



Trauma White Paper

May 2012



Indiana State
Department of Health

If you were asked to name the No. 1 killer of Hoosiers under the age of 45, what would you say? You might guess cancer or heart disease, or maybe even HIV/AIDS. If so, you'd be surprised to learn that the No. 1 killer of young people in Indiana is injury, or trauma, as we often refer to it in its more serious forms. The same is true across the country, and even worldwide; most Americans are unaware that injury is such a killer. Injuries like those suffered in motor vehicle accidents, or as the result of gunshot wounds or falls from a barn or an all-terrain vehicle crash kill more young people in our state than anything else. In fact, more than 32,000 Hoosiers are hospitalized each year from injuries, and more than 3,700 died from those injuries in 2009 (the last year for which complete data is available). And injury is the fifth most common killer of Hoosiers of all ages.

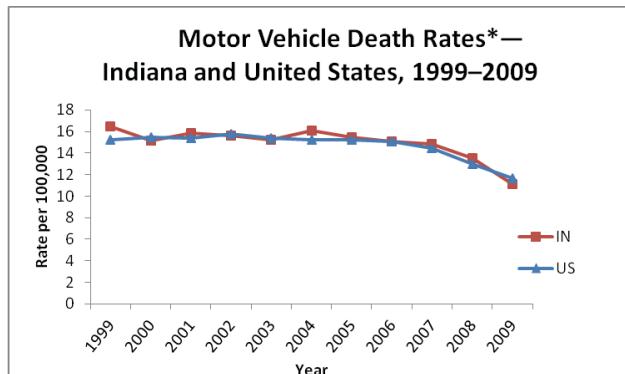
Making those numbers even worse is that young injury victims are in the prime of their lives, meaning that the impact on society as a whole in health care costs and lost productivity makes trauma the most costly health problem in the United States. A 2006 study estimated that the national economic burden from injury exceeds \$400 billion annually. It accounts for 31 percent of all "life years lost" (a measure that accounts for the age at which deaths occur, giving greater weight to deaths at younger ages and lower weight to deaths occurring at older ages). By comparison, cancer accounts for only 16 percent of "life years lost," heart disease for 12 percent and HIV/AIDS for 2 percent. The magnitude of trauma in America today is even greater when you include those who don't die: For every trauma death, an estimated 10 people are hospitalized and transferred to specialized medical care, and 178 people are treated and released from hospital emergency departments.

Trauma was called "the neglected disease of modern society" as long ago as 1966, and despite recent federal, state and local efforts to prevent or minimize it, the title is still deserved. Consider this: For every \$3.51 the federal government spends on HIV research and \$1.65 for cancer, trauma gets 10 cents. And this is true despite the fact that someone dies from a traumatic injury every three minutes in the United States.

In Indiana, trauma is an equally big issue:

- More than 11,650 people in Indiana died from injuries suffered in the years 2007-2009, which translates to about 11 people every day.

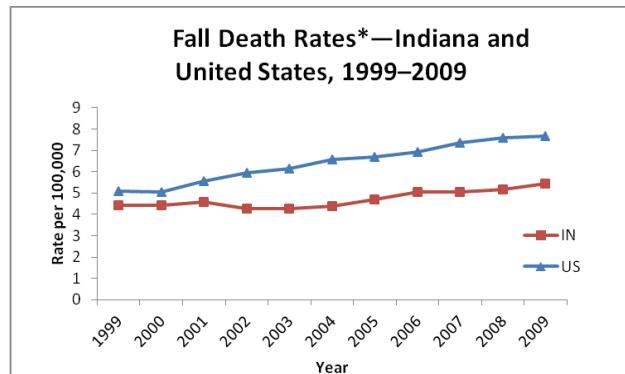
- One of Indiana's special injury challenges is that we rank first in the nation for interstate highway miles per land area. Even though Indiana's motor vehicle collision death rate has decreased significantly in the last 10 years, motor vehicle fatalities remain the No. 1 killer of Hoosiers ages 5-24. More than 700 Hoosiers die every year in motor vehicle collisions, and the economic costs of motor vehicle collisions in Indiana exceeded \$4.4 billion in 2010.



*Age-adjusted rate per 100,000

Source: WISQARS

- At the other end of the age spectrum, falls are the No. 1 injury cause of death of those over the age of 65 in Indiana. The death rate from falls has been climbing every year since 2003; more than 300 Hoosiers ages 65 and older died from fall-related injuries in 2009.



