Health interventions for the metal working industry: which is the most cost-effective? A study from a developing country

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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 use of alternative preventive interventions for reducing the incidence of work injuries, and medical care for reducing mortality and disability in the metal working industry, were studied. The preventive interventions considered were safety goggles, safety shoes, lower back supports, gloves, helmets, aprons, education and training. Education consisted of posters and other methods to encourage the use of health and safety equipment and precautionary measures to prevent accidents in the workplace. Training focused on the proper use of machinery, potential accident hazards and equipment-related protective measures.

Type of intervention
Primary prevention and treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised workers registered in the metal working industry in 1998 in the northern region of Mexico (82,034 in total).

Setting
The settings would appear to be tertiary care and community care. The economic study was carried out in Mexico.

Dates to which data relate
The authors did not report the dates to which the effectiveness data corresponded. The cost data and the price year appear to have related to 1999.

Source of effectiveness data
The effectiveness data were derived from a non-systematic review of completed studies and experts’ opinions.

Outcomes assessed in the review
The outcomes assessed in the review were:

- the coverage of the preventive interventions (expressed as the percentage of workers using the alternative preventive interventions);
- the efficacy rates of each of the preventive interventions for reducing the incidence of work injuries, according to different types of lesions;
the efficacy of medical care for reducing the case-fatality ratio, according to different types of injuries; and
the efficacy of medical care for reducing the case-disability ratio, according to the anatomical region of the 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**
Not reported.

**Methods of combining primary studies**
Not reported.

**Investigation of differences between primary studies**
Not reported.

**Results of the review**
The coverage rates were 80% for the use of safety goggles, 96% for safety shoes, 70% for lower back supports, 96% for gloves, 83% for helmets, 100% for aprons, 43% for education and 70% for training.

The efficacy rates for reducing incidence of work injury, according to the type of injury, were:

99 to 100% for eye-related injuries by using goggles;

100% for foot wound or dislocation, 90% for foot fractures and 85% for foot amputation by using safety shoes;

0% for lumbar spine dislocation by using lower back supports;

100% for hand burns and 85% for hand wounds by using gloves;

100% for head wounds or head trauma, 95% for head fractures and 98% for head burns by using helmets;

100% for thorax wounds, thorax burns, abdomen trauma and abdomen burns by using aprons;

40% for any type of injury by means of education; and

80% for any type of injury by means of training.

The efficacy of medical care for reducing the case-fatality ratio varied from 85 to 100% for injuries of the head, to
100% for injuries of the spine, upper limbs, hands, ankle and feet.

The efficacy of medical care in reducing the case-disability ratio varied from 20 to 90% for injuries in the hand, to 89 to 100% for injuries in the eye and annex.

**Methods used to derive estimates of effectiveness**

Experts’ opinions were used to derive the estimates of effectiveness.

**Estimates of effectiveness and key assumptions**

The effectiveness estimators derived from experts’ opinions could not be differentiated from those derived from the review of the literature. The overall effectiveness estimators obtained from the review and experts’ opinions were given in the ‘Results of the Review' section.

**Measure of benefits used in the economic analysis**

The summary measure of benefit used was the number of healthy life-years (HLYs) gained, both by type of intervention and by type of injury avoided. The authors reported that the HLYs were estimated using methodology proposed by the World Health Organization (Murray, see Other Publications of Related Interest). The total HLYs gained for the total number of workers considered at analysis (i.e. 82,034 workers in the northern region of Mexico during 1998) were estimated.

**Direct costs**

The perspective adopted was not reported and could not be clearly inferred from the information provided. The education and training costs included the salaries and resources needed to implement the interventions. The medical care costs included fixed and variable costs per type of injury. The resource quantities and the costs were not reported separately. Discounting does not appear to have been performed, which may have been appropriate since the period considered for the cost estimation would appear to be one year. The sources of the direct costs were not reported. Therefore, it cannot be determined whether the costing was based on actual data or a guess. The price year was 1999. Prices were used instead of costs and appropriate adjustments, to reflect the opportunity costs of the interventions, do not seem to have been conducted. The total costs per total workers (i.e. 82,034 workers) were reported.

**Statistical analysis of costs**

No statistical analyses of the costs were reported.

**Indirect Costs**

No indirect costs were reported.

**Currency**

US dollars ($). The conversion rate was $1 = Mexican Pesos 9.695.

**Sensitivity analysis**

No sensitivity analyses were carried out.

