ORIGINAL ARTICLE

Inequalities in cycle helmet use: cross sectional survey in schools in deprived areas of Nottingham

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Aims: To describe cycle helmet owning and wearing among children in a deprived area and to investigate the association between helmet ownership and wearing and socioeconomic deprivation.
Methods: Cross sectional survey in 28 primary schools in deprived areas of Nottingham; 1061 year 5 schoolchildren were studied.
Results: All year 5 children attending school on the day of the survey completed the questionnaire (87% of children registered at participating schools). Children residing in a deprived area were less likely to own a bike and more likely to ride it four days a week or more. Half the children owned a helmet (52%), but only 29% of these always wore their helmet. Children in deprived areas were less likely to own a helmet, but those that owned a helmet were not less likely to always wear one. Family encouragement and parental warning of dangers of not wearing a helmet were associated with increased helmet ownership rates. Family encouragement and best friends wearing a helmet were associated with higher rates of helmet wearing.
Conclusions: Programmes aimed at preventing head injury among child cyclists will need to address the inequality in helmet ownership that exists between children residing in deprived and non-deprived areas. Strategies to increase family encouragement to wear a helmet may be useful, as may those recognising the importance of the attitudes and behaviours of peers, such as peer education programmes. Further work is required to assess how exposure to risk of cycling injury varies with deprivation.

Cycle helmets protect their wearers from head and brain injury in cyclists of all ages involved in all types of crash.[1] More than 7000 children under 16 years of age were admitted to NHS hospitals between 1991 and 1995 with bicycle related head injuries.[2] There is a steep social class gradient in cycling injuries in childhood, with mortality rates in children from social class 5 being four times higher than those from social class 1,[3] and hospital admission rates for cycling injuries being 61% higher among children residing in deprived wards compared to affluent wards.[4]

Recent work in the UK suggests that while 86% of 11 year olds ride a bicycle and 69% own a cycle helmet, only 30% regularly wear it.[3] Studies from Canada suggest that bicycle helmet usage rates are lower among children from socioeconomically deprived backgrounds.[4 5] This inequality has not been extensively investigated; in particular we were unable to find any published work examining whether the lower usage rates could be explained by lower rates of helmet ownership, or by differential wearing rates by social group.

This survey was designed to provide the baseline data for a cluster randomised controlled trial of free helmets and an educational intervention to promote bicycle helmet ownership and wearing among children attending school in deprived areas of Nottingham, UK. The objectives of the analyses reported in this paper were: (a) to describe cycle helmet ownership and wearing rates among children from deprived schools in Nottingham; (b) to investigate the association between cycle helmet ownership and wearing and socioeconomic deprivation; and (c) to identify factors associated with helmet ownership and wearing and examine whether these vary by deprivation.

METHODS

All junior schools in wards with Townsend scores above zero were invited to participate in the trial (n = 120) and 30 agreed to participate. One school acted as a pilot and one withdrew prior to the baseline survey. A cross sectional survey of year 5 children (aged 9 and 10) in the 28 participating schools was undertaken using a self completion questionnaire. The Queen's Medical Centre Ethics Committee confirmed that ethical approval was not required as the participants were schoolchildren, not patients.

Questionnaire design

The questionnaire was based on questions taken from a Bicycle Helmet Trust Initiative questionnaire[6] and from a questionnaire previously used with secondary school children in the UK.[3] It included questions on age, sex, postcode, bicycle ownership, bicycle riding, helmet ownership and wearing, reasons for deciding whether to wear a helmet or not, encouragement to wear a helmet by others, best friends helmet wearing, cycling accidents, effect of a helmet law on bike riding, and reasons why young people do or do not wear helmets. The questionnaire was piloted on 30 children in year 5 in a school not taking part in the project. Only minor word changes resulted from the pilot.

Questionnaire administration

The questionnaire was distributed to all participating schools; year 5 teachers asked all children present in class on the day of the survey to complete the questionnaire. All questionnaires were completed in the week beginning 4 June 2001. If children did not know their postcode the questionnaire told them to ask their teacher for help, and the teacher supplied the postcode from the school records.

