

# Non-legislative interventions for the promotion of cycle helmet wearing by children (Review)

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[Intervention Review]

# Non-legislative interventions for the promotion of cycle helmet wearing by children

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## ABSTRACT

### Background

Helmets reduce bicycle-related head and facial injuries for bicyclists of all ages in all types of crash. We aimed to identify non-legislative interventions that are effective in promoting helmet use among children, so future campaigns can be designed on a firm evidence base.

### Objectives

To assess the effectiveness of non-legislative interventions (compared to a lack of interventions) in increasing helmet use among children; to identify possible reasons for differences in the effectiveness of interventions; to evaluate effectiveness with respect to social group; to identify any adverse consequences of interventions.

### Search strategy

We searched 11 electronic databases and manually searched other sources of potentially relevant data.

### Selection criteria

We included randomised controlled trials, cluster randomised controlled trials and controlled before and after studies. Studies included participants aged 0 to 18 years and described interventions to promote helmet use not requiring enactment of legislation. Studies had to report at least one of the following outcomes: observed helmet wearing; self-reported helmet ownership; self-reported helmet wearing.

### Data collection and analysis

Data were extracted by two reviewers working independently. Study results were adjusted to account for clustering. A random-effects model was used to pool data in meta-analyses. Heterogeneity was explored with sub-group analyses.

### Main results

Twenty-two studies were included. The odds of observed helmet wearing were significantly greater amongst those receiving non-legislative interventions (OR 2.30, 95% CI 1.37 to 3.85). Sub-group analysis indicated the effect may be greater for community-based studies (OR 4.30, 95% CI 2.24 to 8.25) and those providing free helmets (OR 4.35, 95% CI 2.13 to 8.89) than for those providing subsidised helmets (OR 2.02, 95% CI 0.98 to 4.17) and for those set in schools (OR 1.82, 95% CI 0.94 to 3.52). We found no significant effect of non-legislative interventions in increasing self-reported helmet ownership, but they were associated with a significant increase in self-reported helmet wearing (OR 3.90, 95% CI 1.42 to 10.69), particularly amongst interventions set in schools (OR 4.73, 95% CI 1.09 to 20.49) but there was significant unexplained heterogeneity between effect sizes for these two outcomes.

## Authors' conclusions

Community-based studies that include the provision of free helmets alongside an educational component increase observed helmet wearing in the areas in which they are set. There is some evidence that interventions in schools and those providing subsidised helmets may increase observed helmet wearing, but possibly to a lesser extent than those set in communities and those providing free helmets.

## PLAIN LANGUAGE SUMMARY

### Campaigns to encourage children to wear cycle helmets usually work, but some work better than others

Many children suffer head injuries while riding a bike. The review focused on encouraging children to wear helmets, as distinct from compelling them to do so through laws. The reviewers wanted to find out which sort of campaigns work best – particularly with children from poor families, who are less likely to own helmets. They found 22 helmet promotion campaigns that had been studied. The campaigns varied widely with regard to where they were carried out, age of the children, campaign methods etc. The results were also very varied but overall, after a campaign, children were more likely to wear helmets than other children. More research is still needed but it seems likely that the best schemes are based in the community and involve both education and providing free, or possibly subsidised, helmets. Promotion of helmets in schools also seems to be effective. The reviewers could not identify the best way of reaching poorer children. The studies they reviewed did not look at the impact of the campaigns on injury rates, or assess whether the promotion campaigns had any negative effects.

## BACKGROUND

Injuries to child cyclists are an important public health problem. On British roads in 2003, for example, 595 children were killed or seriously injured while cycling (DfT 2004). There is a steep social class gradient for cycling injuries in childhood, with mortality rates in children from social class five being four times higher than those from social class one (Roberts 1997). Hospital admission rates for cycling injuries have also been found to be 61% higher amongst children residing in deprived wards compared to those in affluent wards (Hippisley-Cox 2002).

Helmets reduce bicycle-related head and facial injuries for bicyclists of all ages involved in all types of crash (Thompson 2001). Several studies suggest that bicycle helmet usage rates are lower among children from socio-economically deprived backgrounds (Farley 1996; Parkin 1993).

Many authors have described bicycle helmet promotion programmes that aim to encourage children to wear helmets, but the programmes have varied widely in terms of their effectiveness and the strategies employed. It is difficult, therefore, to know from individual trials how effective cycle helmet promotion programmes have been, which elements of the programmes contribute to their effectiveness, and whether the effect is similar in different social groups. This information is vital for planning and delivering ef-

fective cycle helmet programmes in the future. The aim of this review is to identify those non-legislative interventions that are effective in promoting helmet use among children, so that future campaigns can be designed from a firm evidence base.

## OBJECTIVES

The objectives of this review were to:

- assess the effectiveness of non-legislative interventions in increasing bicycle helmet use among children;
- identify possible reasons for differences in the effectiveness of interventions;
- evaluate the effectiveness of these interventions with respect to social group;
- identify any adverse consequences or effects of interventions.

## METHODS

## Criteria for considering studies for this review

### Types of studies

- Randomised controlled trials.
- Quasi-randomised trials.
- Trials with concurrent controls.
- Controlled before-after studies.

### Types of participants

Children and adolescents aged between 0 and 18 years.

### Types of interventions

Interventions designed to promote bicycle helmet use that did not require the enactment of legislation including:

- health education programmes;
- subsidised or free helmet distribution programmes;
- media campaigns;
- interventions that included elements of the above.

Interventions that included legislation as a component were excluded. It is hoped that legislative interventions will be the subject of a further Cochrane Systematic Review.

### Types of outcome measures

- Observed bicycle helmet wearing.
- Self-reported bicycle helmet ownership.
- Self-reported bicycle helmet wearing.

## Search methods for identification of studies

The search was limited to children, from 0 to 18 years of age.

### Electronic searches

The following databases were searched between March and June 2002:

- Cochrane Injuries Group Trials Register;
- CENTRAL (Cochrane Central Register of Controlled Trials);
- DARE (Database of Abstracts of Reviews of Effectiveness);
- MEDLINE;
- EMBASE;
- TRL (Transport Research Laboratory);
- CINAHL;
- ERIC;
- PsycINFO;

- TRIS (Transport Research Information Service);
- BEI (British Education Index).

The search strategy was based on the following terms, using thesaurus terms and truncation+ as appropriate for each database: (bicycle or bicycling) AND (head protective devices or helmets).

### Searching other resources

In addition, reference lists from the following sources were examined:

- Helmet Resource Library ([www.sph.emory.edu/Helmets/helmets.html](http://www.sph.emory.edu/Helmets/helmets.html));
- National Bicycle Safety Network ([www.cdc.gov/ncipc/bike/referenc.htm](http://www.cdc.gov/ncipc/bike/referenc.htm));
- Bicycle Helmet Initiative Trust.

The proceedings of the six World Conferences on Injury Prevention and Safety Promotion between 1989 and 2002 were hand searched for relevant studies.

The journal *Injury Prevention* was handsearched from 1995 to the end of 2002.

## Data collection and analysis

### Selection of studies

The titles and abstracts of trials identified through the searches of electronic databases were inspected by two reviewers independently to determine whether they met the inclusion criteria. Abstracts that did not meet the inclusion criteria were rejected. Two independent reviewers assessed full copies of papers that appeared to meet the inclusion criteria. Uncertainties concerning the appropriateness of studies for inclusion in the review were resolved through consultation with a third reviewer. Non-English language studies were translated and included if they met the inclusion criteria.

### Data extraction and management

A standard data extraction form was designed and used to extract data on participants, socio-economic characteristics, interventions and outcomes. Data were extracted by two researchers independently and then compared. Any discrepancies were identified and resolved at a meeting of the reviewers. The reviewers performing the data extraction were blind to the author and institution of the article. Special care was taken to avoid the inclusion of multiple reports pertaining to the same individuals, for example in trials reporting outcomes over multiple time periods. Where data were not available in the published trial reports, authors were contacted to supply missing information.

### Assessment of risk of bias in included studies

For randomised controlled trials, allocation concealment, blinding of outcome assessment and completeness of follow up were used as the three markers of trial quality. The number of randomised controlled trials included in the review was too small to allow a sensitivity analysis based on these three quality markers. For non-randomised controlled trials, blinding of outcome assessment and completeness of follow-up were used as markers of quality, plus assessment of the distribution of confounders. Two reviewers who were blinded to the study findings assessed quality independently and inter-reviewer agreement was assessed. Findings in relation to quality markers for randomised and non-randomised studies are reported in the table describing the characteristics of included studies.

### Measures of treatment effect

Results were pooled by outcome and are presented as odds ratios (ORs) and 95% confidence intervals (CIs). All analyses were performed using RevMan software with random effects models to allow for and quantify the degree of statistical heterogeneity present between individual studies (DerSimonian 1986). Where cluster randomised trials were reported without appropriate adjustment for clustering, we approached the authors to obtain information on the intra-class correlation coefficient (ICC) or to obtain data from which we could calculate an ICC. Since none of the studies had either calculated an ICC or did not provide us with data from which we could calculate the ICC, we adjusted the reported treatment effect for clustering using an ICC of 0.02 as reported in a school-based health promotion intervention (Murray 2004). We also undertook sensitivity analyses using ICCs of 0.01 and 0.05 because we believe they represent the extremes of a range within which the true value is likely to be found (Ukoununne 1999; Adams 2004).

A sub-group analysis comparing treatment effect by social group was not possible, as only two studies were undertaken with participants from low-income communities and these measured different outcomes. Two further studies reported their results stratified by income (DiGuseppi 1989; Farley 1996) but these used different measures of income level and hence were not comparable.

### Assessment of heterogeneity

Heterogeneity between the results of studies included in the review was explored using forest and Galbraith plots (Sutton 1998; Egger 2001). Chi-squared tests of heterogeneity were used with a P value of 0.1 taken as indicating significant heterogeneity. The reasons for any heterogeneity were explored with sub-group analyses.

### Assessment of reporting biases

The possibility of publication bias was explored using Funnel plots and Egger's test (Egger 1997; Egger 1998).

### Sensitivity analysis

The individual contribution of each study to the pooled result was assessed graphically. The robustness of the findings with respect to study quality was assessed by comparing the pooled treatment effect from randomised controlled trials with the treatment effect derived from all study designs.

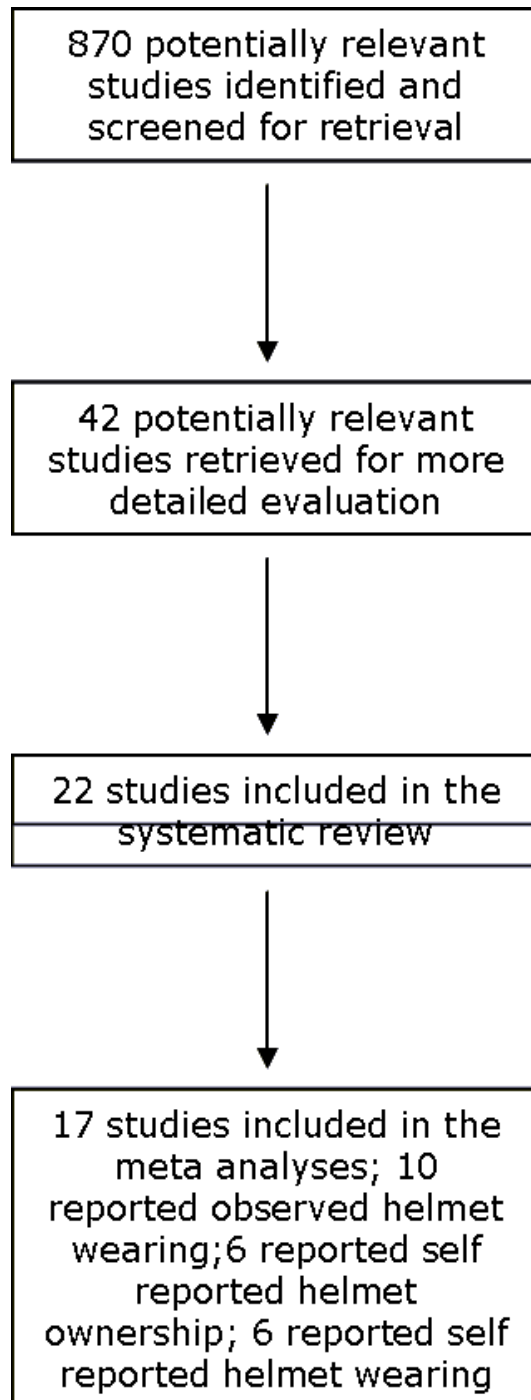
## RESULTS

### Description of studies

See: [Characteristics of included studies](#).

