August 2006

Surveying Datasets Related to Motor Vehicle Related Adolescent Deaths and Injuries

Final Report

Prepared for

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RTI Project Number 0208654.033

RTI Project Number
0208654.033

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*RTI International is a trade name of Research Triangle Institute.

Contents

Figures

Tables

1. INTRODUCTION

1.1 Overview

The National Research Council and the Institute of Medicine's 1985 report *Injury in America: A Continuing Public Health Problem* focused attention on the high rate of unintentional injuries, including those resulting from motor vehicle crashes in the United States, and garnered support for research and programs to address the problem. Subsequent review of public health surveillance also brought the problem of unintentional injuries into focus (Thacker and Berkelman, 1988). Motor vehicle–related injuries kill more children and young adults (i.e., those aged 1 to 24) than any other cause in the United States (Future of Children, 2000). Motor vehicle occupant deaths are the leading cause of unintentional death among adolescents aged 15 to 19, accounting for 19.11 per 100,000 deaths (compared with 2.08 per 100,000 deaths for the second leading cause, drowning or submersion) (CDC, 2000). Teenage drivers in particular are overrepresented in motor vehicle crashes (American Academy of Pediatrics, 1996; CDC, 1996; Ferguson et al., 1996; Liu et al., 1998; Massie, Campbell, and Williams, 1995; Phebo and Dellinger, 1998; Williams, 1996). In 2000, total lifetime costs of motor vehicle injuries were $19 billion for males ages 15 to 24 and $7 billion for females ages 15 to 24 (Finkelstein et al., 2006). Clearly, the burden of adolescent motor vehicle injuries is significant.

Against this backdrop, Healthy People 2010 has a stated objective of reducing adolescent deaths due to motor vehicle crashes to less than 10 per 100,000 (http://www.healthypeople.gov/ document/html/objectives/15–15.htm), a decrease of 37.5%. Consistent with this objective, in August 2005, the Centers for Disease Control and Prevention (CDC) contracted with RTI International (RTI) to survey existing datasets to determine how they could be used to assess the burden of motor vehicle–related deaths and injuries among adolescents and whether there were opportunities for additional data linkages to increase the utility of existing datasets for research and analysis of injury prevention efforts. This effort involved identifying gaps in the datasets and gauging their strengths and weaknesses for quantifying reductions in adolescent motor vehicle injuries that will result from successful injury prevention efforts. In January 2006, RTI convened a panel of experts representing academia, government, and practitioners in the field of injury prevention to identify candidate datasets (see Appendix A for a list of panel members). Through an iterative process with CDC, the list of candidate datasets was revised to include the following:

- Child Death Review (CDR)
- Crash Injury Research & Engineering Network (CIREN)
- Crash Outcome Data Evaluation System (CODES)
- Fatality Analysis Reporting System (FARS)

- Healthcare Cost and Utilization Project Kids' Inpatient Database (HCUP-KID)
- Medical Expenditure Panel Survey (MEPS)
- National Ambulatory Medical Care Survey (NAMCS) and National Hospital Ambulatory Medical Care Survey (NHAMCS)
- National Automotive Sampling System—Crashworthiness Data System (NASS–CDS)
- National Electronic Injury Surveillance System—All Injury Program (NEISS-AIP)
- National Vital Statistics System (NVSS)

In this report, we provide a review of each dataset and its utility for quantifying the burden of adolescent motor vehicle injuries. We describe each dataset, including its strengths, limitations, and availability, and cite examples of relevant research.

1.2 Summary and Recommendations

As detailed in Section 3, no single dataset includes information on all measures of burden (i.e., mortality, morbidity, and healthcare expenditures) and/or follows crash victims over time. This shortcoming limits efforts to quantify the long-term health and economic burden of adolescent motor vehicle injuries and to evaluate national- or state-level policies aimed at reducing the burden of adolescent motor vehicle injuries.

We recommend the following next steps to address these shortcomings:

- Further explore the use of CODES data for state-level policy analysis of adolescent motor vehicle injuries.
- Further explore the use of nonrepresentative datasets (e.g., hospital and/or private health insurance claims data).
- Explore the possibility of surveying adolescents involved in motor vehicle crashes and their families at various intervals after the crash to quantify changes in quality of life for all affected by the crash.

2. DATA SOURCES AND SURVEILLANCE SYSTEMS THAT CAPTURE DATA ON ADOLESCENT DEATHS AND INJURIES RESULTING FROM MOTOR VEHICLE CRASHES

This section describes the 10 datasets that could be used to assess various aspects of adolescent motor vehicle injuries. For ease of exposition, we have grouped the datasets into three categories:

- Those whose primary focus is on mortality:
  - National Vital Statistics System (NVSS)
  - Fatality Analysis Reporting System (FARS)
  - Child Death Review (CDR)
- Those whose primary focus is on morbidity and healthcare utilization:
  - Healthcare Cost and Utilization Project Kids' Inpatient Database (HCUP–KID)
  - National Electronic Injury Surveillance System—All Injury Program (NEISS–AIP)
  - National Ambulatory Medical Care Survey (NAMCS) and National Hospital Ambulatory Medical Care Survey (NHAMCS)
  - Medical Expenditure Panel Survey (MEPS)
- Other databases that capture multiple dimensions of injuries:
  - National Automotive Sampling System—Crashworthiness Data System (NASS–CDS)
  - Crash Injury Research & Engineering Network (CIREN)
  - Crash Outcome Data Evaluation System (CODES)

2.1 Mortality Data

One strategy for assessing the burden of adolescent motor vehicle crashes is to review mortality statistics. In this section, we present three datasets that focus on mortality data: NVSS, FARS, and CDR.

2.1.1 National Vital Statistics System

2.1.1.1 Purpose

NVSS includes detailed information on all fatalities in the United States and five territories (Puerto Rico, the Virgin Islands, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands).

2.1.1.2 Description

State (and territory) offices of vital records maintain death certificate files and provide regular summary reports to NVSS. Conditions related to injury are described in two ways: by the external cause of injury, which describes the mechanism or underlying cause of the

injury (e.g., motor vehicle crash); and by the immediate cause of death (e.g., broken neck). In the event of motor vehicle crashes, the victim is identified as driver, passenger, pedestrian, or other. NVSS data are currently coded according to the *International Classification of Diseases, Tenth Revision* (ICD-10). Before 1999, ICD-9 was used.

2.1.1.3 Data Collection Methods

Through cooperation between the 50 U.S. states; District of Columbia; New York City; Puerto Rico; and the U.S. territories and CDC, death certificate data are compiled into NVSS. Standard forms for data collection and model procedures for the uniform registration of events are recommended for nationwide use.

2.1.1.4 Inclusion Criteria

All deaths occurring in the 50 U.S. states; District of Columbia; New York City; Puerto Rico; and the U.S. territories (Virgin Islands, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands) are included.

2.1.1.5 Strengths

- Uses standard forms for data collection.
- State-, county-, and Metropolitan Statistical Area (U.S. Census)-level data are available.
- It is a census of all deaths.

2.1.1.6 Limitations

- Coding of both mechanism and underlying cause of death are often left to the discretion of the medical examiner and may be subject to substantial uncertainty.
- Coroners and medical examiners often do not know/record whether the occupant killed in a motor vehicle crash was a passenger or the driver, and therefore this information is often unavailable.
- Deaths are enumerated by county of residence rather than county of death.
- NVSS has less detail on fatal motor vehicle crashes than FARS.

2.1.1.7 Examples of Research Using NVSS

- Adekoya, N., D.J. Thurman, D.D. White, and K.W. Webb. December 2002. "Surveillance for Traumatic Brain Injury Deaths—United States, 1989—1998." *Morbidity and Mortality Weekly Report* 51(ss10):1-16.
- Archer, P.J., S. Mallonee, A.C. Schmidt, and R.M. Ikeda. 1998. "Oklahoma Firearm-Related Injury Surveillance." *American Journal of Preventive Medicine* 15(35):83-91.
- Campos-Outcalt, D., C. Bay, A. Dellapena, and M.K. Kota. 2003. "Motor Vehicle Crash Fatalities by Race/Ethnicity. Arizona, 1990–1996." *Injury Prevention* 9:251-256. (Note: Uses data from both NVSS and FARS.)
- Finkelstein, E.A., S.C. Phaedra, T.R. Miller, and Associates. 2006. *The Incidence and Economic Burden of Injuries in the United States*. Oxford: Oxford University Press.

- Vyrostek, S.B., J.L. Annest, and G.W. Ryan. 2004. "Surveillance for Fatal and Nonfatal Injuries—United States, 2001." *Morbidity and Mortality Weekly Reports* 53(SS07):1-57. (Note: Uses data from NVSS and NEISS–AIP.)

2.1.1.8 Data Availability

Data on vital events are published in electronic form at http://www.cdc.gov/nchs/nvss.htm.

In addition to the published documents cited in Section 2.1.1.7, NCHS also makes available electronic micro-data files containing individual vital event records. Public use versions of these files are provided on CD-ROM.

2.1.1.9 Contact Information

Mortality Statistics Branch
Division of Vital Statistics
National Center for Health Statistics
Centers for Disease Control and Prevention
3311 Toledo Road, Floor 7
Hyattsville, MD 20782
301-458-4111

2.1.2 Fatality Analysis Reporting System

2.1.2.1 Purpose

FARS, a National Highway Traffic Safety Administration (NHTSA) database, is a census of all motor vehicle crashes occurring on public roads that resulted in a death.

