MSc Transport Planning

April 2008

Do cyclists have an exaggerated perception of the effectiveness of cycle helmets and the risks of cycling?

Richard Burton

This study was completed for the MSc in Transport Planning at the University of the West of England, Bristol. The work is my own. Where the work of others is used or drawn on, it is attributed.

Signed:

Richard Burton

Word count: 19,997

Abstract

This dissertation examines whether cyclists have a realistic appreciation of the effectiveness of cycle helmets, and whether they have a realistic appreciation of the risks of cycling, and whether the two are related. Because cycle helmets and fear of cycling are deter cycling, and it is government policy to increase cycling for health and other reasons, exaggerated views may prevent policy being carried into practice.

A survey of over 300 cyclists was undertaken to discover the views of cyclists in those two areas. Interviews were also conducted with ten cyclists to explore the subject in more depth.

An extensive literature search was also done, including publicity and research about risks of cycling and helmet effectiveness. This included academic research and also the popular media, to examine if that could be a formative factor in cyclists' perceptions.

The surveys were analysed using a spreadsheet programme, whilst the interviews were examined for common themes and explicit reasons for attitudes. The results were discussed and interpreted and conclusions drawn.

The main conclusion is that the majority of the people surveyed do have an exaggerated opinion of the effectiveness of cycle helmets, and an exaggerated opinion of the risks of cycling, and that the two are associated. These perceptions are likely to be caused by exaggerations in the promotional material for helmets, which exaggerates both the risks of cycling and the effectiveness of helmets.

Following on from this, the exaggerations in the promotional material are likely to both prevent some people from cycling because of the fear of the risk, and to induce risk compensatory behaviour in those who chose to cycle and wear a helmet.

Given the overwhelming benefits of cycling, helmet promotion is found to be counterproductive in both economic and public health terms.

Table of Contents

List of Tables

List of Graphs

Chapter 1 – Introduction

Introduction

Problem Statement

Hypotheses

Method

Results

Value of this research

Introduction

As a life-long cyclist, I have been concerned for some time about the claims made for cycle helmets and their unrelenting promotion as the solution to road danger for cyclists, caused mainly by other road users. The research by Dr Ian Walker (2007) concerning the passing distances of motor vehicles relative to the wearing of a helmet by cyclists was the seed for this research.

Problem Statement

It is necessary to understand the perceptions of cycle helmet effectiveness and the risks of cycling because they have a significant effect on the numbers of people cycling, which has very large effects on society.

There is considerable interest in and debate about the topic of cycle helmets and whether they are effective or not, and whether the publicity about them deters people from cycling and gaining the benefits of regular exercise. There is also considerable disagreement about their effectiveness, with very polarised positions. One side points out that small scale, short term case control studies show very significant benefits (DfT, 2002), and the other side points out that long term, whole population studies show no benefit (Franklin, 2003). Almost everyone agrees however, that helmet laws reduce the number of cyclists.

Over the past few years, there has been a constant stream of research about exercise and how little we do of it, and what a massive negative effect this is having and will have on fitness, health and quality of life (DoH, 2004). One of the most beneficial and easily achieved methods of getting more

exercise is to use the daily commute as an opportunity to exercise regularly, by cycling or walking the journey.

The issue of cycling has considerable relevance in modern society, with continual exhortations to exercise more, reduce carbon footprint, reduce traffic congestion, pollution and danger and to reduce reliance on fossil fuels. Cycling has a very considerable positive effect in all those areas, and transferring trips from cars to cycling is arguably the most beneficial action that an individual could take for themselves, society and the planet. Yet many people are deterred from cycling by oft-repeated messages about its dangers, and the inconvenience of the only solution offered, a helmet. Promotion of helmets reinforces the belief that cycling is dangerous, and may create it where no such belief existed. Helmet promotion reduces the numbers of people who cycle regularly, and the inconvenience of a cycle helmet reduces it further. Since it can be demonstrated that, at a population level, cycle helmets have no effect on deaths or serious injuries, and the benefits of cycling are very high, the overall effect of helmet promotion in health terms is overwhelmingly negative.

Helmet promotion tends to exaggerate the dangers of cycling, and to exaggerate the efficacy of cycle helmets, and it is likely that these exaggerations will have two effects; they will reduce the number of people cycling because of fear, and they will induce “risk compensation” behaviour in those persuaded to wear a helmet. The likelihood of these outcomes is the basis of the hypotheses of this dissertation.

Despite predictions of large reductions in deaths and injuries to cyclists when helmets are promoted or made mandatory (Thompson, Rivara and Thompson, 1999), no such effect can be observed at a population level (Robinson D L, 2000). Risk compensation is the most likely explanation of why the predicted reductions in deaths and serious injuries to cyclists do not occur at a population level. Risk compensation occurs when a safety measure is introduced, but it is used as a performance benefit, maintaining the same level of risk and negating any safety benefit, and this effect has been demonstrated a number of times (Lewis-Evans and Charlton, 2006)(Mok et al, 2004).

It is worth noting that similar interventions that imposed safety measures on road users were not successful in reducing deaths, e.g. seat belts and motorcycle helmets. Predictions of reductions in deaths and injuries were similarly large.

This research was inspired by the work of Dr Ian Walker, who discovered that drivers pass closer to cyclists who wore a helmet than those who did not, clearly indicating that risk compensation is

observable, even in those not directly affected by the safety measure. (Walker, 2007). Since risk compensation is clearly observable in drivers, it is inevitable that risk compensation will affect the users of the safety measure, cyclists, and it should be possible to detect it.

Hypotheses

The basis of the hypotheses for this dissertation are that since helmet promotion inevitably exaggerates the risks of cycling and the efficacy of helmets, and most people are ignorant of how effective cycle helmets are or how risky cycling is, many people will have views which correspond to those exaggerations, rather than a realistic appreciation of the facts.

Hypothesis one: that most people have an exaggerated view of the efficacy of cycle helmets.

Null hypothesis one: that most people have a realistic view of the efficacy of cycle helmets.

Hypothesis two: that most people have an exaggerated view of the risks of cycling.

Null hypothesis two: that most people have a realistic view of the risks of cycling.

Hypothesis three: that hypotheses one and two are related.

Null hypothesis three: that hypotheses one and two are not related.

To investigate hypothesis one, the efficacy, or lack of efficacy, of cycle helmets must be demonstrated, and this will be done at some length in the chapter on literature review. Having examined a very considerable body of evidence, the view of this researcher and many others, is that at best, their efficacy is extremely limited, or they have no efficacy at all, in preventing death or serious injury.

For hypothesis two, it will be necessary to examine the actual risks of cycling, and again, this will be discussed at some length later, but it is worth mentioning here that regular cyclists are likely to live longer than their more sedentary cousins. They are also less likely to suffer from debilitating disease and therefore have a higher quality of life, and it has been estimated that the benefits of cycling outweigh the risks by twenty to one (Hillman, 1992).

If hypotheses three is true, and the two previous hypotheses are linked, this will demonstrate that helmet promotion is effective in increasing the perception that cycling is dangerous. For this to be true, the perception of the efficacy of helmets and the risks of cycling would rise together.

Method

Two methods were used to attempt to discover people's attitudes to cycling and cycle helmets, surveys and interviews. The people selected were almost all cyclists, and most were regular cyclists and adults. A number of children undergoing cycle training were included as it is likely that they would have been exposed to more helmet promotion than the adults and were less likely to be sceptical of it.

The surveys were designed to elicit information about the respondents views about the risks of cycling and the efficacy of helmets, in a format which was both easy to complete and would provide meaningful answers capable of being analysed.

The interviews were designed to investigate in more depth respondents views about helmets, and how they had been formed, and were all undertaken with adult cyclists who were mainly regular cyclists.

Results

The results are discussed at length later, but they do demonstrate that many people have an exaggerated view of both the protection offered by cycle helmets and the dangers of cycling, and that these are likely to be related. Although there were some differences in perceptions between different age groups, there was a consistent over-estimation of the protection offered by cycle helmets and the risks of cycling.

Importance and contribution of this dissertation

For a number of reasons, cycling is increasingly being seen as part of the answer to many problems which beset modern society; obesity, traffic congestion, traffic danger, quality of life, oil dependency, and global warming, to but mention the most frequently repeated ones. If cycling is to realise its potential in these areas, then a considerably larger proportion of the UK population will need to take it up than do at present. The most frequently given reason for not cycling is the danger, and the most frequently given reason for wearing a cycle helmet is also danger (University of Lancashire, 2005)(Scottish Executive, 2005).

If this perception of danger is due to the promotion of cycle helmets, then such promotion is likely to be negative in its overall effect at a population level. If regular cyclists are likely to live longer and be healthier than average, then anything which might dissuade people from taking it up as a means of

transport will have a negative effect, not a positive one, with more people dying early from lack of exercise than from head injuries from cycling.

If it can be shown that helmets are not effective, and that they can induce risk compensation behaviour, then the promotion of them will be counter-productive, reducing the numbers of people taking regular, highly beneficial exercise, whilst not reducing deaths and serious injuries to cyclists. As it has been demonstrated that cyclists' safety improves with the numbers of cyclists (Jacobsen, 2003) and that helmet promotion reduces that number, the risk to individual cyclists would also be higher than if those dissuaded from cycling by the helmet message chose to cycle as well.

The value of this dissertation could therefore be to reduce spending on an ineffective strategy to reduce deaths and injuries to cyclists, and to increase the spending on cycle promotion. This could have significant effects on population levels of cycling, therefore improving health on a large scale, with other benefits of reduced traffic congestion, reduced oil dependency and reduced CO_2 emissions.

The number of people dying from lack of exercise in the UK is very considerable (REF), and the number of people having a seriously reduced quality of life because of illnesses associated with lack of exercise is similarly large. Many of these people would benefit considerably from taking exercise such as cycling, but they could be deterred by a false impression of the dangers of cycling given by helmet promotion.

Similarly, the possible protective effect of helmets is exaggerated in helmet promotion, which could lead to risk compensation, where cyclists take less care because they feel safer. If this is true, then whatever protective effect exists would be overcome to some extent, if not completely, by the extra risk taking.

Finally, if the hypotheses are proved, it would call into question much of the road safety policies and actions which have been proposed and carried out over the past forty years, such as compulsory seat belts and motorcycle helmets.

Chapter 2 – Review of Literature

Headings:

Purpose of this chapter

Effectiveness of helmets

Risks of cycling

Helmet promotion bias

Persistence of myths

Risk compensation

Evidence from similar interventions

Summary

Purpose of this chapter

To demonstrate any possible exaggerated views of cycling and cycle helmets, it is necessary to show what the actual risks of cycling and benefits of helmets are, which this chapter will attempt to do.

This chapter will examine the literature on cycle helmets, and will show that:

- evidence showing large benefits of cycle helmets is unreliable
- evidence showing no benefit is highly reliable
- cycle helmet promotion is highly biased, exaggerating both the risks of cycling and the protection offered by helmets
- continued repetition of these exaggerations is likely to convince people
- risk compensation is a likely explanation for the failure of helmets to protect
- evidence shows that similar interventions have not been successful

Effectiveness of helmets

The most widely quoted figures for the effectiveness of helmets, 85% and 88%, come from a single report “A case control study of the effectiveness of bicycle safety helmets” (Thompson RS, Rivara FP, Thompson DC, 1989). These figures have not been reproduced by any other research, and this report and its conclusions have been widely disputed (Chapman, G, 2007) (Curnow WJ, 1995). Despite its methodology and conclusions being challenged and proven flawed, the original paper and its

extremely high claims for helmet efficacy are still quoted by researchers, (Shah S et al 2007) (Lang IA 2007). There are at least 79 papers citing this research, all of which accept that the original conclusions are valid despite the considerable body of more reliable evidence to the contrary. The number of times the figures from this research have been quoted in the press and helmet promotion material must run into many thousands.

The authors themselves no longer support the figure of 85%, having reduced it to 69% in a subsequent study "Effectiveness of bicycle safety helmets in preventing head injury: a case-control study" (Thompson DC, Rivara FP, Thompson RS, 1996) but the higher figures are still used by helmet proponents, despite knowing that they are not true (Chapman, 2004).

Much of the research into helmet effectiveness which finds that helmets are effective is meta-analysis, and most, if not all of it, cites the flawed Thompson, Rivara and Thompson paper of 1989 paper, and relies on it for its conclusions.

Almost all of the research which concludes that there should be helmet compulsion or promotion is based on selective evidence, ignoring research which shows no benefit, and using only that which shows significant benefit. The paper published by the Department for Transport "Bicycle Helmets: a review of effectiveness" is one such case, and its conclusion that there is "a high level of scientific evidence that bicycle helmets are effective in reducing the rate of head injury to bicyclists." (DfT, November 2002) is widely disputed:

"Although the Review concludes unequivocally that there is considerable scientific evidence that cycle helmets are effective in reducing injury, it examines only one type of evidence, that provided by non-randomised case control studies. Such studies have serious limitations for cycle helmet research and the Review identifies many shortcomings. These limitations are sufficient for at least 8 of the 16 papers reviewed to be ineligible as credible scientific evidence, whilst the remaining papers are unreliable evidence if other factors (identified in this Critique) are taken into account." (Franklin J, 2003).

The Cochrane review of 2007 found that the evidence for cycle helmets was far from conclusive "Bicycle helmet legislation appears to be effective in increasing helmet use and decreasing head injury rates in the populations for which it is implemented. However, there are very few high quality evaluative studies that measure these outcomes, and none that reported data on and possible

declines in bicycle use." (Macpherson A, Spinks A, 2007b). A previous Cochrane review (Thompson et al, 2004) concluded that "Helmets reduce bicycle-related head and facial injuries for bicyclists of all ages involved in all types of crashes including those involving motor vehicles." but this review was widely criticised for its methodological shortcomings. "The review is not a reliable guide to interventions and is not suitable for the Cochrane library." (Curnow WJ, 2005).

The British Medical Association changed its policy on cycle helmets, from promotion without compulsion, to compulsion in 2004. The previous policy had been reached after a comprehensive review of the evidence, but the new policy was arrived at by ignoring any evidence not supporting helmet use, and was conducted without the knowledge of the membership, and it is widely disputed.

"The BMA's previous policy was based on a comprehensive examination of the helmet issue, published in 1999. By contrast, the new stance is based on a short paper which takes a very selective view of the evidence, ignoring a great deal of evidence to the contrary; it cites a number of misleading (and in some cases incorrect) references without referring to published critiques of these; it identifies just one counter-argument to its conclusion (even though many are raised in the published literature), and this one argument is dismissed on entirely spurious grounds." (CTC, 2005)

The efficacy of cycle helmets is accepted at face value by many researchers, apparently based on either the 1989 Thompson, Rivara and Thompson paper or other papers which quote it, and those figures are quoted thousands of times in the popular media as if they were incontrovertible fact.

"Helmets reduce bicycle-related head and facial injuries for bicyclists of all ages in all types of crash." (Royal ST et al, 2006).

"Likewise, because many serious head injuries are sustained by cyclists, it is argued that legislation should be enacted to enforce the use of protective helmets by cyclists." (Shephard RJ**,** 2005)

"Cycle helmets reduce the risk of head injury by 85 percent and reduce the risk of brain injury by 88 percent." (RoSPA, 2002).

A paper by Cook A and Sheikh A (2003) found that cycle helmets were highly effective, and it received much publicity, with many calls for helmets to be made mandatory. The fact that there was a basic error in their calculations and their findings were unjustified received very little publicity (Wardlaw M, 2004).

Some researchers have argued that the observed fall in deaths and injuries to cyclists following the introduction of helmet laws or significant increases in wearing rates is due to a fall in the number of cyclists, which either matched or exceeded the fall in deaths and injuries "This suggests the greatest effect of the helmet law was not to encourage cyclists to wear helmets, but to discourage cycling. In contrast, despite increases to at least 75% helmet wearing, the proportion of head injuries in cyclists admitted or treated at hospital declined by
an average of only 13%." (Robinson DL, 1996) When using pedestrians as a control group, Robinson found that the reduction in deaths and injuries to them closely matched that of cyclists, indicating that it is unlikely that helmets were the cause of any such reduction, and the presence of confounding factors, probably the more rigid enforcement of road laws. (ibid).

Tim Gill found that the case for cycle helmets was not proven "The conclusion from the arguments outlined above is that the case for cycle helmets is far from sound. The strong claims of injury reduction made by helmet proponents have not been borne out for fatalities (which this paper argues is the most methodologically sound test of effectiveness) in real-life settings with large populations." (Gill T, 2005)

The efficacy of cycle helmets is thus contentious, but the most reliable evidence, from whole population, long term studies, shows no reduction in risk to cyclists (Robinson DL, 2006).

