BICYCLE ACCIDENTS IN GÖTEBORG, SWEDEN 1983

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INTRODUCTION

During the last years popularity of bicycling has grown markedly in Sweden, especially in the major cities. The bicycle traffic has increased four to five times in Göteborg since the beginning of the seventies (6). This has altered the pattern of traffic accidents. The total annual number of traffic casualties decreased from about 1500 to about 1100 during the seventies (10). The annual number of injured bicyclists was about 100 during this period and 200 over the last years according to official reports (6). The real number of bicycle accidents is much greater than the official number as only a minor part of these accidents are known by the police (Fig 1). Bicyclists constitute the greatest category of injured road users in Göteborg over the last three years according to hospital records. The number of inhabitans in Göteborg is 430.000.

Fig 1. Number of injured bicyclists in Göteborg 1979-1983 and source of registration.

AIM

The aim of this study was to describe the epidemiology, traumatology and consequences of the bicycle accidents in Göteborg during one year. The study was also a test of a computerized hospital based system for registration and analyses of traffic accidents. This system has been developed from the method of registration presented at the IRCOBI-conference 1982 (4).

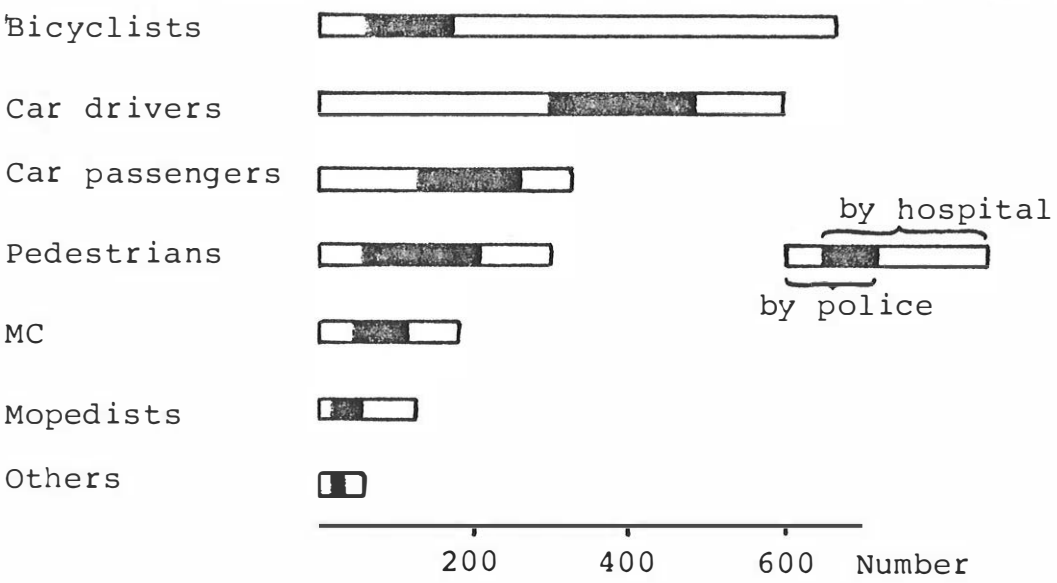
MATERIAL AND METHOD

The material includes all injured bicyclists treated at the emergency departments of all three accident hospitals in Göteborg in 1983. The identity of the injured, the time and place of the accident and the involved traffic elements were noted by the ordinary hospital staff when the injured arrived to the emergency departments. Some other accident parameters were noted: i-e- influence of alcohol, impairment of vision and hearing and use of protective equipment. The injuries were coded according to the WHO:s ICD-list (8) by one specially trained person. The injury severity was classified according to the AIS-, CIS- and ISS-scales. (2,3,5,11,12) and correlated to the type of medical care and duration of hospital stay. All data were computerized. The traffic accident casualties in official reports were matched with the hospital material at the Town Planning Council.

