

The Impact of a Mature, Urban Trauma System on Homicide Rates

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Background

Approximately 50,000 people are victims of homicide each year in the United States. Homicide rates, which have declined between 1995 and 2006 (1) are highest among 20-24 year olds and African-Americans. The majority (64.5 percent) of homicides are committed with firearms, followed by sharp instruments and then other various methods. The decline in the homicide rate during the 1990s has been attributed to a variety of factors including an increase in incarcerations, reductions in the prevalence of firearms, and improvement in economic conditions (2). However, homicide rates are a function of several components including the violent crime rate and the likelihood of death once injured (i.e., the case fatality rate). It has been hypothesized that the homicide rate is reduced with improvements in pre-hospital techniques, most importantly improved transportation. The purpose of this study is to decompose the homicide rate into its components in order to identify those that are related to trauma care and are affected by the presence of a trauma system.

Methods

Study Population

- The Birmingham Regional Emergency Medical Services System regional trauma care coverage began in 1996 and included six counties in North Central Alabama through 2006
- The system covers a population of 1.2 million people and responds to 200,000 emergencies per year on average
- BREMSS is comprised of approximately 180 emergency medical services, 2800 EMTs, and 20 9-1-1 agencies
- Contains three level-I certified trauma centers (one of which is pediatric) and seven level-III centers.

Study Data

- Information regarding violent crimes and homicides that occurred in Birmingham from 1997 to 2006 was collected using annual Uniform Crime Reports from the Federal Bureau of Investigation
- Information regarding serious injuries—defined as an injury which required the individual to be admitted to the hospital or resulted in an on-scene death—was obtained from the University of Alabama at Birmingham trauma center.
- Deaths due to violent crime-related serious injury were categorized according to the time from injury to the time of recorded death (i.e., on scene, ≤2 hours, > 2 hours)

Analysis

- Homicides are defined as deaths that occur due to intentional injuries (i.e., stabbing, gunshot wounds, or assaults). The homicide rate (HR) can be decomposed into its individual components. That is, the rate is the product of the violent crime (VC) rate (defined as the number of homicides and aggravated assaults per 100,000 population), the number of serious injuries (SIs) per VC, and the number of homicides (H) per SI (i.e., the CFR). This can be expressed by the equation:

$$HR = \frac{H}{100,000} = \frac{VC}{100,000} \times \frac{SI}{VC} \times \frac{H}{SI}$$

- Negative binomial and logistic regression was used to estimate trends for rates and proportions, respectively

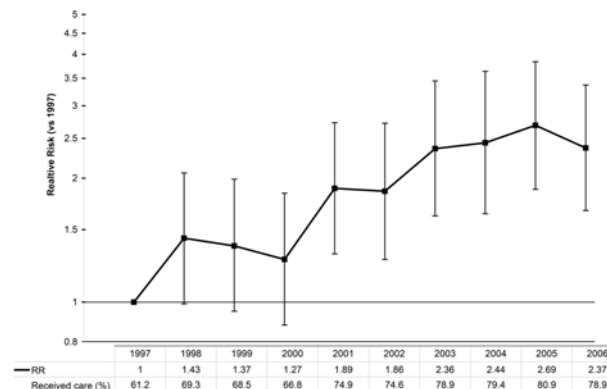
Results

Table 1. Comparison of violent crime and homicide-related statistics by year, 1997-2006

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	trend p-value*
Violent Crimes (VCs)	3785	3640	2843	2947	3027	3187	3347	3261	3449	3175	
Violent crime-related serious injuries (SIs)	258	251	241	238	279	248	284	243	383	375	
Homicides	108	85	81	89	80	71	87	64	105	109	
Homicide rate (per 10,000 persons)	3.92	3.21	3.17	3.51	3.28	2.90	3.62	2.69	4.49	4.67	0.23
VC rate (per 10,000 persons)	137.5	137.5	111.9	116.1	124.2	130.1	139.4	136.9	147.4	135.9	0.16
SI incidence rate (per 100 VCs)	6.8	6.9	8.5	8.1	9.2	7.8	8.5	7.5	11.1	11.8	<0.0001
Case fatality rate (per 100 SIs)	41.9	33.9	33.6	37.4	28.7	28.6	30.6	26.3	27.4	29.1	<0.0001
Mortality (%)											
Died on scene	92.6	90.6	93.8	88.8	87.5	88.7	69.0	78.1	69.5	72.5	<0.0001
Died >0-2 hours	4.6	7.1	4.9	6.7	5.0	1.4	18.4	20.3	20.0	24.8	<0.0001
Died >2 hours	2.8	2.4	1.2	4.5	7.5	9.9	12.6	1.6	10.5	2.8	<0.05
SIs that received medical care (%)	61.2	69.3	68.5	66.8	74.9	74.6	78.9	79.4	80.9	78.9	<0.0001

* Trend tests based on negative binomial or logistic regression for rates and proportions, respectively

Annual trend in the proportion of individuals seriously injured by violent crimes who received trauma care, 1997-2006



Discussion

The results of the current study suggest that a mature trauma system is associated with the violent crime CFR. This can be attributed to an increased proportion of injured individuals who are able to receive pre-hospital and trauma care, as evidenced by the declining proportion of deaths that occurred on-scene. In addition, the survival benefit observed in the current study is similar to research that has described similar benefits for trauma centers regardless of injury intent (3-6).

The current study was strengthened by the long period of observation, which allowed the long-term impact of a trauma system to be assessed, and by the use of urban homicides only. Because survival is decreased for rural homicides due to increased transport times, including these homicides would result in biased estimates if the number of rural homicides were differential across years.

The current study was limited by the lack of pre-hospital data (e.g., time of injury, time to injury scene, and total transport time), which did not allow for assessment of whether the time from injury to hospital admission decreased along with decreasing CFR. Also, the presence and subsequent closing of a second trauma center in the city may have caused the survival benefit of trauma care to be overestimated due to an underestimation of the denominator of the CFR (i.e., the number of serious injuries)

Conclusion

While the rate of violent crime-related serious injuries increased in the study period, the homicide rate, for the most part, remained unchanged. The relative stability of the homicide rate can be partly attributed to a decrease in the CFR which itself may be attributed to the establishment of an organized trauma system. It should be noted, however, that the recent increases in the homicide rate were accompanied by increases in the incidence of serious injury. While the current results do suggest that trauma care can help to minimize the burden of homicides, the fact that serious injury incidence rates have increased in recent years highlights the importance of violence prevention in addition to trauma care resources.

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