2.1.2.2 Description

FARS, a crash mortality census for the 50 states, the District of Columbia, and Puerto Rico, allows comparison of crash outcomes (i.e., fatalities) across states and over time. Data collection goes back to 1975 and includes more than 100 variables that describe the crash; the vehicles involved; and the crash victims, including age, gender, and injury severity. FARS also includes data on blood alcohol concentration (BAC) for vehicle operator and seatbelt use. When alcohol data are incomplete or missing, values are imputed. FARS has been operational since 1975 and has collected information on more than 1 million motor vehicle fatalities.

2.1.2.3 Data Collection Methods

Trained FARS analysts extract information from state source documents and code them on four standard FARS forms: the Accident Form, the Vehicle Form, the Driver Form, and the Person Form. The Person Form captures data on each person involved in the crash, including age, gender, role in crash (driver, passenger, nonmotorist), injury severity, and restraint use. Data on the Person Form include some or all of the following:

- police accident reports (PARS)

- state vehicle registration files
- state driver licensing files
- state highway department data
- vital statistics
- death certificates
- coroner/medical examiner reports
- hospital medical records
- emergency medical service (EMS) reports

2.1.2.4 Inclusion Criteria

To be included in the FARS database, a crash must involve at least one fatality (occupant or nonoccupant), the involved motor vehicle must have been traveling on a traffic way customarily open to the public, and an occupant or nonoccupant must die within 30 days of the crash.

2.1.2.5 Strengths

- Data are available by state (plus the District of Columbia and Puerto Rico).
- FARS' long history allows states to follow motor vehicle fatality trends on public thoroughfares over time.
- Because FARS contains data on the age and gender of each person involved in the crash, the database can be mined for fatal crashes involving adolescents.
- FARS contains data on injury severity for victims of fatal crashes other than the person killed.
- Because trained FARS analysts extract information from state source documents and code them on standard forms, there is standardization of data collected.
- FARS provides more detail on fatal automobile injuries than NVSS.
- Has Web-based query tools.

2.1.2.6 Limitations

- FARS contains data on the initial crash and emergency medical data only.
- FARS captures data only for crashes in which a fatality occurs.
- Coding varies from year to year, so some intertemporal comparisons may be problematic.
- FARS does not provide information on cause of death or specific injuries for nonfatal injuries.
- Although FARS contains information on restraint use, it may not be reliable because it is based on police coded information.

2.1.2.7 Examples of Research Using FARS

- Chen, L.-H., S.P. Baker, E.R. Braver, and G. Li. 2000. "Carrying Passengers as a Risk Factor for Crashes Fatal to 16- and 17-Year-Old Drivers." *Journal of the American Medical Association* 283:1578-1582.
- Gonzalez, M.M., L.M. Dickinson, C. DiGiuseppi, and S.R. Lowenstein. 2005. "Student Drivers: A Study of Fatal Motor Vehicle Crashes Involving 16-Year-Old Drivers." *Annals of Emergency Medicine* 45(2):140-146.
- Nathens, A.B., G.J. Jurkovich, F.P. Rivara, and R.V. Maier. January 2000. "Effectiveness of State Trauma Systems in Reducing Injury-Related Mortality: A National Evaluation." *The Journal of Trauma Injury, Infection and Critical Care* 48(1):25.
- Preusser, D.F., S.A. Ferguson, and A.F. Williams. March 1998. "The Effect of Teenage Passengers on the Fatal Crash Risk of Teenage Drivers." *Accident Analysis & Prevention* 30(2):217-222.

2.1.2.8 Data Availability

NHTSA has a cooperative agreement with one agency in each state government to provide information in a standard format on fatal crashes in the state.

The FARS Query System enables users to perform their own custom queries, such as case listings and univariate and cross-tabulations, and to download subsets of data based on selected fields of interest. The FARS Query System also has a library of frequently requested tables. FARS documentation is available at ftp://ftp.nhtsa.dot.gov/FARS. The data can also be accessed at http://www.fars.nhtsa.dot.gov.

2.1.2.9 Contact Information

National Center for Statistical Analysis
1-800-934-8517 (phone)
1-202-366-7078 (fax)

2.1.3 Child Death Review

2.1.3.1 Purpose

The primary objectives of CDR are to ensure the accurate identification and uniform, consistent reporting of the cause and manner of every child death; improve communication and linkages among local and state agencies and enhance coordination of efforts; and identify and advocate for needed changes in legislation, policy, and practices and expanded efforts in child health and safety to prevent child deaths.

2.1.3.2 Description

CDR programs grew out of a need to accurately identify the causes of unexpected death among children (Durfee, Gellert, and Tilton-Durfee, 1992). There are CDRs in 49 of the 50 states and the District of Columbia, 39 of which were established by state law. In 34 states, local CDRs review individual cases. Their findings are sent to a state panel to review and

make recommendations for policy and practice to prevent deaths. In 15 states, only the state CDR reviews individual cases and develops recommendations. In 2 states, only the local CDR reviews individual cases and responses to findings (Covington, Rich, and Corteville, 2006). In 2005, the U.S. Department of Health and Human Services' Office of Disease Prevention and Health Promotion modified Objective 15.6 of the Healthy People 2010 objectives: "Increase the number of states and the District of Columbia, where 100% of deaths to children aged 17 years and younger that are due to external causes are reviewed by a child fatality team" (USDHHS, 2006). In obtaining data for this proposed change, the National Center for Child Death Review surveyed all 50 states. Thirty-eight states provided baseline data on their 2000 reviews. Twenty-four states reported that they reviewed at least 75% of all injury deaths, and 10 states reported that they reviewed 100% of all injury deaths in 2000 (Covington, 2004).

2.1.3.3 Data Collection Methods

For deaths from motor vehicle crashes, the following information is collected and discussed at most CDR team meetings:

- autopsy
- scene investigation reports and photos
- EMS runs and emergency department reports
- interviews with witnesses
- state uniform crash reports with road and weather conditions at time of crash
- blood alcohol and/or drug concentrations of driver and victim
- previous violations, such as drunk driving or speeding
- out-of-state driving history
- graduated license status and violations
- information on crashes at same site
- lab analysis of safety equipment damage
- anecdotal information on the behavior of drivers, passengers, and pedestrians prior to the crash event from law enforcement, school, mental health, human services, and other professionals attending a review meeting

CDR teams include representatives from law enforcement; public health; district attorneys; health care providers; emergency services; social services, including child protective services; and medical examiners/coroners. Teams in 41 states complete case review reports following the review meeting. Thirty-nine states produce annual reports of their CDR findings. Fifteen states are participating in the first year of a new multistate standardized reporting system, the *Child Death Review Case Reporting System.* In this system, states are reporting on their CDR review findings through a Web-based system housed at the National

Center for Child Death Review Policy and Practice (Covington, Rich, and Corteville, 2005). The motor vehicle section of the case report form includes the following information:

- whether the child was the driver, passenger, or pedestrian
- location of fatal incident
- causes of fatal incident
- type of collision
- driving conditions
- if the victim was a passenger, where the victim was sitting at the time of the incident
- information about all drivers involved in the crash—their age, their drivers license and graduated drivers license (GDL) status, alcohol and drug association
- number of occupants and their ages in the victim's car and the other primary vehicle involved in the crash
- type of restraints needed, present, and used correctly

2.1.3.4 Inclusion Criteria

Cases are selected for review in a number of ways, such as age of the victim, the manner and cause of death, or the place of death. Other factors that influence selection are legislative requirements and caseload of the review team. These selection criteria may be set at the state or local level. As of April 2006, 39 states were reviewing injury deaths to at least age 17. The National Center for Child Death Review Policy and Practice has published standards for review and encourages reviews through age 18 of all deaths due to external causes (Covington, Foster, and Rich, 2005).

2.1.3.5 Strengths

- Includes an in-depth review of adolescent motor vehicle deaths and their underlying causes.
- Provides information about extenuating circumstances, such as victim's blood alcohol/drug levels.
- Provides information about the driver, such as GDL status.
- Provides information about the number and ages of other passengers in the car.
- Links various data sources to provide an overall picture of the circumstances surrounding the crash.
- Has Web-based query tools.

2.1.3.6 Limitations

- Does not include standardized criteria for CDR selection.
- Does not necessarily reflect all adolescent motor vehicle deaths in a state, depending on the state of review.

- In some states, the number of cases are likely too small to be used in multistate policy analysis and may be biased, depending on the review selection procedure, although most review teams examine a high number of motor vehicle crash deaths.

2.1.3.7 Example of Research Using CDR Data

- Cody, B.E., A.Y. Quraishi, M.C. Dastur, and A.D. Mickalide. April 2004. *Clear Danger: A National Study of Childhood Drowning and Related Attitudes and Behaviors*. Washington, DC: National SAFE KIDS Campaign.

2.1.3.8 Data Availability

Aggregated and some case-specific data are available through state annual reports, most of which can be found in PDF form at http://www.childdeathreview.org. Individual states can be contacted to obtain more detailed data on the case reviews. Data outputs from the new *Child Death Review Case Reporting System* will be generated by January 2007. Individual participating states can be contacted for their state data, as allowed by their respective state laws.

2.1.3.9 Contact Information

Theresa M. Covington, MPH, Director
The National MCH Center for Child Death Review
2438 Woodlake Circle, Suite 240
Okemos, MI 48864
1-800-656-2434
1-517-324-7365 (fax)
www.childdeathreview.org

See Table 2-1 for a list of CDR state contacts.