*Age-adjusted rate per 100,000

Source: WISQARS

Problems posed by injury are most acute in our rural areas, for obvious reasons: Ambulances often are not available, and the time it takes an ambulance crew to arrive at the scene of a rural injury is much greater than in urban areas, due to either distance or rural geography and the fact that ambulances must drive over more secondary roads. Most rural hospitals don't have the resources (like surgical specialties) to provide definitive trauma care, and there are no trauma centers in rural

areas of Indiana. Arranging transfers of trauma patients from rural hospitals to trauma centers often takes hours, resulting in more severe injuries and deaths; rural patients have more comorbidities to begin with than do urban patients (for example, they are older and tend to have less access to regular medical care). And, rural occupations overall tend to be more dangerous than those in urban areas; the occupations with the highest mortality and disability rates (miners, farmers and lumberjacks) are primarily based in rural areas. It has been noted that at least 60 percent of all trauma deaths occur in areas of the United States, where only 25 percent of the population resides.

So, what is being done about this killer? We're all aware of injury prevention campaigns carried on by government agencies, hospitals, schools and the like — buckle your seat belt, wear a helmet when riding a motorcycle, don't play with loaded handguns, be careful when working with farm machinery — but is there anything available beyond concerted efforts like that to bring down the horrible toll of trauma? Anything that works effectively and is worth the cost? Yes. A statewide integrated trauma system can reduce death related to trauma.

Where trauma systems don't exist, bad things are more likely to happen to trauma victims. The notion was captured well by Dr. Ben Eiseeman in 1967 during the Vietnam War: "Wounded in the remote jungle or rice paddy of Vietnam, an American citizen has a better chance for quick definitive surgical care by board-certified specialists than were he hit on a highway near his home in the continental United States. Even if he were struck immediately outside the emergency room of most U.S. hospitals, rarely would he be given such prompt, expert operative care as routinely is furnished from the site of combat wounding in Vietnam."

More recently, the co-founder of San Diego County, California's highly successful trauma system, Dr. Brent Eastman, wrote: "Trauma care in the United States is so fragmented, overwhelmed and underfunded that the survival and recovery of those who suffer major trauma often depends on where they happen to be when they are injured. Everyone living or traveling in the United States should be able to expect prompt transport to the appropriate level of care proportionate with their injuries. Wherever the dart lands on a map of the United States, there should be a system to take care of your traumatic injury."

Where trauma systems are in place, they save lives. There are multitudes of anecdotal accounts of trauma victims who were fortunate enough to have access to a trauma system, including the journey of a father and daughter who survived a grizzly bear attack in Glacier National Park in 2005 thanks to a trauma system that flew them to a hospital in Montana and then on to a trauma center in Seattle, Wash. Scientific studies of trauma systems across the country have found the following:

- A regional trauma system started in seven counties around Birmingham, Ala., in 1996 resulted in a 12 percent decrease in the death rate from trauma in those counties by the year 2005.
- Numerous studies over the years have demonstrated that trauma systems improve survival rates in injured patients. One 2007 study found that mortality was reduced by 15-25 percent when severely injured patients were treated at a trauma center.
- The trauma system in Oregon has reduced mortality by more than 25 percent and morbidity by more than 40 percent, and has also reduced costs.
- Trauma systems directing the most severely injured patients to trauma centers reduced preventable death rates by up to 30 percent, with a significant reduction of chronic disabilities and overall community care costs.
- Yet another study found that economic costs of trauma drop 9 percent in mature trauma systems.
- San Diego County (California) has reduced the percentage of preventable deaths from 22 percent in 1984 to approximately 2 percent today.
- One 2006 study that assessed the effectiveness of a mature trauma system in Florida found that counties where trauma centers were located had significantly lower death rates from motor vehicle collisions than did non-trauma center counties.

Trauma systems save lives in a number of ways: They correctly identify patients who need trauma care, anticipate the resources needed to treat trauma patients, locate available needed resources, route patients to the correct facility the first time to reduce the time it takes to get appropriate care, arrange inter-facility transfers if needed to reduce time to appropriate care and improve care through a quality improvement process.

Interestingly, after hearing a description of a trauma system, nine in 10 Americans indicate it is extremely or very important for their state to have one. Other findings from the same survey:

- Nearly nine in 10 Americans think it is extremely or very important for an ambulance to take them to a trauma center in the event of a life-threatening injury, even if it is not the closest hospital.
- Seventy-five percent of American adults said they believed trauma systems were in place in their state.
- Nearly all Americans believe that if they had a serious or life-threatening injury, they would be taken to the hospital that is best equipped to handle their specific injury in less than one hour.
- Nearly eight in 10 Americans (78 percent) would be willing to pay a dime or more per year to have trauma centers and systems in their state. More than half (55 percent) would be willing to pay \$25 or more.
- About one in three Americans believes that the hospital nearest to them is a trauma center.
- Nearly all Americans believe it would take less than one hour to get them to the hospital best equipped to handle their life-threatening injury.
- Six in 10 Americans would be extremely or very concerned if they found out there was no trauma center within easy reach of where they live.

