Emergency Department Use in Maryland: A Profile of Users, Visits, and Ambulance Diversion

Extramural Report Series

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Preface

This report contains findings from a project conducted by the Project HOPE Center for Health Affairs under contract #MHCC-02-08 to the Maryland Health Care Commission (formerly the Maryland Health Care Access and Cost Commission). The findings and recommendations detailed in this report are those of the Project HOPE Center for Health Affairs and do not necessarily reflect the views of the Maryland Health Care Commission. The work described in this report has been monitored by MHCC staff monitored the work completed under this task order to ensure compliance with the contract's technical specifications. Comments about this report may be sent to Ben Steffen at the Maryland Health Care Commission, 4201 Patterson Avenue, Baltimore MD 21215 at (410)-764-3570 or via e-mail at bsteffen@mhcc.state.md.us.

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Executive Summary

Background and Purpose

The growing use of emergency department (ED) services and increasing congestion in emergency rooms in Maryland hospitals has been a source of significant interest and concern to the Maryland Health Care Commission (MHCC). The Joint Work Group on Emergency Department Utilization, convened to study ED issues, released a report, *Trends in Emergency Department Utilization,* in April 2002. This report examined the growth in ED visits and found that, from 1990 to 2001, ED visits rose from 1.5 million annually to 1.9 million--an increase of 27 percent. The work group also found that hospitals are increasingly using temporary closure of the ED to manage overcrowding. As a result, ambulance diversions—as measured by hours that hospitals in the state are operating on yellow alert status--have risen fourfold between 1996 and 2001. These trends in utilization are consistent with the national picture. The Joint Work Group recommended that further research was needed concerning the role of the ED in serving vulnerable populations, options for organizing ED services to meet community needs, and monitoring of utilization patterns to guide policy development.

This report provides a look at the use of Maryland EDs in 2001, the first year for which detailed data on use are available. The empirical findings are descriptive in nature and focus primarily on the demand for ED services. It should be emphasized that the demand for ED services is only one element contributing to ED overcrowding. Two other elements that may contribute to ED overcrowding are (i) a hypothesized increase in patient acuity requiring increased time and resources and (ii) delays in getting patients *out* of the ED, either through admission to an inpatient unit, discharge, or transfer to another facility. Assessing patient acuity over time is not feasible with currently available data. Daily census figures for Maryland hospitals are being collected and the relationship between hospital occupancy rates and ED overcrowding could be addressed in the future.

The purpose of this task order is to begin fulfilling the research needs laid out by the Joint Work Group. There are two primary objectives: (1) to further examine how patients' demand for ED services and hospitals' response may affect the overall use of emergency services; and (2) to provide information and relevant statistics on ED use that will assist the industry and state policy makers better understand factors that may affect ED utilization. We begin with a review of the literature, looking at how hospitals organize their EDs, and which models are

most effective for promoting appropriate health care use. We then examine use of the ED, looking at the characteristics of the patient population, how use rates vary across different population subgroups, and the geographic dispersion of patients. Using an algorithm developed to classify ED visits according to level of urgency and appropriateness, we then analyze ED visits in Maryland. Variation in type of visit is presented by patient and hospital characteristics. The final component of the analysis is an investigation of the use of ambulance diversion by Maryland hospitals.

Result Highlights

Literature Review. Hospitals use a variety of ED organizational models and practices to promote appropriate health care use. These strategies can be classified into those that keep nonurgent cases from coming to the ED (or demand management) and those that improve patient throughput once a person arrives at the ED (or capacity enhancement). Although the literature is spare and the quality of the underlying research is variable, among the key findings were:

- telephone-based nurse triage systems may improve patient satisfaction and offer good returns on investment, but their impact on patient outcomes is still controversial;
- direct diversion of low-acuity patients to next day primary care has been tried with mixed success;
- an ED-managed urgent care center can significantly reduce ED overcrowding and ambulance diversion hours;
- ambulance diversions, while commonly used, have not been found to be highly effective in moderating ED volume; and
- fast-track environments that rely on mid-level staff can be very effective in reducing patient wait times and overall costs, while improving patient satisfaction. There is some evidence that patient outcomes are not adversely affected.

Many studies point to the lack of inpatient beds as being a major contributor to ED overcrowding. As a result, some of the most effective ways in which a hospital can reduce ED overcrowding are those that change the management of inpatient rather then ED resources, such as accelerating the discharge process, or using flexible bed designations.

Profile of ED Use. Findings from the empirical analysis of ED use include the following highlights:

- Almost one-quarter of Maryland residents used a Maryland hospital ED in 2001.

- There were 34 visits per 100 persons, compared to 39 visits per 100 persons nationally.
- Most ED users had only visit during the year, but the top 5 percent of users averaged 3 visits for the year.
- Visit rates varied substantially across population subgroups:
    - The visit rate for blacks was 66 percent higher than for whites.
    - The elderly and children less than 6 years of age had substantially higher than average visit rates.

Using a classification system to assess the urgency and appropriateness of ED visits,

- 17 percent of visits to Maryland EDs were categorized as non-emergent; another 17 percent were considered to be emergent, but treatable in a primary care setting.
- 17 percent of all visits resulted in an inpatient admission.
- Seniors had the lowest percentage of non-emergent visits (9 percent); the rate for the uninsured was only slightly higher than for the privately insured (21 vs. 18% non-emergent visits), and the rate for blacks was higher than that for whites (20 vs. 15%).
- Although Medicaid enrollees and the uninsured accounted for a disproportionate share of non-emergent ED visits, just under half (48%) of all non-emergent ED visits were by the privately insured.

Ambulance Diversion.

- Of the 47 hospital EDs in Maryland, only 5 had no alerts in 2001. Thirteen hospitals—all located in the Baltimore Metro Area or the National Capital Area--were on alert status for more than 2,160 hours (equivalent to more than 90 days).
- The eleven hospitals in Baltimore City accounted for 40 percent of all alert hours statewide; half of yellow alert hours within Baltimore City were attributable to 3 hospitals—Johns Hopkins Bayview, Johns Hopkins University Hospital, and University of Maryland Hospital.
- The mix of patients appears to change somewhat during alert periods, with more patients covered by public programs and fewer white patients.
- The emergent nature of visits changes only modestly during these periods.
- Within Baltimore City and County, only 8.7 percent of yellow alert episodes involved just one hospital on alert status. Almost half of all alert episodes involved four or fewer hospitals, but in one-fifth of episodes eight or more hospitals were on alert simultaneously.

- There were a total of 38,061 yellow alert hours for the 15 hospitals in Baltimore City and County. Almost half of those hours were accounted for by seven or more hospitals being on alert simultaneously.

The higher rates of ED use in Maryland seen for racial minorities, Medicaid enrollees, and the uninsured suggest that EDs serve as an important source of care for disenfranchised and vulnerable groups and that overcrowding may have a particularly adverse impact on these groups. While certain population subgroups—including children less than 6 years of age, blacks, Medicaid enrollees, and the uninsured—disproportionately visit the ED for non-emergent or primary care treatable conditions, persons with private insurance still account for half of 'inappropriate' use. Thus, any efforts to redirect these users must be broad-based. The proportion of visits that could potentially be treated in a primary care setting raise questions of whether there are organizational changes that hospitals can make to re-channel these patients to more appropriate settings. Some of these organizational innovations, such as adjacent urgi-care centers, are being put into practice in Maryland EDs and in other localities; more information is needed as to their effectiveness as well as associated costs. Additional information is also needed on what precipitates ambulance alerts and, in particular, the role of inpatient occupancy rates. All of these issues must be investigated and assessed so that state policy makers and hospital administrators can better understand the possible avenues to lessen overcrowding of Maryland's emergency departments while ensuring that the state's more vulnerable subgroups continue to have access to health care services.

Introduction

The growing use of emergency department (ED) services and increasing congestion in emergency rooms in Maryland hospitals has been a source of significant interest and concern to the Maryland Health Care Commission (MHCC). The Joint Work Group on Emergency Department Utilization convened to study ED issues released a report, *Trends in Emergency Department Utilization,* in April 2002.[1] This report examined the growth in ED visits and found that, from 1990 to 2001, ED visits rose from 1.5 million annually to 1.9 million--an increase of 27 percent. The work group also found that hospitals are increasingly using temporary closure of the ED to manage overcrowding. As a result, ambulance diversions—as measured by hours that hospitals in the state are operating on yellow alert status[2]--have risen fourfold between 1996 and 2001. The Joint Work Group recommended that further research was needed concerning the role of the ED in serving vulnerable populations, options for organizing ED services to meet community needs, and monitoring of utilization patterns to guide policy development.

These trends in utilization are consistent with the national picture. Over the period 1992 to 1999, ED visits increased by 14 percent even as the number of emergency departments fell.[3] Increases in ED use and rising reliance on ambulance diversion to stave off overcrowding have been reported in a number of other states, including California, Massachusetts, Arizona, and Florida. The Arizona Hospital and Healthcare Association reported that emergency rooms in Maricopa County, which includes Phoenix, spent 17,840 hours on diversion status in 2002, down slightly from the 18,431 hours in 2001 but still up 54 percent over 2000.[4] Massachusetts witnessed the first absolute rise in ED visits in a decade in 1999 and directors of all five EMS regions are reporting ambulance diversions to be an increasing problem.[5] A study of health care delivery in 12 communities noted "marked rises in ER use, with notable increases occurring in Boston, Cleveland, Greenville and Phoenix."[6] Based on a national survey of hospitals and site visits to six metropolitan areas, a recently-released report by

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[1] Maryland Health Care Commission and Health Services Cost Review Commission Report of the Joint Work Group on Emergency Department Utilization, *Trends in Maryland Hospital Emergency Department Utilization: An Analysis of Issues and Recommended Strategies to Address Crowding*, April 2002.

[2] Yellow alerts are used when the hospital does not want to receive any patients in need of urgent care via ambulance because of a temporary overload in the ED.

[3] Burt CW, McCaig LF. Trends in hospital emergency department utilization: United States, 1992-99. National Center for Health Statistics. Vital Health Stat 13(150). 2001.

[4] http://www.azhha.org/public/emergency

[5] The Massachusetts Health Policy Forum Issue Brief, Emergency Department Overcrowding in Massachusetts: Making Room in Our Hospitals, 2001.

[6] Brewster LR, Rudell LS, and Lesser CS. "Emergency Room Diversions: A Symptom of Hospitals under Stress," Issue Brief Findings from HSC, No. 38 May 2001.

the US General Accounting Office found that ED crowding and the amount of time hospitals spent on ambulance diversion was greater in the largest MSAs, those with the greatest population growth, and those with the highest proportion of uninsured.[7]

As described in Maryland's Joint Work Group report, there are a number of reasons behind the overcrowding of EDs, due to both increases in the demand for emergency department services and limits on the capacity of those services. In terms of the demand for services, inappropriate utilization of EDs has long been considered a problem.[8] With increases in the number of uninsured and decreased availability of safety net services, there could be increases in demand for ED services on the part of those without a regular source of care. At the same time, recent prudent layperson laws have lessened restrictions on the use of ED services by managed care enrollees and may have thereby precipitated an increase in the use of the ED.[9] On the capacity side, there have been decreases in the number of licensed hospital beds.[10] Higher occupancy rates reduce flexibility in admissions through the ED.[11] In addition, nursing staff have become in short supply, restricting hospitals' ability to provide services both on an inpatient basis and in the ED. Finally, anti-dumping legislation[12] may have altered the management of ED patients, increasing reluctance to release patients without treatment and thus slowing down the workings of the ED.

This report provides a look at the use of Maryland EDs in 2001, the first year for which detailed data on use are available. The empirical findings are descriptive in nature and focus primarily on the demand for ED services. It should be emphasized that the demand for ED services is only one element contributing to ED overcrowding. In addition, it has been hypothesized that the composition of ED users has changed over time, with patients presenting with increasingly

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[7] US General Accounting Office. *Hospital Emergency Departments: Crowded Conditions Vary among Hospitals and Communities*, GAO-03-460, March 2003.

