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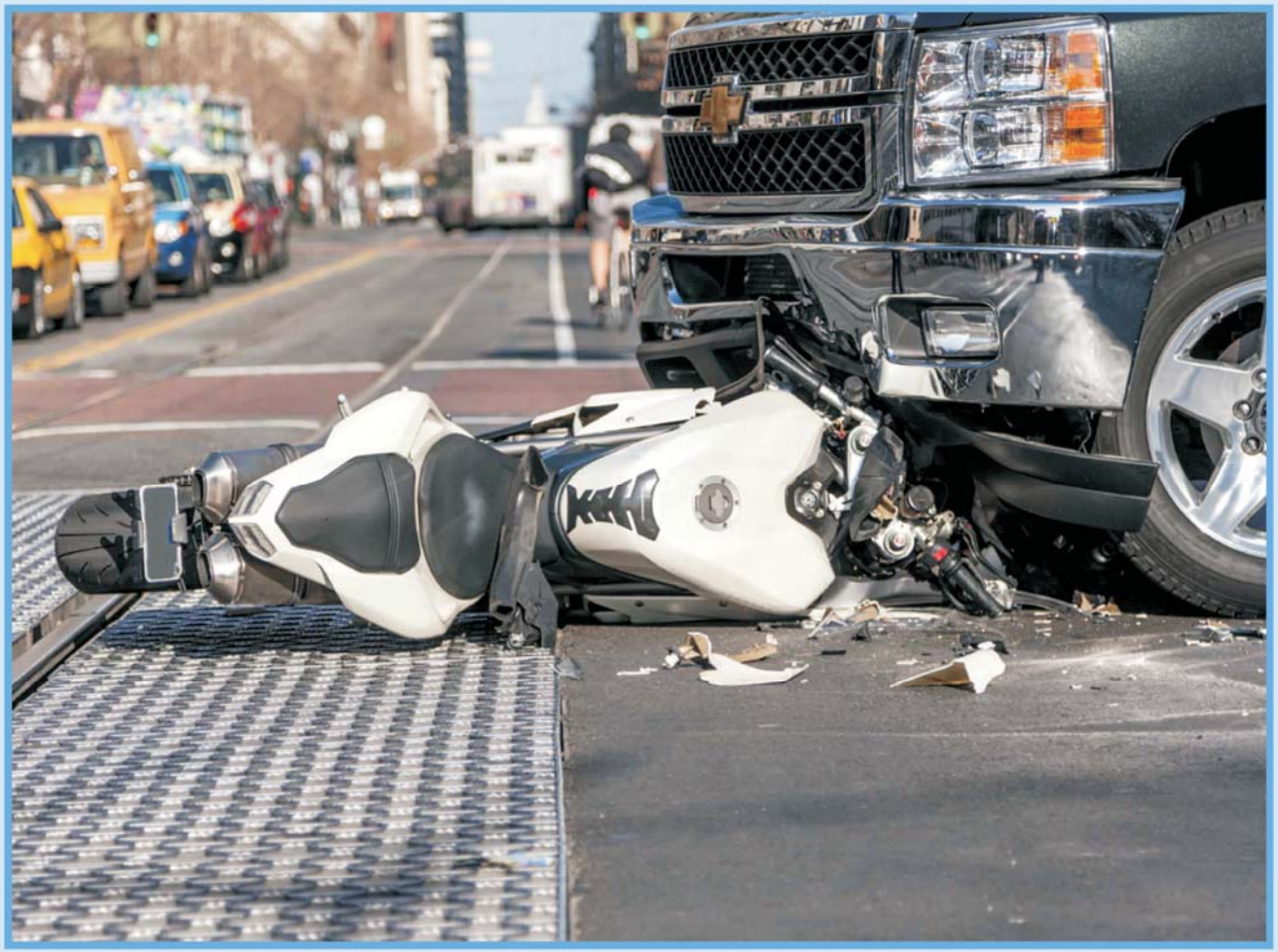
10-Year trends in public-use motor vehicle collision-related injury data

UAB CIREN Center

TRAFFIC SAFETY FACTS 2013



A Compilation of Motor Vehicle Crash Data from the Fatality Analysis Reporting System and the General Estimates System