Forty-one states have a statewide integrated trauma system, but Indiana is not among them. In the last several years, the Indiana State Department of Health, which has the statutory responsibility to “design, implement and oversee” such a system, has been working to bring the power of a statewide trauma system to Indiana.

What is a trauma system?

Indiana has elements of a trauma system (emergency medical services providers, trauma centers and a trauma registry, for example), but no real system, which is, as its name implies, a pre-planned, comprehensive, inclusive network of trained and equipped trauma care providers — including ambulance crews, hospitals, trauma centers, physicians, nurses, rehabilitation specialists, trauma registrars and injury prevention professionals — throughout the state, ensuring that optimal trauma care is available and accessible everywhere. Trauma patients, such as those with signs of shock, airway problems,

head or spinal injuries and multiple long bone fractures and those who were ejected from a motor vehicle or suffered major burns (or smaller burns with other injuries) require the most rapid, specialized care. These most seriously injured patients have the best chance to survive if they receive definitive medical care within “the Golden Hour,” which is the hour immediately following the injury itself. For a severely injured person, the time between sustaining an injury and receiving definitive care is the most important predictor of survival. Trauma survival, then, is time-dependent, putting it into the category of diseases that are best treated with a planned, organized system approach, which is what a trauma system provides. A trauma system enhances the chance of survival regardless of proximity to an urban trauma center. A system approach to trauma care is the best means to protect the public from premature death and prolonged disability from severe injury.

At least as far back as 1797, history records the forerunners of today’s modern trauma systems, as Napoleon’s chief physician implemented a pre-hospital system designed to triage and transport the injured from the field to aid stations. By 1865, civilian ambulance services began in Cincinnati and New York City, and in 1915, the first known air medical transport occurred during the retreat of the Serbian Army from Albania. By the Korean War, air ambulances and forward surgical hospitals (or MASH units) were employed to further reduce the time from injury to definitive surgical care. Cook County Hospital in Chicago opened the first U.S. trauma unit in 1966, and the first statewide trauma system was formed in Maryland in 1969. The extensive use of helicopters in the Vietnam War reduced the time from injury to definitive surgical care to less than one hour. The state of Illinois began designating centers to care for trauma victims in 1971, creating the first trauma system supported by state legislation. The tragic events of Sept. 11, 2001, prompted a reassessment of the strengths and weaknesses of emergency care and public health systems.

Trauma systems seek to decrease the incidence and severity of trauma; ensure optimal, equitable and accessible care for all persons sustaining trauma; prevent unnecessary deaths and disabilities from trauma; contain costs while enhancing efficiency; implement quality and performance improvement of trauma care throughout the system; and ensure certain designated facilities have appropriate resources to meet the needs of the injured.

In a trauma system, all players — EMS and hospital providers, trauma centers and rehabilitation specialists — work as a team to save lives and reduce the impact of trauma. Successful trauma systems are most often “inclusive” in that all phases of care, from pre-hospital care through acute care and rehabilitation, are part of the system. In the same way, inclusive trauma systems guarantee that all injured patients and all providers — not just the trauma centers and the most seriously injured patients — are integral parts of the trauma system. In inclusive trauma systems, patients are triaged to the appropriate facility based on their needs and facility resources; ideally, patients with the least severe injuries might be cared for at appropriately designated facilities in their community, whereas the most severe should be triaged to a Level I or Level II trauma center. In rural areas, oftentimes, smaller facilities must be ready to resuscitate and initiate treatment of major injuries and have systems in place that allow for fast, safe transfer to higher levels of care.

