Road Safety Research

Using Probabilistic Data Linkage in Crash Research

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The Challenge

• Crash, emergency medical services, and medical care data often exist as separate databases without unique identifiers for the individuals involved

• These are usually administrative databases that were not designed with research in mind

• Administrative databases often have high degrees of missing or incomplete data

• These databases are therefore frequently under-utilized for research
What is Data Linkage?

• Utilizes probabilistic linkage to match together records that apply to the same person and event from multiple data sources
• Does not require unique personal identifiers to match records
• Can combine crash data with medical and financial outcome data
Goals of Research Using Linked Data

• Link crash reports with medical, financial, and other data at the state level (and can combine data from multiple states)

• Understand the types of injuries, their severity, risk factors (such as driver behavior, safety equipment, vehicle factors, and crash configuration), and associated costs related to motor vehicle crashes

• Use results to prioritize safety programs and policies
Databases

- Emergency Medical Services Logs
- Emergency Department Records
- Inpatient Records
- Police Crash Reports

LINKAGE
Linkage Model

- Crash
- EMS
- Emergency Dept.
- Hospital Discharge
- Driver’s License
- Death Certificate
- Trauma Registry
<table>
<thead>
<tr>
<th>Crash</th>
<th>EMS</th>
<th>Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Vehicle types (compact, SUV, truck, school bus)</td>
<td>• Incident event info (date, time, location)</td>
<td>• Personal demographics</td>
</tr>
<tr>
<td>• # of vehicles &amp; # of occupants involved</td>
<td>• Personal demographics, alcohol usage, use of protective devices</td>
<td>• Admit / discharge information</td>
</tr>
<tr>
<td>• Crash event info (date, time, location)</td>
<td>• Injury mechanism (E-code)</td>
<td>• Length of stay</td>
</tr>
<tr>
<td>• Road conditions, sequence of events, speed</td>
<td>• Medical assessment and treatment received</td>
<td>• Diagnoses, E-codes</td>
</tr>
<tr>
<td>• Personal information (seating position, use of car safety seat or seat belt, alcohol usage)</td>
<td></td>
<td>• Payer types</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Billed charges</td>
</tr>
</tbody>
</table>
Probabilistic Data Linkage

- Datasets are paired and general possible pairs are identified
- Data fields are evaluated, weighted, and summarized
- Bayesian model used to produce probabilities that each pair is a true match
- Many true links have low probabilities
- Multiply-impute complete, representative linked datasets using Markov-Chain Monte Carlo methods
- Multiple-imputation of missing links and missing data before data analysis
Examples of Research Projects Using Linked Data

• Effect of Pre-Hospital Factors in the EMS/Trauma System on Medical Outcomes of Children in Ohio
• Effect of Delay in Transfer to Advanced Trauma Center Care on Trauma Patient Outcome in Ohio
• Medical and Economic Impact of Motorcycle-Related Injuries in Ohio
• Medical and Economic Impact of Motorized Recreation Vehicle-Related Traumatic Brain Injury in Ohio
• Motorcycle Helmet Effectiveness in Reducing Head, Face, and Brain Injuries by State and Helmet Law
• Effects of Enhancement of Ohio’s Graduated Driver Licensing Law on Crashes, Injuries, Deaths, and Healthcare System Utilization
• Impact of a Standard Enforcement Safety Belt Law on Injuries, Deaths, and Hospital Charges in Ohio
Frequently Asked Questions about the Primary Seatbelt Law

What is Ohio’s current seatbelt law for front seat occupants?
Ohio law requires all front seat motor vehicle occupants to wear a seatbelt. Fines are $30 for drivers and $20 for passengers.

How would HB 2 change that law?
By revising section 4513.263 of the Ohio Revised Code to change the front seat occupant seatbelt provision from a secondary to a primary law. No other changes are made.

What can be saved by the switch to a primary law?
Lives—Decades of research clearly prove that seat belts save lives and prevent injuries. According to the National Highway Traffic Safety Administration (NHTSA), seat belts reduce a front seat occupant’s risk of fatality by 45% in a passenger vehicle and 60% in a light truck; risk of moderate-to-critical injury is reduced by 50% for front seat occupants in passenger vehicles and 65% for light trucks.¹ Seatbelts also prevent total ejections during a crash, an important factor in preventing fatalities, since 75% of car occupants who are totally ejected are killed.

Money—The cost of motor vehicle crashes that occurred in 2000 was $230.6 billion.² A recent study estimated that a primary seat belt law in Ohio would save about $15.4 million in Medicaid costs during its first year, with a minimum of $91.2 million saved in medical costs over the next 10 years. Commercial insurance and HMOs would save $54.2 million and medically uninsured individuals would save $23.3 million.³
Crash data cited in calls for tougher seat belt law

Analysis indicates those who don’t wear seat belts are 47 times more likely to die in a wreck.

By Ken McCall and Cornelius Freilik
Staff Writers
Updated 12:28 AM Sunday, January 30, 2011

Andrea Whitney is a prime example of what can happen if you don’t buckle up.

The 59-year-old Fairborn resident was ejected from her 1995 Chevrolet Blazer after she pulled out in front of a 2007 Toyota Corolla at the intersection of West Eton and Yellow Springs-Fairfield roads, according to the crash report.

Seat belt laws

Ohio has a secondary seat belt law, meaning a driver can’t be pulled over solely for not wearing a seat belt, but can be cited if stopped for another violation, such as speeding. Ohio is one of 20 states that do not allow motorists to be pulled over simply for not wearing a seat belt.

The U.S. Centers for Disease Control and Prevention estimates that upgrading from a secondary to a primary law on average leads to a 14 percent increase in safety belt usage and a 7 percent reduction in deaths related to crashes.

A study by the Center for Injury Research and Policy at the Research Institute at Nationwide Children’s Hospital in Columbus estimated Ohio could save at least $8.5 million a year in Medicaid costs and more than $91 million in 10 years by changing the seat belt law. It assumed a 20 percentage-point increase in seat belt use.

In addition to the safety factor, some of the medical bills resulting from crashes fall on taxpayers. The Center for Injury Research and Policy at Nationwide Children’s Hospital conservatively estimated that injuries resulting from Ohioans not wearing seat belts in 2003 alone would result in at least $169 million in Medicaid bills over 10 years.

“This is even an underestimate of the problem,” said Kristen Conner, the study’s primary author. “More enforcement and a stricter enforcement law could have such a great impact.”
Thank you!