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Rates of, and the factors affecting, cycle helmet use among secondary schoolchildren in East Sussex and Kent

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Abstract

***Objectives*—To assess the level of cycle helmet wearing among young people in two counties in the South East of England in 1994, and to identify the factors associated with helmet wearing.**

***Design*—Cross sectional survey in a convenience sample.**

***Setting*—Secondary schools in East Sussex and Kent.**

***Subjects*—Students in year 7 (aged 10–12 years) and year 11 (aged 14–16 years).**

***Main outcome measures*—Self reported "always wears a helmet".**

***Results*—Among those who ride a bicycle, 32% of boys and 29% of girls aged 10–12 years, and 14% of boys and 10% of girls aged 14–16, reported that they always wear helmets. The variables that were most consistently associated with helmet wearing (that is significantly associated with helmet wearing in at least five of the six age, sex, and county subgroups) were: "parental encouragement to wear a helmet", "closest friend wears a helmet", "belief that laws that make children wear helmets are good", and "sometimes rides off-road".**

***Conclusions*—The self reported rates of always wearing a cycle helmet in East Sussex and Kent are consistent with overseas findings for populations who had not been exposed to intensive helmet promotion. The evidence suggests that parental encouragement has a favourable effect on rates of cycle helmet use among secondary schoolchildren, which is separate from and additional to peer influences. When designing a helmet promotion programme, therefore, it will have added impact if both parents and children are addressed.**

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Keywords: bicycles; helmets; wearing rates

Bicycles are an attractive means of transport. They are inexpensive and relatively easy to maintain. By substituting bicycle for car use, cycling can confer a positive benefit to the environment, and simultaneously increase physical fitness. However, while cycling offers numerous benefits, it also carries risks. Over the last 30 years, the risk of an adult being killed in a cycling accident in Britain has risen per kilometre cycled and is substantially higher than in many other European countries.[1] Two thirds of deaths resulting from cycling are the result of head injuries[2] and between half and three quarters of injured cyclists using hospital services had a head injury.[3–5]

The weight of evidence suggests that helmets are effective in preventing or reducing the severity of some head injuries.[6 7] However, Vulcan and Lane argue that the 85% reduction in the risk of head injury, and the 88% reduction in the risk of brain injury resulting from cycle helmet wearing, estimated by Thompson *et al*,[6] should be regarded as upper limits.[8]

Among children who have been subject to little or no bicycle helmet promotion, the rate of helmet wearing tends to be below 15%.[8–13] Exposure to cycle helmet promotion can increase the rate substantially,[9 10 12] even higher rates can be achieved where intensive and multifaceted helmet promotion methods are used,[8 14 15] and higher rates still (up to 90%) with the enactment of legislation to make helmet wearing compulsory on top of this intensive helmet promotion.[15 16]

The current study aimed to assess the level of cycle helmet wearing among young people in two counties in the South East of England in 1994, and to identify the factors associated with helmet wearing. The identification of factors, in the local population, that appear to influence helmet wearing will guide future health promotion planning and the prevalence of helmet wearing will provide a baseline against which the success of future health promotion activities can be judged.

Methods

Self completion questionnaires, adapted for the UK from an instrument used in a similar survey in the USA,[17] were delivered to 23 secondary schools in the counties of Kent and East Sussex in December 1994. These were completed anonymously during supervised class time by the students in year 7 (aged 10–12 years) and year 11 (aged 14–16 years). Data were collected on the variables listed in table 1.

All East Sussex secondary schools were invited, and 13/35 agreed to take part in this survey. The Kent schools (10/128) were chosen systematically to include both grammar and other secondary schools. All pupils present on the day of the survey in year 7 (median age 11) and year 11 (median age 15) took part.

All students to whom the questionnaires were presented completed them; 68% of these were from East Sussex schools and 32% from

Table 1 Variables derived from the questionnaire data

- Age
- Sex
- County
- School
- Rides a bicycle
- Helmet ownership
- Helmet use
- Parental encouragement
- Parental helmet use
- Friends wear a helmet
- Closest friend wears a helmet
- Time spent riding
- Riding:
  - For fun
  - To get to school
  - To do a paper round
  - For a sporting activity
  - To your friend's home
  - For other reasons
- Riding:
  - On roads
  - Off-road
  - To and from school
- Helmet promotion from:
  - School nurse
  - Teacher
  - Youth worker
  - Doctor
  - Police
  - Road safety advisor
- Attended proficiency course
- Beliefs (social consequences):
  - Laughing/teasing
  - Less fun to ride
  - Poor appearance
- Belief (physical consequences):
  - Can save lives
  - Protects against injury
- Beliefs (other):
  - Helmets cost too much
  - Helmets not comfortable
  - Helmet laws are good
- Attitude:
  - Rather not ride if have to wear a helmet

Kent. A total of 4087 completed questionnaires were used in the estimation of rates of self reported bicycle riding. Only students who reported that they rode a bicycle and responded to the question about their own cycle helmet wearing were included in the estimates of rates of helmet wearing and the investigation of associations with helmet wearing (n = 3082; 75% of all respondents). Similar to Dannenberg *et al*,[17] the measure used for investigating associations with helmet wearing was whether the respondent reported that they always wore a helmet (as opposed to sometimes or never wearing one).

