

# Morbidity and mortality of car occupants: comparative survey over 24 months

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## Abstract

The severity of injuries sustained by 2577 car occupants in road traffic accidents in the catchment area of one district accident service during February 1982 to January 1984 inclusive was assessed using the injury severity score system.

In the first 12 months the mean injury severity score for front seat occupants injured in a road traffic accident was 4.94 and in the second 12 month period, after the implementation of the seat belt law, the mean injury severity score of all injured front seat occupants was 2.80. These figures indicated a reduction in injury severity of front seat occupants of 53.4% on the previous 12 month figures. The severity of injury sustained by unbelted front seat occupants and back seat passengers showed no significant change over the two years.

The number of front seat occupants killed or sustaining serious injuries (injury severity score greater than 12) showed a reduction of 54% in the 12 months beginning February 1983. Front seat occupants requiring admission for injuries sustained showed a decline of 42% in the 12 months after the introduction of the seat belt law, and deaths among front seat occupants fell by 27% compared with the previous 12 months. After the implementation of seat belt legislation those front seat occupants killed or sustaining serious injuries included a significantly higher proportion of victims who were not wearing their seat belts or showed positive evidence of alcohol intake at the time of the accident.

This series suggests that the incidence of serious injury or deaths among front seat occupants of cars has decreased substantially since the seat belt law became effective on 31 January 1983.

## Introduction

Since 1969, when Queensland, Australia, became the first state to introduce legislation making compulsory the wearing of seat belts by front seat occupants of cars, many workers have noted how the wearing of seat belts has resulted in a substantial reduction in the morbidity and mortality<sup>1-3</sup> of car occupants involved in road traffic accidents. Even before legislation became effective in the United Kingdom papers from Britain reported a decrease in severity of injury sustained by front seat occupants who were belted at the time of the accident.<sup>4-6</sup>

Various systems have been used to indicate severity of injury, including relating the length of stay in hospital to severity<sup>7</sup> and classifying injuries into minor, serious, and fatal. The International Classification of Diseases and Injury<sup>8</sup> has also been suggested as

relevant; it, however, indicates the anatomical site of injury but not its severity. In 1974 a system was introduced by Baker *et al* in the United States quantifying severity of injury (abbreviated injuries scale 76).<sup>9</sup> In that system seven body regions are defined and injuries in each scored according to the code. These range from a score of 1, for the most minor, to 6, defined as injuries currently unsurvivable in the light of present knowledge. From that information is derived the injury severity score, which is the sum of the square of the highest totals obtained in three separate regions. The scoring system was amended in 1980<sup>10</sup> and is a measure of the severity of injury, and not necessarily a prognostic index. Since 1966 the abbreviated injuries scale 76 and latterly the abbreviated injuries scale 80 have been widely used and internationally accepted as a means of assessing severity of injury and, although primarily designed for use in injuries sustained in road traffic accidents, have been used effectively in assessing severity of injury in various circumstances.<sup>11,12</sup> The use of injury severity scoring combined with clinical assessment probably provides the most accurate method at the moment of clarifying severity of injuries.

## Methods

In the 24 months beginning February 1982 the notes of all patients brought to hospital after a road traffic accident were perused and information about the accident and details of injury sustained extracted and recorded. An injury severity score was assessed by one person only, and for those patients who were admitted follow up of the patient and the inpatient notes were used in order to amend the final score. This information was supplemented by questionnaires sent to patients when information from clinical notes or initial clinical examination was inadequate for accurately assessing the final severity of injuries.

For those patients who died as a result of injuries sustained in road traffic accidents a provisional injury severity score was allocated from an initial assessment in the accident department, the final score being obtained by studying postmortem findings. In both fatal and non-fatal cases when details of the accident were either not available or inadequate the police and ambulance service records were helpful in supplementing information. Occupants of heavy goods vehicles and public service vehicles were excluded from the survey.

## Results

In the 12 months before the introduction of seat belt legislation 1103 front seat occupants sustained non-fatal injuries. Of these, exactly one third were wearing seat belts and the mean injury severity score was 4.104 (table I). In the first 12 months after seat belt legislation a total of 1042 front seat occupants sustained non-fatal injuries; 85.6% were wearing seat belts and the mean injury severity score was 2.17. In the first 12 month period up to the end of January 1983, 18 front seat occupants were killed; their mean age was 54.2 years and their mean injury severity score 51.8. In the next 12 months 13 front seat occupants were killed; their mean age was 27.9 years and their mean injury severity score 55.5.

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TABLE I—Seat belt wearing rates and injury severity scores of front seat occupants sustaining non-fatal injuries during February 1982 to January 1984

	February	March	April	May	June	July	August	September	October	November	December	January
					1982-3							
% Seat belt wearers	25	27	25	48	22	26	33	36	30	32	43	52
Mean injury severity score	3.75	3.50	4.50	2.80	3.75	4.50	4.00	6.50	4.80	3.75	3.60	3.80
					1983-4							
% Seat belt wearers	92	94	84	89	80	84	84	84	91	88	89	81
Mean injury severity score	1.75	2.70	2.75	1.50	1.50	1.75	2.75	2.70	1.50	3.25	2.10	2.00

Injuries sustained by front seat occupants who were killed in the period February 1983 to January 1984 were studied in depth. Of the 13 who died, eight were not wearing a seat belt, and in none of these cases was there any appreciable intrusion of the front compartment of the vehicle. Six of these eight front seat occupants were unbelted drivers' whose mean blood alcohol concentration was 147.5 mg/dl (32.0 mmol/l).<sup>13</sup> Four of the front seat occupants were ejected from the car on impact. Of three belted front seat occupants sustaining fatal injuries, two showed severe multiple injuries as a result of gross intrusion into the car and the third sustained severe injuries to the cervical spine in a car known to have been travelling at over 100 miles (160 km) an hour.

