, we again purchased the 2 hospital data sets for 2003 and merged these data, as described above. To ensure that 2001 data were accurate, we compared ED visit volume in 2001 with the preliminary database for 2003. Hospitals that reported an ED visit volume increase of greater than 100% or decrease of greater than 30% were contacted by e-mail, fax, or telephone to confirm the number of ED visits in both years (n = 291). Closure of the 2003 data set requires checking its accuracy by comparing 2003 visit volume with both 2005 data sets, which will not be available until early 2007.

Macy report have been addressed, but the recommendations about ED classification have received less attention. In 1999, the Society for Academic Emergency Medicine Emergency Center Categorization Task Force developed a classification system directed toward academic medical centers. Even among academic centers, however, few accepted the “challenge” to get certified because certification provided no tangible benefit. Thus, classification of US EDs has not been achieved, and consequently, the capabilities of US EDs remain unknown.

This study supports the National Hospital Ambulatory Medical Care Survey estimate of the annual number of US ED visits, which differs significantly from the Medical Expenditure Panel Survey estimate. Significant variation exists in the volume received, with one third of all US EDs having an annual volume less than 8,760.

The Institute of Medicine has called for an evidence-based categorization system for emergency medical services systems, EDs, and trauma centers according to adult and pediatric service capabilities. The National Emergency Department Inventory may be an important tool for accomplishing this goal.
The Human Research Committee reviewed this study and classified it as exempt.

To date, no single, consistent definition of an ED exists. An ED is commonly understood to mean a “hospital room or area staffed and equipped for the reception and treatment of persons with conditions (as illness or trauma) requiring immediate medical care.”15 However, legal and administrative definitions vary widely.16,17 We believe that an essential characteristic of an ED is the ability to provide round-the-clock emergency care. Accordingly, EDs were further defined, for the purposes of our analysis, as emergency care facilities that are open 24 hours a day, 7 days a week; “urgent care” facilities known to be closed at certain hours or days were excluded. The remaining EDs were divided into 2 groups: those that received, on average, at least 1 patient per hour, 24 hours per day, 7 days per week (or 8,760 visits/year) and those with fewer visits. Low-volume EDs were those that received fewer than 8,760 visits per year.

Hospitals in US territories and outlying areas (eg, Puerto Rico, Guam, US Virgin Islands) also were excluded from the current analysis. Although the SMG and AHA databases include data on federal hospitals (eg, Veterans Affairs and Indian Health Service hospitals), specialty hospitals, and college infirmaries, these facilities were excluded from the definition of an ED in our analysis. Such facilities and others (eg, correctional centers) may lack emergency care centers and are not necessarily available for use by the general public. In total, we excluded 2,045 hospitals from the merged database and our analysis.

All geographic analyses were conducted on the state or regional level. Geographic regions (the Northeast, South, Midwest, and West) were defined according to Census Bureau boundaries. Rural and urban distinctions were made according to the Office of Management and Budget’s designation of metro areas. We defined “urban” areas as whole counties or groups of counties included in a metropolitan statistical area, whereas “rural” was defined as any county not included in a metropolitan statistical area.18

Emergency medicine residency EDs were defined as all sites affiliated with an emergency medicine residency program, as designated by the Society for Academic Emergency Medicine.19

Primary Data Analysis

Analyses of the National Emergency Department Inventory were performed with Stata 9.0 software (StataCorp, College Station, TX). Means are presented with standard deviation (SD) and medians with interquartile range (IQR). For 34 hospitals reporting an ED but for which no ED visit volume could be obtained (ie, 0.7% of all hospitals with EDs), values were imputed using best subset regression based on being located in a metropolitan statistical area or US region and on 2003 ED visit volume. ED visit rates were calculated by dividing the number of annual ED visits per state by the state’s population in 2001, as estimated by the US Census Bureau.20 Using ArcGIS 9 software (ESRI, Redlands, CA), EDs were geocoded (ie, assigned map coordinates based on zip code). EDs then were mapped according to annual visit volume (<8,760 and ≥8,760 visits/year) and ED visit rate (ie, total ED visits in 2001 per 100 persons in a given state).

RESULTS

Of the 4,917 hospitals studied, 4,862 (99%) reported having an ED. Among these EDs, there were a reported 101.6 million total visits in 2001 and a median annual visit volume of 15,711 (IQR 6,787 to 29,458). Annual visit volume varied greatly among EDs (Figure 1). EDs in the lowest quartile received less than 6,789 visits per year, whereas EDs in the second quartile received between 6,789 and 15,711 visits. EDs in the third quartile received between 15,712 and 29,457 visits, and those in the fourth quartile received between 29,458 and 211,195 visits. The highest quartile had a median value of 41,953 visits per year. Emergency medicine residency EDs in 2001 (n=193) had a median annual visit volume of 48,920 (IQR 37,901 to 66,276). Restricting emergency medicine residency EDs to the primary (or only) site affiliated with the residency program (n=121) yielded a median annual visit volume of 53,736 (IQR 41,285 to 74,631).