The literature on helmet use has shown that there are significant age differences in helmet wearing rates and there may be significant sex differences, although for sex the evidence is not consistent. Furthermore, there were differences between the two counties in the method of selection and the types of schools selected, as well as in the local government organisations responsible for road safety and hence road safety programmes in the two counties. As a result, there was concern that the results for the two counties, or for age and sex subgroups, would not be equivalent. The analytical strategy was, therefore, to investigate the associations for each age, sex, and county subgroup separately.

Bivariate associations between each of the variables and helmet use were initially investigated. The subgroups considered in the bivariate analysis were all combinations of age, sex and county, as seen from table 2. Then the independent associations of all the variables, shown in table 1, with helmet wearing were investigated using multiple linear logistic regression analysis,[18] for each of the age, sex, and county subgroups. Stepwise backward elimination was used, with variables eliminated from the model if they had a p value greater than 0.1. A number of respondents did not answer all of the survey questions. In order to minimise the effect of the missing values in the logistic regression analysis, the missing values for each of the following variables were treated as a separate category and included in the analysis: riding for fun (18%), to get to school (46%), to do a paper round (47%), for a sporting activity (44%), to your friend's home (36%), riding for other reasons (50%), parental encouragement (11%), parental helmet use (2%), friends wear a helmet (19%), closest friend wears a helmet (13%), and attended a cycling proficiency course (3%). The figures in brackets indicate the proportions of missing values for each of these variables among cycle riders.

Table 2 Percentage reporting that they always wear a helmet by selected factors associated with helmet wearing

	Year 7 (aged 10–12)				*Year 11 (aged 14–16)*			
	East Sussex		*Kent*		*East Sussex*		*Kent*	
	*Boys (%)**	*Girls (%)*	*Boys (%)*	*Girls (%)*	*Boys (%)*	*Girls (%)*	*Boys (%)*	*Girls (%)*
Parental encouragement to wear a helmet								
Yes	47	51	55	46	30	26	26	31
No	8	4	3	10	3	3	3	0
Odds ratio†	10.2	25.0	39.5	7.7	13.9	11.4	11.4	‡
Closest friend wears a helmet								
Yes	50	49	62	52	52	26	45	35
No	16	16	18	12	4	6	3	4
Odds ratio†	5.2	5.0	7.4	7.9	26.0	5.5	26.4	12.9
Sometimes rides off-road								
Yes	33	37	44	32	17	14	14	14
No	20	16	39	16	25	13	0	13
Odds ratio†	2.0	3.1	1.2	2.5	0.6	1.1	‡	1.1
Rather not ride a bicycle if had to wear a helmet								
Agree	7	5	12	7	6	1	2	2
Disagree	42	42	52	34	27	20	21	18
Odds ratio§	9.6	13.7	7.9	6.8	5.8	25.0	13.0	10.8
Wearing a helmet is uncomfortable								
Agree	18	22	27	16	11	6	4	12
Disagree	59	50	58	49	36	45	43	21
Odds ratio§	6.5	3.5	3.7	5.1	4.5	12.8	18.2	1.9
Laws that make children wear bicycle safety helmets are good								
Agree	43	40	49	33	26	14	20	13
Disagree	6	6	17	4	4	0	0	0
Odds ratio¶	11.8	10.4	4.7	11.8	8.4	‡	‡	‡

* = Presented is the percentage that report always wearing a helmet among children who reported that they ride a bicycle.
† = Odds ratio was estimated relative to the "No" group.
‡ = Not estimable.
§ = Odds ratio was estimated relative to the "Agree" group.
¶ = Odds ratio was estimated relative to the "Disagree" group.

