Cycle helmets: an overview of the evidence: APPENDIX B

The health impact of mandatory cycle helmet laws: the findings of Piet de Jong, 2012

As discussed in our main briefing, the key issue in the helmet debate is the need to weigh up whether the possible injury savings due to helmet-wearing justify the likely reductions in cycle use and the consequent loss of its health, environmental and other benefits.

A study by Australian statistician Piet de Jong has attempted to address the question algebraically. [1]

De Jong presents his central finding in the form of an equation, where a public health benefit can only arise if:

$$eq > \mu\beta$$

- q is the proportion of the health costs of helmet-free cycling which is due to head injuries
- e is the proportion of those costs which could be avoided if all cyclists wore helmets.

In this equation, e and q are both fractions, i.e. their value lies between 0 and 1 (or possibly between -1 and +1 in the case of e).

So, the left hand of the equation (eq) represents the total injury costs of (helmet-free) cycling which would be avoided if all cyclists wore helmets. It is clearly less than 1, it is probably closer to 0 and it might even be negative.

The right-hand side of the equation consists of two ratios:

- β is the ratio of the health benefits of (helmet-free) cycling relative to its risks. The value for β in the UK used here is 20:1 (see section 1 of the main briefing).
- μ is the ratio of cycle use lost following a helmet law to cycle use retained (n.b. this is not quite the same as the percentage reduction – for instance a 33% reduction in cycle use can be thought of as one unit of cycling lost for every two that remain, hence the equivalent value of μ would be 0.5).

If there is to be a net health benefit, the two ratios μ and β need to counter-balance one another so that, when multiplied together, the result is less than the fractional quantity eq.

In other words, if 20:1 is a correct value for β, then a helmet law can only yield a net health benefit if μ is less than 1:20 (i.e. there is no more than one unit of cycling lost for every 20 which remain), even if head injuries accounted for all of the injury costs of cycling and if helmets were 100% effective at addressing these risks (i.e. if e and q both equalled 1).

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[1] De Jong, P. The health impact of mandatory bicycle helmet laws (published in *Risk Analysis,* March 2012).

So even under these implausible assumptions, a disbenefit occurs if the reduction in cycle use is any more than 4.7% (i.e. 1/21). This figure then has to be reduced further still, in proportion to the values of *e* and *q*.

While the value of *e* is much debated (see Appendix A), *q* is likely to be about 0.5, given that detailed analysis of injury data in Britain published in 2009 suggested that probably c40% of cyclist injuries are serious enough to merit admission to hospital and c80% of fatalities involve head injuries (note, most of these also involved serious injuries to other body regions, particularly in the case of fatalities – see main briefing more on this report).[2]

On this assumption, the allowable reduction in cycle use drops to just 2.4%. It falls by another whole order of magnitude (i.e. to 0.24%) if the effectiveness of helmets is only 10% rather than 100%.

As shown earlier, the experience of enforcing helmet laws typically results in reductions in cycle use of the order of a third (i.e. μ = 1:2), and sometimes more than this. On that basis, and again assuming that head injuries amount to about 50% of the injury costs of cycling (i.e. q = 0.5), a helmet law would have disbenefits unless the health benefits outweighed the risks of cycling by less than about 1 to 1 – not 20:1 as estimated – even if helmets were 100% effective.

In short, as De Jong states: "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."

Finally, it should be noted that these calculations take no account of cycling's wider benefits for air quality, easing congestion, quality of life, equality of opportunity and the climate.

[2] Knowles J, et al. Collisions involving pedal cyclists on Britain's roads: establishing the causes. TRL report PPR 445, 2009.