

# Influence of Road Speed Restrictions on the Incidence and Severity of Head Injuries

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## SUMMARY

A comparative survey has been made of patients with head injuries admitted to hospital in 1973 and 1974, before and after the introduction of fuel-saving measures, which included road speed restrictions. The severity and incidence of injury are shown to have decreased dramatically. It is concluded from this that the main cause of the improvement has been reduced road traffic speeds. A plea is made that they be permanently maintained.

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Abrupt and striking decreases in the road accident rate, morbidity, and mortality were reported throughout South

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Africa after fuel-saving measures were introduced on 16 November 1973.

During the month of December 1973, the national road accident incidence decreased to 13 213 cases, compared with 19 162 cases in December of the previous year.<sup>1</sup> This included a decrease of 51,4% in fatal accidents (representing 411 lives), of 45,6% in major accidents, of 39,2% in minor accidents, and of 27,1% in accidents without injury. In Cape Town, the number of road deaths during the 3 months between 15 November 1973 and 15 February 1974 fell to 37 cases, compared with 89 cases for the corresponding period a year before.<sup>2</sup> On all Cape Provincial roads between December 1973 and April 1974 there were 21 609 traffic accidents with 702 deaths, in contrast with 26 588 accidents with 1 141 deaths during that period in the previous year.<sup>3</sup>

This improvement was the first significant reversal of the trend of our disastrous national road accident record, which had shown a progressive rise from 3 000 deaths in 1961 to 8 661 deaths in 1972.<sup>2,4</sup> This reduction has been maintained at a gratifying rate, even if not at those striking levels seen immediately after November 1973. The Minister of Statistics announced on 16 August 1974 that



since the introduction of fuel conservation measures, the number of people killed on our roads had dropped by 33%, and the number injured by 30,5%.<sup>5</sup>

The impact of this change was immediately felt in hospital accident work. In Transvaal Provincial hospitals, the number of road accident victims treated during the 2 months immediately after 16 November 1973 fell by 46,7%, compared with the 2 months before this date, and mortality among these patients decreased by 67,2%.<sup>6</sup>

Among injuries resulting from road accidents, head injuries form a clearly-defined, large group, with a full spectrum of severity, including high morbidity and mortality. In a neurosurgical unit receiving these patients in large numbers and applying standardised management, the statistical picture of prognosis is stable and well known. These cases therefore constitute a sample which may serve as a sensitive and valid indication of change in the over-all pattern of road accident injury.

The present study was designed to demonstrate the transformation of our road injury picture, and its causes, in terms of comparable samples of patients with head injuries.

**PATIENTS AND METHODS**

All acutely ill patients with head injuries admitted to the wards of the teaching hospitals of Stellenbosch Medical School during 2 comparable 6-month periods, January to June of 1973 and 1974, before and after the introduction of the fuel-saving measures, were studied. Within each series, the road injuries were separated from non-road injuries, and the incidence and severity of each group were analysed. The non-road injuries served as a control of the stability of criteria of admission, assessment of severity, and standards of management.

Patients treated in the casualty department and discharged without formal admission, those dying in these departments before admission to wards and those cases brought to hospital after they had died, were excluded from the study because they were not all seen by members of the Department of Neurosurgery, and doubt could arise as to either the reliability of data or the uniformity of management.

The Department of Neurosurgery assessed and treated all admitted cases. The same criteria for admission, methods and standards of treatment, and assessment of severity were employed for both series.

The criterion for admission was the presence of at least one of the following features: a history of true loss of consciousness when the patient presented within 24 hours of injury; severe persisting headache or vomiting; convulsions; an abnormal state of consciousness; a specific neurological symptom or deficit; skull fracture or clinical suggestion of this; evidence of intracranial infection; and blood loss from the scalp requiring blood transfusion. No other limitation on admission was applied during the periods studied, and all patients received at hospital who fulfilled these criteria, formed part of the study.