Table 3 Children's self reported bicycle riding, helmet ownership, and wearing rates (denominators for the rates are shown in parentheses)

	Age 11	*Age 15*
Per cent (number) ride a bicycle	86 (2553)	60 (1534)
Male	89 (1265)	76 (716)
Female	83 (1288)	47 (818)
Per cent (number) own a helmet	69 (2187)	38 (925)
Male	72 (1119)	45 (542)
Female	65 (1068)	29 (383)
Per cent wear a helmet (overall)		
Always	30	12
Sometimes	38	22
Never	31	66
	(2174)	(908)
Per cent wear a helmet, male		
Always	32	14
Sometimes	39	27
Never	29	59
	(1110)	(531)
Per cent wear a helmet, female		
Always	29	10
Sometimes	37	15
Never	34	75
	(1064)	(377)

Table 4 Adjusted summary odds ratios for variables associated with helmet wearing in the logistic regression models

Factor	*Odds ratio*	*95% Confidence interval*
Parental encouragement	6.77	4.09 to 11.14
Closest friend wears a helmet: age 11*	2.80	2.00 to 3.92
Closest friend wears a helmet: age 15*	17.17	6.86 to 42.73
Sometimes rides off-road	5.69	3.77 to 8.62

*A combined estimate has not been produced due to the significant heterogeneity of the odds ratios between 11 and 15 year olds.

In the analysis, children were included in a given age group if they were in a particular year at secondary school at the time of the data collection (year 7 and 11). Children in these years had a range of ages: ages 10–12 for year 7, and ages 14–16 for year 11. For reporting purposes, the average age for each of the two year groups is stated: 11 and 15 respectively.

In the logistic regression analysis for 11 year old children, the subgroups were: boys in East Sussex, girls in East Sussex, boys in Kent, girls in Kent. For the 15 year old children, the subgroups for the logistic regression analysis were boys combined across county, and girls combined across county. For each variable that showed a consistent, independent association with helmet wearing, a summary odds ratio estimate was produced where a χ^2 test for heterogeneity[19] was not significant. A non-significant heterogeneity χ^2 test indicated that the odds ratio estimates for each subgroup were not significantly different from one another and so could be combined.

Results

The percentages of children reporting bicycle riding, helmet ownership and helmet use are shown in table 3. The level of helmet wearing was substantially less for 15 year old students compared with 11 year old children. Rates were similar for boys and girls at age 11, but were less for girls than for boys at age 15. Table 2 shows the percentages of students reporting that they always wear a helmet, for each of the main levels of those variables found to be associated with reported helmet use.

Logistic regression analysis, which included all the variables shown in table 1, showed that only a small number of the variables were consistently associated with self reported helmet use. Among the child specific attitudinal variables, agreement with the statement that "laws that make children wear a helmet are good" were significantly associated at the 5% level of significance with self reported helmet use for five out of the six age, sex, and county subgroups. Furthermore, agreement with the statements that "helmet wearing is uncomfortable" and "I would rather not ride a bicycle if I had to wear a helmet" were significantly associated with a smaller proportion reporting they always wear a helmet for three out of the four 11 year old groups, but was not significantly associated with reduced helmet wearing for 15 year old boys and girls.

Among the other variables, the ones that were consistently associated with self reported helmet use were: sometimes rides off-road; parental encouragement to wear a helmet; and closest friend wears a helmet.

For each of these variables, there were statistically significant associations, at the 5% level of significance, with self reported helmet wearing for all the age, sex, and county subgroups considered, with the exception of 15 year old boys for the variable "sometimes rides off-road". Odds ratio estimates, combined across the subgroups, for each of these variables are shown in table 4.

For the remaining variables considered in the analysis, significant associations with self reported helmet wearing were not found at all or were only found for one of the six subgroups.

Discussion

The findings that 32% of boys and 29% of girls aged 10–12 years, and 14% of boys and 10% of girls aged 14–16 years, reported that they always wear helmets are similar to the helmet wearing rates found in North America in the early 1990s.[20–23] These North American study populations include a mixture of those who had been exposed to intensive helmet wearing promotion, those who had been exposed to little or no promotion, and all shades between. The rates reported in our study are much lower than those found in Australia and parts of the USA in the early to mid-1990s, many parts of which had been exposed to extensive helmet promotion, and some of which had laws requiring mandatory helmet wearing.[14–16 24–26] In East Sussex and Kent, a multiagency cycle helmet campaign had occurred earlier in the year of the study which, although evaluated as successful, was more limited in scope and much less sustained than those reported for Seattle, Maryland, or in Australia.

In our study, the variables most consistently associated with helmet wearing (that is significantly associated with helmet wearing in at least five of the six subgroups) were: parental encouragement to wear a helmet; closest friend wears a helmet; belief that laws that make children wear helmets are good; and sometimes rides off-road.

Some of the associations found are supported by previous published work by a number of authors.[27–31] Rivara and colleagues found that cyclists when riding off-road were more likely to wear a helmet.[31] However, the association between riding off-road and helmet use in any environment had not been previously reported. We found that those who indicated that they sometimes ride off-road reported that they had a higher rate of helmet use in any environment. The reason for this association is not clear. The term "off-road" could describe many different environments including parks, gardens, pavements, as well as mountain bike routes. Further research is being discussed to investigate this.