Figure 1 is a QUOROM flow diagram describing the process of study selection. Twenty-two studies were included in the review and they are described in the characteristics of included studies table. Three were individually randomised controlled trials, six were cluster randomised controlled trials, 12 were controlled before-after studies and one was a trial with concurrent controls. Thirteen studies were set in the US, six in Canada, two in the UK and one in New Zealand. One study (Britt 1998) only included pre-school children and a second included children aged between five and eight years (Liller 1995). The remainder included children from a range of ages up to 18 years. Four studies involved participants in community settings, four in healthcare institutions and the remaining 14 in schools. Five interventions included the distribution of free helmets and 12 provided subsidised helmets. All 22 included an element of cycle helmet education. Twelve studies reported observed helmet wearing as an outcome, nine included self-reported helmet ownership and 11 self-reported helmet wearing.

Figure 1.



Data extracted from [Kim 1997](#); [Lee 2000](#); [Moore 1990](#); [Pendergrast 1992](#) and [Watts 1997](#) were not included in the meta-analysis because they were not available as numbers of participants in each arm, either from the original paper or the authors. The remaining studies contributed data to at least one of the three meta-analyses, but some data from the following studies were also excluded for the same reason: [Cote 1992](#); [Hendrickson 1998](#); [Parkin 1995](#); [Quine 2001](#); [Wright 1995](#). One arm of the three-arm study by [Morris 1991](#) (education intervention only) was excluded from the meta-analysis, as including comparisons between two treatment arms and a control arm would lead to multiple counting of control arm data. Four studies provided data from more than one time point. We extracted all the data but in the meta-analysis we have only used results at four months from the report of [DiGuseppi 1989](#), results at one year from [Farley 1996](#), results at six weeks from [Hendrickson 1998](#) and results at 19 weeks from [Towner 1992](#) in order to optimise comparability.

### **Risk of bias in included studies**

Comments on the important methodological features of each study are presented in the table of characteristics of included studies. None of the cluster randomised controlled trials or controlled before-after studies made any adjustment for a clustering effect in the data presented. The larger community-based studies such as [DiGuseppi 1989](#) and [Farley 1996](#) were of controlled before-after design, for obvious practical reasons. Two of the RCTs recruited participants in a healthcare setting ([Cushman 1991a](#); [Cushman 1991b](#)) and the third was a small school-based study ([Quine 2001](#)). None of the studies that used randomisation described this in sufficient detail for us to comment on the adequacy of concealment. Among non-randomised studies, two of the ten studies included in the meta-analysis did not report on the distribution of con-

founders ([Britt 1998](#); [Floerchinger 2000](#)). The remaining studies commented on equivalence in the text or presented data demonstrating comparability of the groups at baseline.

### **Effects of interventions**

#### **Inter-reviewer agreement of study quality assessment**

Two independent reviewers rated allocation concealment with 86% agreement, blinding of outcome assessors with 94% agreement and blinding of analysers with 100% agreement.

#### **Adverse effects of interventions**

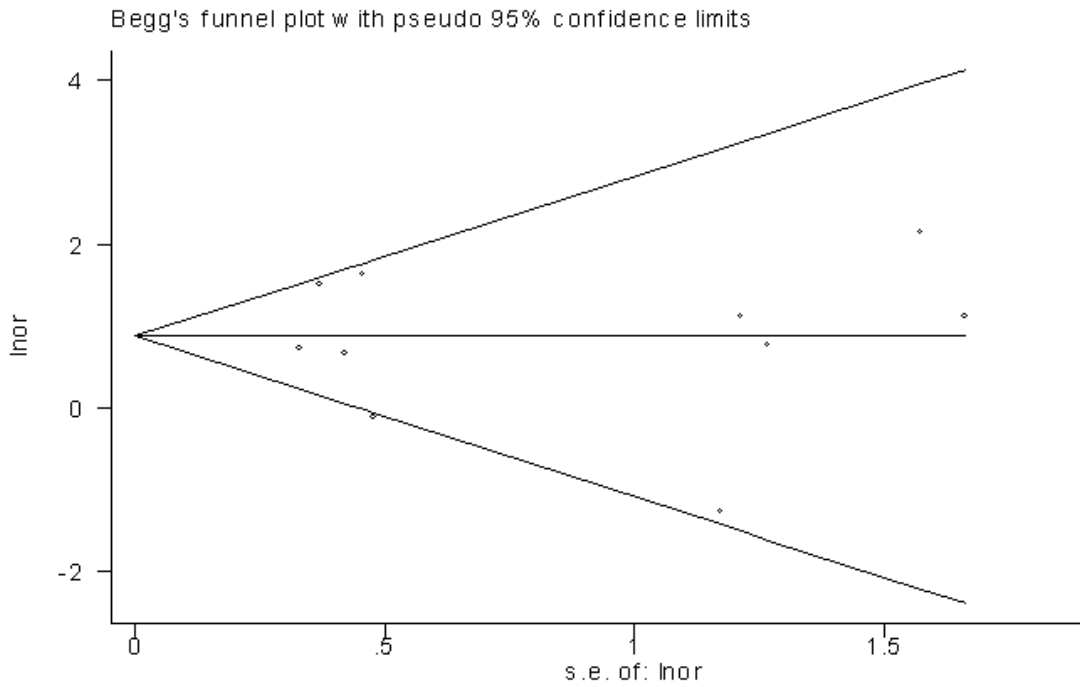
None of the included studies reported any adverse effects of interventions.

#### **Observed helmet wearing**

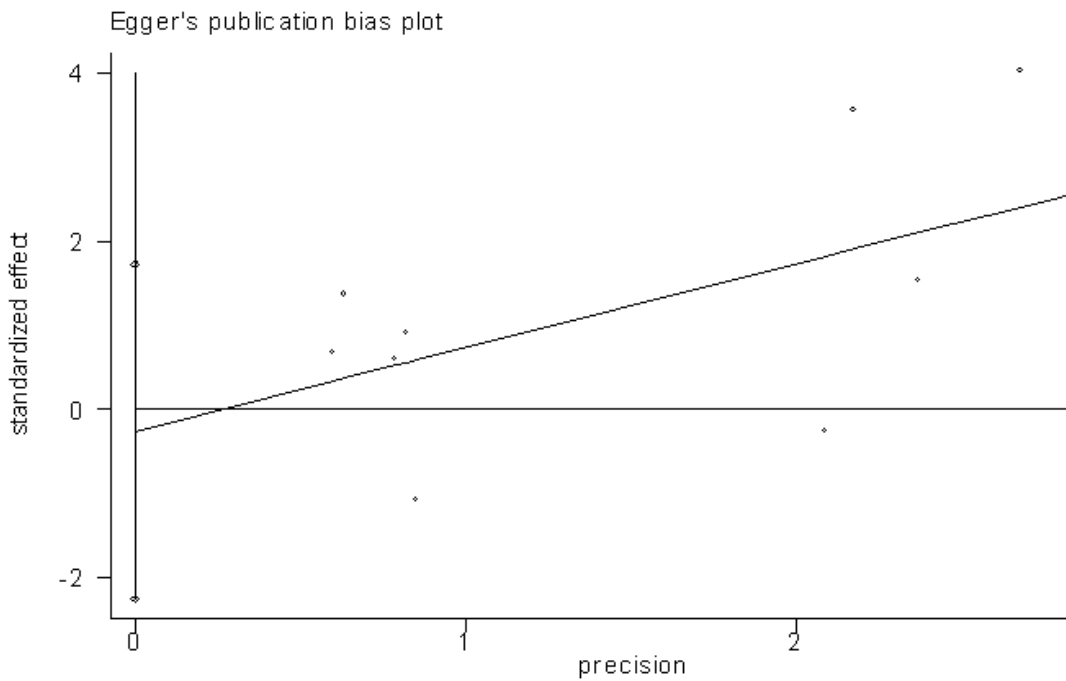
Where studies have used cluster allocation and reported their results unadjusted for clustering, we have assumed an ICC of 0.02 and adjusted the results for this. The meta-analysis indicates that the odds of observed helmet wearing were significantly higher amongst those receiving non-legislative interventions promoting cycle helmet use (OR 2.30, 95% CI 1.37 to 3.85) when compared to those not receiving such interventions. There was significant heterogeneity between the effect sizes of the studies included in this analysis:  $\chi^2 = 25.17$ , degrees of freedom (d.f.) = 9,  $P = 0.003$ . Sensitivity analyses, assuming ICCs of 0.01 and 0.05 for studies using cluster allocation, produced similar effect sizes (although heterogeneity was absent with an ICC of 0.05).

[Figure 2](#) and [Figure 3](#) show that significant publication bias was not detected (Egger's test  $P = 0.77$ ). These findings were robust to assuming ICCs of 0.01 and 0.05 for studies using cluster allocation.

**Figure 2.**



**Figure 3.**



We assessed the effect of study quality by restricting analyses to randomised controlled trials. Two randomised controlled trials reported this outcome and no significant effect was demonstrated in a meta-analysis (OR 1.08, 95% CI 0.02 to 71.20). Similar results were found assuming ICCs of 0.01 and 0.05 for studies using cluster allocation.

As there was significant heterogeneity amongst effect sizes for the analysis assuming an ICC of 0.02, sub-group analyses were undertaken to explore possible explanations for this. These included examining the effect in community-based studies, in school-based studies, amongst programmes providing free helmets, those providing subsidised helmets and those providing education without free or subsidised helmets. We chose these sub-groups as it seemed theoretically plausible that these factors might influence the effectiveness of the intervention. Sensitivity analyses indicated that all results presented below were robust to assuming ICCs of 0.01 and 0.05 for studies using cluster allocation.

Amongst community-based studies, the odds of observed helmet wearing were significantly greater amongst those receiving non-legislative interventions (OR 4.30, 95% CI 2.24 to 8.25) when compared to those not receiving such interventions. There was no evidence of heterogeneity between effect sizes ( $\chi^2 = 0.72$ , d.f. = 3,  $P = 0.87$ ).

Amongst school-based studies, there was some evidence that the odds of observed helmet wearing were greater amongst those receiving non-legislative interventions (OR 1.82, 95% CI 0.94 to 3.52) when compared to those not receiving such interventions, but there was significant heterogeneity between effect sizes ( $\chi^2$

= 19.65, d.f. = 5,  $P = 0.001$ ).

Pooling the results of the two interventions providing free helmets showed that the odds of observed helmet wearing were significantly greater amongst those receiving non-legislative interventions (OR 4.35, 95% CI 2.13 to 8.89) when compared to those not receiving such interventions, and there was no evidence of heterogeneity between effect sizes ( $\chi^2 = 0.60$ , d.f. = 1,  $P = 0.44$ ).

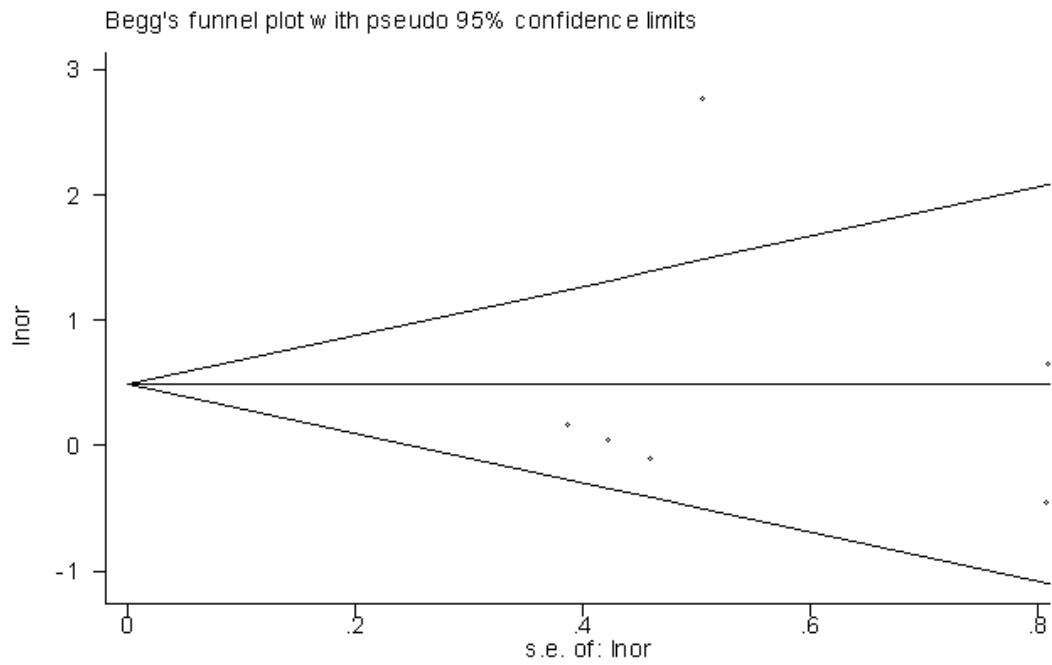
Amongst interventions providing subsidised helmets there was some evidence that the odds of observed helmet wearing were greater for those receiving interventions (OR 2.02, 95% CI 0.98 to 4.17) but there was significant heterogeneity between effect sizes ( $\chi^2 = 20.37$  d.f. = 6,  $P = 0.002$ ).