The overarching goal that many statewide trauma systems aspire to is “getting the right patient to the right place at the right time.” The transition from one element of the system to the next must be seamless; the only way to achieve that is to organize it that way, maximize the ability to coordinate efforts and work at it every day. This seamlessness between each phase of care is the true value of a trauma system. To better understand the importance of this “seamlessness” in high-functioning trauma systems, consider how most trauma patients die:

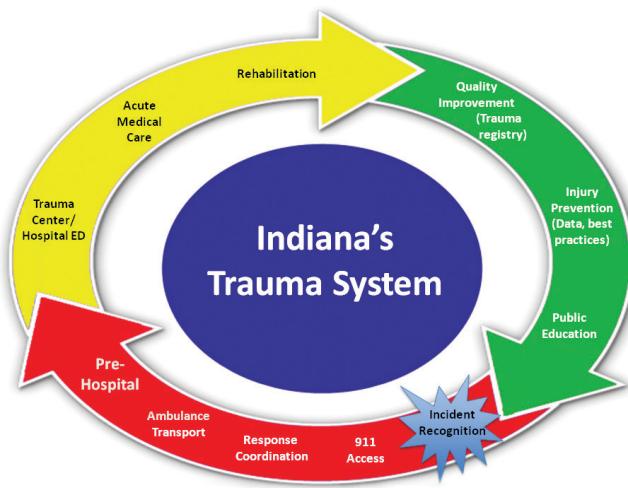
- Some are killed immediately from massive injuries — we usually can’t help these folks except through better injury prevention efforts.
- Many die from head injuries — rapid, efficient care can save many of these.
- Many bleed to death, which is usually internal where only surgery can stop it, and these patients often die waiting for transfer to trauma centers.
- Some die later of complications like organ failure or sepsis — in these cases, survival is often related to how soon the bleeding was stopped and blood volume restored.

Again, consider the challenges posed in rural Indiana that scream for a more integrated trauma system: It’s more difficult to communicate with EMS services that an injury has occurred, it takes longer for ambulance crews to travel to the scene, no trauma centers are located in or near rural areas, and smaller hospitals may not be completely equipped to deal with most trauma scenarios. About 36 percent of Indiana’s hospitals (46 of 129) are located in rural parts of the state, and 16 of Indiana’s 92 counties don’t even have a hospital.

One study has found that trauma patients who die in a rural area without a formal trauma system are less severely injured than those in urban areas but are more likely to die at the scene of the incident. Between 2000 and 2007, more than 135 fatal motor coach crashes occurred every year in the United States. Twenty-five percent of those crashes were in rural areas, yet the rural bus crashes accounted for 56 percent of the fatalities and 72 percent of the non-fatally injured patients. Rural residents are also twice as likely to die of traumatic injuries as urban residents. Kentucky’s trauma system has found that the death risk for rural trauma patients is 15 times greater than it is for urban trauma patients and that preventable deaths in the rural trauma setting are 30 percent higher than in urban settings. Fatality rates from rural vehicular trauma are almost double those found in urban settings. An Alabama study found increased EMS pre-hospital time to be associated with higher mortality rates in rural settings. Residents of some ZIP codes obviously don’t have the same access to quality trauma care as others. An integrated trauma system begins the process of addressing that inequality. Of note is the 2005 study that found that 79 percent of Americans feel it is extremely or very important for people in rural areas to have the same access to trauma care as do people in urban or suburban areas.

It should be noted that, within many statewide trauma systems, there are also regional trauma systems in operation. As “all trauma is local,” these regional systems — like the one being developed in the Evansville, Ind., area — are beneficial as they bring the coordinated power of systems to the local level where it can best be used, while at the same time functioning within the overall statewide trauma system.

What are the typical elements of a trauma system, and where does Indiana stand on each?



- **Pre-hospital providers** (EMS) provide initial assessment, diagnosis and stabilization of patients and safe, rapid transportation to local hospitals or trauma centers. They are often the critical link between the injury-producing event and definitive care at a trauma center or local hospital emergency department. The EMS ambulance that speeds to the scene of a serious auto accident and provides initial care to victims begins the patient's journey through the emergency medical care system. EMS provides care during the first hour post-injury known as "the Golden Hour," when critical skilled care must be provided. The journey's destination may be a trauma center or a local hospital, but either way, the journey and the destination are equally important and require skilled coordination.

There are at least 800 ambulance providers in Indiana, but there aren't enough of them, especially in rural areas. We also rely on volunteer help in the pre-hospital arena, which increases manpower and training problems. The Indiana Department of Homeland Security oversees EMS providers.

- **Hospital emergency departments** are part of the statewide trauma system, as not all injured patients are taken to trauma centers; the vast majority can be, and are, treated at local, non-trauma center hospitals. Non-trauma center hospitals stabilize and provide definitive life-saving care for patients who don't need trauma center care. Many times, especially in rural areas where timely access to trauma centers is not possible, non-trauma center hospital emergency departments provide definitive care to trauma patients out of necessity.

