

# Community Characteristics and Demographic Information as Determinants for a Hospital-Based Injury Prevention Outreach Program

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**Hypothesis:** To focus the efforts of a hospital-based injury prevention outreach program, information on patient demographics, community characteristics, and catchment area must be known.

**Design and Setting:** Evaluation of prospectively collected data maintained in the Trauma Registry of a level I university-based trauma center.

**Patients and Main Outcome Measures:** Demographics, mechanism of injury, mortality, and home ZIP codes of patients admitted to the Adult Trauma Service, The Johns Hopkins Medical Institution, Baltimore, Md, were compared for 2 separate calendar years, at 2 years before (1995) and at 2 years after (2000) the implementation of a dedicated trauma program that includes an injury prevention outreach program.

**Results:** The list of common patient ZIP codes varied minimally from 1995 to 2000. The 18 most common ZIP codes represent (1) 80% of patients, (2) total area of 99 square

miles (257.4 km<sup>2</sup>) (5.7-mile [9.1-km] radius), and (3) a region with a mean household income that is 67% of the statewide median. An increasingly disproportionate percentage of patients with gunshot wounds (GSWs) were the youngest patients (ages 15-24 years) treated by the Adult Trauma Service. While overall survival of trauma patients improved in 2000, no improvement was seen among patients with GSWs. Over half of the nonsurviving patients (37/65 [57%]) seen in 2000 and more than two thirds of patients with lethal GSWs (25/37 [67.6%]) were declared dead in the emergency department, suggesting nonpreventability from a clinical care standpoint.

**Conclusions:** The catchment area represented by the bulk of patients admitted to a level I urban trauma center is compact and economically disadvantaged. While overall trauma mortality has decreased, GSWs are more lethal and prevalent in teenagers and young men. This identifies violence prevention as an area of emphasis.

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THE AMERICAN College of Surgeons document entitled, "Resources for Optimal Care of the Injured Patient: 1999,"<sup>1</sup> stipulates that level I trauma centers are expected to have major activity in prehospital management, education, and injury prevention. Injury prevention activities may take on various forms and include endeavors such as promoting seat belt use for automobile occupants and helmet use for cyclists, as well as promotion of a broad range of violence prevention activities such as youth counseling, after school programs, and structured curricula in conflict resolution. To focus the efforts of a hospital-based injury prevention outreach program, information on patient demographics, community characteristics, and types of injuries seen must be known, so that each trauma center can structure a program that is relevant to its specific clinical experience. The availabil-

ity of mapping software has made it possible to identify high-volume injury areas that are served by a given trauma center. This article represents an effort by the personnel in a level I trauma center to assess patient demographics and community characteristics to configure an injury prevention outreach program.

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## METHODS

Prospectively collected data maintained in the Trauma Registry of a level I university-based trauma center were analyzed. The Trauma Registry is managed by the Collector software (Tri-Analytics, Bel Air, Md) and it collects 90 data elements on each trauma patient, including patient demographics, mechanism of injury, mortality and complications, and hospital charges. Patients' home addresses (not necessarily sites

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**Table 1. List of Top 18 Home ZIP Codes of Trauma Patients Treated by the Adult Trauma Service, The Johns Hopkins Hospital, Baltimore, Md, From 1995 to 2000, and the Characteristics of Those Neighborhoods**

ZIP Code	No. (%) of Patients	Area, Square Miles*	Population (1999)
21213	2213 (18.88)	3.43	37 252
21205	1292 (11.02)	2.17	17 653
21218	1161 (9.91)	4.13	50 673
21202	890 (7.59)	1.65	23 979
21224	713 (6.08)	8.87	45 822
21231	561 (4.79)	0.88	13 897
21206	550 (4.69)	7.22	46 643
21217	288 (2.46)	2.14	39 054
21239	246 (2.10)	3.23	29 167
21215	214 (1.83)	6.75	65 786
21212	207 (1.77)	4.70	32 078
21234	185 (1.58)	12.27	67 739
21216	182 (1.55)	3.34	36 244
21222	168 (1.43)	11.89	57 392
21223	154 (1.31)	2.58	29 189
21214	147 (1.25)	2.76	18 692
21229	134 (1.14)	6.07	48 945
21221	130 (1.11)	15.05	39 043
Cumulative	9435 (80.49)	99.13	699 248

\*English measurement conversion factor: To convert area to square kilometers, multiply by 2.6.

of injury) were entered into Microsoft MapPoint 2001 software (Microsoft Corp, Seattle, Wash) for mapping.