TABLE II—Mean injury severity scores of all car occupants injured and killed during February 1982 to January 1984

Category of car occupant	February 1982 to January 1983		February 1983 to January 1984	
	No seat belt	Wearing seat belt	No seat belt	Wearing seat belt
Drivers	4.74	1.53	4.71	1.69
Front seat passengers	4.87	1.30	4.90	1.45
Rear seat passengers	4.25	—	3.82	—

Serious (injury severity score greater than 12) but non-fatal injuries to drivers were noted. Before the introduction of seat belts 6.6% of injured drivers showed an injury severity score greater than 12 (mean 16.3) and a maximum score of 47; 40.7% had shown evidence of taking alcohol and 3.7% were wearing seat belts. After the introduction of legislation the mean injury severity score of severely injured drivers (that is, 3.4% of all drivers injured) was 20.0 with a maximum score of 35; 58.8% showed evidence of having taken alcohol and 47% had been wearing seat belts.

The number of front seat occupants admitted to hospital as a result of injuries sustained were studied for the two periods. From February 1982 to January 1983, 190 front seat occupants had injuries requiring admission to hospital; in the next 12 months 110 front seat occupants required admission. This represented a reduction of 42.1% compared with the first period. In the 12 months from February 1983, of those front seat occupants who did require admission to hospital 34.2% had not been wearing their seat belts at the time of the accident.

A reason for apparent non-compliance with seat belt legislation was sought and the following reasons emerged: forgetfulness, refusal, or possible inability to fasten the seat belt; overseas visitors who claimed not to realise that the law applied to them; inappropriate or ineffective seat belts—for example, lap strap type belts with no diagonal component; old cars in which seat belts were not fitted and were not required by law to be fitted.

The survey studied injuries sustained by back seat passengers. In the two year period a total of 432 back seat passengers were brought to the accident department having sustained injuries. In no case was there any record of this group of passengers having worn seat belts.<sup>14</sup> The mean injury severity score of the back seat passengers was 4.03, and in the two year period six back seat passengers sustained fatal injuries with a mean injury severity score of 67.8. In the period 1982-3 back seat passengers constituted 16.2% of the total car occupants recorded, and in the second 12 months they constituted 17.3% of all car occupants.

Police information indicates that in East Berkshire, as elsewhere in Britain, roughly 95% of all front seat occupants of cars did comply with seat belt legislation.

## Discussion

Few problems were encountered in using the scoring system. Two patients who sustained impaling injuries presented some difficulty in scoring, but in general the injury severity score correlated well with the clinical findings.

The findings of this survey were similar to those published elsewhere, in particular those from Australia. In analysing the reduction in severity of injury after seat belt legislation, severe injuries and deaths among front seat occupants were found to show an expected high level in the unbelted victims and gave further confirmation, if needed, of the importance of alcohol intoxication in driver victims.

Despite a 95% compliance rate with seat belt legislation after its introduction in the United Kingdom 14.4% of front seat occupants sustaining injuries are known not to have been wearing seat belts.

A cause for concern must be the welfare of the back seat passengers, whose vulnerability to severe injury and death is unaffected by present seat belt legislation. Not only is the rear seat no longer the safe seat of the vehicle but the unbelted occupants in the rear seat are liable to sustain injuries twice as severe as those sustained by belted front seat occupants; hence it is reasonable to suggest that what appears to have been achieved so far by legislation in protecting the front seat occupants should be extended to providing increased protection for the rear seat occupants.

## References

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Could vocal cord paralysis due to whiplash injury be prevented by seat head extensions and are the solid extensions better than the fenestrated variety?

Vocal cord paralysis is a rare complication of whiplash injury, but its prevention is identical with the prevention of all forms of whiplash injury. Classic whiplash occurs when the victim is sitting in a stationary car that is struck from the rear by another vehicle travelling at high speed. As the stationary car accelerates the neck extends until the occupant comes to rest in the interscapular area. The car then comes to rest, and as it does so the head is flung forwards into flexion. Though the medical evidence is limited, a head extension will probably do much to prevent this sequence. Most modern extensions are satisfactory, whether fenestrated or solid, provided that they are high enough to prevent backward movement of the recipient. The stationary car hit from the rear is a relatively infrequent accident, however, and severe neck sprains clinically indistinguishable from those caused by whiplash often result from head on and side on impacts. Head extensions are unlikely to prevent these injuries.—WILLIAM H RUTHERFORD, consultant surgeon, accident and emergency department, Belfast.

Does duodenitis exist as a primary clinical entity? If so what are the criteria for its diagnosis? Does it precede the development of duodenal ulcer?

The topic of duodenitis is surrounded by uncertainty and controversy. Duodenitis may be diagnosed at endoscopy by finding reddening of the duodenal mucosa, often with small erosions, or microscopically in duodenal mucosal biopsy specimens by standard criteria of inflammation (though there is observer variation). Correlation of endoscopic and histological changes is not complete, however—each may occur without the other. Nor is there a good correlation with symptoms. Similarly, dyspepsia may occur in patients with duodenal ulcers, with duodenitis, or with apparently normal duodenums; conversely, ulcers or duodenitis may be found in symptomless individuals. There are a few reports of progression from duodenitis to duodenal ulceration, and in some patients duodenitis may remain (or even appear) after an ulcer has healed. The subject is reviewed in a recent issue of *Clinics in Gastroenterology*.<sup>1</sup>—JOHN R BENNETT, consultant physician, Kingston upon Hull.

1 Lagarde SP, Spiro HM. Non-ulcer dyspepsia. *Clin Gastroenterol* 1984;13:437-46.