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TRAFFIC CRASH VICTIMS	Killed	Injured
Occupants	**22,383**	**2,099,000**
Drivers	16,472	1,450,000
Passengers	5,844	648,000
Unknown	67	<1,000
Motorcyclists	**4,668**	**88,000**
Nonoccupants	**5,668**	**125,000**
Pedestrians	4,735	66,000
Pedalcyclists	743	48,000
Other/Unknown	190	11,000
Total	**32,719**	**2,313,000**

Injury Epidemiology Data

- Some private-use data is available
  - National Trauma Data Bank
  - National Burn Repository
  - CIREN
- There are more public-use resources dedicated to injury than for most other health-related issues
- These datasets cover a wide array of injuries

Public-Use Dataset Examples

- National Automotive Sampling Survey (NASS GES/CDS)
- Fatality Analysis Reporting System (FARS)
- National Electronic Injury Surveillance System – All Injury Program (NEISS-AIP)

NATIONAL TRAUMA DATA BANK (NTDB)

NTDB

- American College of Surgeons
- Largest collection of trauma registry data in the nation
  - Over 3 million cases from nearly 1,000 trauma centers
- National Sample Program Research Data Set (RDS)
  - Contains all records in the NTDB
  - Level I, II, III, IV, and undesignated trauma centers

NTDB

- Limitations
  - Convenience sample
  - Not nationally representative
  - Data submitted voluntarily
  - Only includes persons admitted to a hospital

WEB-BASED INJURY STATISTICS QUERY AND REPORTING SYSTEM (WISQARS)

WISQARS

- Provides basic descriptive statistics for fatal/non-fatal injury rates
- Can stratify rates by
  - Age
  - Race
  - Sex
  - Year
  - State
- http://www.cdc.gov/injury/wisqars/

2013, United States
MV Traffic, Occupant Deaths and Rates per 100,000
All Races, Both Sexes, All Ages

ICD-10 Codes: V30-V39 (.4-.9),V40-V49 (.4-.9),V50-V59 (.4-.9),V60-V69 (.4-.9), V70-V79 (.4-.9),V83-V86 (.0-.3)

Sex	Number of Deaths	Population	Crude Rate	Age-Adjusted Rate**
Males	5,742	155,651,602	3.69	3.64
Females	2,887	160,477,237	1.80	1.73
Total	**8,629**	**316,128,839**	**2.73**	

Overall MV-Occupant Nonfatal Injuries and Rates per 100,000

2013, United States, All Races, Both Sexes, All Ages
Disposition: All Cases

Sex	Number of injuries	Population	Crude Rate	Age-Adjusted Rate**
Both Sexes	2,467,032	316,128,839	780.39	784.91
Males	1,083,121	155,651,602	695.86	693.31
Females	1,383,911	160,477,237	862.37	878.19

WISQARS Data

- WISQARS fatal data come from the CDC annual mortality data files provided by the National Center for Health Statistics (NCHS)
  - Data are derived from the Multiple Cause of Death data

WISQARS Data

- WISQARS nonfatal data come from the National Electronic Injury Surveillance Survey – All Injury Program (NEISS-AIP)
  - Injury must be treated in one of 66 selected emergency departments
  - Provide data on approximately 600,000 injuries per year

WIDE-RANGING ONLINE DATA FOR EPIDEMIOLOGIC RESEARCH (WONDER)

WONDER

- Produces injury mortality rates that can be stratified by
  - Location (i.e., region, division, state, county)
  - Year
  - Age group
  - Race
  - Sex
  - Cause of death
  - Urbanization (i.e., population density classification)

Gender	Deaths	Population	Crude Rate Per 100,000
Female	2,852	160,477,237	1.8
Male	5,549	155,651,602	3.6
Total	**8,401**	**316,128,839**	**2.7**

FATALITY ANALYSIS REPORTING SYSTEM (FARS)

FARS Background

- Census of fatal motor vehicle collisions (MVCs) in the United States
  - Includes Washington, D.C. and Puerto Rico

- To be included, a MVC must:
  - Occur on a public roadway
  - Result in the death of at least one individual (whether a motorist or non-motorist) within 30 days

FARS Background

- NHTSA has contracts with agencies in each state that collect information on fatal MVCs

