Cost-effectiveness of a ROPS retrofit education campaign
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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The study investigated a community educational campaign to influence farmers to retrofit their tractors with a rollover protective structure (ROPS) to protect tractor operators from injury in the event of an overturn. This intervention was compared with a "no ROPS programme".

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised farmers in the USA who drove tractors.

Setting
The study setting was the community. The economic study was carried out at the University of Kentucky, USA.

Dates to which data relate
The effectiveness data were derived from studies published between 1994 and 2001. The price year was 1997.

Source of effectiveness data
The effectiveness data were derived from a review of published studies.

Modelling
A decision analytic two-step model was used to determine the increment of injuries averted by comparing the outcomes from the treatment counties (A and B) to a control county (C) with the use of a series of probabilities affecting injury outcomes. The time horizon was 20 years (changed to 30 years in the sensitivity analysis).

Outcomes assessed in the review
The outcomes assessed were the probabilities of:
- installing an ROPS in the two treatment counties;
- installing an ROPS in the control county;
- an overturn per 2,000 hours of tractor operation;
death resulting from an overturn without an ROPS fitted;

death resulting from an overturn with an ROPS fitted;

a nonfatal injury resulting from an overturn without an ROPS fitted, given survival; and

a nonfatal injury resulting from an overturn with an ROPS fitted, given survival.

Also assessed was the effectiveness of an ROPS to prevent a fatal injury and a nonfatal injury.

Study designs and other criteria for inclusion in the review
Not reported.

Sources searched to identify primary studies
Not reported.

Criteria used to ensure the validity of primary studies
Not reported.

Methods used to judge relevance and validity, and for extracting data
Not reported.

Number of primary studies included
Approximately 5 studies were included in the review.

Methods of combining primary studies
The authors did not combine the primary studies, although they used data from less relevant studies (e.g. studies with US samples, rather than Kentucky-specific samples) in the sensitivity analysis.

Investigation of differences between primary studies
Not applicable.

Results of the review
The probability of:

installing an ROPS in the two treatment counties was 0.059;

installing an ROPS in the control county was 0.031;

an overturn per 2,000 hours of tractor operation was 0.007604;

deadth resulting from an overturn without an ROPS fitted was 0.09593;

deadth resulting from an overturn with an ROPS fitted was 0.00115;

a nonfatal injury resulting from an overturn without an ROPS fitted, given survival, was 0.69; and

a nonfatal injury resulting from an overturn with an ROPS fitted, given survival, was 0.17.
The effectiveness of an ROPS to prevent a fatal injury was 0.012.

The effectiveness of an ROPS to prevent a nonfatal injury was 0.242.

**Measure of benefits used in the economic analysis**
The measure of benefits used was the number of injuries averted.

**Direct costs**
The direct costs included in the analysis were those of the third-party payer and those incurred by the programme. The cost of the intervention included the funds expended on the intervention, cash donations, the investment made by farmers for an ROPS and seatbelt (including purchase, installation, freight and transport), and the in-kind expenditures made by volunteers, public service activities by the media, and business and agency participation. Direct costs to the third-party payer included lifetime medical, insurance administration, property damage, emergency services and injuries to third parties. These costs were derived from published studies. The costs were adjusted to 1997 for inflation, with direct medical costs being adjusted using the US medical price index. As the costs were incurred over a 20-year period, the future costs were discounted at an annual rate of a 4%, following literature recommendations. The study reported the incremental costs.

**Statistical analysis of costs**
The costs were treated as point estimates (i.e. the data were deterministic).

**Indirect Costs**
The indirect costs included in the analysis were lost earnings, household production, fringe benefits, and time loss due to fatal and nonfatal injuries. These costs were derived from published studies. The costs were adjusted to 1997 for inflation using the US consumer price index. As the costs were incurred over a 20-year period, the future costs were discounted at an annual rate of 4%, following literature recommendations. The study reported the incremental costs.

**Currency**
US dollars ($).

**Sensitivity analysis**
Uncertainty within the model was analysed by varying parameter values within a range. As each parameter was varied to test its sensitivity, the other parameters were held at their base-case values. The parameters tested were the length of the analytic horizon, individual county results, overturn probability, and the probabilities of fatal and nonfatal injury. These ranges were derived from the literature, from authors’ assumptions and from data for two Kentucky counties. In the cost analysis, the parameters tested were the analytic horizon, the discount rate, individual county results, the cost of a ROPS retrofit, and the cost of injuries averted using agriculture-specific costs.

**Estimated benefits used in the economic analysis**
In the base-case scenario with a time horizon of 20 years, the authors found that there were 4.55 fatal injuries and 30.07 nonfatal injuries in the ROPS group, compared with 4.82 fatal injuries and 31.60 nonfatal injuries in the no ROPS group. Hence, the ROPS educational campaign averted 0.27 fatal injuries and 1.53 nonfatal injuries. The injuries averted were left undiscounted.

