

Bicycle helmets are protective against facial injuries, including facial fractures: a meta-analysis

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Abstract. Cycling is a popular activity. However there are risks associated with cycling, including facial injury. Helmets are often worn to prevent head injury. Evidence for their protection against facial injury is limited. This meta-analysis investigated the effect of bicycle helmets on the incidence of facial injury. The PubMed/MEDLINE, Google Scholar, and Cochrane Library databases were searched. Studies included were observational and involved adult participants. Paediatric studies, studies on helmet legislation, and those combining facial injuries with other injury types were excluded. The studies were evaluated by two reviewers. Risk of bias was assessed using the RevMan bias assessment tool. Odds ratios (OR) were extracted for facial injuries and facial fractures. Two meta-analyses were performed using these categories. Nine of the 102 studies identified were included. Helmets were protective against facial injury (OR 0.69, 95% confidence interval 0.63–0.75, $P < 0.0001$). Five studies reported facial fracture rates; helmets were protective against these also (OR 0.79 95% confidence interval 0.70–0.90, $P = 0.0003$). There are no randomized controlled trials on this topic and the number of studies available is small. Bicycle helmets offer protection against facial injuries and this should be considered by cyclists when deciding whether or not to use one.

Key words: bicycle; helmet; injury; fracture; prevention.

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Cycling is a popular activity, for recreation, work, and transport. In 2014 in England, 14.7% of adults used a bicycle once a month for any purpose¹. This has many benefits for individuals and society, including increased physical fitness, low-cost transport, and reduced environmental impact. However, there is a risk of personal injury associated with bicycle use, particularly on roads.

Measures to reduce risk include dedicated cycle lanes, increased cyclist visi-

bility, and the use of bicycle helmets. The first systematic review on the subject in 1999, checked as current in 2006, found that helmets are protective against head, brain, and upper and mid-facial injuries². However, regarding facial injuries, the authors were only able to include three studies. The review identified a lack of randomized controlled trials (RCTs) in this subject area, and so included high-quality observational studies. Since the time of this previous review, a number

of further such studies have been published.

The aim of this study was to build on the earlier work in the area and consolidate any evidence that bicycle helmets may provide protection from facial injuries to their users.

Methods

The PRISMA protocol for meta-analysis was used throughout this study (Preferred

Reporting Items for Systematic Reviews and Meta-analyses)³.

Eligibility criteria

As noted previously, there are not any RCTs in this area; therefore the meta-analysis had to be made up of observational studies, as was the case for the original review. Participants in these studies had to be adults who had sustained facial injuries whilst either wearing or not wearing a bicycle helmet.

Studies were included if they were observational, had adult participants (age ≥ 16 years) who used bicycles on roads, compared helmet users to non-helmet users, and reported the incidences in both groups. Studies were excluded if they examined the effects of helmet legislation, reported facial injuries with other injuries, compared different types of helmet, or were wholly paediatric studies.

Facial injury, for the purposes of this study, was determined to be any injury of the bones of the upper third (frontal bone), middle third (maxilla, palatine, zygomatic,

nasal, vomer, and zygomatic processes of the parietal bones), and lower third (mandible) of the face and their associated soft tissues. Injuries included fractures, lacerations, and abrasions^{4,5}.

Information sources and search strategy

Sources of information included the PubMed/MEDLINE, Google Scholar, and Cochrane Library databases. The last search was performed in January 2017.

The search strategy included injuries and fractures to the face, facial region, jaw, maxilla, mandible, zygoma, nose, and orbit in association with bikes, bicycles, and cycles, with and without helmets. Details of the search strategy can be found in the [Supplementary Material](#).

Data collection process

Once the initial list of studies had been obtained, two reviewers used the criteria listed above to independently screen the studies. Studies meeting the exclusion criteria were excluded at this point. This was

performed in the 3 months following the literature search.

A short-list of studies was then reviewed in more detail against the inclusion criteria, again by two independent reviewers. Once a study had met the inclusion criteria, the two reviewers independently extracted data from the studies and recorded the data in separate files, each inaccessible to the other reviewer. The separate datasets were then cross-referenced and combined by one of the reviewers.

Data were collected on the incidence of all facial injuries reported in helmet users and non-helmet users. When reported, separate data were collected on the incidence of facial fractures specifically in the two groups. The principal outcome measure was the odds ratio (OR) of facial injury (and fracture). If this was not reported, it was calculated using data available in the articles.

Risk of bias

The two reviewers also assessed the risk of bias of each study in terms of selection, reporting, attrition, and detection bias.

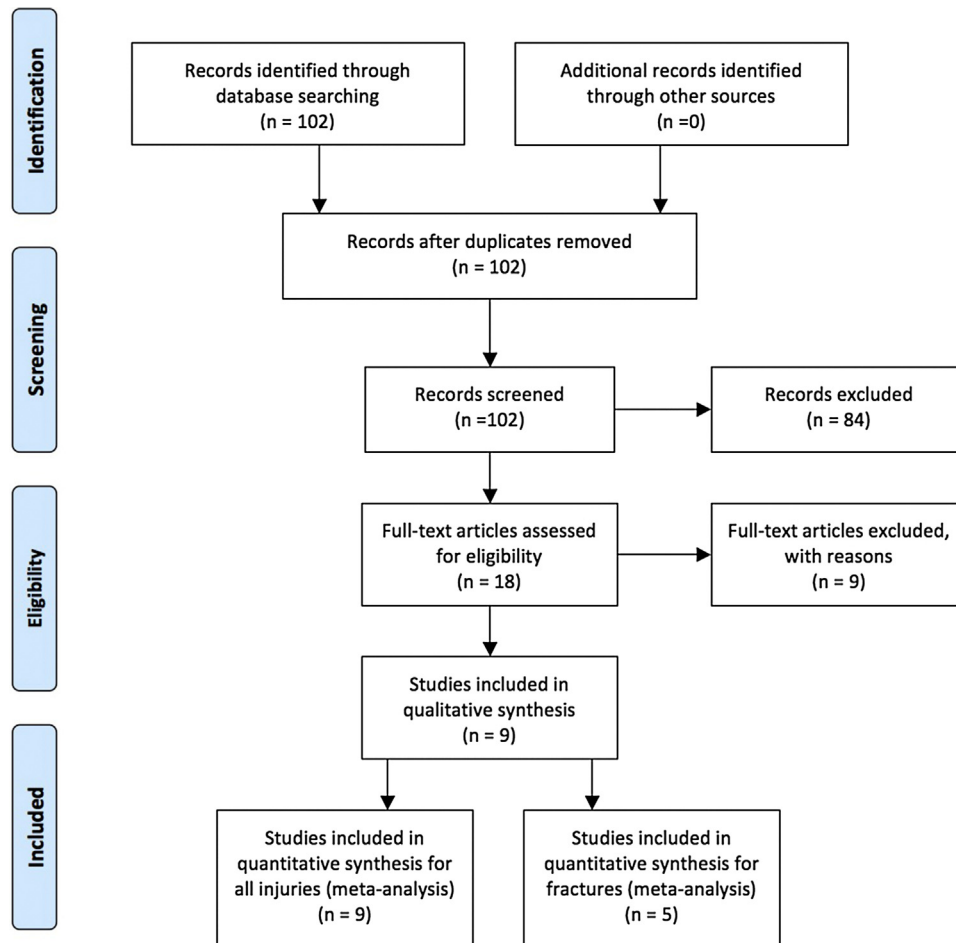


Fig. 1. Flow chart of the study selection process.

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