Emergency departments are not trauma centers, as the typical emergency department treats broken legs, concussions, back sprains, lacerations, injuries resulting from motor vehicle rear-end crashes and trips on the sidewalk, while trauma center "typical patients" include those with multiple fractures, brain injuries, paralysis, punctured lungs, handgun and stab wounds, car rollovers and ejections or falls of more than 30 feet. Indiana has about 120 hospitals that operate emergency departments. The Indiana State Department of Health regulates all hospitals in Indiana.

- **Trauma centers** in Indiana are hospitals that have been granted verification as a trauma center by the American College of Surgeons (Levels I, II and III, with Level I trauma centers providing the highest level of trauma care); in other states, trauma centers are designated through a state-operated process. Trauma centers are unique in their capabilities and are NOT the typical community hospital emergency department. Indiana now has eight trauma centers scattered around the state: Memorial Hospital in South Bend; Parkview Health and Lutheran Hospital in Fort Wayne; Riley Children's Hospital, IU Health-Methodist Hospital and Wishard Hospital in Indianapolis; and Deaconess Health System and St. Mary's Medical Center in Evansville.

But for all the trauma centers we have, there are not enough of them to adequately meet the needs of Hoosiers and visitors to the state who become injured. The ISDH has the authority to write rules governing trauma center designation, which the agency is preparing to do in 2012.

- **Rehabilitation centers** care for trauma patients who survive their injuries and seek to enable these patients to realize their fullest post-injury potential. Oftentimes, these patients have sustained severe or catastrophic injuries, resulting in long-standing or permanent impairments. Rehabilitative interventions strive to allow the patient to return to the highest level of function, reducing disability and avoiding handicap whenever possible. When rehabilitation results in independent patient function, there is a 90 percent cost savings compared with costs for custodial care and repeated hospitalizations. Unfortunately, the rehabilitation phase of care often isn't sufficiently integrated into the trauma system, even in the most mature, well-developed statewide trauma systems. The ISDH provides regulatory oversight of Indiana's rehab facilities.

- **State trauma registries** are not only the repository for data about trauma in their respective states, but they are a key component to performance improvement within the trauma system, using data to measure and analyze all aspects of the system to ensure the highest quality care is provided to all. The ISDH operates the Indiana Trauma Registry and is responsible for instituting processes to evaluate the performance of all aspects of the system, from the EMS provider to the trauma center/acute care hospital and the rehab provider. The ISDH Trauma Registry has been operational since 2008; two new staff members were added to the project in January 2012.
- **Injury prevention/public education programs** begin with the collection and analysis of population and patient data from a wide variety of sources to describe the status of injury morbidity, mortality and distribution throughout the state. Injury epidemiology is concerned with the evaluation of the frequency, rates and pattern of injury events in a population and is obtained by analyzing data from sources such as death records, hospital discharge databases and data from EMS, emergency departments and trauma registries. For years, the ISDH carried on an array of injury prevention programs, but now the agency has shifted focus from programming to the collection and analysis of injury data (epidemiology) and recognizing best practices in the injury field, which can be pushed out to those agencies and organizations around the state conducting impressive and far-reaching injury prevention programming. ISDH hired a new injury epidemiologist in January 2012. The IDHS and other state agencies also conduct injury prevention programs.

Discussing trauma systems would not be complete without a word about disaster preparedness. The trauma system and its trauma centers and pre-hospital providers are central to disaster preparedness as well as to the everyday response to traumatic incidents involving small numbers of people. For example, EMS providers and hospitals/trauma centers within a disaster-affected community are the first line of response to a disaster, especially those involving mass casualties that may result in more patients than local hospitals/trauma centers can handle, requiring the activation of a larger emergency response plan with support provided by state and regional assets. The IDHS is responsible for most aspects of disaster preparedness; the ISDH assists with the medical and public health functions.