### Self-reported helmet ownership

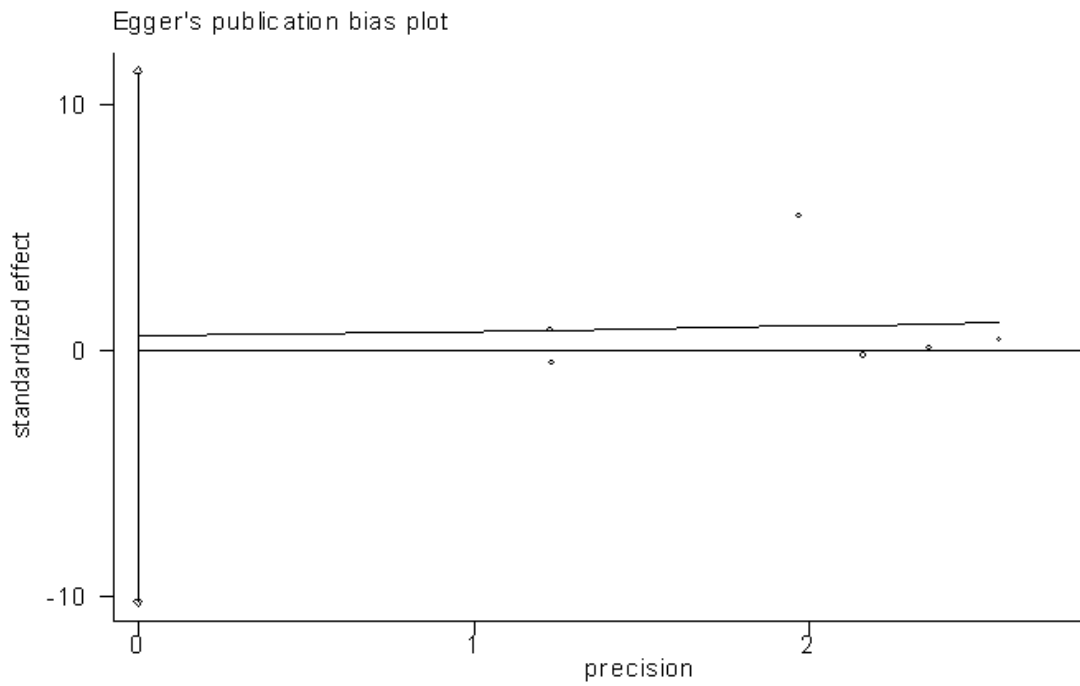
Where studies have used cluster allocation and reported their results unadjusted for clustering we have assumed an ICC of 0.02 and adjusted the results for this. The meta-analysis demonstrates no significant effect of non-legislative interventions (OR 1.69, 95% CI 0.65 to 4.38) compared to no intervention. There was significant heterogeneity between the effect sizes of the studies included in this analysis ( $\chi^2 = 37.53$ , d.f. = 5,  $P < 0.001$ ). Sensitivity analyses assuming ICCs of 0.01 and 0.05 for studies using cluster allocation produced similar effect sizes and significant heterogeneity between effect sizes.

Figure 4 and Figure 5 show that significant publication bias was not detected (Egger's test  $P = 0.89$ ). These findings were robust to assuming ICCs of 0.01 and 0.05 for studies using cluster allocation.

**Figure 4.**



**Figure 5.**



Amongst the three randomised controlled trials, no significant effect of non-legislative interventions was found (OR 1.02, 95% CI 0.66 to 1.56) compared to those not receiving such interventions. There was no evidence of significant heterogeneity ( $\chi^2 = 0.21$ , d.f. = 2,  $P = 0.90$ ).

Sub-group analyses were again undertaken to explore the heterogeneity in the results of the main analysis. These included examining the effect in community-based studies, in schools, amongst programmes providing free helmets and those providing education without free or subsidised helmets. Sensitivity analyses indicated that all results presented below were robust to assuming ICCs of 0.01 and 0.05 for studies using cluster allocation.

Two community-based studies contributed results for this outcome and both also provided free helmets. The odds of self-reported helmet ownership were not significantly greater amongst those receiving interventions (OR 5.65, 95% CI 0.82 to 38.98) compared to those not receiving such interventions. There was significant heterogeneity between effect sizes ( $\chi^2 = 8.67$ , d.f. = 1,  $P = 0.003$ ).

In the two school-based studies no significant effect of non-legislative interventions was found (OR 0.84, 95% CI 0.47 to 1.49) and there was no evidence of significant heterogeneity between

effect sizes ( $\chi^2 = 0.24$ , d.f. = 1,  $P = 0.62$ ).

Pooling the results of the three interventions providing education without free or subsidised helmets demonstrated no significant effect of interventions (OR 1.00, 95% CI 0.60 to 1.66) compared to no intervention. There was no evidence of significant heterogeneity between effect sizes ( $\chi^2 = 0.66$ , d.f. = 2,  $P = 0.72$ ).

### Self-reported helmet wearing

Where studies have used cluster allocation and reported their results unadjusted for clustering we have assumed an ICC of 0.02 and adjusted the results for this. The meta-analysis indicates that the odds of self-reported helmet wearing were significantly greater amongst those receiving interventions (OR 3.90, 95% CI 1.42 to 10.69) compared to those receiving no intervention but there was significant heterogeneity between the effect sizes of the studies included in this analysis ( $\chi^2 = 21.76$ , d.f. = 5,  $P = 0.001$ ). These results were robust to assuming ICCs of 0.01 and 0.05 for studies using cluster allocation.

Figure 6 and Figure 7 show that significant publication bias was not detected (Egger's test  $P = 0.41$ ). These findings were robust to assuming ICCs of 0.01 and 0.05 for studies using cluster allocation.

Figure 6.

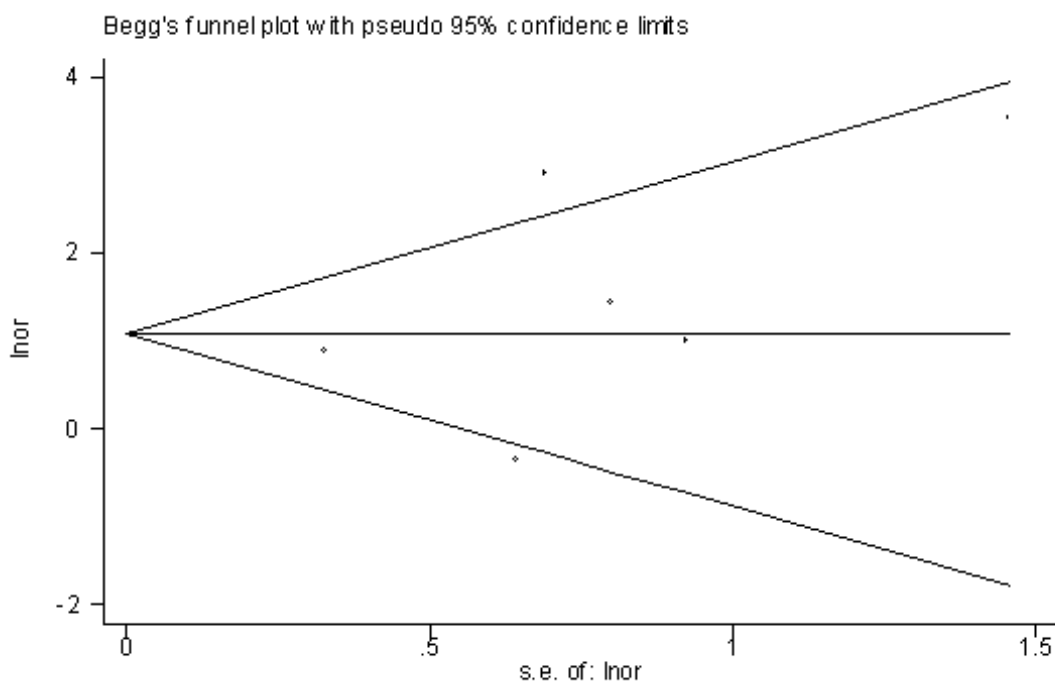
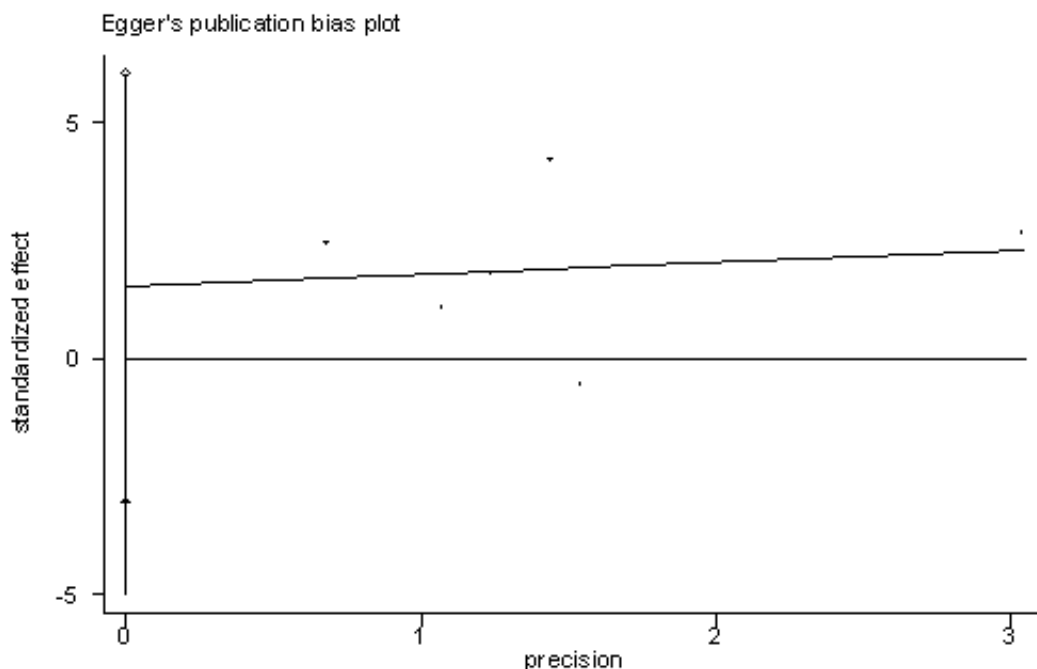


Figure 7.



Amongst the three randomised controlled trials, the odds of self-reported helmet wearing were not significantly greater in those receiving interventions (OR 4.01, 95% CI 0.53 to 30.60) and there was evidence of significant heterogeneity between effect sizes ( $\chi^2 = 17.84$ , d.f. = 2,  $P < 0.001$ ).

Sub-group analyses were undertaken to explore the heterogeneity. These included examining the effect in school-based studies, amongst programmes providing free helmets and those providing education without free or subsidised helmets. All the results below were robust to assuming ICCs of 0.01 and 0.05 for studies using cluster allocation.

Amongst school-based studies, the odds of self-reported helmet wearing were significantly greater amongst those receiving interventions (OR 4.73, 95% CI 1.09 to 20.49) but there was evidence of significant heterogeneity between effect sizes ( $\chi^2 = 20.12$ , d.f. = 4,  $P < 0.001$ ).

Two interventions provided free helmets and after pooling the results there was some evidence of a significant effect among those receiving the intervention (OR 6.05, 95% CI 0.91 to 40.09). There was significant heterogeneity between effect sizes ( $\chi^2 = 10.62$ , d.f. = 1,  $P = 0.001$ ).

