



A Primer for Evaluating the Quality of Studies on Environmental Health

Critical Appraisal of Cohort / Intervention Studies

The following queries are adapted from the *Newcastle-Ottawa Scale* (2005),¹ the Critical Appraisal Skill Programme (2006),² and from critical appraisals by Elwood (2007)³ and Aschengrau and Seage III (2003).⁴

Title Page and Introduction	Examples
In what journal or other medium was the article published? (Journals with high impact factors are usually carefully peer reviewed).	The paper about pesticide risk factors for cancer appeared in <i>Science</i> , the top rated multidisciplinary journal.
Who sponsored the study and what are the authors' affiliations?	The pesticide manufacturer's association was the only sponsor of the study.
What is the context of the study and what is the investigator's motivation? Is there a convincing rationale and purpose (hypothesis) for doing the study? There may be data quality issues with secondary analysis of data or <i>data dredging</i> (unplanned tests of association yielding significant results).	A cohort of 200 household pesticide applicators was followed over ten years, with plans to evaluate cancer outcomes. During the fifth year, questions on current asthma were added. The publication reported a non-significant relationship between pesticide exposure and incidence of asthma. However, there are data quality issues with no evaluation of asthma or history of childhood asthma at the beginning of the study.

Study Methods	Examples
Is the intervention/exposed group representative of the population of exposed individuals in the community?	<p><i>Good quality:</i> A random sample of city households having yard areas was studied for cosmetic pesticides use.</p> <p><i>Poor quality:</i> The general population study included older individuals, although it was the working age population that had the exposure of interest of organophosphates.</p>
Are the non-intervention/non-exposed cohort drawn from the same community as the exposed?	<p><i>Good quality:</i> The unexposed cohort was drawn from households having yards in the same area of the city.</p> <p><i>Poor quality:</i> The intervention group lived in regions with lower socioeconomic status than the controls.</p>
How was intervention/exposure determined?	<p><i>Good quality:</i> The concentration of pyrethroids in carpet dust was determined and classified as high, medium, and low.</p> <p><i>Poor quality:</i> Exposure grouping was based on self-reports of pesticide use in the past decade.</p>
How was the outcome determined? Was it confirmed?	<p><i>Good quality:</i> Questionnaire reports of asthma among a cohort of pesticide manufacturers were confirmed by medical records. The investigator had no knowledge of exposure status.</p> <p><i>Poor quality:</i> The prevalence of occupational asthma was determined by self-report, without confirmation by respirologist records.</p>
Was the outcome of interest not present at the start of the study?	<p><i>Good quality:</i> The risk of current asthma in children was associated with exposure to pesticides prenatally, for infants initially studied during the mother's pregnancy.</p> <p><i>Poor quality:</i> The risk of asthma in children was related to current household pesticide use (asthma may have occurred prior to pesticide exposure).</p>

<p>How comparable are the intervention/exposure groups in age, sex, and socioeconomic status? (use matching or adjustment of confounders)</p>	<p><i>Good quality:</i> Intervention groups were matched by sex and age, with statistical adjustment for education level.</p> <p><i>Poor quality:</i> It was stated that differences between pesticide exposure groups were not statistically significant, but no data were shown.</p>
<p>Was the follow-up time adequate for outcomes to occur?</p>	<p><i>Good quality:</i> Organophosphate levels, measured in pesticide applicators 20 years prior, were associated with the incidence of asthma.</p> <p><i>Poor quality:</i> The incidence of asthma was determined for pregnant mothers exposed to pyrethroids within the past year.</p>
<p>What was the attrition or participation rate?</p>	<p><i>Good quality:</i> The drop-out rate for both exposed and unexposed farm workers was similar, at 10% each.</p> <p><i>Poor quality:</i> Only 45% of the control workers were available for participation in the follow-up study as compared with 75% of the cohort of pesticide applicators.</p>

<p>Results and Discussion</p>	<p>Example</p>
<p>Are the results accurate? Does the study have internal validity? Can bias, confounding, and random error be eliminated as alternative explanations?</p>	<p>The elevated risk of asthma incidence, in children who were exposed to pesticides prenatally, may be affected by systematic differences in socioeconomic status within the cohort.</p>
<p>Can the study findings be generalized to other people and situations? For example, were minorities included?</p>	<p>The elevated relative risk of asthma in the cohort of male pesticide applicators may not be applicable to female pesticide applicators.</p>
<p>Can the results be applied to the local population?</p>	<p>The demonstration of an increased relative risk of asthma related to maternal exposure to pesticides among California children has applicability to local concerns.</p>

Do the results suggest a causal association?	Apply <i>Hill's Guidelines for Assessing Causality</i> ³ (see Background on Epidemiological Studies p.5), particularly considering the temporal relationship between exposure and outcome and the consistency of the findings with other studies.
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References

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3. Elwood M. Critical appraisal of epidemiological studies and clinical trials. 3rd ed. Oxford, UK: Oxford University Press; 2007.
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