Table 2-1. CDR State Contacts[a]

State	Contact Name and Affiliation	Contact Information
Alabama	Bob Hinds, Director Alabama Department of Public Health Bureau of Family Health Services CDR	Tel: 334-206-2953 Fax: 334-206-2972 bhinds@adph.state.al.us
Alaska	Kathleen Hickman, Acting Leading Investigator Alaska Medical Examiners Office	Tel: 907-223-2204 Fax: 907-334-2216 Kathleen_Hickman@health.state.ak.us
Alaska	Renee Rudd State of Alaska HSS/DPS/MCH Epi	Tel: 907-269-3401 Fax: 907-269-3493 renee_rudd@health.state.ak.us
Arizona	Susan Newberry, Manager Office of Women's and Children's Health	Tel: 602-542-1875 Fax: 602-542-1843 newbers@azdhs.gov
California	Craig Pierini Attorney General's Office Child Abuse Prevention	Tel: 916-322-2956 Fax: 916-327-2384 craig.pierini@doj.ca.gov

(continued)

Table 2-1. CDR State Contacts (continued)

State	Contact Name and Affiliation	Contact Information
Colorado	Rochelle Manchego Department of Public Health Injury Prevention Program	Tel: 303-692-2573 Fax:303-691-7720 Rochelle.manchego@state.co.us
Connecticut	Faith Vos Winkel Office of Child Advocate	Tel: 860-566-2106 Fax: 860-566-2251 faith.voswinkel@po.state.ct.us
Delaware	Anne Pedrick, Executive Director Child Death, Near Death, Stillbirth Commission	Tel: 302-255-1760 Fax: 302-577-1129 anne.pedrick@state.de.us
District of Columbia	Penelope Minter District of Columbia Office of Chief Medical Examiner	Tel: 202-698-9099 Fax:202-698-9108 pnelope.minter@dc.gov
Florida	Bob Hodges, Assistant State Attorney State Attorney Office	Tel: 352-369-2469 Fax: 352-620-3365 rodges21@cox.net
Georgia	Eva Patillo, Executive Director Georgia Office of Child Fatality Review	Tel: 770-528-3988 Fax: 770-528-3989 eva_p@bellsouth.net
Hawaii	Susan Anderson, CDR Nurse Coordinator Hawaii Child Death Review	Tel: 808-733-9037 Fax: 808-733-4055 susan.anderson@fhsd.health.state.hi.us
Illinois	Sherry Barr Illinois Department of Children and Family Services	Tel: 217-785-0429 Fax:217-785-0395 sbarr@idcfs.state.il.us
Indiana	Allison Chaney, Assistant Deputy Director Field Operations Indiana Department of Child Services	Tel: 317-233-1743 Fax:317-234-4497 allison.chaney3@dcs.in.gov
Iowa	Stephanie Pettit, PhD Iowa Department of Public Health Division of Health Promotion, Family Services Bureau	Tel:515-281-3108 Fax: 515-281-6384 spettit@idph.state.ia.us
Kansas	Angela Nordhus, Executive Director State Child Death Review Board	Tel: 785-296-7970 Fax: 785-291-3875 nordhus@ksag.org
Kentucky	Gwen Cobb, Health Program Section Supervisor Cabinet for Health Services Department of Health	Tel: 502-564-2154, ext. 3771 Fax: 502-564-8389 gwen.cobb@ky.gov
Louisiana	Arlene Antoine, Coordinator Office of Public Health	Tel: 504-219-4619 Fax: 504-219-4583 aantoine@dhh.la.gov
Maine	Sandra Hodge, Director Division of Policy and Special Requests Bureau of Child and Family Services, DHHS	Tel: 207-586-5315 ssh@lincoln.midcoast.com

(continued)

Table 2-1. CDR State Contacts (continued)

State	Contact Name and Affiliation	Contact Information
Maryland	Joan Patterson, Coordinator State Child Fatality Review Team Maryland Public Health CMCH State Of Maryland	Tel: 410-767-6727 Fax: 410-333-5233 Jpatterson@dhmh.state.md.us
Massachusetts	Randy Moshos Office of Chief Medical Examiner Massachusetts Department of Public Health	Tel: 617-267-6767, ext. 218 Fax: 617-267-4931 randy.moshos@state.ma.us
Michigan	Lynda Meade, Sr. Project Coordinator Michigan Public Health Institute	Tel: 517-324-7330 Fax: 517-324-7365 lmeade@mphi.org
Minnesota	Frances Felix, Child Mortality Review Coordinator Minnesota Department of Human Services	Tel: 651-297-3834 Fax: 651-297-1949 fran.felix@state.mn.us
Mississippi	Stephanie Ivy Mississippi State Department of Health	Tel: 601-576-5980 Fax: 601-576-7498 stephanie.ivy@msdh.state.ms.us
Missouri	Gus Kolilis State Technical Assistance Team	Tel: 573-751-6274 Fax: 573-752-1479 Gus.H.Kolilis@dss.mo.gov
Montana	Julie Chaffee, RN Montana Department of Public Health and Human Services Family and Community Health Bureau	Tel: 406-444-3394 Fax: 406-444-2606 jchaffee@mt.gov
Nebraska	Debra Barnes-Josiah, PhD, Coordinator Office of Family Health Nebraska Health and Human Services System	Tel: 402-471-8566 Fax: 402-471-7049 deborah.barnesjosiah@hhss.ne.gov
New Hampshire	Marc Clement, Professor Colby-Sawyer College	Tel: 603-526-3652 Fax: 603-526-3452 mclement@colby-sawyer.edu
New Jersey	Nelson Gonzalez, CFNFR Coordinator DYFS NJ Child Fatality and Near Fatality Review Board	Tel: 609-292-5823 Fax: 609-984-1018 nelson.gonzalez@dhs.state.nj.us
New Mexico	Bonnie Taylor Office of Injury Prevention New Mexico Family Health Bureau	Tel: 505-476-7833 Fax: 505-476-7810 bonnie.j.taylor@state.nm.us
New York	Thomas Hess New York State Office of Children and Family Services	Tel: 518-474-4086 Fax: 518-402-6824 thomas.hess@dfa.state.ny.us
North Carolina	Brenda Edwards North Carolina Division of Public Health	Tel: 919-707-5623 Fax: 919-870-4882 Brenda.Edwards@ncmail.net

(continued)

Table 2-1. CDR State Contacts (continued)

State	Contact Name and Affiliation	Contact Information
North Dakota	Marlys Baker Child Family Service	Tel: 701-328-1853 Fax: 701-328-3538 sobakm@state.nd.us
Ohio	Merrily Wholf, RN, MPH, Ohio CFR Coordinator Bureau of Child and Family Services Ohio Department of Health	Tel: 614-728-0773 Fax: 614-644-9850 merrily.wholf@odh.ohio.gov
Oklahoma	Lisa Rhoades, Administrator Oklahoma Child Death Review Board	Tel: 405-271-8858 Fax: 405-271-2931 lisa-rhoades@ouhsc.edu
Oregon	Lisa Millet, Section Manager Oregon Department of Human Services Injury and Violence Prevention	Tel: 503-731-8597 Fax: 503-731-4157 lisa.m.millet@state.or.us
Pennsylvania	Vik Zittle, Program Director Pennsylvania American Academy of Pediatrics Child Death Review	Tel: 800-916-9776 Fax: 484-446-3255 vzittle@paaap.org
Rhode Island	Wendy Verhoek-Oftedahl Rhode Island Department of Health	Tel: 401-222-5504 wendy@oftedahl.com
South Carolina	Keisha Adams, Program Coordinator Child Fatality S.C. Department of Health & Environmental Control Division of Injury and Violence Prevention	Tel: 803-898-4153 Fax: 803-253-2765 adamsks@dhec.sc.gov
South Dakota	Brad Randall MD, Forensic Pathologist LCM Pathologists	Tel: 605-333-1741 Fax: 605-328-2765 Fornsix@aol.com
Tennessee	Jacqueline Johnson Tennessee Department of Health	Tel: 615-741-0368 Fax: 615-741-1063 jacqueline.johnson@state.tn.us
Texas	Susan Rodriguez Family Health Research and Program Development Texas Department of State Health Services	Tel: 512-458-7111 Fax: 512-458-7222 Susan.Rodriguez@dshs.state.tx.us
Utah	Trish Keller Utah Department of Health Violence and Injury	Tel: 801-538-6864 Fax: 801-538-9134 trishakeller@utah.gov
Vermont	Patrick Malone University of Vermont	Tel: 802-656-3489 Fax: 802-371-8595 patrick.malone@umv.edu
Virginia	Virginia Powell, PhD Child Fatality Review Team Office of the Chief Medical Examiner	Tel: 804-786-1047 Fax: 804-371-8595 vpowell@vdh.state.va.us

(continued)

Table 2-1. CDR State Contacts (continued)

Washington	Beth Siemon, Health Services Consultant Washington Department of Health Maternal & Child Health	Tel: 360-236-3516 Fax: 360-586-7868 beth.siemon@doh.wa.gov
West Virginia	Maureen Runyon, Coordinator Office of Chief Medical Examiner	Tel: 304-558-6920 Fax: 304-558-9038 maureenrunyon@wvdjjr.org
Wisconsin	Ann Rulseh, CJI Grant Coordinator Department of Justice	Tel: 608-266-3934 Fax: 608-266-6368 rulseham@doj.state.wi.us
Wyoming	Carolyn Patton Major Injury Fatality Review Team	Tel: 307-777-5479 Fax: 307-777-3693 cpatto@state.wy.us

[a]Most state child death review legislation specifies the agency in which the program is housed so that, in the event of staff turnover, researchers can contact the agency directly.