- Data can come from multiple sources
  - Police Accident Reports (PARs)
  - State vehicle registration files
  - State Highway Department Data
  - Coroner/Medical Examiner reports
  - Hospital records

FARS Data

- Data are divided into three datasets
  - Accident-level
    - e.g., time/location of MVC, number of vehicles involved
  - Vehicle-level
    - e.g., vehicle body type, most harmful event
  - Person-level
    - e.g., demographics, date/time of death (if applicable)

NASS
GENERAL ESTIMATES SYSTEM
(GES)

NASS GES

- Annual survey of MVCs in the United States
- Began in 1988
  - Created to identify traffic safety problems areas and form bases of cost/benefit analysis of traffic safety initiative

NASS GES

- In order to be included, a MVC must:
  - Have a PAR completed
  - Involve at least one vehicle on a traffic way
  - Result in property damage, injury, or death
- Approximately 50,000 MVCs are surveyed each year

NASS GES Sampling

- GES data collectors visit 400 police agencies across 60 sites in the United States on a weekly, biweekly, or monthly basis
  - A list is compiled of all qualifying MVCs, and a sample of that list is then selected
  - Collectors send the PARs for the selected MVCs to a contractor for coding, where trained personnel transfer the data from the PARs into an electronic data file

NASS GES Sampling

- The PAR sampling is based on three basic strata
  - Stratum 1: MVCs in which one vehicle was towed from the scene due to damage
  - Stratum 2: MVCs in which no vehicle was towed, but at least one person was injured
  - Stratum 3: All other crashes
- Strata 1 and 2 involve more severe crashes, and are oversampled in PAR selection
- In 2002, stratum 1 was separated into 3 groups based on highest injury severity incurred due to MVC

NASS GES Sampling

- Because the GES survey is not a simple random sample of PARs, data must be weighted to account for the probability of selection
  - Weights are simply the inverse of the product of the probability of selection in each of the three selection stages

$$w(i) = \frac{1}{P(i)_{PSU\ selection} \times P(i)_{PJ\ selection} \times P(i)_{PAR\ selection}}$$

TREND STUDY

Objective

- To compare trends in MVC injury data among major injury data sources
  - WONDER
  - WISQARS
  - GES
  - CDS
  - FARS
  - NTDB

Aims

- Aim 1:
  - Compare 10-year trends among data sources in regards to MVC-related injury rates
- Aim 2:
  - Compare 10-year trends among data sources in regards to MVC-related mortality rates
- Aim 3:
  - Compare body-region specific injury trends among clinical datasets
- Aim 4:
  - Compare mortality associations among clinical datasets

Aim 1: Injury trends

10-year trends in motor vehicle collison-related injuries for vehicle occupants among major injury data sources