Data handling, sample size, and analysis

Data were entered into an Access database. A random sample of 10% of questionnaires was double entered and discrepancies identified. Only 0.97% of keystrokes differed between the two sets of double entered questionnaires. Any discrepancies identified were corrected. The Townsend score was used to measure deprivation at the enumeration district level. The

Table 1 Bike ownership, frequency of bike riding, and helmet ownership

	Frequency (percentage)
Male	533 (50.2)
Median Townsend score (range)	0.81 (–5.7 to 8.5)
Resides in deprived area*	518 (57.6) [161]
Owns bike	955 (90.0)
Rides bike	[16]
Daily	190 (20.2)
4–6 days per week	319 (34.0)
1–3 days per week	201 (21.4)
Less than once a week	150 (16.0)
Less than once a month	79 (8.4)
Rides bike	
To and from school	23 (2.4)
To visit friends	484 (50.7)
For fun	837 (87.6)
Only when has to	87 (9.1)
For sport	336 (35.2)
Owns helmet†	495 (51.8)
Wears helmet when riding‡	[8]
Always	142 (29.2)
Sometimes	234 (48.1)
Never	111 (22.8)
Wears helmet when riding‡	
On the road or street	317 (64.0)
In garden or yard	77 (15.6)
To and from school	26 (5.3)
Off road	240 (48.5)
On cycle route	180 (36.4)
In park	194 (39.2)

Missing values in square brackets.
*Defined as Townsend score >0.
†% of those who own a bike; ‡% of those owning helmet.

study had 80% power at the 5% significance level to detect a difference of 17 percentage points in helmet ownership, based on 44% of children in deprived areas owning a helmet, and an intraclass correlation coefficient of 0.06, which was calculated from the data. It had 80% power at the 5% significance level to detect a difference of 15 percentage points in helmet wearing, based on 27% of children residing in deprived areas wearing a helmet, and an intraclass correlation coefficient of 0.02, which was calculated from the data. Data were analysed using SPSS version 10 and STATA version 7. Univariate and multivariate analyses investigating factors associated with helmet ownership and wearing were undertaken using logistic regression with robust standard errors to adjust for clustering.[7 8] Covariates were included in the multivariate model only if they resulted in a significant improvement in the fit of the model. The relation between deprivation and factors associated with helmet ownership and wearing was examined using likelihood ratio tests comparing models with and without interaction terms. Residuals were plotted to check the models. Significance has been assessed at the 1% level. Analyses of helmet ownership were restricted to children owning a bike and analyses of helmet wearing to those owning a helmet. Children reporting they always wore a helmet have been compared to those sometimes or never wearing a helmet to minimise the effect of potential over reporting of helmet wearing.

RESULTS

There were 1226 year 5 children registered at participating schools. Completed surveys were obtained from all 1061 children in year 5 attending school on the day of the survey (87% of all registered children). Tables 1 and 2 show that the majority of children owned bikes (90%) and that more than half rode their bikes four days a week or more (54%). Children most commonly rode to visit friends or for fun; very few rode to school (2%). Although half the children owned a helmet (52%), only 29% of these always wore their helmet. Fewer than half the children (40%) said their parents encouraged them to wear a helmet. They had most frequently been told of the dangers of not wearing a helmet by parents, teachers, and road safety officers. Fewer than one fifth (17%) said their best friend wore a helmet. Almost one in five (19%) had had a bicycle accident resulting in an injury, which required medical attention. Only 5% said they would stop riding their bike if a law was made to enforce helmet wearing.

Deprivation and helmet ownership and wearing

Children living in a deprived area were less likely to own a bike (87% versus 94%, odds ratio (OR) 0.47, 95% confidence interval (CI) 0.28 to 0.80, $p = 0.005$) and more likely to ride it four days a week or more (56% versus 49%, OR 1.35, 95% CI 1.09 to 1.68, $p = 0.006$). Children in deprived areas were less likely to own a helmet (44% versus 56%, OR 0.47, 95% CI 0.31 to 0.70, $p < 0.001$), but those that owned a helmet were not less likely

Table 2 Frequency of factors that may influence helmet wearing

	Frequency (percentage)
Important or very important reasons for wearing helmet	
How comfortable helmet feels	735 (70.1) [12]
How helmet looks	331 (31.6) [14]
Helmet could save life	995 (94.5) [11]
What friends think and say	250 (24.2) [30]
Wearing helmet is good way of protecting head if fall off bike	983 (95.1) [27]
Encouraged by family members to wear helmet*	367 (40.0) [37]
Told about dangers of not wearing helmet by:	
Parent	829 (78.1)
School nurse	95 (9.0)
Teacher	705 (66.5)
Doctor	183 (17.3)
Policeman	269 (23.4)
Road safety officer	670 (63.2)
No one	49 (4.6)
Other person	225 (21.2)
Best friend wears helmet	176 (17.3) [42]
Had accident on bike requiring medical attention	200 (18.9)
If it was made law to wear helmet would:	[41]
Carry on wearing helmet	287 (28.1)
Start wearing helmet	680 (66.7)
Stop riding bike	53 (5.2)

Missing data points in square brackets.
*% of those who own a bike.

