LIVES SAVED BY VEHICLE SAFETY TECHNOLOGIES 1960 TO 2012

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Objectives

Preview of forthcoming NHTSA technical report:

  - Passenger Cars and LTVs
  - With Reviews of 26 FMVSS and the Effectiveness of Their Associated Safety Technologies in Reducing Fatalities, Injuries, and Crashes
- Charles J. Kahane, Ph.D.
Estimate numbers of lives saved by all vehicle safety technologies from 1960 to 2012, cars and LTVs

- Using effectiveness estimates for individual technologies based on statistical analyses of crash data
  - Lives saved by each technology
  - Lives saved in each calendar year
### “Lives Saved” Model

**Simplified example – consider three live-saving technologies:**

<table>
<thead>
<tr>
<th>Chronology</th>
<th>Technology</th>
<th>Results of statistical analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Energy-absorbing steering assemblies introduced in 1967-68</td>
<td>Energy-absorbing steering columns found to reduce fatality risk of unbelted drivers by 12.1%</td>
</tr>
<tr>
<td>2</td>
<td>3-point belts introduced in 1970s, belt use laws in 1980s</td>
<td>3-point belts found to reduce fatality risk by 42% for drivers in cars equipped with EA columns</td>
</tr>
<tr>
<td>3</td>
<td>Frontal air bags introduced in 1990s</td>
<td>Frontal air bags found to reduce fatality risk of belted drivers by 25.3% in cars with EA steering columns</td>
</tr>
</tbody>
</table>
Continuing the simplified example –
Now consider those three live-saving technologies:
• Suppose we had 1000 driver fatalities in pre-1966 cars in frontal crashes.
• How many of those 1000 drivers would be saved if we added these technologies?
Continuing the Simplified Example:

<table>
<thead>
<tr>
<th>(Chronology) Technology</th>
<th>From our statistical analyses</th>
<th>Consider 1000 driver fatalities in pre-1966 cars in frontal crashes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Energy-absorbing steering assemblies introduced in 1967-68</td>
<td>Reduce fatality risk of unbelted drivers by 12.1%</td>
<td>Would drop to 879 with EA steering columns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1000 x [1-.121]) = 879</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Lives Saved = 1000 − 879 = 121</strong></td>
</tr>
<tr>
<td>(2) 3-point belts introduced in 1970s, belt use laws in 1980s</td>
<td>Reduce fatality risk by 42% in cars equipped with EA columns</td>
<td>Drop to 510 if drivers also buckled 3-point belts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(879 x [1-.420]) = 510</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Lives Saved = 879 − 510 = 369</strong></td>
</tr>
<tr>
<td>(3) Frontal air bags introduced in 1990s</td>
<td>Reduce fatality risk of belted drivers by 25.3% in cars with EA steering columns</td>
<td>Drop to 381 if cars also had frontal air bags</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(510 x [1-.253]) = 510</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Lives Saved = 510 − 381 = 129</strong></td>
</tr>
</tbody>
</table>
“Lives Saved” Model

In reverse, consider 381 FARS cases:
Driver fatalities in post-1997 cars in frontal crashes
If we “remove” technologies, newest first:

• Without air bags, 381 becomes 510 \( \frac{381}{1-0.253} \)
• With buckled belts, 510 becomes 879 \( \frac{510}{1-0.420} \)
• Without EA columns, 879 becomes 1000 \( \frac{879}{1-0.121} \)
  – 1000 potential fatalities if air bags, belts, and EA columns had been “removed”
• We surmise there were 1000-381=619 drivers in crashes (not on FARS) where these technologies saved the driver
• Allocation:
  – 129 saved by air bags \( \frac{510-381}{510} \)
  – 369 by 3-point belts \( \frac{879-510}{879} \)
  – 121 by EA columns. \( \frac{1000-879}{1000} \)
“Lives Saved” Model

The Model Includes:
Safety Technologies that Significantly Reduce Fatality Risk for Car/LTV Occupants
- Seat belts: various types and seating positions
- Air bags: frontal, side, and curtain
- Energy-absorbing steering assemblies
- Child safety seats
- Electronic stability control
- Roof crush resistance
- Fuel system integrity
- Others
“Lives Saved” Model

The model includes:
- Occupants of cars and LTVs
- Peds/bicyclists/motorcyclists saved by car/LTV crash avoidance technologies
- Technologies compliant with FMVSS in effect
- Technologies not required by FMVSS
  - e.g., belt pretensioners and load limiters
- Effect of programs to increase use of seat belts and child safety seats
“Lives Saved” Model

The model does not include:

• Behavioral safety (other than programs to increase restraint use)
  – e.g., programs to reduce drunk driving
• Technologies not involving or benefiting cars and LTVs
  – e.g., motorcycle helmets
• Effect of EMS improvements
“Lives Saved” Model

Actual versus Potential Car/LTV Occupant Fatalities, 1960 to 2012
“Lives Saved” Model

Previous estimates of lives saved:
Earlier report using “Lives Saved” model
(#NHTSA, DOT HS 809 833, Kahane, 2004)
• Estimated 328,551 lives saved 1960-2002

The new report updates through 2012:
• Breaks out specific numbers by technologies contributing
Forthcoming Report

Additional topics in report include:

• Summary and effectiveness findings of NHTSA evaluations
• Actual versus Potential Car/LTV Occupant Fatalities, 1960 to 2012
• Different options for methodologies
  – Indirect vs. direct effects
• Vehicular Risk Index
  – (actual fatalities) ÷ (potential fatalities w/o safety technologies)
• Car/LTV Fatalities per Vehicle Miles Traveled
• Assessing improvements not included in calculations
• Comparison to premature deaths from disease
Forthcoming Report

NHTSA Technical Report

  - Passenger Cars and LTVs
  - With Reviews of 26 FMVSS and the Effectiveness of Their Associated Safety Technologies in Reducing Fatalities, Injuries, and Crashes
- Charles J. Kahane, Ph.D.
- Report No. DOT HS 812 069
- Planned release early 2015
Thank You

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