Amongst interventions providing education without free or subsidised helmets there was no evidence that the odds of self-re-

ported helmet wearing were greater amongst those receiving interventions, (OR 3.08, 95% CI 0.69 to 13.80) and again there was significant heterogeneity between effect sizes ( $\chi^2 = 9.64$ , d.f. = 3,  $P = 0.02$ ).

#### Studies not included in the meta-analyses

Five studies satisfied our inclusion criteria but could not be included in the meta-analyses for reasons described in the table of characteristics of included studies. [Kim 1997](#) reported an adjusted odds ratio for helmet use comparing co-payment with free helmets of 1.66 (95% CI 0.94 to 2.92). They concluded that helmet use was not significantly different among children whose parents were asked for a small copayment compared with those receiving free helmets. [Lee 2000](#) reported an increase in self-reported helmet use among 11 to 15 year olds living in the campaign area from 11% to 31% after 5 years ( $P < 0.001$ ) with no change in the control group. [Moore 1990](#) reported a significant increase in observed helmet wearing from a baseline of 3.5% in the experimental group to 33.3% at 10 weeks. In the control group there was a non-significant increase from 6.3% to 10.9%. [Pendergrast 1992](#) did not report significant changes in self-reported helmet ownership or wearing over the course of their intervention. [Watts 1997](#) reported a significant increase in helmet use among children given

a free helmet ( $P < 0.01$ ) that was not found among children who only received an educational intervention.

## DISCUSSION

### Main findings

This systematic review has identified 22 studies of non-legislative interventions to promote the wearing of bicycle helmets by school children. The studies varied widely in a number of important characteristics including: setting, age of participants, components of the intervention, length of follow-up, and outcomes reported. This 'clinical' heterogeneity was reflected to some extent in statistical heterogeneity when results were pooled in some of the meta-analyses. We have explored this heterogeneity in sub-group analyses and have identified some features of interventions that are associated with significant increases in helmet ownership and wearing. Community-based studies that include the provision of free helmets alongside an educational component increase observed helmet wearing. However, we were unable to disentangle the effect of study setting from that of the provision of free helmets, as both studies providing free helmets were community-based. There was some evidence that interventions providing subsidised helmets may increase observed helmet wearing, but possibly to a lesser extent than those providing free helmets. There was also some evidence that interventions set in schools may increase observed helmet wearing, and given that the studies demonstrating the most positive effect were those which included the youngest participants (Britt 1998; Liller 1995), this may reflect a tendency for these interventions to be more effective in younger children. In the meta-analysis and sub-group analyses of studies using self-reported helmet ownership as an outcome, Britt 1998 stands out because of its positive results. This study was unique in that it was confined to a younger age group than any of the other studies, and also in that it was the participant's parents rather than the participants themselves that reported helmet ownership. Hence it is possible that parents may have over-reported their children's helmet ownership. This study was also one of the two non-randomised studies that contributed data to the meta-analysis but did not comment on the distribution of confounders, hence it is possible that differences between the treatment groups may partly explain the positive findings.

In the meta-analysis of self-reported helmet wearing we found a significant increase in helmet wearing associated with non-legislative interventions and significant heterogeneity between effect sizes, which may be related to differences in the methods used to measure helmet wearing between studies. The majority of studies reported helmet wearing frequency using a range of responses and we used the results relating to the category referring to the most frequent helmet wearing (e.g. always or nearly always), to reduce

the potential for over reporting of helmet wearing. One study (Hendrickson 1998) classified participants as helmet wearing 'yes' or 'no' and did not record wearing on an ordinal scale. Hence, there is likely to be variation in the interpretation of such scales both by participants within studies and when comparing studies. The latter probably contributes to the observed statistical heterogeneity which we were unable to explain with sensitivity analyses. Several of our sub-group analyses included only a small number of studies and a relatively small number of study participants which lead to imprecise estimates of the effect of interventions. This was particularly true of the sub-group analyses relating to randomised controlled trials, community-based studies reporting self-reported helmet ownership, school-based studies and studies providing free helmets which reported self-reported helmet wearing. Hence, failure to demonstrate an effect of the intervention in these analyses may have resulted from a lack of power.

Our use of a sub-group analysis confined to randomised controlled trials as an assessment of the effect of study quality on outcomes was limited as two of the three randomised controlled trials were hospital-based studies, evaluating physician counselling without helmet subsidies or free provision, so differences in the effect size between these studies and the remaining studies included in the meta-analyses may have arisen as a result of differences in participants, interventions and settings rather than in study quality.

As the cluster allocated studies did not report an ICC or provide us with data from which we could estimate this, we used the ICC from a study of a school-based health promotion intervention (Murray 2004). Our sensitivity analyses indicated that with the exception of one of our analyses, our findings were robust to using a range of ICCs (Ukoununne 1999; Adams 2004). The lack of significant heterogeneity for observed helmet wearing assuming an ICC of 0.05 was not surprising, as adjusting for greater degrees of clustering will widen confidence intervals and reduce heterogeneity.

Our finding of a significant positive effect overall and within several sub-group analyses for observed helmet wearing are important, as observed helmet wearing is the most objective outcome measured in the studies included in our review.

### Strengths and weaknesses of this review

This is a rigorously conducted and methodologically sound systematic review that has important implications for clinicians and policymakers planning non-legislative interventions to promote cycle helmet use in children. However, health promotion interventions are notoriously difficult to combine in conventional systematic reviews because of clinical and statistical heterogeneity and this review is no exception. We have identified this in our meta-analyses but have not been able to fully explain it with sub-group analyses. A lack of randomised controlled trials in this area means that the majority of included studies were potentially at risk of bias and confounding. The included studies also share two other im-

portant characteristics that limit the usefulness of our conclusions to some extent. Firstly, most of the studies reported their results after a short follow-up period (median 2 months, range 2 weeks to 1 year) and the sustainability of any positive effects cannot be evaluated. Secondly all of the included studies were conducted in high-income countries, hence we are not able to comment on the generalisability of our results to lower-income countries. Although none of the included studies identified any adverse effects of interventions, there remains a possibility that interventions to promote cycle helmet wearing may reduce cycling in children, which could have a negative effect on their health. Further work is needed in this area.

## AUTHORS' CONCLUSIONS

### Implications for practice

We believe that there is good evidence to suggest that community-based helmet promotion programmes that include free helmet provision are effective in increasing helmet use in children. Programmes including subsidised helmets and those in other settings may also be effective but the evidence is not as strong.

### Implications for research

Further high-quality studies are needed in this area to identify the effect of non-legislative interventions, particularly those providing subsidised helmets in a range of settings, and to identify which components of the interventions are responsible for the observed effect.

## ACKNOWLEDGEMENTS

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\* Indicates the major publication for the study

## CHARACTERISTICS OF STUDIES

### Characteristics of included studies [ordered by study ID]

#### Britt 1998

Methods	CBA. Neither the outcome assessors nor the analysis were blind. The proportion of participants with outcomes reported as a percentage of those allocated to each group was 70% in the intervention group and 90% in the control group. Assessment of distribution of confounders not reported.
Participants	880 3 and 4 year-olds receiving routine health promotion home visits in Washington, US.
Interventions	Free helmets and a promotion programme including parental information, lessons and other events.
Outcomes	Self-reported helmet ownership; self-reported helmet wearing; observed helmet wearing. Measured at 2-3 weeks.
Notes	At baseline self(parent)-reported helmet data was collected in study year 1 only and observation data was collected in study years 1 and 2 in the intervention group and study year 2 in the control group. Participating sites probably represent clusters but no adjustment was made for this in the analysis. All sites were classified as low income.

#### *Risk of bias*

Item	Authors' judgement	Description
Allocation concealment?	Unclear	D - Not used

#### Cote 1992

Methods	CBA. Neither the outcome assessors nor the analysis were blind. Some completeness of follow up data presented but not numbers initially allocated to each group. An assessment of the distribution of confounders is presented. The median household income of the intervention area was \$58900 compared to \$40600 in the control area.
Participants	328 under 16 year-olds observed riding bicycles in 2 US counties.
Interventions	Subsidised helmets, a helmet education programme and a local media campaign.
Outcomes	Observed helmet wearing. Measured at 9 months.
Notes	Only follow-up data presented for self-reported outcomes which were excluded from the analysis. One additional county included in the report had passed legislation and was therefore excluded. Participating sites probably represent clusters but no adjustment was made for this in the analysis.

#### *Risk of bias*

Item	Authors' judgement	Description
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**Cote 1992** (Continued)

Allocation concealment?	Unclear	D - Not used
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**Cushman 1991a**

Methods	RCT. The analysis was not blind. The proportion of participants with outcomes reported as a percentage of those allocated to each group was 89 % in the intervention group and 89% in the control group. An assessment of the distribution of a number of confounders is presented and no statistically significant differences were reported.	
Participants	373 1-17 year-olds presenting to an emergency room in Canada with bicycle-related injuries.	
Interventions	Helmet promotion counselling from emergency physician.	
Outcomes	Self-reported helmet ownership. Measured at 2-3 weeks.	
Notes	This study excluded children already owning helmets.	

**Risk of bias**

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

**Cushman 1991b**

Methods	RCT. The analysis was not blind. Data relating to completeness of follow up not presented but it appears that outcomes are reported for all families allocated. Assessment of the distribution of confounders limited to age and whether family member owns helmet. The differences were not statistically significant.	
Participants	576 5-18 year-olds from 339 families presenting for a routine ambulatory visit at clinics in the US.	
Interventions	Helmet promotion counselling session from clinicians.	
Outcomes	Self-reported helmet ownership. Measured at 2-3 weeks.	
Notes	Families are the unit of analysis in this study, since the family was randomised as a whole and received the intervention as a whole. The outcome used in this analysis is the number of families buying helmets as a result of the intervention.	

**Risk of bias**

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

**DiGiuseppi 1989**

Methods	CBA. The outcome assessors were not blind. Completeness of follow-up not applicable because of population based design. Assessment of distribution of confounders presented. The areas were well balanced in terms of climate, population, ethnic groupings, education levels, unemployment levels, and mean household income.	
Participants	3-year campaign reporting 9827 helmet observations in 5-15 year-olds in Seattle and Portland, US.	
Interventions	Subsidised helmets, helmet education and a television and media campaign.	
Outcomes	Observed helmet wearing. Measured at 4, 12 and 16 months. 4-month data used in meta-analysis.	
Notes	This large geographical study compared observed helmet wearing before and after a promotion campaign in one area (Seattle) with changes in observed helmet use in a distinct control area (Portland). This analysis uses unadjusted helmet wearing rates (rates adjusted for confounding also reported).	
<b><i>Risk of bias</i></b>		
<b>Item</b>	<b>Authors' judgement</b>	<b>Description</b>
Allocation concealment?	Unclear	D - Not used

**Farley 1996**

Methods	CBA. Neither the outcome assessors nor the analysis were blind. Completeness of follow-up not applicable because of population based design. An assessment of the distribution of confounders was not reported although control locations were chosen for their similarity to intervention sites and age, sex and grade were not significantly different.	
Participants	Approximately 50000 5-12 year-olds attending 244 intervention schools in the Monterege region of Canada and 6513 control children from another region.	
Interventions	Free and subsidised cycle helmets and a cycle helmet education programme.	
Outcomes	Self-reported helmet ownership; observed helmet wearing. Measured at 1, 2 and 3 years. 1 year data used in meta analysis.	
Notes	Although reported as baseline data the first measurements were made 1 year after the start of the programme, true baseline data not available.	
<b><i>Risk of bias</i></b>		
<b>Item</b>	<b>Authors' judgement</b>	<b>Description</b>
Allocation concealment?	Unclear	D - Not used

**Floerchinger 2000**

Methods	CBA. Neither the outcome assessors nor the analysis were blind. The proportion of schools with outcomes reported as a percentage of those allocated to each group was 50% in the intervention group and 54% in the control group. An assessment of the distribution of confounders was not reported.
Participants	5-12 year-olds attending 4 intervention schools and 19 control schools in Idaho, US. The numbers of children at each school are not reported.
Interventions	Helmet promotion programme.
Outcomes	Observed helmet wearing. Measured at approximately 12 months.
Notes	This study reported the results of a bicycle and motor vehicle safety promotion programme. Only data relevant to this review has been extracted.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	Unclear	D - Not used