Table 3 Univariate and multivariate associations with helmet ownership

	Univariate analysis Odds ratio (95% CI)	Multivariate analysis Odds ratio (95% CI)
Sex	1.00 (0.75 to 1.33), p=0.98	
Residence in deprived area*	0.47 (0.31 to 0.70), p<0.001	0.47 (0.33 to 0.69), p<0.001
Rides bike ≥4 days per week	0.61 (0.49 to 0.76), p<0.001	0.57 (0.44 to 0.74), p<0.001
Rides bike		
To and from school	0.85 (0.28 to 2.61), p=0.78	
To visit friends	0.75 (0.58 to 0.98), p=0.03	
For fun	1.22 (0.78 to 1.91), p=0.38	
Only when has to	0.86 (0.60 to 1.22), p=0.39	
For sport	1.16 (0.90 to 1.49), p=0.27	
Important or very important reasons for wearing helmet		
How comfortable helmet feels	0.86 (0.67 to 1.12), p=0.26	
How the helmet looks	0.85 (0.62 to 1.17), p=0.33	
Helmet could save life	1.13 (0.56 to 2.28), p=0.73	
What friends think and say	0.89 (0.60 to 1.31), p=0.56	
Wearing helmet is good way of protecting head if fall off bike	1.28 (0.81 to 2.03), p=0.30	
Encouraged by family members to wear helmet	3.46 (2.53 to 4.72), p<0.001	2.67 (1.93 to 3.69), p<0.001
Told about dangers of not wearing helmet by:		
Parent	2.64 (1.81 to 3.85), p<0.001	2.09 (1.38 to 3.17), p<0.001
School nurse	0.90 (0.50 to 1.61), p=0.72	
Teacher	1.16 (0.86 to 1.56), p=0.33	
Doctor	0.73 (0.53 to 1.00), p=0.05	
Policeman	0.90 (0.68 to 1.18), p=0.43	
Road safety officer	1.05 (0.69 to 1.60), p=0.82	
Other person	1.57 (1.14 to 2.17), p=0.006	
Best friend wears helmet	1.84 (1.18 to 2.85), p=0.007	
Had accident on bike requiring medical attention	0.78 (0.57 to 1.07), p=0.13	

*Defined as enumeration district with Townsend score >0.

to always wear one (27% versus 29%, OR 0.90, 95% CI 0.60 to 1.36, p = 0.63). Table 3 shows the odds ratios for factors associated with helmet ownership. The multivariate analysis shows that residence in a deprived area and riding a bike at least four days a week were associated with lower rates of helmet ownership, while family encouragement to wear a helmet and parental warning of the dangers of not wearing a helmet were associated with higher rates of helmet ownership. The relations between helmet ownership and frequency of riding (p = 0.51), family encouragement to wear a helmet (p = 0.91), and parental warning of dangers of not wearing a helmet (p = 0.95) were similar for children living in deprived and non-deprived areas.

Table 4 shows the odds ratios for helmet wearing. The multivariate analysis shows that family encouragement to wear a helmet, having a best friend who wears a helmet, and thinking helmet comfort is important were associated with higher rates of helmet wearing. Riding a bike to visit friends was associated with lower rates of helmet wearing. The relations between helmet wearing and riding a bike to visit friends

Table 4 Univariate and multivariate associations with helmet wearing

	Univariate analysis Odds ratio (95% CI)	Multivariate analysis Odds ratio (95% CI)
Sex	0.90 (0.58 to 1.40), p=0.65	
Residence in deprived area*	0.90 (0.60 to 1.36), p=0.63	
Rides bike ≥4 days per week	0.80 (0.48 to 1.32), p=0.38	
Rides bike		
To and from school	0.24 (0.07 to 0.82), p=0.02	
To visit friends	0.62 (0.41 to 0.92), p=0.02	0.62 (0.43 to 0.89), p=0.01
For fun	1.14 (0.60 to 2.19), p=0.69	
Only when has to	1.29 (0.72 to 2.31), p=0.39	
For sport	0.86 (0.60 to 1.24), p=0.42	
Important or very important reasons for wearing helmet		
How comfortable helmet feels	1.87 (1.23 to 2.84), p=0.004	1.68 (1.12 to 2.53), p=0.01
How the helmet looks	0.59 (0.38 to 0.91), p=0.02	
Helmet could save life	3.15 (0.83 to 12.05), p=0.09	
What friends think and say	0.85 (0.57 to 1.27), p=0.43	
Wearing helmet is good way of protecting head if fall off bike	4.49 (1.11 to 18.15), p=0.04	
Encouraged by family members to wear helmet	7.45 (4.47 to 12.42), p<0.001	7.19 (4.22 to 12.25), p<0.001
Has been told about dangers of not wearing helmet by:		
Parent	2.01 (1.03 to 3.93), p=0.04	
School nurse	0.74 (0.44 to 1.24), p=0.26	
Teacher	0.84 (0.57 to 1.19), p=0.33	
Doctor	1.17 (0.69 to 1.98), p=0.55	
Policeman	0.94 (0.64 to 1.39), p=0.76	
Road safety officer	0.94 (0.60 to 1.47), p=0.79	
Other person	0.83 (0.57 to 1.22), p=0.35	
Best friend wears helmet	2.89 (1.77 to 4.72), p<0.001	2.05 (1.18 to 3.57), p=0.01
Had accident on bike requiring medical attention	0.79 (0.54 to 1.15), p=0.21	