[8] There is a large literature on the use of EDs for non-urgent care. See, for example, Washington DL, Stevens CD, Shekelle PG, Henneman PL, and Brook RH. "Next-Day Care for Emergency Department Users with Nonacute Conditions: A Randomized Controlled Trial," *Annals of Internal Medicine*. 2002;137:707-714, Rubin MA and Bonnin MJ. "Utilization of the Emergency Department By Patients With Minor Complaints," *The Journal of Emergency Medicine*, Vol. 13, No. 6, pp.839-842, 1995, O'Brien GM, Stein MD, Zierler S, Shapiro M, O'Sullivan P, and Woolard R. "Use of the ED as a Regular Source of Care: Associated Factors Beyond Lack of Health Insurance," *Annals of Emergency Medicine* Vol. 30, No. 3, September 1997.

[9] Maryland's prudent layperson law, see Article § 19-701 et seq

[10] Article § 19-307.2 requires the Department to limit a hospital's licensed capacity to 140% of each hospital's average daily census for the recent 12-month period prior to July 1 of each year.

[11] Analysis of Massachusetts data indicates that ambulance diversion is "better correlated with total hospital occupancy than with the number of ED visits."

[12] The Federal Emergency Medical Treatment and Active Labor Act (EMTALA), part of the 1986 COBRA legislation and commonly referred to as the Patient Anti-Dumping Law, requires hospitals to provide medical screening to anyone seeking care and to stabilize persons with emergency medical conditions before arranging transfer to another hospital. http://www.aaem.org/emtala/index.shtml

complex conditions requiring an overall greater use of resources.[13] If this is the case, then the increased number of procedures and ancillary services required would tend to increase the average time spent in the ED, so that congestion might increase even without an increase in the number of patients. At this time, however, there is no available Maryland data to investigate this issue. A third element that likely contributes to ED overcrowding is the delay in getting patients *out* of the ED, either through admission to an inpatient unit, discharge, or transfer to another facility. While this report does not examine the relationship between ED overcrowding and hospital occupancy rates, daily census figures for Maryland hospitals are being collected and this issue could be addressed in the future.

The purpose of this task order is twofold: (1) to further examine how patients' demand for ED services and hospitals' response may affect the overall use of emergency services; and (2) to provide information and relevant statistics on ED use that will assist the industry and state policy makers better understand factors that may affect ED utilization. We begin with a review of the literature, looking at how hospitals organize their EDs, and which models are most effective or cost-effective for promoting appropriate health care use. We then examine the demographic characteristics and source of payment for emergency department users in the state, by region. We look at reason for visit as well as visit rates for different population subgroups. Using an algorithm developed to classify ED visits according to level of urgency and appropriateness, we then analyze ED visits in Maryland. Variation in type of visit is presented by patient and hospital characteristics. The final component of the analysis is an investigation of the use of ambulance diversion by Maryland hospitals. We present statistics on the number of hours on alert status, and how the characteristics of ED users and visits change during periods of alert. We then look at the frequency of overlapping alerts—how often multiple hospitals are on alert status during the same period.

Findings

Literature Review--Organizational models

Hospitals have a variety of tools to manage ED demand and expedite patient flow that may be useful in classifying models of ED organization from the perspective of policy makers. The literature on this topic is relatively sparse

[13] National data suggest several changes that may support this hypothesis. For example, between 1992 and 1999 the average age for ED patients increased, the proportion of visits due to illness rather than injury increased, the number of drug mentions rose, and the use of specific diagnostic services (CAT scans, MRIs, and mental status exams) also went up. Burt DW, McCaig LF. Trends in hospital emergenc department utilization: United States, 1992-99. National Center for Health Statistics. Vital Health Stat 13(150). 2001.

and no comprehensive review of the relative advantages of these practices has been completed. The GAO report notes that—while hospitals and communities have addressed ED crowding in a number of different ways—"the effects of these efforts have not been widely studied."[14] It is also difficult to assess the quality of many reports, which are often reported in ED management journals or newsletters and pertain to the experience of one hospital. Nevertheless, these studies suggest there may be substantial improvements in patient satisfaction, hospital revenue, and potentially societal savings by using some of these techniques.

These practices may be classified into demand management or capacity-enhancing techniques. Among capacity-enhancing techniques, it is useful to distinguish those that address ED capacity versus those that address inpatient capacity. There are also statewide systems to support appropriate allocation of ED resources, such as the establishment of a comprehensive regional trauma system, or ED triage system to coordinate diversion activities during alert status. These statewide systems have not been reviewed in this report, but clearly affect the organization and management of EDs.

Demand management

Telephone-based nurse triage systems. Telephone-based nurse triage systems are commonly used by hospitals to identify patients with non-urgent care needs before they present to the ED. Individual hospitals may offer these services or they may collaborate with a group of hospitals or contract these services to an outside entity (Derlet, 2002). While some studies found substantial gains in patient satisfaction and good returns on investment by implementing these systems (O'Connell et al., 2001; Wahlberg et al., 1999), their impact on patient outcomes is still controversial. Some critics contend the visual cues in face-to-face encounters with emergency physicians provide additional important information (Brillman et al., 1997). However, despite widespread use of these systems over the last decade, little systematic research has been done on their effect on patient outcomes.

Strengthening ties to the community and primary care. By strengthening ties to the community, a hospital may encourage patients with less urgent health needs to seek more appropriate care settings than the ED. For example, patient education provided by primary care doctors and pharmacists were found to effectively reduce nonurgent ED visits among Medicaid children and chronically-ill patients (Grossman et al., 1998; Coleman et al., 2000). Some hospitals have adopted programs that educate physicians, and nursing homes

[14] GAO-03-460, page 32. The report also notes that appropriate solutions will vary across hospitals and communities because the reasons for overcrowding differ.

about ED alternatives, and encourage these providers to educate their patients. Hospitals also have developed aggressive health promotion activities that are designed to prevent emergencies from happening.

As an illustration, one Regional Health Authority in England hired a full-time ED practice manager to improve relationships between the ED and general practitioners in the community. The practice manager hosts regular meetings between with community doctors and ED staff to identify problems and define solutions. The ED also provides reports to primary care providers about their patients' attendance at the ED. Patients who do not have a primary care provider are also given information about general practice physicians in their area, and the ED supports several health promotion activities (Hadfield et al., 1994).

A program with some similar components, known as the *Reverse Referrals* program, is currently being undertaken in Maryland. In this program, uninsured patients reporting to the ED at Johns Hopkins Bayview Medical Center are linked to primary care providers within the Baltimore Medical System. The project also includes outreach to improve the uninsured's access to primary care (Maryland Health Care Foundation, 2003). The effect of this program on patient outcomes and reduced costs is currently being evaluated.

Direct diversion of low-acuity patients to next-day care with primary care providers has also been tried with mixed success. A California study that randomly-assigned patients with nonacute conditions to next day care found 33 percent of patients presenting at the ED met the criteria for deferred care (Washington et al., 2002). Patients who were re-assigned had a roughly equivalent chance of seeing a physician about their complaint and there were no negative effects on patients' self-reported health status. However, just under half of patients selected for the study declined to defer their care. Notably, this study was confined to week-day hours and did not evaluate the effects of deferred care during nights or weekends. Another study that diverted low-income pediatric patients to next-day appointments with primary care providers had limited success. Not only did the majority of diverted patients not show for their assigned visit, but this program also did not decrease subsequent ED use (Gadomski et al., 1995). The lack of available next-day care can also be an obstacle to these strategies.

Ambulance diversions. Ambulance diversions are a blunt demand management tool that have become increasingly common. A recent study in Maryland, however, suggests that general ED diversion policies have only a modest effect in reducing ED patient volume in urban and in suburban areas, and no effect in rural areas (Scheulen et al., 2001). Similarly, in Rochester, New York, diversion

policies were not found to be highly effective in moderating ED overcrowding (Schneider et al., 2001). An EMS director in Texas also reported that despite long periods of being on divert status, only 600 of 180,000 ED visits (0.3%) were actually diverted as a result of divert protocols (Saslow and Bartlett, 2001). However, the Maryland study also found that diversions policies aimed to reduce the delivery of patients that require intensive care unit (ICU) services did limit general ED visits effectively and had an inordinate effect on diverting patients that did not require an ICU. Ironically, ICU admissions were only minimally affected. This study suggests there is a need for further research to ensure diversion policies are having their intended effect.

Urgent care centers. Freestanding urgent care centers are designed to treat lower-acuity walk-in patients that otherwise would be treated in the ED. Hospitals sometimes open urgent care centers as a means of reducing ED overcrowding. These centers may or may not offer acute care beds and often operate at night or on weekends (Weinick et al., 2002). They may be operated adjacent to and managed by the hospital's ED. A prospective, observational study of a hospital that opened a freestanding 14-bed acute care unit that was managed by the ED found this had a significant impact on reducing ED overcrowding (Kelen et al., 2001). The numbers of patients who left without being seen at the ED declined by half and mean monthly ambulance diversion hours decreased by 40%.

ED capacity-enhancement

In addition to moderating the volume of patients that present at the ED, changes in ED structure or internal processes can help improve patient throughput, reduce waiting times, and help channel patients to the most appropriate level of care.

Structure. We found four major structural changes that were discussed in the literature. These included: the use of an ED observational unit to monitor short-term stays; changes in staffing configuration within the ED – including the addition of fast-track environments within the ED; and the use of electronic patient tracking systems to improve clinical decision making and monitor patient status.

ED observation units

Many hospitals offer an ED observation unit for chest pain and other short stays. A survey of academic departments of emergency medicine found 37% had an observation unit, which was staffed in all cases by an emergency physician (Counselman et al., 2000). A study by a Colorado

hospital found an observation unit within the ED was cost-effective and useful in the management of trauma victims (Conrad et al., 1985), and the use of these units are encouraged in ED management books. Many ED observation units were closed when Medicare stopped paying for observation services under its hospital outpatient prospective payment system (ED Management, 2001). However, a rule change effective in 2003 now allows reimbursement for observation for specific conditions, and the management literature anticipates that closed observation units may re-open.

Staffing

Emergency physician staffing ratios vary substantially among hospitals (from 1.8 – 5.0 patients per physician hour). In small hospitals, the emergency physician may be the only physician on duty, whereas in larger hospitals, another physician is available to respond to inpatient needs (Zun, 2001). Lower ratios of physicians and triage nurses to patients are associated with longer waits (Lambe et al., 2003). A Canadian study found lower levels of ED staffing used on weekends corresponded with higher patient mortality rates (Bell and Redelmeier, 2001).

EDs also vary in their reliance on certified emergency physicians versus physicians with other training, and mid-level staff, such as physician assistants and nurse practitioners. A 1994 survey of US hospitals found 22 percent used mid-level staff (or physician extenders) in their ED, and that twice as many were expected to be using physician extenders by 1996 (Ellis and Brandt, 1997). Patient satisfaction with mid-level staff for minor complaints has been found to be equivalent to that with physicians (Counselman et al., 2000). In a recent study, higher nurse staffing ratios were effective in reducing bottlenecks in the ED (Brewster et al., 2001). However, many hospitals have found it difficult to recruit and retain emergency nurses and other mid-level staff.

Staffing may also be configured to allow a fast-track system to divert lower acuity patients to separate areas of the ED that rely upon the use of mid-level staff. Fast-track systems tend to be found in high-volume EDs (Ellis and Brandt, 1997), and are common among academic emergency medicine departments (Counselman et al., 2000). In a prospective, double-blind study of fast-tracking in an academic emergency department, this method was found to reduce wait times by half and improve patient satisfaction for selected low-acuity conditions (Killic et al., 1998). Other benefits include fewer tests, lower charges to insurers, improved overall department revenues and equivalent outcomes to

patients seen in a regular ED (Simon et al., 1997; Simon et al., 1996; Hampers et al., 1999).

Other staffing changes, such as the addition of a dedicated ED pharmacist (Whalen, 1981) or access to 24-hour CAT scan (Kercheval, no date) may help to reduce patient wait times and improve patient throughput, but may not be cost-effective for smaller hospitals. A dedicated ED pharmacy has been shown to reduce medication errors and produce cost-savings through the use of less expensive, but appropriate medications.

Electronic Patient Tracking Systems

Some hospitals have adopted real time, electronic patient tracking systems in their EDs (ED Management, 2002a; Levary RR. 1997). For example, Beth Deaconess Hospital uses a status board display, which alerts ED staff to changes in room status and when waiting times exceed pre-determined targets. This system also allows staff to see at a glance whether a bed has been requested or a laboratory test is pending. The literature does not discuss whether these systems are in widespread use, or their effectiveness or cost.

