



## A Primer for Evaluating the Quality of Studies on Environmental Health

### Critical Appraisal of Cross-Sectional Studies

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

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? Is the issue clearly focussed? Did the study try to detect a beneficial or harmful effect? There may be data quality issues with secondary analysis of data or data dredging (unplanned tests of association may yield significant results).	In a survey of neurobehavioral symptoms among 150 household pesticide applicators, the questionnaire was altered mid-stream to include a question on current asthma. The focus of the paper became the non-significant relationship between pesticide exposure and asthma for 80 subjects. Was the study now underpowered? Was childhood or adult-onset asthma considered? Was asthma determined by a physician?

Study Methods	Examples
Is the exposed group representative of the population of exposed individuals in the community?	<p><i>Good quality:</i> A random sample of berry farm households was surveyed, regarding use of malathion on crops.</p> <p><i>Poor quality:</i> A convenience sample of exposed subjects was obtained through a marketing survey of <i>weed 'n feed</i>.</p>
How was exposure determined? Was it validated?	<p><i>Good quality:</i> Measurement of blood acetylcholinesterase was used in addition to occupational history to determine past exposure to organochlorine compounds.</p> <p><i>Poor quality:</i> Surveyed farmers were asked to list all pesticides used in the past 20 years.</p>
How comparable are the exposure groups (including unexposed) in age, sex, and socioeconomic status?	<p><i>Good quality:</i> There was less than 10% difference in prevalence of demographic variables between groups; in addition, sex and age were statistically adjusted in all analyses.</p> <p><i>Poor quality:</i> A statement, "There were no differences between groups." was not backed up by tables showing the distribution of potential confounders.</p>
How was the outcome determined? Was it validated?	<p><i>Good quality:</i> Questionnaire information on sleep disturbances among pesticide applicators was validated in the sleep laboratory.</p> <p><i>Poor quality:</i> The outcome of chronic sleep disturbance symptoms was determined through self-report over the last 5 years.</p>

Results and Discussion	Example
Are the results accurate? Does the study have internal validity? Could bias, confounding, and random error be eliminated as alternative explanations?	The association between ADHD in children and organophosphate pesticide exposure in early childhood may be affected by inner city residence, as there is a strong association between socioeconomic status and pesticide use.
Can the study findings be generalized to other people and situations? For example, were minorities included?	Urinary metabolites of diazinon were found to be associated with neurological disorders in male pesticide workers. Because women metabolize diazinon differently, the result cannot be generalized to all pesticide workers.
Can the results be applied to the local population?	The demonstration of an increased prevalence of childhood ADHD, related to maternal exposure to organophosphate pesticides among California residents, has applicability to local concerns.
Do the results suggest a causal association?	Apply <i>Hill's Guidelines for Assessing Causality</i> <sup>3</sup> (see Background on Epidemiological Studies p.5), with particular consideration for the temporal relationship between exposure and outcome and the consistency of 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.
4. Aschengrau A, Seage III GR. Essentials of epidemiology in public health. Sudbury, MA: Jones & Bartlett Learning; 2003.

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