CORRELATIONS BETWEEN ACCIDENT CIRCUMSTANCES AND THE TYPE AND GRADE OF INJURIES IN TRAFFIC ACCIDENTS

WILLIAM DAMHOLT, H. VICTOR NIELSEN, and ERIK L. NORDENTOFT, Odense University Hospital (Denmark)

The co-ordinated registration of traffic accidents which has been performed in the Odense district since 1 February 1971 has been presented before, namely at the IRCOBI Congress in Amsterdam 1973 (7). Shortly summarized the hospital registers the following data:

Time and place of accident and first treatment.
Category of road user, means of transportation, and possibly position in vehicle.
Use of seat belt/crash helmet.
Counterpart.
Accident situation according to police report.
Pattern of injuries.

The injuries are subdivided into 34 groups according to type, i. e. soft tissue or fractures, and region. Furthermore they are graded into seven severity groups according to expected duration of incapacitation, occupation, age, sex, and other influential factors taken into account:

1. Suspected.
2. Light injury - no incapacitation.
3. Light injury - incapacitation less than 2 weeks.
4. Medium injury - incapacitation from 2 weeks to 3 months.
5. Heavy injury - incapacitation from 3 to 6 months.
6. Heavy injury - incapacitation exceeding 6 months.
7. Most essential cause of death.

This gradation was chosen instead of the abbreviated injury scale (1) as the latter does not allow a subdivision of light and moderate injuries, and is thus not convenient for a broad epidemiological survey and injury cost analysis. The validity of the predicted incapacitation time is still undergoing control with samples from various groups of occupation and age. The aim of this is to define the actual mean incapacitation time within the severity groups. This has been demonstrated in the lighter groups (8), while the more severe groups still need more follow-up work.

The hospital covers a population of 230 000 inhabitants. The

records comprised 12 500 persons injured in road traffic accidents by 1 June 1975. The material is computerized and available through a number of output programs from the hospital's computer room.

In this presentation the Odense material has been used for an analysis of the regional distribution and severity of the lesions according to accident circumstances.

Age emerged as a decisive factor for the location and severity of lesions. Therefore the material was further subdivided into 3 age groups: children 0-14, adults 15-64, elderly 65-99.

The analysis comprises lesions inflicted in various age groups in protected and unprotected situations as well as lesion distribution according to use of seat belts and crash helmets.

Fig. 1. Lesions in car riders. There is a significant occurrence of lesions to extremities in adults and especially elderly persons entailing incapacitation of long duration; this to some extent gives too little priority to the head and neck lesions which on the whole are graded as light. The children's lesion pattern is characterized by very few lesions of legs and truncus, slightly more arm lesions, but otherwise completely dominated by the head lesions. No lethal truncus lesions have been registered in children during this four-year period, and during the entire period there have only been 4 serious abdominal organ lesions in children in this accident situation.

In children only a total of 3 light neck lesions have been registered. In elderly persons 9 neck lesions have been registered, but only one of grade 5, the rest under grade 4. In adults have been registered 134 neck lesions - 12 of these in groups 5-6 - but only 1 fatal (a carotis laceration in the windscreen). About 1/3 of the neck lesions are luxations and fractures, the rest are lesions to soft tissue.

There are twice as many facial lesions as commotio/fractura cranii. Approximately 10% of the facial lesions are of more serious character, greater soft tissue lesions or fractures necessitating treatment.

Fig. 2 shows lesions in accidents involving falls with cycles, mopeds, and motor cycles. As could be expected there is a lighter lesion pattern and in all age groups a relative overweight of arm lesions.

Fig. 3 shows lesions in unprotected persons in collision with heavier vehicles. There are relatively more extremity lesions - especially leg lesions in all age groups - than is the case with car riders, and there is a greater number of severe and lethal lesions. Children and adults have 2% lethality, whereas lethality was 10% in the group of elderly persons. It is important to keep this difference in lethality in mind in

comparisons between materials.