EDs were separated into 2 groups according to the 8,760 visits-per-year cutoff. On average, 3,327 EDs (68%) received at least 1 patient per hour, whereas 1,535 (32%) received fewer patients. The 3,327 higher-volume EDs received a combined total of 95.2 million annual visits, with an average of 28,000 visits per ED per year. Thus, these higher-volume EDs, which comprise two thirds of US EDs, received 94% of all ED visits. Low-volume EDs received 6.38 million visits, or 6% of all ED visits.

Among all EDs, annual ED visit volume varied according to rural or urban location. The median value of annual ED visits in urban settings was 25,997 (IQR 15,461 to 38,867) compared with 7,070 (IQR 2,786 to 13,541) in rural settings. Among the 3,327 higher-volume EDs, 72% (n=2,405) were located in a metropolitan statistical area. The remaining 28% (n=922) of EDs were located outside of a metropolitan statistical area. By contrast, among the 1,535 low-volume EDs, 17% (n=257) were located in a metropolitan statistical area, whereas 83% (n=1,278) were located in a rural setting.
The proportion of higher-volume EDs varied by region (Figures 2, 3). In 2001, 72% of EDs in the South (n=1,328) were considered higher-volume. The Midwest had a total of 1,425 of EDs, 55% of which were higher volume (n=778). The West had a total of 890 EDs, of which 66% (n=588) experienced a visit volume greater than 8,760 visits per year. The Northeast had the lowest number of EDs (n=713) but the highest percentage of higher-volume EDs (89%, n=633).

Among the higher-volume EDs, the average number of visits per region varied significantly, with the Northeast receiving the most annual visits per ED (30,482; SD 20,596) and the Midwest receiving the fewest (26,544; SD 16,350). Average ED visit volume by region fluctuated from the mean of 23,875 visits per region but by no more than 6.8%.

State-specific ED visit rates were heterogeneous and ranged from a low of 23 visits per year per 100 people (Hawaii) to 65 visits per year per 100 people (Washington, DC). The lowest ED visit rates occurred in Hawaii, South Dakota, and Utah, whereas the highest occurred in Washington, DC; West Virginia; and Mississippi. Nine of the 12 states in the highest quartile of ED visit rate (41.7-64.8 visits/year per 100 people) were in the South; the other 3 states in the highest quartile were from the Northeast (Maine, Massachusetts, and Rhode Island). No states in the Midwest or West were in the highest quartile of ED visit rate (Figure 4).

LIMITATIONS

The National Emergency Department Inventory has several potential limitations. At this point, we have only limited data available about each ED. Our long-term goal is to perform simple, short surveys to enhance the database and to monitor ED changes over time. Furthermore, the National Emergency Department Inventory alone cannot answer causal questions about observed differences in ED use. We do not know, for example, if there is high per-capita ED use in southern states because there are many EDs or if there are many EDs because there is high demand. These important questions will be a focus of longitudinal research by our group, building on the baseline data presented here.

Another potential limitation is the admittedly arbitrary criterion of 8,760 visits per year to separate low-volume and higher-volume EDs. Although 1 visit per hour is an intuitive standard, it requires validation. Moreover, a terminology that describes 9,000 visits per year as “higher-volume” will come as a surprise to many in emergency medicine because 1 patient per hour is less than half of the typical productivity of an emergency physician. Future data collection efforts by our group may reveal the value of using different cut points for examining different issues (eg, availability of important clinical services, the balance between provision of emergency care versus safety net function for not-yet-emergent problems). Evaluating these issues in different EDs will help to determine whether 8,760 visits per year is a useful criterion for distinguishing among the many diverse EDs.

In addition, we categorized EDs as urban or rural according to definitions established for statistical purposes by the Office of Management and Budget. This classification system does not enable a precise urban-rural classification of EDs, because metropolitan statistical areas may contain both urban and rural territories and populations. There is no uniform definition of rural used across all federal agencies, and how it should be defined for the purpose of health care policy and delivery is an important topic for discussion.

Finally, the underlying data themselves have some limitations. For example, data pertain to 2001 and may not reflect more recent years. These data are, by nature, time dependent, and their accuracy (and relevance) will diminish over time. Though the SMG Database and AHA Database values were highly correlated, we quickly noted many important discrepancies in these national data sets. These discrepancies led us to contact approximately 146 (3%) hospitals for clarification of the 2001 data and then contact 291 (6%) of hospitals for further clarification once we had the preliminary 2003 data set. An important lesson from this project is that until the creation of the National Emergency Department Inventory, an accurate national inventory of EDs simply had not existed.