Processes. In addition to structural changes, EDs may make changes in their processes of care that can substantially improve operating efficiency. Some of these changes can be relatively simple, such as improving interdepartmental cooperation. For example, delays in laboratory results, slow x-ray turnaround times, or delayed delivery of medical records can contribute to ED wait times. Giving emergency physicians greater control over inpatient beds has also been helpful.

In addition to reducing patient volume at an ED, placing a hospital on divert status may also affect the internal protocols in place system-wide or within the ED, which can improve patient throughput. A plan devised by the Maryland Institute for Emergency Medical Services Systems (MIEMS) recommends that hospitals centralize patient routing to maximize hospital resources, convert surgical recovery areas to critical care units, and cancel elective and non-emergency surgery during periods of extended regional overload[15] (MHCC and HSCRC, 2002). The extent to which hospitals actually follow these recommendations has not been documented. As another example of changes in procedures, one hospital in the Midwest introduced a Code "purple" protocol (ED Management, 2000). Under this protocol, the hospital creates short-term hall

[15] Defined as when hospitals within a region are on yellow alert status for more than 35 percent of collective time within a specified period (regional overload), and have been on overload for more than 30 days.

spots for ED patients waiting admission and holds non-stat laboratory results pending completion of ED lab tests.

The introduction of Continuous Quality Improvement (CQI) is a more expansive change in procedures. CQI offers a framework for repeated evaluation and process redesign to improve patient care and outcomes within the ED on a continuous basis. Adoption of CQI techniques has been found to decrease unnecessary waiting times, improve patient satisfaction, increase ED throughput, and improve net revenue for the department (Lavely et al., 2002).
CQI may involve:

- the introduction of formal processes or committees to review delays in implementation of admission orders or other bottlenecks in the ED;
- the use of information technology to support better clinical decision-making, improve resource utilization, and evaluate processes of care; and
- the adoption of critical pathways for treating and diagnosing specific symptoms.

Inpatient-capacity enhancement

Although not strictly ED organization, better management of inpatient resources has been shown to be among the most effective ways in which a hospital can reduce ED overcrowding (Schneider et al., 2001). In fact, this New York study found some of the most effective techniques to reduce overcrowding were related to organizational or process changes made external to the ED, rather than within the ED. According to the ED management literature, "The management of inpatient flow is paramount to avoiding ED flow breakdown." (ED Management, 2002b). This goal can be further supported by studies that point to the lack of vacant inpatient beds as being a major contributing factor to overcrowding of the ED (McManus, 2001).

Some of the organizational or process changes that have been shown to be effective are:

- ongoing evaluations of length of stay;
- accelerating the discharge process by discharging earlier in the day or moving patients to extended care facilities;
- the use of flexible bed designations;
- restriction of in-house transfers;
- the use of "over-census" beds; and
- the introduction of protocols to reduce inappropriate admissions (Lynn and Kellerman, 1991; Kossovsky et al., 2002).

Use of ED to Enhance Market Share

In the late 1990s, academic emergency departments reported growing ED volume, increasing patient acuity, and enhanced net patient revenue (Counselman et al., 2000). Revenue was enhanced partly because states began adopting prudent layperson definitions of "emergency", so that insurers are now less likely to deny payment for ED visits. Hospitals also have begun to recognize that the ED is an important source of inpatient revenue. In one tertiary care hospital, admitted ED patients accounted for 34% of inpatient revenue (Sacchetti et al., 2002). In Maryland, more than half of all inpatient revenue comes from patients admitted via the ED.

With these positive revenue trends, hospitals have begun to advertise their increasingly sophisticated and comfortable ED services (Page, 2000). In a recent survey of academic departments of emergency medicine, a lower proportion of departments reported aggressively redirecting patients away from their ED than in an earlier study (22% versus 30%) (Counselman et al., 2000). Maryland also reports increased expansions and renovations in its EDs. Although there are reports that expansions of ED services in some hospitals have been designed to attract the insured walk-in patients who have a choice of setting (Kercheval, no date), there has been no research on these trends to date.

An Overview of Emergency Department Users and Visits

Of Maryland's 5.4 million residents, almost one-quarter used a Maryland hospital's emergency department during 2001.[16] Table 1 provides the distribution of the resident population by age, race, sex, and insurance status and a comparison to the characteristics of emergency department users along these same dimensions.[17] In terms of age, children less than 6 years old, adults 18 to 34 years of age, and adults 65 and older used EDs somewhat more than their representation in the population would suggest. These differences were not large, however. Children under 6 represent 8.1 percent of the Maryland population and accounted for 10.4 percent of ED patients. Adults 18 to 34 comprise 22.6 percent of the population and 26 percent of ED users, while the

[16] There were 90,251 ED patients from outside of Maryland who were excluded from this analysis. It should be noted that the analysis potentially over-counts the actual number of unique users and therefore overestimates the proportion of the population with use. While a unique patient identifier allows us to account for one person having multiple visits within a given hospital, there is no unique patient identifier *across* hospitals. Thus, an individual who receives ED care at more than one facility is counted as more than one user. The 24% figure, being somewhat overstated, is probably similar to the approximately 20 percent of the population nationally with at least one ED visit. (from Natinal Center for Health Statistics. *Health, United States, 2002 With Chartbook on Trends in the Health of Americans*. Hyattsville, Maryland: 2002.) Maryland patients that use out-of-state hospitals are not counted in this analysis. Use of DC hospitals by Maryland residents is significant—one-third of DC hospital admissions are for Maryland residents. About 31% of DC hospital admissions from the ED are for Maryland residents.

[17] Patients are classified according to county of residence. Persons who use Maryland EDs but reside out of state are excluded from this analysis.

elderly make up 11.3 percent of the persons overall and 14.5 percent of ED patients. These same three age groups accounted for a slightly disproportionate number of ED patients in all five Maryland regions as well.

Across Maryland, women represent 51.7 percent of the population and 53.2 percent of ED patients. This slightly disproportionate use of EDs by women holds across all of the regions. In terms of race, whites comprise 64 percent of the state's population but make up 55.8 percent of ED users, while blacks are 27.9 percent of the population and 39.3 percent of ED patients. Blacks account for a higher proportion of ED users across all five regions, though the difference is small in Western Maryland and largest in the National Capital Area. Compared to their representation in the population, the privately insured appear to use less ED care relative to Medicaid and Medicare enrollees and, in particular, relative to the uninsured. This general pattern holds across all regions. The largest differences by source of payment are, first, for the uninsured and, second, for Medicaid enrollees. Approximately 8.8 percent of the people in Maryland are uninsured, but they account for 21.7 percent of ED patients.[18]

[18] Medicaid and Medicare figures are based on administrative data from Maryland's Department of Health and Mental Hygiene and the Centers for Medicare and Medicaid Services, respectively. The private insurance estimates represent people continuously insured and are derived from HMO enrollment figures collected by Interstudy (an organization that studies the HMO industry) and from the Current Population Survey. The uninsured estimates are the remaining population after subtracting the Medicaid, Medicare, and private figures.

Table 1. Emergency Department Use in Maryland, by Region, 2001
Comparison of ED Users and Maryland Residents, by Selected Characteristics

	ED Users	Western MD	Baltimore Metro	National Capital Area	Southern MD	Eastern MD	**All Maryland**[19]	Western MD	Baltimore Metro	National Capital Area	Southern MD	Eastern MD
All (in thousands)	1,283	106	683	321	67	106	5,375	432	2,512	1,675	281	396
Age												
<6	10.4%	10.4%	10.0%	11.3%	11.2%	9.4%	8.1%	7.8%	6.1%	8.5%	8.7%	7.2%
6 – 10	5.3	5.8	5.0	5.4	6.1	5.4	7.5	7.2	7.6	7.7	8.5	7.1
11-17	8.5	9.9	8.2	8.0	10.5	9.5	10.0	10.0	10.1	9.8	11.6	9.8
18-34	26.0	25.8	25.8	26.9	25.4	24.5	22.6	22.0	23.0	23.7	21.5	20.7
35-54	28.0	25.9	28.7	28.0	27.8	26.4	31.6	31.3	31.9	32.1	32.8	30.3
55-64	7.3	7.3	7.3	7.2	7.0	7.8	8.9	9.0	9.0	8.7	8.5	10.3
65+	14.5	14.9	15.0	13.1	11.9	16.9	11.3	12.8	12.3	9.6	8.5	14.6
Sex												
Male	46.8	48.4	47.0	45.5	47.6	47.5	48.3	49.9	48.0	47.9	49.5	51.1
Female	53.2	51.6	53.0	54.5	52.4	52.5	51.7	50.1	52.0	52.1	50.5	48.9
Race/ ethnicity												
White	55.8	90.6	53.0	40.8	72.3	74.2	64.0	90.7	67.0	46.7	76.6	80.4
African American	39.3	7.2	44.1	47.7	25.7	23.3	27.9	6.2	27.7	37.9	18.9	16.7
Asian	1.3	0.5	0.8	3.1	0.4	0.2	4.0	1.1	2.7	7.7	1.6	0.9
Insurance Status[20]												
Private	49.7	51.2	45.1	59.1	56.7	45.2	69.9	69.0	67.2	74.0	72.8	67.9
Medicaid	13.2	12.4	16.2	7.1	10.3	14.3	8.8	8.8	11.4	7.6	7.9	11.4
Medicare	15.5	16.3	16.5	12.6	12.4	18.3	12.5	14.1	13.5	10.2	12.9	16.2
Other/Uninsured	21.7	20.1	22.2	21.2	20.6	22.2	8.9	8.1	7.9	8.2	6.4	4.5

[19] 2002 population estimates for July 1, 2001, US Census Bureau.

[20] Medicaid and Medicare enrollment figures are based on administrative data. Private insurance figures are from the Current Population Survey. The uninsured population are those not covered by private, Medicare, or Medicaid.

There were almost 2 million visits to Maryland hospital emergency departments in 2001. The mean number of emergency department visits per person with at least one visit was 1.4.[21] The vast majority of ED users (over 75%) had only one visit annually within a given hospital. The top 5 percent of users each had three visits or more.

An alternative way of looking at who uses the emergency department is to look at visit rates for various population subgroups. These visit rates are shown in Table 2. For each group we calculate the number of ED visits per 100 persons. The overall rate for the state is 34 visits per 100 persons. This compares to 39 visits per 100 persons nationally in 2000.[22] There is considerable variation in visit rates across the groups shown here.[23] A substantial difference is observed in visit rates between blacks and whites; the number of visits per 100 blacks is 65 percent higher than the number of visits per 100 whites. Rates differ across age groups as well, with the youngest group (children less than 6 years of age) and the oldest (persons 65 years of age and older) having the highest visit rates. Those in the 18 to 34 age group also have more visits than average. There is some regional variation as well, though the lower rate in the National Capital Area is primarily due to the exclusion of visits by Maryland residents to Washington hospitals.

Almost half of all visits (46%) were paid for by private insurance. Eighteen percent were reimbursed by Medicare, 15 percent by Medicaid, and another 18 percent were classified as self-pay. The distribution of ED visits by reason for visit and payer status is shown in Figure 1. Just under 70 percent of visits were for a medical condition and approximately 31 percent resulted from an injury.[24] There appears to be some relationship between reason for visit and payer. Injuries accounted for approximately one-third of visits covered by private insurance or not covered by any insurer but only 22 percent of Medicare and Medicaid visits.

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[21] The mean of 1.4 likely undercounts the actual number of visits per person. As noted earlier, the data do not allow identification of multiple visits by the same person at different hospitals.

[22] National visit rates are calculated using population estimates that exclude the institutionalized population while the population estimates used in this analysis include the institutionalized. Thus, in relative terms, the 39 visits per 100 persons overstates the comparable visit rate. McCaig LF, Ly N. National Hospital Ambulatory Medical Care Survey: 2000 emergency department summary. Advance data from vital and health statistics; no. 326. Hyattsville, Maryland: National Center for Health Statistics, 2002.

[23] We are not able to calculate visit rates by payer status because our insurance estimates (the denominator for the rate) are not able to account for persons who change insurance status during the year.

