Cycle helmets

An overview of the evidence

we are cycling UK

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Notes:

All documents with hyperlinks accessed in October 2023.

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Cycle helmets and mandatory helmet laws: an overview of the evidence

Cycling UK does not take sides on whether it is a good idea for individuals to wear cycle helmets, but it's clear from other countries' experience that making it compulsory puts significant numbers of people off cycling.

This is the main reason why Cycling UK opposes mandatory helmet laws (MHL).

It is, after all, important to encourage and enable people to cycle, and avoid doing anything that deters them. This is because the relatively small risks of cycling are dwarfed by its benefits for public health, air quality and our chances of meeting net zero.

In other words, as the Department for Transport has stated, "The safety benefits of mandating cycle helmets for cyclists are likely to be outweighed by the fact that this would put some people off cycling, thereby reducing the wider health and environmental benefits."

This briefing sets out the case for not introducing MHL.

As will be seen from below, much research in this field is contradictory. Appendix A explores why this might be, looking at: the weakness of case-control studies; not accounting for wider trends; attitudes to risk/risk compensation; helmet design issues; and meta analyses. Download from cyclinguk.org/briefing/cycle-helmets

1. The benefits v risks of cycling in perspective

A report for the British Medical Association published in 1992 estimated that: "... even in the current hostile traffic environment, the benefits gained from regular cycling outweigh the loss of life years in cycling fatalities by a factor of around 20 to 1."[1]

Since 1992, the number of cyclists killed or seriously injured per billion miles cycled has been dropping in Great Britain,[2] which suggests that if this ratio were recalculated now, the benefits would outweigh the risks by an even greater margin.

Indeed, others have investigated the benefits v the risks of cycling since 1992, drawing on similar factors and/or including others (e.g. polluted air). As a result, there can be little doubt that the public health benefits of cycling by far outweigh the risks and that the 20:1 ratio – arguably the best known estimate – easily falls between the range suggested by subsequent research.

If we take the 20:1 estimate, then, telling people to wear helmets would result in a net increase in early deaths (due to physical inactivity etc.) should more than one person be

[1] Quoted in The Health Impact of Mandatory Bicycle Helmet Laws, Piet de Jong, 2012. Note that de Jong advises that this "…. estimate must be interpreted with care. It is an average with likely variations depending locality, age, experience and even individual rider." In other words, the estimate does not necessarily reflect any given individual's level of risk.
[2] See Department for Transport Road Casualties GB, Table RAS0201, for the rates for the past 10 years.

deterred from cycling for every 20 who continue, even if helmets were 100% effective at preventing all cycling injuries (i.e. not just head-only injuries).

Once you factor in the proportion of serious and fatal cycling injuries that are not head-only injuries, and the at-best limited protection that helmets could provide anyway (see section 7a), it can be shown that it only takes a fraction of a percentage point reduction in cycle use for mandatory helmet-wearing to shorten many more lives than it could possibly save.

Backing up this theory with an algebraic model, Australian statistician Piet de Jong concludes: "Even with very optimistic assumptions as to the efficacy of helmets, relatively minor reductions in cycling on account of a helmet law are sufficient to cancel out, in population average terms, all head injury health benefits."[3] See **Appendix B.**

2. Effective approaches to improving cycle safety

Given the above, Cycling UK believes that decision-makers should do all they can to enable more as well as safer cycling instead of jeopardising it through MHL.

This means, for example: introducing 20 mph speed limits; designing cycle-friendly roads and junctions; offering high-quality training both for cycle users and drivers; reviewing road traffic law; enforcing the law effectively; promoting and publicising the Highway Code's new rules; and tackling the threats from lorries. (See our Road Safety briefing for more).

Indeed, as will be evident from some of the studies cited below, a number of academics have concluded that this kind of intervention is clearly associated with improving overall cycle safety, whereas MHL make no perceptible difference or, in some cases, can even make things worse and/or undermine the 'safety in numbers' effect.

3. Mandatory helmet laws: negative impact on cycling levels

Firstly, it's worth noting that the Netherlands, Denmark and Germany enjoy high levels of cycling compared to other countries in Europe and do not mandate helmets.

In the Netherlands, for example, cycling's 'modal share' is around 27% and, thanks largely to pro-cycling policies (including reducing cyclists' exposure to motor traffic through high-quality planning and infrastructure), the country's record on cycling safety is exemplary.[4]

In other countries, however, where decision-makers have concluded that mandatory helmet laws (MHL) are the way forward, before and after counts show that the move depresses cycling levels, especially among young people. This is a highly undesirable and counterproductive effect, given that the benefits of cycling are huge and far outweigh the risks (see section 1 above).

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[3] De Jong, P. The health impact of mandatory bicycle helmet laws (as published in Risk Analysis, March 2012).
[4] Schepers, P, et al. The Dutch road to a high level of cycling safety. Safety Science, vol 92, pp 264-273. 2017.

a. Australia

Australian states and territories introduced various MHLs between 1990 and 1992. By 1992, researchers in metropolitan Melbourne observed:

- A 43% drop in cycle use amongst teenagers (although numbers had been rising beforehand)
- A 9% drop amongst children
- A 21% drop amongst all cyclists.[5]

In Sydney in 1993, compared to 1991 when the law came in:

- 22% fewer adult cyclists and 55% fewer child cyclists were counted at road intersections
- At primary school and high school gates, child cyclists dropped by 50% and 68% respectively
- Cycling to secondary schools by girls dropped by 91%.[6]

In Perth, counts suggested:

- A 26% reduction across two entry point bridges in October 1992 compared to the same month in 1991 (continuing to almost 40% below pre-law levels after three years).[7]

b. New Zealand

New Zealand introduced a MHL on 1 January 1994.

- Traffic statistics suggest that cycling trips declined by 26% between 1989/1990 (pre-law) and 1997/1998 (post-law), and continued falling to 51% below their pre-law levels by 2006
- Total distance travelled by cycle fell by 19% (1989/90 - 1997/98) and by 29% (1989/90 - 2006)
- It's estimated that around 136,000 adults and children – nearly 4% of the total population at the time – quit cycling in the immediate aftermath of the legislation, 47,000 being teenagers (13-18 years).[8]

