

Study of Airbag Effectiveness in High Severity Frontal Crashes

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Objectives

- Examine high severity frontal crashes involving depowered airbags
- Calculate *risk of serious injury vs. delta-V* with depowered airbag deployed
- Review deployment rate vs. delta-V for depowered airbags
- Determine the factors influencing the *likelihood of fatality* for belted drivers in frontal crashes
- Assess the effectiveness of depowered airbags in reducing odds of fatality in terms of delta-V

Data Used

- FARS Data 1998-2007
- NASS/CDS Data 1997-2007

Methodology

- FARS Analysis
 - Exactly 2 vehicles in a crash (a subject vehicle and an “other” vehicle)
 - Subject vehicle 1998 model year or later, “other” vehicle 1990+ model year
 - Select belted driver pairs with driver fatality in the “other” vehicle
 - Frontal crashes (12 o’clock point of impact)
 - Logistic Regression
- NASS/CDS Analysis
 - Examine injury risk by delta-V
 - Estimate the average delta-V for the crash set analyzed using FARS

Methodology

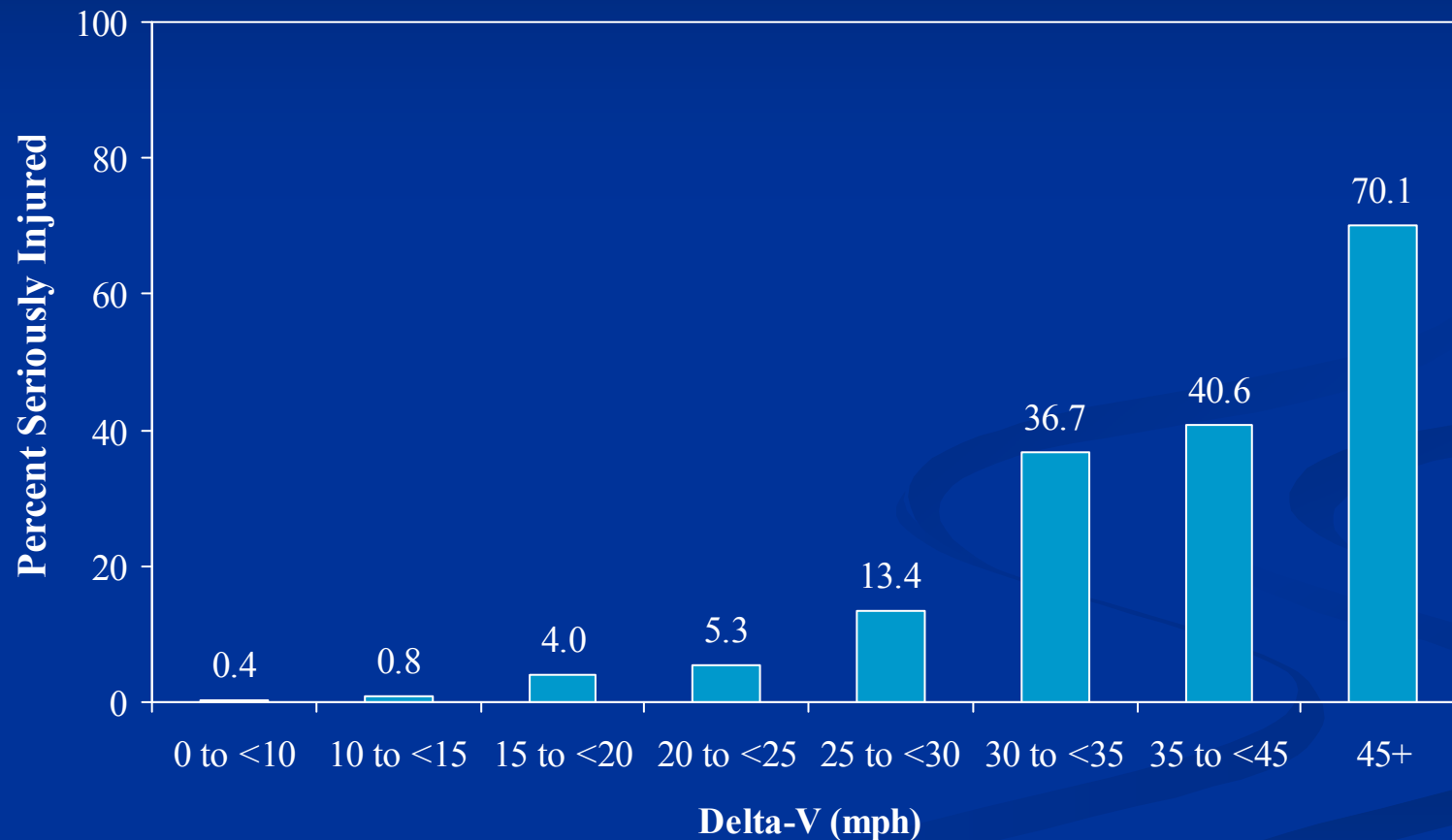
- FARS Analysis
 - “Control” group (subject vehicle drivers with no airbag deployment, including not connected airbags) vs.
 - “Response” group (subject vehicle drivers with airbags deployed)

