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Bicycle safety helmet usage in Berlin 1999: an observational study

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Riding a bicycle has become very popular in the big cities in Europe and USA. With this development goes along an increased number of traffic accidents involving bicyclists.

According to the Census Bureau of Germany in the year 1997 there were 501 094 persons injured in the traffic in Germany, 14.4% were bicyclists. From the same source, there were 8 549 traffic accident deaths of which 7.9% were bicyclists.

It is estimated that about one third of all bicycle accidents involve head injuries and that 75% of all subsequent deaths are due to head injuries (Europäisches Forum für Gesundheitsinformationen 1999). For the United States, avoidable head injuries by wearing safety helmets is estimated about 85%, but helmet usage is less than 30% (Europäisches Forum für Gesundheitsinformationen 1999). In the year 1996 there were about 757 total accident deaths of bicycle users in the U.S., and 727 (96%) were wearing *no safety helmet* when the accident took place (Europäisches Forum für Gesundheitsinformationen 1998). Though the percentage (of no helmets user among all bicycle accident deaths) appears high, it is necessary to compare this number with the associated number in the general populations of bicyclists. It is estimated that the percentage of safety helmet users in this population is about 24% (Jacques 1994; Weiss 1996), leading to an odds ratio of 7.65 (exposure: wearing no helmet; outcome: death from bicycle accident) which clearly demonstrates a strong association. In connection with a widespread occurrence of the exposure (using no safety helmet) we are confronted with a major public health problem. Bicycle use has become very popular in the Berlin metropolitan region as well, though little quantitative knowledge is available on safety helmet usage, which would allow to provide a reliable

estimate of the prevalence of exposure. Variation in prevalence of exposure, and consequently, identifying sources for this variation, might provide initial target populations for effective prevention strategies. Various studies have found solid evidence that wearing no safety helmet is a risk factor (for head injuries) for various countries (Australia, USA, Canada) and for various demographic groups (children and adolescents) (Dorsch et al. 1987; Thompson RS et al. 1989; Thomas et al. 1994, Finvers et al. 1996; Linn et al. 1998). In addition, other risks have been studied, including injuries of legs and arms (Reinhardt & Scholz 1996), facial injuries (Thompson DC et al. 1990), dental injuries (Linn et al. 1998).

Consequently, helmet usage in the general population of bicyclist is important and has been investigated with percentages between 24%–29% (Jacques 1994; Weiss 1996; Jacobson et al. 1998). Other studies discuss the causes of bicycle accident (Ashbaugh et al. 1995), the avoidable deaths and head injuries by wearing safety helmets (Sosin et al. 1996), the potential higher bicycle-accident-injury risk in rural regions (Welander et al. 1999), the specific importance of bicycle accidents for children (Puranik et al. 1998), and the aspects of prevention of bicycle accidents by education and prevention (Rivara et al. 1998). In addition, various studies point out that the proportion of safety helmet users is smaller in children than in adults (Jacques 1994; Sosin et al. 1996; Jacobson et al. 1998).

Objectives

A crosssectional study was undertaken to estimate the proportion (prevalence) of helmet usage in the Berlin metropolitan area. It was also of interest if this prevalence changes with weekday, daytime, season of the year, the climatic conditions, and with basic demographic subgroups (gender and age).

Material and Methods

Observers were used to determine safety helmet usage of passing bicyclists. Measurements were taken at six sites in four cities (Charlottenburg, Schöneberg, Spandau, Köpenick) of the Berlin metropolitan region. The first three belong to the former western part of Berlin. The sites were selected as popular biking routes in the cities. The observation time were in April and June/July 1999. Non-participating standardised observation was used to record the safety helmet usage of the passing bicyclist, her/his gender and whether she/he was a child or adult. The form used for the standardised observation is enclosed in the appendix. In addition, daytime of observation, the weekday, the season, the weather condition (sunny, dry/cloudy, rainy) and the geographic position of the observer were recorded. Four different observers have been used and they have been trained to use the measuring instrument in identical ways. Proportion of safety helmet users among all observed bicyclists were calculated associated with 95%-Clopper-Pearson confidence intervals (Collet 1991). This was done as well for the subgroups created by location, daytime, weekday, season, weather condition, gender, and grown-up status. The statistical package MINITAB (1996) was utilised for all computations.

Results

The overall prevalence of safety helmet users in Berlin is found to be 3.99 per 100 (95% CI: 3.17–4.97). This number is based upon 1926 passing bicyclist of which only 77 were wearing a helmet. Table 1 provides details for various subgroups. For location we find that the only eastern region (Köpenick) shows a smaller proportion, though the difference to the western districts is not significant. No differences were found with respect to daytime and weekday. The helmet usage is higher in spring than in summer, likewise there is an increasing trend in helmet usage with respect to weather conditions (the better the weather, the less the proportion of helmet users) though this trend is not significant (test of trend $\chi^2 = 0.9020$, p-value = 0.3423). Females are wearing less helmets than males, again the difference being not significant. Striking is the significant difference between children and adults in helmet usage where children are wearing helmets about five times as often as adults.