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[5] Finch, C, et al. Bicycle use and helmet wearing rates in Melbourne, 1987 to 1992: the influence of the helmet wearing law. Monash University, report no. 45, 1993, pp. 35, 36, 43 / Head injury reductions in Victoria two years after introduction of mandatory bicycle helmet use. Monash University, July 1993.
[6] Smith, N & Milthorpe, M. An Observational Survey of Law Compliance and Helmet Wearing by Bicyclists in New South Wales – 1993. Roads & Traffic Authority, New South Wales.
[7] Electronic count data from Main Roads Western Australia, reproduced at www.cycle-helmets.com/bicycle_numbers.html. See also www.cyclehelmets.org/1113.html.
[8] Taylor, M & Scuffham, P. New Zealand Bicycle Helmet Law – Do the Costs Outweigh the Benefits? Injury Prevention, vol. 8 pp. 317–320, Table 2. 2002. The 1996 New Zealand census estimated a total population of c.3.7 million

c. Nova Scotia, Canada

Nova Scotia's MHL came in on 1 July 1997, and was enforced. According to counts in Halifax on arterial, residential and recreational roads at peak time on sunny days:

- "In 1995/96, 1494 cyclists were observed on 17 days. In 1997, 636 cyclists were observed on 19 days. In 1998/99, 672 cyclists were observed on 13 days." This equates to a drop of 62.5% in cyclists counted not long after the law came in. Levels recovered somewhat in 1998/1999, but to nothing like pre-law levels.[9]

d. Modifications and repeals

In some places, the original legislation has been reduced in scope in some respect, e.g. changing it to cover children only, rather than all ages, or exempting cycling in certain settings. This happened to the Northern Territory (Australia) law in 1994.

Mexico City repealed its 2009 law after only a year, thanks to the realisation that it wasn't conducive to achieving targets to increase cycling.

For more on modifications and repeals, see: cyclehelmets.org/1214.html.

4. Longer-term cycling levels

Determining how long any given MHL impacts on cycling levels and, indeed, the exact extent of it at the time, is not straightforward.

This is because there are numerous factors at play, some affecting the collection of before and after data, some associated with enforcement, some with public awareness campaigns, and some not directly linked with MHL at all.

Helmet-centric research isn't necessarily definitive about what these factors might be, but they are likely to include:

- The timing and consistency of before and after counts, their chosen locations and the weather
- Whether the law is enforced by the police, how stringently and for how long (people who are resistant to helmet-wearing might give up cycling initially, but return if they doubt that they'll be penalised)
- Whether the administration has invested in campaigns promoting helmet-wearing in the run-up to the law (these can, for example, put people off in advance, especially if they dangerise cycling, meaning that the baseline is lower than it would have been)
- Existing acceptance of helmet-wearing
- Other road safety policies or infrastructure improvements introduced at around the same time or later on

[9] LeBlanc, J.C, et al. Effect of legislation on the use of bicycle helmets. CMAJ 2002 166 (5) pp 592-595. 2002.

- Population increases (for example, the population of Western Australia increased by 48.5% from 1991 to 2012 [10])
- Fuel prices, the economy etc.

A study based on the results of a cross-sectional survey published in 2011, however, led its authors to predict that repealing the MHL in Sydney, Australia, would have a positive effect on cycling levels. This implies that the law was still managing to deter people twenty years after it was introduced.

While a significant proportion would continue to wear helmets, the authors found:

- One in five (22.6%) respondents said they would cycle more if they did not have to wear a helmet, particularly occasional cyclists (40.4% of those who had cycled in the past week and 33.1% of those who had cycled in the past month).
- One third (32.7%) did not support mandatory helmet legislation.

The authors concluded: "While a hypothetical situation, if only half of the 22.6% of respondents who said they would cycle more if they did not have to wear a helmet did ride more, Sydney targets for increasing cycling would be achieved by repealing mandatory bicycle helmet legislation."[11]

Incidentally, Australia failed to meet its target to double cycling between 2011-2016[12], and the results of its last participation survey (2023) were disappointing.[13]

5. Negative impact on different groups and activities

MHL are also likely to have a particularly detrimental impact on: cycling among teenagers, women, low income groups and ethnic minorities; cycle-commuting; bike share schemes; and the 'safety in numbers' effect. What's more, they waste both police resources and public money.

a. Teenagers

Most alarmingly, the data from Australia and New Zealand cited above suggest that teenagers, especially girls, would rather not cycle than wear a helmet. This is particularly damaging because young people need all the encouragement they can get to keep active and maintain the habit of cycling for life.

More recently, research from New Zealand (2018 – almost a quarter of a century after the country's MHL came it) shows that many young people still view helmets as a barrier:

- One in five pupils at 12 secondary schools said they would cycle to school more often if helmet use was not mandatory. Also, the perception that cycling to

[10] cycle-helmets.com/bicycle_numbers.html
[11] Rissel C, et al. The possible effect on frequency of cycling if mandatory bicycle helmet legislation was repealed in Sydney, Australia: a cross sectional survey. Heath Promotion Journal, Australia. 2011.
[12] Australian Bicycle Council. Australian Cycling Participation – reporting for the National Cycling Strategy 2011-2016. To be fair, Australia is not the only country that's failed to meet its targets.
[13] CWANZ. National Walking and Cycling Participation Survey 2023.

school is not 'cool' was positively associated with the perception that having to wear a helmet is a barrier.[14]

MHL do not necessarily translate into higher levels of helmet use either:

- A US study of children aged under 18 found: "There was no significant change in helmet usage between before and after legislation in helmet legislation areas or over time in non–helmet legislation areas." [15]

Of course, even if a parent/guardian makes sure their child rides off from home wearing a helmet, there's no guarantee that they'll go on wearing it once out of sight. Yet, in a country where helmets are mandatory, it's the parent/guardian who could then be prosecuted and penalised for the breach.

b. Women

Cycling levels among women in Britain are already low, much lower than they are for men. This is a persistent disparity, and MHL would almost undoubtedly make it worse:

- Generally speaking, women seem less willing to wear cycle helmets than men.[16]
- Research shows women are less likely to feel confident about cycling than men[17] and, unsurprisingly, don't cycle as much.[18]
- In contrast, women's cycling levels are much healthier and in fact outdo men's in the Netherlands (c55%).[19]
- MHL may well contribute to the perception of cycling as an unsafe activity (i.e. people need armour to do it).[20]

This suggests that, instead of making cycle helmets compulsory, it is vital to: stress that cycling's health benefits far outweigh the risks; that it's entirely possible to ride in whatever clothes people feel comfortable wearing, with or without headgear; and tackle the intimidating and hostile conditions that impact negatively on both female and male cycling on all too many of Britain's roads.

c. Low income groups & ethnic minorities

Research shows that people on low incomes, children from socially deprived areas and minority ethnic groups are less likely than others to own or wear cycle helmets.