Methodology

Logistic Regression

- Study controlled for additional factors (*other than the presence of depowered airbags*) to address the relative influence of airbag deployment on odds of fatality. (belted drivers studied).
- Additional Factors:
 - Mass ratio (striking vehicle/struck vehicle)
 - Driver age
 - driver alcohol presence

Risk of Serious Injury vs. Delta-V Frontal Crashes with Airbag Deployment

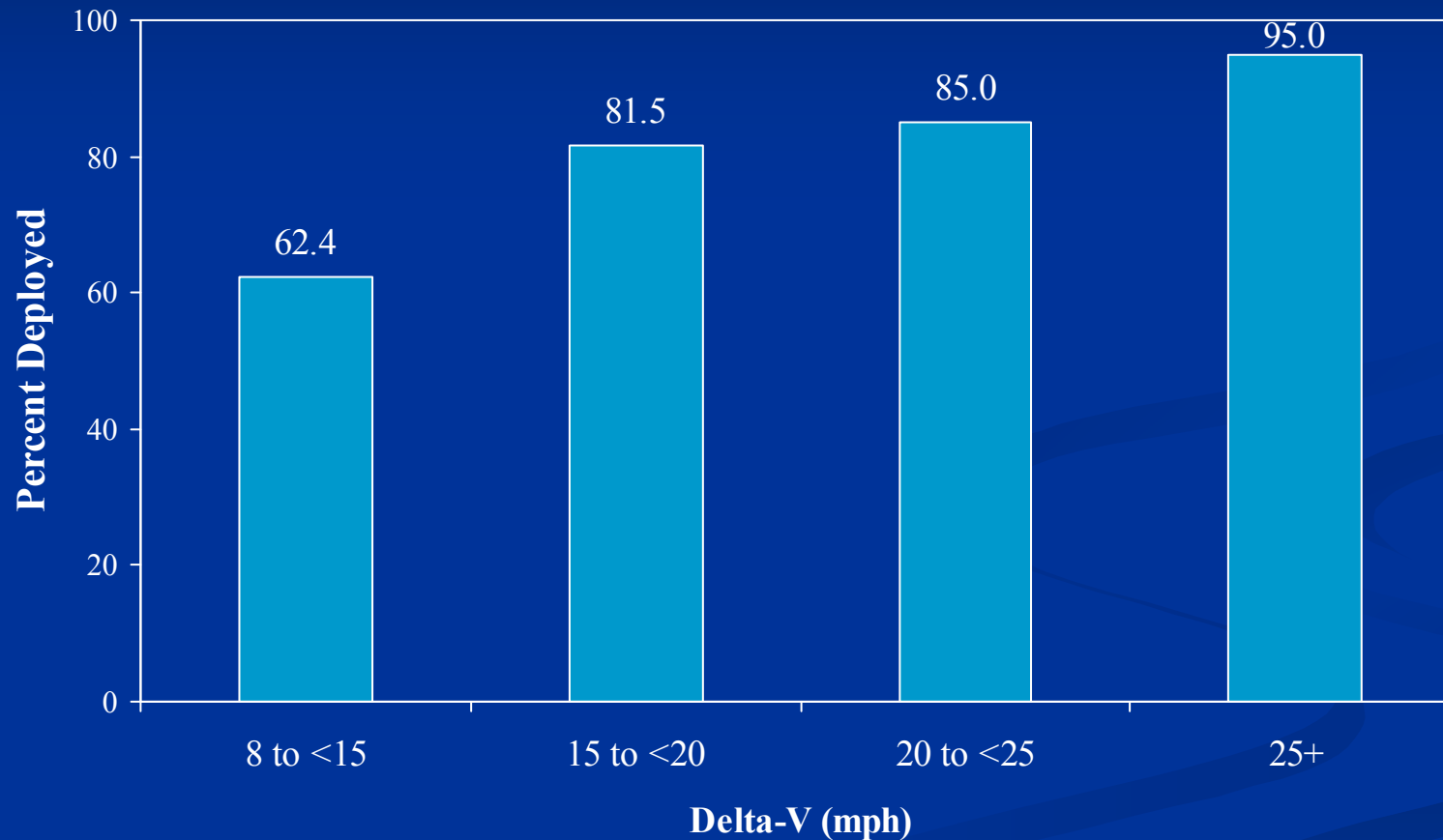


Source: NASS/CDS, 1997-2007. Includes 1998-2007 model year light vehicles.
(Delta-V unit of 1 mph is equivalent to 1.61 km/h). Serious injury includes MAIS
3-6/fatal.

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Airbag Deployment Rate in Frontal Impacts

Depowered Airbags



Source: NASS/CDS, 1997-2007. Includes 1998-2007 model year light vehicles.
(Delta-V unit of 1 mph is equivalent to 1.61 km/h)

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Airbag Effectiveness

Airbag Effectiveness: Fatal Crashes

Logistic Regression

Factor	Odds Ratio	Significance*
Log Mass Ratio (per 10% mass ratio increase)	1.54	Yes
Subject Vehicle Driver's Age (per 10 years increase)	1.52	Yes
Subject Vehicle Driver's Alcohol	2.03	Yes
Opposite Vehicle Driver's Age (per 10 years increase)	0.86	Yes
Subject Vehicle's Airbag Deployed		No

*At 95% confidence level.

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Airbag Effectiveness: Results

- Increasing mass ratio by 10% increases the odds of fatality to belted driver in subject vehicle by 54%.