RESULTS

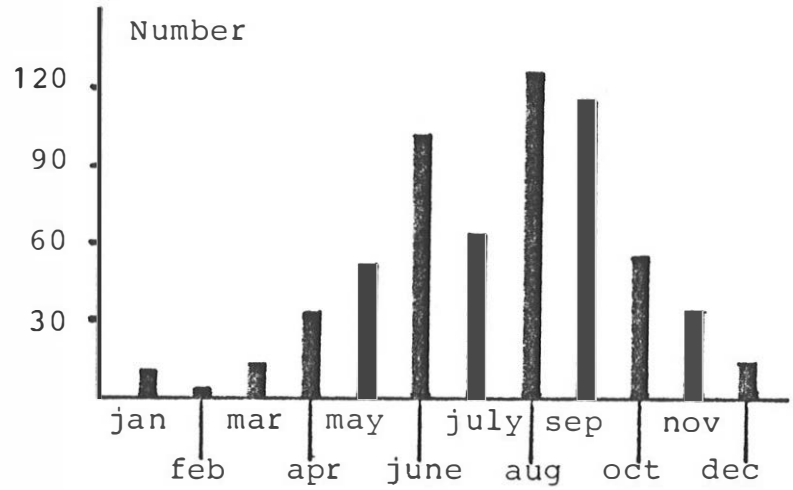
A total number of 2226 persons were injured in traffic accidents reported by the police and hospitals (Fig 2). The number of casualties reported by the hospitals were 1690. Bicyclists constituted the largest category of road users in traffic accidents.

Fig 2. Number of injured and killed persons in traffic accidents in Göteborg 1983 and source of registration.



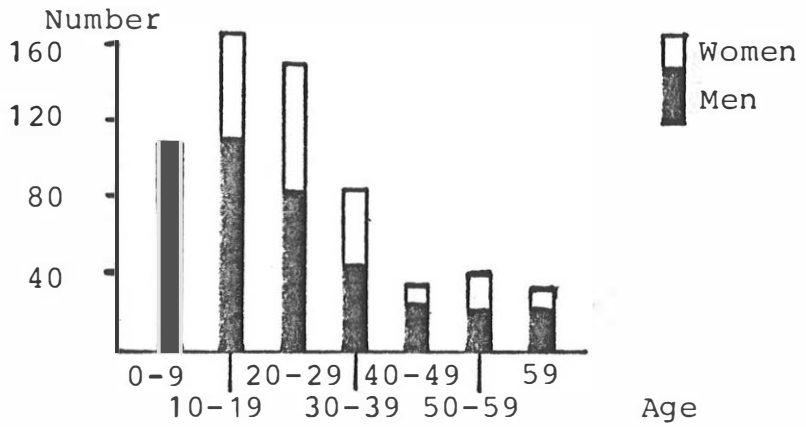
In the following only the 610 injured bicycle drivers reported by the hospitals are analysed. The major part of the bicycle accidents occured in the summermonths and 97% occured in the city of Göteborg (Fig 3).

Fig 3. Number of injured and killed bicyclists in Göteborg January-December 1983.



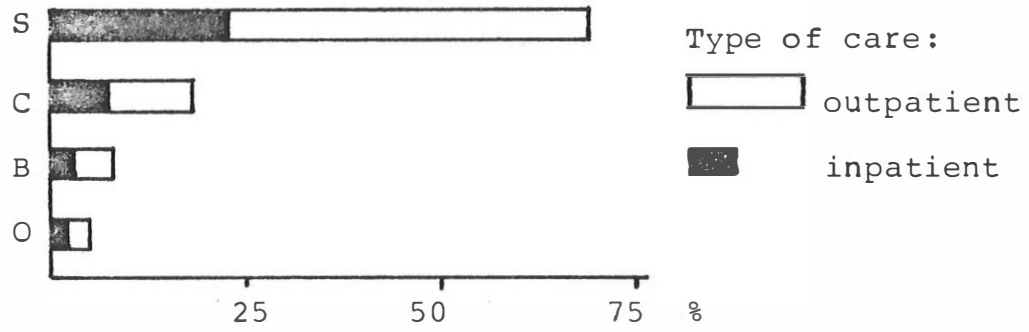
Among the 610 injured bicyclists in the hospital records 61% were men and 39% women (Fig 4). This does not differ from the sex distribution in the whole population of traffic accident casualties in the city. The age group between 10 and 29 years dominate and the proportion of women is greatest in the groups between 20 and 39 years.