In the 722 children no lethal lesions have been registered apart from those in the head/neck region. There were 14 lethal brain lesions and 4 lethal neck fractures/luxations. There were 11 abdominal lesions in group 4 (mainly abdominal haemorrhages) and 3 urinary tract lesions in groups 4-5, 5 thorax lesions of grade 4, but no fatal truncus lesions in children.

In 1 916 adults were registered 33 lethal brain lesions and 3 lethal neck lesions. Seven fatal thorax lesions and 2 abdominal lesions were registered. There are 284 fractures to lower extremities and 111 to upper extremities.

Elderly persons are characterized by a high lethality. In 369 elderly persons there were 22 fatal brain lesions and 3 fatal neck lesions (all luxations and fractures). Other fatal lesions were 2 in the spinal column, 10 in the thorax, 2 persons died from pelvic fractures, none from abdominal or urinary tract lesions. There were 115 fractures in the elderly person group with a considerable overweight towards prognostically poor groups. Two died from complications.

Fig. 4 shows the lesion pattern in car drivers, belted and unbelted. There is a clear drop in number of head lesions from 80 to 62% in wearers of belts. It is not possible to ascertain any change in lesions apart from head/neck. Eleven per cent of belted drivers have had neck lesions against 4% of unbelted drivers, but only the latter group has had serious lesions. Only one single belted driver had a grade 4 lesion, the rest were lighter.

Fig. 5 shows the lesions in front seat passengers. There is a clear change in lesion pattern in relation to use of seat belts. Head lesions have fallen to 50%. There is a corresponding relative redistribution of lesions to truncus (1 fatal) and legs, as the injury index (=number of lesions per patient) was the same for those belted and those unbelted.

Lesions to the neck have been found in 8% of belted passengers, but only very light ones (not above grade 3) against 4% in unbelted passengers, these, however, with a somewhat more severe pattern, 1 being fatal. In front seat passengers there was a relative increase in number of truncus lesions in those belted, but shifted towards the lighter grades. Truncus lesions of grade 4 were found in 14% of belted front seat passengers and in 8% of those unbelted. Grade 4 lesions in belted passengers consisted in 5 cases of costa fractures (3 with intrathoracic lesion) and 2 pelvic fractures. Generally more severe truncus lesions have not been demonstrated in belted as opposed to unbelted passengers.

Fig. 6 shows single accidents of moped riders. Head lesions in the

helmeted rider group are 36% lower than in the unhelmeted group. It is not possible to demonstrate a corresponding rise in other lesions, but there is a drop in injury index from 1,48 to 1,35. Changes in grade or type of neck lesions cannot be ascertained in the group wearing helmets. There were no fatal lesions among helmet users.

Fig. 7 shows a corresponding drop in head lesions in the helmeted group of moped riders in collisions with larger vehicles (a drop of 38%). There is a small drop in injury index from 1,68 to 1,58, but a relative increase in the great number of incapacitating leg lesions of long duration. There were no fatal lesions in the helmeted group. Two thirds of the unhelmeted killed riders died from head lesions. In the helmeted group no neck lesions have been registered.

Fig. 8 shows lesions of motor cyclists in single accidents. There is a slightly more severe pattern than that found for moped riders. In the helmeted group a corresponding drop in number of head lesions (25%) is seen; there was one group 6 lesion, whereas among unhelmeted riders there was one fatal (=no difference).

Fig. 9 shows motor cyclists in collison with a heavier counterpart. Here head lesions are reduced by half in the helmeted group, and there is a corresponding overweight of the many severe leg lesions. The injury index drops from 1,63 to 1,49. A light neck lesion was found in one helmeted rider, none among those unhelmeted.

In the case of 207 moped riders there was no information as to whether a helmet had been worn or not. The lesion pattern of this group was more severe than in the groups where information was available with 59% head lesions. Ten were killed out of a total of 16 lethal lesions. Upon further investigation of the files of those killed it was found that four of them had not used a helmet, whereas no further information was available on the remaining six riders.

Of 25 motor cyclists it is not known whether they were helmeted or not. These 25 persons had a high injury index (1,84) and further an overweight of head lesions (60%) compared with those registered as unhelmeted. There were no fatal cases.

