

Effect of BMI on the Risk of AIS 3+ Injury Outcome in Frontal Impact Crashes With/Without Belt

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Abstract

Objective: Investigate the effect of BMI on the risk of serious injury (AIS 3+) to different human body regions for all age groups in frontal car crashes.

Methods: 13 years period (2001-2013) data from National Automotive Sampling System, Crashworthiness Data System (CDS) was employed for this study. An eight-group categorization for frontal car crashes was conducted on these data to identify frontal-impact tow-away cases. Subjects in this study included occupants involved in tow-away crashes of passenger cars, light trucks, vans and sport utility vehicles. BMI was divided into four groups called: (1) underweight (BMI < 18.5), (2) normal range (BMI 18.5-24.99), (3) overweight (BMI 25-29.99), (4) obese (BMI > 30). Multivariate logistic regression analysis was utilized examining the effect of BMI on risk of AIS 3+ injury.

Results: Occupant BMI was available on 42366 subjects (72.7%) in the CDS database. Mortality was 1.72%. After adjustment for some confounding variables (age, gender, seatbelt use, seat position, delta-V, model year and curb weight), the significant relationship ($p < 0.05$) between occupant BMI and risk of AIS 3+ injury persisted in some body regions. The odds ratio for sustaining face injury with AIS 3+ was 0.945 (95% CI: 0.898, 0.994) for each unit increase in BMI. The odds ratio for sustaining thorax injury with AIS 3+ was 1.006 (95% CI: 1.002, 1.011) for each unit increase in BMI. And the odds ratio for sustaining lower extremity injury with AIS 3+ was 1.010 (95% CI: 1.006, 1.014) for each unit increase in BMI. Meanwhile we found belt usage always had significant effect on risk of injury, except neck. Among the belted occupant group, with increasing of BMI, the risk of thorax and lower extremity injury was increasing, and abdomen injury risk was also increasing. However, among the unbelted group, with increasing of BMI, only the risk of lower extremity injury was increasing.

Conclusions: Increasing BMI increased risk of thorax and lower-extremity injury in frontal crashes, decreased risk of facial injury. The effect of BMI on the risk of human body injury are different between belted and unbelted group. These findings may have some suggestions for vehicle safety system design, as well as for transport safety policy.