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[14] Molina-Garcia, J, et al. Would New Zealand adolescents cycle to school more if allowed to cycle without a helmet? Journal of Transport & Health, vol. 11, pp 64-72. Dec 2018.
[15] Williams, C, et al. Pediatric bicycle helmet legislation and crash-related traumatic brain injury in Illinois, 1999-2009. JSR, vol 222, pp 231-237. Feb 2018.
[16] Valero-Mora, P, et al. Why women do not use the helmet when riding a bicycle. Proceedings of the Human Factors and Ergonomics Society Annual Meeting. 2018.
[17] DfT. National Travel Attitudes Survey: Wave 5. 2021.
[18] See Q6 of Cycling UK's Cycling Statistics.
[19] Goel, R, et al. Cycling behaviour in 17 countries across 6 continents: levels of cycling, who cycles, for what purpose, and how far? Table 8. Transport Reviews, vol 42. 2022.
[20] Gerhard, R. Mandatory helmet legislation and risk perception: A qualitative study in Melbourne, Australia. Journal of Transport and Health, vol 33. 2023.

It follows that MHL put them at added disadvantage, potentially leading to discrimination and increasing health inequalities by making it unaffordable for people from deprived areas to cycle in accordance with the law.

MHL make little difference to helmet-wearing rates among these groups, although they may well deter them from cycling should the law be strictly enforced where they live. Rigorous enforcement by the police, in fact, can exacerbate any existing tensions.

- A large study in Toronto, which examined the impact of cycle helmet legislation six years after its introduction, found that children in lower and mid-income areas were consistently less likely to wear helmets than their counterparts in more affluent areas.[21]
- A study in Quebec found that a four-year helmet-wearing campaign was less effective in more socially deprived areas, despite offers of discount coupons to help buy helmets. The researchers concluded that even with a subsidy, helmets were still beyond the means of many families in these areas. [22]
- A major Transport Research Laboratory survey of cycle helmet-wearing rates in Britain (2008) found that 'white' cyclists were more likely to wear a helmet than those of other ethnic origins.[23]
- In the US, a review of court and police records in Dallas found significantly uneven enforcement of the city's helmet law, with 96% of citations outside 'downtown' being written in neighbourhoods of colour, and 86% in areas with a large number of households below the poverty line. Findings were similar in New York City and in Tampa, Florida.[24]
- Research into helmet wearing by Los Angeles children who had been involved in cycle crashes, found a significantly lower use of helmets among children of minority background and lower socio-economic status: Whites = 35.2%, Asians = 7.0%, Blacks = 6.0%, Hispanics = 4.2%.[25]

In the UK, circumstantial evidence suggests that cycling is a popular way for migrant workers to commute to and from employment, while helmet usage among them is low. MHL would undoubtedly affect them, especially those who don't speak or read English fluently and might not realise that they could be penalised for riding helmetless.

Furthermore, some people wish to wear the headwear prescribed by their religions, e.g. Sikh turbans.

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[21] Macpherson, A, et al. Economic disparity in bicycle helmet use by children six years after the introduction of legislation. Injury Prevention, vol. 12, pp. 231-235, 2006.
[22] Farley, C, et al. The Effects of a 4-Year Program Promoting Bicycle Helmet Use Among Children in Quebec. American Journal of Public Health, vol. 85, pp. 46-51, 1995.
[23] Transport Research Laboratory (for the DfT). Cycle Helmet Wearing in 2008. TRL Report PPR420. 2009.
[24] Cited in NACTO. Equitable bike share means building better places for people to ride. July 2016. NACTO comments: "Reports from around the United States suggest that such [mandatory helmet] laws often give police an additional reason to stop and question people and are disproportionately enforced against low-income people and people of colour."
[25] Sullins, V, et al. Race/Ethnic and Socioeconomic Disparities in the Use of Helmets in Children Involved in Bicycle Accidents. Journal of Pediatric Surgery, vol 49, issue 6, pp. 1000-1003. 2014.

Given the above, helmet laws would almost certainly discriminate against people on low incomes, those living in deprived areas, members of minority racial and ethnic groups and against those who hold certain religious beliefs.

This is unfair: their chosen transport option/leisure activity is not especially hazardous, and where hazards do exist, they are mostly imposed by inconsiderate and dangerous drivers, whose behaviour genuinely needs correcting in everyone's interest.

d. Cycle-commuting

Another major concern is the negative impact MHL could have on cycle commuting trips. These may well be substituted by driving rather than by other forms of physical activity, especially if a workplace seems too far to walk. Unlike driving, however, cycle commuting is a convenient way of keeping fit, contributing to better air quality, and reducing the economic costs of congestion.

e. Bike share schemes

Bike share schemes help make environmentally-friendly travel in cities more feasible for many people (e.g. in London), but helmet laws can inhibit take-up. This is probably because a good number of potential hirers don't want to or can't carry a helmet with them, while those thinking of hiring a bike spontaneously are most unlikely to have a helmet on them.

- Having looked at the evidence on the impact of MHL for adults, NACTO (National Association of City Transportation Officials) in the US, has stated: "The impact of mandatory adult helmet laws on bike share and general bike ridership is large and negative." It also says: "In Seattle, the only U.S. city with a mandatory helmet law [i.e. city with a bike share scheme as well], bike share ridership has been well below expectations, less than one ride per bike per day."[26]

f. 'Safety in numbers'

Evidence suggests that the number of people cycling and the safety of cycle use are correlated. This, the Safety in Numbers effect, will be compromised if, as is likely, fewer people choose to cycle in the wake of a mandatory helmet law.

g. Police resources

Helmet laws are not always strictly enforced, but when they are it usually involves heavy investment – especially by the police (e.g. in Queensland, Australia [27]). This is not a proportionate, let alone cost-effective use of their resources (often stretched).

The main threat to cycle safety stems not from riding helmetless, but from bad and illegal driving (e.g. speeding) – threats from which cycle helmets are not designed to protect their wearers. It therefore makes far better sense for the police to tackle them.

h. A country's resources

- An analysis of the costs and benefits of introducing a cycle helmet law in Germany concluded that it would be a waste of the country's resources because

[26] NACTO. Equitable bike share means building better places for people to ride. July 2016.
[27] Robinson, D.L. Helmet laws and cycle use. Injury Prevention. Research letter published in 2003.

the benefits of such a law would be about 0.714 of the costs. The author accounted for: the benefit of increased security when cyclists wear a helmet or use a transport mode that is less risky than cycling; the cost of purchasing helmets, reduced fitness when cycling is replaced by a motorised transport mode; the discomfort of wearing helmets; and environmental externalities. [28]

- A 1999 analysis of Western Australia's helmet law suggested its net impact lay in the range from a 2 million AUS$ benefit to a 10 million AUS$ disbenefit.[29]
- An analysis of New Zealand's helmet law found a small cost saving in the youngest age group, but "large costs from the law were imposed on adult (≥19 years) cyclists." (This was based on estimates of the total spending on helmets, the value of head injuries averted, and medical costs for cyclists admitted to hospital). [30] A re-analysis of this study by another researcher found no benefit for child cyclists either.[31]

