. Seguí-Gómez M, Lopez-Valdes FJ, Crandall JR. Characterizing the distribution of injury and injury severity for belted front seat occupants involved in frontal crashes. *Proceedings of IRCOBI Conference* 2009:155-168. (NO PMID).

# Characterizing the distribution of injury and injury severity for belted front-seat occupants involved in frontal crashes

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## ABSTRACT

Probability distribution curves at each AIS level within each body region were developed for front seat occupants in frontal crashes as a function of crash severity. Multivariate regression models used data on passenger vehicles 15 years old or newer with no rollover or fire as documented in USA NASS CDS 1998-2007. The 7268 subjects, representing 2.8 million occupants, had a 6% (95%CI 5-7) probability of sustaining MAIS2+ and 2% (95%CI 1-2) probability of sustaining MAIS3+ in at least one body region, demonstrating the limited risk of sustaining serious injuries for belted occupants in frontal crashes during the last decade. Models accounted for occupant's age, gender and height, vehicle's wheelbase, curb weight, age and model year, deployment of frontal airbags and specific direction of impact. The severity of crash resulted in statistically significant and positive relationships with the severity of injuries across all body regions but neck. Older occupant's age also resulted in statistically significant and positive relationships with more severe injuries in most body regions, particularly when evaluating MAIS3+.

Keywords: Epidemiology, Injury Probability, Velocity

ASSESSMENT AND DEVELOPMENT OF INJURY COUNTERMEASURES is typically based on probability distribution curves created using a limited number of experimental tests (Mertz (2002)) and scarce real world data (Huelke (1979), Laituri et al (2003b), Koh et al (2005),). The use of population-based data sets for the development of probability-based estimates of injury is far less common. As priorities for future research, policies, and countermeasures are developed, it is necessary to assess the current distribution of injuries and their severity in motor vehicle crashes as they relate to various occupant, vehicle, restraint and crash characteristics. In this paper, we focus on developing contemporary probability distribution curves for belted front seat occupants in frontal crashes using advanced statistical models that allow to simultaneously controlling for all these parameters.

## METHODS

### DATA SOURCE

Data from USA National Highway Traffic Safety Administration National Automotive Sampling System Crashworthiness Data System 1998-2007 were used. The NASS CDS is a stratified sample representative of police-reported crashes in the USA involving passenger vehicles in which at least one of the vehicles is towed away from the scene because of the damage from the crash (NHTSA (1998)). Trained investigators complete an extensive questionnaire of data elements to describe the crash, vehicles involved, the occupants and their injuries. During this time period, injury severity was assessed using the 1998 update of the AIS Scale (AAAM (1998)). About 5000 crashes per year are investigated and the selection for investigation follows an inverse relationship with the severity of the crash. Thus, each case is assigned a sampling weight to indicate how representative it is from other crashes in the USA. While data are publicly available at ftp://ftp.nhtsa.dot.gov/NASS/, a research-oriented version of the publicly available data available at http://www.unav.es/ecip/NASS/asistente/ was used for the analyses due to the relational

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