**Hendrickson 1998**

Methods	Cluster RCT. The analysis was not blind. 81% of the participants completed data collection but this is not presented with respect to allocated group. An assessment of the distribution of confounders is not presented.
Participants	407 10-13 year-olds from low income schools in Central Texas, US.
Interventions	Free cycle helmets and a cycle helmet education programme aimed at children and parents.
Outcomes	Self reported helmet wearing. Measured at 2 weeks and 6 weeks. 6 week data used in meta analysis.
Notes	This study had 2 intervention arms and a control arm. The first intervention group received a classroom-based educational intervention. The second intervention group received the classroom intervention and a telephone intervention to parents. The control group were offered a free helmet after the study. The analysis was not adjusted for clustering. Analysis presented is using data from classroom and parents intervention.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

**Kim 1997**

Methods	Cluster RCT. Neither the outcome assessors nor the analysis were blind. 84.4% follow-up in intervention group, 82.6% in control. An assessment of the distribution of a number of confounders is presented. There were some significant differences between gender, parents education, median household income and method of follow up between the intervention and control groups.
Participants	506 6-12 year-olds attending public health clinics in Washington, US.
Interventions	Free cycle helmets (subsidised in control group) and educational intervention delivered by clinicians.
Outcomes	Self-reported helmet wearing. Measured at 2-3 weeks.
Notes	Data from this study has not been included in the meta analysis because the control group received subsidised helmets.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

**Lee 2000**

Methods	CBA. The outcome assessors were not blind. Data relating to completeness of follow up is not clear. An assessment of the distribution of confounders is not presented.
Participants	500 11-15 year-olds from intervention and control areas completed questionnaires at the beginning and end of the campaign each year for 3 years (6000 children in total). Control and intervention areas were both UK cities.
Interventions	Subsidised helmets and an education programme.
Outcomes	Self-reported helmet wearing.
Notes	Data from this study has not been included in the meta analysis because we could not obtain it in a form that would allow the calculation of odds ratios.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	Unclear	D - Not used

**Liller 1995**

Methods	CBA. Neither the outcome assessors nor the analysis were blind. Completeness of follow up not applicable because of population based design. An assessment of the distribution of confounders is not reported although the authors state that intervention and control schools were matched on socioeconomic variables.
Participants	5-8 year olds attending 9 intervention schools and 9 control schools Florida, US. 3428 children received the intervention.
Interventions	Subsidised helmets and an education programme.
Outcomes	Observed helmet wearing. Measured at 2-3 weeks.
Notes	No adjustment for clustering reported.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	Unclear	D - Not used

**Macarthur 1998**

Methods	Cluster RCT. The analysis was not blind. Data relating to completeness of follow up presented (see notes). An assessment of the distribution of a number of confounders is presented and no significant differences are reported.
Participants	141 9-10 year-olds from metropolitan Toronto, Canada.
Interventions	Education programme.
Outcomes	Self-reported helmet wearing. Measured at 3 months.
Notes	Responders and non-responders were compared and found to be similar in all respects except gender (more female non-responders). Overall outcomes were reported in 83% of those allocated. The main focus of the education programme was on improving bicycle skills, helmet wearing was a secondary outcome measure.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

**Moore 1990**

Methods	CBA. Neither the outcome assessors nor the analysis were blind. An assessment of the distribution of confounders is not reported although the authors state that intervention and control schools were matched for size, age group and socioeconomic status of communities.
Participants	11-13 yr olds from one intervention and one control school from inner city areas of New Zealand.
Interventions	Subsidised helmets and an education programme.
Outcomes	Observed helmet wearing. Measured at 6 and 10 weeks.
Notes	The raw numbers of students exposed to the intervention and the numbers wearing helmets are not available from the published report or its authors.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	Unclear	D - Not used

**Morris 1991**

Methods	Cluster RCT. The outcome assessors were not blind and an assessment of the distribution of confounders is not presented.
Participants	5-13 year-olds attending 3 schools in a city in Ontario, Canada.
Interventions	1 school received an education programme, 1 school an education programme and subsidised helmets and the third school was the control.
Outcomes	Observed helmet wearing. Measured at 1 month.
Notes	The numbers of children receiving each intervention are not reported. Each school had "about 400 students". Data is presented for education and subsidy school v. control.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

**Parkin 1993**

Methods	CBA. Neither the outcome assessors nor the analysis were blind. Completeness of follow up not applicable because of population based design. An assessment of the distribution of a number of confounders is presented. Intervention and control schools were similar with respect to average family income, university education, owner occupation of dwellings and one-parent families.
Participants	4 intervention schools (2 high-income and 2 low-income) with a total of 1100 5-14 year olds and 18 control schools (numbers of children not reported) from metropolitan Toronto, Canada.
Interventions	Subsidised helmets and an education programme.
Outcomes	Observed helmet wearing. Measured at 2-6 months.
Notes	This study included a sub-group analysis comparing the observed helmet wearing rates post-intervention in high vs. low income groups. No adjustment for clustering in the analysis.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	Unclear	D - Not used

**Parkin 1995**

Methods	CBA. Neither the outcome assessors nor the analysis were blind. Completeness of follow up not applicable because of population based design. An assessment of the distribution of a number of confounders is presented. Intervention and control schools were similar with respect to average family income, university education, owner occupation of dwellings and one-parent families.
Participants	5-14 year olds from areas of low average family income and defined geographic communities within a large urban Canadian city. 1415 children received the intervention.
Interventions	Subsidised helmets and an education programme.
Outcomes	Observed helmet wearing. Self-reported helmet ownership also mentioned but full data not presented. Measured at approximately 2 months.
Notes	This study included a sub-group analysis comparing the observed helmet wearing rates post-intervention in high vs. low income groups. Data extracted for analysis relates to the group receiving subsidised helmets and an educational programme v. control and only includes observed helmet wearing as an outcome. No adjustment for clustering in the analysis.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	Unclear	D - Not used

**Pendergrast 1992**

Methods	Trial with concurrent controls. The analysis was not blind. Age and socioeconomic status are reported in the baseline characteristics of the participants and these were well balanced.
Participants	287 children from grades 2, 3 and 4 from 2 elementary schools in suburban Augusta, US were sent a pretest questionnaire and 527 children were sent a posttest questionnaire.
Interventions	Subsidised helmets and an education programme.
Outcomes	Self-reported helmet ownership and self-reported helmet wearing. Measured at 10 months.
Notes	Participant's parents were also sent a questionnaire asking about their child's helmet wearing behaviour. Data from this study has not been included in the meta analysis because we could not obtain it in a form that would allow the calculation of odds ratios.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	Unclear	D - Not used

**Quine 2001**

Methods	RCT. The analysis was not blind. 93% of the participants randomised completed data collection but this is not presented with respect to allocated group. An assessment of the distribution of confounders is not presented.
Participants	97 11-14 yea-olds that regularly cycled to school in the UK but did not wear a helmet.
Interventions	Education programme based on theory of planned behaviour.
Outcomes	Self-reported helmet ownership and self reported helmet wearing. Measured at 5 months.
Notes	Since the education programme was carried out in the classroom, control group children in that class may have been contaminated. Only self reported helmet wearing has been extracted for use in this analysis because ownership data is not presented with respect to group.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

**Stutts 1990**

Methods	CBA. Neither the outcome assessors nor the analysis were blind. 70% follow-up in intervention group, 60% in control group. An assessment of the distribution of a number of confounders is presented and there were significant differences in rates of previous bicycle related injury but not frequency of riding or helmet ownership between intervention and control groups.
Participants	404 4th and 5th grade children from 4 elementary schools in North Carolina, US.
Interventions	Education programme consisting of 7 lessons delivered in schools.
Outcomes	Self-reported helmet ownership; self-reported helmet wearing. Measured at 8 weeks.
Notes	Response rates to baseline and follow-up surveys are not accurately reported. At follow-up, response rates are reported as approximately 70% for the intervention group and approximately 60% for the control group. The baseline helmet ownership rates were also slightly higher in the control schools than the intervention schools and no adjustment has been made for this.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	Unclear	D - Not used

**Towner 1992**

Methods	Cluster RCT. Neither the outcome assessors nor the analysis were blind. The baseline survey of helmet use had a 35% response rate and the follow up survey a 20% response rate. These figures are not broken down into allocation groups. An assessment of the distribution of a number of confounders is not presented although schools were matched for size and socioeconomic status.
Participants	2211 children attending 6 elementary schools (3 intervention, 3 control) in the US.
Interventions	Subsidised helmets and an education programme.
Outcomes	Self-reported helmet ownership; observed helmet wearing. Measured at 2 weeks and 19 weeks. 19 week data used in meta analysis.
Notes	Follow-up data reported at 2 and 19 weeks post-intervention. 19-week data extracted for analysis.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

**Watts 1997**

Methods	Cluster RCT. Neither the outcome assessors nor the analysis were blind. Baseline helmet ownership and baseline helmet wearing rates are reported but not by treatment group.
Participants	926 5-12 year-olds from 2 elementary schools in Virginia, US.
Interventions	Education programme given to both schools and free cycle helmets given to participants at intervention school.
Outcomes	Self reported helmet ownership and self-reported helmet wearing. Measured at 1 month.
Notes	Response rates are not reported. Data from this study has not been included in the meta-analysis because we could not obtain it in a form that would allow the calculation of odds ratios.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

**Wright 1995**

Methods	CBA. Neither the outcome assessors nor the analysis were blind. Completeness of follow-up data not presented (see notes). An assessment of the distribution of a number of confounders is presented and the groups were well balanced with respect to age, gender and ethnicity.
Participants	741 11-18 year-olds from 3 middle schools and 3 high schools in Washington, US.
Interventions	Education programme.
Outcomes	Self-reported helmet wearing and observed helmet wearing. Measured at 2 weeks.
Notes	The control group was older than the intervention group. The results were not adjusted for clustering. Survey response rates for intervention and control schools are not reported although the study was a "repeated anonymous cross sectional survey" design so before and after participants may not be the same. Observations of helmet wearing were not undertaken for control group; therefore, only self-reported helmet wearing data has been extracted.

***Risk of bias***

Item	Authors' judgement	Description
Allocation concealment?	Unclear	D - Not used

RCT=Randomized controlled trial  
CBA=Controlled before-after study

## DATA AND ANALYSES

### Comparison 1. Non-legislative interventions vs control

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Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Observed helmet wearing	10	2408	Odds Ratio (M-H, Random, 95% CI)	2.30 [1.37, 3.85]
2 Self-reported helmet ownership	6	1399	Odds Ratio (M-H, Random, 95% CI)	1.69 [0.65, 4.38]
3 Self-reported helmet wearing	6	829	Odds Ratio (M-H, Random, 95% CI)	3.90 [1.42, 10.69]

### Comparison 2. Non-legislative interventions vs control (RCTs only)

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Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Observed helmet wearing	2	215	Odds Ratio (M-H, Random, 95% CI)	1.08 [0.02, 71.20]
2 Self-reported helmet ownership	3	852	Odds Ratio (M-H, Random, 95% CI)	1.02 [0.66, 1.56]
3 Self-reported helmet wearing	3	371	Odds Ratio (M-H, Random, 95% CI)	4.01 [0.53, 30.60]

### Comparison 3. Non-legislative interventions vs control (community-based interventions)

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Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Observed helmet wearing	4	473	Odds Ratio (M-H, Random, 95% CI)	4.30 [2.24, 8.25]
2 Self-reported helmet ownership	2	426	Odds Ratio (M-H, Random, 95% CI)	5.65 [0.82, 38.98]
3 Self-reported helmet wearing	0	0	Odds Ratio (M-H, Random, 95% CI)	Not estimable

**Comparison 4. Non-legislative interventions vs control (school-based interventions)**

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Observed helmet wearing	6	1935	Odds Ratio (M-H, Random, 95% CI)	1.82 [0.94, 3.52]
2 Self-reported helmet ownership	2	300	Odds Ratio (M-H, Random, 95% CI)	0.84 [0.47, 1.49]
3 Self-reported helmet wearing	5	493	Odds Ratio (M-H, Random, 95% CI)	4.73 [1.09, 20.49]

**Comparison 5. Non-legislative interventions vs control (free helmets)**

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Observed helmet wearing	2	318	Odds Ratio (M-H, Random, 95% CI)	4.35 [2.13, 8.89]
2 Self-reported helmet ownership	2	426	Odds Ratio (M-H, Random, 95% CI)	5.65 [0.82, 38.98]
3 Self-reported helmet wearing	2	450	Odds Ratio (M-H, Random, 95% CI)	6.05 [0.91, 40.09]

**Comparison 6. Non-legislative interventions vs control (subsidised helmets)**

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Observed helmet wearing	7	1804	Odds Ratio (M-H, Random, 95% CI)	2.02 [0.98, 4.17]
2 Self-reported helmet ownership	0	0	Odds Ratio (M-H, Random, 95% CI)	Not estimable
3 Self-reported helmet wearing	0	0	Odds Ratio (M-H, Random, 95% CI)	Not estimable