6. Promotional campaigns

Simply promoting helmet wearing rather than mandating it may reduce cycle use too, possibly because it implies it's unsafe:

- A 2004 report for the European Conference of Transport Ministers noted that: "From the point of view of restrictiveness, even the official promotion of helmets may have negative consequences for bicycle use, and that to prevent helmets having a negative effect on the use of bicycles, the best approach is to leave the promotion of helmet wear to manufacturers and shopkeepers".[32]
- Even picturing helmets on marketing materials designed to promote cycling appears to have an adverse impact: Danish research concluded that "A picture of a smiling leisure cyclist has a clear positive marketing effect on cycling. A picture of a bicycle accident or a picture of a cyclist wearing a helmet, on the other hand, has an evident negative marketing effect." [33]
- Research commissioned by the UK Department for Transport (DfT) concluded that, in areas where a helmet campaign was held, "a larger increase in helmet wearing was found than in the areas which had not held such a campaign. However, this increase was found to be strongly linked to a decrease in the numbers of cyclists observed: in those areas where a campaign had been held and the numbers of cyclists had increased, helmet wearing fell".[34]

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[28] Sieg, Gernot. Costs and benefits of a bicycle helmet law for Germany. Institute of Transport Economics Münster working paper No. 21. March 2014.
[29] Hendrie, D, et al. An Economic Evaluation of the Mandatory Bicycle Helmet Legislation in Western Australia. Road Accident Prevention Research Unit, University of Western Australia. 1999.
[30] Taylor, M & Scuffham P. New Zealand bicycle helmet law-do the costs outweigh the benefits? Injury Prevention, vol 8 pp 317-320, 2002.
[31] Robinson D. Cost and benefits of the New Zealand helmet law. Bicycle Helmet Research Foundation, undated.
[32] European Conference of Transport Ministers. Implementing Sustainable Urban Travel Policies: Moving Ahead - National policies to promote cycling. ECMT, 2004.
[33] Hjuler, S & Krag, T. Measuring the impact of bicycle marketing messages. Proceedings from the Annual Transport Conference at Aalborg University. 2013. See also: http://thomaskrag.com/trma/index_en.htm
[34] Bryan-Brown, K & Taylor, S. Cycle helmet wearing in 1996. TRL, Report 286.

7. Cycle helmets and head injuries

For any individual whose life has been affected by a head injury while cycling, or for anyone bereaved by such an incident, it is a very understandable reaction to feel that anything that might have prevented it must be desirable. Consequently, they may call for a helmet law.

But the introduction and implementation of any legislation that affects the whole population must be evidence-based, proportionate, and ensure that singling out a specific target for intervention above others is justified.

In the case of MHL, this means examining:

- how much protection cycle helmets really offer
- how big a problem serious or fatal head injury really is among cyclists and how this compares to other groups
- whether experience from countries with MHL shows that the law has directly led to a net reduction in the proportion of cyclists presenting with head injuries
- weighing this up against the health and other benefits lost if, as is more than likely, MHL deter cycling (covered in section 1 above).

a. Cycle helmet design

Cycle helmets are and can only be designed to withstand minor knocks and bumps, not collisions with fast cars or lorries; nor can they protect anyone from crushing injuries if they are run over.

Helmets must also be worn correctly and the right fit, which is by no means always the case. [35]

The design of cycle helmets is largely dictated by the nature of cycling itself. It's an activity that involves physical effort, so cycle helmets can't be as heavy or bulky as those worn by motorcyclists. To be wearable, therefore, they need to be light, well-ventilated, aerodynamic etc. They also need to affordable.

Inevitably, these requirements affect the level of protection cycle helmets can realistically offer, the claims manufacturers and retailers can plausibly make about them, and what the applicable standards expect. In fact, the tests helmets go through to meet the required standard only expect them to offer similar protection afforded to a pedestrian who trips and falls to the ground.

One concern expressed about helmets is their capacity to protect brains from rotational motion after an oblique impact and, moreover, the theory that helmets might increase severity. This is important because not only is an oblique impact more likely but, in inducing head rotation, it is also said to injure the brain more seriously.

The Transport Research Laboratory tested helmets for this in 2007, concluding: "… in both low speed linear impacts and the most severe oblique cases, linear and rotational

[35] Farag, N, et al. Factors associated with bicycle helmet use and proper fit: a cross-sectional survey of Montreal cyclists during the COVID-19 pandemic. Canadian Journal of Public Health. 2023

accelerations may increase to levels corresponding to injury severities as high as AIS 2 or 3, at which a marginal increase (up to 1 AIS interval) in injury outcome may be expected for a helmeted head." They added, however: "The true response of the bare human head to oblique, glancing blows is not known and these observations could not be concluded with certainty, but may be indicative of possible trends."[36]

Nowadays, it is possible to purchase helmets fitted with mechanisms specifically intended to reduce rotational motion. These systems, and protocols for testing how effective they are, have been subject to research and, according to that, are largely a positive advance (depending on the system tested).[37] They are not required by the traditional standards, however. [38]

A further concern about helmets – that younger children have in the past been strangled or choked by chin straps – is covered by EN1080:2013, a standard specifying that a strap is designed to snap.

But, irrespective of the level of protection offered, helmets can't prevent collisions happening in the first place, whereas high-quality infrastructure, lower speeds, considerate driving and effective enforcement etc. can and do.

b. Head injuries among cyclists

Many researchers have tried to establish whether people who wear cycle helmets are less or more likely to suffer from injuries to the head or brain than those who do not.

The results of their studies, which are usually based on data relating to injured cyclists admitted to hospital, are mixed, contradictory and sometimes hotly debated.

Some research, for instance, concludes that helmets make little, if any difference; some that helmeted cyclists are more at risk; some that helmets protect against certain types of head injury but not others and/or increase the likelihood of certain (e.g. neck) injuries; and some that people who go on riding after the introduction of MHL are less safe than they were before.

In Appendix A (downloadable from cyclinguk.org/briefing/cycle-helmets), we investigate why cycle helmet-related studies are so often contradictory, and possible explanations for researchers' regular failure to detect any net benefits of helmet-wearing.

Below, we look at examples of the evidence itself.

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[36] St Clair, V.J.M / Chinn, B.P. Assessment of current bicycle helmets for the potential to cause rotational injury. TRL report PPR213. May 2007.

[37] See, for example: Hoshizaki, T, et al. Evaluation of two rotational helmet technologies to decrease peak rotational acceleration in cycling helmets. Scientific reports, article number 7735 (2022). May 2022. / Bottlang, M, et al. Impact Performance Comparison of Advanced Bicycle Helmets with Dedicated Rotation-Damping Systems. Annals of Biomedical Engineering, 2020; 48 (1): 68-78. 2019 / Bliven, E, et al. Evaluation of a novel bicycle helmet concept in oblique impact testing. Accident Analysis & Prevention, vol. 124, pp 58-65. 2019.