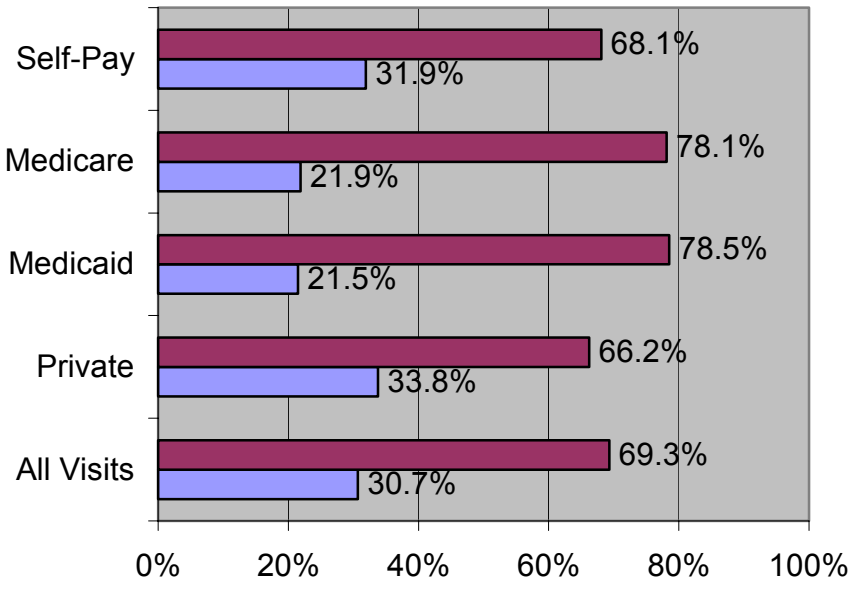
[24] As a point of comparison, in 2000, 29 percent of ED visits nationally had a primary diagnosis of injury or poisoning. McCaig LF, Ly N. National Hospital Medical Ambulatory Medical Care Survey: 2000 emergency department summary. Advance data from vital and health statistics; no. 326. Hyattsville, Maryland: National Center for Health Statistics, 2002.

Table 2. Number of Emergency Department Visits per 100 persons, for Selected Subgroups, 2001

	Number of ED Visits*	Population** (in thousands)	ED Visits per 100 Persons
All Maryland	1,824,022	5,375	34
Western MD	165,423	441	38
Baltimore Metro	977,206	2,531	39
Nat'al Cap. Area	420,973	1,708	25
Southern MD	95,474	291	33
Eastern MD	164,946	404	41
Age			
<6	186,226	434	43
6 – 10	84,389	406	21
11 – 17	139,362	536	26
18 – 34	471,132	1,217	39
35 – 54	522,736	1,696	31
55 – 64	132,426	477	28
65 +	287,570	608	47
Sex			
Male	840,202	2,596	32
Female	983,382	2,779	35
Race* **			
White	1,000,671	3,510	29
Black	740,682	1,529	48

*Number of visits does not always sum to total due to missing values for certain variables. Age is missing for 181 observations, race for 5,424 observations, and sex for 438 cases.
**May not add to total population due to rounding
**There are 77,245 visits for persons of races other than white or black.

Figure 1. Reason for Visit, by Payer



To understand the volume of visits at different EDs, it is useful to examine where ED patients at different hospitals reside. There are a number of factors that could influence which ED a patient visits for care. While proximity to residence may be one fairly significant factor, there are a host of other possible influences. For example, a patient may choose to go to a certain ED based on the hospital's reputation in terms of quality of care or their perceptions about waiting time or other amenities. Privately insured persons, in particular, may call their physician and visit the hospital where their doctor has admitting privileges or the one their doctor recommends based on its having specialized equipment that may be needed for diagnosis or treatment. In the case of a patient taken by ambulance, state-level protocols may dictate where the patient is taken. To further examine this issue, we looked at the proportion of visits accounted for by residents of the hospital's primary service area (PSA) vs. those who come from some other location. For each hospital, a primary service area has been defined with respect to inpatient hospital services. The PSA is a grouping of Zip Codes from which a hospital draws a large percentage of their patients. The inpatient primary service area definition provides a basis for understanding the geographic dispersion of the population using the ED.[25]

[25] The primary service area is defined as: (i) the Maryland postal Zip Code areas from which the first 60% of a hospital's patient discharges originate during the most recent 12-month period, (ii) Maryland Zip Codes physically contiguous to any of the Zip Codes designated in (i) that provided 50% or more of their discharges to the hospital in the 12-month period; and (iii) any point Zip Codes physically within any of the Zip Codes designated in (i) or (ii) above.

Across Maryland, 66 percent of all ED visits are from persons who reside within the hospital's primary service area. The two hospitals designated as Level 1 Trauma and PARC receive a higher proportion of patients from outside of their PSA—42 percent of ED patients compared to the mean of 34 percent. The Level 2 Trauma hospitals also obtain a higher than average percentage of patients from outside their PSA, though the difference is small. Hospitals in more urban areas such as those in EMS Region IIIa (Baltimore City and County) and Regions Va and Vb (the National Capital Area) tend to draw a lower proportion of patients from their own PSA, while hospitals in more rural areas appear to serve a higher proportion of local patients.

In terms of the geographic dispersion of patients—measured here by the number of Zip Codes from which patients are drawn—hospitals, on average, draw a large proportion of patients from a relatively small area but the overall ED patient population is quite dispersed geographically. Across all hospitals in Maryland, half of ED patients for a given hospital come from only 4 Zip Codes, though 90 percent of patients come from 50 Zip Codes. The Level 1 Trauma and PARC hospitals draw from a wider area than do the other hospitals. The more rural hospitals receive a high proportion of their patients from a small number of Zip Codes but, overall, draw from a very broad area. For example, Region IV hospitals obtain half of their patients from only 3 Zip Codes, but get 90 percent of ED patients from over 100 Zip Codes. This compares to hospitals in Baltimore City and County, where 50 percent of patients come from 5 Zip Codes while 90 percent of patients come from 34 Zip Codes.

As an illustration of the complexity of this issue, we provide, in Appendix A, more in-depth information on the geographic distribution of patients for Johns Hopkins University Hospital ED and the distribution of patients for two different Zip Codes near that particular hospital.

Table 3. Geographic Location of ED Patients by Hospital Characteristics, 2001

	Mean Percent of ED Patients from Hospital PSA	Mean No. of Zip Codes that provide 50% of ED patients	Mean No. of Zip Codes that provide first 75% of ED patients	Mean No. of Zip Codes that provide 90% of ED patients
All	65.7%	4	15	50
Level 1 Trauma & PARC[26]	57.9%	7	21	75
Level 2 Trauma	63.8%	4	13	42
Level 3 Trauma	68.8%	4	14	46
Non- Trauma	66.2%	4	14	51
EMS Region[27]				
Region I	63.9%	2	10	70
Region II	77.3%	3	11	34
Region IIIa	61.5%	5	13	34
Region IIIb	69.8%	4	11	30
Region IV	69.2%	3	20	112
Region Va	65.0%	5	16	54
Region Vb	61.7%	5	14	40
Region Vc	79.4%	4	10	27

Classification of Visits by Appropriateness and Urgency

As the volume of emergency department visits increases, there is renewed interest in assessing the appropriateness of ED use and in the potential for channeling patients with less urgent needs to other settings. Inappropriate use can be the result of a number of factors, including lack of information about where to obtain care, lack of a usual source of care, or difficulty in seeking care during regular hours of operation. Low-wage workers who are unable to use sick leave for doctor visits may choose to use the ED at night rather than give up

[26] Level 1 Trauma and PARC (Primary Adult Resource Center): Johns Hopkins Hospital and Shock Trauma Center UMMS; Level 2 Trauma: Washington County Hospital, Johns Hopkins Bayview, Sinai Hospital, Suburban Hospital, and Prince George's Hospital Center; Level 3 Trauma: Memorial Hospital of Cumberland and Peninsula Regional Medical Center; all other hospitals are considered non-trauma.

[27] EMS Region I: Allegany and Garrett Counties; Region II: Frederick and Washington Counties; Region IIIa: Baltimore City and Baltimore County; Region IIIb: Anne Arundel, Carroll, Harford, and Howard Counties; Region IV: Cecil, Dorchester, Kent, Somerset, Talbot, Wicomico, Worcester Counties; Region Va: Montgomery County; Region Vb: Prince George's County; Region Vc: Calvert, Charles, and St. Mary's Counties.

wages or risk job loss by missing work. Uninsured individuals may not be aware of health clinics that provide free or reduced cost care but they know that Maryland hospital EDs can't or won't turn them away. Others may experience symptoms in the evening when their primary care physician does not have office hours.

The classification system used in this analysis attempts to categorize visits based on whether care was needed urgently, defined as within 12 hours.[28] It also distinguishes care that may require attention within that time period, but for which the needed care could be given by a primary care physician in an office setting. Finally, the categorization attempts to identify conditions that may require emergency department care, but for which early and appropriate treatment of the condition in a primary care setting would have mitigated the need for urgent care. In addition to these groupings, we separate out visits that resulted in an inpatient admission with the presumption that these ED visits were appropriate and urgent care was required. There are three remaining categories that are outside this framework.[29] These are: (1) injuries; (2) psychiatric, drug and alcohol-related diagnoses, and (3) a residual 'unclassified' category where sample sizes for any single diagnosis are small.

It should be emphasized that the algorithm for classifying visits is based on the primary diagnosis that is recorded in the discharge or visit patient record. There is clearly a substantial amount of supporting information that is necessary to make a definite determination of whether or not a visit was appropriate. In fact, several studies have shown that physicians from different specialties frequently disagree on whether a visit was appropriate, and these disagreements take place with more information than is available through the data used in this analysis.[30] Nonetheless, in the aggregate, these estimates provide a rough idea of the distribution of visits by type and the variation across different population subgroups.

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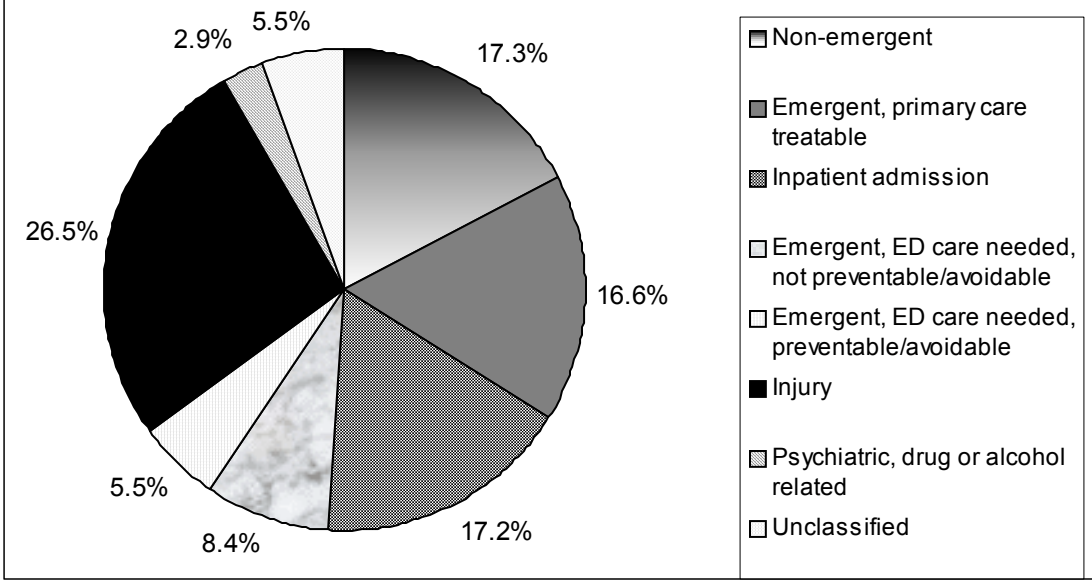
[28] This methodology was developed by John Billings and colleagues at the Robert F. Wagner School of Public Service, New York University. Additional information is provided in Appendix B, Data Sources and Methods. For a more detailed treatment, see Billings J, Parikh N, and Mijanovich T. Emergency Department Use in New York City: A Substitute for Primary Care? Issue Brief November 2000, The Commonwealth Fund.

[29] The developers of the classification system note that users expressed interest in examining these conditions separately so that they were pulled out of the standard classification.

[30] In a study of approximately 900 visits to an urban ED, physicians reviewed nurses' triage notes to answer the following question: Could this have been taken care of within 24 hours by a primary care physician without harm to the patients? The study found only moderate agreement (absolute agreement in 42% of cases) between internists and emergency physicians about the appropriateness of the complaint for an ED visit. O'Brien GM, Shapiro MJ, Fagan MJ, Woolard RW, O'Sullivan PS, and Stein MD. "Do Internists and Emergency Physicians Agree on the Appropriateness of Emergency Department Visits?" *J Gen Intern Med* 1997; 12:188-191.

