

Epidemiology of Injury and Violence in North Carolina

Scott Proescholdbell, Katherine J. Harmon

Injury and violence are significant public health problems in the state, on par with other leading causes of deaths. This article reviews the leading causes of injury-associated deaths, hospitalizations, and emergency department visits for North Carolina residents; outlines data resources and policy implications; and facilitates further discussion on injury epidemiology and surveillance needs.

Every day in North Carolina, 17 people die as a result of an unintentional injury or an act of violence (North Carolina State Center for Health Statistics [SCHS], unpublished data, 2010). Injury and violence are significant public health problems in the state, on par with other leading causes of deaths. Moreover, hospitalizations and emergency department (ED) visits related to injury and violence represent a significant number of admissions to health care facilities each day in North Carolina (SCHS, unpublished data, 2010; North Carolina Disease Event Tracking and Epidemiologic Collection Tool [NC DETECT], unpublished data, 2010). It is estimated that 1 in 4 Americans visit their physician each year for an injury-related event [1]. Yet, injury and violence seem to lack the public recognition that these significant numbers would seem to garner.

This article reviews the leading causes of injury-associated deaths, hospitalizations, and ED visits for North Carolina residents; outlines data resources and policy implications; and facilitates further discussion on injury epidemiology and surveillance needs. Unless otherwise indicated, data are from the SCHS (unpublished, 2010).

The greatest burden of injuries falls on younger people. Unintentional injuries are, collectively, the leading cause of death among people aged 1-44 years in both the nation and North Carolina. Analyses that account for years of potential life lost reveal that injury and violence lead the state by a wide margin, with nearly 20 years of potential life lost on average (Table 1) [2]. Furthermore, when unintentional injuries are combined with violence-related events, they are the third leading cause of death among all North Carolinians, after cancer and heart disease.

There are common misconceptions that injuries are "random," "accidents," "acts of nature or god," "unexplained," or "destined to occur." However, when carefully and closely examined, the vast majority of injuries have predictable patterns, have known risk factors, and affect specific populations, thus providing opportunities for intervention and

Table 1.
Leading Causes of Death in North Carolina

Cause(s)	Deaths, no.	Years of potential life lost ^a	
		Per death, mean	Total
Cancer	17,476	3.46	60,420
Heart disease	17,133	2.70	46,269
Injury, violence	6,074	19.29	117,143
Stroke	4,391	1.96	8,602
Chronic lower respiratory disease ^b	4,324	1.31	5,646
Alzheimer disease	2,645	0.04	112
Diabetes mellitus	2,107	3.40	7,165
Hypertension	796	2.40	1,912
Atherosclerosis	215	0.78	168
Any	76,948	5.06	389,358
Chronic disease only	51,846	2.73	141,294

Note. Values in boldface represent the peak in each column. Data are from [2].

^aBased on deaths that occurred prior to age 65 years.

^bDefined as asthma or chronic obstructive pulmonary disease.

Scott Proescholdbell, MPH head, Injury Epidemiology and Surveillance Unit, Injury and Violence Prevention Branch, Division of Public Health, North Carolina Department of Health and Human Services, Raleigh, North Carolina (scott.proescholdbell@dhhs.nc.gov).

Katherine J. Harmon, MPH Council of State and Territorial Epidemiologists applied epidemiology fellow, Chronic Disease and Injury Section, Division of Public Health, North Carolina Department of Health and Human Services, Raleigh, North Carolina (katherine.harmon@dhhs.nc.gov).

prevention. Injury and violence cover a broad array of subjects and overlap many disciplines. The injury and violence umbrella is diverse; topics range from car seat use to homicides, and disciplines include public health, public safety, and transportation. To a certain extent, this breadth and crossover create challenges to defining the field and performing comprehensive surveillance.

Intention is a fundamental construct in the injury and violence field. Injuries are divided largely between intentional events and unintentional events. Intentional acts are defined as active, deliberate uses of force against oneself (eg, suicide or attempted suicide) or another person (eg, assault or homicide), whereas unintentional acts are defined as events in which a harmful outcome was not sought and the injury occurs within a short time frame (eg, injury due to motor vehicle traffic [MVT] crash, injury, falls, and poisoning). Fundamentally, injuries are categorized by intent. Clearly, in terms of prevention and intervention, this distinction is critical. Injuries whose intents are unknown or whose data coding is incomplete are counted differently or not at all. Completeness of coding for injury and violence is an important issue for accurate and comprehensive surveillance. North Carolina is fortunate to have many surveillance