- Increasing subject vehicle's driver's age by 10 years increases his/her odds of fatality by 52%.
- Presence of alcohol for subject vehicle driver increases the odds of fatality by a factor of 2.
- Increasing other vehicle driver's age by 10 year decreases subject vehicle driver's odds of fatality by 14%.
- *The airbag deployment was not found to be statistically significant in reducing odds of fatality to subject vehicle driver.*

NASS/CDS Analysis to Characterize the Studied FARS Data Set

- Reviewed NASS/CDS cases to quantify the range of delta-V crashes which closely reflect the FARS data set
 - 19 cases were selected
 - Average delta-V is about 35 mph (56 km/h)
 - 67% had delta-V greater than 30 mph (48 km/h)
 - 24% had delta-V 20-30 mph (32-48 km/h)

Conclusions

Conclusions

- NASS/CDS review shows that in 5% of frontal crashes with delta-V greater than 25 mph (40 km/h) airbags did not deploy.
- Risk of serious injury to belted drivers in frontal crashes with airbag deployment increases with delta-V.
- In fatal crashes, airbag deployment was not statistically significant predictor for the likelihood of belted driver fatality. The analyzed severe crashes had an average delta-V of about 35 mph (56 km/h). About 67% of these crashes had delta-V of 30 mph (48 km/h) or higher.
- Other factors, including mass ratio of the vehicles, driver age and alcohol presence were found to be significant predictors of the likelihood of fatality.