**Comparison 7. Non-legislative interventions vs control (education only)**

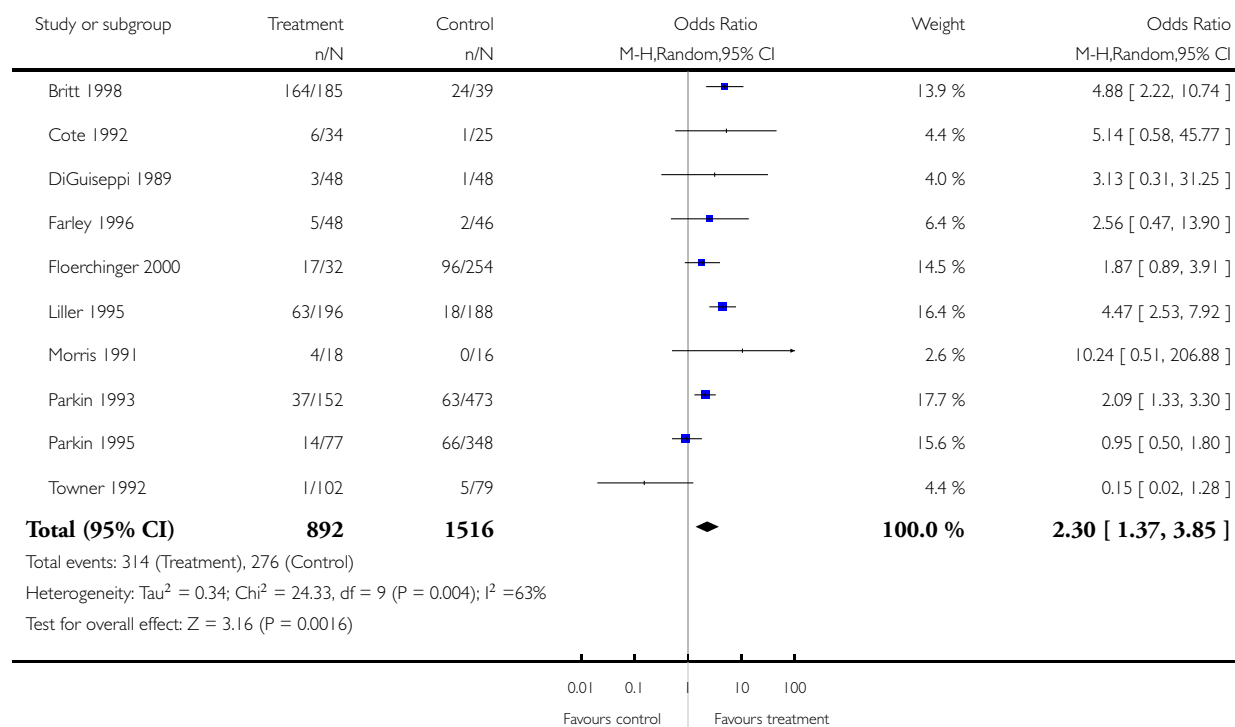
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Observed helmet wearing	0	0	Odds Ratio (M-H, Random, 95% CI)	Not estimable
2 Self-reported helmet ownership	3	794	Odds Ratio (M-H, Random, 95% CI)	1.00 [0.60, 1.66]
3 Self-reported helmet wearing	4	379	Odds Ratio (M-H, Random, 95% CI)	3.08 [0.69, 13.80]

### Analysis 1.1. Comparison 1 Non-legislative interventions vs control, Outcome 1 Observed helmet wearing.

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 1 Non-legislative interventions vs control

Outcome: 1 Observed helmet wearing

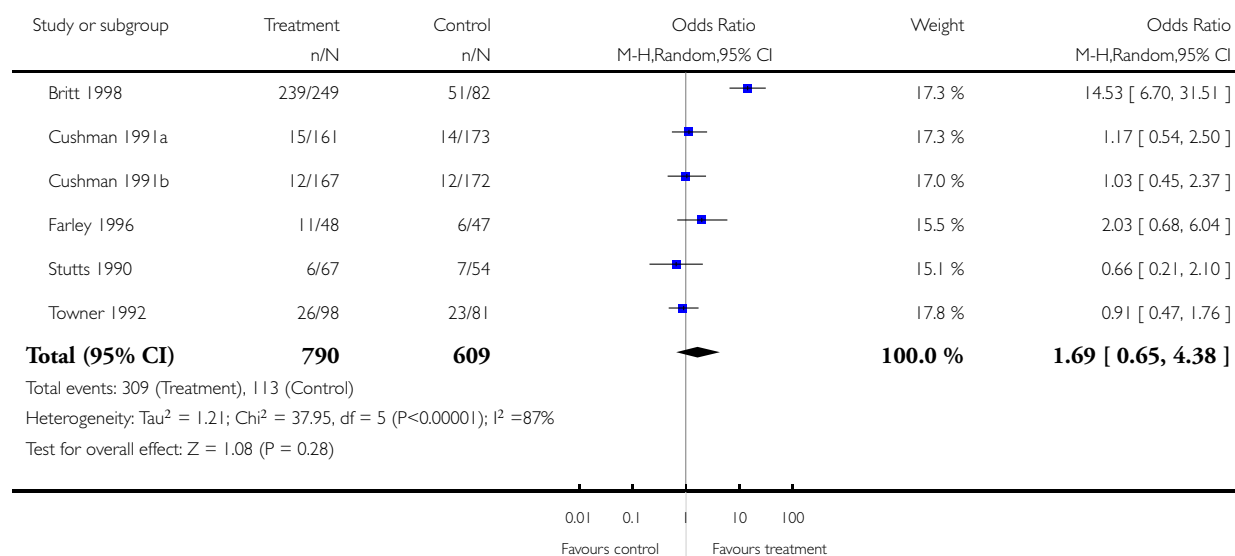


## Analysis 1.2. Comparison 1 Non-legislative interventions vs control, Outcome 2 Self-reported helmet ownership.

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 1 Non-legislative interventions vs control

Outcome: 2 Self-reported helmet ownership

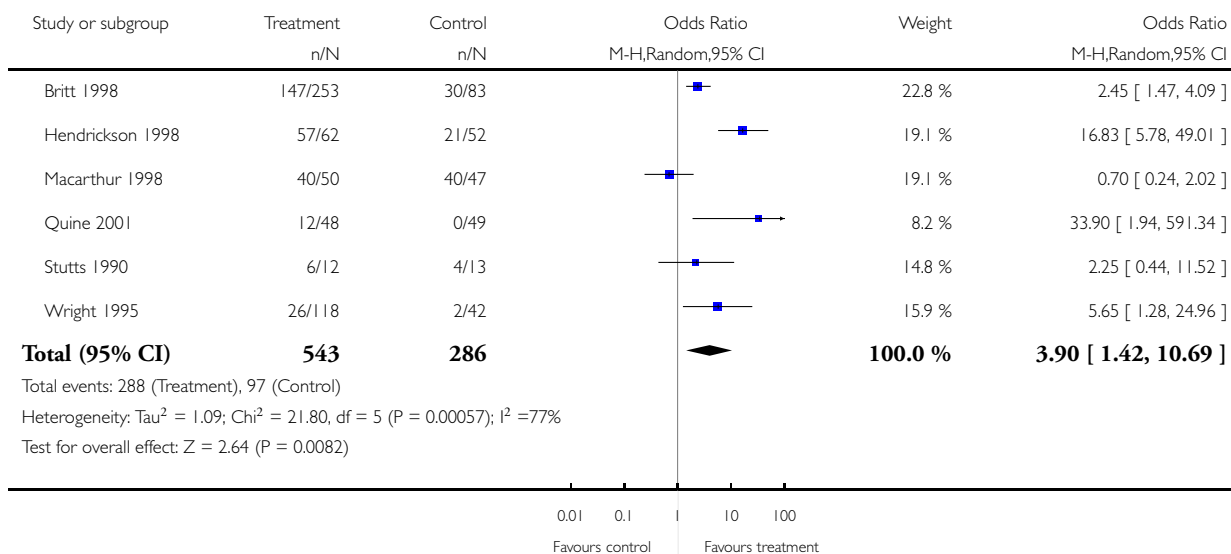


### Analysis 1.3. Comparison 1 Non-legislative interventions vs control, Outcome 3 Self-reported helmet wearing.

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 1 Non-legislative interventions vs control

Outcome: 3 Self-reported helmet wearing

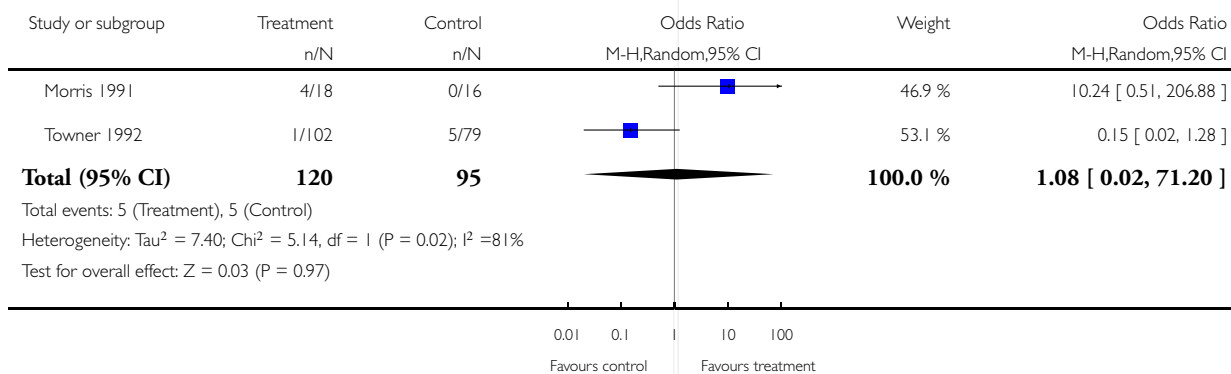


### Analysis 2.1. Comparison 2 Non-legislative interventions vs control (RCTs only), Outcome 1 Observed helmet wearing.

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 2 Non-legislative interventions vs control (RCTs only)

Outcome: 1 Observed helmet wearing

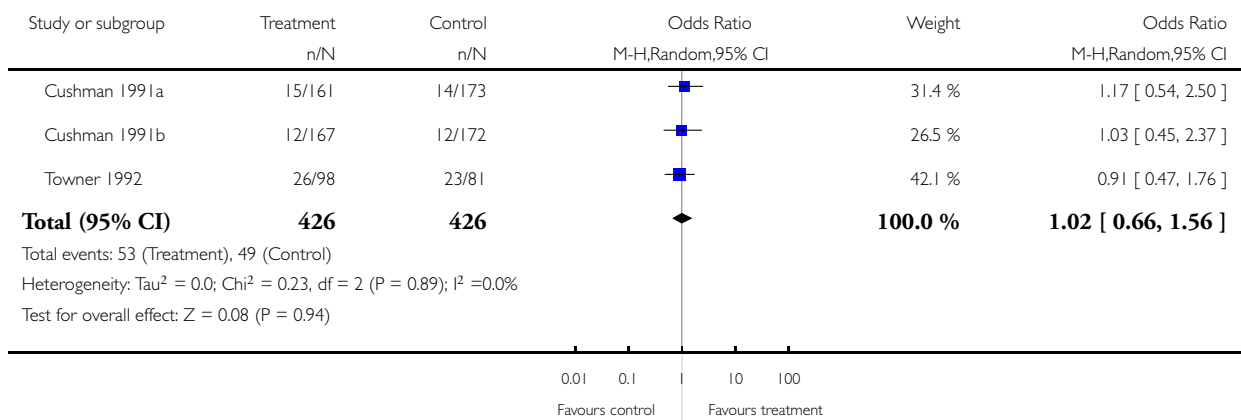


### Analysis 2.2. Comparison 2 Non-legislative interventions vs control (RCTs only), Outcome 2 Self-reported helmet ownership.