In the case of 112 car drivers and 29 front seat passengers there was no information as to whether they had used a seat belt or not. The pattern of injury was more severe than that found with unbelted car riders with a further overweight of various head and neck lesions (in 119%and 100% respectively). In this group there were 5 drivers and 4 front seat passengers who were killed. Upon closer investigation of the files it was found that 2 of the front seat passengers had not used a seat belt; no additional information was available on the others.

The more severe pattern of lesions observed in the group "no additional information available" may to some extent be explained as a result of considerations of treatment outweighing considerations of registration at all stages. The patterns of lesions in this group are otherwise distributed in moped riders and motor cyclists as well as car riders as a further aggravation of the pattern of those unprotected. It must therefore be permissible to disregard the "no additional information available"-group when comparing wearers and non-wearers of helmets and belts.

Discussion

Lesions have been analysed in a total of 1o763 persons injured in typical traffic accident situations, i. e. injury as protected (car riders), unprotected (cyclists, moped riders, and motor cyclists) single, and unprotected (those previously mentioned + pedestrians) versus stronger parties.

The analysis shows the lightest pattern of injury in the single accidents in unprotected situations, and the most severe pattern when those unprotected had collided with cars. Within this group there was a particular overweight of severe leg lesions. In car riders head lesions dominated, especially in children who had very few leg lesions. Lethality in the elderly was 4 times as great as in children and young persons at injury in an unprotected situation; as car riders it could not with any certainty be put as greater.

The distribution corresponds with earlier findings in several reviews (2, 6, 9). The demonstrated dependence on age of injury patterns and grades is less known.

The protective effect of crash helmets and seat belts has been shown in many previous investigations. An injury material as the present is not suited for evaluation of this effect as accidents in which the protective effect has been absolute will not be represented.

Re use of seat belts: In a hospital-selected material one must expect a redistribution of the injuries away from typical points of contact at "second collision" with the points of contact of the seat belt. By far the greater number of seat belts in our material (practically all) were 3-point belts. This anticipated redistribution was confirmed in the investigation.

Correspondingly we found as anticipated a reduction in the number of head injuries in helmeted motor cyclists and moped riders. As in the case of use of seat belts the reduction can only be taken as an absolute minimum expression of the protective effect as only persons with lesions are included in the material.

From several quarters serious lesions in users of seat belts have been described (3, 5). Our material with 199 belted drivers and front seat passengers with only one fatal truncus lesion and without demonstrable rise in the number of neck lesions does, however, indicate that these lesions must be very rare. At any rate this is the case in the mixed traffic of the admittance area without longer stretches of motorways, and it agrees with Dutch experiences (4).

The protective effect of crash helmets in moped riders and motor cyclists has been investigated in numerous materials. It has not been possible to find information as to whether changes have been noted in cervical injuries as a result of changed rotational and angular effects on the neck of helmet users. We have noticed a few moderate neck contusions caused by the neck piece of "visor helmets" (pilot and integral-type helmets). In our patient material we found in 340 helmeted moped riders no neck lesions prognosticated at more than 14 days' incapacitation, and in 189 helmeted motor cyclists there was one serious neck lesion. The helmets used were of varying type and quality. With this reservation use of helmets does not seem to predispose an increased number of neck lesions.

Abstract

1o 763 traffic casualties were analysed for distribution and prognosticated severity of lesions according to age and accident situation. Head injuries dominated in children car riders compared with adults. Leg injuries dominated when unprotected road users were hit by cars. Lethality was 4 times greater in the age group above 65 years.

The number of head lesions was clearly reduced in users of seat belts. It could not be demonstrated that there was an increased occurrence of neck lesions or serious lesions to the thorax or abdomen in 199 users of seat belts. In 340 helmeted moped riders and 189 helmeted motor cyclists an anticipated relative reduction in number of head injuries was demonstrated, but not an increased number of neck lesions.