Nowhere that has introduced compulsory cycle helmets, or where there has been significant helmet promotion, has been able to conclusively demonstrate a reduction in risk to cyclists, which could not be accounted for by confounding factors.

The research which shows large benefits is predominantly of the case control study type, which has been criticised for its methodological problems, and there have been many cases where its results have been disproved, including Hormone Replacement Therapy and Vitamin supplements. In both of these cases, the small scale, short term case control studies showed very significant benefits, but large scale, long term research showed none, and the latter is accepted as being accurate (Lawlor DA et al, 2004).

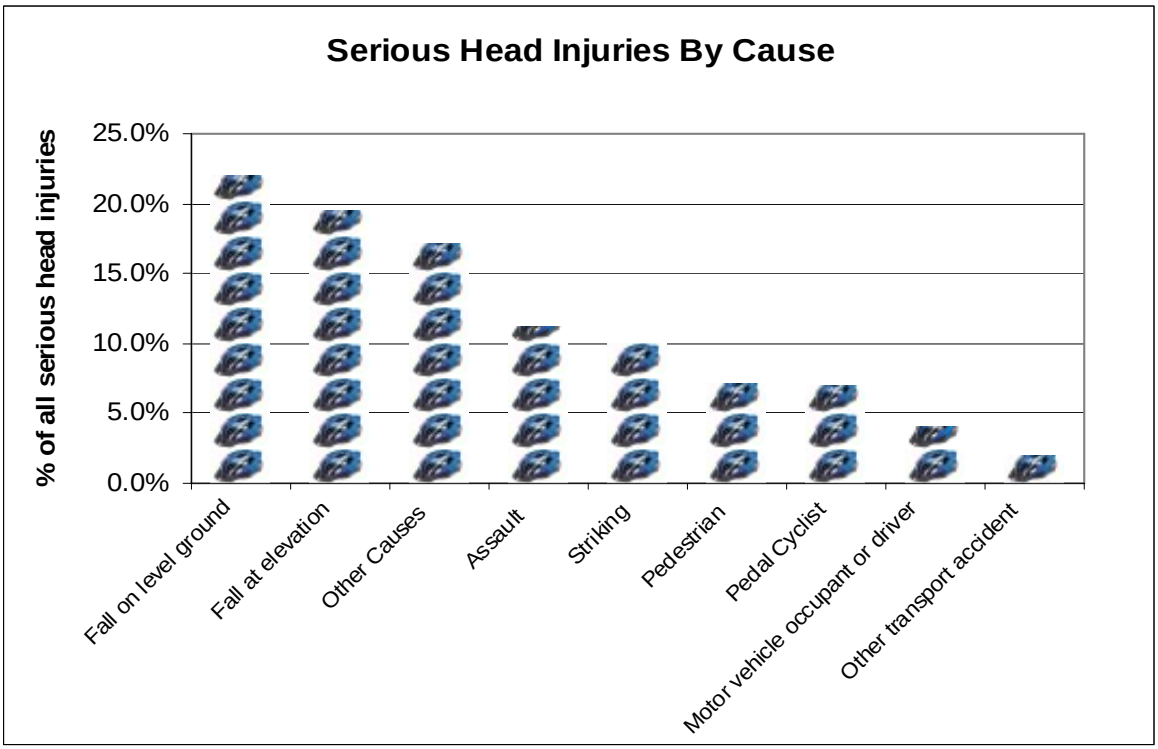
The case of cycle helmets mirrors both of those cases very closely: the benefits predicted from short term, small scale, case control studies has not been reproduced in long term, large scale research. This principle, of the former being disproved by the latter, is not accepted by helmet proponents, but why they do not accept it is not clear, as it is apparently accepted in all other situations. The accuracy of the long term, whole population studies is not challenged by helmet proponents, except on matters of minor detail, and it is generally accepted as being highly reliable, and certainly more

reliable than case control studies. Helmet proponents ignore such evidence in their research and publications.

Therefore, according to the most reliable evidence, cycle helmets have no effect on deaths or serious injuries at a population level, and if they provide protection in some circumstances, then they must also cause harm in a similar number of situations. Since the bicycle rider cannot know in advance what the exact circumstances of any collision will be, it is impossible to know whether wearing a cycle helmet will be beneficial or damaging, and there is therefore no reason to wear one. However, cyclists are bombarded with overt and covert messages that a cycle helmet will save their life, and therefore it is not surprising that many of them chose to do so.

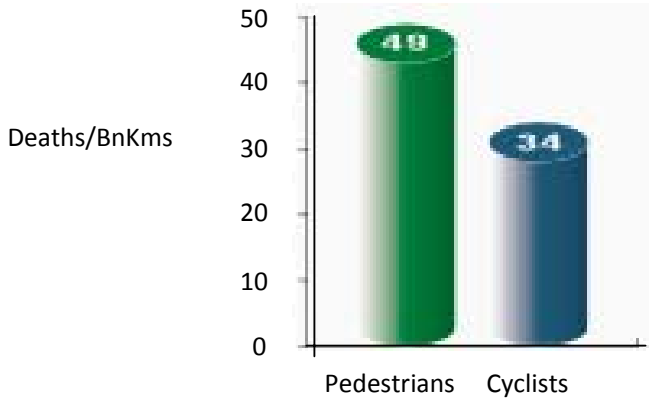
Risks of cycling

For distance travelled, cycling is approximately as risky as walking (DfT, 2007).



Graph 2.1 – Serious head injuries by cause (Chapman G, undated)

Graph 2.2 shows the causes of all head injuries, and it is obvious that cycling is not a major cause of head injuries, with many other causes being greater, and the greatest of which is suffered by pedestrians.



Graph 2.2 Relative risk of death for cycling and walking (Wardlaw M, 2002)

The above graph shows the relative risk of death for cycling and walking for distance travelled, and, on this basis, cycling is considerably less risky than walking.

This is not to say that cycling is without risk, but it is no more risky than other common daily activities such as walking, and it becomes safer as more people do it "For every doubling of cycle use, the risk per cyclist goes down by 37%." (Franklin J, 2002) but perspective is sadly missing from any promotional material about cycle helmets.

As Wardlaw (2000) points out, the inherent risks of road cycling are minute "Of at least 3.5 million regular cyclists in Britain, only about 10 a year are killed in rider only accidents. This compares with about 350 people younger than 75 killed each year falling down steps or tripping." The risk for cyclists is from motor vehicles, not cycling itself.

Helmet promotion bias

As befits such a controversial topic, there is an abundance of published research, promotion and articles about cycle helmets, which falls into two broad categories; helmet promotion, and helmet scepticism. The former are frequently written by people who do not cycle and are either politicians or health specialists in a narrow field, whilst the latter tend to be written by cyclists and people with a more general interest in health.

All publications, academic and otherwise, which conclude that cycle helmets should be promoted, exaggerate the risks of cycling. There appears to be no helmet promotion, whether printed, web-based or broadcast, which puts the risks and benefits of cycling in context, comparing those risks and

benefits with other common daily activities, and academic research also appears similarly biased, with highly selective choice of material.

“In 2004 over 3,500 teen cyclists aged 11-16 were killed or injured on Britain's roads. If you want to protect yourself you must take cycle safety seriously.” (Department for Transport, 2008)

“Action should be taken to both reduce the high rate of fatal and serious accidents suffered by cyclists, and to encourage participation in cycling as a healthy leisure activity and alternative mode of transport.” (British Medical Association, 2007).

“However, research shows that 50 children a year under the age of 16 still die of cycling related head injuries and a further 22,500 suffer head injuries.” (Bicycle Helmet Initiative Trust (BHIT), 2004).

“Thousands of children and young people are injured every year while out and about on their bikes.” (Child Accident Prevention Trust, 2008).

“If you don't wear a helmet you might as well write your will. My mum is a nurse and has seen some nasty injuries caused by not wearing a helmet.” (BBC, 2005).

The protective effect of cycle helmets is likewise exaggerated, frequently using figures which have been discredited and acknowledged as incorrect by the authors of the research which produced them:

“Cycle helmets reduce the risk of injury by up to 85%” (BHIT, 2008)

“Cycle helmets have great potential for reducing bicycle-related head injuries and death. Properly worn, they have been shown to reduce the risk of brain injury by almost 90%. Thousands of cyclists are hurt in accidents, both ON and OFF-ROAD, every year. *Well over half of them suffer head injuries.* **Wearing a helmet is the best way to protect your head**.”
(Oxfordshire County Council, undated).

“In fact, statistics show that head injuries are responsible for 75 percent of the 500 or more annual deaths from cycling. Since medical research has shown that wearing a bicycle helmet can prevent 85 percent of head injuries from cycling, why wouldn't you wear one?” (Howstuffworks, 2008).

“Although the use of helmets can reduce the risk of head injury by 85%,.....” (LeBlanc et al, 2002)

"The consensus is that they reduce anything up to 88% of serious head injuries if they are used," said Professor Sheikh, from the Division of Community Health Sciences." (BBC, 2008)

There are many academic papers concerning cycle helmets which are biased in favour of helmets, making unrealistic claims about the dangers of cycling and the protective effect of helmets:

"However, bicycle-related injuries are common and frequently lead to hospitalisation. It is a global public health problem....." (Macpherson A, Spinks A, 2007a)

There is also considerable covert advertising of cycle helmets, with photographs and other publicity materials showing many times the rate of helmet wearing than exists. It has been alleged that no publication funded by the DfT is allowed to show unhelmeted cyclists, and an examination of recent publications supports this contention.

Particularly ironic is the stance of many health related charities, which seem to have adopted the same policy e.g. the British Heart Foundation (BHF, 2006). Approximately 110,000 people died from heart disease in England every year, and about 120 cyclists die in the same time. Cycling is proven to significantly reduce deaths from heart conditions, but the organisation deters people from cycling by implying that it is dangerous. BHF sell cycle helmets on their website with the caption "Stay safe when you're cycling with this fully ventilated red and silver adjustable cycle helmet." which clearly states that wearing a helmet makes you safe (BHF, 2008).

The medical profession itself, which acknowledges the huge benefits of cycling given the current large and growing problems of ill health caused by increasingly sedentary lives, promotes cycle helmets. The most recent briefing paper of the BMA (2008) is typical of the helmet promotion literature, using highly emotive uproveable unreferenced statements:

“While training for a charity bike ride, Kirsty was struck by a car. The accident left her with a brain injury that has changed her life. Kirsty is now registered disabled and suffers from balance problems, fatigue, headaches, lack of concentration, short-term memory loss
and has poor spatial awareness. Doctors believe that had she not been wearing a cycle helmet at the time of her crash, she would have died.” (BMA, 2008)

There are nine such statements in this document, with none questioning the benefits of helmets to balance them. The research examined is likewise highly biased, with none of the evidence showing no benefit being included. As a document produced under the name of the Board of Science of the BMA, it will have considerable standing, and will further spread the myth of cycle helmet effectiveness and increase the perception of cycling as a dangerous activity, and it actively promotes that view “Attitudinal factors shown to influence rates of helmet use include low risk perception (with cycling not being viewed as a dangerous activity)" (ibid). The risks of cycling are comparable or less than, the risks of walking per mile travelled.

The Royal College of Nursing, the World Health Organisation, the British Dental Association, the Royal College of Surgeons and many other medical organisations support the introduction of a law making it a crime to cycle without a helmet.

No cycle helmet manufacturer makes any claim for the protective effect of their product, other than that it meets a standard for cycle helmets. This is presumably because they realise that any such a claim cannot be proved and they are therefore prevented from doing so by consumer and advertising laws. Indeed, many helmet manufacturers do exactly the opposite, and warn purchasers that the helmet does not protect:

“Unfortunately, some accidents result in head injury that cannot be prevented by any helmet. Depending on the type of impact, even very low speeds can result in a serious head injury or fatality.” (Raleigh Helmet Owners Manual, undated)

And

"A biking helmet can only protect if it fits properly and sits firmly against the head, but it can never guarantee that injuries will not occur." (Uvex bike & inline helmets booklet, undated)

However, it seems unlikely that more than a small proportion of helmet purchasers would read the small print on the attached documents, and, given the overwhelming amount of advertising and publicity material informing them that a helmet is highly effective, this message is unlikely to be understood or acted upon.

Given that all long term, large scale, highly reliable research shows no benefit from cycle helmets, the promotional material claiming or inferring benefit is clearly inaccurate and biased.

Persistence of myths

One of the reasons that helmet efficacy is accepted as being much higher than it actually is, is "persistence of myths". Once a perception of something has been repeated often enough and has been accepted as fact, it is very difficult to change that perception. The messages that a cycle helmet is an essential piece of personal protective equipment, and in particular the figure of 85% protective effect, have been repeated so often that they are now accepted as true. Thus, the more reliable evidence has little effect on people's perception, and can even lead to the reinforcing of the original message which it contradicts completely "Once memory for substantive details fades, familiar statements are more likely to be accepted as true than to be rejected as false." (Schwarz et al, 2007).

Schwarz found that a leaflet issued to correct common misperceptions of flu vaccine, containing both the false statements and their refutations, had very little effect, because people remembered the familiar, but wrong statements, and forgot the correct, but less familiar statements. Thus, articles which dispute claims such as the "helmets prevent 85% of injuries" may merely be increasing acceptance of that figure by repetition, which is remembered, whilst the more accurate analysis is forgotten. This misremembering of facts in favour of often repeated untruths should not come as a surprise to anyone who recalls the statement by Lenin "A lie often repeated becomes the truth".

At what point does helmet promotion become the logical fallacy of "proof by assertion" the repeated statement of something as fact despite contradictory evidence? It could be argued that that point was passed some time ago, with organisations such as the BMA using blatantly biased evidence to support mandatory helmet wearing.

"The BMA paper is not a comprehensive or balanced review of evidence. Its references have been accepted at face value even when the subject of published criticism or contradictory evidence. Some

of the facts on which the paper relies are simply wrong." (Bicycle Helmet Research Foundation, 2005).

This criticism could also be extended to the charities that show only pictures of helmeted cyclists (Marie Curie Cancer Care, 2007) in their publicity, and the very strong advice, almost insistence, that helmets be worn on their rides.

"Most serious injuries from cycling accidents are caused by falling on your head. We strongly recommend that you wear a properly fitted cycle helmet." (British Heart Foundation, undated)

The Department for Transport publishes much advice and exhortation to wear a cycle helmet, and the Highway Code says:

"These rules are in addition to those in the following sections, which apply to all vehicles..... 59 Clothing. You should wear

a cycle helmet which conforms to current regulations, is the correct size and securely fastened" (DfT, 2007)

The unwary might be forgiven for assuming that a "rule" in the Highway Code was just that, a rule, but this is not the case, it is advice only. The DfT also publishes helmet advice online exhorting the use of helmets, specifically their "Think!" campaign. The DfT publishes details of how successful that campaign has been in terms of messages remembered (Childwise, 2007) which shows clearly that such advertising has a significant effect in increasing cycle helmet wearing.

So the continued repetition of highly contentious and sometimes disproved "facts" contributes to the public perception of helmets, but simple denial of those facts is unlikely to change that perception.

Risk Compensation

Since helmets have no effect on deaths and injuries at a population level, but small scale research claims large benefits, there must be some mechanism to account for the difference. The most frequently proposed explanation is of risk compensation, the theory that people have a fixed level of perceived risk, and if that level is reduced, their behaviour will change to compensate.

The theory of risk compensation has been demonstrated a number of times in different situations, and now appears to be generally accepted, except in the case of cycle helmets. The theory of risk compensation is largely derived from road safety interventions which have had considerably less effect than that which was predicted, such as seat belts, motorcycle helmets and airbags.

There is considerable research to show that risk compensation exists, much of which is specific to road situations, and therefore demonstrates likely effect of helmet wearing on cyclists. In an examination of two fleets of taxis, one equipped with significant safety features and one without, greater risks were taken in the former group "Taxis with ABS had significantly shorter time headways than taxis without ABS." (Sagberg F et al, 1997)

"Mandatory wearing of seat belts reduces the likelihood of death or injury in case an accident happens, but does not reduce the death rate per capita." (Wilde GJS, 1998).

"... airbag equipped cars tend to be driven more aggressively and that aggressiveness appears to offset the effect of the airbag for the driver and increases the risk of death to others". (ibid)

"Cars outfitted with antilock brakes are driven faster, more carelessly, and closer to the car in front, braked more abruptly, and have no lower accident rate per hour of exposure than cars without these devices. Similarly, with better road lighting motorists drive faster and pay less attention." (ibid)

There is also research showing that risk compensation is not limited to road behaviour, but exists in other areas, such as children's play behaviour, and the acceptance of risk by their parents, which is relevant to the behaviour of both groups concerning cycling and cycle helmets.