*Defined as enumeration district with Townsend score >0.

(p = 0.31), family encouragement to wear a helmet (p = 0.89), the importance of helmet comfort (p = 0.89), and best friends wearing a helmet (p = 0.10) were similar for children living in deprived and non-deprived areas.

DISCUSSION

Principal findings

Our study has found that children residing in deprived areas are less likely to own a bike, but those that do own bikes ride them more frequently than children in non-deprived areas. Helmet ownership is less common among children residing in a deprived area and those who ride their bikes most frequently. It is more common where there is family encouragement and where parents inform their children of the dangers of not wearing a helmet. These relations are similar for children residing in deprived and non-deprived areas. Once a helmet is owned, helmet wearing is not related to deprivation. Parental encouragement and best friends wearing helmets are associated with higher helmet wearing rates. Riding a bike to visit friends is associated with lower helmet wearing rates. Again these relations are similar for children residing in deprived and non-deprived areas.

Limitations of the study

Our study was confined to children in year 5 in order to facilitate the delivery of the educational intervention to be tested in the subsequent cluster randomised trial. This narrow age group probably does not represent the experiences of older secondary school children or younger primary school children, and the results should not be generalised to younger or older children. The questions asking about helmet wearing behaviour are most susceptible to misclassification. We have tried to minimise over reporting of helmet wearing by comparing children always wearing a helmet to those wearing a helmet less often,[9] but while accepting that some over reporting may still have occurred there is disagreement about its extent in surveys of this type. One study comparing self reported helmet wearing with helmet wearing recorded in the medical records of injured cyclists found self report to have a positive predictive value of 96%,[10] although only 25% of the participants were children and self report may be more or less accurate in children than adults. The Seattle Children's Bicycle Helmet Campaign[11] found observed baseline helmet use in the study population of 5.5%, while a simultaneous questionnaire survey (response rate 48.5%) completed by the parents of a sample of the same population suggested a helmet wearing rate of 13%.[12] Another trial of a bicycle helmet promotion intervention found a similar level of parent reported helmet use (15%) in a baseline survey compared with observed helmet wearing in the region of 1.6%.[13] Interestingly two other trials appear to have found observed helmet wearing rates to have been similar or even higher than parent or child reported helmet use.[14 15] Even if our self reported helmet wearing does represent an over report, we have no reason to believe the over reporting differed by deprivation, hence it is unlikely to have biased our analyses in relation to deprivation.

We were unable to obtain Townsend scores for 161 children, of whom 146 owned a bike and 68 owned a helmet. This was due to children not knowing or incorrectly recording their postcode, and in one school the head teacher would only provide us with the ward in which the child lived, not the postcode. We undertook a sensitivity analysis, assuming firstly that all children with missing postcodes lived in a deprived area, and secondly that none of them lived in a deprived area. We then recalculated the odds ratios for helmet owning and wearing comparing children in deprived and non-deprived areas. The odds ratios and 95% confidence intervals changed little from those for the main analysis for either helmet owning or wearing. Assuming all children with missing postcode data lived in a deprived area, the odds ratio for helmet ownership was 0.48 (95% CI 0.31 to 0.72) and for helmet wearing was 0.97 (95% CI 0.66 to 1.42). Assuming all children with missing postcodes lived in a non-deprived area, the odds ratio was 0.57 (95% CI 0.41 to 0.79) for helmet owning and 0.87 (95% CI 0.60 to 1.25) for helmet wearing. This suggests that had postcode data been available on these children, it would not lead us to alter our conclusions regarding the effect of deprivation on helmet ownership and wearing.