Fig 4. Age and sex distribution.



Single accidents constituted 69% and collisions with cars 18%. Fifty bicyclists (8%) were injured in collisions with another bicycle. The bicyclists were hospitalized in about 30% of the cases regardless of type of accident (Fig 5).

Fig 5. Type of accident and care.(S=single accident,C=collisions with cars,B=collisions with bicycle,O=others).



The bicyclists were treated 673 days in hospital altogether, corresponding to 15% of the time for all traffic casualties. The mean time of the hospital treatment was 1,1 days for all bicyclists, 0,8 days for bicyclists in single accident and 1,4 days for bicyclists in collision with cars. The mean hospital time was 2,2 days for bicyclists over the age of 59 years.

The different injuries were described by up to ten diagnosis per case. A total number of 1090 injuries were diagnosed for the 610 casualties, which corresponds to a mean of 1,8 injuries per bicyclist. The number of injuries was somewhat greater for bicyclists in collisions with cars (2.2) than for single accidents (1.7). Five percent of the bicyclists sustained four or more injuries (Table 1).

Table 1. Number of injuries per individual.

	Number of injuries					
	1	2	3	4	5	>5
Number of bicyclists	344	131	84	27	10	9

The head and the upper extremities were most frequently injured (Table 2). A typical injury combination was cerebral concussion and some injury to the upper extremity, e.g. fracture of the clavicel. Bicyclists in collisions with cars more often sustained injuries to the lower extremities and fewer facial injuries than bicyclists in single accidents. This was true even for accidents with serious injuries (AIS $\geq$ 3).

Table 2. Percentage distribution of all injuries in different body regions.

	Skull	Face	Neck	Thorax	Abdomen	Extremities upper	Extremities lower	
All bi-cyclists	14	22	1	4	2	34	23	100
Single accidents	13	24	1	4	2	36	20	100
Coll. with cars	13	16	2	4	5	27	33	100
AIS > 3	14	7	2	11	3	39	24	100

The majority of the injuries were of minor or moderate severity according to the AIS-scale (AIS =1 or 2). There were only minor differences in injury severity between the different accident types (Table 3).

Table 3. Percentage distribution of AIS-codes for different types of accidents.

	AIS-code						
	1	2	3	4	5	6	
All bicyclists	74,4	19	5	0,4	0,1	0,1	100
Single accidents	74,5	20	5	0,3	0,0	0,2	100
Coll. with cars	80,2	16	3	0,4	0,4	0,0	100

Five persons (1%) sustained serious injuries (AIS $\geq$ 4). Two were injured in single accidents, two in collisions with cars, and one in a collision with a truck. One person died of head injuries on the day of admission. He was injured in a single accident.
The permanent impairment, as indicated by the CIS-scale, was possible to code for 485 injuries (Table 4). The risk of injuries leading to permanent impairment did not seem to be higher in collisions with cars than in single accidents.

Table 4. Percentage distribution of CIS-codes for different types of accidents.

	CIS-code						
	1	2	3	4	5	6	
All bicyclists	83	9	6	2	0	0	100
Single accidents	82	9	6	3	0	0	100
Coll. with cars	90	5	5	0	0	0	100

Only 16 (3%) bicyclists had ISS-scores greater than ten. Ten of these were injured in single accidents, three in collisions with cars and one in collision with a bus, a truck and a tram respectively. There was no obvious correlation between the ISS-scores and the length of hospital stay.
Influence of alcohol was noted in 37 cases (6,1%), impaired vision in 16 (2,6%) and impaired hearing in 4 (0,7%). The injury severity in bicyclists influenced by alcohol was not greater than in other cases. A minor part, 13 (2%), wore protective helmets.

DISCUSSION

In a previous study the number of persons injured in traffic accidents in Göteborg exceeded the number reported by the police with approximately 60% (10). The discrepancy was much greater for bicyclists and especially bicyclists in single accidents. In this study 69% of the bicycle accidents were single accidents. Only 10% of these were known by the police. This indicates the need of a hospital based traffic accident registration for this type of accidents.