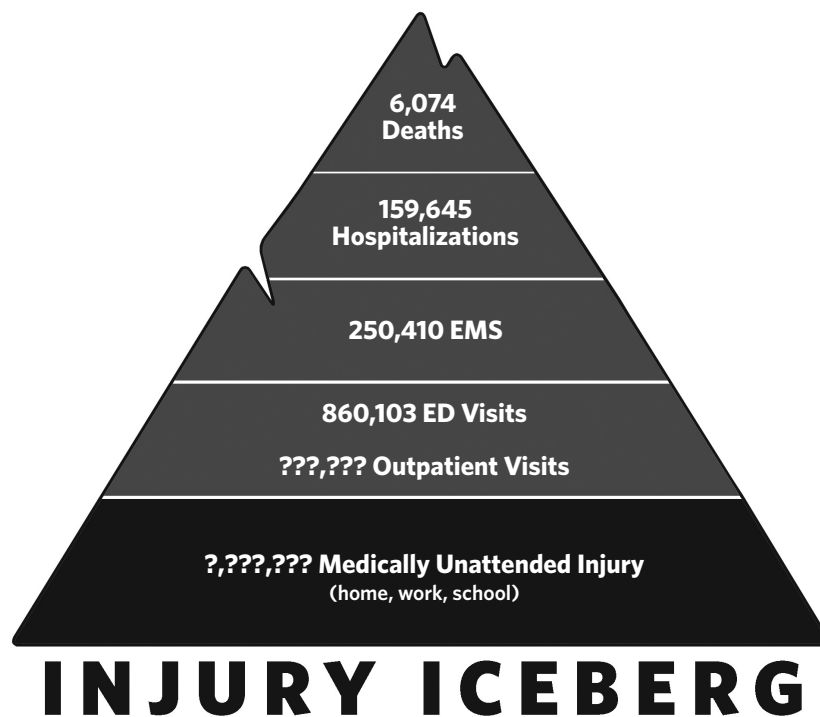
systems in place that are high quality and readily available for public health use. For example, the SCHS maintains death certificates and hospital-discharge data. The department of emergency medicine at the University of North Carolina School of Medicine, in conjunction with the North Carolina Division of Public Health, maintains the NC DETECT (available at: <http://www.ncdetect.org>), a statewide syndromic-surveillance system of data from EDs and other sources.

The ultimate goal of injury epidemiology and surveillance is to provide meaningful information that can direct actions to prevent morbidity and early death. A focus on preventing morbidity and early death is especially pertinent to younger populations, because they experience the greatest injury burden and have the potential to lose the greatest number of productive years of life. Data-driven programs and interventions can lead to the reduction and prevention of injuries. It is hoped that increased understanding of the scope and burden of injuries can significantly decrease early deaths, injuries, and injury-related disabilities, thereby allowing people to live their lives to the fullest potential.

Overall, injury and violence resulted in more than 6,000 deaths among North Carolina residents in 2009 (Figure 1). In 2009, 68% of injuries were unintentional, 28% were intentional, and 4% were undetermined, due to legal intervention, or due to other intents. Sixty-seven percent of deaths involved males, and 33% involved females. A total of 76% of deaths occurred among residents aged 25 years or older. Whites (79%) and blacks (18%) had the largest percentage of deaths, but adjustment for population size yielded percentages that were very similar to the state's overall demographic composition. However, in specific injury areas (eg, unintentional poisoning and homicide), the number of injury-associated deaths per 100,000 persons varied significantly.

Figure 1 also highlights several limitations in surveillance data. For example, the number of outpatient visits associated with injuries, as well as the number of North Carolina residents with an injury that was medically unattended, were unknown for 2009. In addition to the limitations highlighted in Figure 1, there are further constraints on the injury surveillance data in North Carolina. Currently, Hispanic ethnicity and race are specified on death certificates; however, this information is unavailable for hospitalization and ED data.

Figure 1.
Injury and Violence Iceberg for North Carolina, 2008 and 2009



Note. Data on hospitalizations are from 2008 (North Carolina State Center for Health Statistics [SCHS]; unpublished, 2010), and data on deaths (SCHS, unpublished, 2010), emergency medical services (EMS; North Carolina Office of EMS, unpublished, 2010), and emergency department (ED) visits (North Carolina Disease Event Tracking and Epidemiologic Collection Tool, unpublished, 2010) are from 2009.

Also, many counties have so few deaths in a given year that their mortality rates are considered statistically unrepresentative and unreliable.