The results of the classification of Maryland ED visits by urgency and appropriateness are shown in Figure 2. Overall, approximately one-third of visits are classified as not requiring care in an emergency department. Within this one-third, roughly half (17.3% of total visits) were considered to be non-emergent and half (16.6% of total visits) were emergent but primary care treatable. Twenty-seven percent of all visits were related to injuries; the algorithm does not classify these injury-related visits as to whether they required ED care though it is likely that a considerable proportion if not the vast majority would require prompt attention and specialized equipment or personnel found in the ED. Similarly, the 3 percent of visits with psychiatric or substance abuse diagnoses are not classified. Those remaining visits categorized as requiring ED care can be broken down into three groupings. Approximately 17 percent of all visits in 2001 resulted in an inpatient stay, another 6 percent were classified as requiring ED care for conditions that were not preventable or avoidable, and 9 percent of visits required ED care but the need for care might have been avoided with earlier treatment of the underlying condition(s).

Figure 2. Classification of Emergency Department Visits, 2001



The appropriateness/urgency of visits by patient characteristics is shown in Table 4. Visits by females were more likely to be for non-emergent or primary care treatable conditions and less likely to be for injuries than were visits by males. There is a clear relationship between age and likelihood of inpatient admission following an ED visit. Among visits to the ED, almost half of visits by the elderly and 30 percent of visits for those aged 55 to 64 resulted in an admission to the hospital. Over 40 percent of visits by children ages 6 to 17 were

because of an injury and half of visits for children under age 6 were classified as not requiring ED care.

There are also fairly substantial differences in use of the ED by race. Compared to visits by whites, visits by blacks were somewhat more likely to be classified as non-emergent (15% for whites vs. 20% for blacks) or emergent, primary care treatable (15% for whites vs. 19% for blacks). And 20 percent of visits by whites resulted in an inpatient admission compared to 14 percent of visits by blacks. These differences may relate to socio-economic characteristics, individual preferences, or access to care as influenced by insurance status and other factors.

Payer status may also influence use as it relates to socio-economic characteristics, individual preferences that may correlate with insurance type, the level of access enjoyed by those insured by public vs. private plans, or insurance rules concerning the use of the ED. Use by Medicare enrollees is largely the same as that seen above for the 65 and over population, with only 10 percent of visits classified as non-emergent and almost half resulting in an inpatient admission. Of interest, there are few differences between the privately insured in HMO and non-HMO plans. This may be due, in part, to recent loosening of restrictions on ED use brought about by prudent layperson rulings by the courts. Visits by persons on Medicaid differ slightly from those of the privately insured. There is only a small difference in the proportion of non-emergent visits between the two groups. In the other two categories where poor access might predict a difference—emergent, primary care treatable and emergent, ED care needed, preventable/avoidable--Medicaid visits are only slightly greater in the former and are less in the latter. Rates for these categories are similar for the uninsured (referred to as 'self-pay' in the hospital data). This group, possibly related to its age composition, is disproportionately represented with injuries and psychiatric/drug/alcohol diagnoses. Only 6 percent of the uninsured who use the ED are admitted for an inpatient stay.

Many of the differences seen by race are lessened when payer status is taken into account, although it varies by payer. For instance, the differences in non-emergent visits and visits that are emergent but primary care treatable are relatively small between blacks and white on Medicaid. Sizeable differences remain in these two categories, however, between blacks and whites with private insurance, both HMO and non-HMO. In terms of visits leading to inpatient admissions, there is no difference by race for Medicaid enrollees but the percentage of privately insured whites in this category is higher than the percentage of privately insured blacks. There are also differences between whites and blacks in the self-pay (uninsured) category, with blacks having a higher proportion of visits not requiring ED care and a lower percentage of injury-related visits.

Table 4. Classification of Emergency Department Visits, by Selected Patient Characteristics, 2001

	# of Visits (in thousands)	Non-emergent	Emergent, primary care treatable	Emergent, ED care needed, **not** preventable/ avoidable	Emergent, ED care needed, preventable/ avoidable	Inpatient admission	Injuries	Psych/drug/ alcohol	Unclassified
Age									
<6	195	22.7%	27.1%	9.5%	6.5%	5.5%	22.8%	0.1%	5.7%
6-10	88	18.5	16.9	8.4	5.0	3.8	42.0	1.5	3.9
11-17	146	14.8	13.1	5.2	5.4	4.5	47.5	5.4	4.1
18-34	505	21.1	18.4	5.2	8.8	7.2	29.8	3.7	5.8
35-54	555	18.0	16.3	5.1	10.0	15.5	25.5	4.2	5.5
55-64	142	13.0	14.1	4.8	10.0	29.8	20.0	2.1	6.2
65+	303	9.0	10.4	3.9	8.1	48.4	13.5	1.1	5.6
Gender									
Male	896	15.2%	14.9%	5.3%	8.0%	16.9%	30.8%	2.6%	5.3%
Female	1038	19.1	18.1	5.7	8.9	17.4	22.7	0.0	5.6
Race									
White	1075	15.1%	14.6%	4.4%	8.4%	19.9%	29.5%	3.2%	4.9%
Black	770	20.3	19.3	7.1	8.5	14.0	21.9	2.7	6.2
Other	83	17.5	17.8	5.0	9.0	12.8	29.8	2.5	5.7
Payer Status									
Medicare	339	9.8%	10.8%	4.2%	7.9%	47.0%	12.6%	2.0%	5.5%
Medicaid	296	20.4	20.5	7.6	7.3	16.3	18.7	3.7	5.5
Private non-HMO	517	18.0	17.1	5.1	9.0	11.1	32.1	2.3	5.4
Private HMO	361	18.1	18.3	5.9	10.0	11.6	28.4	2.5	5.1
Self-pay	346	21.2	18.4	6.0	8.3	6.1	28.9	5.2	6.0
Other	69	11.4	6.9	1.6	4.3	5.4	64.2	1.6	4.5

From a policy perspective, it is important to understand not only which population groups use non-emergent care disproportionately, but which groups account for the majority of inappropriate ED use. In other words, if we look at all ED visits classified as non-emergent, what proportion of these visits are accounted for by various groups? While the uninsured and Medicaid enrollees are disproportionately represented in the count of non-emergent visits, the privately insured still account for almost half—47.6 percent—of all non-emergent visits. This proportion is about the same including visits that are emergent but primary care treatable along with non-emergent visits. Thus, any initiative aimed at reducing inappropriate ED use must be broad-based and not just target the uninsured or Medicaid enrollees. One-quarter of non-emergent visits are for children less than 18 years of age. Adults 18 to 34 years of age account for 31.9 percent of non-emergent visits and adults 35 to 54 years of age are responsible for another 29.8 percent of these visits. Almost half of non-emergent visits (46.9 %) are made by blacks.

Table 5 provides the distribution of ED visits, classified by urgency, by hospital trauma designation and EMS region. There is no clear pattern to the type of visits seen at hospitals by trauma level. There are slightly more non-emergent visits at the two Level 1 trauma and PARC-designated hospitals. It should be noted that the trauma center visits are not separated from the ED visits in this analysis, so that the disproportionate number of low urgency visits is probably related to the hospitals' locations rather than the sophisticated services offered. There are also fewer injuries treated at these two hospitals though the analysis does not account for the severity of the injuries. The Level 1, PARC, and Level 2 hospitals appear to receive more visits with psychiatric and substance abuse diagnoses than other hospitals though the differences are fairly small. The classification of visits by EMS region indicates a higher proportion of visits leading to inpatient stays in Region IIIa (Baltimore City and County) and Region I (Allegany and Garrett Counties). This may relate to the slightly higher than average proportion of residents 65 and over in these regions. Regions I, II, IIIa, and Vb have the highest proportion of non-emergent visits. Two of these regions (Region IIIa and Vb) have substantial black populations and Region IIIa also has a higher than average Medicaid population.

Ambulance Diversion--EDs on Alert Status

As noted in the Joint Work Group report, hospital hours spent on ambulance diversion have increased substantially in recent years. Current guidelines for the maximum length of time that a hospital should remain on alert status are routinely overstayed and there is concern that access to emergency care and health outcomes may be at risk.

We examine 3 of the 5 types of alerts used in Maryland. The most common is the yellow alert, which is a request by the hospital that it receive, via ambulance, absolutely no

Table 5. Classification of Emergency Department Visits, by Selected Hospital Characteristics, 2001

	# of Visits (in thousands)	Non-emergent	Emergent, primary care treatable	Emergent, ED care needed, **not** preventable/ avoidable	Emergent, ED care needed, preventable/ avoidable	Inpatient admission	Injuries	Psych/drug/ alcohol	Unclassified
Trauma Designation[31]									
Level 1 and PARC[32]	84	21.1%	17.0%	6.5%	8.7%	17.7%	16.3%	3.6%	9.1%
Level 2	263	17.7	16.0	5.3	8.3	18.6	24.5	3.6	6.1
Level 3	89	17.4	17.1	5.6	7.5	16.3	28.5	1.8	5.7
Non-trauma	1499	17.0	16.7	5.5	8.5	17.0	27.3	2.9	5.2
EMS Region									
Region I	68	18.0%	16.8%	4.4%	6.9%	18.7%	27.8%	1.9%	5.5%
Region II	119	18.5	16.5	4.4	8.8	14.5	29.4	3.4	4.4
Region IIIa	724	18.0	16.5	5.8	8.2	19.8	22.6	3.6	5.5
Region IIIb	280	15.3	15.4	5.0	8.8	17.7	30.2	3.0	4.6
Region IV	175	16.1	16.5	5.7	7.6	15.8	30.1	2.6	5.5
Region Va	240	15.8	16.0	5.2	9.6	16.8	29.1	2.5	4.9
Region Vb	240	19.2	18.8	6.2	8.7	11.9	25.3	2.1	7.7
Region Vc	88	16.7	17.2	5.5	8.3	14.6	30.1	2.6	5.1

[31] Includes visits in the emergency department or the trauma unit. Level 1 trauma centers include the R. Adams Crowley Shock Trauma Center and Johns Hopkins Hospital Adult Trauma Center; Level 2 centers include Johns Hopkins Bayview Medical Center, Prince George's Hospital Center, Sinai Hospital Trauma Center, and Suburban Hospital; Level 3 centers include Western Maryland Health System – Memorial Trauma Center, Regional Washington County Hospital Trauma Center, and Peninsula Regional Medical Center Trauma Center.

[32] Trauma services provided at R. Adams Crowley Shock Trauma Center and emergency services provided at University of Maryland Health Care System have been combined under Level 1 and PARC.

patients in need of urgent care because of a temporary overwhelming overload.[33] The second most common is the red alert, used when no inpatient ECG-monitored beds are available (including critical care and telemetry beds). Least frequently used among the three is the re-route alert, which signals that beds are unavailable in a reasonable time-frame. Blue and mini-disaster alerts[34] are not analyzed in this study. Data from MIEMSS shows that these alerts occur least frequently.

Of the 47 hospitals in Maryland with emergency departments,[35] only 5 had no yellow, red, or re-route ambulance alerts during 2001. Across all hospitals in the state, there were a total of over 67,000 hours on ambulance diversion. The mean time on alert status for hospitals with at least one alert was about 1,600 hours, indicating that a hospital was on alert, on average, 18 percent of the hours in the year. The maximum number of hours on alert was 5,926 hours, or approximately two-thirds of the year. Looking separately by type of alert, hospitals spent the most time on yellow alert, with 1,086 mean hours per hospital over the year. Red alerts were only slightly less common with an annual mean of 863 hours, while hospitals spent an average of 41 hours on re-route alerts in 2001.

In terms of the number of days (or parts of days) spent on any of the three alerts, the median across hospitals with at least one alert was 190, indicating that half of all hospitals were on alert status over half the days in the year. The maximum number of days on which there was an alert for an individual hospital was 361—in other words, only 4 days during the year with no alert.

