Critical Appraisal of Occupational Epidemiology Papers

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Summary of talk

- What is critical appraisal?
- Why critical appraisal is important in occupational and environmental medicine
- Steps in critical appraisal of a paper
- Introduction to causal criteria
- Further reading

What is Critical Appraisal?

- Critical appraisal is a systematic approach to reading, understanding, interpreting, identifying the limitations of, and deciding upon the usefulness of, results of published and unpublished research papers and other sources of information from human studies.

- Series of points the reader should consider as s/he reads and tries to interpret findings and understand the meaning of a paper

- Don’t take a ‘checklist’ approach

Why is it important?

- For those who work in occupational health, questions constantly raised about work hazards causing ill-health, effectiveness of clinical and work interventions, screening tests, etc.

- Important skill for occupational and environmental physicians to be able to gauge the ‘evidence base’ to inform policy and occupational health practice.

- Epidemiological research, being observational rather than experimental, can have many limitations. We need to be able to understand these limitations and their impact on interpretation of the findings from human studies.

“In epidemiology there are rarely RIGHT answers, merely the most appropriate interpretation of observed phenomena”

Original research

OPEN ACCESS

Asthma in pesticide users: an update from the Great Britain Prospective Investigation of Pesticide Applicators' Health (PIPAH) cohort study

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ABSTRACT

Objectives To define the prevalence and incidence of asthma in a large working population of pesticide workers and to assess which exposures are potentially of relevance to causing or aggravating this condition.

Methods A baseline cross-sectional study at recruitment (2013–2017, n=5817), with follow-up in 2018 (n=2578), was carried out in predominantly Great Britain based pesticide workers. At baseline, participants completed a health and work questionnaire which included questions on demographic, lifestyle, socioeconomic and work-related factors, pesticide use and doctor diagnosed health conditions. In January 2018, a follow-up questionnaire focused on respiratory ill health, with questions covering self-reported respiratory symptoms and doctor diagnosed respiratory conditions. The associations of various exposures with asthma were estimated using logistic regression adjusting for age as a continuous variable, and for sex where possible. An estimate of hours worked with pesticides in the previous year was calculated for each participant.

Results At baseline, 608 (10.4%) had doctor diagnosed asthma. In 2018 the figure was 297 (11.5% of the follow-up population); the incidence of new asthma cases between surveys was 1.7 cases per 1000 participants per year. At follow-up, 18.1% reported wheeze in the last 12 months, 73.2% of those with self-reported asthma noted it to be persistent and using a more specific definition of asthma (doctor diagnosed asthma with at least one asthma-related symptom in the last year); 6.8% (95% CI 5.9% to 7.9%) fulfilled this definition. At follow-up, 127 participants felt that their asthma was caused or made worse by their work, with 77 (63.6%) nominating organic dust, 13 (10.7%) unspecified dust, 12 (9.9%) chemicals, 9 (7.4%) mixed exposures, 7 (5.8%) physical agents and 3 (2.5%) fumes or other irritants. There was little or no association between high pesticide exposure and doctor diagnosed asthma or self-reported recent wheeze, although there was an elevated risk for work-related wheeze (OR for high exposure=2.67; 95% CI 1.16 to 6.18). High pesticide exposure (high vs low exposure category OR 2.68, 95% CI 1.28 to 5.60) was also associated with work-related chest tightness. Exposure to organic dusts was associated (significantly, p=0.026) with persistent asthma when adjusted for the effects of age and smoking.

Conclusions This large study of pesticide workers has identified expected levels of doctor diagnosed asthma, and high levels of self-reported respiratory symptoms. Pesticide exposure was associated with an increased risk of self-reported work-related wheeze, but not with asthma or wheeze in general. Further work is needed to identify more clearly which exposures within a complex mixed exposure profile are likely causative in order to best focus interventions to reduce work-related asthma and related conditions.

Key messages

What is already known about this subject?
⇒ Pesticide exposure is complex, and various exposures have been linked to non-malignant and malignant health outcomes. The levels of evidence underpinning these associations are variable. Real-world health data from pesticide exposed working populations are uncommon.

What are the new findings?
⇒ This study identifies a substantial prevalence and incidence of self-reported asthma, and high levels of respiratory complaints in pesticide users. Some of these appear to have a dose response relationship. Pesticide exposure was associated with an increased risk of self-reported work-related wheeze. However, workers more often report organic dust exposures as the perceived cause of their ill health, rather than pesticide or chemical exposures.