What needs to be done for Indiana's trauma system

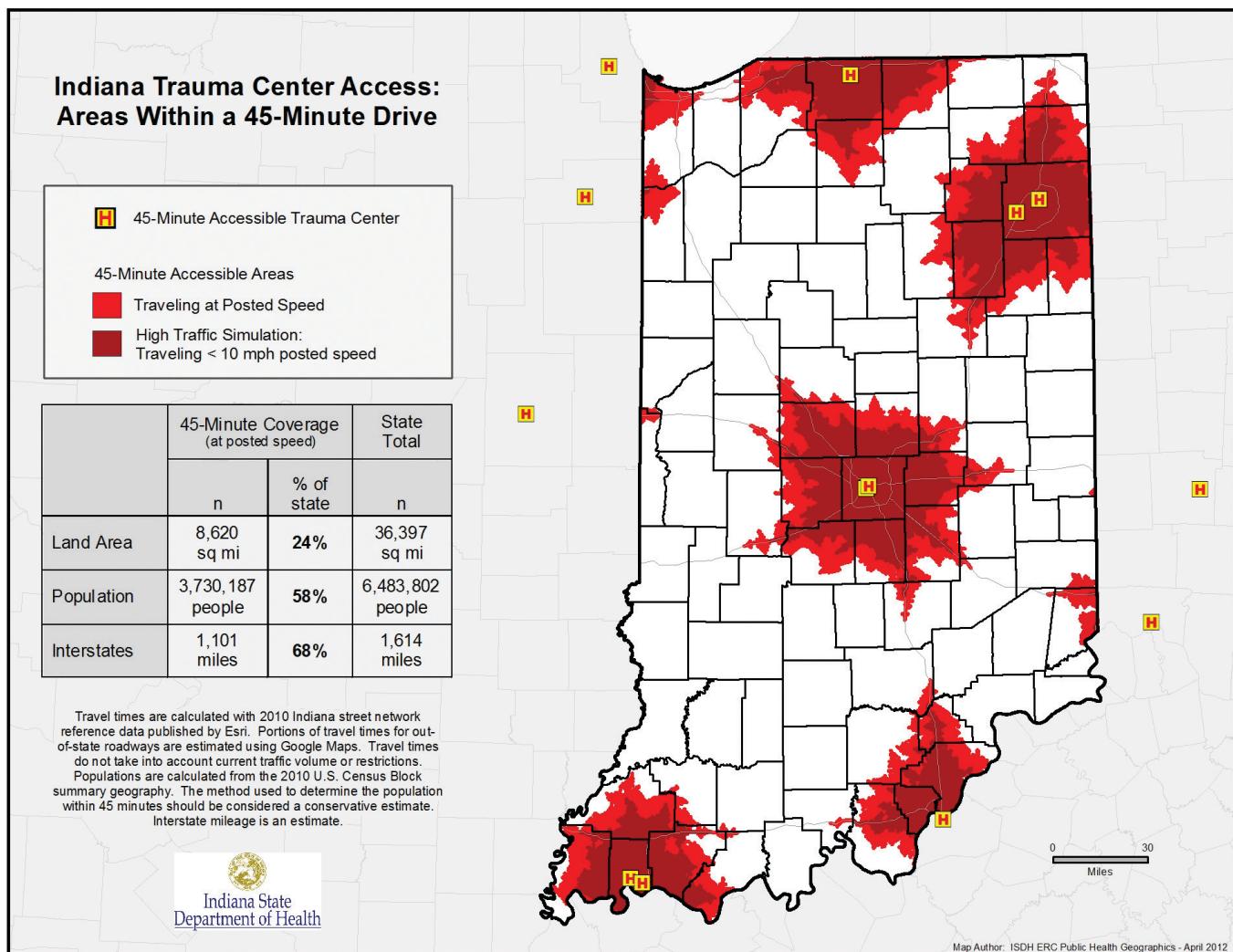
Indiana has a good start with many pieces of a trauma system; however, we are lacking a comprehensive system working as a team on behalf of trauma patients. The ACS, which is the preeminent trauma authority in the United States, conducted a consultation visit in 2008 and told the state what Indiana must do to improve its system. Recommendations are below in *italics* with the current status of the item following:

- *Create a governor-appointed, multi-disciplinary state trauma advisory board to advise the ISDH in developing, implementing and sustaining a comprehensive statewide trauma system.* This was accomplished by executive order in 2009.
- *Develop an Office of Emergency Care within the ISDH that includes both the trauma program and EMS.* Nearly all states — 41 in total — combine the EMS and trauma programs in the same state agency, most often the public health agency. The ISDH currently has responsibility to develop, implement and oversee the trauma system. The responsibility for EMS lies with the IDHS.
- *Hire sufficient staff based on the recommendations identified in the trauma system plan.* The ISDH Trauma Division hired a director in August 2011 and added two trauma registry staff and an injury epidemiologist in January 2012. These are not state-funded positions but are paid for by two different federal grant programs, both of which face questionable futures.
- *Develop a plan for statewide trauma system implementation using the broad authority of the 2006 trauma system legislation.* A draft trauma registry rule is nearly ready for publication; the ISDH and the IDHS have worked with EMS to adopt a rule that directs the most seriously injured patients be taken to trauma centers, and later this year ISDH will propose a state designation program for trauma centers to complement the ACS verification system.
- *Develop a detailed budget proposal for support of the state trauma system infrastructure.* Currently, there is no state funding for Indiana's trauma program. A detailed budget proposal could be one result of discussions ISDH has in the coming months.
- *Recruit and hire a qualified state trauma/EMS medical director and involve that person in statewide disaster*

planning initiatives. The ISDH has significant medical and public health resources on staff. The Trauma Division does not have a medical director.