Four categories of severity of head injury were used, designed to reflect the total temporary and permanent disability suffered by these patients. Assessment was based

on the expected rate and final quality of over-all functional recovery projected from the observed course during the stay in hospital. Thus **good recovery** was assessed as normality after a period of hospitalisation and convalescence not exceeding 1 month; **fair recovery**, normality or persisting neurological defect which may impede but not prevent the patient from returning to his or her previous work or activities 2 months after injury; **poor recovery**, permanent major loss of neurological function with proved reduction in quality of life or work capability; and **death** in hospital.

**RESULTS**

**Incidence of Road Injury (Figs 1 and 2)**

The total admission of patients with head injuries during the 1974 period was 393 cases, compared with 345 cases in the 1973 period—an 11,4% increase. The patient

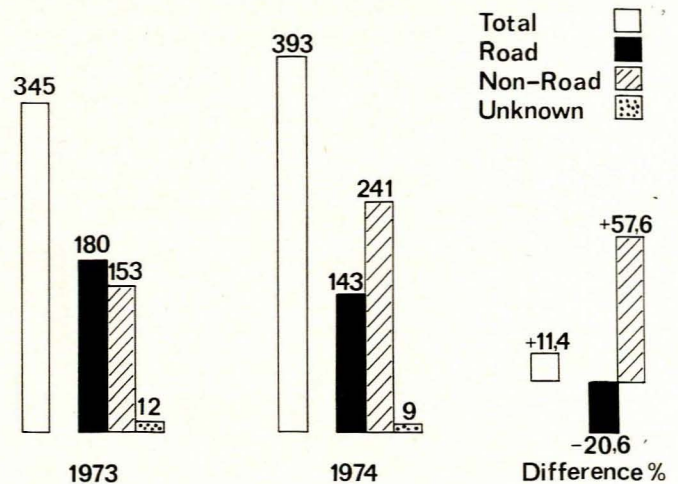


Fig. 1. Incidence and cause of head injury admissions during 1973 and 1974, January to June.

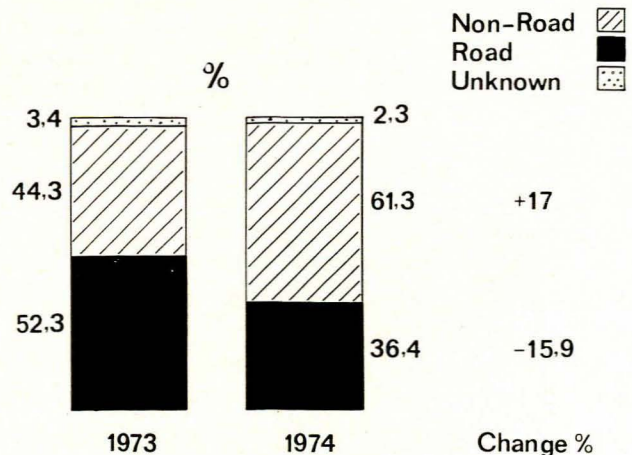


Fig. 2. Relative incidence of road and non-road head injuries admitted during 1973 and 1974, January to June.

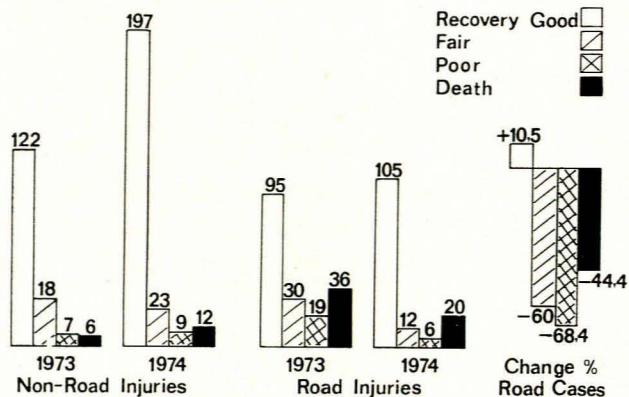


intake of the Department of Neurosurgery has expanded steadily since its inception at the beginning of 1972, and this increase conforms to the existing growth rate.