[38] The British Standards for helmets are BS EN 1078 and BS EN 1080 (the latter was created in 2013 for helmets worn by young children to integrate testing for a quick-release system to stop children being strangled by do fastening mechanisms).

Prevalence

Firstly, though, a good deal of evidence suggests that people who cycle are not unduly at risk of injuring their heads anyway, while it goes without saying that it's not the only activity that can lead to someone being hospitalised for a head injury:

- Falling from height (including downstairs) was the most common cause of head injury among children admitted to 216 UK hospitals for more than four hours over a seven-month period (2009-2010): 62% out of 5,700 cases. Only 5% were hurt while cycling, despite it being a popular activity for children. (The researchers were not examining helmet-use, so it is impossible to say whether any of the cyclists were helmeted).[39]
- A UK-wide study (Feb 2001-Aug 2003) of children requiring intensive care for traumatic brain injury (TBI) found that: 36% were pedestrians, another 24% had suffered falls, 10% were cyclists and 9% motor vehicle occupants. Half of the children who died (23/46) were motor vehicle occupants.[40]
- A study covering the mid-1990s to 2002/3 found that just 7-8% of the head injuries for which children under 16 were admitted to English hospitals were cycling-related. The authors estimated that just a quarter of these were to parts of the head that might be protected by a helmet – and it is likely that some of the children were wearing helmets anyway. They also found that head injuries accounted for 37.6% of cycling injuries, but 43.7% of pedestrian injuries.[41]
- One academic found "… no evidence that cycle helmets reduce the overall cyclist injury burden at the population level in the UK when data on road casualties is examined." [42]
- The same researcher also investigated population level trends in head injuries among child pedestrians and cyclists in the UK and found that rates were falling for both groups, but that "the time series are inconsistent with helmet wearing data." [43]
- A study to determine how important head injuries in cyclists are as a cause of road death in England (2007-2012) concluded that it depends on the metric used: "Pedestrians and drivers account for five and four times the number of fatal head injuries as cyclists. The fatal head injury rate is highest for cyclists by time travelled and for pedestrians using distance travelled."[44]
- One author, who examined the effect of MHL in Australia noted in 1996: "Despite the risk of dying from head injury per hour being similar for unhelmeted

[39] Trefan, L, et al. Epidemiology of children with head injury: a national overview. 2016. Published in BMJ.
[40] Parslow, R, et al. Epidemiology of traumatic brain injury in children receiving intensive care in the UK. Archives of Disease in Childhood, vol 90 pp 1182-1187, 2005.
[41] Franklin, JA & Chapman, G. Quantifying the risk of head injury to child cyclists in England: an analysis of hospital admissions data. Bicycle Helmet Research Foundation 2005.
[42] Hewson, P. Cycle helmets and road casualties in the UK. Traffic Injury Prevention, vol 6 no. 2 pp127-134, 2005.
[43] Hewson, P. Investigating population level trends in head injuries amongst child cyclists in the UK. Accident Analysis & Prevention, vol 37 no. 5 pp 807-815, 2005.
[44] Lloyd, M, et al. Are head injuries to cyclists an important cause of death in road travel fatalities? Journal of Transport & Health, vol 10, pp 178-185. Sept 2018.

cyclists and motor vehicle occupants, cyclists alone have been required to wear head protection."

- Australian data from 2003-04 suggested that the proportion of head injuries requiring hospitalisation was about the same for cyclists (27.4%) as for drivers (26%) and less than for pedestrians (33.3%).[45]
- A German Federal Highway Research Institute report from 2009 found that the rate of serious head injuries amongst cyclists, pedestrians and car occupants is similar.[46]
- Danish data have shown that, compared with pedestrian and car occupant injuries, cycling injuries result in the shortest hospital stays and are least likely to be serious.[47]
- A 2009 report on collisions involving cyclists on Britain's roads found that:
    - For fatalities, "the majority of the pedal cyclists who died (62% London, 76% rural) sustained severe injury (AIS 3+) to more than one body region, the most combination being 'head and thorax' (20% London, 34% rural).
    - The head was the only body region seriously injured (AIS 3+) in 27% of fatal injuries of the London sample and 20% in the rural sample."
    - For those who died of a head injury only, a quarter were hit in the rear by a vehicle.
    - The London cyclist fatalities who sustained both head and thorax injuries at AIS 3+ "typically were involved in collisions where either a larger goods or passenger vehicle turned left across their path and ran them over or the cyclist lost control and fell into the path of the other vehicle". (As discussed above, cycle helmets are not designed to protect cyclists if they are run over). Note: The report did not examine helmet use.[48]

- Having examined 67,000 records of bicycle-related injuries among 5-17-year-olds admitted to US emergency depts, researchers estimated that nationally:
    - Upper extremities were the most commonly injured body region (36% - most often to the wrist), followed by the lower extremities (25% - most often to the knee)
    - TBI represented just 11% of the total, and was the second, not topmost common injury for the 4.2% who were hospitalized (43.4% were hospitalized for a fracture, 31.9% for a TBI).
    - Motor vehicle involvement increased the odds of bicycle-related TBIs. [49]

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[45] Berry, J & Harrison, J. Serious injury due to land transport accidents, Australia 2003-4. Australian Institute of Health and Welfare, Flinders Uni., Adelaide, 2007.
[46] Auerbach, K, et al. Medizinische Folgen von Straßenverkehrsunfällen: Drei Datenquellen, drei Methoden, drei unterschiedliche Ergebnisse? (Medical consequences of road traffic accidents: three data sources, three methods, three different results?) Federal Highway Research Institute. Oct 2009. (Page 10).
[47] Krag, T. Cycling, safety and health. 2011.
[48] Knowles, J, et al. Collisions involving pedal cyclists on Britain's Roads: establishing the causes. TRL Project Report PPR 445. 2009.
[49] McAdams, R.J, et al. Bicycle-related injuries among children treated in US emergency departments, 2006-2015. Sept. 2018. The full text is available for a fee, but the detailed results were reported elsewhere (e.g. by Nationwide Children's)

Helmets and cycle safety

Much evidence refutes the argument that helmets and/or MHL materially improve cyclists' overall safety, even where a law increases the proportion of people wearing them.

Where fatalities decline in places with MHL, it is probably because cyclist numbers have declined alongside, (see section 1 above), and not because helmets make any perceptible difference to fatality levels. In some cases, head or other injuries seem to have declined less steeply than cycling levels, implying that the risk actually increased.