2.2 Morbidity and Healthcare Utilization Data

2.2.1 Healthcare Cost and Utilization Project Kids' Inpatient Database

2.2.1.1 Purpose

HCUP–KID is one of a family of databases and software tools developed as part of HCUP. This federal-state-industry partnership sponsored by the Agency for Healthcare Research and Quality (AHRQ) was specifically designed to permit researchers to study a broad range of conditions and procedures related to hospitalizations of children.

2.2.1.2 Description

HCUP-KID is a database of hospital inpatient stays for newborns, children, and adolescents (aged 20 or younger at the time of admission). It is developed using available State Inpatient Databases (SID) under HCUP and has been released every 3 years beginning in 1997. It enables research on a broad range of health policy issues, including cost and quality of health services, medical practice patterns, access to healthcare programs, and outcomes of treatments.

2003 KID data represent 3 million discharges, which are stratified into birth-related and nonbirth-related classifications, the latter of which includes discharge of teens who were hospitalized for injuries from motor vehicle crashes. Discharge data, which are drawn from 3,438 hospitals in 36 states, are weighted using American Hospital Association (AHA) annual survey data to provide nationally representative estimates. KID includes more than 100 clinical and nonclinical variables for each hospital stay, including the following:

- primary and secondary diagnoses
- primary and secondary procedures

- admission and discharge status
- patient demographics (e.g., gender, age, race, median income for zip code)
- expected payment source
- total charges
- length of stay
- hospital characteristics (e.g., ownership, size, teaching status)

2.2.1.3 Data Collection Methods

KID is a stratified random sample drawn from community, nonrehabilitation hospitals in the HCUP SID that could be matched to the AHA survey data (subject to state-specific restrictions). A systematic random sampling method is used to select hospital discharges to include birth-related and nonbirth-related discharges for patients less than 20 years of age.

2.2.1.4 Inclusion Criteria

All discharges for patients (aged 20 or younger at admission) from community, nonrehabilitation hospitals from states participating in HCUP are eligible for stratified random sampling. Short-term rehabilitation hospitals were included in the 1997 KID but excluded from the 2000 and 2003 KID.

2.2.1.5 Strengths

- Developed specifically to study inpatient utilization of patients less than 20 years of age.
- Hospitalizations due to motor vehicle injuries can be estimated using HCUP-KID.
- KID includes facility charge information on all patients, regardless of payer, including those covered by Medicaid, private insurance, and the uninsured.
- It is possible to identify hospital discharges for adolescents involved in a motor vehicle crash using E-codes. Any separately reported E-codes and any E-code encountered in the diagnosis array are placed into a specific array called ECODEn.
- National estimates can be obtained using discharge weights developed from AHA annual survey data.
- Has Web-based query tool.

2.2.1.6 Limitations

- Geographic regions are represented disproportionately in 2000 KID (90% of the hospitals in the Northeast region are represented, compared with 77% in the West, 63% in the South, and 30% in the Midwest), precluding regional comparisons of teen crash injuries.
- Because KID data are based on discharges, they may include the same patient/injury more than once; for example, when an injured child is discharged after initial hospitalization and then is readmitted (to either the same or a different hospital) for a series of corrective surgeries.
- Does not include children seen as outpatients.

- Physician charges are not included in KID.
- Does not include crash data.
- There is no post-discharge follow-up data to characterize the long-term health care needs of affected patients.
- Data are compiled every 3 years.

2.2.1.7 Example of Research Using HCUP-KID

- Killingsworth, J.B., J.M. Tilford, J.G. Parker, J.J. Graham, R.M. Dick, and M.E. Aitken. 2005. "National Hospitalization Impact of Pediatric All-Terrain Vehicle Injuries." *Pediatrics* 115(3):e316-e321.

2.2.1.8 Data Availability

Purchase of the HCUP-KID files is open to all individuals who sign a data use agreement. Users must agree to use the database for research and statistical purposes only and to make no attempts to identify individuals or to link the data to other sources. KID files for 1997, 2000, and 2003 are available through the HCUP Central Distributor and can be purchased for any year for $200 each. Researchers can contact the HCUP Central Distributor to complete the data use agreement, to answer questions about any year of the KID, and to purchase the data.

2.2.1.9 Contact Information

HCUP Central Distributor
866-556-4287 (phone)
301-628-3201 (fax)
hcup@s-3.com

2.2.2 National Electronic Injury Surveillance System—All Injury Program

2.2.2.1 Purpose

The primary focus of NEISS–AIP is to estimate the number of injuries treated in emergency departments.

2.2.2.2 Description

Under the auspices of the U.S. Consumer Product Safety Commission (CPSC), NEISS has been gathering product-related injury data from emergency departments in hospitals selected as a probability sample since 1973. During that time, the number of hospitals varied from year to year, hovering around 100. In July 2000, NEISS, in collaboration with CDC's National Center for Injury Prevention and Control, expanded its data collection effort in a subset of 64 hospitals to identify and capture injuries resulting from all causes, including motor vehicle crashes. Data are collected daily on all patients admitted to emergency departments in NEISS–AIP hospitals by logging and coding patient injuries while they are in the emergency department.

Although it is currently not possible to link NEISS–AIP data to other data sources, it is possible to prospectively capture additional data for select injuries. For example, as part of targeted research efforts, NEISS–AIP provided motor vehicle air bag injury data to NHTSA and occupational injury data to NIOSH.

2.2.2.3 Data Collection Methods

Data collection begins when a patient is admitted for an injury to the emergency department in one of the 64 NEISS–AIP hospitals. During the course of care for the patient, emergency department staff chart the patient's progress and treatment in the medical record. At the end of the day, a NEISS–AIP coordinator abstracts information from the chart, codes it using the NEISS–AIP Coding Manual, drafts an incident scenario, and submits the data to NEISS–AIP. NEISS-AIP codes major external cause groupings based on ICD-9 guidelines. The variables that are collected include the following:

- date of treatment
- case record number
- age of patient
- gender of patient
- injury diagnosis (NEISS–AIP diagnosis code)
- body part affected
- disposition (e.g., treated and released, hospitalized)
- products mentioned
- locale
- whether work-related
- race and ethnicity
- incident scenario (narrative of circumstances surrounding the crash)
- whether intentionally inflicted

Telephone follow-ups for other federal agencies are only part of a special study and are not part of the main NEISS-AIP.

2.2.2.4 Inclusion Criteria

The sampling frame includes all injuries treated in emergency departments in the subset of 64 NEISS–AIP hospitals across the United States.

2.2.2.5 Strengths

- Can produce quick answers or permit detailed analyses from complex studies.
- Can be used to track trends and identify problems as they relate to motor vehicle injuries.
- Can carry out focused in-depth studies upon request.

2.2.2.6 Limitations

- Historical focus is on consumer products—has only been collecting data on motor vehicle injuries since 2000.
- Captures data on only the principal diagnosis. Does not use ICD-9 coding to classify diagnosis. Uses a broad, classification system unique to NEISS–AIP.
- Captures data on injuries treated in emergency departments only.
- Does not track injuries post discharge.
- Does not differentiate between driver and passenger.
- Cannot provide state-based estimates.

2.2.2.7 Examples of Research using NEISS–AIP

- Ballesteros, M.F., R.A. Schieber, J. Gilchrist, P. Holmgreen, and J.L. Annest. 2003. "Differential Ranking of Causes of Fatal Versus Non-Fatal Injuries Among U.S. Children." *Injury Prevention* 9:173-176. (Note: This article also demonstrates use of NVSS.)
- Shults, R.A., A. Greenspan, A. Dellinger, T. Haileysus, and K.C. Lee. June 2006. "Nonfatal Injuries and Restraint Use among Child Passengers—United States 2004." *Morbidity and Mortality Weekly Report* 55(22):624-627.
- Shults, R.A., S.D. Wiles, M. Vajani, and J.C. Helmkamp. 2005. "All-Terrain Vehicle-Related Nonfatal Injuries among Young Riders in the United States, 2001–2003." *Pediatrics* 116:e608-e612.

2.2.2.8 Data Availability

NEISS–AIP motor vehicle data are sent to the National Center for Injury Prevention and Control (NCIPC) where they are summarized according to ICD-10 codes. Researchers can access summary national and state-level data from WISQARS at http://www.cdc.gov/ncipc/wisqars/. For example, WISQARS in its 2004 national estimate of nonfatal injuries indicates that there were 460,960 adolescent motor vehicle injury visits (14 per 100,000) in NEISS–AIP hospital emergency departments. WISQARS also indicates 2,859 deaths due to motor vehicle crashes for adolescents aged 15 to 19 in 2003.

Although CPSC makes all routinely collected data available to government agencies at no cost, an interagency agreement between the agency and CPSC is required when additional data are requested.

2.2.2.9 Contact Information

Thomas Schroeder, Director
Division of Hazard and Injury Data Systems—U.S. Consumer Product Safety Commission
4330 East West Highway
Bethesda, MD 20814
301-504-7431

2.2.3 National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey

2.2.3.1 Purpose

NAMCS and the two NHAMCS components—outpatient departments (OPD) and emergency departments (ED)—provide information on the demographics, illnesses, treatments, office procedures, screenings, and counseling services for patient visits to outpatient care settings.

2.2.3.2 Description

NAMCS, established in 1973, is a national probability sample survey of visits to office-based physicians. NHAMCS, established in 1992, is a national probability sample survey of visits to emergency departments (NHAMCS-ED) and outpatient departments (NHAMCS-OPD) of nonfederal, short-stay, and general hospitals. Data are collected annually. These surveys use a four-stage probability design to generate nationally representative estimates of outpatient use. Sampling begins with geographically defined areas. Hospitals within these areas are then sampled, followed by clinics within the ODs and EDs. As a final step, patient visits are sampled. Data are available for the United States as a whole and for four geographic regions.

