



# **ASSINGMENT REPORT** **ON** **WRITING CRITICAL APPRAISAL**

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Assignment: Read the paper titled “Arsenic exposure from drinking water and mortality from cardiovascular disease in Bangladesh: prospective cohort study” by Chen Y et al / (BMJ 2011;342:d2431) and write a critical appraisal based on the attached critical appraisal worksheet

### Critical Appraisal Worksheet (CAW)\*

Can you find the information in the paper?	Is the way this was done a problem?	Does this problem threaten the validity of the study?
<p><b>1. What is the research question</b>  <b>Answer:</b></p> <p>a. Is there any association between arsenic exposure and mortality from cardiovascular disease?</p> <p>b. Is there any synergy between arsenic exposure and cigarette smoking in mortality from heart disease?</p>	<p><b><i>Is it concerned with the impact of an investigation, causality or determining the magnitude of a health problem?</i></b></p> <p>Yes</p>	
<p><b>2. What is the study type?</b>  <b>Answer:</b> Prospective cohort study</p>	<p><b><i>Is the study type appropriate to the research question?</i></b></p> <p>Yes, according to the study objectives, variabilities, and follow-up visits history (three times) the prospective cohort study was appropriate.</p>	<p><b><i>If not, how useful are the results produced by this type of study</i></b></p>
<p><b>3. What are the outcome factors and how are they measured</b>  <b>Ans:</b>  <b>Outcome factors:</b>            Death from cardiovascular disease  <b>Measures:</b></p> <ul style="list-style-type: none"> <li>• Outcome factors were measured by using the Hazard Ratio.</li> <li>• Verbal autopsy (VA) used to ascertain the causes of deaths.</li> </ul>	<p><b><i>Are all relevant outcomes assessed?</i></b></p> <p>Yes, all relevant outcomes were measured based on the research questions.</p> <p><b><i>Is there measurement error?</i></b></p> <p>Yes, I found that the robust standard errors for the proportional hazards model was used to account for potential influence.</p>	<p><b><i>How important are omitted outcomes?</i></b></p> <p>The authors have found strong relationship among the exposures and outcome. The outcome was influenced by the confounders which were adjusted.</p>
<p><b>4. What are the study factors and how are they measured</b>  <b>Answer:</b>  <b>Study factors:</b> Age, Sex, Baseline educational level, body mass index, blood pressure,</p>	<p><b><i>Is there measurement error?</i></b></p> <p>Yes, the authors found some measurement errors for exposures such as:</p> <ul style="list-style-type: none"> <li>• Ecological measures of</li> </ul>	<p><b><i>Is measurement error an important source of bias?</i></b></p> <p>Yes, it was the source of bias the led towards the null but could also generate spurious</p>

<p>diabetes and smoking status.</p> <p><b>Measures:</b></p> <ul style="list-style-type: none"> <li>The arsenic exposure was measured by the graphite furnace atomic absorption spectrometry.</li> <li>Dietary intakes were measured at baseline with a validated semiquantitative food frequency questionnaire designed for the study population.</li> </ul>	<p>arsenic exposure are subject to large measurement errors when there is variation in water concentrations within a study region.</p> <ul style="list-style-type: none"> <li>Measurement errors in ascertainment of exposure</li> </ul>	<p>association under certain conditions.</p>
<p><b>5. What important potential confounders are considered?</b></p> <p><b>Answer:</b> Age, Sex, Smoking Status, Educational attainment, Body Mass Index and Urinary Arsenic Concentration were considered as potential confounders.</p>	<p><b>Are potential confounders controlled for?</b></p> <p>Yes, the confounders were adjusted from the hazard ratios estimated from Cox Proportional hazards regression.</p>	<p><b>Is confounding an important source of bias?</b></p> <p>Sometimes the confounders could be the important source of bias but for this study the authors didn't mention the confounding bias. It was adjusted by using the multivariate regression.</p>
<p><b>6. What are the sampling frame and sampling method</b></p> <p><b>Answer # Sampling frame and methods:</b></p> <ul style="list-style-type: none"> <li>HEALS methodologies were used for sampling frame and sampling methods.</li> <li>Population based survey, key persons interviewed and well water samplers used for cluster sampling for the selection of households.</li> <li>It has not clearly mentioned the sampling methods which is one of the major drawbacks.</li> </ul>	<p><b>Is there selection bias?</b></p> <p>Yes, because the mentioned measures were taken after the completion of the household survey and well sampling, it is unlikely that they have biased of study results.</p>	<p><b>Does this threaten the external validity the study?</b></p> <p>We didn't find any evidence that we can use this data for other areas in the country hence it has external validity issue.</p>
<p><b>7. In an experimental study how were the subjects assigned to the groups?</b></p> <p><b>Answer:</b> The random assignment which is</p>		<p><b>Does this threaten the internal validity of the study?</b></p> <p>No, the authors adjusted the potential confounders by using a</p>