Table 6 shows the distribution of hospitals by the number of hours on yellow alert status during 2001. With the majority of hospitals on diversion for between 30 and 90 days during the year and one-fifth of hospitals on diversion for more than 90 days, it is clear that this is a widespread phenomenon. Examined by EMS Region, it is notable that all of the hospitals with more than 720 hours on alert status are located in the Baltimore Metro Region or the National Capital Area. These metropolitan regions also have no hospitals with zero hours on alert status. Regions I, II, and IV combined only have one hospital with more than 168 hours on yellow alert.[36]

[33] Priority 1 patients (critically ill or injured persons requiring immediate attention or unstable patients with potentially life-threatening injury or illness) may still arrive by ambulance during a yellow alert. Walk-in patients are also accepted during periods of ambulance diversion.
[34] Blue alerts are for snow, icing, and flooding. Mini-disaster alerts are used when there is a power outage, fire, gas leak, or bomb scare.
[35] These tabulations combine the EDs at Johns Hopkins main hospital and the oncology center but treat Laurel General Hospital and its Bowie campus as distinct facilities.
[36] The GAO report supports the finding of ambulance diversion being more common in larger metropolitan areas.

Table 6. Distribution of Maryland Hospitals by Hours on Yellow Alert, 2001

Number of hours on yellow alert	Number of Hospitals All Maryland	EMS Region				
		I	II	III	IV	V
Zero	5	2	1	0	2	0
1-168 hours (up to 7 days)	10	1	0	2	4	3
169-720 (up to 30 days)	8	0	1	3	0	4
721-2,160 hours (up to 90 days)	15	0	0	9	0	6
More than 2,160 hours	10	0	0	8	0	2

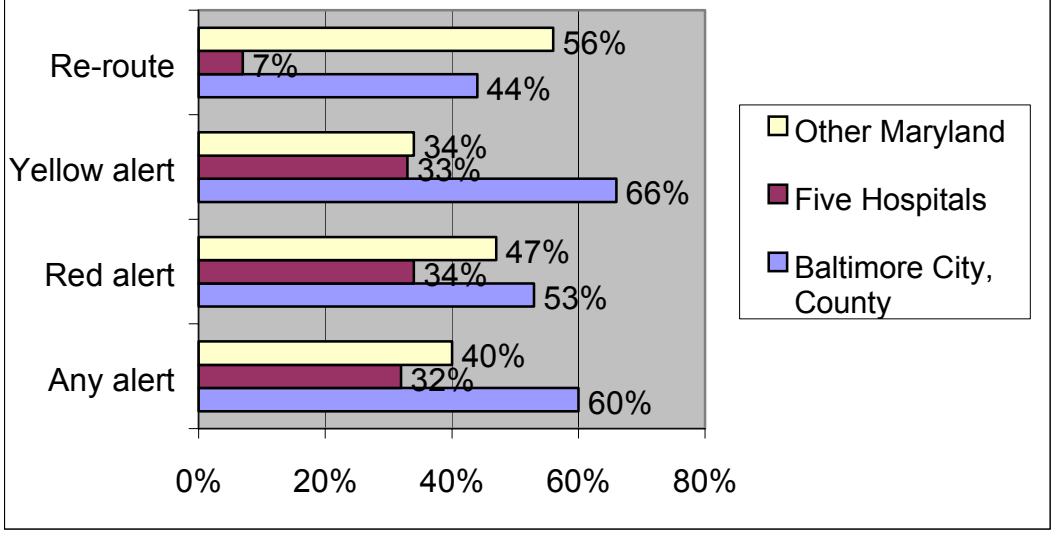
Eleven of Maryland's hospitals are located in Baltimore City and another 4 in Baltimore County. These fifteen hospitals combined spent more time on alert status than hospitals in the rest of the state, and five of the fifteen hospitals within Baltimore City and County accounted for half of all alert hours in these two jurisdictions. In Table 7, each of the hospitals within Baltimore City and Baltimore County is listed in order of total yellow alert hours, from highest to lowest.

Table 7. Total Yellow Alert Hours, 2001
Hospitals in Baltimore City and Baltimore County

Hospital	Annual Yellow Alert Hours	Percent of Total
Johns Hopkins Bayview	4,790	15.8%
Johns Hopkins Hospital	2,669	8.8
University of Maryland	2,662	8.8
St. Joseph Hospital	2,630	8.7
Greater Baltimore Medical Center	2,481	8.2
Northwest Hospital Ctr	2,446	8.1
Franklin Square Hosp	2,431	8.0
Sinai Hospital	2,363	7.8
St. Agnes Healthcare	2,076	6.9
Bon Secours Hospital	1,735	5.7
Maryland General Hosp	1,008	3.3
Union Memorial Hosp	879	2.9
Mercy Medical Center	777	2.6
Harbor Hospital Center	634	2.1
	30,280	**100.0**

Figure 3 shows the percent of all alert hours attributable to these five hospitals, the fifteen hospitals in Baltimore City and County, and the hospitals in the remainder of the state. Hospitals in Baltimore City and County account for 60 percent of all alert hours statewide. For yellow alerts, these two jurisdictions are responsible for 66 percent of all alert hours and, for red alerts, 53 percent. With the exception of re-route alerts, the five hospitals with the most alert hours contribute one-third of the alert hours statewide.

Figure 3. Percent of All Alert Hours,Baltimore City and County, Other Maryland, and Five Hospitals with Most Alert Hours

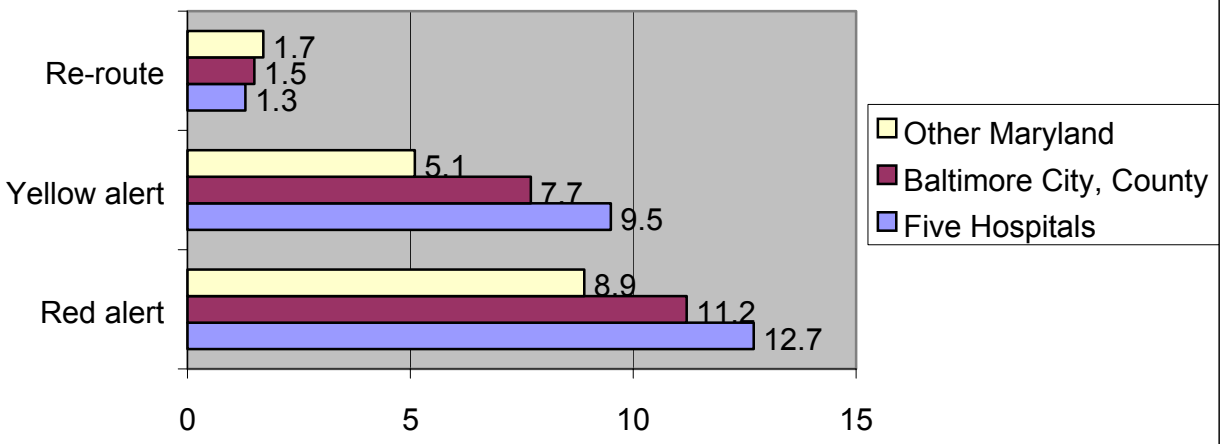


Note: The five hospitals are University of Maryland, Johns Hopkins, Johns Hopkins Bayview, St. Joseph, and Greater Baltimore Medical Center. The remaining Baltimore City and County hospitals are Bon Secours Hospital, Franklin Square, Good Samaritan Hospital, Harbor Hospital, Maryland General Hospital, Mercy Medical Center, Northwest Hospital Center, Sinai, St. Agnes Healthcare, and Union Memorial Hospital.

Figure 4 shows the mean number of hours on alert status for days with an alert. While yellow alerts account for the most hours overall, red alerts consume more hours in an alert day. With the exception of re-route alerts, Baltimore City and County had longer alerts than the hospitals in the rest of the states. For red alerts, the mean length on an alert day was 11.2 hours for Baltimore City and County, 8.9 hours for the rest of the state, and 12.8 hours for the five hospitals with the most alert hours. Yellow alerts were somewhat shorter, with the mean

number of hours 7.7 for Baltimore City and County, 5.1 hours for other parts of Maryland, and 9.5 hours for the five hospitals.

Figure 4. Mean Hours on Alert Status Per Alert Day, Baltimore City and County, Other Maryland, and Five Hospitals with Most Alert Hours



Note: The five hospitals are University of Maryland, Johns Hopkins, Johns Hopkins Bayview, St. Joseph and Greater Baltimore Medical Center. The remaining Baltimore City and County hospitals are Bon Secours Hospital, Franklin Square, Good Samaritan Hospital, Harbor Hospital, Maryland General Hospital, Mercy Medical Center, Northwest Hospital Center, Sinai, St. Agnes Healthcare, and Union Memorial Hospital.

Emergency Department Use during Alert Periods

One of the issues raised by the frequent use of ambulance alerts is the effect on access to care. Policymakers and hospital administrators need to understand how the use of ED services changes during alert periods. The purpose of the alert is to slow down the flow of new patients to the ED so we would likely see an increase in volume prior to the alert and a decrease in the volume of visits during these periods. In addition, if ambulances are diverted then most new patients are walk-ins.[37] Thus, one might expect that the mix of patients would be skewed more to those who are less sick and less in need of urgent care.

Table 8 shows the characteristics of ED users during periods without an alert and during alert periods. In this analysis, all visits that take place during a day when there is an alert for any part of that day are included as visits that take place

[37] Priority 1 patients may still arrive by ambulance.

during the alert.[38] This makes it difficult to observe changes in volume, since the increase in visits prior to the alert may balance the decrease in visits during the alert. In order to attempt to observe more closely the actual alert periods, days with alerts are further divided into those with short vs. long alerts; short is defined as less than the mean number of hours for the specific type of alert. For yellow alerts, the mean is 6.4 hours, for red alerts it is 9.5 hours, and for re-route alerts the mean is 1.7 hours.

The mix of patients served during alert periods—particularly long alerts--appears to differ somewhat from those served when there is no alert, as seen in Table 8. During periods of alert, the proportion of patients with private coverage falls and the proportions covered by Medicare and Medicaid or without coverage rise. The largest change observed is the increase in Medicaid patients during long yellow alerts. Substantial changes are also seen in the racial mix of patients. In periods of no alert, whites comprise 62 percent of patients, but only 47 percent of patients during long yellow alerts. Accordingly, the percentage of black patients increases considerably during long yellow alerts, from 33 to 49 percent. The changes are smaller but in the same direction during red alert periods. There is also some difference in the age composition of patients during long alert periods. During these periods, the presence of children 10 or younger falls from 17 percent to between 12 and 13 percent as does the proportion of persons 35 to 54 and 65 and older rises slightly.

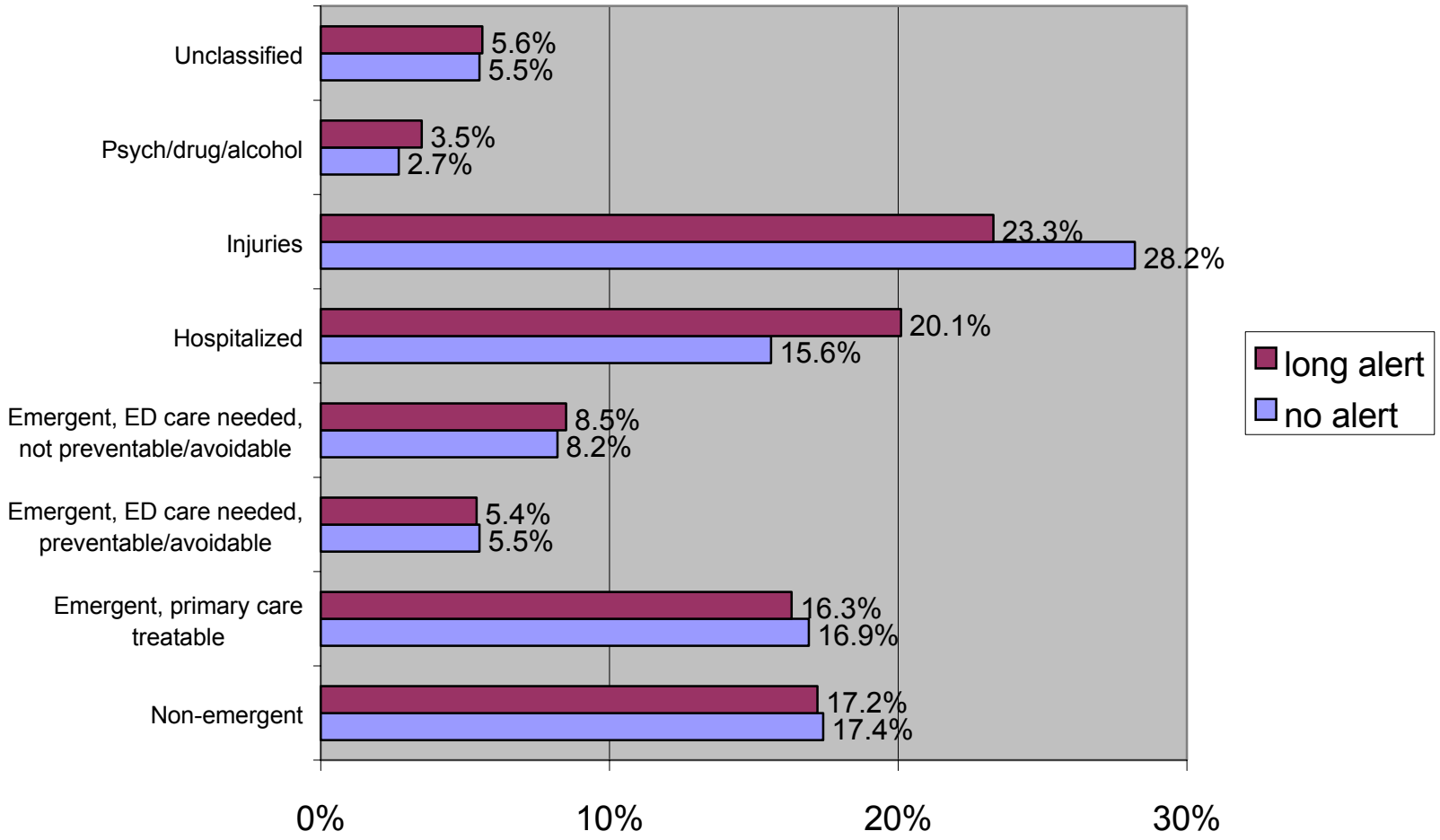
[38] While the data provide the hour for the start and end of the alert, the visit is identified only by the day on which it occurs. Thus, we don't know if the visit took place before, during, or sometimes even after the alert.