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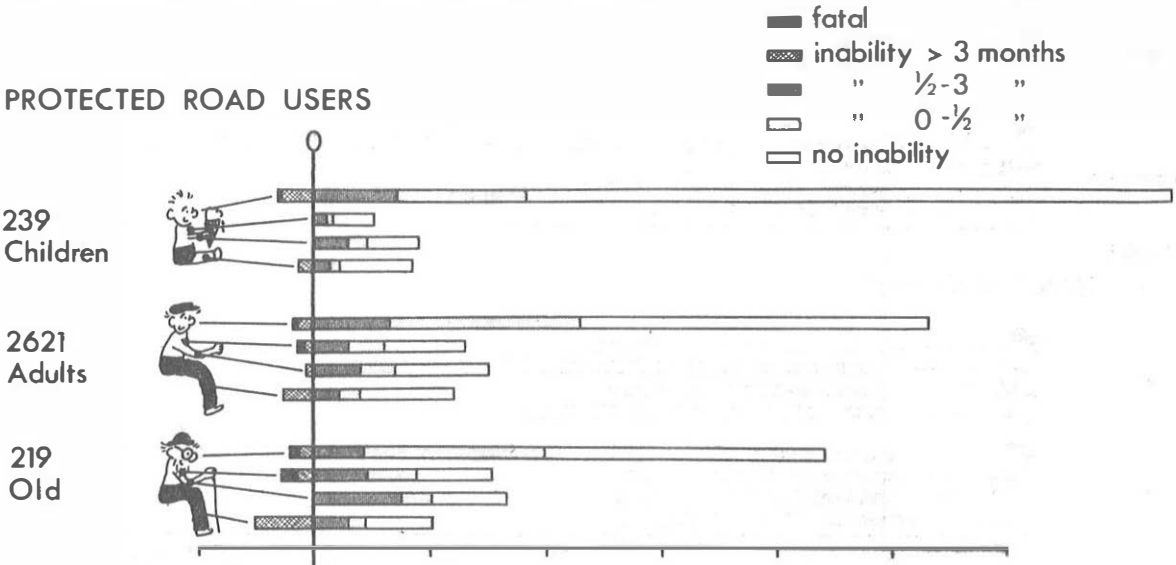
DISTRIBUTION OF MOST DISABLING LESION