Also, injuries among cyclists and/or other road users too may have been trending downwards for other reasons anyway (e.g. improved hospital procedures), and/or the MHL coincided with other, genuinely useful, road safety measures.

In other words, attributing casualty reductions directly to compulsory helmet-wearing, or determining whether cycle helmets are a worthwhile road safety measure, is by no means an exact science, and fraught with confounding factors:

- A systematic review of the evidence from places with MHL found no link between increases in helmet-wearing and improvement in cyclists' safety.[50]
- In Western Australia, the percentages of both pedestrians and cyclists hospitalised for head injuries had been trending downwards from around 1980. The sharp increase in helmet-wearing following the 1992 MHL made no apparent difference to the hospitalisation trend for cyclists.[51]
- Research based on data from New South Wales (NSW) suggested: "With 36% and 44% fewer child cyclists in the first and second years of the law, it would have been expected that, even if helmets had no effect, head and other injuries to child cyclists would reduce commensurately". Instead, though, they declined by less, suggesting that the risk of these injuries went up.[52]
- The same author found that, despite a huge leap in helmet wearing in Australia (e.g. from 31% to 75% in Victoria), "… the proportion of head injuries in cyclists admitted or treated at hospital declined by an average of only 13%. The percentage of cyclists with head injuries after collisions with motor vehicles in Victoria declined by more, but the proportion of head injured pedestrians also declined; the two followed a very similar trend." These trends, the author suspected, may have been due to major initiatives directed at speeding and drink-driving that were introduced at the same time.[53]
- Another researcher who examined original count data from NSW concluded that the reduction in fatalities after helmets were made compulsory was probably due to lower cycle use in general plus significantly fewer child cyclists, who accounted most frequently for cycling-related fatalities beforehand. The

[50] Robinson, D. No clear evidence from countries that have enforced the wearing of helmets. 2006 Mar 25; 332(7543): 722–725. BMJ. 2006.
[51] Robinson, B. Is there any reliable evidence that Australian helmet legislation works? 1996.
[52] Robinson, D. Head injuries and bicycle helmet laws. Accident Analysis and Prevention, vol 28, no. 4, pp 463-475, 1996.
[53] Robinson, D. Head injuries and bicycle helmet laws. Accident Analysis and Prevention, vol 28, no. 4, pp 463-475, 1996.

researcher also found that fatalities were already dropping pre-law for cyclists, pedestrians and motorcyclists, and that the MHL coincided with road safety improvements (e.g. mobile speed cameras, random breath testing and 'black spot' remediation), and "... the construction and increasing use of both on- and off-road cycleways and shared paths".[54]

- In New Zealand, the percentage reduction in cyclists' head injuries differed very little from the reduction in head injuries overall (road users and others), with no effect detectable in 1994, the year the law was introduced, despite a very sharp increase in adult and teenage helmet-wearing rates that year.[55]
- Researchers who looked at hospital admission rates (2006-2011) for cycle-related injuries in Canadian jurisdictions with different helmet laws did not find a relationship between MHL and hospitalization rates for brain, head, scalp, face or neck injuries. They therefore suggested that policymakers who want to reduce cycling injury rates in the population should focus on other factors, such as increasing cycling mode share via segregated infrastructure and quiet streets. [56]
- Another study from Canada concluded: "Reductions in the rates of admissions to hospital for cycling related head injuries were greater in provinces with helmet legislation, but injury rates were already decreasing before the implementation of legislation and the rate of decline was not appreciably altered on introduction of legislation." [57]
- Two studies from the US come to opposing conclusions about the impact of helmet laws. One concluded: "Bicycle helmet safety laws are associated with a lower incidence of fatalities in child cyclists involved in bicycle–motor vehicle collisions." (Note, the authors did not address the effect of helmet laws on levels of ridership).[58] The other study, which investigated the rate of head and intra-abdominal injury in Los Angeles County before and after helmet legislation was introduced in 1994, states: "Injury patterns did not change ... with head injuries predominating" (the rate of helmet use did not change either).[59]
- Comparing the effect of helmet legislation in Seattle (introduced in 2003) with that in King County (introduced 1994), researchers found "no significant change in the proportion of bicyclists admitted to the hospital and treated for head injuries in either Seattle [...] nor in the rest of King County. However, bicycle-related major head trauma as a proportion of all bicycle-related head trauma did decrease significantly in Seattle [...] while there was no significant change in King County [...]". The authors add: "While the results do not show an overall

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[54] Lemon, J. Changes in participation, demographics and hazard associated with mandatory bicycle helmets in New South Wales, Australia. Journal of Transport & Health, vol 9, pp 195-202. 2018.
[55] Perry, N. The Bicycle Helmet Legislation - Curse or Cure? 2001. Not online. Cited at cycle-helmets.com/helmet-curse.pdf.
[56] Teschke, K, et al. Bicycling injury hospitalisation rates in Canadian jurisdictions: analyses examining associations with helmet legislation and mode share. Oct 2015. Published in BMJ.
[57] Dennis J, et al. Helmet legislation and admissions to hospital for cycling related head injuries in Canadian provinces and territories: interrupted time series analysis. BMJ 2013;346:f2674. 2013
[58] Meehan, W.P, et al. Bicycle Helmet Laws Are Associated with a Lower Fatality Rate from Bicycle-Motor Vehicle Collisions. Journal of Pediatrics, vol 163, issue 3, pp 726-729. 2013.
[59] Castle, S.L, et al. Bicycle Helmet Legislation and Injury Patterns in Trauma Patients Under Age 18. Journal of Surgical Research, vol 173, issue 2, pp 327-331. 2012.

decrease in head injuries, they do reveal a decrease in the severity of head injuries, as well as bicycle-related fatalities, suggesting that the helmet legislation was effective in reducing severe disability and death". [60]

- In Halifax, Nova Scotia (MHL introduced in 1997), the initial 60%+ reduction in cycle use recovered to a 40%+ reduction in the second year of the law. Reporting on the numbers of bicycle-related casualties recorded at a health centre, researchers found: "416 [...] in 1995/96, 222 in 1997 and 443 in 1998/99. Head injuries accounted for 15 (3.6%), 3 (1.4%) and 7 (1.6%) of the injuries respectively (p = 0.06)." In other words, the initial c50% reduction in cyclist hospitalisations bounced back up and, in the second year of the law, total admissions were 6% higher than they had been in the year before.[61]
- A study from 2007 says: "There is evidence of increased accident risk per cycling-km for cyclists wearing a helmet. In Australia and New Zealand the increase is estimated to be around 14%."[62]
- Calling it a "paradoxical observation", researchers who looked at the prevalence of bicycle injuries in a large urban hospital in California concluded that: "The prevalence of significant head trauma was 35% in the group of patients with helmet and 34% in the group without helmets [...]." They also noted that "... the prevalence of all significant trauma was 26% in the group of patients with helmet and 20% in the group without helmets [...]. The overall mortality was 1%. There was no difference in mortality between helmeted and non-helmeted patients." [63]
- A US study of bicycle use and cyclist safety following Boston's cycle infrastructure expansion (2009-2012) found that "... individuals with documented helmet use were found to have 1.85 [...] times the odds of non–helmet users of being involved in an injury-related accident." [64]
- A four-year review of bicycle injuries (2009-12) published in the European Journal of Trauma and Emergency Surgery (2014) concluded that: "Bicycle helmets may have a protective effect against external head injury but its protective role for intra-cranial hemorrhage is questionable." [65]