Table 8. Characteristics of ED Users, No Alert vs. Alert

	No Alert	Yellow Alert		Red Alert	
		Short	Long	Short	Long
All	694,581	436,247	338,346	223,739	152,383
Age					
<6	11.1%	9.8%	9.0%	9.6%	8.1%
6-10	5.6	4.6	4.2	4.6	3.8
11-17	8.6	7.6	8.5	7.6	7.5
18-34	25.7	26.4	27.2	26.8	26.9
35-54	27.2	28.9	29.6	29.4	29.8
55-64	7.3	7.3	7.3	7.4	7.6
65+	14.5	15.4	15.4	14.6	16.3
Race					
White	61.9	51.0	46.6	49.5	57.2
Black	33.4	43.4	49.4	45.2	39.4
Other	4.8	5.5	3.9	5.3	3.3
Gender					
Male	47.2	46.3	46.5	46.7	46.5
Female	52.8	53.7	53.5	53.3	53.5
Payer					
Private	50.6	48.7	43.7	47.0	45.2
Medicaid	12.6	13.1	16.1	13.9	14.3
Medicare	15.5	16.5	17.1	16.1	18.3
Self-Pay	16.8	18.5	20.0	19.8	18.5

There are relatively few changes in the categorization of visits shown in Figure 5. The percentage of visits not requiring ED care (either non-emergent or emergent, primary care treatable) is quite similar during periods of no alert and long alerts. However, 16 percent of visits that take place when there is no alert result in hospitalization compared to 20 percent of visits during a long alert and the proportion of visits related to injuries falls from 28 to 23 percent during long alert periods. Visits with psychiatric or substance abuse-related diagnoses also rise.

Figure 5. Classification of Visits during Alert Periods



Over half (53%) of yellow alerts begin after 3 p.m. and almost three-quarters of yellow alerts begin after noon. Almost half of red alerts and two-thirds of re-route alerts begin after 3 p.m. This suggests that looking at the volume of visits on a day in which an alert begins should give an accurate indication of whether the alert was indeed triggered by a high volume of demand.[39] In fact, the mean number of visits on days with and without alerts differs only minimally. For yellow alerts, across all hospitals, the mean number of visits on non-alert days is 114 while the mean for alert days is 120. For red alerts, the mean number of visits per day with and without alerts is 118 and 119, respectively. While one would expect the volume of visits to be higher directly prior to the alert (on the alert day as argued above), one would also expect the volume of visits to drop sharply after the alert is implemented. This may explain why the difference in visit volume is not larger.[40]

Overlapping Alerts

Adverse impacts on access to care during periods of ambulance diversion could be magnified if multiple hospitals are on alert at the same time. This could happen by chance, if an outside event (e.g., a multi-vehicle accident) increases immediate demand for ED care, or if there were a cascading effect among hospitals, with one hospital going on alert triggering other hospitals to do the same in an essentially defensive posture. We examine the frequency of overlapping periods of alert using two different approaches. We also estimate the duration of alert periods according to the number of hospitals on alert. In this analysis, we examine yellow alerts only and limit the analysis to the fifteen hospitals in Baltimore City and Baltimore County.[41] This lessens the geographical dispersion and increases the likelihood that an action on the part of one hospital might have an effect on another hospital. Still, it should be emphasized that we cannot assume a causal relationship among hospitals on alert status at the same time.

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[39] This would not be the case if alerts tended to start in the early hours of the morning; in that case, it would make more sense to look at volume on the day prior to the alert. The necessity of making this distinction arises because, while we know the precise time when the alert starts, we only know the day of the visit.

[40] It is also possible, as noted above, that alerts may be more closely tied to hospital occupancy rates than to the volume of ED visits (see earlier footnote).

[41] The 11 hospitals in Baltimore City are Bon Secours Hospital, Good Samaritan Hospital, Harbor Hospital Center, Johns Hopkins Bayview Medical Center, Johns Hopkins Hospital,Maryland General Hospital, Mercy Medical Center, Sinai Hospital, St. Agnes Healthcare, Union Memorial Hospital, and University of Maryland Hospital. The four Baltimore County hospitals are Franklin Square Hospital, Greater Baltimore Medical Center, Northwest Hospital Center, and Saint Joseph Medical Center.

Our first approach to estimating the extent of overlapping alerts is to ask the question—when a hospital goes on alert status, how many other hospitals are *already* on alert? Thus, as part of this approach, an 'alert episode' is defined as beginning each time an individual hospital goes on alert; we then count the number of hospitals on alert at the onset. The results from this first approach are shown in Table 9, below. Defined this way, there were almost 4,000 yellow alert episodes in 2001. Fewer than 10 percent of these episodes involved only one hospital on alert status. In other words, 90 percent of the time that a hospital goes on alert status, at least one other hospital is already on alert. Almost half of all alert episodes involved four or fewer hospitals. While this indicates that a substantial proportion of episodes are limited in terms of the number of hospitals involved, in one-fifth of episodes eight or more hospitals were on alert simultaneously. While there is no way to determine exactly how many hospitals need to be on alert status at the same time to precipitate delays in ambulance transport and the potential for effects on access to care, it is clear that multiple-hospital alerts are relatively frequent a cause for some concern.

Table 9. Number of Hospitals on Alert, by Frequency of Yellow Alert Episodes, Baltimore City and County Only, 2001

Number of hospitals On alert status	Yellow alert Episodes (number)	Percent of all Episodes	Cumulative Percent of Episodes
1	346	8.7	8.7
2	545	13.7	22.3
3	550	13.8	36.1
4	503	12.6	48.7
5 – 7	1243	31.1	79.8
8 or more	805	20.2	100.0

Another way of looking at how often hospital EDs are on diversion at the same time is from the perspective of the total number of alert hours. For the 15 Baltimore City and County hospitals, we count the total number of hours that each hospital is on alert and sum across all hospitals. In 2001, there were 38,061 total yellow alert hours for the 15 hospitals in Baltimore City and County. On average, 4.7 hospitals were on alert in any given alert hour.[42] Less than 30 percent of all alert hours were attributable to 4 or fewer hospitals on alert. And almost half of alert hours were accounted for by seven or more hospitals on alert status simultaneously. As with the

[42] This mean is calculated by dividing 38,061 (the total number of alert hours for all hospitals) by 8032 (the total number of hours in the year--365 X 24=8,760 minus the 728 hours with no hospitals on alert.

previous approach, we get a picture of extensive periods of time with multiple hospitals on alert.

Table 10. Number of Hospitals on Alert, As Percent of Total Yellow Alert Hours, Baltimore City and County Only, 2001

Number of hospitals On alert status	Yellow alert hours (per hospital)	Yellow alert hours (all hospitals)	Percent of All Hours	Cumulative Percent of Hours
0	728	na		
1	1,145	1,145	3.0	3.0
2	1,193	2,386	6.3	9.3
3 – 4	1,996	6,921	18.2	27.5
5 – 6	1,589	8,679	22.8	50.3
7 – 9	1,398	11,003	28.9	79.2
10 or more	711	7,927	20.8	100.0
	8,760	**38,061**		

We also examined the duration of overlapping alert periods in order to see whether the length of the alert was related to the number of hospitals on alert at the same time. The average length of time that only one hospital was on alert was 1.7 hours and for two hospitals it was just over an hour.[43] We also looked at the duration of alerts separately for 3 to 15 hospitals being on alert at the same time. In almost all cases, the durations were slightly less than an hour and there was no apparent relationship between the duration and the number of hospitals on alert. Defined this way, a 5-hospital alert may end by becoming a 6-hospital alert or a 7-hospital alert may end by becoming an 8-hospital alert. In one of these situations, the true alert period is longer than what we measure here.

From a system perspective, these multiple hospital alerts are likely to be of as much concern whether they are five hospitals, eight hospitals, or eleven hospitals on alert together. Thus, we also looked at the duration of alerts for 3 *or more* hospitals simultaneously on alert. In this case, the mean duration was much longer--8.6 hours, indicating that after an average of 8.6 hours at least one of the hospitals would go off alert status. In the case of 5 or more hospitals on alert, the mean length of the alerts was 5.7 hours. There is considerable variation within alert durations as well; in the situation of 3 or more hospitals being on alert at the same time, one-quarter of the time the alert would last less than an hour and a half and one-quarter

[43] Under the approach used to measure alert duration, a 2-hospital alert ended if either of the hospitals went off alert. Thus, the duration is the continuous time that two hospitals are on alert simultaneously.

of the time the alert would last more than 15 hours. However, it is measured, it seems apparent that there were substantial periods of time with multiple hospitals on yellow alert status. [44]

The information presented here describes the considerable extent to which Maryland hospitals are resorting to the use of ambulance diversion to manage overcrowding in the ED. These statistics paint a picture of substantial ambulance diversion, with a disproportionate use concentrated within the more metropolitan areas. Multiple hospitals are frequently on alert status at the same time, suggesting that the EDs are experiencing considerable distress. At the same time, these statistics tell us little about what is happening within the ED when it begins an alert or whether there is a link among EDs that increases the frequency of multiple-hospital alerts. A greater understanding of the chain of events leading to the use of ambulance alerts is clearly needed before the problem of overcrowded emergency departments can be resolved.

Conclusions and Policy Implications

Within Maryland and across the nation, hospital emergency departments have been facing increasing pressures, with rising demand for services but little excess capacity and few effective strategies for handling the increased volume of patients. One of the outward signs of this strain is the growing use of ambulance diversion to lessen the patient flow into emergency departments. While the use of ambulance diversion may mitigate overcrowding for individual EDs, it is not an efficient system-wide nor long-term solution.

As Maryland policymakers and health care providers continue to grapple with these issues, we make the following recommendations based on the findings from this study:

1. **Continue to monitor health care provided to low-income and minority populations and the effect of ED overcrowding on access to care. In particular, the role of safety net providers in meeting the ongoing health care needs of these populations should be explored.**

From a public policy perspective, a central issue is the effect that overcrowding has on the quality of health care delivered in the ED. Some of the potential deleterious effects that have been cited include public safety at risk, prolonged pain and

[44] Looking at consecutive minutes with *no* hospitals on yellow alert, the mean time over the course of 2001 was just under 4 hours.

suffering, and long waits and dissatisfaction of patients.[45] In a nationwide survey of 836 EDs, 91 percent reported overcrowding as a problem and one-third reported specific poor health outcomes for patients as a result.[46] A recent study of 30 EDs in California indicated that 42 percent of patients waited longer than one hour and that longer waits were more frequent in hospitals located in low-income neighborhoods.[47] A study of the predictors of patients leaving the ED without being seen identified ED volume as the primary determinant.[48] The higher rates of ED use in Maryland seen for racial minorities, Medicaid enrollees, and the uninsured suggest that EDs serve as an important source of care for disenfranchised and vulnerable groups and that overcrowding may have a particularly adverse impact on these groups.