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 2 Non-legislative interventions vs control (RCTs only)

Outcome: 2 Self-reported helmet ownership

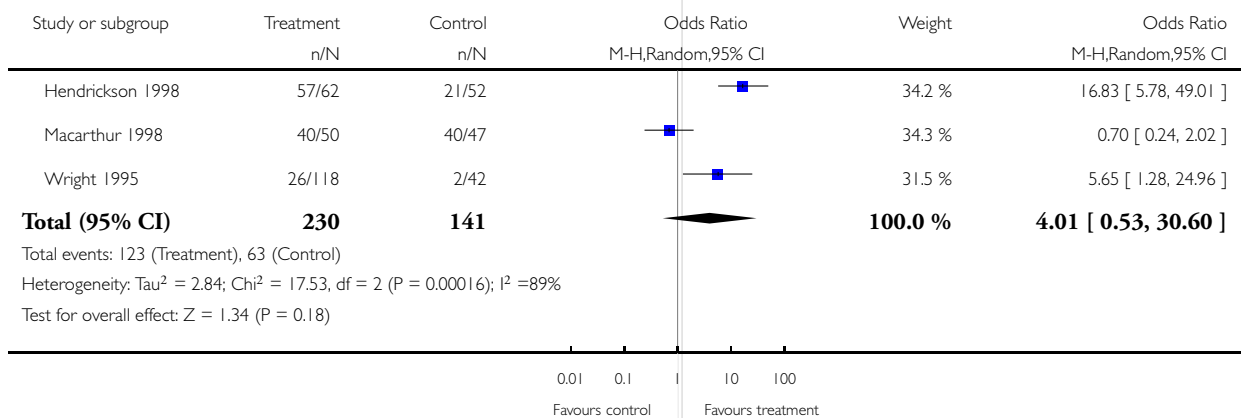


### Analysis 2.3. Comparison 2 Non-legislative interventions vs control (RCTs only), Outcome 3 Self-reported helmet wearing.

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 2 Non-legislative interventions vs control (RCTs only)

Outcome: 3 Self-reported helmet wearing

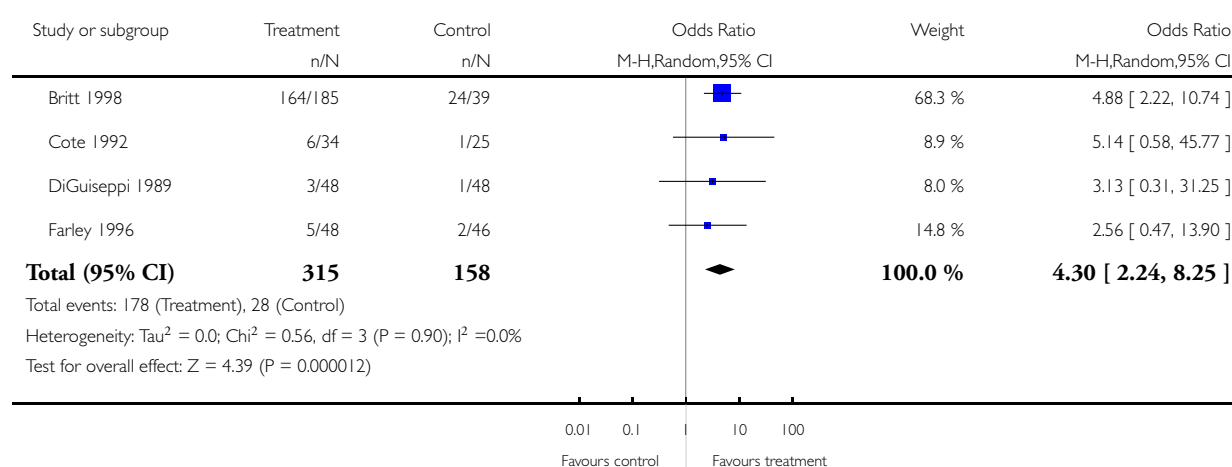


### Analysis 3.1. Comparison 3 Non-legislative interventions vs control (community-based interventions), Outcome 1 Observed helmet wearing.

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 3 Non-legislative interventions vs control (community-based interventions)

Outcome: 1 Observed helmet wearing

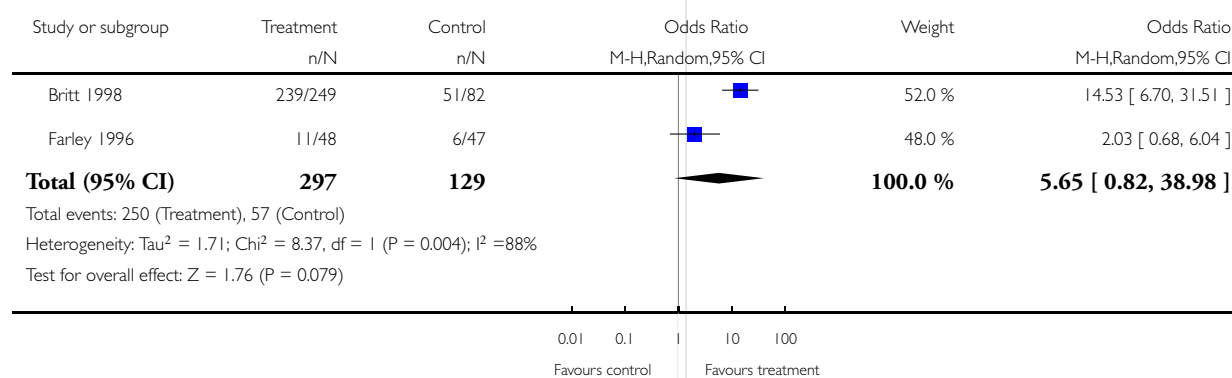


### Analysis 3.2. Comparison 3 Non-legislative interventions vs control (community-based interventions), Outcome 2 Self-reported helmet ownership.

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 3 Non-legislative interventions vs control (community-based interventions)

Outcome: 2 Self-reported helmet ownership

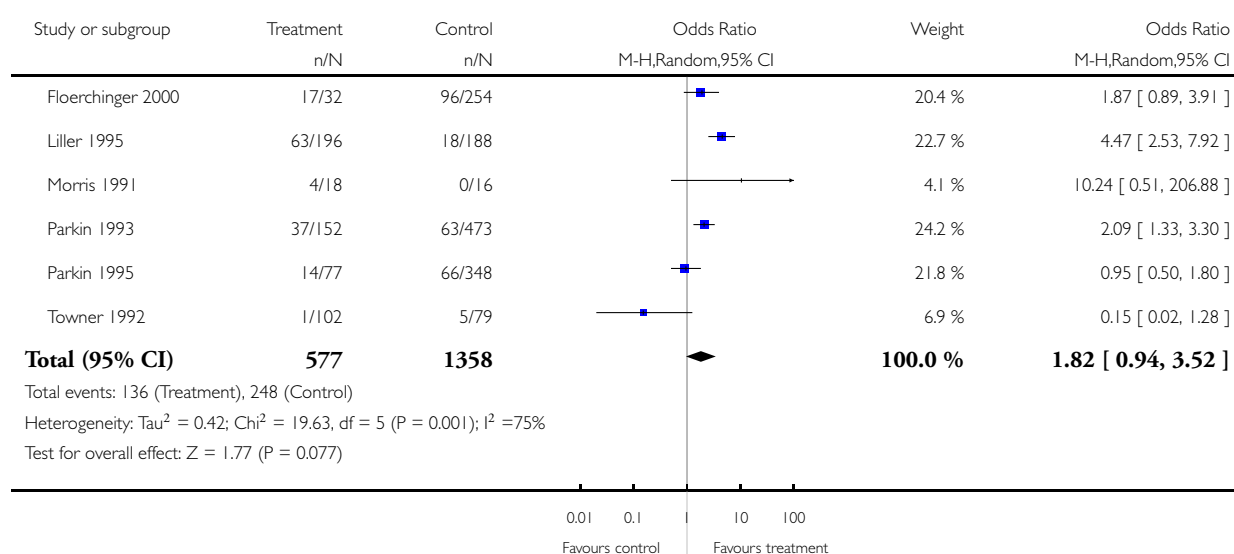


### Analysis 4.1. Comparison 4 Non-legislative interventions vs control (school-based interventions), Outcome 1 Observed helmet wearing.

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 4 Non-legislative interventions vs control (school-based interventions)

Outcome: 1 Observed helmet wearing

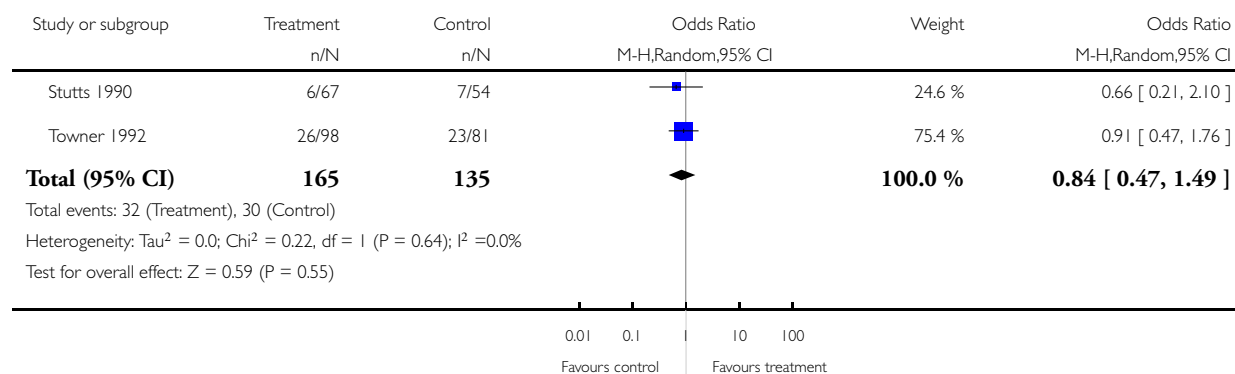


### Analysis 4.2. Comparison 4 Non-legislative interventions vs control (school-based interventions), Outcome 2 Self-reported helmet ownership.

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 4 Non-legislative interventions vs control (school-based interventions)

Outcome: 2 Self-reported helmet ownership

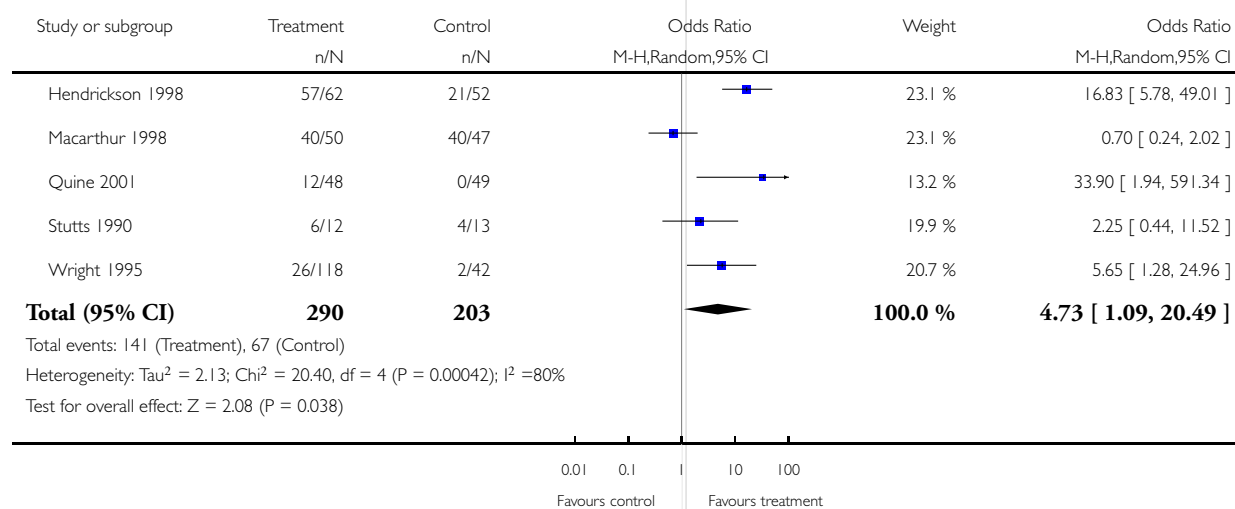


### Analysis 4.3. Comparison 4 Non-legislative interventions vs control (school-based interventions), Outcome 3 Self-reported helmet wearing.