2.2.3.3 Data Collection Methods

For both NAMCS and NHAMCS, data collection includes demographic characteristics of patients, expected source(s) of payment, patients' complaints in their own words, physicians' diagnoses, diagnostic/screening services, procedures, medication therapy, disposition, and types of health care professionals seen. Between 1997 and 2004, data were collected on the cause of injury. Reasons for visits (in the patient's own words) are coded using an internal NCHS classification, which is updated annually. Beginning in 2005, only the NHAMCS-ED component collects data for cause of injury. NHAMCS-OPD and NAMCS no longer collect E-codes.

2.2.3.4 Inclusion Criteria

All patients who fall into the randomization process described above and who are treated in nonfederal, short-stay, and general hospitals are included in the sample.

2.2.3.5 Strengths

- Data are collected by medical professionals.
- Data can be used to find out how many ambulatory care visits were made involving motor vehicle crashes by age group.
- The cause of injury code (ICD-9-CM Supplementary Classification of External Causes of Injury and Poisoning) identifies motor vehicle crashes.

- Together, NAMCS and NHAMCS cover outpatient visits regardless of setting.
- Surveys are designed to provide national estimates.

2.2.3.6 Limitations

- Does not differentiate between automobile and motorcycle injuries.
- State-specific data are not available.
- No way to track subsequent medical utilization.
- As of 2005, only NHAMCS-ED collects data on cause of injury.
- There are likely to be substantial differences between patients' self-report of reason for visit and physician's coding, especially for subsequent visits that may originally result from an automobile injury.

2.2.3.7 Examples of Research Using NHAMCS

- Hambridge, S.J., A.J. Dairdson, R. Gonzales, and J.F. Steiner. 2002. "Epidemiology of Pediatric Injury—Related Primary Care Office Visits." *Pediatrics* 109(4):559-565.
- Simon, T.D., C. Bublitz, and S.J. Hambidge. 2004. "External Causes of Pediatric Injury-Related Emergency Department Visits in the United States." *Academic Emergency Medicine* 11(10):1042-1048.

2.2.3.8 Data Availability

NAMCS and NHAMCS data can be downloaded from the Inter-University Consortium for Political and Social Research (ICPSR) at www.icpsr.umich.edu/index.html.

For researchers who want to use these data but need data items that are not available on the downloadable public use micro-data files, the National Center for Health Research is an alternative. Researchers must submit a proposal that is reviewed by NCHR staff. Fees are charged for accessing the data. More information is available at http://www.cdc.gov/nchs/r&d/rdc.htm.

2.2.3.9 Contact Information

For more information about NAMCS and NHAMCS, call 1-301-458-4600. A person is assigned each day to answer data questions.

2.2.4 Medical Expenditure Panel Survey

2.2.4.1 Purpose

MEPS provides policy makers, health care administrators, businesses, and others with timely, comprehensive information about health care use and costs in the United States with the intention of improving the accuracy of economic projections.

2.2.4.2 Description

MEPS, which is cosponsored by AHRQ and NCHS, is a nationally representative survey of the civilian noninstitutionalized population that quantifies total annual medical expenditures for each participant by payer (e.g., Medicaid, Medicare, private insurance) and service type (e.g., inpatient, outpatient, emergency room, office-based, prescription, other).

MEPS uses an overlapping panel design in which data are collected through a preliminary contact followed by a series of five rounds of interviews over a 2.5-year period. Each annual file includes data from two panels: a panel continuing their MEPS participation from the previous year and a panel beginning their MEPS participation in the current year. For researchers who want to examine medical expenditures and use over a 24-month period or increase the MEPS population size, AHRQ provides a pooled linkage file that adjusts the population sampling unit (PSU) and stratum variables for datasets pooled over multiple years.

Data from the various MEPS components (i.e., the Household Component, Medical Provider Component, and the Insurance Component) are combined to produce an annual Consolidated Data File. Each year of MEPS data also includes a Medical Conditions File that compiles unique records for each medical condition reported by a participant over a 12-month period and provider-specific (e.g., inpatient or office-based) Event Files that follow that condition through various stages of treatment. Although medical conditions are self-reported, they are later verified using information from the service provider and/or insurer. Medical conditions are defined on the basis of *International Classification of Diseases, Ninth Revision, Clinical Modifications* (ICD-9-CM) codes. MEPS coders use Clinical Classification Software (formerly known as Clinical Classifications for Health Care Policy Research [CCHPR]) to aggregate ICD-9-CM condition codes into 260 mutually exclusive, clinically meaningful categories. In addition, for each reported condition, participants are asked if the condition was due to an accident or injury. If a participant confirms that the condition was due to an accident or injury, he is then asked if a motor vehicle was involved. These variables can be used with expenditures data from the Consolidated Data File to estimate the cost of motor vehicle injuries.

Although MEPS was not designed for state-level analyses, it is sometimes possible to generate state-representative estimates for the 30 largest states. State geographic codes are not publicly available (the lowest level of analysis is geographic region), but approved projects can access state-level variables at the CFACT Data Center in Rockville, Maryland. However, given the small number of annual motor vehicle injuries recorded by MEPS (e.g., 87 motor vehicle injuries were reported among 10- to 18-year-olds in 2001), it is likely impossible to generate stable motor vehicle injury cost or incidence estimates at the state level, even after pooling multiple years of MEPS data.

2.2.4.3 Data Collection Methods

MEPS data are collected in three components: the Household Component, the Medical Provider Component, and the Insurance Component.

The Household Component (which collects detailed data on demographic characteristics, health conditions, health status, use of medical care services, charges and payments, access to care, satisfaction with care, health insurance coverage, income, and employment) uses an overlapping panel design in which data are collected through a preliminary contact followed by a series of five rounds of interviews over a 2.5-year period. Using computer-assisted personal interviewing (CAPI) technology, data on medical expenditures and use for 2 calendar years are collected from each household. This series of data collection rounds is launched each subsequent year on a new sample of households to provide overlapping panels of survey data and, when combined with other ongoing panels, provides continuous and current estimates of health care expenditures.

The Medical Provider Component, conducted through telephone interviews and records abstraction, supplements and/or replaces information on medical care events reported in the Household Component by contacting medical providers and pharmacies identified by household respondents. The Medical Provider Component sample includes all home health agencies and pharmacies reported by Household Component respondents. Office-based physicians, hospitals, and hospital physicians are also included in the Medical Provider Component but may be subsampled at various rates, depending on burden and resources, in certain years.

The Insurance Component, conducted through a prescreening telephone interview, a mailed questionnaire, and a telephone follow-up for nonrespondents, collects data on health insurance plans obtained through private and public-sector employers. Data obtained in the Insurance Component include the number and types of private insurance plans offered, benefits associated with these plans, premiums, contributions by employers and employees, eligibility requirements, and employer characteristics.

Establishments participating in the MEPS Insurance Component are selected through three sampling frames:

- a list of employers or other insurance providers identified by MEPS Household Component respondents who report having private health insurance at the Round 1 interview
- a Census Bureau list frame of private sector business establishments
- the Census of Governments from the Bureau of the Census

To provide an integrated picture of health insurance, data collected from the first sampling frame (employers and insurance providers identified by Household Component respondents) are linked back to data provided by those respondents.

2.2.4.4 Inclusion Criteria

The sampling frame for the Household Component is drawn from respondents to the National Health Interview Survey (NHIS). NHIS provides a nationally representative sample of the U.S. civilian noninstitutionalized population, with oversampling of Hispanics and blacks. MEPS is limited to the civilian noninstitutionalized population.

2.2.4.5 Strengths

- MEPS tracks medical costs up to 24 months.
- Because MEPS data are comparable to those from earlier medical expenditure surveys (including the 1987 National Medical Expenditures Survey), it is possible to analyze long-term trends.
- MEPS provides a single source for both incidence and expenditures data.
- MEPS collects payer-specific and provider-specific expenditures data.
- Has Web-based query tool.

2.2.4.6 Limitations

- MEPS motor vehicle injury sample is relatively small, which limits potential stratifications (e.g., by ICD, by state).
- MEPS does not provide detailed data on motor vehicle crashes (e.g., was the injured person a passenger or driver?).
- MEPS is unlikely to be useful for state-level analyses or for policies that impact adolescents only because there are not enough observations.

2.2.4.7 Examples of Research Using MEPS

- Chu, May. December 2004. *Characteristics of Persons Who Seldom or Never Wear Seat Belts.* Statistical Brief #62. Rockville, MD: Agency for Healthcare Research and Quality.
- Finkelstein, E.A., I. Fiebelkorn, and P. Corso. 2004. "Medical Expenditures Attributable to Injuries—United States, 2000." *Journal of the American Medical Association* (reprinted from *Morbidity and Mortality Weekly Report*) 291(7):817-818.

2.2.4.8 Data Availability

Most MEPS data releases are available for public use on diskettes, CD-ROMs, and the Internet at the MEPS Web site: http//www.meps.ahrq.gov.

Researchers with approved projects are allowed access to variables not available for public use (such as state-level geographic codes); however, analyses must be completed at the CFACT Data Center in Rockville, Maryland. For general information, researchers can be reached by phone at 1-301-427-1406 or by fax at 1-301-427-1276.