- Perform a needs assessment to determine the number and level of trauma hospitals needed within the state. Informal needs assessments have been conducted, and ISDH is working to identify strategies to persuade more hospitals, in the right places, to become trauma centers.
- Develop, approve and implement pre-hospital trauma triage guidelines as well as inter-facility transfer criteria. Along with the IDHS, ISDH has proposed a rule to accomplish this that will be considered at the May 18 meeting of the EMS Commission (see above; also see map below).

- Create a performance improvement subcommittee of the Trauma System Advisory Task Force (now the Trauma Care Committee) to develop a trauma system performance improvement plan. Such a committee has been created but has not yet begun work on a plan.
- Amend or create a statute with specific language to ensure the confidentiality of the trauma registry and of trauma system performance improvement activities and to protect both from discoverability. A trauma registry rule will soon be published in the Indiana Register which ensures the confidentiality of registry data.
- Create and implement a trauma system information management plan. This has not been done.



Conclusions

In these pages, we have explored the landscape of trauma in Indiana. While the solution is not simple, ISDH has proposed the trauma system concept as a way of reducing the number of trauma deaths in the state. Key highlights of this paper include:

- Injury is the No. 1 killer of Hoosiers under the age of 45 and the No. 5 killer of Hoosiers of all ages. These are predominantly young people being killed, which are not only sad for them, their friends and families, but it also takes a huge toll on society in years of productive life lost.
- Problems posed by injury are most acute in our rural areas.
- A major way that states address the problem of trauma is through the design, implementation and oversight of a statewide trauma system. The ISDH has that statutory responsibility in Indiana.
- Bad things happen where state trauma systems are not in place; where trauma systems exist, they save lives. Trauma systems lower preventable death rates by as much as 25-30 percent.
- Indiana has in place several elements of a statewide trauma system, but we don't yet have what can honestly be described as a "system." Other challenges with our current approach to trauma include:
 - ▶ We don't have enough EMS providers, especially in rural areas.
 - ▶ There aren't enough trauma centers.
 - ▶ At the state level, not all components of the trauma system are located in the same state agency.
- A 2005 Harris poll found that nine in 10 Americans indicate it is extremely or very important for their state to have a trauma system. Nearly all Americans surveyed believe that if they had a serious or life-threatening injury, they would be taken to the hospital that is best equipped to handle their specific injury in less than one hour. Nearly eight in 10 Americans (78 percent) would be willing pay a dime or more per year to have trauma centers and systems in their state. More than half (55 percent) would be willing to pay \$25 or more.

Indiana is prepared and motivated to create a statewide trauma system, putting in place a system to reduce preventable death due to trauma. This concept will be presented to Hoosiers in the summer of 2012 as ISDH rolls out the statewide Trauma Listening Sessions. The goal of the sessions is to increase discussion and attention on trauma care and collect input from communities on their trauma needs.

According to the Washington State Department of Health, "The fundamental prerequisite for the development of a successful trauma care system is our society's resolve to commit the resources required to get the job done." ISDH looks forward to partnering with Hoosiers to reduce preventable death in Indiana.

