

Bicycle Helmets – Do We Need a European Legislation?

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ABSTRACT

An increased use of bicycles comes along with an increased number of bicycle accidents. Bicycle accidents are more frequent than recorded by the police.

To evaluate the real number of bicycle accidents during 12 months in Münster, Germany, injuries were collected by the Police and in each emergency unit anonymously.

2,153 patients had to be treated in a hospital, nearly triple the number of accidents that were registered by the police. Beside fractures of the upper extremities with major surgery, traumatic brain injuries were the leading cause for hospital admission.

Bicycle helmet use can reduce traumatic brain injuries and the related number of deaths and hospital admissions. Laws on bicycle helmet might decrease the use of bicycles and therefore the reduction of positive health benefits. Other methods of accident prevention may lead to positive effects as helmet legislation as well, while having no reduction in bicycle use.

INTRODUCTION

The bicycle is becoming increasingly popular. The awareness of environmental issues, prices for gas and gas, and an ever more mobile population are just some of the reasons for this. In Münster, a German town with a population of 273,000, the bicycle was the main method of transportation in 2009, used more often (37.8%) than the car (36.4%). Each day in Münster, bicycles are used around 450,000 times. In 1982 it was only used around 270,000 times a day.

However, the increased use of bicycles has also led to an increased number of bicycle accidents. In 2009, the number of people in Europe injured in a bicycle accident (85,596) exceeded that of motorcycle accidents (30,419) by more than two times. In the same year, the Münster police was called to 690 bicycle accidents with an injured cyclist. During the same time, all patients that were admitted to an emergency unit in one of the six hospitals in Münster were anonymously reported to the Münster Bicycle Study. Within one year, 2,153 patients had to be treated in an emergency unit, nearly triple the number of accidents that were registered by the police.

While the number of recorded accidents is already high, the number of unrecorded cases is even higher. This is due to the nature of bicycle accidents, which often do not involve another persons or property, hence not leading to the involvement of the police. If someone slips with his or her bike and falls, there is no reason for calling the police most of the time.

Since this will be the same situation in other cities across Germany and Europe as well, it is highly possible that the number of unrecorded bicycle accidents also exceeds the number of recorded accidents by far in other cities.

In order to make a judgement about the necessity of European bicycle helmet legislation, we do need to first answer the question, if traumatic brain injury is a common injury in bicycle accidents. We will then have to look at the current situation across Europe. In addition, it is also important to know what other kinds of prevention methods exist. Based on these findings, we will discuss if a European legislation on bicycle helmets should be introduced and will make suggestions for future steps.

METHODS

Between February 2009 and January 2010, data on bicycle-accidents leading to injuries were collected by the Police of Münster and in all emergency units of the six hospitals in Münster. A systematic acquisition of technical data from the Police and the medical data from the hospitals were combined anonymously. In the case of a bicycle-accident, the police are not always called and not every bicycle-accident results in injury. Therefore a simultaneous and complete recording of eclectic data became necessary.

The data are collected from three different sources:

1. Voluntary patient report
2. Police accident report
3. Hospital health record

All forms did not contain any personal data of patients involved. These anonymous forms contained only age, sex, time and place of the bicycle-accident to match the questionnaires. The data were entered into a central database (MS Access for input / MySQL for data retrieval).

In order to provide an overview on the existing bicycle helmet regulations and its effects in Europe, a literature research using Pubmed/Medline as well as an Internet research (using the keywords bicycle helmet, bicycle helmet use, law, legislation, Europe) was performed.

RESULTS

2,153 patients were included into study. For each of these patients either a patient record or a hospital record or a police record or a combination of any of these different records existed in our database. 1,410 patient records and 1,529 hospital records were included in the database. In total, 1,767 patients received medical treatment at a hospital, 386 people included in the study did not go a hospital. Three casualties died in a bicycle accident. At the same time period, 633 bicycle accidents with injured persons were recorded by the police.