"These data may reveal a compensatory mechanism by which parents escalate their threshold for acceptable risk behaviour in the presence of safety precautions for their children. Such tendencies have the potential to offset some of the protection provided by the use of safety equipment." (DiLillo D, Tremblay G, 2001).

Risk compensation was demonstrated in children running around an assault course "Results indicated that children went more quickly and behaved more recklessly when wearing safety gear than when not wearing gear, providing evidence of risk compensation." (Morrongiello BA et al, 2006). Helmets are particularly recommended for children by helmet proponents, and most children use their bicycles for play and it seems certain that risk compensation will take place.

Given that the evidence is so conflicting, but that the most reliable evidence shows that cycle helmets have no effect at a population level, risk compensation seems a reasonable explanation for the disparity between the predictions of case control studies and long term, whole population research. If cyclists think that helmets do have considerable effect, and they change their behaviour to maintain the same level of perceived risk, the actual risk will remain the same or will rise.

Risk compensation is not accepted by those who consider helmets to be effective, but they provide no reasonable explanation of why population figures show no benefit from cycle helmet laws, and the logic of their arguments is questionable. For example, Caroline Acton (1998) claims that cyclists' deaths would have remained the same even if a significant number of them gave up cycling because of the helmet law "In 1992, 198 cyclists in Australia died in bicycle crashes; the following three years this number fell by about 50 and increased to 161 in 1997. These annual figures would be similar from one year to the next had helmets deterred many cyclists from their ride." These figures appear consistent with a fall in cycling because of the helmet law, and risk compensation from those remaining cyclists. Risk compensation is dismissed in this article even though it has been demonstrated in many other facets of human behaviour.

There is also evidence that helmet wearers are more likely to be risk averse and to adopt less risky behaviour. In a survey in Oxford (McGuire L, Smith N, 2000) it was found that helmet wearers were more likely to use other safety measures. If those choosing not to wear helmets are more risk-taking, and are then forced to wear one by law, it seems likely that risk compensation would occur.

There is also evidence that other road users are prone to risk compensation concerning cycle helmets, with drivers passing closer to a cyclist wearing a helmet than one without. Ian Walker found that drivers passed closer to him when riding his bicycle when he was wearing a cycle helmet "Additionally, wearing a bicycle helmet led to traffic getting significantly closer when overtaking." (Walker I, 2007). If this kind of behaviour is exhibited by other road users in response to cyclists wearing helmets, it seems extremely unlikely that cyclists would not be similarly affected.

If risk compensation occurs as a result of helmet promotion material which exaggerates the effectiveness of helmets, that risk compensation would be similarly exaggerated.

Evidence from similar interventions

When cycle helmets are discussed, two other road safety interventions are often raised: laws for motorcycle helmets and seat belts, and large claims are made about their effectiveness. In fact, despite those large claims, neither was effective. Both of these cases mirror that of cycle helmets closely, with predictions of very large reductions in deaths made to support the introduction of a law, but in neither case can any such benefits be shown.

In the case of seat belts, the government of the time commissioned research into claims that they did not reduce deaths overall (Isles JE, 1981) which looked at data from eight countries with seat belt

laws and compared it with data from two countries without such laws. It was found that the main effect of seat belt laws was to increase the incidence of death and injury to vulnerable road users, cyclists and pedestrians. The author predicted an increase in the order of 11% for deaths. Other research showed that there was also an increase in killed and seriously injured (ksi) collisions for cyclists, of about 8% (Dulisse B, 1997), and an increase in deaths to rear seat passengers of 75 (West-Oram F,1990).

Supporters of the seat belt law have shown that there was a significant fall in ksi's to car drivers subsequent to the introduction of the law, but this fall is due to the introduction of a drink driving campaign and breath testing at the same time. The fall in ksi's to drivers occurred almost entirely between the hours of 10pm and 4am (Adams J, 1995) and it seems unlikely that seat belts were more effective during that time.

The claims made for seat belts are based on the similar evidence to that used for cycle helmets, with hospital based studies predominating, which show a reduction in ksi's, but whole population studies show no benefit.

The common perception is that motorcycle helmets have been successful in reducing ksi's to riders, but this is not true. In Taiwan, the introduction of a motorcycle helmet law resulted in a 14% decrease in overall fatalities, a 22% decrease in head injury fatalities and a rise in fatalities from other causes of 20% (Tsai M-C, Hemenway D, 1999). Non-fatal injuries fell by 31%, suggesting that there was a large fall in the amount of riding, much greater than the fall in overall fatalities. Despite the lack of data for exposure, in the form of distance travelled, and the probability that it had fallen considerably, Tsai and Hemenway conclude that "This study indicates that large, immediate public health benefits resulted from the mandatory motorcycle helmet law in Taiwan." (ibid). Given the likelihood of the fall in motorcycling and the lack of data for exposure, this conclusion is not justified.

Goldstein (1990) writing about research which claimed that states of the USA with helmet laws had a significantly lower death rate for motorcyclists than those without said "Once these factors are appropriately controlled for, no statistically significant differences in fatality rates across states with different helmet law coverage can be found."

When helmet wearing was enforced in a region of Italy, the level of Traumatic Brain Injury (TBI) admissions to hospital fell by 31.4%, but the number of registered motorcycles, used as an indicator of exposure, fell by 31.7% (Servadei F et al, 2003) so exposure fell more than the reduction in TBI. The conclusion that "The revised Italian mandatory helmet law, with police enforcement, is an effective measure for TBI prevention at all ages." seems unjustified.

A motorcycle helmet law was introduced in Spain in 1992, and when the effects were studied, it was found that there had been a reduction in deaths relative to exposure, but that the overall injury severity was higher after the law, indicating a risk compensation effect (Ferrando J et al, 2000).

Analysis of deaths vs exposure have shown that states, of the USA, which have motorcycle helmet laws do not have a better safety record than those without: “If we use the same statistics, but count fatality rates per 10,000 registered motorcycles rather than per all residents, one finds that helmet-law states actually suffered a higher average fatality rate (3.38 deaths per 10,000) than non-helmet-law states (3.05 deaths).” (Teresi D, 1999)

Summary

This chapter has shown that the risks of cycling are inherently low, and lower for distance travelled than walking.

The evidence for the benefits of cycle helmets is exaggerated.

Cycle helmet promotion is biased and likely to mislead, and it exaggerates the risks of cycling.

Risk compensation has occurred in other similar interventions, and it is a reasonable explanation for the failure of the predicted benefits of helmets to be observed.

Similar interventions have not been successful.

Chapter 3 – Methodology

Purpose of this chapter

Research Design

Sample Size

Questionnaire

Data Collection Procedure

Data Analysis

Summary

Purpose of this chapter

In the preceding chapters, the research hypotheses are proposed regarding the perceptions of cyclists about cycle helmets and the risks of cycling, and what influence that attitude is likely to have on their behaviour. This chapter will demonstrate the methodology applied to test the hypotheses, and it will detail research design, sampling procedure and data analysis.

Research design

The choice of data collection method was constrained by the type of research being undertaken, and an appropriate method had to be chosen to obtain the required information about attitudes. A survey was decided upon as the most suitable method for achieving the objective of collecting data about attitudes to cycling and cycle helmets. To gain more in depth information about attitudes than was possible with a simple questionnaire, it was decided to undertake a series of ten personal interviews.

Observational studies can study behaviour, but cannot be used to obtain information about attitudes, so a combination of surveys and interviews was used, to obtain both quantitative and qualitative data. The survey was designed to be both descriptive and relational, to describe attitudes about cycling and cycle helmets and to test any possible relationship between those attitudes. There was also a causal element, attempting to find out if respondents were influenced by publicity campaigns or articles and pictures featuring cyclists wearing cycle helmets or other information about helmets. The questionnaire was constructed to give the responses numerical values, or attributes, to variables about attitudes to cycle helmets and cycling, to make numerical analysis possible.

The questionnaire obtains information about cyclists' attitudes to cycling and cycle helmets through asking specific questions in a structured manner, in a way which made estimation of their attitudes measurable. It also allowed for any personal comments to be added, if the respondent so wished, and a considerable number of people did make such comments.

The personal interviews explored attitudes in a deeper way, discovering if there was a specific reason or incident which had caused the person to adopt a particular attitude. The interviews also attempted to discover the person's opinions and views of cycle helmets and the risks of cycling and whether those opinions and views were exaggerated or reasonable.

This dissertation aims to investigate cyclists' attitudes to cycle helmets and therefore the reliability and accuracy of the information about those attitudes is critical. Although both methods of data collection, surveys and interviews, have their drawbacks, the use of them in combination addresses these practically. The use of electronic questionnaires has similar problems to the use of paper-based questionnaires, reliability, validity, and sampling. This research used both methods, electronic and paper, and there was no perceptible difference in the results between them. Since all the people using the electronic questionnaire were computer literate and experienced, the electronic method did not appear to introduce any particular problems.

Sample Size

To obtain a reasonable sample size, previous research in this field was examined. In "An Investigation of Behavioural Adaptation to Airbags and Antilock Brakes among Taxi Drivers, Sagberg et al (1997) used 213 taxis. There were only 48 participants involved in Elliot & Shanahan's (1986) research into Australian schoolchildren's attitudes to cycle helmets, but this was over a narrower age range than that of this dissertation. In their research of 1989, Ferris et al surveyed 280 schoolchildren cyclists. Given these figures were seen as reasonable to make valid deductions, a minimum of 250 responses for the survey was taken to be a realistic minimum figure, and a minimum of eight interviews. In the event, the response rate was considerably better than expected, and over 300 questionnaires were completed and ten interviews were conducted.

Questionnaire (Appendix A)

The questionnaire consisted of a set of nine questions, starting with the simplest first, to encourage interaction and continued participation, and finishing with the more contentious and difficult to

answer ones. Each questionnaire could be numbered and the type of source identified i.e. whether it was from a club cyclist, council employee, Sustrans employee or child trainee.

The questionnaire was designed to be simple enough to be completed without difficulty by children, whilst still achieving meaningful results, and to avoid respondent fatigue by being overlong, and to achieve a high response rate. It was designed to be self-administered, and therefore had to be relatively easy to understand and complete. The questions were all multiple choice, making answering quick and easy. To gather deeper information about attitudes, respondents could if they wished make individual comments about their views on cycle helmets and the risks of cycling.

The questionnaire was developed over four iterations to find a good compromise between being easy to understand and quick to fill in, whilst still eliciting useful information. Each iteration was tested on a small group of people to validate the changes and improvements, and then retested until it was satisfactory.

The final version of the questionnaire was simple and quick to complete, and asked a number of questions about cycling, helmet-wearing and risk, which the interviews explored in greater depth, and they were completely anonymous.

Interviews

A standard text (Appendix B) was employed to try to ensure that the responses were comparable and relevant. The aim of the interview was to explore attitudes to cycle helmets and to risks of cycling in more depth than was possible in a simple survey. Respondents seemed to have no difficulty understanding the interview and its purpose, and most of them expressed their views in a clear manner, with more questions being asked to explore matters when clarification was useful.

The standard text was piloted three times and edited in the light of the responses, then retested each time until it was satisfactory.

Data Collection Procedure

Whilst it would be possible to randomly stop cyclists and ask them to fill in the questionnaire, this would have been impractical for several reasons; many of the cyclists would be on time-constrained utility journeys, and therefore unwilling to participate, and stopping and questioning child cyclists would have been fraught with ethical difficulties. Those who did stop and agree to fill in the questionnaire would be a self selecting group with sufficient time to participate, and therefore this method could introduce a sampling bias. A method was therefore devised which, although not

strictly random, especially in the case of the electronic responses, nevertheless ensured a wide distribution of responses.

The questionnaires were distributed to cyclists, and some others, mainly in Bristol, with the aim of reaching many different types and ages of cyclist, to achieve as broad a spread of views as possible, including members of Sustrans, Bristol City Council and the National Travelwise Association.

Bristol is the headquarters of Sustrans, the engineering charity constructing the National Cycle Network, and many of its employees are cyclists. Bristol City Council has policies to encourage cycling, and many of its employees commute by bicycle, and they are encouraged to use bicycles for short trips around the city for work, rather than drive. The National Travelwise Association, an organisation which, amongst other things, encourages cycling for commuting, held its Annual General Meeting during the period of this research, and many delegates completed questionnaires, and this gives the data a geographical spread for the entire country, and all of the respondents from the AGM were cyclists. The Road Safety section of Bristol City Council undertakes training of child cyclists, and the trainers were asked to hand out questionnaires at training sessions during the relevant period, gaining the views of younger cyclists who had just undergone official training. Bristol and other local authorities in the area run cycle forums, where cyclists can pass on their concerns to local authority officers, and these cyclists are mainly mature and informed, and they were also asked to fill in questionnaires.

The questionnaires were handed out on cycle club rides, at local authority cycle related meetings, to children undergoing cycle training, to employees of Sustrans in Bristol, to members of the National Travelwise Association, and electronically via the internal email system to employees of Bristol City Council. A total of over three hundred were completed and returned, almost all from cyclists, and almost all of them were valid. The response rate for the printed questionnaires was extremely high, with almost all (99%) responding, perhaps indicating the interest in the subject. The printed questionnaires comprised over 55% of the responses, with the other 45% being electronic through Bristol City Council.

Whilst the selection of respondents was not completely random, the high response rate from the printed questionnaires and the broad range of age and type of cyclist, suggests that the data is likely to be valid. The printed questionnaires were handed out personally, and almost all were completed there and then, with almost no queries about how to complete it, indicating that it was clear and easy to fill out. The responses from club cyclists and Sustrans employees may be biased because these people could be expected to be better informed about the risks of cycling and the effectiveness

of cycle helmets than the general public, and therefore more likely to be sceptical of the claims for the effectiveness of helmets, and to have a realistic appreciation of the risks of cycling.

The electronic responses may have been biased because they were self-selecting within the group of Bristol City Council employees, and it seems likely that most of these respondents were convinced of the effectiveness of helmets, and that the non-responders had no strong opinion either way. Without conducting a survey of the number of cyclists working for Bristol City Council, it is impossible to estimate the non-response rate for the electronic responses. Nevertheless, the number of these responses, 134, indicates that a considerable number of cyclists were interested enough to respond, and therefore indicates how strongly held are their opinions. This possible bias would offset the possible bias in the responses from club cyclists and Sustrans employees, but it is impossible to estimate to what extent.

A number of returned questionnaires had unanswered questions, with the most common unanswered question being about the speed at which helmets are effective, with 39 non-responses, but almost all respondents answered the questions about the risks of cycling and the efficacy of cycle helmets. The different distribution methods attempted to cover a broad range of cyclists, from the enthusiastic club cyclist to young novice children, from cyclists who were informed transport professionals to those ignorant of transport risks. The procedure did achieve responses from a very wide age range, from children to old age pensioners, and it reached many different types of cyclist, from club cyclists riding every day, to those who rode less than once a week, from utility road-riders, to those who rode only for leisure on cycle routes.

No inducements were used to obtain responses, and the response rate indicates the interest in the subject, with many people requesting that an abstract of the results be sent to them. A significant minority of the respondents were self-selecting, which may have led to some bias in the results, with those having fixed ideas and considering helmets to be effective being more likely to respond. But since a significant proportion of cyclists in Bristol wear helmets, approximately 50% of commuter cyclists by observation, this is not out of line with the real world and should not significantly bias the results.

Under the circumstances, the method of distribution may have led to some bias, but was a reasonable method of obtaining data without an extended project to stop and interrogate cyclists, which would have created its own problems of bias, or to develop some other method which would ensure completely unbiased results.

The questionnaires were distributed in an eight week period from mid-September to mid-November 2007, and responses were numbered and the organisation of the respondent was noted.

Three local schools were approached to take part, but all declined due to pressure of the syllabus, which has led to very few respondents of secondary school age taking part.

For the interviews, ten employees of Bristol City Council were randomly selected from the considerable number, 27, who volunteered, and all but one was a regular cyclist who used their bicycles for commuting. The exception was a leisure cyclist, who used his bicycle for mountain bike riding, and rode on the highway only to get to wherever those rides started. Each interview was tape-recorded and then transcribed, and edited to remove irrelevancies whilst retaining the sense and meaning, and then examined for common themes. The ages of the interviewees varied from 27 to 62, with most between the ages of 30 and 50.