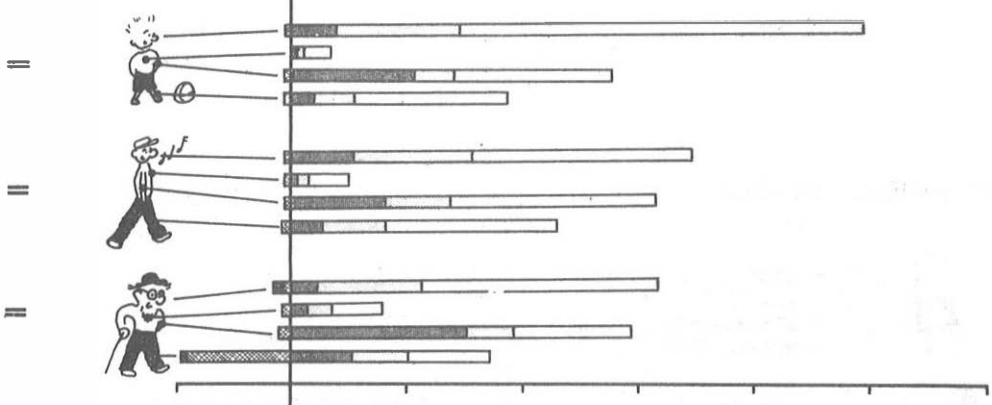
FIGUR

1. PROTECTED ROAD USERS



FIGURE

2. UNPROTECTED - SINGLE



FIGURE

3. UNPROTECTED VERSUS STRONGER PARTIES

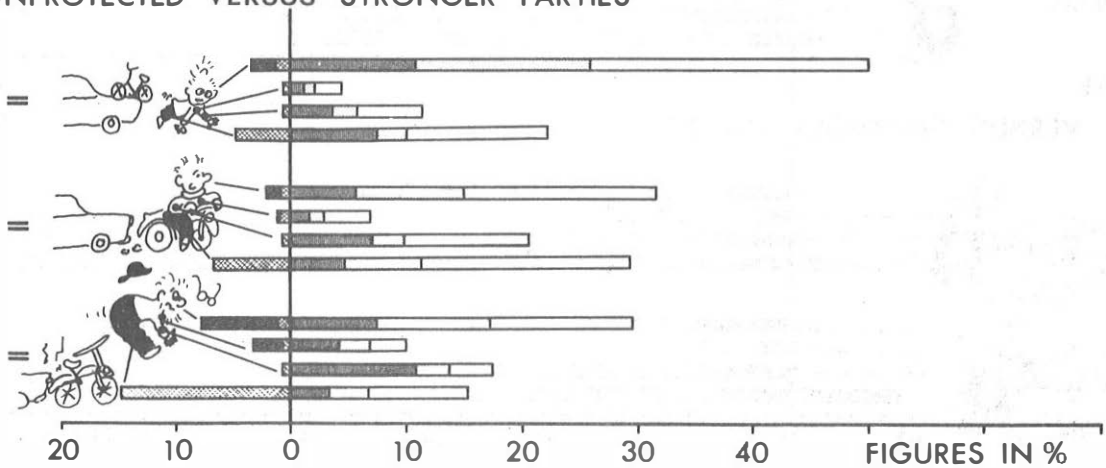


FIGURE
4. DRIVERS

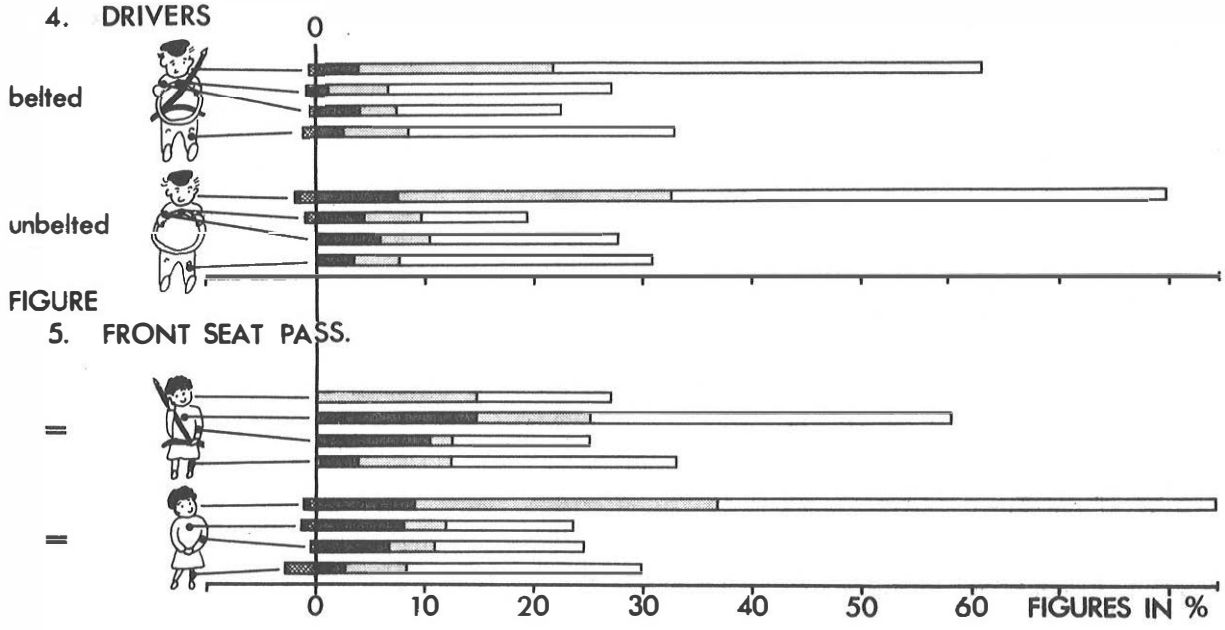


FIGURE
5. FRONT SEAT PASS.