2.2.4.9 Contact Information

Project Director, Center for Financing,
Access and Cost Trends
Medical Expenditure Panel Survey
Agency for Healthcare Research and Quality
540 Gaither Road
Rockville, MD 20850
310-427-1656
Mepspd@ahrq.gov

2.3 Linked Database that Captures Multiple Dimensions of Injuries

2.3.1 Crash Outcome Data and Evaluation System

2.3.1.1 Purpose

CODES data links crash, vehicle, and medical records data to better understand the true burden of motor vehicle crashes and identify effective strategies for prevention.

2.3.1.2 Description

CODES is a state-specific collaborative approach for obtaining vehicle crash information and medical record information. By linking the electronic statewide police crash data, electronic statewide medical record data and claims data, CODES provides a rich source of information to analyze and report on crash factors associated with injury, medical costs and utilization.

The types of data elements that identify a crash include day and month of crash, year of crash, hour and minute of crash, latitude/longitude for crash, county/city of crash location, type of vehicle, vehicle identification number, EMS agency providing transport, police, and hospital. Types of data elements that identify a person include age, day and month of birth, year of birth, gender, vehicle number for crash, seating position, injury status, transport by EMS, admission as a hospital inpatient, residence zip code, and name (if available). Social security number (if available) is also recorded but is not released to the public.

In order for a state to qualify as a CODES state, it must have statewide, population-based computerized data related to motor vehicle crashes for 2 calendar years. This electronic data must be able to discriminate between crashes and the persons involved in them and must have a process to ensure routine linkage of crash and injury data. Electronic data may include some or all of the following:

- crash data (required)
- EMS
- emergency department/hospital data
- other data, including death certificates, traffic records, vehicle registration, and insurance claims

Eligible states must have personnel experienced in working with Microsoft Access, SAS, and crash and/or injury state data files and must show a willingness to collaborate with NHTSA, provide state matching funds, and convene both data owners and data users in a CODES Board of Directors and CODES Advisory Committee, respectively. Table 2-2 presents the 29 participating CODES states, the first year that inpatient data was linked with crash data, and Web site locations (when available) for obtaining more detailed information from the respective states. Researchers should contact NHTSA rather than the individual states if they are interested in conducting a study using CODES.

Table 2-2. First Year of Linked Data and CODES State Web Site Locations

State	First Year of Linked Data	Web Site Location
Arizona	1998	Tel: 520.620.6838 Fax: 520.882.5014 E-mail: cconroy@email.arizona.edu
Connecticut	1999	Tel: 860.509.8116 Fax: 860.509.7987 E-mail: bill.teel@po.state.ct.us
Delaware	1998	Tel: 302.739.4710 Fax: 302.739.2352 E-mail: bstevenson@state.de.us
Georgia	2000	Tel: 404-679-0542 Fax: 404-679-4976 E-mail: sdavidson@gdph.state.ga.us
Hawaii		Currently inactive due to data availability problems
Illinois	New—in process	
Indiana	2002	
Iowa	1996	
Kentucky	1999	Tel: 859.257.6777 Fax: 859.257.3909 E-mail: pdwill00@pop.uky.edu
Maine	1995	Tel: 207.624.5467 Fax: 207.624.5470 E-mail: cathy.s.stpierre@state.me.us
Maryland		Tel: 410.767.5780 Fax: 410.333.7279 E-mail: demeterl@dhmh.state.md.us
Massachusetts	1999	Tel: 617.284.8401 Fax: 617.284.8456 E-mail: brad.prenney@state.ma.us
Missouri	1999	Tel: 573.751.6274 Fax: 573.526.4102 E-mail: vantum@mail.health.state.mo.us
Minnesota	2000	www.dps.state.mn.us/OTS/crashdata (select CODES project)

(continued)

Table 2-2. First Year of Linked Data and CODES States' Web Site Locations (continued)

State	First Year of Linked Data	Web Site Location
Nebraska	2001	Tel: 402.471.0566 Fax: 402.471.6436 E-mail: ming.qu@hhss.state.ne.us
New Hampshire	1995	Tel: 603.271.0351 Fax: 603.271.1030 E-mail: hetcon@mediaone.net
New York	1995	Tel: 518.473.1143 Fax: 518.474.3067 E-mail: slb05@health.state.ny.us
Ohio	2002	
Oklahoma	1995	Tel: 405.271.1324 Fax: 405.271.3397 E-mail: Ross-Clarke@ouhsc.edu
Pennsylvania	1994	Tel: 412.648.9290 Fax: 412.648.8924 E-mail: hweiss@injurycontrol.com
Rhode Island	2000	Tel: 401.222.5142 Fax: 401.273.4350 E-mail: tedd@doh.state.ri.us
South Carolina	1998	Tel: 803.898.9955 Fax: 803.898.9972 E-mail: mpease@drss.state.sc.us
South Dakota	1995	Tel: 605.367.5252 or 605.677.5543 Fax: 605.677.5427 E-mail: kdougher@charlie.usd.edu
Tennessee	2000	Tel: 615.253.5519 Fax: 615.253.5523 E-mail: rthomas5@mail.state.tn.us
Texas	1999	
Utah	1996	Tel: 801.588.3280 Fax: 801.588.3297 E-mail: mike.dean@hsc.utah.edu
Virginia	2001	
Wisconsin	1991	www.chsra.wisc.edu/codes

2.3.1.3 Data Collection Methods

Crash and medical data elements are collected at the crash scene, en route to the emergency department, in the emergency department, in the hospital, and from other sources. Separately for each participating state, data from all of these sources are linked using a probabilistic matching algorithm and the CODES2000 software. The algorithm is necessary because in most instances unique data identifying the individual (e.g., name, SSN) is not available on the datasets that are trying to be linked. To create the data

linkage, the software compares the common information about the crash and the person in both files (e.g., gender, date of crash/hospitalization) and computes the probability that pairs of records represent the same individual. Multiple imputation methods are then applied, which in turn require special analytical methods. NHTSA staff and consultants provide support to CODES states and their partners concerning appropriate strategies for analyzing the data once the linkage is complete.

2.3.1.4 Inclusion Criteria

All crashes included on participating state police accident report (PAR) files are eligible for inclusion in CODES.

2.3.1.5 Strengths

- Linked data in CODES allow for addressing a much broader range of research questions than most currently available crash datasets.
- The datasets are unique to each state, but because some data elements are common across states, analyses involving more than one state may be possible for some research questions.

2.3.1.6 Limitations

- Only available for 29 states.
- Years of data availability vary across states. The earliest data available is from 1990 (see Table 1).
- CODES data elements vary across states (although all states maintain a common core set of areas for which data are collected such as crash type, vehicle type, hospital charges, hospital length of stay).
- CODES reporting formats vary across states as influenced by user needs, although NHTSA is working to provide common reports across states in the future.
- Data are highly reliable for some variables (e.g., day of crash, time of crash) and less reliable for others (e.g., seat belt use, alcohol use).
- Due to the probabilistic matching algorithm and analyses involving multiple imputed datasets, the results are subject to variability.
- Without using the sophisticated methods recommended by NHTSA, results may produce misleading or inappropriate conclusions.

Expert panel members offered additional limitations, including the following:

- State to state comparisons may be problematic because of differences in coding and/or other state differences that may confound the analyses.
- States may be unwilling to have their data used in state to state comparisons.

2.3.1.7 Examples of Research Using CODES

- Gill, S.S., J.W. Jakub, M.C. Pease, and C.D. Woolen. 2002. "The Economic Impact of Motor Vehicle Crashes: The Cost of Restrained Versus Unrestrained Occupants in South Carolina." *American Surgeon* 68(6):569-574.

- Hyde, L.K., L.J. Cook, L.M. Olson, H.B. Weiss, and J.M. Dean. 2003. "Effect of Motor Vehicle Crashes on Adverse Fetal Outcomes." *Obstetrics and Gynecology* 102(2):279-286.
- Nolan, R. 2004. *Seatbelt Use in Motor Vehicle Crashes: Rhode Island, 2001* (Issue 04-1). Providence, RI: Rhode Island Department of Health.
- Rivara, F.P., P. Cummings, and C. Mock. 2003. "Injuries and Death of Children in Rollover Motor Vehicle Crashes in the United States." *Injury Prevention* 9:76-80.

2.3.1.8 Data Availability

It is recommended that NHTSA be the primary point of contact for research based on CODES data. However, each state exercises control over its linked data through state CODES Boards of Directors that determine user access in compliance with state privacy legislation and regulations. Most states do not give outside agencies and organizations access to the actual datasets.

2.3.1.9 Contact Information

To learn more about CODES from NHTSA go to http://www.nhtsa.dot.gov/departments/nrd-30/ncsa/CODES.html.

2.3.2 National Automotive Sampling System—Crashworthiness Data System

2.3.2.1 Purpose

NASS–CDS provides nationally representative data on motor vehicle traffic crashes for use in developing and evaluating motor vehicle safety standards and other safety countermeasures.

2.3.2.2 Description

Under the auspices of NHTSA, NASS–CDS collects crash data from chosen geographic areas that are weighted to represent a nationwide sample. Detailed information is collected on key aspects of each motor vehicle crash selected, including crash location, vehicles, and people's injuries. Information collected in NASS–CDS, with all personal identifiers removed, is made available to all data users. Data are available on more than 140,000 crashes going back to 1979.

2.3.2.3 Data Collection Methods

The sampling frame is drawn from police-reported traffic crashes involving passenger vehicles that were towed from the scene due to damage from the crash. Trained crash researchers obtain data and photographs from crash sites collecting evidence such as skid marks, fluid spills, broken glass, and guardrails. They locate the vehicles involved, photograph them, measure the crash damage, and identify interior locations that were

struck by the occupants. These on-site investigations are followed up by interviewing crash victims and reviewing medical records to determine the nature and severity of injuries.