The 3 leading causes of death due to unintentional injury in 2009 were MVT crashes (1,342 deaths), poisoning (1,036 deaths), and falls (837 deaths) (Figure 2). Suicide (1,161 deaths) and homicide (826 deaths) were the leading causes of deaths due to intentional injury. Combined, these 5 causes accounted for more than 75% of deaths in 2009, similar to past years. Decreases or increases in these areas will measurably impact the overall toll of injury and violence in the state. Consideration of the mechanism of injury, regardless of intention, reveals that MVT crashes (1,342 deaths), poisoning (1,308 deaths), and firearms (1,109 deaths) were associated with a significant proportion (62%) of deaths.

Although the number of deaths related to MVT crashes decreased by 400 from the 10-year peak of 1,742 deaths observed in 2006, MVT crashes were still the leading cause of injury-related death in the state during 2009. The age-adjusted rate of death due to MVT crash-related injuries during this period was 14.1 deaths/100,000 persons. Males were more than twice as likely as females to die of injuries due to MVT crashes (20.3 vs 8.4 deaths/100,000 persons).

Poisoning was the second-leading cause of death due to unintentional injury during 2009, and the rate of poisoning-related death increased by more than 210% since 1999. There were 1,036 deaths due to unintentional poisoning (11.1 deaths/100,000 persons) in 2009, for an average of 3 poisoning-related deaths per day. Poisoning rates tended to be higher in the western region of the state.

The third-leading cause of death due to unintentional injury during 2009 was falls. Death due to injuries associated with falls increased from 5.3 to 8.8 cases/100,000 persons between 1999 and 2009, a difference of almost 70%. Rates were slightly higher among males, compared with females, and among whites, compared with other racial groups.

In 2009, suicide was the leading cause of death due to intentional injury in North Carolina and the second-leading cause of death due to any injury, after MVT crash-related injury. The age-adjusted rate of suicide-related death was 12.2 cases/100,000 persons. Rates of suicide were highest among males and whites. Homicide was the second-leading cause of death from intentional injury in North Carolina during this period. The rate decreased by approximately 30% since 1999, to 6.0 deaths/100,000

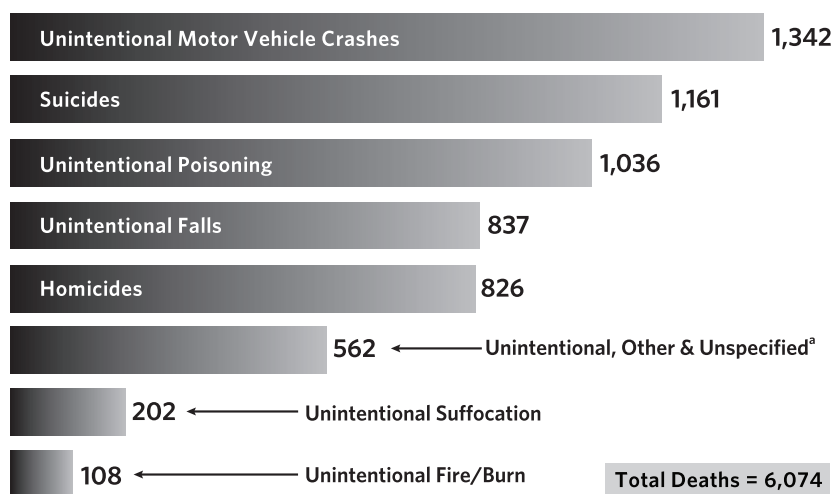
persons. Suicide and homicide rates among males were over 3 times the rates among females, and rates among African Americans and American Indians were approximately 4 times the rates among whites. For both suicide and homicide, firearms were the leading mechanism of death.

In 2008, there were nearly 160,000 hospitalizations for treatment of an injury or violence-related event. Of the 119,431 hospitalizations for which the intent was coded, 46% involved an unintentional event, and 8% involved an intentional event. It should be noted that nearly 25% of hospitalizations resulting from injury or violence (40,214) were missing external cause of injury codes (E-codes), which are used to code intention. Females represented 52% of admissions, whereas males represented 48%. More than 84% of admissions related to injury or violence involved people aged 35 years or older. Although there were some regional variations, by and large the state trends held true at the county level for the vast majority of hospitalizations related to injury or violence.

In 2008, the leading cause of hospitalization due to unintentional injury was falls. The age-adjusted rate of hospitalization due to an unintentional fall was 280.5 hospitalizations/100,000 persons. The rate increased with age and peaked at 4,645.6 hospitalizations/100,000 persons for individuals older than 84 years. The rates for MVT crash-related injury and poisoning were 77.2 and 39.6 hospitalizations/100,000 persons, respectively.

