Injury Panorama for Drivers in Frontal Car Crashes with and without Deployed Airbag

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BACKGROUND

To produce an effective traffic safety work, models and methods are needed as a help to give priority to different preventive measures to reduce the number of accidents, as well as the number and severity of injuries in traffic accidents. One area where better methods are needed to estimate the benefit-cost of preventive systems is the interior safety of cars.

It has been shown in several studies that airbags are effective protective systems in frontal car crashes. The benefit of airbags has been estimated to be 20-25% reduction for fatalities and 30-40% reduction for severe head and neck injuries. It has also been shown that the protective effect for occupants is more effective if airbags are used in combination with seat-belts. As a side effect, airbag inflation can cause injuries, especially at low crash velocities. This is especially pronounced if the occupant is near the cushion or out of position at the time of deployment. However, these findings and figures have been widely discussed and differ a lot between studies.

AIM

The overall aim of this project is to develop a method for cost-benefit analysis of passive safety for occupants involved in car crashes with focus on the beneficial effects on airbags and improved seat-belt systems.

The purpose of this study was to investigate the injury panorama for drivers in frontal car crashes in Sweden with and without deployed airbags. The results should serve as a base for a first approach for the evaluation of the beneficial effects of restraint systems in cars.

MATERIAL and METHODS

In this study, two groups of drivers involved in frontal car crashes with cars of model year 1991 or newer have been analysed. The first group consists of 120 drivers in cars with deployed airbags, and the second group consists of 600 drivers in cars not equipped with airbags. The information has been taken from a database developed at the Department of Injury Prevention at Chalmers University in Göteborg, Sweden. The database consists of information of about 5000 cars involved in crashes in Sweden during 1994 and 1995. The information is compiled from police reports, questionnaires to drivers and medical reports if available. The response rate for the questionnaires was about 55%.

The type and extent of injuries were correlated to driver parameters (sex, age, weight and height), belt usage, airbag deployment as well as to different crash parameters such as type of car, crash direction and subjective crash severity (low: delta v<25 km/h, high: delta v>25km/h).

RESULTS

For both investigated groups, about 20% of the drivers were females. The age varied from 18-85 years. 90% of the drivers were wearing a seat-belt. In 70% of the investigated crashes the estimated velocity was low. The results show that about 80-85% of the drivers in both groups were either uninjured or had only minor injuries (AIS 1). About 10% of the drivers had moderate injuries (AIS 2). Only a few drivers (less than 5%) had injuries classified as AIS 3 or higher.

For high velocity frontal collisions, drivers in cars with deployed airbags were less injured in the head, neck and chest regions than drivers in cars without airbag deployment, although no significant differences were found. Some injuries to the lower extremities were found in both groups. However, a few airbag specific injuries were found especially in the face and upper extremities.

For low velocity collisions, minor airbag specific injuries occurred (AIS 1), e.g. haematoma, abrasion and contusion in the thorax and face regions, burn injuries on hands, wrists, arms and face, and minor neck problems. These kind of injuries were not found in the group without airbag deployment.

Short females showed a slightly increased risk of being injured in the head, chest and abdomen by the inflating airbag, especially if they were not wearing a seat-belt. Older people had a slightly increased risk of being injured by the restraint system.

DISCUSSION

In this study no significant differences, only trends and indications, were found when comparing injuries of drivers in frontal car crashes with and without deployed airbag. This may be explained by the following factors:

- The number of car crashes analysed with deployed airbags were too few. During 1994 and 1995 only a few car makes and models were equipped with airbags in Sweden.
- Most of the drivers in Sweden are wearing a seat-belt. The seat-belt is a very effective protective system during frontal car collisions. This may be the reason that the injuries are minor.
- The cars involved in this study were newer cars. Most of the cars were either medium-sized or large cars, or small cars classified as safe (Swedish insurance ranking).
- The data for the subjective estimation of the crash velocity might be too weak, i.e. the crash severity was not recorded. In addition, to few high velocity crashes were involved in this study.
- The information in the police reports and in the questionnaires may not be complete, especially the description of injuries, crash velocity and seating position. The response rate of the questionnaires was typically low, but increased for cars equipped with airbags (75%) due to repeated appeal for help.

CONCLUSION

The results indicate that airbags are effective protective systems in frontal car collisions, particularly at higher impact velocities. At low velocities, however, the airbag seems to induce injuries not seen in the control-group, indicating a dis-benefit from airbag deployment in this velocity range.