Interviewees were first asked simple, easy to answer questions, to allow them to relax and become familiar with the process, before moving on to the questions which were more important to the research. They were asked about what might have formed their attitudes, whether it be an individual incident, peer pressure or conforming to the group stereotypes. The interview situation made it possible to follow up in more detail when the interviewee expressed opinions about cycle helmets and to attempt to discover what had formed those opinions.

Again, no inducements were offered to take part in the interviews, and the interviewee did incur some time penalty for the interview, but the number volunteering demonstrates the interest in the subject of cycle helmets. Nine of the ten interviewees expressed an interest in seeing the final report.

Data Analysis

A fairly simple analysis was undertaken, using a spreadsheet. Having seen so many examples of errors in sophisticated statistical analysis in the literature relating to cycle helmets which failed to account for confounding factors or were simply incorrect, no such sophisticated analysis was undertaken.

The data analysis first examined the basic data, which was presented in table form, then compared various responses and investigated possible links between different responses, including age, helmet-wearing and attitude to helmet effectiveness. Possible relationships between responses to

the different questions were tested, with special attention given to possible relationships between attitudes to risks of cycling and helmet wearing.

The basic responses to each question were examined first, with simple data such as the spread of ages, to find out if there was a particular bias in the age ranges. Whether the respondent rode on the highway was examined as this was likely to affect helmet wearing, followed by the data on helmet wearing whilst riding on the road. The data about how many days per week the respondents rode their bicycles was tabulated to show the relative proportions of weekly trips. Question 5 gave data about whether the cyclists also drove cars, allowing comparison of helmet wearing with those who did not drive. Results from question 6, comparing the risks of cycling and walking for the same trip, were tabulated to show what percentage of people considered cycling more dangerous than walking. The most important question for this research was question 7, asking whether cycle helmets prevented death or serious injury, and these results were tabulated to demonstrate the proportions of people's opinions. A table was also produced for question 8, which demonstrated the proportion of opinions about what speed helmets are effective at, and finally, the responses from question 9, about the individual's source of information about helmets, were tabulated.

Following on from the examination and tabulation of the basic data, a number of graphs were constructed to demonstrate the relationships between data from different questions, in the form of bar charts. The aim of producing these charts was to visually demonstrate possible relationships between various different opinions and behaviours of the respondents.

The relationships examined focussed on attitudes and opinions of the effectiveness of helmets and various other factors, such as age, frequency of riding and whether the respondent drove a motor vehicle.

Of particular interest was the relationship between the perceived risks of cycling and effectiveness of helmets, since most publicity concerning cycle helmets tends to exaggerate both. Many other possible relationships were explored in this manner, with a particular interest in discovering whether there was any relationship between the opinions of the effectiveness of helmets and other factors, which might relate to the exposure to helmet publicity e.g. helmet-wearing vs age.

The interviews were examined for common themes and responses, relative to the hypotheses on attitudes to risks of cycling and cycle helmets. They were also examined to discover whether Prospect Theory applied to choice of riding with or without a helmet.

Summary

The adoption of a suitable technique for this investigation has been described, survey and interviews, together with how the questionnaire and interviews were refined through iteration.

The methods of data gathering, questionnaires and interviews, and of data analysis, have been described. The questionnaires were deliberately simple and unambiguous, dictating that the analysis would also be relatively simple.

Possible sources of bias in the data-gathering have been discussed, and how they might have affected the results, but the data is considered to be a reasonable picture of the population of cyclists in Bristol.

For deeper understanding of cyclists' attitudes, the interviews were undertaken, and the method for this process was described.

Chapter 4 - Results and Analysis

Introduction

Survey results

Interview results

Questionnaire analysis

Interview analysis

Summary

Introduction

The previous chapter detailed the methodology used in collecting data. This chapter presents the results and analysis of that data. The basic responses are examined first, then relationships between different sets of data.

Survey results

The basic responses from the surveys are given below.

Q1. Age

The age profile of the 294 respondents who gave their age is shown in table 4.1

Age range	No of respondents	%
0-11	22	7.5
11-16	11	3.8
17-21	3	1
22-30	63	21.4
31-40	69	23.5
41-50	62	21
51-60	50	17
60+	14	4.8
Total	294	100

Table 4.10 – Age of respondents

It is clear that there are fewer respondents in the younger age ranges, reflecting the difficulty of gaining the cooperation of local schools for the project. Nevertheless, there is a sufficient number (33, 11%) below the age of 16 to be useful. The majority of respondents (258, 88%) were between the ages of 22 and 60, probably reflecting the age group which are regular or fairly regular cyclists.

Q2. Do you ride a bicycle on the road?

Of the 300 who responded this question, 262 responded yes, and 38 responded no. The majority of the latter were young children who may have been prevented from riding on the road by their parents.

Ride on Road	No of respondents	%
Yes	262	87.3
No	38	12.7
Total	300	100

Table 4.11 – Ride on the road.

Q3. If you ride a bicycle on the road, do you wear a helmet?

Wear Helmet	No of respondents	%
Yes	148	55.7
No	79	29.7
Sometimes	39	14.6
Total	266	100

Table 4.12 – Helmet wearing whilst riding on the road.

This shows that the majority of respondents do wear a helmet when riding on the road, which is more than would be expected from recent published statistics about the numbers of cyclists wearing helmets (McGarry T & Sheldon A, 2008). This probably demonstrates that many of the people who responded had firm views about helmets and were more likely to respond.

Q4. If you ride a bicycle, approximately how many days a week do you do so?

No of days/week	No of respondents	%
0	17	6.1
1	66	23.9
2	28	10.1
3	26	9.4
4	25	9
5	48	17.3
6	33	11.9
7	34	12.3
Total	277	100

Table 4.13 – Frequency of riding

Although the largest single response was for riding only one day per week, the majority of respondents, 60%, rode three days a week or more. The next largest response was for five days per week, indicating that this mode of transport was used for commuting.

Q5. Do you drive a car?

Drive	No of respondents	%
Yes	206	79
No	54	21
Total	260	100

Table 4.14 – Car driving

It can be seen that the vast majority of cyclists also drive cars, indicating that although their journeys may have been made by car, they choose to ride a bicycle instead. These figures exclude responses from those sixteen years old or younger.

Q6. It is more dangerous to make the same trip by cycling rather than walking

Disagree /agree	No of respondents	%
Strongly agree	62	21.2
agree	84	28.8
neutral	78	26.7
disagree	47	16.1
Strongly disagree	21	7.2
Total	292	100

Table 4.15 - Cycling more/less dangerous than walking

Whilst a considerable number of people thought that cycling and walking the same trip posed a similar risk, more than twice as many,146, considered cycling to be more dangerous than those who thought it less dangerous, 68. For distance travelled, the risk of cycling is similar, or slightly lower, than for walking (DfT, 2007).

Q7. Cycle helmets prevent death and serious injury

Disagree /agree	No of respondents	%
Strongly agree	113	40.2
agree	59	21
neutral	72	25.6
disagree	19	6.8
Strongly disagree	18	6.4
Total	281	100

Table 4.16 - Cycle helmets prevent death and serious injury

This table clearly shows that the majority of respondents (172, 61.2%) consider that cycle helmets are effective at preventing death and serious injury, whilst a very small minority (37, 13.2%) are of the opposite opinion.

Q8. If cycle helmets do prevent death and serious injury, up to what collision speed?

Speed mph	No of respondents	%
10	54	20.8
20	93	35.9
30	81	31.3
40	21	8.1
50	2	0.8
60	8	3.1
Total	259	100

Table 4.17 - Speed that cycle helmets prevent death and serious injury

Cycle helmets are tested at an effective speed of approximately 12mph, at which they may be effective at reducing acceleration forces to less than that considered fatal. Collision speeds above this would be beyond the mechanical capacity of the helmet, and therefore unlikely to provide effective protection. It is noteworthy that almost 80% of respondents considered that helmets provided protection at speeds higher than this.

Q9. Where did you get your information about cycle helmets and their effect on safety?

Source	No of respondents	%
BHIT	6	1.4
Teacher	20	4.7
Family	73	17
Friends	15	3.5
Highway Code	22	5.2
Trainer	9	2.1
DfT	16	3.8
Magazine	39	9.2
Newspaper	28	6.6
Other Cyclists	80	19
Cycle shop	29	6.9
Other	85	20
Total	422	

Table 4.18 - Information source about helmets

Since the respondents could select multiple answers, there are more than 300 responses to this question. It is worth noting that the majority of respondents selected answers which indicated that they received their information from other people, either family, friends or other cyclists. This indicates that a perception which has been accepted by some people, is repeated and accepted as fact by others.

More detailed analysis of the survey data follows later in this chapter.

Interview results

The interviews, a total of ten, provided more and deeper information about cyclists' attitudes to cycle helmets and safety, and were particularly useful regarding prospect theory. Most of the cyclists were long term utility cyclists, and most of them were involved with transport as part of their jobs, and might therefore have been expected to have considerable knowledge of the issues. Of the ten, five regularly wore helmets, and the other five did not.

Interviews will be discussed and analysed in more detail later in this chapter.

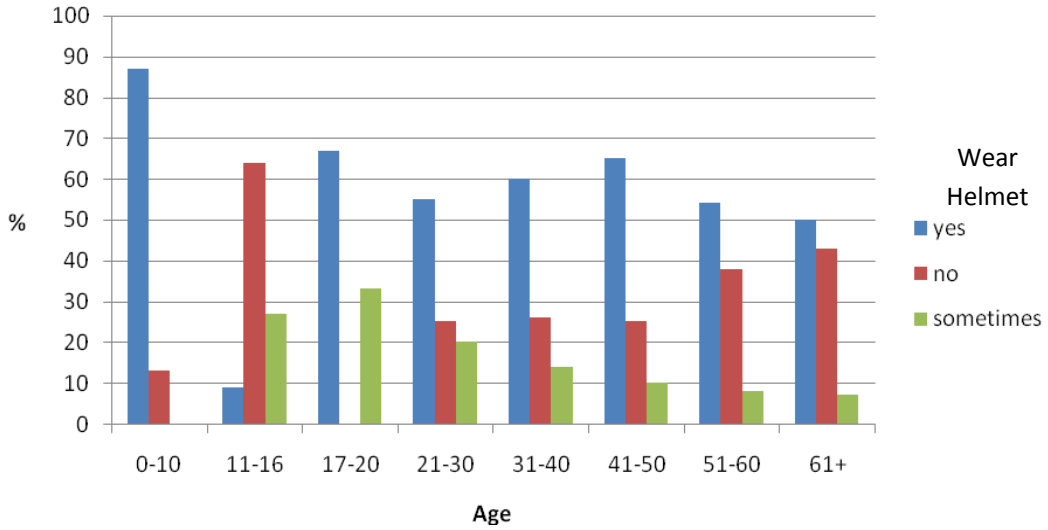
Analysis

From the basic data of the surveys, a number of useful comparisons can be made about the relationships between attitudes about helmets and other factors, and this section will explore those relationships.

Age and helmet-wearing.

Age	wear helmet			Total	Wear	Doesn't wear	Wear Some-times
	yes	no	sometimes				
0-10	20	3	0	23	87%	13%	0%
11-16	1	7	3	11	9%	64%	27%
17-20	2	0	1	3	67%	0%	33%
21-30	22	10	8	40	55%	25%	20%
31-40	30	13	7	50	60%	26%	14%
41-50	31	12	5	48	65%	25%	10%
51-60	21	15	3	39	54%	38%	8%
61+	7	6	1	14	50%	43%	7%
Total	134	66	28	228			
	59%	29%	12%				

Table 4.19 Age vs Helmet-wearing



Graph 4.10 – Age vs % Helmet-wearing N.B. % refers to that age group only.

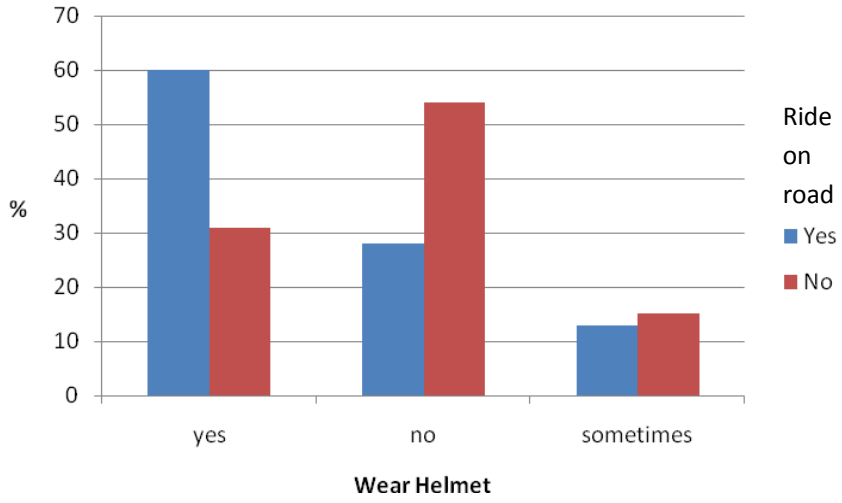
It can be seen that helmet-wearing is most common in the lowest age group, and this is probably due to parental compulsion. The total number of respondents between the ages of 11 and 20 means that any analysis of these figures is questionable, but the low figure of helmet wearing in this group may be due to adolescent rebellion. For the older groups, the percentage of helmet-wearing is between 50% and 65%. This is somewhat higher than the population as a whole and may well demonstrate that the respondents were self-selecting by helmet-wearing attitude, and that those with no particular views were less likely to respond.

The number of respondents who definitely did not wear a helmet rose considerably with age, from 25% between 21-30 years old, to 43% of over 61 years old. This is most likely due to the fact that the older cyclists have been cycling regularly for most of their life without a helmet and can see no need for one, compared to younger people who are more likely to be influenced by their peers and advertising of helmets.

Ride on the road Vs wear a helmet.

Ride on Road	**wear helmet**			**Total**	**wear helmet %**		
	yes	no	sometimes		yes	no	sometimes
Yes	128	59	27	214	60	28	13
No	4	7	2	13	31	54	15
Total	132	66	29				

Table 4.20 Ride on road vs helmet-wearing



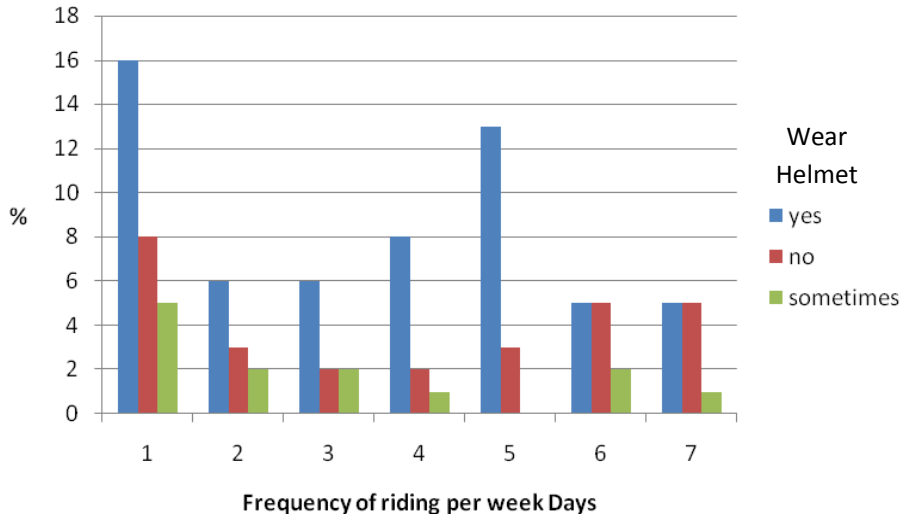
Graph 4.11 - Ride on road vs helmet-wearing

In this sample, it is clear that the majority of people who ride on the road always wear a helmet, probably because they fear of being struck by a vehicle, but this is where a cycle helmet is least likely to be effective. This is confirmed by the numbers who do not wear a helmet when riding off-road, where a helmet is much more likely to be effective, although the numbers are small, so this is not conclusive. Some of those who ride off-road will be engaged in sporting mountain biking, where a helmet is de rigeur, so the numbers for helmet-wearing off-road will be higher than for those doing utility or leisure trips off-road. Note that this graph shows percentages, and the actual numbers of those not riding on the road are relatively small.