A number of variables, previously found to be associated with helmet use, were not included in the questionnaire given to the students: perceptions of risk, regular use of seat belts in cars, parental education, family income, lack of secure helmet storage facilities, and a previous accident involving a head injury.[10 11 17 20 27 28] These questions were not included because they were considered either too intrusive for this type of survey, or would elicit responses of questionable accuracy. This removed the opportunity to investigate possible associations with, and confounding by, these variables.

As with many schools based studies, the schools could not be selected in a random manner. The non-significant "schools" term in the logistic regression analysis and the consistency of the results for East Sussex and for Kent, suggest that the different methods of selection or the types of schools selected for the survey may have made no difference to the prevalence estimates or the associations found. This survey cannot, however, be construed as being population based as we have no way of knowing whether the findings from the schools sampled reflect those for schools not in the sample.

Although DiGuiseppi *et al* commented that self reported helmet wearing rates were much greater than observed rates,[10] their comparisons were between rates derived from data collected in different parts of the USA one to three years apart,[12 32] each of which could account for some of the difference observed. Where self reported and observed wearing rates were studied in the same geographic area during the same time period,[17 25] similarities in rates were found. Self reported always or usually wearing a helmet was found to be very highly correlated with wearing a helmet on the most recent cycle ride.[17] Additionally, work by Rivara and colleagues found that self reported helmet wearing was accurate for 96% of subjects sampled from their study.[33] Consequently, fears that the use of self reported helmet wearing may produce biased findings appear to be unfounded.

The advantage of carrying out the logistic regression analyses for the six age/sex/county subgroups was that the replicability of the results could be investigated and confirmed. Where consistency was observed it gives greater strength to our inference around the observed associations. The disadvantage of this approach is that the individual subgroup analyses would be working at a lower power to detect significant associations than a combined analysis across all subgroups. Inspection of the results of the logistic regression analyses suggest, however, that a combined analysis may not have identified any additional variables significantly associated with cycle helmet wearing.

The differences in helmet wearing rates for the two year groups which were found in our study may be explained in two ways: (1) the drop in rates between ages 11 and 15 reflects the increasing independence of the child and the sense of invulnerability that characterises adolescence; or (2) a cohort effect, where the younger group had more, or more recent, exposure to helmet promotion than the older children. A follow up study is planned for 1998 to explore this issue.

This study found that a smaller percentage of girls reported that they wear a helmet than boys. This difference was most marked at age 15. Surprisingly, a substantial number of studies do not report whether there is any variation in use by sex. Little difference was found in the rates for boys and girls in Toronto[20] and North East Ontario.[23] In contrast to our study, greater rates of helmet use were found among girls than boys in Seattle.[24] The reason for this lack of consistency across studies is unclear.

Similar to Dannenberg and colleagues,[17] this work dichotomised self reported helmet wearing into: "always wears" compared with "sometimes or never wears" a helmet. The primary justification for this was an interest in promoting head protection for the child cyclist on *all* cycle journeys. The results of this study, however, also provide evidence to suggest that parental encouragement, for example, not only increases the rate with which a child always wears a helmet, but is also associated with a shift in children from the group reporting no helmet wearing to reporting sometimes wears a helmet. A larger effect, therefore, would be estimated if the always versus never dichotomy was considered.

Vulcan and Lane argue that although improving the design of helmets is important, it should not detract from "getting more helmets on heads".[8] Reviews of previous work which have evaluated the effectiveness of helmet promotion[22 34 35] indicate that the most successful programmes combine a number of health promotion interventions including targeting parents and children. The results of this survey adds support to this. Successful interventions have included: communitywide coalitions; face to face promotion; publicity campaigns; and actions to make helmets more readily available (for example subsidising the purchase price). These have been found to be enhanced by legislation.[22 34] It is our belief that legislators should not seek to make helmet wearing compulsory in the UK at this time. If they were to do so, it would be contested vigorously. In the unlikely event that compulsory helmet wearing were to become law before the rates of helmet wearing are increased through other helmet promotion methods, it is our concern that there would be a real danger of a backlash.

Conclusion

Previous research has shown that promotion of helmet wearing is likely to be most effective if it is multifaceted. Central to the success of such efforts is making helmets more available and affordable. Our research indicates that parental encouragement appears to have an effect on helmet wearing rates which is separate from and additional to peer influences. When designing a helmet promotion programme, therefore, it would have added impact if both parents and children were the focus. Limited but important change is likely to occur with peer and parental programmes.

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