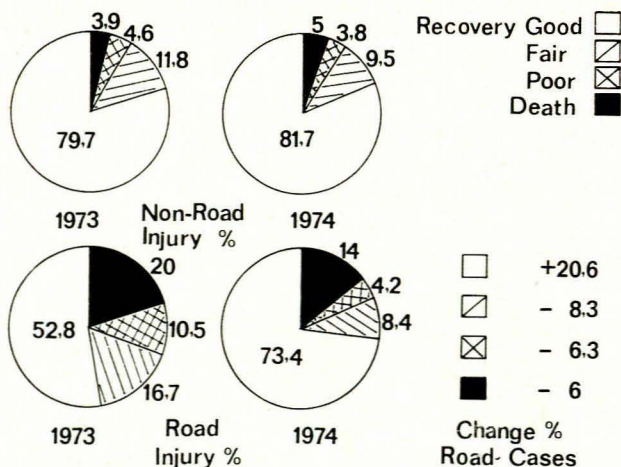
Of these totals, 180 cases were injured in road accidents in the 1973 series, and 143 cases in 1974—a decrease of 20,6%. The relative incidence of road accident injuries compared with head injuries from other causes was 52,3% in 1973. This reduced by 15,9% to 34,4% in the 1974 series. The proportion of head injuries as a result of road accidents had previously remained stable at 51% ± 1,5 during 1972 and 1973. Even disregarding the rising incidence of admissions, these differences are highly significant ( $P < 0,001$ ).

**Severity of Injury (Figs 3 and 4)**

Non-road injuries maintained a very constant pattern of severity during the 2 periods. By comparison, the group of 1973 with road injuries demonstrates the far worse prognosis of head injury due to this cause. In 1974, however, each category of severity had improved greatly. The relative mortality rate dropped by 6%, representing 44,4%



**Fig. 3. Prognosis for cases of head injury in road and non-road injuries during 1973 and 1974.**

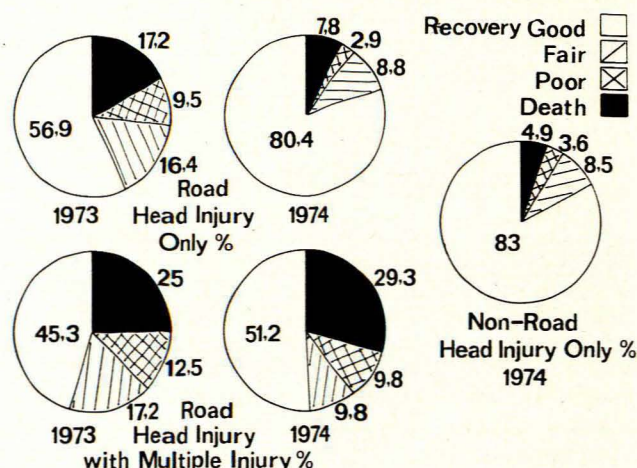


**Fig. 4. Relative prognosis of head injury in road and non-road injuries during 1973 and 1974.**

fewer deaths; the poor recovery rate was lowered by 6,3%; fair recovery by 8,3%; and the good recovery rate improved by 20,6%. The differences are highly significant ( $P < 0,001$ ).

**Multiple Injury and Severity (Table I and Fig. 5)**

Those cases of road accidents with multiple system injury were separated from those with head injury alone, in order to isolate this potent adverse factor in prognosis. Where head injury alone had occurred, a further striking improvement in all categories of prognosis was seen ( $P < 0,001$ ), and the pattern begins to compare with that of those who were not injured on the roads, without multiple injury.



**Fig. 5. Influence of multiple injury on relative prognosis of head injury in road accidents during 1973 and 1974.**

**TABLE I. INFLUENCE OF ASSOCIATED MULTIPLE INJURY ON OUTCOME OF HEAD INJURY IN ROAD ACCIDENTS**

Recovery	Road injury		Head injury with multiple injury		Non-road injuries	
	Head injury alone	Head injury with multiple injury	Head injury with multiple injury	Head injury with multiple injury	Head injury alone	Head injury alone
Good ... ..	1973 66	1974 82	1973 29	1974 21	1973 118	1974 185
Fair ... ..	1973 19	1974 9	1973 11	1974 4	1973 15	1974 19
Poor ... ..	1973 11	1974 3	1973 8	1974 4	1973 5	1974 8
Death ... ..	1973 20	1974 8	1973 16	1974 12	1973 6	1974 11
Totals	116	102	64	41	144	223

**Cause Unknown**

In 12 cases in 1973 (3,4%), and in 9 cases in 1974 (2,3%), the cause of injury was either unknown or uncertainly re-



corded. There is no good reason for supposing that the distribution of cause or severity of injury in these cases was biased. One death occurred in each of these groups.