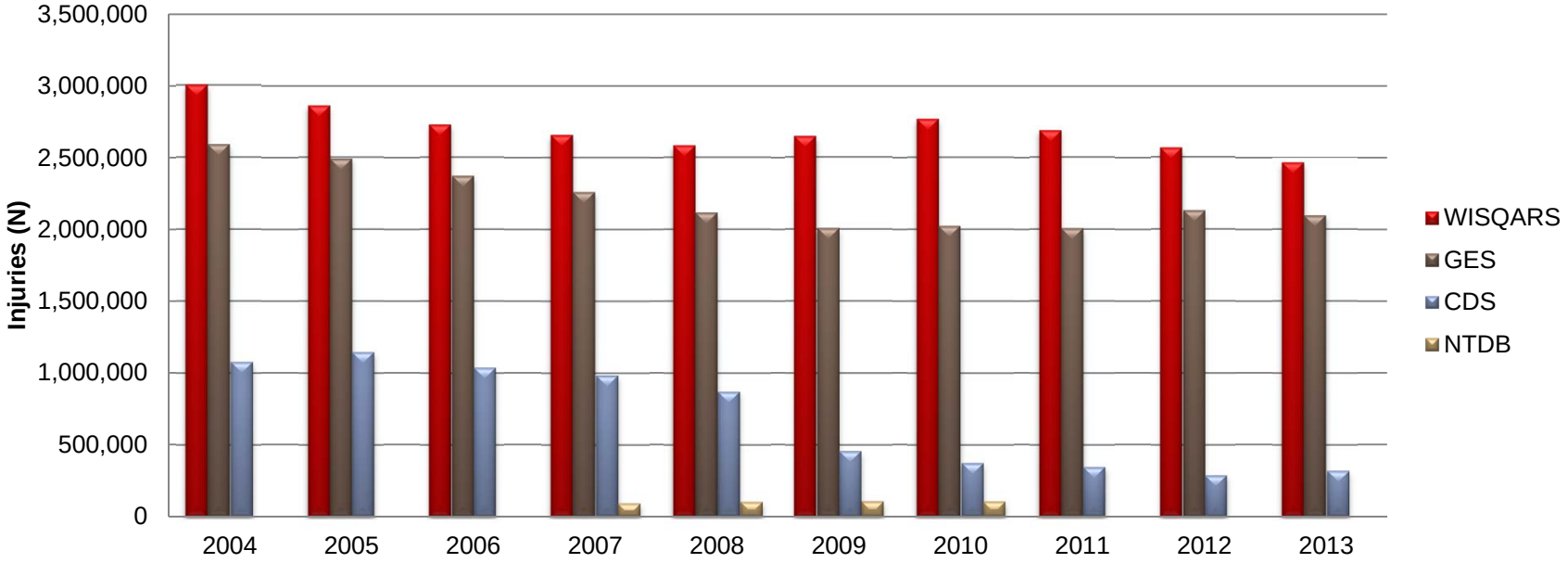


Table 1. Annual trend in MVC-related injury by data source, 2004-2013

	WISQARS	GES	CDS
Injury rate ratio	0.977	0.966	0.837
2004-2008	0.954	0.943	0.937
2009-2013	0.971	1.006	0.898

Aim 2: Mortality trends

10-year trends in motor vehicle collison-related mortality for vehicle occupants among major injury data sources