FIGURE
6. MOPED RIDERS SINGLE

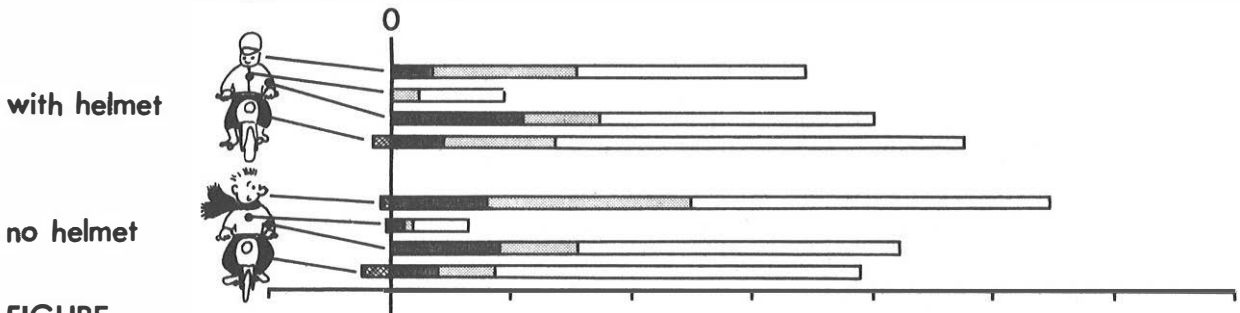


FIGURE
7. VERSUS STRONGER PARTIES

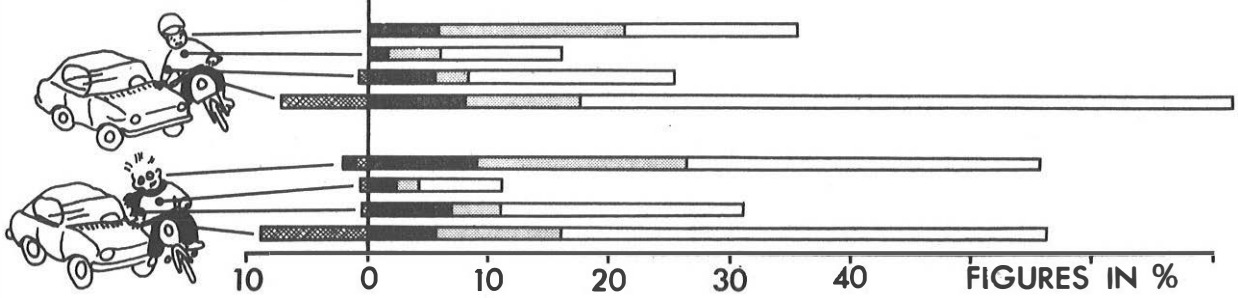


FIGURE
8. MOTOR-CYCLISTS SINGLE

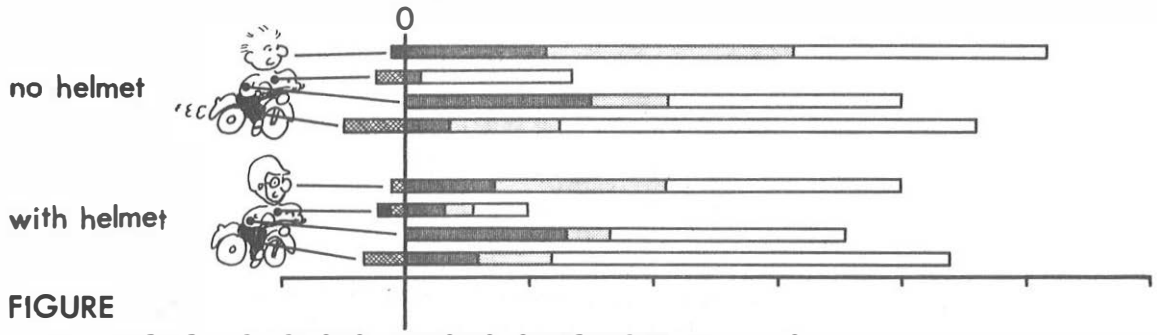


FIGURE
9. MOTOR-CYCLISTS VERSUS STRONGER PARTIES