Frequency of riding and helmet-wearing

Frequency of riding per week	Wear helmet			Total	Wear helmet%		
	yes	no	sometimes		yes	no	sometimes
1	35	17	10	62	16	8	5
2	14	6	4	24	6	3	2
3	14	5	4	23	6	2	2
4	18	4	3	25	8	2	1
5	28	6	1	35	13	3	0
6	10	12	4	26	5	5	2
7	10	12	2	24	5	5	1
Total	129	62	28	219			

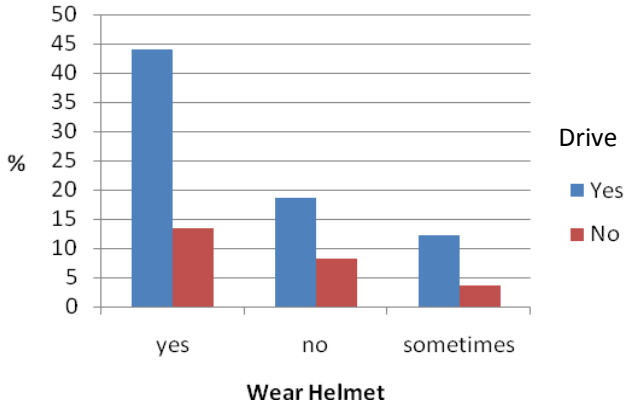
Table 4.21 – Frequency of riding vs helmet-wearing



Graph 4.12 – Frequency of riding vs helmet-wearing

It can be seen from the above graph that people who ride up to five days per week are more likely to wear helmets, but that those who ride six or seven days a week are less likely to wear one. This appears to be perverse, as it might be assumed that helmet-wearing would increase with frequency of riding, but it may be that those who ride most frequently are members of cycling clubs, and are therefore better informed about the risks of cycling and the protection afforded by helmets. In fact, 79 of the respondents were members of cycling organisations, and 56% of them wore helmets, identical to the overall percentage.

Driving and helmet-wearing



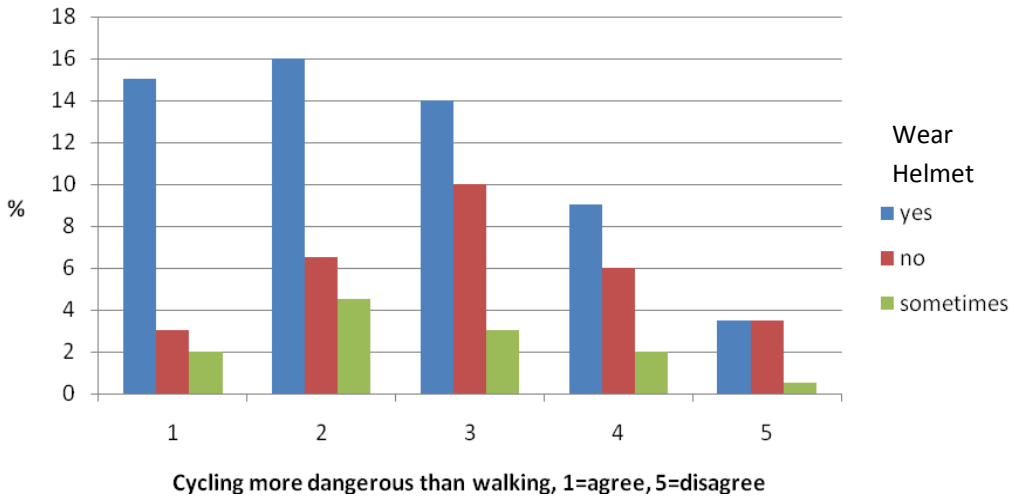
Graph 4.13 – Driving vs Helmet-wearing

This graph shows an interesting relationship: those people who drive and cycle are more likely to wear a helmet than those who do not drive, although why this should be so is a matter for speculation. It may be that they have a greater appreciation of the dangers caused by cars to cyclists, or perhaps that they know as drivers how difficult it can be to see a cyclist.

Cycling more dangerous than walking

1=Strongly agree 5=Strongly disagree	Wear helmet			
	yes	no	sometimes	total
1	35	7	5	47
2	37	15	10	62
3	31	22	7	60
4	20	13	5	38
5	8	8	1	17
Total	133	66	28	227

Table 4.22 – Cycling more dangerous than walking vs helmet-wearing



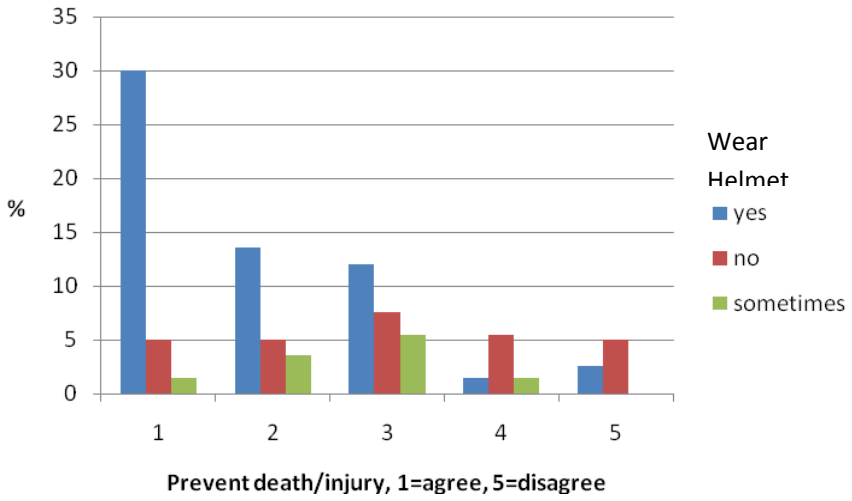
Graph 4.14 – Cycling more dangerous than walking vs helmet-wearing

The above graph clearly demonstrates that many more people who wear helmets consider that cycling is more dangerous than walking for the same trip. As the response changes from more to less dangerous, the level of helmet wearing falls.

Cycle helmets prevent death and serious injury

1=strongly agree, 5=strongly disagree	wear helmet			
	yes	no	sometimes	total
1	68	11	3	82
2	31	11	8	50
3	27	17	13	57
4	3	13	4	20
5	6	12	0	18
Total	135	66	29	230

Table 4.23 – Cycle helmets prevent death and serious injury vs helmet wearing



Graph 4.15 – Cycle helmets prevent death and serious injury vs helmet wearing

This is the most interesting of the results, as it most accurately shows the attitudes of cyclists about cycle helmets. It is clear from this chart and the preceding table, that those who wear helmets consider that helmets are effective in preventing death and serious injury, and that those who chose not to wear one are more likely to consider them ineffective. Whilst that is hardly surprising, the figures shown some interesting anomalies, with six people considering that helmets did not prevent death/serious injury nevertheless choosing to wear one, and 11 people who did consider them effective electing not to wear one. What is clear is that the majority, 57%, of people who wear a

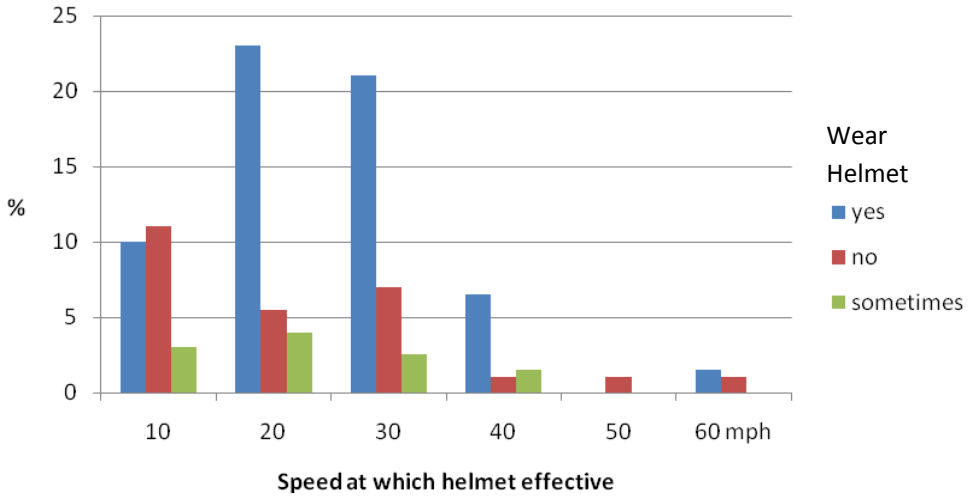
helmet consider them to be effective at preventing death or serious injury, with over 35% strongly agreeing that they did so.

Given that the most reliable data about cycle helmets shows that they have no effect on death and serious injury, this shows clearly that the majority of cyclists in this research have an exaggerated opinion of the effectiveness of helmets. In absolute terms, 132 people agreed or strongly agreed that helmets were effective in preventing death or serious injury, from a total of 230.

Speed at which helmets effective

Helmets effective at what speed mph	wear helmet			
	yes	no	sometimes	total
10	20	22	6	48
20	46	11	8	65
30	42	14	5	61
40	13	2	3	18
50	0	2	0	2
60	3	2	0	5
Total	124	53	22	199

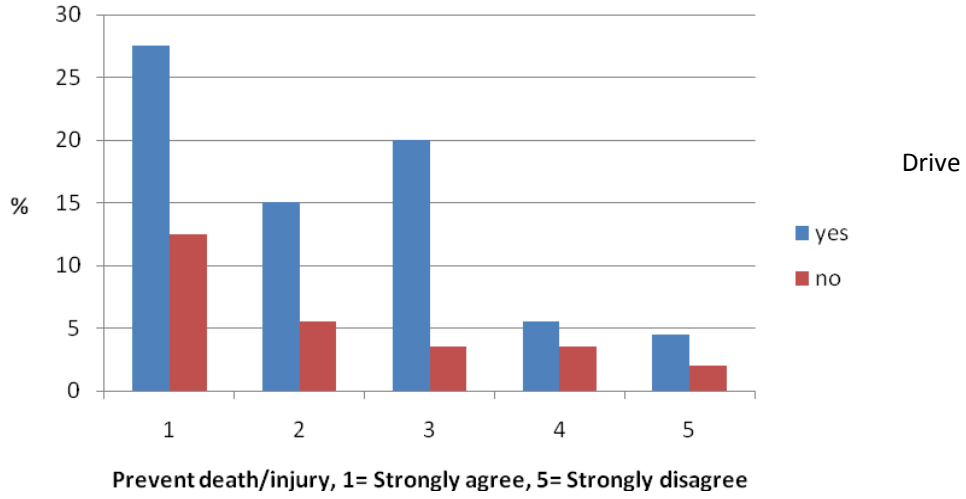
Table 4.24 – Speed at which helmets are effective at preventing death and serious injury



Graph 4.16 – Speed at which helmets are effective vs helmet wearing

The table and the graph show clearly that the majority, 76%, of cyclists consider that a cycle helmet will prevent death and serious injury at speeds up to 30mph. The current testing regime of helmets, to EU1078 standard, is most nearly related to 10mph, so this clearly demonstrates that the majority of cyclists have an exaggerated view of the efficacy of cycle helmets. However, it is worth noting that of the total number of surveys received, 300, only 199 people answered this question, so a significant minority, including some who stated that helmets were not effective at any speed, did not respond.

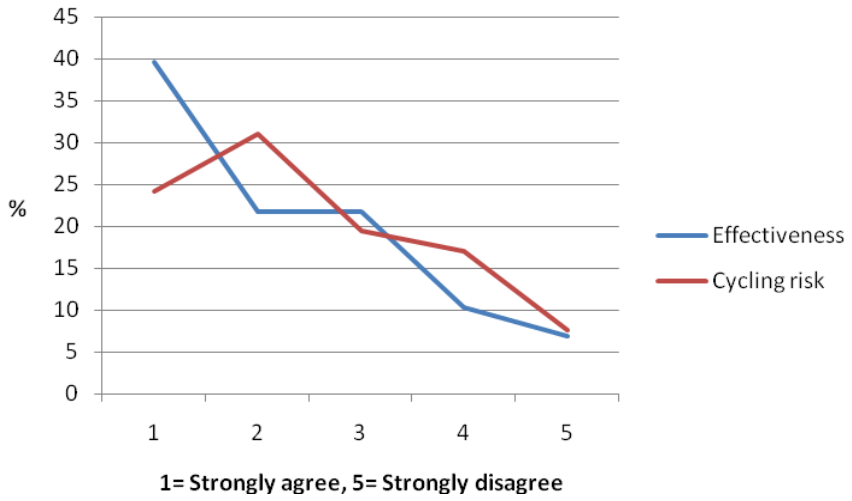
Driving and helmet effectiveness



Graph 4.17 – Helmets prevent death/serious injury vs driving

This graph reinforces the evidence from graph 4.14, which showed that people who drove were more likely to wear a helmet when cycling, and it shows that people who drive are more likely to believe that cycle helmets are effective at preventing death and serious injury. This result confirms other research, which found that drivers tended to drive closer to cyclists who were wearing a helmet (Walker I, 2007). Of the 26 drivers who do not ride a bicycle on the road, 19 strongly agreed that helmets prevented death and serious injury. The fact that they chose not to ride on the road may indicate that they are risk averse and therefore more likely to use safety equipment and they could also be off-road leisure cyclists.

Comparing attitudes about helmet effectiveness with cycling more dangerous than walking

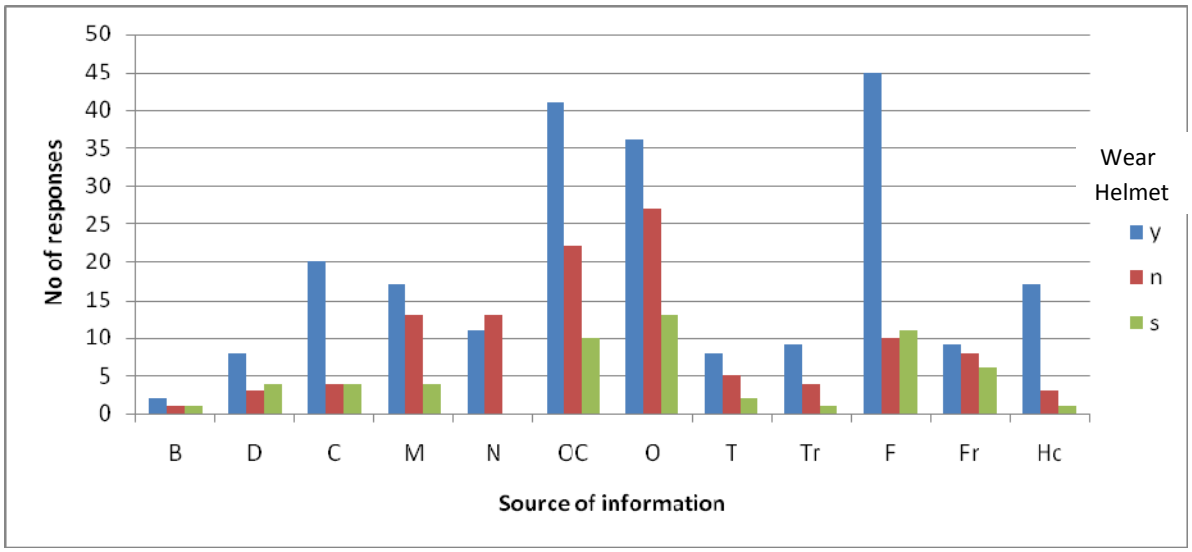


Graph 4.18 – comparing attitudes about helmet effectiveness and the risks of cycling

This graph compares the data on how risky people consider cycling compared to walking, and how effective they think helmets are. It clearly indicates that those people who think that cycling is more dangerous than walking also tend to consider helmets to be more effective. Although it cannot be proved by these figures, it may be that these responses are at least in part due to the type of advertising used by DfT and others, about cycle helmets, which portray cycling as dangerous and helmets as extremely effective.

Source of information

The wide number of possible answers and the ability to select more than one makes it difficult to draw firm conclusions from this data.



Code	B	D	C	M	N	OC	O	T	Tr	F	Fr	Hc
Source	Bicycle Helmet Initiative Trust	DfT	Cycle shop	Maga-zine	Newspaper	Other cyclist	Other	Teacher	Trainer	Family	Friends	High-way code

Graph 4.19 – Source of information about cycle helmets

However, it is obvious that most people get their information from other people, whether that be other cyclists, family or friends. In only one case, that of people who said that they obtained their information from a newspaper, did the number of unhelmeted cyclists outnumber those wearing a helmet. Apart from the sources "other cyclists" and "family" none of the other categories was of sufficient size to be meaningful. Of some interest is the category "other" in which the most frequent responses were "guessed", "intuition" and "common sense". There were many who responded "other" who had read research about helmets and were not convinced of their effectiveness, and this would explain the high number of this group which does not wear helmets.

Interviews and Prospect Theory

A total of ten interviews were conducted, with employees of Bristol City Council, all of whom were cyclists, and most of them were regular utility cyclists, using their bicycles for daily commuting. The interviews were examined from the point of view of Prospect Theory, to see if it applied.