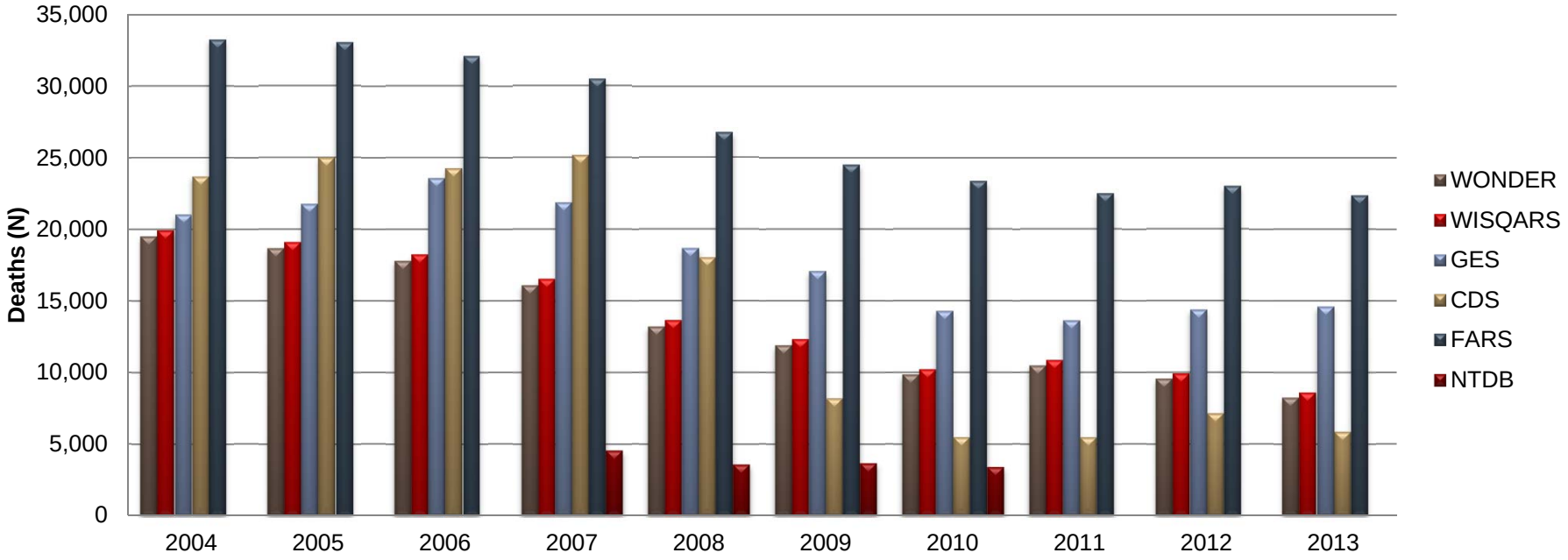


Table 2. Annual trend in MVC-related mortality by data source, 2004-2013

	WONDER	WISQARS	GES	CDS	FARS
Mortality rate ratio	0.896	0.898	0.932	0.816	0.939
2004-2008	0.906	0.908	0.969	0.944	0.942
2009-2013	0.920	0.921	0.960	0.947	0.973

Aim 3: Injury patterns

Table 3. Distribution of body-region specific injury and injury severity by data source, 2000-2004			
	NTDB	CDS	CIREN
Head injury (%)	**59.3**	**63.2**	**74.7**
Mean AIS	2.1±1.1	1.2±10.6	1.8±1.6
AIS 2+	37.8	9.8	47.5
AIS 3+	16.5	3.0	28.7
AIS 4+	8.2	1.8	16.3

Aim 3: Injury patterns

Table 3. Distribution of body-region specific injury and injury severity by data source, 2000-2004

	NTDB	CDS	CIREN
Neck injury (%)	**16.2**	**4.1**	**9.5**
Mean AIS	2.0±1.2	1.0±3.3	0.1±0.4
AIS 2+	9.0	0.1	1.2
AIS 3+	4.6	0.0	0.8
AIS 4+	1.5	0.0	0.3

Aim 3: Injury patterns

Table 3. Distribution of body-region specific injury and injury severity by data source, 2000-2004			
	NTDB	CDS	CIREN
Thorax injury (%)	**34.4**	**23.3**	**58.7**
Mean AIS	2.5±1.2	1.4±12.3	1.7±1.8
AIS 2+	24.1	4.7	44.5
AIS 3+	19.9	3.3	38.7
AIS 4+	6.3	1.4	20.1

Aim 3: Injury patterns

Table 3. Distribution of body-region specific injury and injury severity by data source, 2000-2004			
	NTDB	CDS	CIREN
Abdomen/Pelvis injury (%)	**20.0**	**10.5**	**44.8**
Mean AIS	2.1±1.1	1.3±9.4	1.0±1.4
AIS 2+	13.7	1.9	29.6
AIS 3+	6.0	0.8	17.8
AIS 4+	2.6	0.4	7.3