2.3.2.4 Inclusion Criteria

- A police report on the crash must be filed with the state.
- At least one vehicle in the crash must be a passenger vehicle (i.e., passenger car, pickup, van, sports utility vehicle).
- The vehicle must be reported to police as towed because of crash-related damage.

2.3.2.5 Strengths

- NASS–CDS is a national sample of tow-away crashes of all severities.
- NASS–CDS uses common coding for all crashes. These include variables on the events in the crash, about vehicles (e.g., identification, rollover damage patterns), vehicle occupant (age, seating, alcohol, restraint use), and injuries sustained from the crash (severity, body region, lesion type).
- Multiple years of data make trend analysis possible.

2.3.2.6 Limitations

- Information about specific crash locations is not included in any NASS–CDS files.
- The sample only includes data on tow-away crashes.
- Occupant information, including injuries, is only available for occupants of towed passenger vehicles.
- Cannot generate state-level estimates.
- The national sample is from chosen regions rather than states.

2.3.2.7 Examples of Research Using NASS–CDS

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- Newgard, C.D., R.J. Lewis, and B.T. Jolly. 2002. "Use of Out-of-Hospital Variables to Predict Severity of Injury in Pediatric Patients Involved in Motor Vehicle Crashes." *Annals of Emergency Medicine* May;39(5):481-491.
- Rivara, F.P., P. Cummings, and C. Mock. 2003. "Injuries and Death of Children in Rollover Crashes in the United States." *Injury Prevention* (9):76-80.

2.3.2.8 Data Availability

Information collected in NASS, with all personal identifiers removed, is made available to researchers and organizations involved in highway safety initiatives. Data are available free on CD-ROM from the Bureau of Transportation Statistics.

2.3.2.9 Contact Information

For statistical publications and information, case data or data files, contract:

National Highway Traffic Safety Administration
National Center for Statistics and Analysis
Information Services Branch, NPO-121
400 7th Street, SW
Washington, DC 20590
1-800-934-8517
http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/

2.3.3 Crash Injury Research & Engineering Network

2.3.3.1 Purpose

CIREN uses NASS–CDS together with medical and injury databases to develop a better understanding of the biomechanics of severe motor vehicle crashes involving late model vehicles (last 6 years) and how those crashes affect subsequent health outcomes.

2.3.3.2 Description

CIREN encompasses 10 study sites located in Seattle, Washington; San Diego, California; Milwaukee, Wisconsin; Ann Arbor, Michigan; Winston-Salem, North Carolina; Philadelphia, Pennsylvania; Baltimore, Maryland; and Falls Church, Virginia. Seven of the Centers are federally funded; two (Mercedes Benz CIREN and Ford Inova Fairfax Hospital Center) are privately funded; and the tenth, Froerdtert Hospital and Medical College in Milwaukee, Wisconsin, is self-funded.

The CIREN database goes back to 1999. It links medical records information with crash data contained in NASS–CDS (for a discussion of NASS-CDC, see Section 2.3.2). CIREN studies focus on how late-model automobiles (models from the past 6 years) perform in serious crashes and how use or nonuse of safety equipment (i.e., seatbelts and airbags) affects medical outcomes. Each of the CIREN Centers follows crash victims for up to 1 year, to determine the long-term consequences of their injuries and the associated physical, emotional, and psychosocial sequelae.

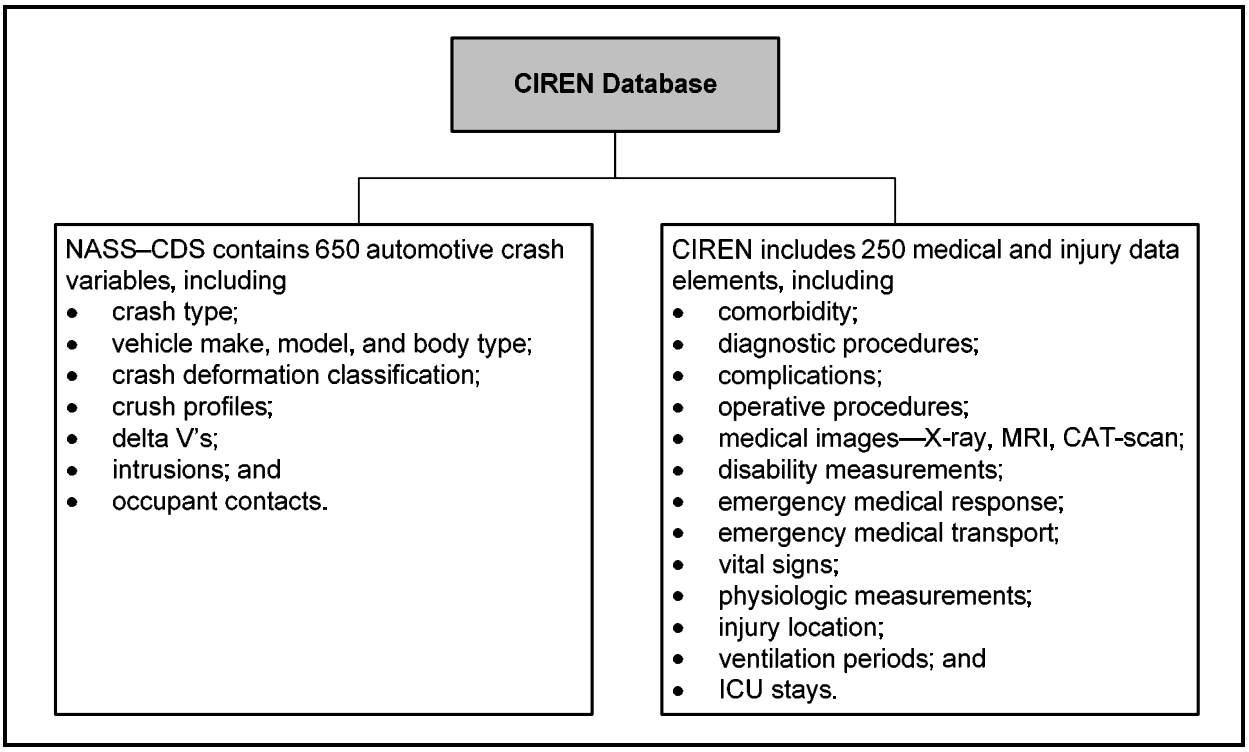
All cases included in the CIREN database involve crash victims that were taken to a Level 1 trauma center. There are currently about 4,000 cases in the CIREN combined datasets, of which about 250 are drivers or occupants between the ages of 12 and 18. Figure 2-1 presents an overview of the CIREN database structure.

2.3.3.3 Data Collection Methods

CIREN Center researchers screen all crash victims coming into their respective partner trauma centers on a regular basis. The screener determines potential case eligibility based on the year of the crash automobile and the severity of the crash victim's injury or injuries.

The Centers' Team reviews the NASS–CDS data and medical record for the victim to determine eligibility for inclusion.

Figure 2-1. CIREN Database Structure



2.3.3.4 Inclusion Criteria

To be included in the sample, the crash victim must have been treated in a Level 1 Trauma Center.[1] The automobile involved in the crash must be a model from the past 6 years. Finally, to be enrolled in CIREN, patients have to have at least one injury of AIS 3 or greater, *or* an AIS 2 in two or more body regions*, or* an AIS 2 in a lower extremity injury with significant articular (i.e., joint) involvement.

2.3.3.5 Strengths

- CIREN Centers follow crash victims for up to 1 year.
- CIREN includes the Medical Outcome Study 36 Item Short Form Health Survey (SF-36), a generic health status measure, to determine the medium (one-year) term

[1]A Level 1 trauma center provides trauma care for most seriously injured adults. To receive level 1 verification, the staff of the hospital must have met rigorous criteria defined by the American College of Surgeons. Level 1 trauma centers are required to have physicians specializing in cardiac, orthopedic, oral, hand, spine, and neurosurgical surgeries on its staff. The Abbreviated Injury Scale (AIS) is an anatomical scoring system in which injuries are ranked by their threat to life on a scale of 1 to 6, with 1 being minor, 5 severe, and 6 an unsurvivable injury.

consequences of their injuries on physical, emotional, and psychosocial function and well-being.

- The linkage between NASS–CDS data and medical records provide insight into risk factors for the crashes in CIREN studies.
- CIREN case selection process has the strength of being able to detect new serious injury patterns early on and studying them in detail.

2.3.3.6 Limitations

- The CIREN database includes crashes of only 6-year old automobile models or newer.
- The CIREN database includes only the most seriously injured victims.
- Of the 4,000 cases in the CIREN database, only about 250 are drivers or occupants between the ages of 12 and 18.
- Because of the select nature of cases enrolled in CIREN, it is not a representative sample of crash victims.

2.3.3.7 Examples of Research Using CIREN

- Melton, S.M., G. McGwin, J.H. Abernathy, P. MacLennan, J.M. Cross, and L.W. Rue. 2003. "Motor Vehicle Crash-Related Mortality Is Associated with Prehospital and Hospital Based Resource Availability." *Journal of Trauma* 54:273-279.
- Moran, S.G., J.S. Metzger, G. McGwin, J.E. Alonso, and L.W. Rue. 2003. "Relationship between Age and Lower Extremity Fractures in Motor Vehicle Collisions." *Journal of Trauma* 54:261-265.

2.3.3.8 Contact Information

Learn more about CIREN at http://www.nhtsa.dot.gov/departments/nrd-50.ciren/html.

