S20/HSS317/Ethics/**Assignment-III**/08-March-2020

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Total points: 10

To determine whether something, X, causes condition Y (e.g. whether a chemical causes cancer), scientists usually compare the effects of X on two groups. It could be on humans or lab animals like mice depending on the case. Let's consider experiments on mice. One group is exposed to X (this is the 'exposed' group) and the other group of mice is not exposed to X (this is the 'control' group). If the exposed group has more mice with Y than the control group, statistical tests are done to determine how likely it was that the exposed group has a higher number of mice with Y purely as a matter of chance. This determination is important to rule out the possibility that the mice in the exposed group have Y because of some random health condition and not because of being exposed to X. If the probability of Y being caused in in the exposed group by random factors is sufficiently low, say 5% (this means that 5 cases of Y out of 100 cases of Y are due to random factors other than X), scientists would conclude that X causes Y. In this case, they would be adopting a 95% statistical significance level for making the inference. There is no logical reason why one wouldn't choose a less strict significance level, say 90% (thereby willing to conclude that X causes Y even if it turns out that 10 out of 100 cases of Y may be due to random factors other than X) or a more stringent significance level, say 99% (thereby willing to conclude that X causes Y only when there is at the most 1 out 100 cases of Y caused by random factors other than X). As with any reasoning in science, the non-deductive nature of the inference allows that it is possible for the conclusion to be false. Scientists make a *false positive error* when they conclude "X causes Y" but in fact X does not cause Y. They make a *false negative error* when they conclude "X does not cause Y" when in fact X does cause Y.

Suppose scientist A is investigating whether a certain chemical (C) found in soft drinks causes cancer (E). A conducts experiments to confirm this and gathers evidence but finds that with a significance level of 95%, it cannot be concluded that C causes E. However, if the level is reduced to 90%, it can. A's colleague, B, advices him to lower the significance level since by doing so A would be doing the ethically right action: "If you make a false negative error, you would be bringing about more harm. People lives would be at risk because of the chemical. You are ethically responsible to warn people of a potential carcinogen. So you can lower your standards of evidence when human lives are at risk. You should not worry about making a false positive error and instead prioritize on avoiding false negative error." Another colleague of theirs, C, overhears this conversation and intervenes: "If you make a false positive error, you would be bringing about unnecessary panic. Your study would be used to bring in regulation that would affect the economic chain and thereby affecting some people's livelihood. You are ethically responsible to keep these consequences in mind. So you should increase your standards of evidence and adopt a higher significance level. You should not worry about making a false negative and instead prioritize avoiding a false positive". Whose advice should A follow? Explain whether it is possible for A to avoid ethical considerations altogether in judging whether C causes E. Should ethics matter when assessing evidence?