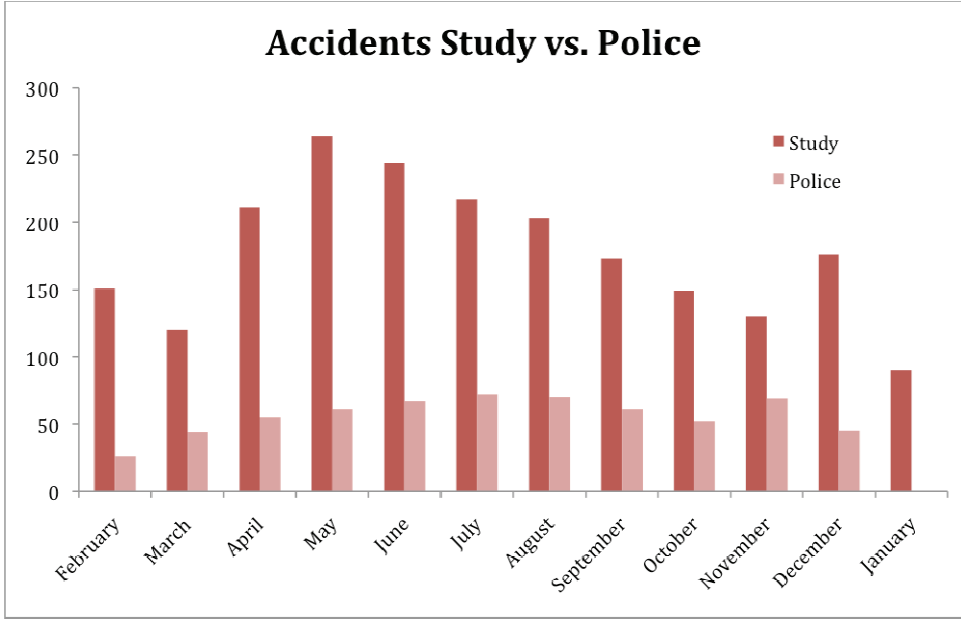


Figure 1. Comparison of Accident Numbers

The distribution of age of all patients included into the study, differed from the distribution in the complete population of Münster. Opposed to the general population, the proportion of bicycle drivers of the age between 10 and 29 was larger in the accident population.