How this study compares to other studies

Two previous UK surveys in children of a similar age to our study population found helmet ownership rates of 69% in East Sussex[3] and 58% in South Staffordshire,[16] higher than the 52% found in our study. The first found 30% of 11 year olds reported always wearing a helmet,[3] very similar to our findings. The second study found that 64% of helmet owners reported wearing them always or nearly always,[16] higher than that found in our study. It is likely that we found a lower prevalence of helmet ownership as a result of selecting a population from schools in deprived areas. The higher helmet wearing rate in the South Staffordshire study may reflect the combining of the response categories always and nearly always, which is likely to lead to a less conservative estimate of wearing rates than that based on responses indicating the child always wears a helmet.

Our study is the first set in the UK to compare helmet ownership and wearing by deprivation, although work from the US supports our principal findings. The baseline data from two studies attempting to promote helmet use in low income children found higher rates of helmet use among more affluent socioeconomic groups.[4 5] Two national (US) telephone surveys found that higher levels of parental education and household income were associated with increased levels of helmet ownership and wearing.[17 18]

The two previous UK surveys,[3 16] a recent Finnish survey,[19] and the Seattle Children's Bicycle Helmet Campaign[12] highlighted the importance of friends and parents in influencing helmet wearing. Our study is the first to examine whether these influences on helmet ownership and wearing are related to deprivation. Our findings that parental encouragement and warning of dangers, and helmet use by friends have similar effects in terms of influencing helmet use in children residing in deprived and non-deprived areas are encouraging. The prevalence of parental encouragement (OR 0.81, 95% CI 0.53 to 1.25, p = 0.35) and warning of dangers (OR 0.86, 95% CI 0.52 to 1.44, p = 0.57) did not differ between deprived and non-deprived areas, suggesting parental attitudes to helmet use are similar in deprived and non-deprived areas. Interventions aimed at increasing parental encouragement or peer group use of helmets are therefore important in both deprived areas and non-deprived areas.

There are concerns that cyclists wearing helmets may act in a more risky manner because of the sense of increased protection offered by the helmet.[20–22] There are also concerns that increasing cycle helmet use, particularly through the use of legislation, may be associated with a reduction in cycling and in the health benefits associated with cycling.[1 21] While we support programmes to increase cycle helmet use, cycle helmets are only one part of a strategy for reducing cycling injuries. Similarly, encouraging cycling can only ever form part of a strategy to promote child health.

Implications

Our study found that helmet ownership is less common among bicycle owning children in deprived areas. This may form part of the explanation for the inequality in cycling injuries. Programmes aimed at preventing cycling injuries will need to address the inequality in helmet ownership that exists between children residing in deprived and non-deprived

areas. Strategies to increase family encouragement to wear a helmet may be useful, in both deprived and non-deprived areas, as may those recognising the importance of the attitudes and behaviours of peers, such as peer education programmes.

Our study also suggests that children in deprived areas ride their bikes more frequently than children in non-deprived areas, which may also partly explain the social gradient in cycle injuries. Further work is required in this area to assess other exposures to risk of cycling injury by deprivation.

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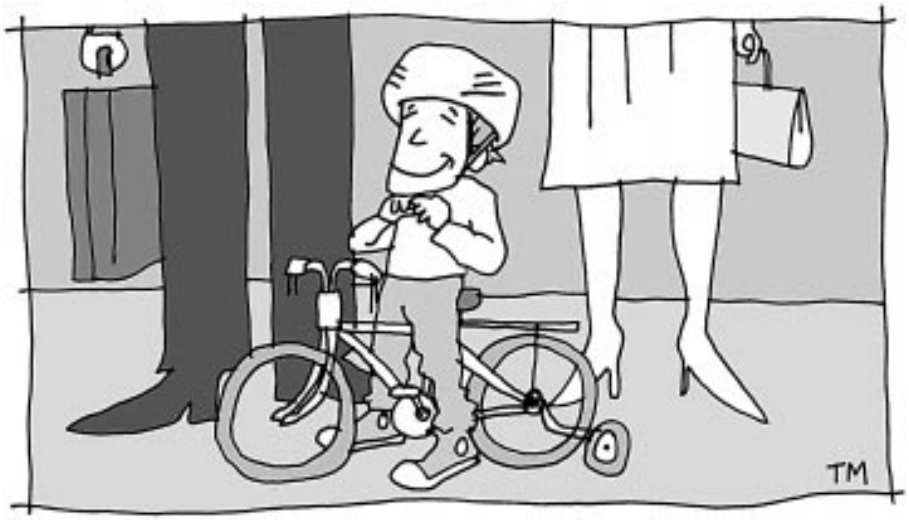

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