<p>the primary way that researchers accomplish this kind of control of extraneous variables across conditions.</p> <p>The assignment of participants to different conditions according to a random procedure, such as flipping a coin, rolling a die, or using a random number generator.</p> <p><b><i>In a longitudinal study how many reached final follow-up?</i></b></p> <p>Answer: The researchers were observed 77252 persons years during the follow-up period. Many deaths were recorded during the period of study for the disease of circulatory system, heart disease, ischemic disease and cerebrovascular disease. Finally, the Hazard ratio was calculated for 73,835 persons years and after the total death (460) we can see 76792 was reached in the final follow-up.</p>		<p>very standard way and measured the mortality outcomes.</p>
<p><b><i>8. Are statistical tests Considered?</i></b></p> <p><b>Answer:</b> Yes. Cox proportional hazard regression, Sensitivity analysis, Survival analysis.</p>	<p><b><i>Were the tests appropriate for the data?</i></b> Yes, the mentioned statistical tests were appropriate for this study.</p> <p><b><i>Are confidence intervals given?</i></b> Yes, 95% confidence intervals were used by the standard delta method.</p> <p><b><i>Is the power given if null result?</i></b> Yes, it was 80% power with alpha value 0.05 to detect a hazard ratio of 1.22 for cardiovascular disease mortality associated with 1 SD difference in baseline well arsenic concentration.</p> <p>In cohort study, for one variable we need to consider at-least 30 individuals. This study sample size was adequate.</p>	

<p><b>9. Are the results clinically /socially significant?</b></p> <p><b>Answer:</b></p> <p>Yes, since this is a wide scale study the researcher found a synergistic effect between arsenic exposure and cigarette smoking on mortality from ischemic heart disease and other heart disease.</p> <p>The findings are comparable with other similar studies in Bangladesh. The result has significant importance in public health implications to the expected reduction in mortality in heart disease.</p>	<p><b>Was the sample size adequate to detect a clinically /socially significant result?</b></p> <p>Yes, the sample size was adequate for this type of study.</p>	<p><b>Is the study useful or is the result inconclusive?</b></p> <p>Yes, this study is definitely useful for the national level policymakers.</p> <p>Though, it has some limitations such as didn't consider individuals metabolites of arsenic, could not assess susceptibility from methylation capacity. The BMI were measured for the specific group of population so that the results might not be applicable for generalizable for other populations. After adjustment of confounders there were no major changes happened.</p>
<p><b>10. What conclusions did the authors reach about the study question?</b></p> <p><b>Answer:</b></p> <p>Yes, the study questions were retorted and statistically derived.</p> <p>The authors found a dose-response relation between arsenic exposure and mortality specially heart disease.</p> <p>There was a synergistic effect between cigarette smoking and arsenic exposure at moderate or high levels on mortality from ischemic heart disease and other heart disease.</p>	<p><b>Do the results apply to the population in which you are interested?</b></p> <p>Actually, the selection of population group for this study was not generalized but the results may help to conduct similar studies. I think this study protocol will help me to observe the similar relationships.</p>	

\*Darzins PJ, Smith BS, Heller RFH> Principles behind the practice: How to read a journal article. Medical Journal of Australia 1992; 57: 389-94