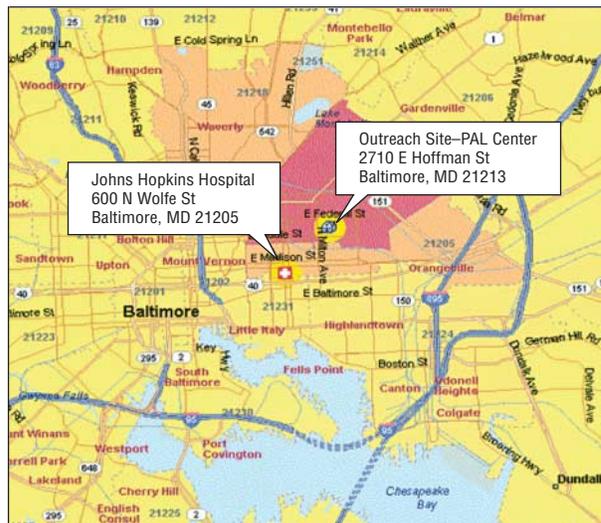
Elements of patient demographics, mechanism of injury, and patient outcomes were analyzed for 2 separate calendar years, at 2 years before (1995) and at 2 years after (2000) the implementation of a dedicated trauma outreach program. The features of the trauma outreach program implemented in 1997-1998 included 24-hour in-house faculty, regular multidisciplinary performance improvement meetings, trauma core curriculum, and an injury prevention outreach program (slide and videotape presentations, hospital visits to see survivors of gun violence) geared toward at-risk youth in the hospital catchment area.

## RESULTS

The list of frequently appearing patient home ZIP codes varied minimally from 1995 to 2000. About 80% of the trauma patients reside in 18 ZIP codes (**Table 1**) that have a total area of 99 square miles (257.4 km<sup>2</sup>), or approximately a 5.7-mile (9.1-km) radius (**Figure**). The mean household income in this region is 67% of the median for the state, according to the database in Microsoft MapPoint 2001.

**Table 2** gives the total number of patients along with sex, mechanism of injury, age breakdown, and mortality. Although the number of patients with gunshot wounds (GSWs) admitted to this level I trauma center dropped dramatically toward the end of the decade, an increasingly disproportionate percentage of patients with GSWs was the youngest patients (ages 15-24 years) treated by the Adult Trauma Service, The Johns Hopkins Medical Institution, Baltimore, Md (62.0% in 2000 vs 53.5% in 1995,  $P=.03$ ).

Although overall survival of trauma patients improved in 2000, no improvement was seen among patients with GSWs (**Table 3**). Over half of the nonsur-



Distribution of trauma patients evaluated by the Adult Trauma Service, The Johns Hopkins Hospital, Baltimore, Md, from 1995 to 2000. About 80% of the trauma patients reside in the areas shaded in red, orange, and tan. PAL indicates Police Athletic League.

**Table 2. General Characteristics of Trauma Patients\***

Variable	1995	2000	P Value
Total No. of patients	1641	2139	
Males	1280 (78)	1453 (68)	<.01
Penetrating trauma	652 (39.7)	492 (23.0)	<.01
GSWs†	432 (26.3)	271 (12.7)	<.01
Males among patients with GSWs	391 (91)	255 (94)	.12
Age, y 15-24†	532 (32.4)	710 (33.2)	.62
Age, y 15-24 among GSWs	231 (53.5)	168 (62.0)	.03

Abbreviation: GSW, gunshot wounds.

\*Data are given as the number (percentage) of trauma patients.

†The percentage is for the total number. Calendar year 1995 indicates 2 years before and 2000, 2 years after, the implementation of a dedicated trauma program including an injury outreach program.

living patients (37/65 [57%]) seen in 2000 and more than two thirds of the patients with lethal GSWs (25/37 [67.6%]) were declared dead in the emergency department, suggesting nonpreventability from a clinical care standpoint.

## COMMENT

Injury prevention activities are becoming an increasingly important component of the activities of a level I trauma center. The pursuit of reducing the effect of injury, once limited to resuscitation and surgical and postoperative clinical management, has advanced to the point where the vast majority of patients arriving alive at trauma centers will ultimately survive.<sup>2-4</sup> Further improvement in mortality must, therefore, include considerations of the particulars of prehospital management and true injury prevention.<sup>5,6</sup> Each trauma center is likely to focus its injury prevention activities in a way that is most relevant to its clinical experience.<sup>7-9</sup> It is clear that our trauma center draws the bulk of its patients from a relatively compact and economically disadvantaged area surrounding

**Table 3. Outcome Differences of Trauma Patients\***

Outcome	1995	2000	P Value
Mortality, No. (%) of trauma patients†	86 (5.2)	65 (3.0)	<.01
Mortality among patients with GSWs, No. (%) of trauma patients	49 (11.3)	37 (13.7)	.36
Deaths in ED‡	39/86 (45.3)	37/65 (56.9)	.16
Deaths in ED among patients with lethal GSWs excluding ED deaths	30/49 (61.2)	25/37 (67.6)	.54
Overall mortality	47/1602 (2.9)	28/2074 (1.4)	<.01
Death among trauma patients with an ISS >15	44/202 (21.8)	26/160 (16.3)	.19
Death among trauma patients with a head injury AIS score ≥3	31/134 (23.1)	17/117 (14.5)	.08

Abbreviations: AIS, Abbreviated Injury Severity; ED, emergency department; GSWs, gunshot wounds; ISS, Injury Severity Score; SBP, systolic blood pressure.