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 4 Non-legislative interventions vs control (school-based interventions)

Outcome: 3 Self-reported helmet wearing

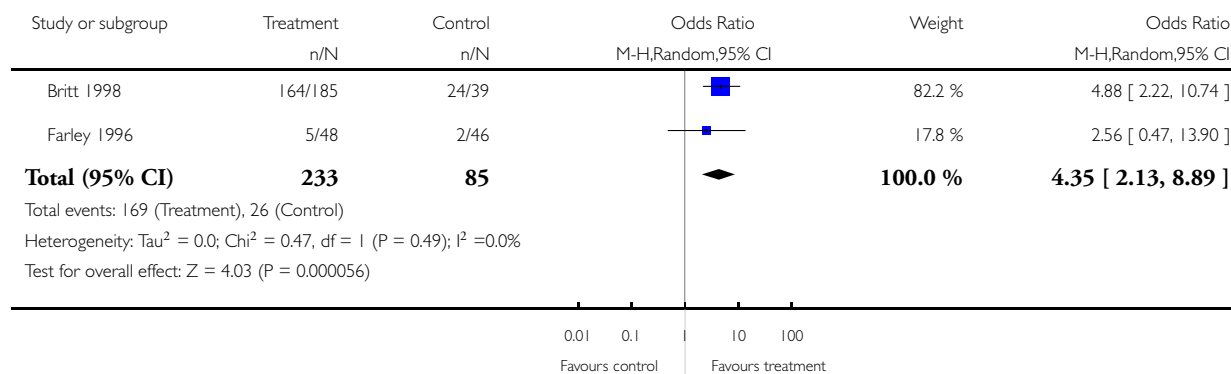


### Analysis 5.1. Comparison 5 Non-legislative interventions vs control (free helmets), Outcome 1 Observed helmet wearing.

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 5 Non-legislative interventions vs control (free helmets)

Outcome: 1 Observed helmet wearing

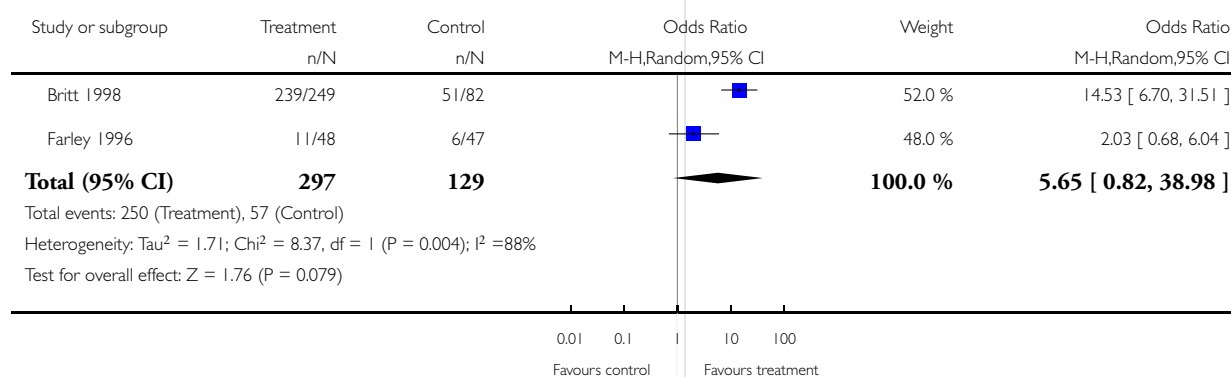


### Analysis 5.2. Comparison 5 Non-legislative interventions vs control (free helmets), Outcome 2 Self-reported helmet ownership.

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 5 Non-legislative interventions vs control (free helmets)

Outcome: 2 Self-reported helmet ownership

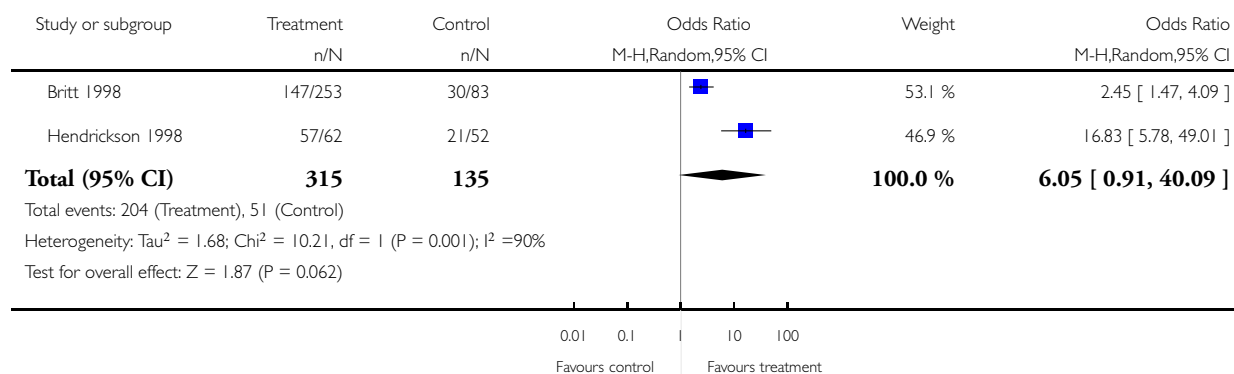


### Analysis 5.3. Comparison 5 Non-legislative interventions vs control (free helmets), Outcome 3 Self-reported helmet wearing.

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 5 Non-legislative interventions vs control (free helmets)

Outcome: 3 Self-reported helmet wearing

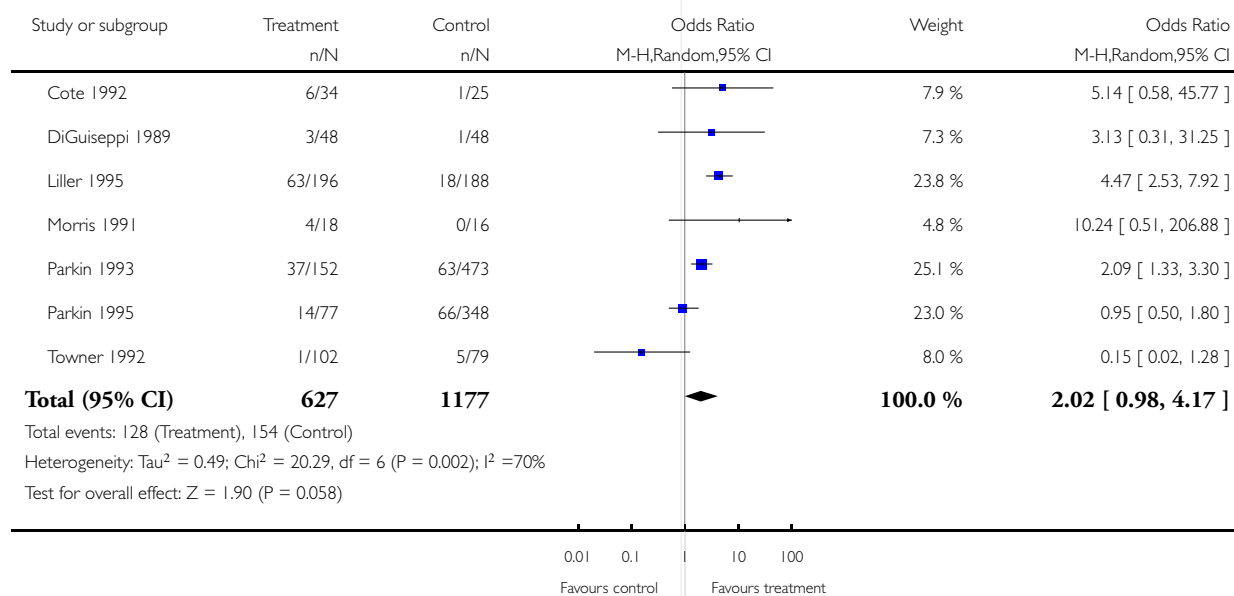


### Analysis 6.1. Comparison 6 Non-legislative interventions vs control (subsidised helmets), Outcome 1 Observed helmet wearing.

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 6 Non-legislative interventions vs control (subsidised helmets)

Outcome: 1 Observed helmet wearing

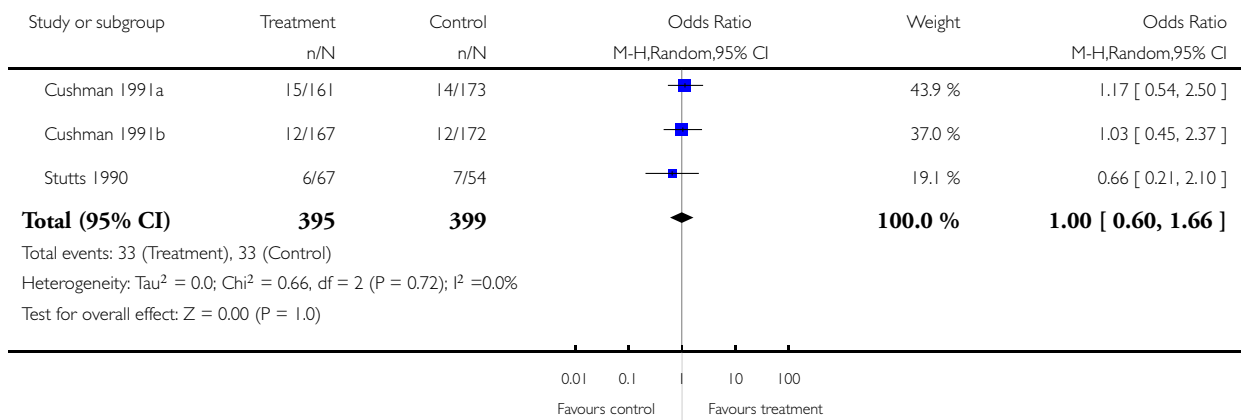


**Analysis 7.2. Comparison 7 Non-legislative interventions vs control (education only), Outcome 2 Self-reported helmet ownership.**

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 7 Non-legislative interventions vs control (education only)

Outcome: 2 Self-reported helmet ownership

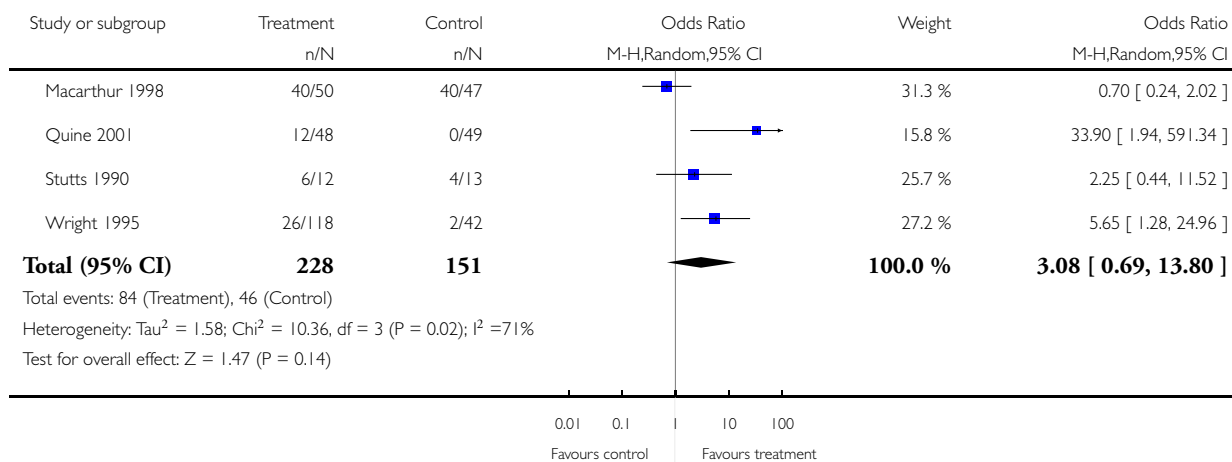


### Analysis 7.3. Comparison 7 Non-legislative interventions vs control (education only), Outcome 3 Self-reported helmet wearing.

Review: Non-legislative interventions for the promotion of cycle helmet wearing by children

Comparison: 7 Non-legislative interventions vs control (education only)

Outcome: 3 Self-reported helmet wearing



## WHAT'S NEW

Last assessed as up-to-date: 21 February 2005.

2 June 2008	Amended	Converted to new review format.
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## HISTORY

Protocol first published: Issue 1, 2003

Review first published: Issue 2, 2005

## DECLARATIONS OF INTEREST

Denise Kendrick and Simon Royal have conducted a cluster randomised controlled trial of an educational package and subsidised cycle helmet scheme for primary school children.

## **SOURCES OF SUPPORT**

### **Internal sources**

- University of Nottingham, UK.

### **External sources**

- No sources of support supplied

## **INDEX TERMS**

### **Medical Subject Headings (MeSH)**

Adolescent; Bicycling [legislation & jurisprudence; \*statistics & numerical data]; Head Protective Devices [\*utilization]

### **MeSH check words**

Child; Child, Preschool; Humans