The agees between 20 and 39 years constitute 38% of the injured bicyclists in this study. This differs markedly from several earlier reports in which children were in a great majority, (7,9,13). This might be due to an increased popularity of bicycling in the cities mainly in the younger middle agees and especially in females. The same result has been reported by Aalberg and Jensen from Copenhagen, Denmark (1).

A major part was single accidents. This is in good accordance with other studies (1,9). The significant number of bicycle to bicycle accidents may be explained by too many bicycles in to narrow bicycle roads. Single accidents were more frequent among children younger than ten years.

The distribution of the injuries to different body regions shows well established facts (1,9): Injuries to the head and upper extremities dominate. In collisions with cars there was a shift from injuries to the upper extremities to the lower ones and a lower risk of injuries to the face. In these accidents the impact of the car to the legs is probably a more important injury cause than the contact to the ground.

The injury severity can most easily be defined by the type of medical care. Patients with "minor" injuries are treated as outpatients and patients with

"non minor" injuries as inpatients. The admittance rate was relatively high (30%), but the length of hospital stay was short (mean value 1.1 days for all bicyclists). This probably depends on the high frequency of cerebral concussion. Most of these injuries need only one day at hospital.

The length of hospital stay is a somewhat better measure of the injury severity. The small difference of injury severity between single accidents and collisions with cars is somewhat puzzling. The AIS-, CIS- and ISS-ratings were not higher in collisions with cars than in single accidents. The only parameters that showed a difference between these groups were the mean value of the hospital stay (single accidents 0,8 days and collisions with car 1,4 days) and the number of diagnosis per injured (single accidents 1,7 and collisions with car 2,2). One conclusion is that there are no major differences in the severity of the injuries between single accidents and collisions. However, there might be a certain number of single accidents with slight injuries which do not need hospital care. This might cause a biased selection.

Bicyclists were more severly injured than car drivers in general. Pedestrians in car accidents had a longer hospital stay than any other category of road users. Most of the pedestrians were elderly.

The lack of correlation between the ISS-ratings and the time at hospital in our material may be explained by the small number of causalties with ISS-ratings exceeding ten. In other studies including all types of traffic accidents, there has been a good correlation in this respect (3).

A rough estimation of the risk of accident for bicyclists has been made. Measurements of traffic flows in Göteborg have shown that the exposure for bicyclists are less than five percent of that for the car drivers (6). In spite of this there were more bicyclists injured in traffic accidents than car drivers and the mean accident outcome was more severe for the bicyclists. This means that in Göteborg the risk to be injured in a traffic accident as a bicyclist is at least twenty times as high as for a car driver.

The influence of alcohol was noted on clinical findings by the staff at the emergency department. No blood samples for alcohol concentration test were drawn. This probably means that the number of bicyclists noted as influenced by alcohol (6%) is to small.
Impaired vision and hearing were also noted by the staff and is therefore a general judgement too.

The protective effect of helmets could not be evaluated as the number of bicyclists who used helmets was to small (2%).

The results of the hospital registration are continously reported to The Town Planning Council of Göteborg. The accident places and the course of the accidents are usually difficult to specify at the emergency department. From 1983 these data are continously checked via interviews. This significantly increase the number of bicycle accidents known by the Council and is used in the work of traffic planning. As a result more money has been allocated for improvement of bicycle roads in Göteborg in 1984.
A similar registration and cooperation with the authorities have been used since several years in Odense, Denmark (14).

CONCLUSIONS

1. The number of injured bicyclists has increased markedly over the last five years and now constitute the greatest category of injured road users in Göteborg.

2. The number of bicycle accidents known by the police is low (25%).

3. The ageclasses between 20 and 39 are prominent (especially for women) for injured bicyclists.

4. Two thirds of the bicycle accidents are single accidents.

5. The injury severity is low in most bicycle accidents.

6. There are only minor differences in injury severity between different types of bicycle accidents.

7. The risk to be injured for bicyclists is at least twenty times that for car drivers.

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