Bicycle injuries and helmet use: a systematic review and meta-analysis

Jake Olivier* and Prudence Creighton

School of Mathematics and Statistics, University of New South Wales, Sydney, NSW, Australia

*Corresponding author. School of Mathematics and Statistics, The Red Centre, University of New South Wales, Sydney NSW 2052, Australia. E-mail: j.olivier@unsw.edu.au Accepted 20 May 2016

Abstract

Background: The research literature was systematically reviewed and results were summarized from studies assessing bicycle helmet effectiveness to mitigate head, serious head, face, neck and fatal head injury in a crash or fall. Methods: Four electronic databases (MEDLINE, EMBASE, COMPENDEX and SCOPUS) were searched for relevant, peer-reviewed articles in English. Included studies reported medically diagnosed head, face and neck injuries where helmet use was known. Nonapproved helmets were excluded where possible. Summary odds ratios (OR) were obtained using multivariate meta-regression models stratified by injury type and severity. Time trends and publication bias were assessed.

Results: A total of 43 studies met inclusion criteria and 40 studies were included in the meta-analysis with data from over 64 000 injured cyclists. For cyclists involved in a crash or fall, helmet use was associated with odds reductions for head (OR.0.49, 95% confidence interval (CI): 0.42–0.57), serious head (OR.0.31, 95% CI: 0.25–0.37), face (OR.0.67, 95% CI: 0.56–0.81) and fatal head injury (OR.0.35, 95% CI: 0.14–0.88). No clear evidence of an association between helmet use and neck injury was found (OR.0.96, 95% CI: 0.74–1.25). There was no evidence of time trends or publication bias.

Conclusions: Bicycle helmet use was associated with reduced odds of head injury, serious head injury, facial injury and fatal head injury. The reduction was greater for serious or fatal head injury. Neck injury was rare and not associated with helmet use. These results support the use of strategies to increase the uptake of bicycle helmets as part of a comprehensive cycling safety plan.

Key messages

• This is the largest ever systematic review and meta-analysis of bicycle injury and helmet use, with over 64 000 injured cyclists from 40 studies.
• Bicycle helmet use was associated with reductions in head, serious head, face and fatal head injury.
• Reductions were greater for serious injury than for injuries of any severity.
• Neck and diffuse axonal injury were rare among cyclists and were not associated with helmet use.