Injury patterns in cyclists attending an accident and emergency department: a comparison of helmet wearers and non-wearers


**Summary of paper**

1,040 patients presented themselves to Addenbrooke's hospital, Cambridge, with cycling related injuries in 1992, 114 of whom had worn a cycle helmet at the time of injury. Two groups of patients, with and without helmets, were compared for type of accident and nature and distribution of injuries. The authors concluded that there were no significant differences between the two groups with respect to type of accident or nature and distribution of injuries other than those to the head. Head injury was sustained by 4% of helmet wearers compared with 11% of non-wearers. The incidence of head injuries sustained in accidents involving motor vehicles was significantly higher than in those not involving motor vehicles. The authors claim a risk factor of 2.5 for crashes involving a motor vehicle and a protective factor of 3.25 for wearing a helmet.

**BHRF Commentary**

Table III of the paper (reproduced below) shows that the 95% confidence limits for the protective effect of wearing a cycle helmet ranged from 1.16 to 9.06. Whilst the authors suggest a mid-range protective factor of 3.25 for wearing a helmet, the possibility that wearing a helmet makes almost no difference to the outcome of a crash is also within the range of statistical validity, as is the possibility that a helmet offers near-perfect protection. The wide range of the confidence limits is probably because the sample of helmeted cyclists was so small. However, this makes the study weak, the results inconclusive, and the authors’ conclusion not robust.

<table>
<thead>
<tr>
<th>Injury site</th>
<th>Helmet worn</th>
<th>Odds ratio</th>
<th>95% confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>Yes (n=114)</td>
<td>4 (4%)</td>
<td>3.25 (1.16 to 9.06)</td>
<td>0.024</td>
</tr>
<tr>
<td></td>
<td>No (n=928)</td>
<td>100 (11%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Face or neck</td>
<td>Yes (n=114)</td>
<td>22 (19%)</td>
<td>1.32 (0.77 to 2.26)</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>No (n=928)</td>
<td>212 (23%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trunk</td>
<td>Yes (n=114)</td>
<td>11 (10%)</td>
<td>0.54 (0.26 to 1.11)</td>
<td>0.092</td>
</tr>
<tr>
<td></td>
<td>No (n=928)</td>
<td>48 (5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arm</td>
<td>Yes (n=114)</td>
<td>56 (49%)</td>
<td>0.90 (0.61 to 1.33)</td>
<td>0.59</td>
</tr>
<tr>
<td></td>
<td>No (n=928)</td>
<td>418 (45%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leg</td>
<td>Yes (n=114)</td>
<td>31 (27%)</td>
<td>0.90 (0.57 to 1.42)</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>No (n=928)</td>
<td>231 (25%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table III also suggests that helmeted cyclists were twice as likely to suffer injuries to the trunk, but again numbers are too small to attach significance to this.

There is little information about the severity of head or other injuries. Only 5 of the 102 head-injured cyclists were admitted to hospital for more than 5 days. It is unknown how many of the crashes included head impact as distinct from head injury - helmeted cyclists may have had fewer head injuries because they had hit their heads less often. The paper gives no information about the type of crashes in which the cyclists were involved, nor where they took place. There is no socio-economic information about the casualties. This means that it is impossible to judge if there were differences other than helmet use between the cyclists wearing and not wearing helmets. In general there are too many variables that were not controlled by the researchers for reliable conclusions to be drawn.

The authors note that cyclists who owned a cycle helmet but did not use it had a similar chance of head injury to those who neither owned nor used a helmet, and thus suggest that there was no difference in risk-taking between helmet owners and non-owners. This might not be the case, however, if risk-taking is associated with helmet wearing rather than helmet ownership.
The study is based in most cases on the self-reporting of injuries to hospital. If voluntary helmet wearing is weighted towards people that are more cautious, these people may also be more likely to attend hospital for minor injuries. Middle-class children are more likely to wear helmets, and their parents are more likely to require their them to go to hospital for minor injuries as a precaution. In either case, the average injury severity of those who attend for minor injury is likely to be lower.

