Effectiveness of interventions in reducing pesticide overexposure and poisonings

Keifer M C

Authors' objectives
To review the effectiveness of interventions to reduce pesticide overexposure and poisonings in workers.

The systematic review was one of many undertaken as part of an occupational injury project coordinated by the Harborview Injury Prevention Research Centre in the US. It included participants from the Injury Control Research Centres, and the Division of Safety Research, Agricultural Safety and Health Centres. Some methodological details of the review were published elsewhere (see Other Publications of Related Interest).

Searching
Relevant studies from peer-reviewed journals, technical and government reports, and unpublished reports were retrieved by searching MEDLINE, EMBASE and NIOSHTIC (the search dates were unclear). The literature search was published previously (see Other Publications Of Related Interest), although this did not include details of the search terms used and the years searched. Additional information sources were identified by examining references and by consulting experts in the field.

Study selection

Study designs of evaluations included in the review
There appeared to be no restriction on study design other than the necessary inclusion of a control population or control method. Both epidemiologic designs of interventions, and field trials of protective equipment, were included if the methods were clearly described and there were objective data for exposure (or a surrogate for exposure). Articles from the US and other countries were included provided they were published in the English language.

Specific interventions included in the review
The studies had to include an evaluation of an intervention designed to reduce exposure to pesticides or pesticide poisonings. The interventions considered were: pesticide safety training; applicator training and licence; field re-entry restrictions; use of personal protective equipment (PPE); use of isolation techniques such as closed tractor cabs; pesticide handling (mixing, loading or storage) techniques or procedures; or biological-monitoring programmes. The included studies could be grouped into three categories, although several studies bridged these categories.

1. The effectiveness of PPE or workplace modifications in reducing worker exposure.
2. The effectiveness of modified pesticide-handling procedures on reducing worker exposure.
3. The effect of biological-monitoring programmes on reducing the risk of pesticide exposure.

Participants included in the review
Individuals of all ages and both genders were considered. They could be workers who were mixers, loaders or sprayers; general farm workers; or the general population. The type of participants evaluated by the included studies were farm workers, greenhouse workers, workers applying pesticides in flower greenhouses, and unspecified pesticide handlers, applicators or mixers.

Outcomes assessed in the review
To be considered for inclusion, studies had to use an objective outcome measure such as changes in surveillance data or some measure of pesticide exposure, as determined by biological monitoring or exposure monitoring. Cholinesterase (AChE), an enzyme measurable in blood and whose activity is reduced by exposure to organophosphate and carbamate, was considered appropriate for biological monitoring. Pesticide exposure was evaluated in the included studies using the following methods: AChE levels; alpha cellulose pads or dermal patches placed on and beneath protective clothing; the level of urinary ethion metabolites; fluorescent tracer with or without video imaging techniques; inhalation exposure...
measurements; and reported 'toxic' symptoms.

How were decisions on the relevance of primary studies made?
The abstracts were reviewed independently by two reviewers. The full articles were reviewed if the abstract appeared to identify an intervention aimed at reducing exposure or poisonings; or identified a control population or control method; and objective data were included in the report.

Assessment of study quality
Validity was not systematically assessed. The author discussed some aspects relating to study validity in a narrative.

Data extraction
The author does not state how the data were extracted for the review, or how many of the reviewers performed data extraction.

Methods of synthesis
How were the studies combined?
The studies were combined as a narrative.

How were differences between studies investigated?
The differences between the studies were investigated as a narrative.

Results of the review
Seventeen studies were included: 4 retrospective cohort studies, 7 field tests, 1 crossover field test, 1 prospective crossover field test, 1 prospective crossover study, 1 prospective non-randomised study, 1 controlled cross-sectional study, and 1 review of unpublished studies. Nine studies involved a minimum of 1,386 participants; the number of participants was not stated for the remaining studies.

A meta-analysis was not attempted due to the differences in the interventions and the methods used to estimate the exposure.

The majority of the studies evaluated exposure during differing configurations of PPE, or during different mixing or handling methods. Most of the studies were small field tests of protective equipment involving less than 20 workers. Some studies examined biological indices of exposure, such as AChE or urinary metabolites. The studies showed that PPE was effective in reducing exposure. No controlled studies were found that addressed reducing pesticide poisonings.

Authors' conclusions
Changes in application procedures, packaging, mixing, use of PPE, and biological monitoring reduced pesticide exposure under controlled conditions. The monitoring of AChE can identify workers with a higher risk of overexposure. The majority of the techniques were not tested in actual worksite programmes. Interventions should be examined for their ability to reduce pesticide overexposure in actual working populations. No controlled evaluations of large legislative initiatives were found.

CRD commentary
This appeared to be a review of moderate quality, and the inclusion and exclusion criteria were clearly defined. The search strategy appeared to be fairly comprehensive and included a search of unpublished data. However, the years searched and the specific search terms used were not reported. Some information about the review process was presented, although it was not reported how the data were extracted, or how many reviewers performed the data extraction. Relevant details of the primary studies were presented in tabular format and as a narrative, along with comments on the validity of the studies. However, a systematic appraisal of the validity of the included studies was not
reported. The heterogeneity between included studies was discussed, and a narrative summary of the results was appropriate.

The author’s conclusions appear to follow from the results. However, the review did not evaluate the efficacy of AChE as an indicator of pesticide exposure.

**Implications of the review for practice and research**

**Practice:** The author did not state any implications for practice.

**Research:** The author states that larger studies testing the effectiveness of programmes and techniques in the 'real world' are required. The study of statewide legislative changes could be accomplished through appropriately designed ecological studies. The effectiveness of different training methods and techniques could be compared in controlled studies, using either measures of actual or simulated pesticide exposure as an objective outcome exposure. Tests of whether biological-monitoring programmes reduce exposure should be developed with biological monitoring as objective outcomes.

The authors went on to state that the actual effectiveness of surveillance systems for pesticide poisonings should be scrutinised, given the demands on limited public health funds. Also, a concerted effort to evaluate the effectiveness of intervention programmes designed to reduce pesticide overexposure and poisonings is overdue, given the costs of illness and intervention.

**Bibliographic details**


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10793284

**Other publications of related interest**


**Indexing Status**

Subject indexing assigned by NLM

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**Record Status**

This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.