In 2008, 70.8 hospitalizations/100,000 persons occurred because of self-inflicted injury. Although the mortality rate due

Figure 2.
Leading Causes of Injury-Related Death in North Carolina, 2009



Note. Data are no. of deaths (North Carolina State Center for Health Statistics, unpublished, 2010).

^a“Unintentional, other” comprises several smaller defined causes of death, whereas “unintentional, unspecified” refers to unintentional deaths that were not categorized, owing to coding challenges.

Interest and Need Greatly Outpace Resources for Youth Suicide Prevention

Sherry Lehman, Jane Ann Miller

The North Carolina Division of Public Health's Injury and Violence Prevention Branch was awarded the Garrett Lee Smith Memorial Suicide Prevention Grant in 2008. The intent of the grant was to provide suicide prevention strategies to youths in school systems across the state. The need for this funding has long been apparent on the basis of youth suicide statistics, but no one expected the overwhelming support and desire for training that school staff expressed.

Trainees included school nurses, social workers, teachers, principals, and other school administrators. Trainings were held in 8 regions across the state, covering 30 school systems. Through a partnership with the North Carolina Comprehensive School Health Training Center (NCCSHTC), a total of 9 Applied Suicide Intervention Skills Training (ASIST) sessions, 11 safeTALK training sessions, and 6 Lifelines training sessions were held. All 3 trainings are evidence based. As a result of these activities, 409 school personnel were trained in how to recognize the signs and symptoms of suicide among youths. To date, 68 students have been identified as at risk for suicide; 61 were referred for services, of whom 10 were younger than 10 years.

Recent attention on suicide among military personnel has emphasized the need to strengthen suicide prevention for service members. The Garrett Lee Smith funding has allowed prevention efforts to go one step further by inviting staff at schools with a high percentage of students whose parents are in the military to participate in the Lifelines curriculum trainings. Personnel at Fort Bragg, Camp Lejeune, and other military bases have capitalized on the opportunity.

This winter, youth suicide education will continue for public school staff, with additional ASIST and safeTALK trainings. The scope of the grant will expand to involve institutions of higher education across the state. Ten regional trainings will be offered to staff of community colleges, as well as staff at the University of North Carolina (UNC)-Chapel Hill and North Carolina State University. To complete the full range of suicide education services, a training on postvention response will be offered to the NCCSHTC training cadre. Postvention curricula are used to teach people how to respond to individuals, families, and friends of a person who has attempted or

completed a suicide. Following the postvention training of trainers, 6 regional workshops will be offered for staff at the public schools.

The Injury Prevention Research Center at UNC-Chapel Hill is evaluating the effectiveness of the ASIST and safeTALK trainings. Training participants were given a pretest before the workshop, to measure knowledge and skills, and a posttest after the workshop, to measure any differences. Analyses of the test results indicated positive findings for multiple learning objectives.

Personal responses from the participants have been encouraging. Paulina Etzold, from Burnsville, North Carolina, commented, "Thanks for such an excellent training. I am weary of so many mediocre workshops/trainings/meetings and greatly appreciate attending events that matter." One participant had her new skills reinforced through practice. Bill McCullough, from the Cleveland County school system, reported that during the week after a staff member attended the training, the individual saved a student's life by preventing a suicide attempt. Dr. Antonio Blow, from the Greene County school system, requested that we return to his system and train every school counselor in the county's schools.

During 1999-2006, North Carolina lost almost 1,100 young people 10-24 years old to suicide. This number reflects an average of 135 deaths per year, making it the third-leading cause of death among individuals aged 10-24 years. These numbers do not have to repeat themselves every year: suicide is a preventable public health problem. For more information about suicide prevention, please visit the Injury and Violence Prevention Branch Web site (available at: <http://www.injuryfreenc.ncdhhs.gov>). NCMJ

Sherry Lehman, MEd, LPC school consultant, Youth Suicide Prevention Program, Injury and Violence Prevention Branch, Division of Public Health, North Carolina Department of Health and Human Services, Raleigh, North Carolina (sherry.lehman@dhhs.nc.gov).

Jane Ann Miller, MPH consultant, Injury and Violence Prevention Branch, Division of Public Health, North Carolina Department of Health and Human Services, Raleigh, North Carolina (jane.miller@dhhs.nc.gov).

to self-inflicted injury (ie, suicide) was higher among males, the rate of hospitalization was higher among females (82.8 vs 59.1 hospitalizations/100,000 persons). Poisoning was the leading mechanism of self-inflicted injury and accounted for 81% of all related hospitalizations.