The empirical classification of visits suggests that there is significant use of Maryland EDs by individuals who could be treated in a primary care setting. In particular, young children, Medicaid enrollees, African Americans, and the uninsured disproportionately use the ED for non-emergent care. The literature points to a wide range of reasons for this use, including not having a regular source of care, lack of insurance or concern about payment, and convenience. The issue of convenience arises because many primary care providers do not offer evening hours or walk-in appointments but also because many individuals have expectations about their need or desire to receive prompt care. This use raises questions of whether there are organizational changes that hospitals can make to re-channel these patients to more appropriate settings. Some of these organizational innovations, such as adjacent urgi-care centers, are being put into practice in Maryland EDs and in other localities. As recommended by the Joint Work Group, the effectiveness of these arrangements--in terms of decreasing ED overcrowding, increasing access to health care for vulnerable populations, and improving health outcomes--needs to be more fully assessed. Any analysis should include an examination of the role of safety net providers such as community health centers (CHCs) and an assessment of the reasons that CHCs may not be meeting the ongoing health care needs of low-income and minority patients who seek care in the ED, particularly for non-urgent complaints.

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[45] Derlet RW and Richards JR. "Overcrowding in the Nation's Emergency Departments: Complex Causes and Disturbing Effects," *Annals of Emergency Medicine* 35:1, pp. 63-68, January 2000.

[46] Derlet RW, Richards JR, and Kravitz RI. "Frequent Overcrowding in US Emergency Departments," *Academic Emergency Medicine*, February 2001, Volume 8, Number 2.

[47] Lambe S, Washington DL, Fink A, Laouri M, Liu H, Scura Fosse J, Brook RH, and Asch SM, "Waiting times in California's emergency departments," *Annals of Emergency Medicine* January 2003, Volume 41, Number 1.

[48] Hobbs D, Kunzman SC, Tandberg D, and Sklar D. "Hospital Factors Associated with Emergency Center Patients Leaving Without Being Seen," *American Journal of Emergency Medicine*, Vol. 18, No. 7, November 2000.

2. **Gather information on organizational innovations undertaken by Maryland hospitals and assess the effectiveness of these efforts.**

Strategies for reducing overcrowding--through triaging or re-directing patients with less urgent needs or increasing the efficiency of existing capacity--have been described in the literature and should be considered for closer examination. One approach that has been tried elsewhere with mixed success is the direct diversion of low-acuity patients to next day primary care. An alternative is implementing a telephone-based nurse triage system or an ED-managed urgent care center to see patients with less complex needs. Other initiatives focus on increasing the efficient use of existing capacity including creating fast-track environments that reduce patient wait times, increase the turnaround time on lab and ancillary services. Information should be gathered on whether any of these arrangements have been tried at Maryland hospitals and how effective they have been at alleviating ED overcrowding. In the absence of direct experience, mechanisms for implementing such programs on an experimental basis should be explored. The impact of current financing arrangements also needs to be investigated in terms of the feasibility of implementing these initiatives and the ability of hospitals to re-coup their investments.

3. **Conduct an analysis of the relationship between ambulance diversions and inpatient occupancy rates.**

There is still much to be learned about what precipitates ambulance alerts. Data limitations preclude a straightforward analysis of the relationship between the volume of visits and alert status.[49] Moreover, there is some evidence that inpatient occupancy rates have a stronger relationship with ambulance diversion than does ED volume. In the Joint Work Group report, it is noted that, "(d)iscussions with Maryland hospital staff suggest that delays in the ability to transfer patients from the emergency department to appropriate inpatient units within the hospital are a significant factor contributing to congestion." This relationship is also noted in a Massachusetts study[50] where it is reported that "calls for diversion status now arise because of gridlock when hospitals are full and EDs are occupied with patients awaiting admission." As Recommendation #4 of the Joint Work Group suggests, there needs to be an investigation of the relationship between ED backlog and inpatient occupancy rates in the state, taking into account the alternative methods

[49] This is because there is no information on the time at which visits occur, so that visits cannot be linked to an alert unless the alert covers the entire day. Thus, when looking at the relationship between the volume of visits and alert status, one might observe a constant volume when what is really going on is an upswing in volume prior to the alert and a dropoff directly afterwards. A possible remedy would be to require hospitals to include hour of presenting at the ED in their records.

[50] The Massachusetts Health Policy Forum Issue Brief, Emergency Department Overcrowding in Massachusetts: Making Room in Our Hospitals, 2001.

for measuring occupancy rates. Data collection efforts currently underway at MHCC will provide the basis for such analysis.

All of this information is needed so that state policy makers and hospital administrators can better understand the possible avenues to lessen overcrowding of Maryland's emergency departments while ensuring that the state's more vulnerable subgroups continue to have access to health care services. Strategies have been identified for managing the growing demand for ED services, increasing efficiency so as to make the most of existing capacity, or physically expanding the size of EDs. Within each of these avenues there are multiple options that need to be considered along with available data and in light of the ongoing needs of the community.

Appendix A

Illustration of Use by Primary Service Area

The tabulations presented here are intended to illustrate the complexity of assessing where a hospital ED's patients come from and how the mix of patients might compare to what one would expect, given the hospital's location. Given the reputation of Johns Hopkins, this may be an extreme example though from the analysis of Zip Codes it is apparent that the majority of hospitals draw patients from a large and diverse geographic area. In addition to demonstrating that the hospital draws from a large area, the numbers presented here indicate that the composition of the patient population varies considerably with residential origin. For example, as shown in Table A1, three-quarters of all visits to the Johns Hopkins ED are made by black patients. However, the proportion of patients that are black varies considerably across the different geographic areas from which the hospital draws, with 88 percent of within-PSA visits by black patients but only 19 percent of visits from patients living outside of the state.

Table A1. Johns Hopkins ED
Main Hospital

	All ED Visits	Percent of Visits by Black Patients
Johns Hopkins PSA	60%	88%
Outside PSA		
Baltimore City	17%	84%
Other Baltimore Metro	16	44
Other Maryland	4	31
Non-Maryland	3	19
Total	100%	76%

Table A2 further illustrates the choices of patients in their ED care. Visit rates are shown for two Zip Codes that are close to the hospital. In Zip Code 21205, for example, almost three-quarters of black residents obtain their ED care at Johns Hopkins Hospital, compared to only one-quarter of white residents of the Zip Code. In another nearby Zip Code, approximately half of black patients choose to use Johns Hopkins while only 14 percent of whites do so. While visit rates (visits per 100 persons) are much higher for blacks than for whites, the Johns Hopkins visit rates for blacks are 4.5 to 6 times higher than for whites but the visit rates across all hospitals are less than double those for whites. Part of the complexity comes from the area covered by a single Zip Code. Zip Code 21205 is not only in the PSA of the main Hopkins hospital but also in the PSA of its Bayview Medical Center. Residents of the eastern portion of the Zip Code are closer to Bayview than to the main hospital.

Table A2. Case Study of Patients from 2 Zip Codes in Hospital Primary Service Area

	ED visits per 100 persons		Percent of visits to Johns Hopkins
	Johns Hopkins	All Hospitals	
Zip Code 21205			
Black residents	109	148	74%
White residents	24	97	25%
Zip Code 21224			
Black residents	60	124	49%
White residents	10	71	14%

Appendix B

Data and Methods

Data Sources

This project relied on a number of data sources, each of which is described briefly here.

HSCRC Hospital Ambulatory Care Data Set, 2001. This data file contains patient-level data on emergency department encounters to Maryland hospital emergency departments for the calendar year 2001. The file is maintained by the Health Services Cost Review Commission and an extract was prepared for use in this project. There is one record for each of approximately 2 million ED visits that did not result in a hospital admission. Variables of interest included in the file are:

- Demographic characteristics of the patient--age, race, and sex;
- Visit characteristics—
    - Date of visit
    - Diagnoses
    - Source of payment (primary and secondary)

HSCRC Inpatient File. The inpatient file includes records for all inpatient stays at Maryland hospitals. This file—also maintained by HSCRC—includes the only record of ED visits that resulted in a hospital admission. These records were identified by MHCC staff using a variable that specifically indicates whether the admission was through the ED. The selected records were then extracted for use in the analysis. Variables of interest include—

- Demographic characteristics of the patient--age, race, and sex;
- Visit characteristics—
    - Date of admission
    - Diagnoses
    - Source of payment (primary and secondary)

While the inpatient file includes a variable indicating whether the patient arrived as a walk-in or via ambulance, the ED file does not contain such and indicator. In both the inpatient and ED files, the patient identifier is unique within each hospital but not across hospitals. This means that visits for the same patient can be identified within a hospital, but when describing characteristics of users *across* hospitals, the characteristics of an individual who visits more than one hospital will be counted more than once.

County/Hospital Alert Tracking System (CHATS) data. The CHATS data, maintained by the Maryland Institute for Emergency Medical Services Systems (MIEMSS), includes information on hospital alerts. Variables include hospital identifier, type of alert, and the date(s) and time(s) that each alert begins and ends.

Other data sources. The algorithm used to classify visits by level of urgency and appropriateness was developed by researchers at the New York University Center for Health and Public Service Research with funding from The Commonwealth Fund, the Robert Wood Johnson Foundation, and the United Hospital Fund of New York. The algorithm was developed in consultation with ED and primary care physicians, using a sample of almost 6,000 ED records. Initial data used to created the algorithm included initial complaint, presenting symptoms, vital signs, medical history, age, gender, diagnoses, procedures performed, and resources used. Based on this information, each case was classified into one of the following categories:

- non-emergent;
- emergent/primary care treatable;
- emergent--ED care needed—preventable/avoidable; or
- emergent—ED care needed—not preventable avoidable.

Because this full set of information is not commonly available, these classifications were linked to a discharge diagnosis. For each diagnosis, the percentage of sample cases that fell into each category was used to develop the final algorithm. In addition to these groupings, we separate out visits that resulted in an inpatient admission. The algorithm is not meant to be used for cases involving a primary diagnosis of injury, mental health problems, alcohol, or substance abuse. Therefore, we report these visits as separate categories. After classifying visits using the algorithm, some proportion of visits will remain unclassified primarily because individual diagnostic categories represent too few visits to be reported separately.

We also used data from the 2000 Census to characterize Maryland residents statewide, by Maryland region, and by hospital primary service area (PSA). The Maryland regions are groupings of counties. Hospital primary service areas are defined by the Zip Codes that account for the greatest number of the hospital's patients. Census data were compiled by 5-digit ZCTA (or zipcode tabulation area). Breakdowns by population characteristics were then calibrated to Census population projections for July 1, 2001. Data on insurance status for Maryland residents was provided by MHCC staff and was based on estimates from the Current Population Survey (private insurance) and administrative files (Medicaid and Medicare). The number of uninsured is calculated as the total population minus the number of persons covered by private or public insurance.

Development of Analytic File(s)

The analytic files used to investigate the characteristics of patients using Maryland's EDs is a patient-level file, with a record for each patient-visit pair. Patient characteristics from the original files—such as age, sex, and race are appended to each record. The classification of race is limited to white, black, Asian, and other. While the inpatient file includes a variable indicating Hispanic ethnicity, the emergency department file does not include such a variable.

Payer data is classified as follows:

- Medicare, including Medicare HMOs
- Medicaid, including Medicaid HMOs
- Private, including Blue Cross of MD, Blue Cross of the National Capital Area or other Blue Cross; any commercial insurance, and any commercial HMO
- Other, including Title V, other government programs, worker's compensation, and other
- Uninsured, including self-pay and charity

The ambulance diversion data is analyzed at the hospital level for some analyses and merged with patient-level data by hospital for other analyses. When analyzing visit data relative to periods of alert status, we are limited by the availability of time indicators on the visit data. While CHATS data have time that alert starts and ends, the visit data only provide the date of service. Thus, when we assign a visit to an alert day, it is not clear whether the visit actually occurs during the alert, or before or after the alert.

Appendix C

Literature Cited in Review

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