Aim 3: Injury patterns

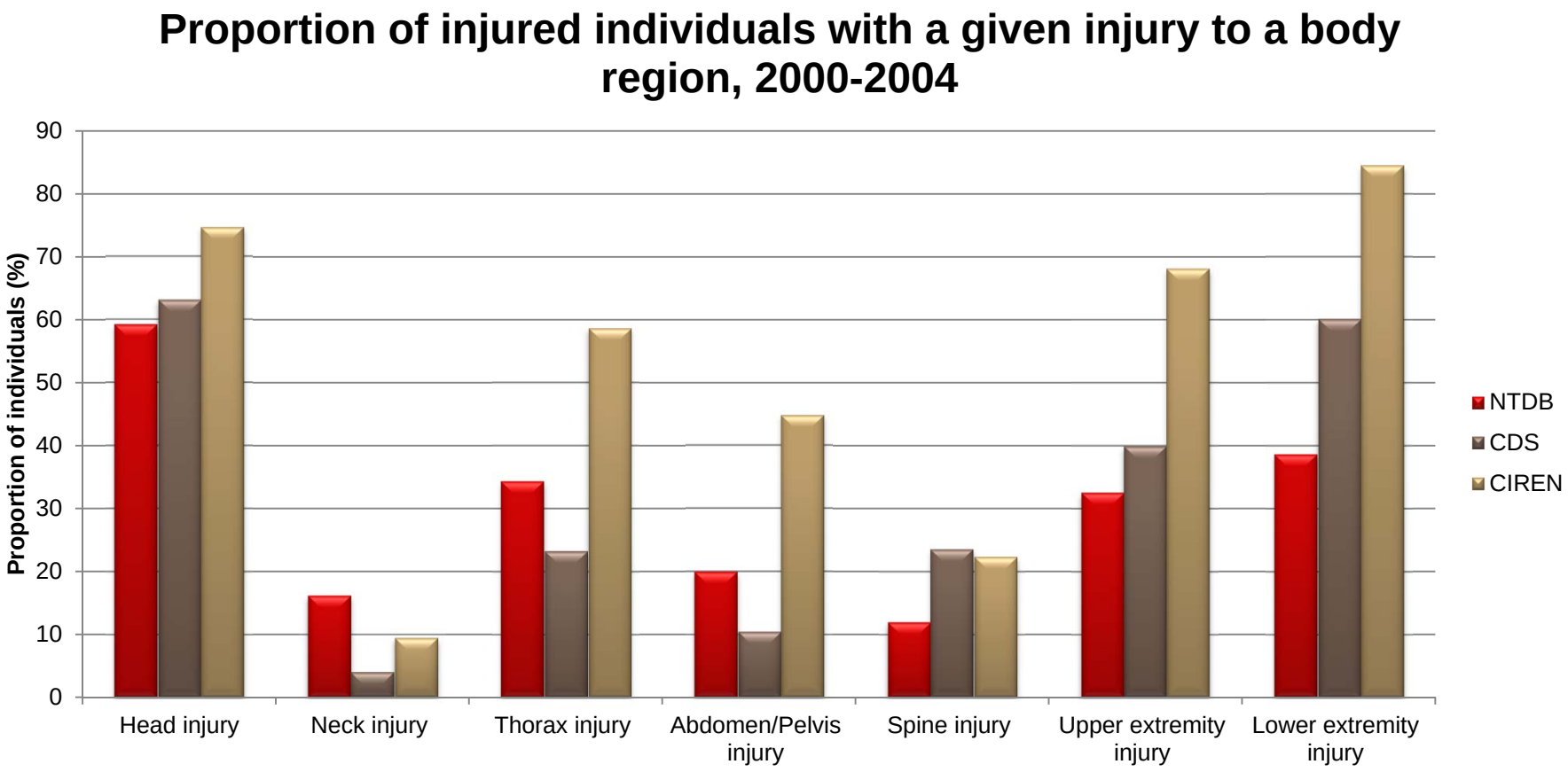
Table 3. Distribution of body-region specific injury and injury severity by data source, 2000-2004			
	NTDB	CDS	CIREN
Spine injury (%)	**12.0**	**23.6**	**22.4**
Mean AIS	2.0±0.8	1.2±8.2	0.6±1.2
AIS 2+	9.6	2.5	20.1
AIS 3+	1.8	0.8	9.9
AIS 4+	0.5	0.2	3.2