References

- A comparison of 5 state trauma systems meeting all 8 essential ACS criteria: A descriptive survey, the Journal of Emergency Nursing, Dec. 2004, p.536-538:
- Assessing effectiveness of a mature trauma system: Association of trauma center presence with lower injury mortality rate, Papa, Linda, MD, Journal of Trauma-Injury Infection & Critical Care, August 2006, Vol. 61, Issue 2, pp 261-267.
- Brent Eastman, M.D., "Wherever the Dart Lands: Toward the Ideal Trauma System," Journal of the American College of Surgeons, August 2010
- Current Opinion in Critical Care: December 2007 - Volume 13 - Issue 6 - p 686-690, Trauma: Edited by Bertil Bouillon: Do designated trauma systems improve outcome?, Lansink, Koen WW; Leenen, Luke PH
- Does increased emergency medical services pre-hospital time affect patient mortality in rural motor vehicle crashes? A statewide analysis, The American Journal of Surgery, Volume 197, Issue 1, Pages 30-34, Richard P. Gonzalez, Glenn R. Cummings, Herbert A. Phelan, Madhuri S. Mulekar, Charles B. Rodning.
- Emergency Medical and Trauma Services System, Annual Legislative Report, submitted to the Colorado Legislature by the Emergency Medical and Trauma Services Section of the Colorado Dept. of Public Health and Environment, Nov. 1, 2010.
- Emergency Medical Services & Trauma System, Washington State Department of Health, website, 2.17.2011.
- EMS Incident Response and Readiness Assessment, NASEMSO National Rollout, February 2011.
- Finkelstein, E.A., Corso, P.S., & Miller, T.R. The Incidence and Economic Burden of Injuries in the United States. USA: Oxford University Press, 2006
- Indiana Criminal Justice Institute. Indiana Crash Facts – 2010. Available from URL: http://www.in.gov/cji/files/FactBook_2010.pdf
- Michigan Statewide Trauma System: A Guide to Development and Operation of Regional Trauma Networks, August 17, 2009, Michigan Dept. of Community Health.
- Model Trauma System Planning and Evaluation, US Department of Health and Human Services, Health Resources and Services Administration (HRSA), Released February 2006.
- National Center for Health Statistics. Web-Based Injury Statistics Query and Reporting System (WISQARS) (Online), 2011. National Center for Injury Prevention and Control, Centers for Disease Control and Prevention. Available from URL: <http://www.cdc.gov/injury/wisqars>
- National Trauma Institute. Available from URL: <http://www.nationaltraumainstitute.org/>
- National Trauma Institute, website, 4.14.12:
- North Dakota Trauma Program. Available from URL: <http://www.ndhealth.gov/trauma/stats/>
- Optimal Trauma Destination Determination, Andrew C. Bernard, MD, trauma medical director, UK Healthcare Trauma Center, Kentucky EMS Conference, Sept. 29, 2011.
- Overview of Kentucky's Trauma System, Andrew Bernard MD, Chair, Kentucky Trauma Advisory Committee, Trauma Center Development Seminar, Hazard KY, Jan. 6, 2012.
- Pennsylvania Trauma System Overview, Dec. 1, 2009, Juliet Geiger, RN, MSN, executive director, Pennsylvania Trauma Systems Foundation, PowerPoint.
- Report on Injuries in America, National Safety Council, 2003.
- Resources for Optimal Care of the Injured Patient, 2006, Committee on Trauma, American College of Surgeons.
- Safe Kids USA. Unintentional injury risk for children. Available from URL: <http://www.safekids.org/assets/docs/ourwork/research/2011-high-risk-fact-sheet.pdf>
- Selection on observables and unobservables: Level I Trauma Center effects on return to work outcomes by Prada, Sergio I., Ph.D., UNIVERSITY OF MARYLAND, BALTIMORE COUNTY, 2010, 148 pages; 3422851.
- State Flex Program EMS/Trauma Activities and Integration of Critical Access Hospitals into Trauma Systems, March 2010, with funding from the federal Office of Rural Health Policy, for the Medicare Rural Hospital Flexibility Program (Flex Program), prepared by the rural health research centers at the University of Minnesota, North Carolina and Southern Maine.

The American public's views of and support for trauma systems, A Congressional Briefing, survey conducted for The Coalition for American Trauma Care, March 2, 2005 by Harris Interactive

Trauma deaths in a mature urban vs. rural trauma system: A comparison (Archives of Surgery, 1997 April), p. 376-61, Rogers FB, Shackford SR, Hoyt DB, Camp L, Osler TM, Mackersie RC, Davis JW.

Trauma center care cost-effective: Greatest effect seen in younger patients and those with severe injuries, The Journal of Trauma Injury, Infection and Critical Care, July 2010, Johns Hopkins Bloomberg School of Public Health's Center for Injury Research and Policy, Ellen McKenzie, PhD

Trauma system agenda for the future, coordinated through the American Trauma Society, sponsored by the US Department of Transportation, National Highway Traffic Safety Administration, October 2002

Trauma System Consultation, State of Indiana, December 14th-17th, 2008, American College of Surgeons Committee on Trauma.

Trauma system implementation and recommendations, Report to the Minnesota Legislature 2010, Minnesota Department of Health, January 2010

2009 Oregon Trauma System Celebration, as cited in The Oregon Trauma System, a PowerPoint presentation. Presented by Nicole VanDerHeyden, MD, Salem Hospital Trauma Medical Director.