**Cost results**
The ROPS educational programme had a total incremental cost over a no ROPS programme of $222,072 over the 20-year period.
Synthesis of costs and benefits
The costs and benefits were combined using an incremental cost-effectiveness ratio (i.e. the additional cost per injury prevented). At a 4% discount rate and 20-year analytic horizon, the total cost per injury averted by the ROPS campaign was $172,657.

Results from the sensitivity analysis showed that varying the analytical horizon to 30 years reduced the cost per injury averted by 13% to $150,504. A 0% discount rate reduced the cost to $98,652 per injury averted over 20 years, while an 8% discount rate increased that cost to $247,241 per injury averted. Using county-specific data, the intervention in county B was shown to be more cost-effective at $112,535 per injury averted than the intervention in county A ($238,798 per injury averted). When the unit cost of a ROPS retrofit was increased from $674 to $1000, the cost per injury averted rose 14% to $199,872. When the unit cost was reduced to $400, the cost per injury averted was $149,784.

The authors also performed additional sensitivity analyses on the number of injuries averted by the ROPS education programme, although these were not included in the cost-effectiveness sensitivity analysis reported above. The authors found that the number of injuries averted was very sensitive to the probability of a fatality associated with an overturn, and was also sensitive to the probability of an overturn. The model was insensitive to the change in the probability of a death, and was moderately sensitive to a change in the probability of a nonfatal injury related to an overturn with an ROPS-equipped tractor.

Authors’ conclusions
The educational campaign on the retrofit of tractors with a rollover protective structure (ROPS) was cost-effective. The authors also concluded that if the results were extrapolated state-wide in Kentucky, the intervention would save 7 tractor overturn-related fatalities and an additional 40 nonfatal injuries.

CRD COMMENTARY - Selection of comparators
Although no explicit justification was given for using a “no ROPS education programme” as the comparator, it would appear to represent current practice in the authors' setting. You should decide if the comparator represents current practice in your own setting.

Validity of estimate of measure of effectiveness
The authors did not state that a systematic review of the literature had been undertaken to identify relevant research and minimise biases. No details on the methodology of the review were provided. The study appears to have used, for the base-case analysis, data from studies more relevant to the authors' settings (e.g. Kentucky-based). Sensitivity analyses were performed on all variables, using ranges derived from the literature, county-specific reports, or the authors’ own assumptions. However, this sensitivity analysis did not show how these changes affected the overall cost-effectiveness of the education programme, but rather how they affected the number of injuries averted.

Validity of estimate of measure of benefit
The estimation of benefits was modelled. The authors did not discount the benefits, even though they could have been incurred over a 20-year period. The use of a specific health benefit (injuries averted) limits the possibility of comparing the results across other health care interventions, as would be possible with life-years saved or quality-adjusted life-years (QALYs).

Validity of estimate of costs
All the cost categories relevant to the societal perspective adopted were included in the analysis. No major cost components appear to have been omitted from the analysis. The costs and the quantities were not reported separately, which will limit the generalisability of the authors' results. The costs of the intervention programme were derived from the authors’ setting, whereas direct medical cost and indirect costs were derived from the literature. A limited sensitivity
analysis of the costs was undertaken by varying the cost of retrofitting an ROPS. Since the costs were incurred over a 20-year time horizon, they were discounted. However, the authors appear to have discounted their costs inappropriately, as the total costs were higher when discounted than when they were left undiscounted. This is contrary to what might be expected as costs incurred in the future are more favourable than costs incurred now, owing to time preferences. The price year was reported, which will aid any future inflation exercises.

Other issues
The authors reported that the educational intervention examined in their study was about one third the cost per injury averted reported in a US-wide study, which found that installing an ROPS on tractors would cost $489,373 per injury averted. The issue of generalisability to other settings was partially addressed in the sensitivity analysis. The authors do not appear to have presented their results selectively. However, the results from this study should be treated cautiously as the discounting exercise does not appear to have been undertaken properly. In addition, it was unclear how the authors calculated the cost per injury averted reported in the base-case ($172,657). If the total number of injuries averted was 1.80 (0.27 + 1.53) and the total cost of the intervention was $222,072, this would result in a cost per injury averted of $123,373. Further, the authors’ conclusion that the ROPS education programme was cost-effective would appear too strong, as they did not report a cost-effectiveness threshold against which they could compare their estimate (a commonly quoted threshold in health care is $50,000 per QALY or life-year). The authors reported limitations with the available evidence. For example, the need to calculate the probability of an overturn using calculations derived from the probability of a fatal injury from an overturn.

Implications of the study
The authors reported that however intensive the educational campaign, it left most non-ROPS tractors unaffected. Hence, additional avenues are needed.

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Bibliographic details

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Other publications of related interest


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