A total of 30.1 hospitalizations/100,000 persons occurred during 2008 because of assault-associated injuries. The most common assault-associated cause of hospitalization involved being struck by a person or object (27% of cases), followed closely by firearms (23% of cases).

There were more than 860,000 ED visits in North Carolina associated with injury or violence during 2009. Of the visits for which an intent was coded, unintentional injuries accounted for the vast majority (88%), whereas intentional, undetermined, and other intent were associated with only 12%. More than 20% of ED visits were missing E-codes. Males and females were equally likely to visit the ED because of injury or violence. A total of 51% of ED visits occurred among people aged 20-64 years, with the remaining visits occurring among people aged younger than 20 years or older than 64 years.

In 2009, more than 182,000 (21.2%) of ED visits were related to unintentional falls (NC DETECT, unpublished data, 2010). The rate of ED visits related to unintentional falls was 1,947.8 visits/100,000 persons. Unlike the mortality rate for unintentional falls, the rate of ED visits was greater among females than among males (2,093.0 vs 1,740.9 visits/100,000 persons). MVT crash-related injury was the cause of an additional 88,842 ED visits (956.6 visits/100,000 persons). The rate of ED visits associated with MVT crash-related injury was considerably higher among individuals aged 15-24 years (ie, 1,905.3 visits/100,000 persons) than among those in other age groups. Compared with other types of injury, the number of ED visits due to unintentional poisoning was relatively low (101.3 visits/100,000 persons).

In 2009, there were more ED visits related to assault (31,386 visits) than to self-inflicted injury (9,830 visits) (NC DETECT, unpublished data, 2010). The rate of ED visits due to assault was 341.9 visits/100,000 persons. Among ED visits, the most commonly cited cause of an assault-related injury was being struck (52% of cases). The ED visitation rate for self-inflicted injury was 106.5 visits/100,000 persons. The most frequently specified mechanism of self-inflicted injury that yielded an ED visit was poisoning (69% of cases).

Policy Implications

Given the scope and range of injury and violence, timely, regular, and comprehensive data are essential for the creation of public policy. Moreover, for prevention programs to be successful, it is imperative that they decrease morbidity and mortality over the long term. We need to move from data collection to supporting the creation of evidence-based prevention programs and to translating these programs into successful community interventions. For successful translation and dissemination to occur, we need to maintain and improve our data sources and to develop new sources to address existing data gaps. With high-quality data, targeted and specific interventions will reduce the toll of injury and violence in communities across North Carolina. As the body of evidence around injury and violence grows, data will play an even greater role in the public policy arena in shaping and informing public policy decisions.

Discussion

Injury and violence wreak a tremendous toll on the

health and well-being of North Carolinians. As surveillance systems improve, programs will benefit by becoming more data driven. As the need to evaluate strategies and interventions grows, data systems and prevention programs will improve. An important but often neglected area is the development of partnerships among key data stakeholders. Developing ongoing relationships with the agencies and people who manage data sources can be beneficial. A growing area for opportunity involves linking disparate data systems. These linkage projects have provided a wealth of information that any one system alone cannot provide. Two of the best examples in the areas of injury and violence are the North Carolina Violent Death Reporting System (NC VDRS) and the Fatal Analysis Reporting System (FARS) for MVT crashes, injuries, and fatalities. The NC VDRS works to link medical examiner reports, vital records, and law enforcement data to better understand homicide, suicide, and other types of violent deaths. FARS links MVT crash information with injury-related events and deaths. These linkages enable programs to use variables gathered for one specific purpose or perspective to examine a wide range of variables used for other purposes. For example, the ability to combine basic demographic characteristics with circumstances leading to the violent death is possible only because of the NC VDRS. North Carolina must continue to improve the data systems that are used for injury and violence and to expand them where needed. As previously mentioned, E-coding continues to be problematic for both hospital-discharge and ED-visitation data. Completeness of E-coding is critical in order to fully understand the scope and burden of injury and violence in the state. Efforts to improve E-coding have been implemented at the national level, but efforts still need state input and consideration. North Carolina has a strong history of data collaboration and partnership. When data are safeguarded from abuse and used appropriately, they can have a tremendous impact on state and local programs. Reductions in injury and violence can be one of the major public health accomplishments of the 21st century if these areas are given the level of attention their burden merits. NCMJ

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