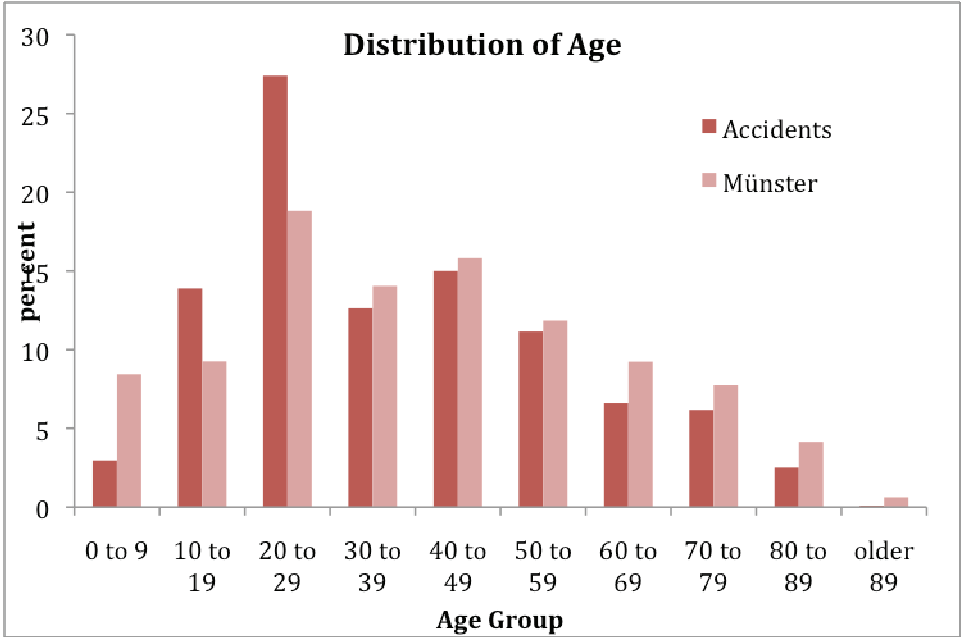


Figure 2. Comparison of Age Distribution

Every injury was classified according to type (strain, fracture, bruise (no open wound), open wound, brain injury) and localization. Each patient could have multiple injuries and the same injuries could be classified into multiple types. An open fracture was thus classified as a fracture and an open wound for example.

Localization	Strain	Fracture	Bruise	Open wound	Brain Injury
Abdomen			14	8	
Pelvis		7	87	19	
Head (excl. Face)		9	83	85	101
Face	1	62	54	192	
Upper Extremity	97	203	327	202	
Chest		26	94	15	
Lower Extremity	88	70	329	186	
Spine	52	23	31	13	

Table 1. Types and Localization of Injuries

Looking at reasons for hospital admission, traumatic brain injuries were the leading cause. However, the largest resource consumption was attributed to fractures of the upper extremities with major surgery.

DRG	Number	Description (simplified)	Costs
B80Z	39	Traumatic Brain Injury	31.668,00 €
I21Z	21	Fracture of Upper Extremity with Major Surgery	55.272,00 €
J65B	12	Soft Tissue Damage, Open Wound	9.744,00 €
I57C	9	Lower Extremity Fracture with Minor Surgery	25.956,00 €
I13B	8	Lower Extremity Fracture with Major Surgery	33.600,00 €

Table 2. Reasons for Hospital Admission and the incurred expenses (Top-5)

Although bicycle speed is rather limited, it is acknowledged that a properly designed helmet provides very good protection for the most vulnerable part of the body, the head, from being severely injured in a crash. Several reviews have been conducted on the effectiveness of bicycle helmets in reducing head and facial injuries. [4], [1], [5], [6], [7], [8]

In 2000, the European Conference of Ministers of Transport (ECMT), published the following data concerning bicycle helmet use and laws in Europe [1]:

- Finland: 15% (voluntary)
- United Kingdom: 17% (voluntary)
- Sweden: 7% (voluntary)
- Norway: 6% (voluntary)

According to the European Transport and Safety Council (ETSC), cycle helmets have become mandatory in some European countries since then [2]:

- Malta (All cyclists, April 2004)
- Sweden (Only for children up to 15 years, January 2005)
- Slovenia and Czech Republic (Only for children up to 15 years, no date mentioned)
- Spain (Only outside urban areas)

In 1990, Australia introduced a law requiring bicycle helmet wear. While there was an increase in helmet wear from 31% in March 1990 to 75% in March 1991, there was also a reduction in bicycle use by 36% in children. The highest decrease of bicycle use occurred among 12-17 years old, where it

dropped by 44% [3]. The decrease in bicycle use was noted as a negative effect of helmet laws, since there is evidence that regular bicycle use has a positive effect on population health. Leisure time physical activity was inversely associated with all cause mortality. Those who did not cycle to work experienced a 39% higher mortality rate than those who did [9].

An alternative approach to bicycle safety was adopted by the Netherlands. The Dutch government, private safety organizations and cyclists' groups all tend to agree on the following propositions: Promoting the use of bicycle helmets runs counter to present government policies that are aimed at the primary prevention of crashes (as opposed to secondary prevention) and at stimulating the use of the bicycle as a general health measure. Attempts to promote bicycle helmets should not have the negative effect of the incorrect link of cycling and danger. Furthermore the promotion of helmets should not result in a decrease in bicycle use. Because of these considerations, a mandatory law for bicycle helmet use has not been thought an acceptable or appropriate safety measure in the Netherlands [10].