How might this impact on policy or clinical practice in the foreseeable future?
⇒ Pesticide exposures should remain an important focus for regulatory and health and safety authorities. Further work should be carried out to identify which particular types of exposure are important to respiratory health, and to inform evidence-based workplace interventions to reduce risks to health.

INTRODUCTION

Occupational exposures to pesticides have been linked to increased levels of reported respiratory symptoms,[1 2] changes in pulmonary function[3–6] and specific diagnoses including asthma. The effects may not be confined just to adults, as a recent systematic review of childhood data also suggests that

First step?

First step

- Read the abstract or summary
- Gives a concise overview of what the paper or report is about
- Tells if relevant to the topic you are interested in
- Will generally cover the good points of the paper
- If you want to refer to the paper, don’t just rely on the abstract or summary as it doesn’t contain sufficient information to fully evaluate the paper

What is the Research Question?

- A very important part of any paper
- How clearly is it stated by the authors?
- Needs to be as specific as possible
- Guides the methodology for the study, data analysis and conclusions
- ‘Road map’ for the research
- Avoid the ‘Columbus phenomenon‘

What is the Study design

- Should be explicitly stated in the paper
- Clinical/Intervention trial - experimental
- Cohort study (prospective/historical)
- Registry study
- Case -control study
- Cross-sectional study
- Ecological study
- Case series/ case report
- Is the design appropriate for the research objectives?
- What are limitations?

How was the study group defined?

- Is it a sample of a larger population?
- If so, what sampling approach was used?
- Is the sample representative of the larger population? How generalisable?
- How was the sample size decided upon?
- Was there a sample size calculation, based on statistical power?
- Were there any inclusion/exclusion criteria?
- What were the response rate and drop out rate?
- What do we know of non-participants?

How was the comparison group defined?

- ALWAYS need a comparison group in epidemiology
- How were they defined?
- What was the source of the controls? Population based, hospital, geographical etc
- Was it a sample?
- Were they matched in some way?
- How comparable were they to the study group?
- Should be similar in most ways, except for the exposure variable(s)

How were the health outcomes measured?

- What measurements were used?
- How valid are they in measuring what we want them to measure? Any objective check?
- How reproducible are the measures?
- Were subjects and observers blinded to exposure?
- What quality control was used?
- Completeness of data?

Exposure measures

- Very important factor in occupational and environmental epidemiological studies
- How was exposure measured?
- Were individual or population data used?
- Information collected directly from individuals or from records?
- Environmental or personal measures?
- How complete are the exposure data, especially for retrospective studies?
- How likely is misclassification bias and what impact could it have?

How was the analysis done?

- What statistical methods were used?
- Were these appropriate for the type of study?
- What level of statistical significance was used?
- Were there too many analyses, which would increase the risk of chance findings? Type 1 error.
- Multiple comparisons problem – $p < 0.05$

How were the findings presented?

- Tables/figures help to organise the findings
- Are there clear tables and figures?
- Are there clear titles, headings, footnotes etc?
- Are there too much or too little presented data to answer the research question(s)?
- Data should not be in both tables and the text - key findings in the text
- Make your own assessment of presented results

Confounding factors?

- A confounder is a possible third factor related to both the exposure and the outcome variable which is not in the causal pathway.
- Therefore, confounders could be an alternative explanation for positive findings.
- Authors need to have excluded major possible confounders to conclude that the exposure and health outcome are associated
- May be unknown confounders acting!
- Can adjust for these in analyses (to a point)

Could biases explain the findings?

- Bias is systematic error
- More serious than random error and more difficult to assess and control for
- Selection bias
- Participation bias
- Survivor bias
- Observer bias
- Information/recall bias
- Many more - authors should discuss possible direction and implications

Making a judgement

- What were the main findings?
- Could these be explained by chance, confounding or bias?
- If not, then conclude there is an association
- Next question is how do the results fit in with other known information about this particular topic?
- How will these findings influence our thinking on this topic?

Association or causation?

- In aetiological studies, just because we have found an association, doesn’t mean that a causal link has been proven
- There is a series of further points we need to consider, before we can make conclusions about a causal link
- Bradford Hill’s causal criteria

Bradford Hill Criteria

- Strength of the association
- Consistency
- Dose-response gradient
- Temporality
- Specificity
- Biological plausibility
- Coherence
- Experiment
- Analogy

Further reading

- Fowkes FG & Fulton PM. Critical appraisal of published research: introductory guidelines. 1991 May 11; 302(6785): 1136–1140.

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