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[60] Kett, P, et al. The Effect of an All-Ages Bicycle Helmet Law on Bicycle-related Trauma. Journal of Community Health. 2016.
[61] LeBlanc, J, et al. Effect of legislation on the use of bicycle helmets. Canadian Medical Association Journal, vol 166, no.5, pp 592-5. 2002.
[62] Erke, A & Elvik, R. Making Vision Zero real: preventing pedestrian accidents and making them less severe. TØI (Institute for Transport Economics) report 889/2007, p28. Oslo, 2007.
[63] Khan.N, et al. The Prevalence of Bicycle Injuries in a Large Urban Hospital. International Journal of Advanced Research in Orthopaedics. 2019.
[64] Pedroso. F.E, et al. Bicycle Use and Cyclist Safety Following Boston's Bicycle Infrastructure Expansion, 2009-2012. American Journal of Public Health. Dec. 2016. The authors also note: "One interesting result in our study was the 118% increase in the odds of being injured in a bicycle accident among individuals who were wearing a helmet at the time of the accident. Although the reasons for this finding are unknown, helmet use is probably confounded by the riding behavior of helmet users, who may be more aggressive, faster riders. Furthermore, as noted, there may be selection bias in reporting of helmet use at the scene among those who are injured".
[65] Joseph, B et al. Rethinking bicycle helmets as a preventive tool: A 4-year review of bicycle injuries. European Journal of Trauma and Emergency Surgery, vol 40, pp 729-732. 2014.

- A review of helmet evidence commissioned by the DfT published in 2009 noted that it was "impossible to definitively quantify the effectiveness or otherwise of cycle helmets based on the literature reviewed." [66]
- Research published in 2005 concluded: "There is no evidence that cycle helmets reduce the overall cyclist injury burden at the population level in the UK when data on road casualties is examined. This finding, supported by research elsewhere could simply be due to cycle helmets having little potential to reduce the overall transport-related cycle injury burden." [67]
- A report by the same author, also from 2005, found: "head injuries are falling among child pedestrians and cyclists in the UK as a proportion of all injuries requiring hospital attention", but that "the time series are inconsistent with helmet wearing data". In other words, the fall could not be explained by helmet wearing. [68]
- A study of 119 cyclist fatalities in two Czech regions (1995-2013) concluded that 44 of them (37%) would have survived if they had been wearing helmets, mostly in single-vehicle crashes and in certain cases where an intracranial injury was the primary cause of death. It follows, however, that helmets would not have helped the other 63%. The authors also concluded that helmets would not have helped in "most high-energetic crashes, especially when motor-vehicles or trains were involved," or "in some rear-end crashes outside urban areas." [69]
- One calculation from 1996, based on Australian data, concluded that cycling without a helmet carried only slightly more risk of death or serious injury per hour than driving.[70]

Please note that some of the research mentioned above still advocates cycle helmets and even helmet laws.

On the other hand:

- A study of children admitted for head injuries to a Nottingham (UK) intensive care unit (January 2011-June 2018) concluded that they were significantly less likely to be wearing a helmet than the 'general population'. None of the 22 injured children, in fact, was wearing a helmet. (See footnote for critique).[71]

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[66] Hynd D et al. The potential for cycle helmets to prevent injury - a review of the evidence. TRL research report PPR 446, 2009.
[67] Hewson, P. Cycle helmets and road casualties in the UK. Traffic Injury Prevention, vol 6 no. 2 pp127-134, 2005. The author adds: "Equally, it could be a manifestation of the "ecological fallacy" where it could be conceived that the existence of various sub-groups of cyclists, with different risk profiles, may need to be accounted for in understanding the difference between predicted and realised casualty patterns."
[68] Hewson, P. Investigating population level trends in head injuries amongst child cyclists in the UK. Accident Analysis & Prevention, vol 37 no. 5 pp807-815, 2005.
[69] Bil, M, et al. Cycling fatalities: When a helmet is useless and when it might save your life. 2018.
[70] Robinson, D. Head injuries and bicycle helmet laws. Accident Analysis and Prevention, vol 28, no. 4, pp 463-475, 1996.
[71] Carone, L, et al. Cycling related traumatic brain injury requiring intensive care: association with non-helmet wearing in young people. International Journal of the care of the Injured, vol 50, issue 1, pp 61-64. Jan 2019. But the authors estimated children's helmet wearing rates (17.3%) from observing only 133 individuals at six local schools. This means they didn't account for children's habits when riding for

- A 2019 study of cyclists (aged 16+) admitted to hospitals with major injuries over a five-year period concluded that there is a "significant correlation between use of cycle helmets and reduction in adjusted mortality and morbidity associated with TBI and facial injury." (See footnote for critique). [72]
- An observational study of head injury patterns among cyclists admitted to hospital in London concluded: "In a largely urban environment, the use of cycle helmets appears to be protective for certain types of serious intra and extracranial head injuries."[73]
- A study to determine whether helmets could offer a protective advantage even in a "dense urban setting with a commitment to road safety" - New York in this case – states that the protective impact "remains significant."[74]
- Researchers, also in the US, who examined 67,000 cases of bicycle-related injuries among children (5-17 years, 2006-2015), concluded that traumatic brain injuries – which included concussion, fracture to the head and internal organ injury to the head – were more frequent among non-helmet users and children with injuries sustained in collision with a motor vehicle. (This conclusion was not based on all 67,000 cases, however, but 9,600 (14%), because the records did not always state whether or not a child was wearing a helmet). [75]
- A study of the effectiveness of cycle helmets in preventing head injury in collisions with motor vehicles claimed that helmet use was "associated with

recreation (when they aren't subject to any helmet-wearing policy imposed on them by school), or any different kind or riding environment. Also, over two-thirds (15/22 or 68%) were hit by a motor vehicle, i.e. the type of impact that helmets are not specifically designed to mitigate.