The authors exaggerate the likelihood of head injury when cycling by reference to the under-reporting of cycle accidents. The likelihood of under-reporting decreases markedly with increased severity of injury. All fatalities and the great majority of the most serious types of injury are reported (Mills, 1989). Similarly reference to the higher rate of cyclist injuries in Cambridge per capita population is misleading. Cambridge also has the highest rate of cycling in the UK and risk per cyclist is lower.

Peer criticism

A letter published in BMJ in response to this paper noted (Keatinge, 1994):

"Three assertions are fundamental to their argument, all denying the likelihood that people who voluntarily wear helmets accept different levels of risk. Firstly, they state that 'Cyclists who wore safety helmets were just as likely to be involved in accidents.' However, they give no relevant information on cyclists who did not have accidents, and so they cannot estimate the relative likelihood of having an accident with or without a helmet. Secondly, they argue from the premise that cyclists who own helmets but do not wear them would behave as cautiously as helmet wearers. This idea is also unsupported by evidence. Thirdly, they reject the idea of greater caution among cyclists voluntarily wearing helmets because their non-head injuries were similar to those of cyclists without helmets. However, Maimaris et al give no reason to expect that injuries to more cautious cyclists, when they occur, will be intrinsically different. Finally, risk compensation behaviour is not mentioned, although it could nullify any benefits of enforcing helmet use. Their conclusions are therefore not based on a scientific argument from evidence."

The paper was also discussed in an article concerning the Cochrane Review meta-analysis of helmet effectiveness (Curnow, 2005):

"Head injury is defined as skull fracture and brain injury, but the data for the two are not separated, include no recognised severity ratings such as AIS and nothing about types of helmet. These data are inadequate to support valid conclusions about effects of helmets on brain injury."

Other evidence from Cambridge does not support conclusion

Traffic casualty statistics for Cambridge show that injury severity for road cyclists (the proportion of injuries that were serious or fatal) was falling steadily before, during, and after the study period, the continuation of a trend that started well before cycle helmets were in common use (Cambridgeshire, 2000):
In 1992 cycle helmet use in Cambridge was 9%, rising by 1995 to 28% (adults 29%, children 22%) on radial routes. In 1998 this had risen to 33% (Maimaris, 1994b). Despite this large increase in the proportion of cyclists wearing helmets, there has been no noticeable impact on the Cambridge cyclist injury severity trend.

The paper states that in 1992, 872 cyclists were treated at Addenbrooke’s hospital, compared with 307 cycle crashes reported to the police. County Council statistics confirm the latter figure, which is 35% of the hospital total and the casualties represented in the graph above. As these casualties will include all, or nearly all, of the most serious injuries covered by the study, this would suggest that helmets are not effective against serious injury, contradicting the authors’ assertion that they are effective in all types of cycling accident.
References

Cambridgeshire, 2000
Casually statistics from Cambridgeshire County Council.

Curnow, 2005
http://www.cyclehelmets.org/1146.html

Keatinge, 1994
http://bmj.bmjjournals.com/cgi/content/full/309/6953/541/a

Maimaris, 1994b

Mills, 1989

The Bicycle Helmet Research Foundation (BHRF), an incorporated body with an international membership, exists to undertake, encourage and spread the scientific study of the use of bicycle helmets. Also to consider the effect of the promotion and use of helmets on the perception of cycling in terms of risk and the achievement of wider public health and societal goals.

BHRF strives to provide a resource of best-available factual information to assist the understanding of a complex subject, and one where some of the reasoning may conflict with received opinion. In particular BHRF seeks to provide access to a wider range of information than is commonly made available by those that take a strong helmet promotion stance. It is hoped that this will assist informed judgements about the pros and cons of cycle helmets.

For more information, please visit www.cyclehelmets.org.

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