\*Data are given as the number (percentage) of trauma patients over the total number of trauma patients unless otherwise indicated. Calendar year 1995 indicates 2 years before and 2000, 2 years after, the implementation of a dedicated trauma program including an injury outreach program.

†The percentage is for the total number of trauma patients.

‡The percentage is for all of the deaths.

the hospital. Although patients' addresses are reliably recorded and mapped, we are unable to achieve the same specifics regarding the site of injury because (1) some paramedic run sheets are missing, and (2) patients who get to the hospital without Emergency Medical Services assistance could not provide details on the location of where the injury occurred. However, well-established triage patterns describe a scene-of-injury catchment area for our trauma center that is similar to the area provided by the mapping software used for addresses.

Inspection of Table 2 may raise questions as to why injury prevention activities at our trauma center focuses on prevention of GSWs and intentional injuries in at-risk youths. Why focus on prevention of GSWs when it represents a dramatically decreased proportion of our clinical activity (12.7% in 2000 vs 26.3% in 1995,  $P < .01$ )? The answer is found in both the demographic information and the mortality data. Although penetrating trauma represented a less common mechanism of injury in the year 2000, patients in the earliest decade of life (ages 15-24 years) treated by the Adult Trauma Service represented a dramatically greater proportion of all GSWs. While this age group represented 33% of the total number of patients admitted to the Adult Trauma Service, they represented almost two thirds of the patients admitted with GSWs. More importantly, as the implementation of the dedicated trauma program was associated with a significant decrease in overall mortality (Table 3), no progress was made in saving patients presenting with GSWs.

The importance of true injury prevention is highlighted when one looks at Table 3. Almost 99% of patients leaving the emergency department alive in 2000 ultimately survived, a significant improvement over 1995. While the numbers were not large enough for trends in mortality reduction among the more severely injured subset (Injury Severity Score >15, or severe head injury) to

achieve statistical significance, there was not even a suggestion of improvement in mortality among patients with GSWs because two thirds of those who died were either dead on arrival or declared dead shortly thereafter. Therefore, we have established a multidisciplinary community outreach collaborative targeting youth residing in the area responsible for the greatest number of trauma patients with GSWs. We have developed a relationship with the Police Athletic League Center located in the high-volume region (Figure, outreach site). Specific interventions include dissemination of videotapes aimed at adolescents dramatizing the true consequences of gun violence, slide presentations by health care professionals graphically depicting the anatomical damage produced by gun violence, hospital tours to visit survivors of interpersonal violence, and inpatient counseling and outpatient referral and follow-up for young trauma patients whose injuries were alcohol and/or drug related.

## CONCLUSION

Since most patients with lethal GSWs are declared dead shortly after arrival in the emergency department and these injuries disproportionately affect the youngest segment of the population, and most importantly, since the mortality of GSWs did not improve despite a broad-reaching institutional commitment to overall trauma care, we have identified violence prevention among at-risk youth as a major area of emphasis in our hospital-based injury prevention outreach program.

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## REFERENCES

- American College of Surgeons Committee on Trauma. *Resources for Optimal Care of the Injured Patient: 1999*. Chicago, Ill: American College of Surgeons; 1999.
- Demetriades D, Berne TV, Belzberg H, et al. The impact of a dedicated trauma program on outcome in severely injured patients. *Arch Surg*. 1995;130:216-220.
- Luchette F, Kelly B, Davis K, . Impact of the in-house trauma surgeon on initial patient care, outcome, and cost. *J Trauma*. 1997;42:490-497.
- O'Keefe GE, Jurkovich GJ, Copass M, Maier RV. Ten-year trend in survival and resource utilization at a level I trauma center. *Ann Surg*. 1999;229:409-415.
- Cornwell EE III, Kennedy F, Berne TV, Asensio J, Demetriades D. Gunshot wounds to the thoracic aorta in the '90's: only prevention will make a difference. *Am Surg*. 1995;61:721-723.
- Stewart RM, Myers JG, Dent DL, et al. Seven hundred fifty-three consecutive deaths in a level I trauma center: the argument for injury prevention. *J Trauma*. 2003; 54:66-71.
- Cooper A, Barlow B, Davidson L, Relethford J, O'Meara J, Mottley L. Epidemiology of pediatric trauma: importance of population-based statistics. *J Pediatr Surg*. 1992;27:149-154.
- Durkin MS, Davidson LL, Kuhn L, O'Connor P, Barlow B. Low-income neighborhoods and the risk of severe pediatric injury: a small-area analysis in northern Manhattan. *Am J Public Health*. 1994;84:587-592.
- Laraque D, Barlow B, Durkin M, Heagarty M. Injury prevention in an urban setting: challenges and successes. *Bull N Y Acad Med*. 1995;72:16-30.