3. QUANTIFYING THE NET BURDEN OF ADOLESCENT MOTOR VEHICLE CRASHES

3.1 What the Data Tell Us

The three primary measures of burden are mortality, morbidity, and health care expenditures. Our summary reveals that, although no single source of data adequately captures all of these dimensions, each is captured to some extent by the available data. Table 3-1 summarizes the key dimensions of burden captured in each dataset and indicates whether the dataset would be useful for national or state-level policy analysis of adolescent motor vehicle injuries. This indicator is based on the size and representativeness of the dataset at the national or state level.

Table 3-1. Key Dimensions of Burden

Dataset	Mortality	Morbidity	Health Care Expenditures	Useful for National-Level Intervention Evaluation and Policy Analyses	Useful for State-Level Intervention Evaluation and Policy Analyses
CDR	Yes	No	No	Yes	Yes
CIREN	No	Yes	No	No	No
CODES	Yes	Yes	Yes	No	Yes[a]
FARS	Yes	No	No	Yes	Yes
HCUP-KID	No	Yes	Yes	Yes	Yes
MEPS	No	Yes	Yes	No	No
NASS–CDS	No	Yes	No	Yes	No
NEISS-AIP	Yes	Yes	Yes	Yes	No
NAMCS	No	Yes	Yes	Yes	No
NHAMCS	NO	Yes	Yes	Yes	No
NVSS	Yes	No	No	Yes	Yes

[a]CODES: State to state comparisons may be problematic because of differences in coding and/or other state differences that may confound the analyses.

As can be seen from the table, although some datasets provide detailed information related to motor vehicle crashes and/or injuries, they are not necessarily useful for evaluating national- or state-level policies aimed at reducing the burden of adolescent motor vehicle injuries. For example, although NASS–CDS captures detailed information about the crash itself, including the type/model of vehicle involved, it has limited follow-up data related to motor vehicle occupants and includes only those crashes where the vehicle was towed because of crash-related damage. Although CIREN links data from medical records with crash data, its expressed focus is on the biomechanics of the crash and the dataset is too

small for meaningful policy analysis; only 250 of the 4,000 cases in the database are drivers/occupants between 12 and 18 years of age. Furthermore, its inclusion criteria of late model cars (six years or newer) and crash victims treated in Level 1 trauma centers limits its utility for policy analyses. With that said, CIREN captures SF36 information for all subjects, making it a unique source of data for capturing changes in health status resulting from automobile injuries. Additional strengths and limitations of each of the datasets are summarized in Table 3-2.

Table 3-2. Strengths and Limitations of Each Dataset

Dataset	Strengths	Limitations
CDR	State-level data are available	Considers mortality outcomes only
CIREN	Follows crash victims for up to 1 year; administers the SF-36 to quantify changes in health status	Includes only the most seriously injured victims Includes a small number of adolescent drivers and occupants (250 of the 4,000 cases in data set are drivers/occupants between 12 – 18 years of age) are in the database.
CODES	All states collect data on a core set of areas Links data that include rehabilitation long-term care and insurance claims data providing the opportunity to follow the crash victim beyond the crash and acute medical treatment/ hospitalization State-level data from 29 states	Some data elements vary from state to state Years of data availability vary from state to state Probabilistic matching algorithm requires sophisticated statistical procedures
FARS[a]	State-level data are available	Reports only crashes in which a fatality occurs.
HCUP-KID[a]	Developed specifically to study inpatient utilization of patients less than age 20 Hospitalizations due to motor vehicle injuries can be estimated using HCUP-KID	No post-discharge follow-up data to characterize the long-term health care needs of crash victims Data only collected every 3 years
MEPS[a]	Tracks medical costs for 24 months	Small number observations for motor vehicles injuries (87 reported for 10- to 18-year-olds in 2001)
NASS–CDS	Includes national sample of all severities of injury Multiple years of data	Largely focuses on biomechanics of the crash Limited data on burden of injury.
NEISS-AIP	Can carry out focused in-depth studies upon request Can access data via WISQARS	Cannot provide state-based estimates Includes data on emergency room visits only No ability to link visits for a given individual
NAMCS and NHAMCS	Data are collected by medical professionals Together NAMCS and NHAMCS cover outpatient visits regardless of setting	Includes data on outpatient visits only State-level data not available Since 2005, only NHAMCS - ED (Emergency Department) has been collecting data on cause of injury No ability to link visits for a given individual
NVSS	State-level data	Considers mortality outcomes only

[a]Has Web-based query tools.

For the morbidity datasets, we also assessed whether any of the included datasets are able to capture the long-term burden associated with an injury. CIREN allows for following crash victims for up to 1 year post injury. MEPS captures medical costs over a 24 month period, so depending on the date of the injury, anywhere from 0 to 24 months post injury data may be available. HCUP-KID, NEISS, NAMCS, and NHAMCS track unique visits as opposed to unique victims and therefore cannot identify subsequent visits associated with a given injury or visits that take place in other treatment settings. None of the datasets adequately capture long-term health care utilization and expenditures that may result from an automobile injury.

Our review also revealed other unique features of the datasets. For example, coding is not systematic across datasets. Some datasets (e.g., NVSS) use ICD-10 codes whereas many are still using ICD-9 codes and one (NEISS-AIP) uses a unique classification system. Of these, not all include E-codes to identify the external cause of injury. CIREN and CODES link crash data with medical records data that are E-coded. For HCUP-KID, any separately reported E-codes and any E-code encountered in the diagnosis array are placed into a specific array called ECODEn.

Most policy analyses will also want to identify whether adolescents injured in motor vehicle crashes are drivers or passengers. All of the datasets reviewed, with the exception of HCUP-KID and MEPS, provide an identifier to differentiate between driver and passenger, although data completeness can vary. FARS provides more complete data on driver and passengers than NVSS.

3.2 Summary and Recommendations

One of the primary shortcomings revealed through this analysis is that no single dataset includes information on all measures of burden and/or follows crash victims for extended periods of time. This limits efforts to quantify the long-term health and economic burden of adolescent motor vehicle injuries, which may have life altering consequences. Moreover, whereas it might be possible to capture this information by linking existing datasets, the ability to link datasets is limited by privacy concerns. In fact, nearly all of the datasets specify that any effort to identify specific individuals and/or to link the data to other sources is strictly prohibited. This is a significant limitation.

The one notable exception is CODES, which has made great strides in linking data across multiple sources. Although CODES linkages vary from state to state, efforts have been made to link crash and injury outcome data with utilization data in acute care, rehabilitation and long term care settings and also with mortality files. Additional linkages focus on incorporating state data such as driver licensing, vehicle registration, citation/conviction records, and automobile and health insurance claims data. Although CODES is not without limitations (see Section 2.3.1), these linked data allow for addressing a much broader range

of research questions and may be extremely useful for state-level policy analysis. However, CODES is not available for all states, and even for participating states, the data elements and level of coding accuracy vary across states (although all maintain a common core). Moreover, the probabilistic matching algorithm complicates analyses with the CODES data. Even with these caveats, a primary recommendation for this analysis is to further explore the ability to use the CODES data for state-level policy analyses concerning adolescent motor vehicle injuries. If it is found that the CODES data has the ability to quantify the impact of these policies, then that will represent a major step forward for the field.

Another recommendation is to further explore the usefulness of nonrepresentative datasets. Although these datasets may not be directly useful for policy analysis, they may add to our understanding of the burden associated with adolescent motor vehicle injuries. For example, hospital and/or private health insurance claims data, possibly linked with automobile insurance claims, as is the case with an ongoing collaborative involving Children's Hospital of Philadelphia and State Farm Insurance, may provide an opportunity for quantifying the health and economic burden of nonfatal injuries for extended durations (Durbin et al., 2001). Because many adolescents will remain insured by a single health insurance carrier for years following an automobile injury, an assessment of their insurance claims should allow for quantifying the long-term health expenditures and utilization resulting from the injury. These estimates could be combined with other data sources for use in cost and cost-effectiveness analyses of specific interventions.

To our knowledge, there are currently no sources of data, with the possible exception of CIREN, that attempt to quantify indirect costs associated with adolescent motor vehicle injuries. CIREN uses the SF36 to quantify changes in health status but only for select cases and only up to 1-year post injury. An additional recommendation is to explore the possibility of fielding additional data collection efforts that survey adolescents and families of those involved in motor vehicle crashes at various intervals after the crash to quantify changes in quality of life for all those affected by the crash. This survey could also quantify other indirect costs, including caregiver time and expenditures that may not be covered by health insurance but may be required as the result of the injury. For severe injuries, especially among adolescents, reductions in quality of life and productivity losses represent the majority of the burden. Future efforts should focus on refining the data and methods required to quantify this additional burden and strategies for effectively reducing this and the direct medical burden through effective prevention programs.

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APPENDIX A:
EXPERT PANEL MEETING (JANUARY 2006)

Last Name	First Name	Organization
Blincoe[a]	Larry	NHTSA
Cassidy[a]	Laura	
Council[a]	Forrest	UNC Highway Safety Research Center
Covington[a]	Teri	National MCH—Center for Child Death Review
Dischinger[a]	Pat	University of Maryland National Center for Trauma and EMS
Fingerhut[a]	Lois	NCHS
Foss[a]	Rob	UNC
Greenspan[a]	Arlene	CDC
Kindelberger[a]	John	NHTSA
Margolis[a]	Lewis	UNC
Miller[a]	Ted	PIRE
Schroeder[a]	Tom	CPSC
Shope[a]	Jean	UMTRI
Shults[a]	Ruth	CDC
Winston	Flaura	

[a]Participated in meeting