Many of the most common perceptions about cycling were repeated by each respondent, and many of the arguments made about helmets were reflected in them, including:

- Vanity – messes up your hair
- Peer pressure
- Mandating for children
- Other safety measures more effective
- Other road users suffer similar injury rates
- Risk compensation
- Helmet advertising
- Inconvenience, storage
- May change attitudes of other road users
- Effectiveness
- Inconclusive evidence
- Not useful in collisions with motor vehicles
- Low risk of head injury
- Low likelihood of helmet being effective
- Wear for higher risk journeys
- Better visibility for other road users
- Habit
- Individual experience
- Promotion but not compulsion
- Compulsion would deter cycling
- Helmets causing injury
- Propaganda influence
- Transfer from mountain biking
- Helmets don't prevent collisions
- Helmets don't protect rest of body
- Spoils cycling experience
- Individual decision

- Parents seeing them as panacea
- Only prevent minor injuries
- Cycling isn't dangerous

The behaviours demonstrated and the choices made were mainly consistent with the Prospect Theory (PT). The Prospect Theory assigns greater value to losses than gains, but several of the interviewees recognised the possibility of a collision causing serious injury or death, and did not wear a helmet. This is explained by the fact that they did not consider a helmet to be effective in preventing such an outcome, and it would not prevent loss. Several interviewees recognised that helmets may be effective in preventing minor injuries, but considered the inconvenience of carrying and wearing a helmet to outweigh the benefits of preventing such an unlikely occurrence. The interviewees who evinced this attitude also proposed risk compensation, and that it was better to prevent a collision by being more aware than to ameliorate the effects of a collision caused by a reduced level of awareness.

Prospect Theory also suggests that people exaggerate small risks, and adjust their behaviour accordingly, and it could be said that the five helmet wearers demonstrated this behaviour, having acknowledged that helmets were of limited effectiveness. However, this was not demonstrated by several of the interviewees, who realised that a helmet may have a beneficial effect in a tiny minority of collisions, but still chose not to wear one. The interviewees in these cases believed that the health benefits of cycling considerably outweighed the extremely small risk of death or injury.

The further development of Prospect Theory, Cumulative Prospect Theory, proposes that people overweight extremely unlikely events, but underweight "average" events, but this does not seem to explain the observed attitudes of some of the interviewees. They correctly identified and gave reasonable value to the extremely unlikely event of them being killed or seriously injured, and gave higher value to the much more likely outcome of better health.

Prospect theory was developed as a method of explaining behaviour in taking economic decisions, and it may be that it is not completely applicable to situations where the decisions to be taken are not strictly economic, but involve other, less quantifiable factors.

It was also notable that most interviewees had a realistic view of the risks of cycling, but this may have been a reflection of their professional interest in transport.

Summary

The results show a broad response from all ages except for secondary schoolchildren, and the number of responses indicates that the results are likely to be valid. The proportion of respondents who wore helmets is greater than current population wearing rates would suggest, indicating some self-selection in the responses.

There was a broad range of cyclists, from those who use bicycles for leisure to those who use it for utility and have no other vehicle.

Responses for some questions were lower than for others, especially for the effectiveness of helmets and at what speed they were effective, indicating a lack of knowledge in the general population.

The analysis showed that helmet-wearing falls with age, that most helmet wearers are concerned about the danger from traffic and fewer people wear one off-road. It also showed that people who drive are more likely to wear a helmet when cycling.

A majority of people have an exaggerated perception of both the risks of cycling and the effectiveness of cycle helmets.

People who consider cycling to be more dangerous than walking for the same trip are more likely to consider helmets to be effective and to wear one, indicating that helmet promotional material which exaggerates both the effectiveness of helmets and the risks of cycling, is effective.

People who consider that helmets are effective are much more likely to wear one, and drivers are more likely to consider helmets effective.

No conclusions can be reached about the source of information about cycle helmets, but the misperceptions of cycling risk and the effectiveness of helmets indicates that helmet promotion material is likely to the ultimate source of those views. Such views will be absorbed by some people and then repeated to family and friends.

Chapter 5 - Discussion and Interpretation

Introduction

Are the hypotheses proven?

Why do cyclists have those views?

Effects of helmet promotion and laws

Benefits of changing cyclists' views

How can those views be changed?

What public policies are affected?

Comparison to related research and policies

Possible courses of action

Summary

Introduction

This chapter examines whether the three hypotheses are supported, and the results of the research are discussed and compared to relevant previous research, to find whether those results are reasonable and valid. Reasons why hypotheses are or are not supported are suggested and discussed.

The likely effects of helmet promotion are discussed, in particular whether this has a positive or negative effect on public health. The benefits of cycling are examined, and the likely results of cyclists having an exaggerated view of helmets and the risks of cycling.

The problem of how to change the widely held view that helmets are effective is also examined, and the problem of "persistence of myths".

Are the hypotheses proven?

To restate the hypotheses:
Hypothesis one: that most cyclists have an exaggerated view of the efficacy of cycle helmets.
Null hypothesis one: that most cyclists have a realistic view of the efficacy of cycle helmets.
Hypothesis two: that most cyclists have an exaggerated view of the risks of cycling.
Null hypothesis two: that most cyclists have a realistic view of the risks of cycling.
Hypothesis three: that hypotheses one and two are related.
Null hypothesis three: that hypotheses one and two are not related.

It is clear from the results in the previous chapter that hypothesis one is proved, and that most cyclists do have an exaggerated view of the efficacy of cycle helmets, ascribing to them protective effects which far exceed their capabilities. Over 57% of cyclists agreed that helmets prevented death or serious injury, and 35% strongly agreeing that they did so (Graph 4.16). As discussed in the chapter on Literature Review, all of the most reliable, long term, whole population evidence clearly and consistently shows that cycle helmets have no effect on death and serious injury.

Hypothesis two is similarly proved, with many cyclists having a view of the risks of cycling which far outweigh the real level of risk, and approximately 42% of cyclists agreed that the same journey was more dangerous by bicycle than by walking, with 20% strongly agreeing (Graph 4.15). For distance travelled, cycling is slightly less risky than walking (DfT, 2007a).

From the research (Graph 4.18) there would appear to be an association between hypotheses one and two, and that cyclists who have an exaggerated view of the risks of cycling also have an exaggerated view of the efficacy of cycle helmets, and therefore hypothesis three appears true also.

Why do cyclists have those views?

In countries where cycling is a normal everyday activity, it is seen as perfectly safe and does not require any special protective equipment. Anyone who has visited Denmark or Holland will immediately be aware of the vast numbers of cyclists, very few of whom have helmets, so why do so many cyclists and other people in the UK and elsewhere, have the views that cycling is dangerous and a cycle helmet is essential?

As shown in the chapter on Literature Review, there is an extensive and long term, covert and overt, publicity drive in the UK and some other countries to make cyclists wear helmets. This publicity exaggerates both the dangers of cycling and the efficacy of cycle helmets, and it is inevitable that this has this had an effect on the views of cyclists and others. Many people consider that they are unaffected by advertising, but such a long term, insidious advertising campaign will undoubtedly affect a considerable number of people, and Cycling England (2007) make that point “Within our own remit, we estimate that overstated safety fears have significantly contributed to a fifty per cent decrease in young people’s cycling over a space of a generation...”

It would appear that the helmet proponents have, not unnaturally perhaps, adopted the principles of the market place, by first creating a need for protection by peddling the myth that cycling is especially dangerous, and then fulfilling that need by providing helmets. The helmet manufacturers of course, can do no such thing, as this would fall foul of advertising regulations, and it seems

particularly perverse that helmet promoters are allowed to make statements that a seller cannot, and very effectively sell the product for them.

Whilst some cyclists are aware of the limitations of helmets and have a realistic evaluation of the dangers of cycling, many appear to have been influenced by the advertising in all forms of media. The message that a cycle helmet is essential is pervasive and widespread, overt and covert, and is long term, and it is therefore hardly surprising that it appears to be effective.

Whilst it is true that many cyclists have an exaggerated view of both the risks of cycling and the efficacy of helmets, there were significant minorities who had a realistic appreciation of both. These tended to be keen cyclists, who used their cycle for transport and leisure, and were interested enough to have examined at least some of the evidence about helmets. It seems that most people who had not examined independent evidence, but had only been exposed to advertising and reporting in the popular media, were likely to have an exaggerated opinion. It therefore seems likely that the helmet campaigns, exaggerating the dangers of cycling and the effectiveness of helmets, and the general portrayal in the media of helmeted cyclists, have been effective.

A further point is that research which proposes helmet promotion or laws receives widespread media attention, but refutations of that research do not receive the same, or even any such attention. The case of Cook and Sheikh (2003) who proposed that cycle helmets should be made mandatory on the basis of flawed use of statistics is one such, and it received considerable publicity at the time, but the fact that their analysis was incorrect received almost none. The BBC website report is typical (BBC, 2004) accepting as valid figures which were highly contentious and wrong, with no subsequent reporting of the fact that the figures were not correct. The research has also been widely reported in the medical and health press, and although the errors have been publicised in some of them (Injury Prevention, 2004) others appear not to have published corrections.

Effects of helmet promotion and laws

The only demonstrable effect of helmet laws and promotion is an immediate and sustained reduction in the numbers of cyclists, and in the number of people gaining the benefits of regular exercise.

The benefits of cycling are so great, especially in today's sedentary society, that one researcher has said that if those benefits were a drug, it would be the highest selling drug in the world (Davis A, 2008). Other researchers have found similar benefits, with cyclists typically living longer, healthier lives than the rest of the population studied.

“Bicycling to work decreased risk of mortality in approximately 40% after multivariate adjustment, including leisure time physical activity.” (Andersen L B et al, 2000).

“Health tests conducted at the University of Western Australia’s (UWA) Human Movement Department demonstrated that four short cycle rides a week for one year could reduce elevated cholesterol levels by half.” (Department of Environmental Protection, 2000)

“Physical activity reduces the risk of developing major chronic diseases (e.g. coronary heart disease, stroke and type 2 diabetes) by up to 50%, and the risk of premature death by about 20-30%.” (Macdonald B, 2007)

The Department of Health (2005) lists some of the conditions that activity, such as cycling, is beneficial for:

- Coronary heart disease
- Diabetes
- Cancer
- Mental health
- Weight management
- Osteoporosis
- osteoarthritis

Hillman (1993) estimated that the benefits of cycling outweighed the risks by twenty to one, but, given that there has been a considerable decline in exercise levels and an increase in obesity since then, this is likely to be a substantial underestimate in relation to today’s society.

It is therefore clear that cycling, whilst not a panacea for modern ills, will, if sufficient people are persuaded to take it up regularly, have a very significant positive effect on public health. Anything which may deter people from taking it up should be of such clear and overwhelming benefit that it would outweigh the loss of public health from reduced cycling. The most reliable evidence shows that cycle helmets do not produce any such benefit for cyclists (Robinson DL, 1996, 2006)(DfT, 2007a))(Wardlaw M, 2002) and therefore their promotion cannot be warranted.

Conversely, the promotion of helmets and the imposition of helmet laws have been shown to deter cycling "Fear of traffic peril is a huge deterrent, though fear usually exceeds true danger. Discussion

of safety frequently sharpens fear and so deters cycling." (Davies DG et al, 1998). This report showed that councils which ran cycle helmet campaigns suffered large falls in cycling levels. The introduction of helmet laws has had a similar, but probably larger, effect, and by significantly reducing the numbers of people taking healthy exercise, such promotion and laws are therefore seriously damaging to the public health.

“The statistical wrangle over the effectiveness of helmets is actually a side issue; what we need people in authority to understand is that cycle helmets inevitably damage public health.” (Wardlaw M, 2000).

It is ironic in the extreme that the promoters of helmets and helmet laws are predominantly from the medical profession, and the British Medical Association (BMA, 2007) the Royal College of Nursing, Royal College of Paediatrics and Child Health, the Royal College of Surgeons (BHIT, 2004) and the World Health Organisation (WHO, 2008) all have policies promoting cycle helmets and cycle helmet laws. All of these organisations base their policies on the assumption that such helmets are effective and that their promotion does not have any undesired effects such as reducing the number of people taking exercise, the first of which has not been proved but the latter has.

Is there an economic case for the promotion of helmets or a helmet law? Since head injuries are potentially lethal or severely disabling, with associated high economic costs, if helmets reduced such events by even a small amount, such promotion and laws would be economically sound. Ignoring for the moment that there is no reliable evidence that cycle helmets do prevent such injuries, the economic case for a helmet law has been examined (Hendrie D et al, 1999) and found wanting. It discovered that the value of the injury reduction attributed to helmets was outweighed by at least ten times by the costs of the helmet law, and this did not include estimates for the losses caused by reduced cycling. If that loss had been included, the costs would have been considerably higher, and the economic case would have been even weaker.

Benefits of changing cyclists’ views

The benefits of changing cyclists’, and others, opinions about the risks of cycling and the effectiveness of cycle helmets are many and profound. If those views could be changed to a realistic perception of the risks and benefits of cycling, and the effectiveness of cycle helmets, it is likely that many more people would use bicycles for utility trips, since risk is one of the main reasons given for

not cycling “The main deterrent to cycling is road traffic....” (University of Central Lancashire, 2005) and of course, if more people rode bicycles instead of driving, risk would fall because of the reduction in the number of motor vehicles.

The health benefits have already been mentioned above, but it is worth restating that regular cyclists are fitter, healthier and suffer less from all forms of morbidity than the population as a whole “Cycling to work decreased the risk of dying by approximately 40%.” (Cycling England, undated). If more people could be persuaded that cycling was a perfectly normal form of transport for short journeys, and used a bicycle regularly for such journeys, the effect on the health of the population would be very significant, and there are several schemes currently trying to do just that “Active Travel works with policy-makers and practitioners to promote walking and cycling as health-enhancing physical activity.” (Sustrans, 2008)

There is currently great concern at the “obesity epidemic” in the UK and other western countries, which is occurring mainly because of sedentary lifestyles, and regular commuting cyclists have been found to be less at risk than people who drive “Walking and bicycling to work are significantly negatively associated with overweight + obesity and, to some extent, obesity.” (Lindström M, 2007). A return to levels of commuting cycling of fifty years ago would significantly reduce the overweight and obesity problems of modern society.

There are many other areas where increased cycling would be beneficial including; traffic congestion, pollution, road safety and global warming to mention but the most obvious ones.

Traffic congestion is now at such a level in UK cities that it is frequently quicker to cycle than to drive, and cyclists almost always win “commuter races”. Reducing traffic congestion has been a central government policy for many years, and it has passed on responsibility for this to local government. The aims of doing so are partly economic, and estimates of the cost of congestion are extremely high, £20 billion according to the CBI. If the number of motor vehicles could be reduced by 10%, about the same as the drop during school holidays, there would be a significant reduction in congestion, and a very high economic benefit.

Pollution from local traffic is of concern nationally and locally, especially since the increase in diesel vehicles and the consequent rise in particulate emissions from traffic. Many of the pollutants from petrol vehicles are not effectively reduced by catalytic converters until the engine has reached

working temperature, and in areas where cars are used for short journeys this will be a significant source of pollution. If those short car journeys were replaced by cycle trips, the levels of local pollution would fall considerably.

The most effective method of improving safety for cyclists has been shown to be increasing the number of cyclists on the roads (Wardlaw M, 2002) and this may be another explanation of why cycle helmet promotion and laws do not reduce deaths, as if fewer people cycle because of them, the risk per cyclist rises.

Motor traffic is a very large source of CO_2 and it has been estimated that if commuters with journeys of less than five miles switched from cars to bicycles, it would reduce CO_2 emissions by 44,000 tonnes per week (Cycling England, 2007a) thus reducing a source of global warming gas emissions.

Perhaps the benefits were best summed up by Cycling England "No other single activity simultaneously improves public health, reduces childhood obesity, tackles local road congestion and emits zero carbon emissions" (2007c, Staying Safe Response, p3)

How can cyclists' views be changed?

It can be very difficult to change the deeply embedded view of an individual, and much harder to change a view which is widely accepted by the majority of society. Nevertheless, the benefits of doing so are so large to individuals and society that a sustained effort is worthwhile and should be made.

It will first be necessary to halt the continued repetition of the messages that cycling is dangerous and that helmets are extremely effective, but since the government and many powerful establishment organisations are repeating exactly those messages, this would pose some difficulties. Merely ceasing the repetition of untrue messages will not be enough to change opinions however, as they are widely accepted as true and repeated by many people.