Aim 3: Injury patterns

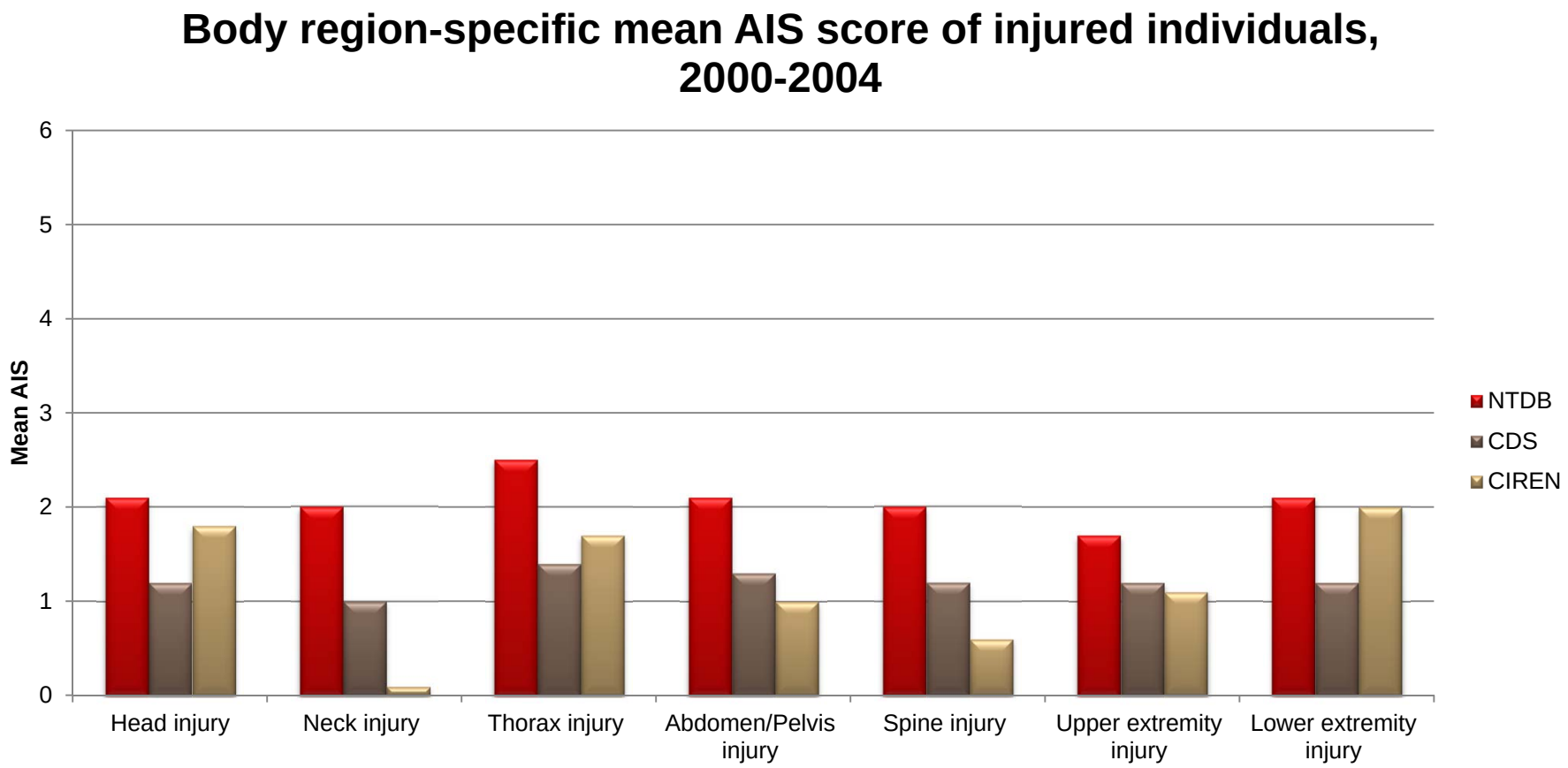
Table 3. Distribution of body-region specific injury and injury severity by data source, 2000-2004

	NTDB	CDS	CIREN
Upper extremity injury (%)	**32.6**	**40.0**	**68.2**
Mean AIS	1.7±0.7	1.2±6.3	1.1±1.0
AIS 2+	18.4	4.8	29.1
AIS 3	4.2	1.2	11.2
Lower extremity injury (%)	**38.7**	**60.2**	**84.6**
Mean AIS	2.1±0.8	1.2±7.3	2.0±1.1
AIS 2+	27.2	7.7	65.0
AIS 3+	13.5	2.6	46.1

Aim 3: Injury patterns



Aim 3: Injury patterns



Aim 4: Mortality associations

Table 4. Associations between age, sex, vehicle type, and ΔV with MVC-related mortality by data source, 2000-2004

	NTDB	CDS	CIREN
Age 65+	3.19 (3.03-3.37)	2.84 (2.13-3.80)	0.85 (0.19-3.91)
Male sex	1.24 (1.18-1.30)	1.99 (1.74-2.27)	1.27 (0.97-1.68)
Vehicle type			
Passenger vehicle	-	Ref	Ref
SUV/Van	-	0.74 (0.60-0.91)	0.74 (0.51-1.07)
Pickup truck	-	1.23 (1.07-1.43)	0.65 (0.38-1.11)
ΔV (km/h)			
0-25	-	Ref	Ref
26-49	-	9.36 (7.53-11.63)	1.72 (0.99-2.98)
50-74	-	53.95 (40.92-71.13)	1.54 (0.831-2.87)
75+	-	164.71 (95.93-282.78)	12.83 (6.14-26.83)