The following countries have mandatory helmet laws, in at least one jurisdiction, for either minors only, or for all riders: Australia, Canada, Czech Republic, Finland, Iceland, Israel, Slovakia, Sweden, USA, and New Zealand. Spain requires helmets on interurban routes. In the U.S., 37 states have mandatory helmet laws, and nearly 9 in 10 adults support helmet laws for children. Israel's helmet law was never enforced or obeyed, and the adult element has been revoked; Mexico City has repealed its helmet law. [11], [12], [13], [14]

Although the link is not causal, it is observed that the countries with the best cycle safety records (Denmark and the Netherlands) have among the lowest levels of helmet use. [15]

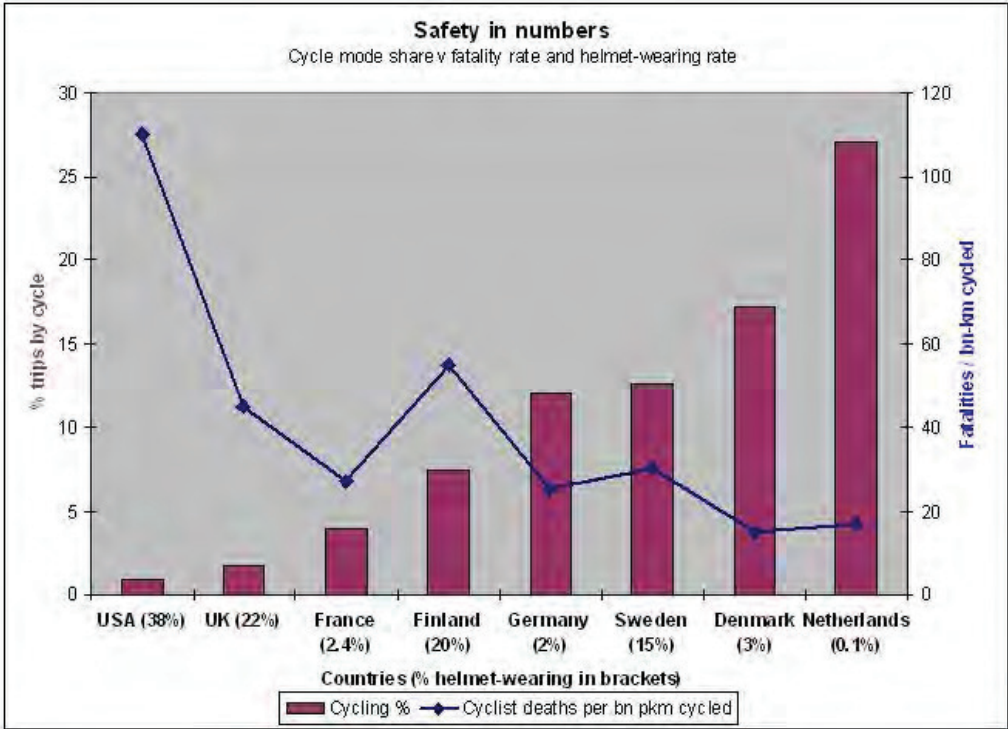


Figure 3. Comparison of Bicycle Helmet Wearing and Fatalities [15]

Figure 3. was created by the Cycle Helmet Research Foundation [15]. The number derived from the following sources: Cycle helmet wearing: Netherlands, Denmark, Finland, Sweden [16]; Germany [17]; UK [18]; USA & France (Paris) [19]. Cyclist deaths: EU [20]; France [14], USA [17]. Cycle Percentage of trips: Flanders cities [21]; USA, Canada, France, Italy, Austria [17]; UK, Norway, Switzerland, Sweden, Denmark [16]; Germany [22]; Netherlands [23]

DISCUSSION

Bicycle accidents are more frequent than recorded by the police. The first results of the Münster Bicycle Study have shown that the actual number of bicycle accidents exceeds the officially reported number by nearly three times.