**Estimated benefits used in the economic analysis**

The total number of HLYs gained by type of intervention were:

376.11 HLYs with education;
752.22 HLYs with training;
386.56 HLYs with medical care;
112.40 HLYs with helmets;
3.55 HLYs with safety gloves;
3.09 HLYs with safety goggles;
8.70 HLYs with lumbar supports;
18.62 HLY with safety shoes; and
0.33 HLYs with safety aprons.

**Cost results**
The total costs for the total number of workers were:

- $239,742 for education;
- $1,567,701 for training;
- $856,104 for medical care;
- $353,690 for helmets;
- $168,468 for safety gloves;
- $147,653 for safety goggles;
- $737,164 for lumbar supports;
- $1,727,072 for safety shoes; and
- $383,051 for safety aprons.

**Synthesis of costs and benefits**
Cost-effectiveness ratios (CERs) were estimated as the cost per HLY gained with each intervention. These were placed in order from the most to the least cost-effective intervention.

The final ranking of CERs was:

- $637 per HLY gained with education;
- $2,084 per HLY gained with training;
- $2,215 per HLY gained with medical care;
- $3,147 per HLY gained with helmets;
- $47,432 per HLY gained with safety gloves;
- $47,736 per HLY gained with safety goggles;
$84,757 per HLY gained with lumbar supports;

$92,766 per HLY gained with safety shoes; and

$1,147,770 per HLY gained with safety aprons.

No incremental analyses of effectiveness and costs were reported.

**Authors' conclusions**
The most cost-effective intervention was education, followed by training which, although very expensive, was also the most effective.

**CRD COMMENTARY - Selection of comparators**
The interventions considered at analysis were chosen because they seemed to be the currently used health interventions in the authors' setting to reduce incidence, disability and mortality associated with work-related injuries. You must decide which is the most widely used health technology for reducing incidence, disability and mortality related with work injuries in your own setting.

**Validity of estimate of measure of effectiveness**
The authors reported that an extensive review of the literature was performed to obtain the estimates of effectiveness. However, no information about this review was reported. It did not seem to be a systematic review and, moreover, none of the effectiveness estimators were directly linked to the reviewed studies. The authors neither reported the methods used to find and select the primary studies, nor commented on the validity of the estimates. Further, no sensitivity analyses were performed. As the authors reported, the effectiveness estimators of the interventions may have been overestimated, as they reflected a combination of health intervention effectiveness and not the results of a single intervention being implemented. Experts' opinions were also used to obtain the effectiveness estimates, but it was not possible to identify which estimates were derived from the review of the literature and which from opinions. All these facts limit the validity of the effectiveness results.

**Validity of estimate of measure of benefit**
The estimation of benefits was obtained by applying the methodology proposed by the World Health Organization. The use of HLYs gained, the summary measure of benefit used in the economic analysis, permits comparisons of the health benefits obtained across different interventions. However, the authors did not report the sources consulted to obtain the data used to apply this methodology. This introduces uncertainty into the reliability of the estimates of health benefit.

**Validity of estimate of costs**
The perspective adopted could not be clearly inferred since the reporting on the costs considered in the economic analysis was limited. The costs and the quantities were not reported separately, which hinders reflation exercises in other settings. No statistical or sensitivity analyses were performed to reduce the uncertainty surrounding the cost estimation. Moreover, prices, which do not reflect the true opportunity costs of the interventions compared, were used instead of costs and no correction for this was made. The price year was reported. Discounting was not performed, which was appropriate as the costs appear to have been estimated for a one-year period. Also, no incremental analysis of the costs and benefits was performed. This would have been appropriate since it would have allowed the correct comparison between alternatives, hence providing the potential extra cost incurred in order to obtain an extra HLY.

**Other issues**
The authors made appropriate comparisons of their findings with those from other studies, commenting that there was no consistent evidence on the effectiveness and costs of the interventions compared. Although the authors did not explicitly discuss the issue of the generalisability of the results, the reader should bear in mind that this study was
carried out in the context of a developing country. Therefore, the results should only be extrapolated to settings similar to that evaluated in this study.

**Implications of the study**
The authors recommended that further research, to collect more information about the effectiveness of the preventive measures evaluated in this study and of other available strategies, should be carried out.

There is considerable uncertainty surrounding the performance of this study and the results obtained (as shown by the study caveats highlighted). Therefore, the results should be interpreted with great caution.

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**Other publications of related interest**


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