[72] Dodds, N. et al. Evaluating the impact of cycle helmet use on severe traumatic brain injury and death in a national cohort of over 11000 pedal cyclists: a retrospective study from the NHS England Trauma Audit and Research Network dataset. BMJ. 2009. After excluding patients whose injuries did not reach a certain threshold of severity, along with over 4,500 seriously injured cyclists for whom no data on helmet use was recorded, the authors were left with 6,621 cases. Of these, 4,075 were wearing helmets and 2,546 not (i.e. more helmeted cyclists were admitted with major injuries than un-helmeted cyclists - the authors do not cite helmet-wearing rates in the general population). The study also found that: "There was a statistically significant increase in chest, spinal, upper and lower limb injury in the helmeted group in comparison with the helmet group". For example, 10.7% of helmeted cyclists suffered serious spine injuries, compared to 5.4% of un-helmeted cyclists. Although they knew that most of their subjects were male (84.7%), they had no idea what type of cycling they were doing (e.g. MTB or urban commuting), or what type of helmets they were wearing and could not take account of evidence suggesting that cyclists who wear helmets differ from those who do not. They did, however, record at least one other disparity in the two groups: around 15.6% of their un-helmeted cyclists had alcohol in their system as opposed to only 2.1% of those who were helmeted. Yet they do not acknowledge that this finding strongly implies that their un-helmeted subjects were far more likely to crash than their helmeted subjects in the first place and, as such, their decision to ride un-helmeted was not the only salient difference between them and the helmeted group.

[73] Forbes, A, et al. Head injury patterns in helmeted and non-helmeted cyclists admitted to a London Major Trauma Centre with serious head injury. PLOS ONE. 2017.

[74] Sethi, M, et al. Bicycle helmets are highly protective against traumatic brain injury within a dense urban setting. International Journal of care of the Injured, vol 46, issue 12, pp 2483-2490. 2015.

[75] McAdams, R.J, et al. Bicycle-related injuries among children treated in US emergency departments, 2006-2015. Accident Analysis & Prevention, vol 118, pp 11-19. Sept. 2018.

reduced risk of head injury in bicycle collisions with motor vehicles of up to 74%, and the more severe the injury considered, the greater the reduction."[76]

- An analysis of emergency department (ED) and hospitalisation data before and after an MHL came in for under-18-year-olds in Alberta, Canada, concluded: "Our data indicate significant declines in the proportion of child bicyclist ED HIs [head injuries] and child, adolescent and adult bicyclist HI hospitalizations. This is in contrast to no significant trends in the proportion of ED or hospitalized HIs among pedestrians and the unexpected increases in the proportion of ED HIs for adult bicyclists." (Note that, according to separate research, the rate of hospital admissions for cycling related head injuries per 100,000 person years had been on its way down for some years prior to the law anyway for both adults and people under 18, but more markedly for adults who were not covered by the law).[77]
- The authors of a computer simulation study concluded: "Bicycle helmets were found to be effective in reducing the severity of head injuries sustained in common accidents."[78]
- Over time, other researchers in the US have variously concluded that helmet use protects again severe traumatic brain injury and/ or head and neck injuries (see footnotes [79, 80], for example).
- A meta-analysis concluded that helmets were protective against facial injury.[81] Other studies have also looked at whether helmets help protect against facial injuries, but come to opposing views.[82, 83]

Many of the above studies were hospital-based, i.e. they looked at hospital data only and directly compared injury outcomes among helmeted cyclists with those among un-helmeted cyclists.

This points to an inherent shortcoming: their conclusions assume that the absence or presence of a helmet is the only difference between the two groups in the context of injury outcomes. This means they ignore other differences that may well be correlated with the

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[76] Bambach. M.R, et al. The effectiveness of helmets in bicycle collisions with motor vehicles: A case–control study. Accident Analysis & Prevention, vol. 52, pp 78-88. 2013.
[77] Dennis, J, et al. Helmet legislation and admissions to hospital for cycling related head injuries in Canadian provinces and territories: interrupted time series analysis. BMJ 2013.
[78] McNally, D.S / Whitehead, S. A computational simulation study of the influence of helmet wearing on head injury risk in adult cyclists. Accident Analysis & Prevention, vol. 60, pp 15-23. 2013.
[79] Williams, C. et al. Pediatric bicycle helmet legislation and crash-related traumatic brain injury in Illinois, 1999-2009. Journal of Surgical Research, vol 222, pp 231-237. Feb 2018.
[80] Joseph, B. et al. Bicycle helmets work when it matters the most. American Journal of Surgery, vol. 213, issue 2, pp 413-417. Feb 2017.
[81] Fitzpatrick, D.G, et al. Bicycle helmets are protective against facial injuries, including facial fractures: a meta-analysis. International Journal of Oral & Maxillofacial Surgery, vol 47, issue 9, pp 1121-1125. Department of Maxillo-Facial Surgery. September 2018.
[82] Stier, R. et al. Reality or wishful thinking: do bicycle helmets prevent facial injuries? International Journal of Oral & Maxillofacial Surgery, vol. 48, pp 1235-1240. September 2019.
[83] Dodds, N, et al. Evaluating the impact of cycle helmet use on severe traumatic brain injury and death in a national cohort of over 11000 pedal cyclists: a retrospective study from the NHS England Trauma Audit and Research Network dataset. BMJ. September 2009.

chances of a cyclist falling and suffering a head injury in the first place. This problem, and the contradictions that arise from it, is covered in more detail in Appendix A (downloadable from cyclinguk.org/briefing/cycle-helmets).

8. Conclusion

The relatively small risks of cycling do not remotely justify banning any age group from cycling without a helmet, while mass helmet use has not in practice been found to materially reduce those risks anyway.

What is clear is that enforced helmet legislation suppresses cycling, and that the lost health benefits alone can impose a serious net cost to society.

With mounting concerns over physical inactivity, pollution and climate change, the last thing we should be doing is forcing yet more people, especially children, into car-dependent, sedentary lifestyles. Instead, to improve cycle safety tangibly and positively, along with people's perceptions of it, we recommend:

- Investing in safe, attractive cycling conditions including widespread default 20 mph speed limits and high quality infrastructure
- Promoting cycling as a healthy and enjoyable means of transport and recreation, both for the population in general, and for specific groups, e.g. school and college pupils, employees, women, health patients, and various disadvantaged or minority groups
- Introducing high-quality cycle training for all children in Year 6/7, and making it widely available more generally
- Strengthening road traffic law and its enforcement, and promoting and publicising the changes to the Highway Code made in 2022 (especially the 'Hierarchy of Users', new rules/guidance on junctions, overtaking and opening car doors).

9. Further reading

See separate appendices on:

- Cycle helmet studies: possible explanations for contradictory findings and failures to detect net benefits from helmet use (Appendix A)
- Piet de Jong's 2012 study, The health impact of mandatory bicycle helmet laws (Appendix B).