DISCUSSION

The 2001 National Emergency Department Inventory provides a profile of 4,862 EDs in the United States and reveals substantial diversity in ED distribution and usage. An overview of the National Emergency Department Inventory data, including state-specific ED statistics (total number of EDs, median number of ED visits, IQR, and total number of ED visits), is available at http://www.emnet-usa.org/nedi/nedi_usa.htm. These EDs collectively received 101.6 million total visits in 2001. This total supports the higher of 2 widely divergent federal estimates: the 2001 National Hospital Ambulatory Medical Care Survey estimate of 107.5 million visits per year (95% confidence interval [CI] 99.7 to 115.3 million) versus the 2001 Medical Expenditure Panel Survey estimate of 55.0 million visits per year (95% CI 51.8 to 58.2 million).
Figure 3. Distribution of US EDs according to annual visit volume.
Perhaps the most striking finding of the National Emergency Department Inventory is that one third of US EDs receive less than 8,760 visits a year, or, on average, less than 1 visit per hour, 24 hours per day, 7 days per week. Most of these small-volume EDs (83%) are concentrated in rural areas, but not all. The distribution of the small-volume EDs translated into large regional differences in the annual ED visit volume. The Midwest has the highest proportion of low-volume EDs (45%), whereas the Northeast has the lowest (15%). These differences may largely reflect differences in population density surrounding EDs, but they highlight the heterogeneity of what is meant by an "ED."

Given that population density likely affects ED visit volumes, a comparison of per-capita ED visit volumes, or ED visit rates, was undertaken. ED visit rates also exhibit substantial regional differences. Per-capita ED visit rates are higher in southern states. Western states, on the other hand, experience the lowest ED visit rate. It is not clear why ED visit rate should vary so much between US regions. A recent study by the Centers for Disease Control and Prevention, however, points to heavy “safety net” use of EDs in the South. This particular use of EDs may help explain the higher ED visit rate in the South. Although it is tempting to link this practice with lack of insurance, other recent studies suggest that ED use has little or no relation to insurance status. Another possibility is that states with substantial primary care shortages have higher rates of per-capita ED use, a hypothesis that requires further research.

Proximity to an ED may play a role in ED visit rates. Approximately 28% of the higher-volume EDs are located in rural areas, where 20% of the US population lives. These rural areas, however, comprise 84% of US lands. This discrepancy suggests that there are large tracts of land in rural areas across which EDs are thinly dispersed. The very low per-capita ED use observed in western states, for instance, could point to difficulty in accessing emergency care. Further research will need to establish whether the physical distance of patients from EDs in rural areas does, in fact, discourage ED usage generally and whether EDs near rural areas tend to treat different types of clinical problems (eg, primary-care-sensitive conditions).

ED visit rates varied widely by region; however, the average number of annual ED visits per hospital in each region varied from the national mean by no more than 6.8%. Regions with more EDs, namely, the Northeast and South, had greater-than-average annual visit volumes. Others have previously noted that increased access to many health care resources results in increased usage. The same may hold true for EDs, with volume rising to fill the availability of care provided. Increasing the number of EDs might increase demand for ED services. At the other end of the spectrum, we imagine there is a threshold below which basic emergency care needs cannot be met. These important issues require further discussion and formal study.

Likewise, we were struck by the differences between the typical US ED from the emergency medicine residency sites that train future emergency physicians. There were 193 emergency
musican annual ED visit volume among emergency medicine residency EDs was 48,920; this visit volume is larger than that of 92% of the EDs nationwide. This stark difference raises questions about the optimal training for the literally thousands of emergency physicians who will one day need to work beyond the familiar urban “teaching hospital” environment. Indeed, earlier studies found that the majority of the emergency care provided in rural settings was by family practitioners and internists or those without any residency training at all.32 What are the workforce implications of the National Emergency Department Inventory? What incentives will it take to attract residency-trained emergency physicians to rural areas? Can rural hospitals really afford this?32 Ultimately, given the observed heterogeneity in US EDs, is there really one “optimal” training program for all future emergency physicians, or should the United States, like Canada, adopt more than 1 type of training program?33 These and other workforce issues will require further study.

Finally, by demonstrating the heterogeneous nature of the US “ED,” the National Emergency Department Inventory provides support for development of easily applied criteria that would better categorize these thousands of diverse EDs. As previously noted, one third of EDs received, on average, less than 1 visit per hour (or <8,760 visits/year). It seems likely that these low-volume EDs vary greatly in the levels of care they provide and in the ready availability of important services. EDs’ capacity for treating larger numbers of patients (eg, terrorism and national disaster response) is uncertain. Classifying EDs would allow for a better assessment of the level of care available in US EDs and of their surge capacity and assist initiatives that aim to increase access to emergency care, as directed by Healthy People 2010.34 An easily understood classification system also would be of possible value at the local level to clinicians and patients.

The National Emergency Department Inventory holds promise for furthering understanding of the use and distribution of EDs in the United States. The National Emergency Department Inventory, in this preliminary analysis, helped identify disparities in the geographic distribution of EDs and in per-capita ED visit volumes. Perhaps more important, it can help frame questions for future analyses and national surveys and thereby guide recommendations for future ED-related health policy.

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