The perception that cycling is dangerous and cycle helmets are effective is so ingrained in the public mind that only a sustained, effective, long term campaign will change it. Research has shown that there is an effect, dubbed "the persistence of myths" which shows that such well accepted myths are very difficult to change "...attempts to inform people that a given claim is false may increase acceptance of the misleading claim." (Schwarz et al, 2007). This research applied to short term campaigns to correct widely held myths, and found that they were not successful. It is not clear what

resources and length of time would be required to correct the misperceptions about cycling and helmets.

What public policies are affected?

The government has many policies about health, transport, pollution and global warming which are affected by people's view of cycle helmets, and the reduction in cycling which has occurred because of the promotion of them. It is perhaps ironic that at one level, government is promoting cycling for health reasons and traffic congestion, and at another level suppressing it by promoting cycle helmets and exaggerating the risks of cycling.

But such policies are not limited to the government, and many other organisations concerned with the public health have policies which are affected, including the British Medical Association, Royal College of Nursing, World Health Organisation, Royal Society for the Preventions of Accidents, the British Heart Foundation and many others. All of these organisations exist for the promotion of public health, but their stated policies on helmet promotion and laws have been demonstrated to have nothing but an adverse effect on the public health. It is not clear why they have adopted these policies, which gain considerable publicity in the media, and reinforce the message that cycling is dangerous and helmets are the only way to protect against the danger. These organisations are well respected and messages from them are likely to be treated by the public as being highly reliable.

Comparison to related research and policies

In other fields of road safety, it has been shown that interventions which increase the perception of security of the user will be used as a performance benefit (Adams J, 1995) thus maintaining the same level of risk, and either partly or completely negating any safety benefits. The same effect has been noted by other researchers (Peltzman S, 1975). Wilde (1982) postulated that risk is an inherent part of human psychology, and that each individual has their own "risk homeostasis" of perceived risk, which they will maintain at a constant level. It seems inarguable that there is such an effect, otherwise the human race would have been wiped out by excessive risk-taking or not developed at all because of excessive caution.

As shown in chapter 2, risk compensation seems to be particularly obvious in the cases of motorcycle helmets and car seat belts, and it has been shown in children who have been given protective equipment, and it seems unlikely that it would exist in those circumstances but not that of cycle helmets.

Psychologists have long-held theories that relate to risk taking, and it is now generally accepted that humans have an inherent necessity to take risks, although this varies from person to person:

"Risk-taking domains and tendencies should reflect recurrent survival and reproductive challenges that humans faced during our evolutionary history. Our analyses confirmed separate domains of risk taking which generally follow our theoretical predictions." (Kruger D et al, 2007)

"Although some people are undoubtedly "riskier" than others, it can be argued that we have evolved as a species to take risks in order to survive. Our own DNA is therefore likely to contain genes that influence our risk taking behaviours." (Llewellyn D, 2008)

If there is an inherent psychological effect which sets the level at which each person accepts risk, it seems logical to assume that such an effect would be present continually, and there seems to be no research suggesting that it is somehow turned on and off. There may be occasions where it is raised or lowered, perhaps by alcohol, or showing off, but generally it will always be present at a fixed level. Since risk compensation has been demonstrated in a number of cases, and accepting that this behaviour is inherent, it must change the behaviour of those who wear a cycle helmet, although the proponents of cycle helmets do not accept this (Thompson D et al, 2002).

From some interviews and surveys, it was clear that some cyclists do change their behaviour in accordance with their perceived risk, stating that they wore a helmet only on busy roads. Since the only purpose of doing so is that they would be safer, or feel safer, risk compensation in relation to helmets is clearly demonstrated as they accept the perceived greater risk of riding on a busy road only if they can reduce that perception by wearing a helmet. Since helmets are unlikely to be effective in collision with a motor vehicle, that perception is misplaced, and is likely to be at least part of the explanation for the difference between case control studies of helmets showing great benefits and whole population studies showing none.

Because cyclists have an exaggerated view of the efficacy of cycle helmets, research into risk compensation and psychology supports the view that they would change their behaviour accordingly. The research of Walker (2006) clearly showed that risk compensation also occurred in others observing the helmets, but not wearing a helmet themselves. This is supported by TRL research (Basford L et al, 2002) which found that drivers would give more consideration and space to cyclists who they viewed as less competent, and less to those they considered experienced, and by implication, safe.

Possible courses of action

Cycle helmet promotion and laws are counterproductive for the public health and the public purse, and if the government and other bodies pursuing such policies should ceases to do so, there would be a significant improvement in the public health and resources could be put to a more constructive use.

There is a clear need for the public to be informed about the real effectiveness of helmets and the dangers of risk compensation when wearing one, and both government and other bodies have a responsibility to provide such information "It's much safer than we're led to believe … statistics need to be publicised so that more people know the truth." (Cycling England, 2007b). The responsibility to provide accurate and honest information implies that the government and other bodies will cease their overt and covert advertising campaigns which exaggerate both the risks of cycling and the benefits of helmets.

It seems likely that, if people were given accurate information about helmets, that they are not effective in preventing death or serious injury, fewer people would wear one. Similarly, more people would cycle if the risks of cycling were not exaggerated in order to promote cycle helmets. This leaves the cycle helmet proponents in some difficulty: if they are accurate about the risks and benefits of cycling and the effectiveness of cycle helmets, fewer people will chose to wear a helmet and more people are likely to use cycling for short journeys.

Summary

The hypotheses have been shown to be true, and many cyclists do have an exaggerated view of the risks of cycling and the benefits of cycle helmets, and the two do seem to be related, although no causal link can be demonstrated. However, there appears to be no other causative mechanism other than the long term, insidious advertising of cycle helmets which exaggerates the risks of cycling and the benefits of helmets, so it appears likely that this is responsible for such exaggerated views.

The effect of cycle helmet promotion and laws has been to depress levels of cycling, but not to reduce the death rate of cyclists, which has led to public health costs, increased traffic congestion, pollution and danger to vulnerable road users.

The benefits of changing the views of cyclists, and others, would be an improvement in the public health, reduced energy consumption, reduced congestion and road danger. It is not clear how those views could be changed, as they are so deeply embedded in the public consciousness.

A number of public policies are affected negatively by the continued emphasis on the risks of cycling and the alleged benefits of helmets, so helmet promotion runs counter to much of that public policy.

Related research shows that similar road safety interventions have not been as effective as they were claimed to be before their introduction, and that risk compensation is a likely explanation for at least some of the disparity.

The continued repetition of inaccurate information should cease immediately, and ways to change public opinion about the risks of cycling and the benefits of cycle helmets should be undertaken.

Chapter 6 - Summary and Conclusions

Summary

Overview of dissertation

Contribution of the dissertation

Limitations and future research

Possible actions

Conclusions

Summary

This research has shown that many cyclists have both an exaggerated view of the effectiveness of cycle helmets and the risks of cycling, and that the two views are associated. Whilst this research does not prove a causal link, it would appear likely that the long term, widespread message that cycling is dangerous and that cycle helmets are effective and necessary, is responsible for this, and other researchers have also concluded that this is so. Other researchers have also shown that the single largest effect of cycle helmet promotion and laws is to reduce the number of cyclists, and that, at a population level, there are no benefits in reduction of the rate of deaths of cyclists.

The literature review showed that a number of other similar road safety interventions, motorcycle helmets and seat belts, had not been effective as claimed before their introduction, at least partly because of risk compensation. There is a systemic failure to analyse properly the effects of road safety schemes, and even where there has been some attempt to do so, there has been a failure to consider confounding factors and other explanations for observed changes.

It has also been shown that there is no economic case for the promotion of helmets or the enactment of helmet laws, as the benefits gained, even on the most optimistic assumptions, are outweighed by the costs by at least ten times. The costs in this instance fall entirely on the individual, and this may be partly responsible for the reduction in cycling which follows the introduction of helmet laws.

The benefits of cycling are so great, especially in today's exercise poor society, that any intervention which might cause a reduction in cycling should have demonstrably clear and irrefutable benefits which outweigh the losses in public health and other factors. Cycle helmet proponents have been unable to conclusively demonstrate any benefit at all, except in research which has been peer reviewed and shown to be fatally flawed.

Promotion of helmets and mandatory helmet-wearing have both been shown to reduce the number of cyclists, and no benefit can be demonstrated at a population level. No compensating mechanism for the loss of the benefits of cycling has been demonstrated e.g. ex-cyclists jogging to work, and therefore, helmet promotion and laws must be a significant public health loss.

Overview of dissertation

This dissertation examined attitudes towards cycle helmets and the risks of cycling, and whether the two were linked. It has shown that most cyclists have an exaggerated view of the effectiveness of cycle helmets and the risks of cycling, and that there is an association between the two. It considered the theory of risk compensation, and found that it explained to some extent the differences in the findings of different types of research, and in the projections of lives saved by helmets.

It has also shown that helmet promotion and laws are a significant public health disbenefit, reducing the number of people getting regular exercise, increasing car use, danger, congestion, and local and global pollution.

The conclusion reached was that helmet promotion and laws cannot be warranted in terms of public health benefit, as no benefit can be demonstrated. Even if such benefit could be shown, the case for helmet promotion would still be weak unless it could be shown that the benefits provided by helmets outweighed the demonstrable benefits of cycling. In purely economic terms, the costs of cycle helmet promotion and laws outweigh the benefits by at least ten times.

Contribution of this dissertation

This dissertation makes a theoretical contribution to the debate about cycle helmets, by showing that cyclists have an exaggerated view of the effectiveness of cycle helmets, and that this view may lead to risk compensation. This effect is likely to be at least part of the explanation of why case control studies predict very large savings in cyclists' deaths, but no such savings can be demonstrated at a population level. This research also shows that many cyclists have an exaggerated view of the risks of cycling, and that this is associated with the exaggerated view of the effectiveness of cycle helmets.

It has demonstrated that helmet promotion and laws are fundamentally flawed, having no provable benefits, and considerable disbenefits. Since cyclists' views about the risks of cycling and the benefits of helmets seem to be associated, and there appears to be no other mechanism for these

exaggerated views, it has shown that promotion of cycle helmets is likely to increase the perception of the risks of cycling, and those perceptions are likely to dissuade people from cycling.

Limitations and future research

In common with most research, this dissertation contains limitations, which may suggest fruitful avenues for further research.

The research methods and analysis employed are relatively simple, deliberately so, to provide clarity and minimise the statistical errors with which this field of research is so strewn. It also had problems of possible bias, arising from the way respondents were selected.

No causal effect could be proved between the promotion of cycle helmets and the perceptions of increased risk and effectiveness of helmets demonstrated by the respondents.

Future research could usefully explore this subject in a more sophisticated manner, focussed on investigating the links between perceptions of cycle helmets and the risks of cycling. A more robust and random method of selecting respondents to avoid the possibility of bias could also be helpful in confirming the results of this research. It would also be useful to examine more closely the possible link between helmet promotion and how such promotion affects the perceptions of cyclists about the risks of cycling and the effectiveness of helmets.

Future research could also examine specifically the differences between populations which have been exposed to the long term helmet promotion and those which have not. This would involve considerable effort and resources, as it may be easy to find areas which have been subject to the promotion, but areas which have not been so exposed may only exist in other countries, such as Holland or Denmark.

Since the “persistence of myths” is a very significant obstacle to be overcome in promoting cycling, an aim of government and a very significant benefit to society and the individual, it would be necessary to find the best way of dispelling the myths of helmet effectiveness and the dangers of cycling. The great difficulty of changing views which have entered the public consciousness and are now accepted as true, are not to be minimised, and it will take some considerable effort to change those views. Nor is there a great deal of time to do so; the current generation of schoolchildren are being told that helmets are effective and that they must wear them, creating a whole generation who will consider the case for helmets to be unchallenged and obvious. This is also the generation apparently suffering most from the obesity epidemic, and which would therefore benefit most from regular cycling.

A further subject for future research could also be the examination of safety interventions in general, and road safety interventions in particular. While there are many investigations into such matters, many appear to be flawed and few of them could be described as robust. It is apparent that many road safety interventions are made using flawed and incomplete information, sometimes based on little more than opinions and "common sense". Authoritative research of this type would prove invaluable to inform future decisions.

Also worth investigating would be the subject of improving road safety by making drivers feel less safe. The main danger to all road users comes from the drivers of motor vehicles, whose sense of danger is reduced by all the "safety" equipment they are surrounded by, causing them to drive less carefully. It seems that an intervention which reduced the drivers' sense of safety and made them feel more aware of their own vulnerability would be likely to have very significant benefits for all road users. The oft-quoted example of a rusty bayonet mounted on the steering wheel and no driver's seat belt has been just as often ridiculed, but any vehicle equipped in such a manner would be driven very carefully indeed, thus reducing danger to all road users.

Conclusions

There is no reliable evidence that cycle helmets are effective in preventing death or serious injury, and helmet promotion is based on a narrow view of a small range of the available evidence, which has serious methodological shortcomings, whilst more reliable evidence is ignored or denied. Other similar road safety interventions, seat belts and motorcycle helmets, have not achieved what was promised for them before they were introduced, but scientific examination of their effects is rarely undertaken, or has been ignored where it has been undertaken.

Many cyclists have an exaggerated perception of the risks of cycling and of the effectiveness of cycle helmets, and these are most probably caused by the long term overt and covert promotion of helmets, as there does not appear to be any other causative mechanism. These two views appear to be associated and if a person has an exaggerated view of the risks of cycling, they are also likely to have an exaggerated view of the effectiveness of cycle helmets.

The continued repetition of highly exaggerated, unproven and contested claims presented as facts, about the effectiveness of cycle helmets and the risks of cycling by authoritative sources (BMA, DfT, various MPs) gives considerable credence to these views.

These views affect behaviour by reducing the amount of cycling done, and because of the reduction in the number of people getting regular exercise, there is a consequent reduction to public health. Because the costs of inactivity are so high, and the benefits of regular exercise are so large, there is a

considerable economic disbenefit to society as a result of reduced levels of cycling caused by the inaccurate views of risks of cycling and cycle helmets. There are other disbenefits caused by those views, such as increased congestion, pollution, CO_2 emissions and danger.

There appears to be no benefit to society in any way from these exaggerated views, in economic, public health, congestion, pollution, global warming or danger reduction or in any other way. There may be some benefits for individuals in avoiding death or injury which may have been caused as a result of cycling, but it is likely that this will be outweighed by their loss of life-years and quality of life by not taking regular exercise.

The promotion of cycle helmets, and the deliberate exaggeration of both the risks of cycling and the effectiveness of cycle helmets, are therefore a considerable cost to society, in economic, environmental, and personal terms to the vast majority of individuals.

Since the views of cyclists appear to be influenced by the promotion of helmets, and there is no benefit to society from doing so, and it runs counter to many government policies, such promotion should cease immediately.

Trials should be undertaken to discover the best method of changing the widespread belief that helmets are effective and that cycling is uniquely dangerous. When such a method has been arrived at, it should be used widely to change the current perceptions for more realistic ones.