Traumatic brain injuries were the main cause for hospital admission, while only 8% of the bicycle users wear helmets. With a higher rate of helmet wear, a number of these brain accidents could have been avoided.

Using costs associated to accidents as provided by the German Road Agency (BASt) [24], a total burden to society summing up to 28,349,749 Euro was caused by bicycle accidents within one year in the city of Münster. Among these, one case of death and 39 hospital admissions were caused by traumatic brain injury exclusively, summing up to a total cost to society of 4,565,376 Euro.

While bicycle accidents pose a great burden not only to the injured individual, but also on the entire society, regular bicycle use does have a positive effect. Using the Health Economic Assessment Tool provided by the WHO [25], the present value of the mean annual benefit of bicycle in Münster was 77,063,000 Euro. However, a 10% drop in bicycle use would decrease this benefit by nearly 7 million Euros.

Since there is evidence that the introduction of bicycle helmet laws leads to a decrease of bicycle usage, the potential negative effects may outweigh the positive. Even if a bicycle helmet law could prevent all brain injuries and would at the same time prevent 10% of the former bicycle users from continuing their bicycle usage, it would have a negative burden of nearly three million Euros on society.

In addition, a bicycle helmet cannot prevent an injury from happening (secondary prevention method). If accidents could be avoided from the start (primary prevention methods), the number of traumatic brain injuries would also decrease as would the number of other types of injuries.

Towner et al. [5] have summarised the arguments in favour of and against bicycle helmet legislation as follows:

In favour of legislation: Bicycle helmet use can reduce traumatic brain injuries and the related number of deaths and hospital admissions.

Against legislation: Laws on bicycle helmet lead to decline in cycling, thus reducing positive health benefits. Other methods of accident prevention may lead to the same positive effects as helmet legislation while having no reduction in bicycle use.

However, while helmet legislation leads to a decrease of bicycle use, in the long run this effect may vanish. The effect of the introduction of laws enforcing helmet wear has not been analyzed over a longer period so far. Changes in complex systems can lead to a decrease in the short time. After a while the system might regain its normal state. Looking back at the reinforcement of seat belt use and helmet use for motorcyclists, these measures did not prevent drivers or motorcyclist in the long run from driving their car or motorcycle. Instead, using a seat belt or a motorcycle helmet became commonly accepted behaviour. Therefore the social attitude is an important factor that should be considered.

Bicycle helmets cannot avoid accidents; therefore it is dangerous to focus on helmet wear as the only prevention method. Other factors, such as weather, pavement and default of traffic, roadworthiness of the bicycles or alcohol / drug abuse also affect the accident rates. Experience in other countries with good infrastructure for bicycles (like the Netherlands) has shown that an improvement of bicycle roadways etc. can also lead to a decrease in bicycle accidents. The introduction of a law for bicycle helmet wear may lead to neglect other effective methods of injury prevention.

The member states of the EU are well advised to support the safe use of bicycles as the main way of short distance transportation. This support has been done in various ways. Member states can learn from success and failure of projects performed in other states. Since the circumstances in each member state differ (e.g. separate bicycle roads in the Netherlands compared to high risk cycling in London City), the needed measures will also differ. It may be worth thinking of enforcing bicycle helmet wear only for selected groups (e.g. children) or in special areas (e.g. areas with heavy traffic).

Bicycling is the most environment friendly, health beneficial way of transportation for shorter distances. As such, it should be promoted by the EU. A joined EU effort is necessary to make cycling safer. This should not focus alone on bicycle helmet use, but include other factors. Infrastructure and Cyclist equipment as well as the use of drugs or alcohol and a regulation offending behaviour of bikers have to be examined and improved. Considering such aspects, the EU should seek to make cycling safer and more attractive likewise, leading to lower accidents rates and increased bicycle usage.

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