Discussion

The overall proportion of bicyclists wearing a helmet is with 4 in 100 (95% CI: 3.17–4.97) surprisingly low, especially if compared with the proportions known from the United States

Table 1 Helmet users per 100 with 95% confidence intervals for various subgroups

Variable	Subgroup	Helmet users per 100 (sample size)	95% CI (lower – upper end)
<i>Overall</i>		3.99 (1926)	3.17–4.97
<i>Location</i>	Schöneberg 1	3.75 (160)	1.39–7.98
	Schöneberg 2	3.33 (120)	0.92–8.31
	Charlottenburg 1	4.18 (526)	2.64–6.26
	Charlottenburg 2	3.89 (745)	2.62–5.54
	Spandau	5.33 (244)	2.87–8.94
	Köpenick	2.29 (131)	0.47–6.55
<i>Daytime</i>	13.00	3.33 (120)	0.92–8.32
	14.00	4.84 (186)	2.24–8.99
	15.30	4.05 (173)	1.64–8.16
	18.00	4.14 (290)	2.16–7.12
	19.00	4.50 (600)	2.99–6.48
	20.00	2.61 (153)	0.72–6.55
	21.00	4.03 (273)	2.03–7.10
<i>Weekday</i>	Monday	3.42 (702)	2.20–5.04
	Tuesday	4.14 (507)	2.58–6.26
	Friday	5.00 (40)	0.61–16.92
	Saturday	5.80 (138)	2.54–11.10
	Sunday	4.08 (539)	2.58–6.11
	<i>Season</i>	spring	4.36 (1215)
summer	3.38 (711)	2.17–4.98	
<i>Weather</i>	sunny	3.51 (770)	2.32–5.06
	dry/cloudy	4.20 (810)	2.92–5.82
	rainy	4.62 (346)	2.67–7.40
<i>Adult/child</i>	adult	3.06 (1797)	2.31–3.97
	child	17.05 (129)	11.01–24.67
<i>Gender</i>	female	3.23 (805)	2.12–4.70
	male	4.55 (1121)	3.41–5.94

which are around 25 in 100 (see above) (Jacques 1994; Weiss 1996; Jacobson et al. 1998). These proportions for the U.S. could be confirmed by own observations (n = 240) in the city of Chicago in May 1999 where 23.33 out of 100 passing bikers wore safety helmets (95% CI: 18.13–29.21). The low helmet usage rate is also in contrast to public opinion where proportions above 10 in 100 are frequently believed. This result as such underlines the need for further preventive action.

In addition, the study clearly indicates that helmet usage is higher in children than in adults in contrast what is often reported otherwise (see above) (Jacques 1994; Sosin et al. 1996; Jacobson et al. 1998). From the results of this study daytime and weekday appear to be of no influence. These factors had been studied to account for potentially different bicyclists populations (occupational population versus non-occupational population). Season and weather conditions seem to have an influence on helmet usage, though the study lacks of power to assess these effects. The type of study has its limitations not only in determining precisely simple demographic variables such as age, but also in finding determinants for helmet usage. For example, it remains unclear

why helmet usage is less frequent in females than in males. One reason might be fashion („I do not want to ruin my hair style“), another reason might be seen in the statement of another female bicyclist: “I am driving so carefully that there is no need for a safety helmet for me”. To find out more about this a different instrument is required (such as questionnaire). This aspect has been considered in the literature elsewhere (Siegrist et al. 1999).

At this point, it is important to emphasize that this type of study is not able to identify whether different bicyclists populations are characterised by the mentioned covariate combinations like season, weather, time, and location, or if the behaviour of the bicyclists changed with respect to helmet usage according to the change in the environmental, spatial, or temporal conditions. Here, a different study type needs to be employed. On the other hand, there are many

advantages of this measuring instrument as well. In our study, there was no problem with missing values, rejected responses, finding enough study objects, the design of place and time of observations, and there are low costs and low logistic challenges involved.

The study can easily be extended to study other aspects in more detail such as the rural-urban contrast (Welander et al. 1999), the existence of an east-west difference, or other aspects of locality/globality.

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Appendix

Form used for standardised observation in epidemiological study on helmet usage of Berlin bicyclists (translated from German)

ID	Helmet yes = 1	Helmet no = 0	Sex m = 1	Sex f = 0	Adult yes = 0	Adult no = 1
1						
2						
3						
...						
37						
38						
39						
40						

Sheet: _____ observer: _____ (Bö = 0, Saul = 1, Boose = 2, Kurzawski = 3)

Location: _____ (Schöneberg = 1 x, Charlottenburg = 2 x, Köpenick = 3 x, Spandau = 4 x, Mitte = 5 x)

Daytime: _____ (starting time of observation) week day: _____ (So = 1, ..., Sa = 7)

Season: _____ (early = 0, late = 1)

Weather: _____ (sunny = 0, dry/cloudy = 1, rainy = 2)