References

Chapter 1 - Introduction

DfT, 2002, Bicycle Helmets: a review of their effectiveness

DoH, 2004, At least five a week: Evidence on the impact of physical activity and its relationship to health

Franklin, 2003, Bicycle Helmet Effectiveness – a broader perspective

Hillman M, 1993; Cycle helmets—the case for and against. Policy Studies Institute, London

Jacobsen, 2003, Safety in numbers: more walkers and bicyclists, safer walking and bicycling, *Injury Prevention*, p205-209

Lewis-Evans and Charlton, 2006, *Accident Analysis & Prevention*, Volume 38, Issue 3, May 2006, Pages 610-617

Mok, Gore, Hagel, 2004, Risk compensation in childrens' activities: A pilot study, *Pediatrics and Child Health*, May/June 2004, Volume 9 Issue 5: 327-330

Robinson, 2000, Changes in head injury with the New Zealand bicycle helmet law, *Accident Analysis and Prevention*, 33 (2001) 687–691

Scottish Executive, 2005, Cycling in Scotland 2005

Thompson, Rivara and Thompson, 1999, Cochrane Review: Helmets for preventing head and facial injuries in bicyclists

University of Lancashire, 2005, Cycling in Lancashire - Report for Lancashire County Council

Walker, 2007, Drivers overtaking bicyclists: Objective data on the effects of riding position, helmet use, vehicle type and apparent gender. *Accident Analysis and Prevention*, 39, 417-425

Chapter 2 – Review of Literature

Acton C, 1998, *Injury Prevention* 1998;4;171-172

Adams J, *Risk*, UCL Press Ltd. University College, London 1995

BBC, 2005, http://news.bbc.co.uk/cbbcnews/hi/newsid_4700000/newsid_4703600/4703667.stm

BBC, 2008, http://news.bbc.co.uk/1/hi/health/3756385.stm

BHF, 2006, Hearts First Events Diary 2007 booklet, British Heart Foundation

BHF, 2008, http://britishheartfoundation.sandbag.uk.com/Store/DII-44-3-helmet+redsilver+.html

Bicycle Helmet Initiative Trust, 2004, Ride to the Race leaflet, http://www.chapmancentral.co.uk:8080/Web/public.nsf/images/gchn-664etv/$file/ridetotherace.pdf

BHIT, 2008, http://www.bhit.org/home.html

British Medical Association, 2007, Cycling safety and health, www.bma.org.uk/ap.nsf/Content/Cyclsafety

Chapman G, undated, www.cyclenetwork.org.uk/papers/040402.pps

Chapman G, 2007, http://www.chapmancentral.co.uk/wiki/Thompson,_Rivara_and_Thompson_(1989)

Chapman G, 2004, http://www.chapmancentral.co.uk:8080/Web/public.nsf/Documents/ASA_Complaint?OpenDocument

Child Accident Prevention Trust, 2008, Cycle Safety Factsheet, available at http://www.capt.org.uk/pdfs/factsheet%20road%20accidents.pdf

CTC, 2005, The BMA and cycle helmets, http://www.ctc.org.uk/resources/Campaigns/0506CTCBMApositionpapercritiqueBrf.doc

Curnow, WJ, 1995, Review of Evidence of the Efficacy of Helmets for Cyclists, http://members.tip.net.au/~psvansch/crag/efficacy.htm

Curnow WJ, 2005, The Cochrane Collaboration and bicycle helmets, *Accident Analysis and Prevention* 37 (2005) 569–573)

Dulisse B, Methodological Issues in Testing the Hypothesis of Risk Compensation, *Accident Analysis and Prevention* Vol. 25 (5): 285-292, 1997

DfT, 2007, Road Casualties Great Britain 2006, p162

Department for Transport, 2008, http://www.cyclesense.net/fset.htm

DiLillo D and Tremblay G, 2001, Maternal and Child Reports of Behavioral Compensation in Response to Safety Equipment Usage, *Journal of Pediatric Psychology*, Vol. 26, No. 3, 2001, pp. 175-184

Ferrando J, Plaséncia A, Orós M, Borrell C, Kraus JF, 2000, *Injury Prevention*, 2000;6;184-188

Franklin J, 2002, Cycle Helmet Performance in the Real World, www.cyclecraft.co.uk/digest/2002glos.pdf

Franklin J, 2003, Bicycle Helmet Effectiveness – a broader perspective, p1, http://www.cyclecraft.co.uk/digest/broader.pdf

Gill T, 2005, Cycling and Children and Young People: a review, National Children's Bureau, December 2005, p46

Goldstein JP, 1986, The Effect of Motorcycle Helmet Use on the Probability of Fatality and the Severity of Head And Neck Injuries, http://usff.com/hldlhome.html

Goldstein JP, 1990, Review of the 1990 CDC Study on Head Injury Deaths and Helmet Laws, http://usff.com/hldl/frames/50state.html

Howstuffworks, 2008, http://products.howstuffworks.com/bicycle-helmet-buying-guide.htm

Isles JE, 1981, Seat Belt Saving (aka Isles Report) p1, http://john-adams.co.uk/wp-content/uploads/2007/01/isles%20report.pdf

Lang, IA, 2007, Demographic, socioeconomic, and attitudinal associations with children's cycle-helmet use in the absence of legislation, *Injury Prevention* 13: 355-358

Lawlor DA, Smith GD, Ebrahim S, 2004, Commentary: The hormone replacement–coronary heart disease conundrum: is this the death of observational epidemiology? *International Journal **of** Epidemiology*, Volume 33, Number 3, pp. 464-467)

LeBlanc JC, Tricia L. Beattie, Christopher Culligan, 2002, Effect of legislation on the use of bicycle helmets, *Canadian Medical Association Journal,* 2002;166(5):592-5, Abstract

Macpherson A, Spinks A, 2007a, Bicycle helmet legislation for the uptake of helmet use and prevention of head injuries, *Cochrane Database of Systematic Reviews*, 2007 Issue 4, p2

Macpherson A, Spinks A, 2007b, Bicycle helmet legislation for the uptake of helmet use and prevention of head injuries, *Cochrane Database of Systematic Reviews*, 2007 Issue 4, p1

McGuire L, Smith N, 2000, Cycling safety: injury prevention in Oxford cyclists, *Injury Prevention* 2000;**6**:285-287

Morrongiello BA, Walpole B, Lasenby J, 2006, Understanding children's injury-risk behavior: Wearing safety gear can lead to increased risk taking, *Accident Analysis and Prevention* 39 (2007) 618–623

Oxfordshire County Council, undated, Use it don't lose it, leaflet, available at http://portal.oxfordshire.gov.uk/content/publicnet/council_services/roads_transport/road_safety/cyclists/cycle-helmet-leaflet.pdf

Robinson DL, 1996, Head Injuries and Bicycle Helmet Laws, *Accident Analysis and Prevention*, Vol. 28, No. 4, pp. 463-475, 1996

Robinson DL, 2006, Do enforced bicycle helmet laws improve public health? D L Robinson, *British Medical Journal,* 2006;332;722-

RoSPA, 2002, Teachers' fact file:Cycle helmets, http://66.102.9.104/search?q=cache:7pjxATyrXC8J:www.projectboxes.co.uk/resources/smash/cycle_helmets.doc+cycle+helmet+85%25&hl=en&ct=clnk&cd=22&gl=uk

Royal ST, Kendrick D, Coleman T, 2006, Non-legislative interventions for the promotion of cycle helmet wearing by children Cochrane Review, *The Cochrane Database of Systematic Reviews* 2006 Issue 4

Sagberg F, Fosser S, and Sætermo I-AF, 1997, An investigation of behavioural adaptation to airbags and antilock brakes among taxi drivers, *Accident Analysis & Prevention* Volume 29, Issue 3, May 1997, Pages 293-302

Schwarz N, Sanna LJ, Skurnik I, Yoon C, 2007, Metacognitive Experiences and the Intricacies of Setting People Straight: Implications for Debiasing and Public Information Campaigns, *Advances in Experimental Social Psychology*, Vol 39, p151

Servadei F, Begliomini C, Gardini E, Giustini M, Taggi F, Kraus J, 2003, Effect of Italy's motorcycle helmet law on traumatic brain injuries, *Injury Prevention* 2003;**9**:257-260

Shah S, Sinclair SA, Smith GA, Xiang H. 2007, Pediatric hospitalizations for bicycle-related injuries, *Injury Prevention* 13: 316-321

Shephard RJ, 2005, Towards an evidence based prevention of sports injuries, *Injury Prevention,* 2005;11:65-66

Teresi D, 1999, The Wild One, *Forbes Magazine*, http://www.forbes.com/fyi/1999/0503/041.html

Thompson DC, Rivara FP, Thompson R. Helmets for preventing head and facial injuries in bicyclists. *Cochrane Database of Systematic Reviews* 1999, Issue 4

Thompson RS, Rivara FP, Thompson DC, 1989, *New England Journal of Medicine*: 1989 v320 n21 p1361-7 – US Page139

Thompson DC, Rivara FP, Thompson RS, 1996, Effectiveness of bicycle safety helmets in preventing head injury: a case-control study, *Journal of the American Medical Association* 1996 vol 276 p1968-73.)

Tsai M-C, Hemenway D, 1999, Effect of the mandatory helmet law in Taiwan, *Injury Prevention*, 1999;**5**:290-291

Walker I, 2007, Drivers overtaking bicyclists: Objective data on the effects of riding position, helmet use, vehicle type and apparent gender, *Accident Analysis and Prevention* 39 (2007) 417–425

Wardlaw M, 2000, Three lessons for a better cycling future, *British Medical Journal*, 2000;321:1582-1585, http://www.bmj.com/cgi/content/full/321/7276/1582#SEC2

Wardlaw M, 2002, Assessing the actual risks faced by cyclists, *Traffic Engineering and Control*, December 2002

Wardlaw M, 2004, Effectiveness of cycle helmets and the ethics of legislation, *Journal of the Royal Society of Medicine*, Volume 97 August 2004, p409

West-Oram F, Casualty Reductions whose Problem?, *Traffic Engineering and Control*, Sept. 1990

Wilde GJS, 1998, Risk homeostasis theory: an overview**,** Gerald J S, *Injury Prevention* 1998;4:89-91

Chapter 3 - Methodology

Elliot & Shanahan Research, 1986, An Exploratory Study of High School Students' Reaction to Bicycle Helmets, The Road Traffic Authority of Victoria, Melbourne, April 1986

Ferris et al, 1989, Cycle Injuries and Attitudes to Safety Helmets, *British Journal of Accident and Emergency Medicine*, December 1989

Sagberg F, Fosser S, Sktermo I-A F, 1997, *Accident Analysis and Prevention*, Vol. 29, No. 3, pp. 293-302. 1997

Chapter 4 – Results and Analysis

DfT, 2007, Road Casualties Great Britain 2006, p162

McGarry T & Sheldon A, 2008, Road Safety Research Report No 84, p13

Walker I, 2007, Drivers overtaking bicyclists: Objective data on the effects of riding position, helmet use, vehicle type and apparent gender, *Accident Analysis and Prevention* 39 (2007) 417–425

Chapter 5 – Discussion and Interpretation

Adams J, 1995, *Risk*, UCL Press

Andersen LB, Schnohr P, Schroll M, Hein HO. All-cause mortality associated with physical activity during leisure time, work, sports, and cycling to work. *Archives of Internal Medicine*, 2000 Jun 12;160(11):1621-8.

Basford L, Reid S, Lester T, Thomson J,Tolmie A, 2002, TRL 549, Drivers' perceptions of cyclists

BBC, 2004, http://news.bbc.co.uk/1/hi/health/3756385.stm

BHIT, 2004, DOCTORS SUPPORT COMPULSORY CYCLE HELMETS FOR ALL, press release

BMA, 1992, *Cycling towards health and safety*, table 10.4, p119

BMA, 2007, Cycling Safety and Health, http://www.bma.org.uk/ap.nsf/Content/Cyclsafety++

BMA, 2008, Promoting safe cycling and helmet use, A briefing from the Board of Science

British Heart Foundation, undated, BHF Bike Ride Rules of the Road.

Bicycle Helmet Research Foundation, 2005, http://www.cyclehelmets.org/mf.html#1101

Childwise, 2007, Teenage Road Safety Advertising Tracking, p19
http://www.thinkroadsafety.gov.uk/research/pdf/2007-09.pdf

Cook and Sheikh, 2003, Trends in serious head injuries among English cyclists and pedestrians, *Injury Prevention*, 2003;9;266-267

Cycling England, 2007, Staying Safe Response, p4

Cycling England, 2007a, Staying Safe Response, p9

Cycling England, 2007b, Staying Safe Response, p11

Cycling England, 2007c, Staying Safe Response, p3

Cycling England, undated, Cycling and Health, What's the evidence, p16

Davies DG, Emmerson P, Gardner G, 1998, Achieving the Aims of the National Cycle Strategy: TRL Report 365

Davis A, 2008, Presentation – Active Travel and the built environment: A public health evidence based perspective.

Department of Environmental Protection [Western Australia], 2000, Annual Report 1999-2000, p70

Department of Health, 2005, Choosing Activity: a physical activity plan, p6

DfT, 2007a, Road Casualties Great Britain 2006, p162

DfT, 2007, The Highway Code, http://www.direct.gov.uk/en/TravelAndTransport/Highwaycode/DG_069837

Hendrie D, Legge M, Rosman D, Kirov C, 1999, An Economic Evaluation of the Mandatory Bicycle Helmet Legislation in Western Australia, University of Western Australia

Hillman 1993; Cycle helmets—the case for and against. Policy Studies Institute, London

Injury Prevention, 2004, http://injuryprevention.bmj.com/cgi/content/full/9/3/266

Kruger D, Wang X, Wilke A, 2007, Towards the development of an evolutionarily valid domain-specific risk-taking scale, *Evolutionary Psychology*, www.epjournal.net – 2007. 5(3): 555-568

Lindström M, 2007, Means of transportation to work and overweight and obesity: A population-based study in southern Sweden, *Preventive Medicine*, Volume 46, Issue 1, January 2008, Pages 22-28

Llewellyn D, 2008, Conclusions, http://www.risktaking.co.uk/intro.htm#psycho

Macdonald B, 2007, Valuing the benefits of cycling - A report to Cycling England, p12

Marie Curie Cancer Care, 2007, Bike the Baltic leaflet

Peltzman S, The effects of automobile safety regulation, *Journal of Political Economy* 1975;83:677–725

Robinson DL, 1996, Head injuries and bicycle helmet laws, *Accident Analysis & Prevention* Volume 28, Issue 4, July 1996, Pages 463-475

Robinson DL, 2006, Do enforced bicycle helmet laws improve public health?, *British Medical Journal,* 2006;332;722, http://www.bmj.com/cgi/reprint/332/7543/722

Schwarz N, Sanna LJ, Skurnik I, Yoon C, 2007, Metacognitive Experiences and the Intricacies of Setting People Straight: Implications for Debiasing and Public Information Campaigns, *Advances in Experimental Social Psychology*, Vol 39, p151

Sustrans, 2008, http://www.sustrans.org.uk/default.asp?sID=1089735305687

Thompson D, Thompson R, Rivara F, Risk compensation theory should be subject to systematic reviews of the scientific evidence, *Injury Prevention* 2002;8:e1 (http://www.injuryprevention.com/cgi/content/full/8/2/e1)

University of Central Lancashire, 2005, Cycling in Lancashire,

Wardlaw M, 2000, Three lessons for a better cycling future, *British Medical Journal* 2000;321:1582-1585 (23 December)

Wardlaw M, 2002, Butting heads over bicycle helmets, *Canadian Medical Association Journal*, August 20, 2002; 167 (4)

Wardlaw M, Dec 2002, Assessing the actual risks faced by cyclists, *Traffic Engineering and Control*

Walker I, 2006, Drivers overtaking bicyclists: Objective data on the effects of riding position, helmet use, vehicle type and apparent gender, *Accident Analysis and Prevention* 39 (2007) 417–425

WHO, 2008, http://www.whohelmets.org/

Wilde G, 1982, The theory of risk homeostasis: implication for safety and health. *Risk Analysis*, 1982;2:209–25

Appendix A

Cycle Helmet Survey

This is a short survey about what you think about cycle helmets. No information which can identify you is asked for. Please answer as accurately as possible.

Answer the questions by circling your answer e.g. **YES** **NO**

1. How old are you? **11-16** **17-21** **22-30** **31-40** **41-50** **51-60** **61+**

2. Do you ride a bicycle on the road? **YES** **NO**

3. If you ride a bicycle on the road, do you wear a helmet? **YES** **NO** **SOMETIMES**

4. If you ride a bicycle, approximately how many days a week do you do so?

1 **2** **3** **4** **5** **6** **7**

5. Do you drive a car? **YES** **NO**

6. It is more dangerous to make the same trip by cycling rather than walking.

(1=Strongly agree, 5=Strongly disagree)

1 **2** **3** **4** **5**

7. Cycle helmets prevent death and serious injury.

(1=Strongly agree, 5=Strongly disagree)

1 2 3 4 5

8. If cycle helmets do prevent death and serious injury, up to what collision speed?

10mph - 20mph - 30mph - 40mph - 50mph - 60mph

9. Where did you get your information about cycle helmets and their effect on safety?

Bicycle Helmet Initiative Trust - Teacher - Family - Friends - Highway Code - Trainer - Department for Transport - Magazine - Newspaper - Other cyclists - Cycle shop

Other, please say where.....

Any other comments?

Thank you for your time.

Appendix B

Interview text

Brief introduction:

This is a brief interview, and there are no trick questions.

I'm doing some research into what people think about cycle helmets for my dissertation, so this is all about what you think, and there are no right or wrong answers.

You will not be identified in the dissertation.

Questions:

Are you a cyclist?

Do you do a lot of cycling?

Are you ever put off by bad weather?

Do you wear a cycle helmet?

If yes, then why?

Is there any particular incident which happened to them or to an acquaintance that has influenced them?

Was there any peer pressure to get you to wear a helmet?

Are you more likely to wear a helmet if lots of other people do?

Have they fallen off themselves?

How effective do you think a helmet is?

In just falling off?

And in collision with a motor vehicle?

Are you aware of any research into the effectiveness of cycle helmets?

Have you seen any publicity about cycle helmets?