## DISCUSSION

Head injuries due to causes other than road accidents of a severity to warrant hospital admission, recover well in 80% of cases, and the mortality rate is approximately 4.5%, by our criteria. By comparison, it had become customary before 1974 to find that road accident head injury carried a far worse prognosis, with only half of the patients recovering well, one-third suffering severe and prolonged disability, and with a mortality rate of 20%. They made up about half of all head injuries admitted to hospital, and their numbers were constantly increasing.

During the first 6 months of 1974, there was a striking improvement in prognosis of this latter group, and a reversal of the incidence trend, without change in the conditions of their hospital management. The numbers were reduced by 20.6% compared with the year before, notwithstanding a continuing rise in total head injury admissions. The severity of injury was so reduced that now 73.4% of these cases made good recoveries, with a mortality of 14%. If associated multiple injury, which severely affects prognosis, is excluded, the prognosis began to compare with that for non-road head injuries.

### Reason for Improvement

This change in the otherwise bleak picture of head injuries sustained on the roads is so remarkable that its causes must be clearly identified.

The fuel-saving measures introduced were the following: filling stations closed between 1800 h and 0600 h the next morning and at weekends; hoarding of petrol in excess of 10 litres per owner not permitted; and speed limits of 60 kilometres/hour in urban areas (initially 50 kilometres/hour for 2 months), and 80 kilometres/hour outside these areas applied. Previously these limits had been between 56 and 80 kilometres/hour on urban streets, and 112 kilometres/hour on national inter-urban roads. In addition, widespread publicity was given to the need to conserve fuel, and traffic police surveillance, particularly of speed limits, was intensified.

As a result, three essential changes occurred in vehicle behaviour which can be related to accidents. Vehicle speed was absolutely reduced, traffic movement became more uniform and orderly, and long-distance driving was probably reduced in extent. The flow of vehicles on urban

and peri-urban roads, where the great majority of accidents occur, did not diminish.<sup>2</sup>

The critical finding in the present study has been the marked reduction in severity of injury seen in head injury due to road accidents. Under the stable criteria of hospitalisation held for the comparisons, improved prognosis could only have occurred as a result of reduced severity of injury. There has been no change in the type of injury which might affect prognosis. This result is independent of the total number injured. Yet a decrease in severity of injury would play an effective part also in reducing the over-all incidence of admission to hospital, and the numbers in each prognostic group.

It is this finding that supports most pointedly the conclusion that it is indeed reduced speed that has been the dominant ameliorating influence. Of the many factors involved in determining the severity of acceleration/deceleration craniocerebral stress so characteristic of road accident head injury, be it of pedestrian or vehicle occupant, it is basically vehicle speed alone that has been altered by the fuel-saving measures. To our knowledge, there have been no other changes unrelated to speed which might have diminished the violence of accident and injury.

These reductions in the expected number of dead, and in the amount of suffering shown by this small study, attain dramatic dimensions when referred to road injuries of all types, to the country as a whole, and to the accumulation of benefit with time. Nothing that was said or done before appeared to have any noticeable influence on the grim and deteriorating national road accident picture. The extraordinary improvement that has now occurred is a side-effect of measures aimed at conserving fuel. This unintended effect has proved so beneficial and of such national public interest, that it must become a matter of primary importance to maintain this gain in its own right.

The experience gained from lowered speed limits, when effectively enforced, has presented the country with an unprecedented opportunity to achieve a lasting improvement in road safety. It amply demonstrates both a method and its effectiveness. Whatever other causes of traffic accidents and injury there may be, and admittedly there are many, let us do all in our own power to retain this one proven check we now have.

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