**Answers to Study Questions for Chapter One**

1. Group selection bias (or selection bias) is a systematic difference between groups on variables other than the independent variable that may influence the dependent variable. In the context of causal inferences, this often occurs in non-randomized studies, such as participants self-select into groups. Those who choose the treatment group (i.e., participate in an intervention) may have different characteristics than those who do not. E.g., treatment participants may be more motivated to change, have higher levels of achievement, or have a greater risk for having a certain disease. If the treatment and control groups are different before the intervention, it may be unreasonable to conclude that a group difference on the dependent variable after the intervention was caused by the intervention. That is, the pre-existing characteristics of the group may be responsible for the group difference on the dependent variable, not the intervention.
2. A propensity score is the conditional probability that a participant will be in a particular group based on a set of observed covariates. In most studies, the propensity score estimates the probability that a participant will be in the treatment group. In such studies, propensity scores that are close to one (e.g., *PS* = .8) indicate that the participant has the characteristics of someone who will choose (or be assigned to) the treatment group. Those who have propensity scores close to zero (e.g., *PS* = .2) have the characteristics of someone who is unlikely to be in the treatment group.
3. Researchers should use PS methods to control for selection bias when (a) they are trying to make a causal inference about the effect of an intervention or characteristic, (b) the assignment mechanism is unknown (i.e., from quasi-experiments or causal comparative studies), and (c) they have several measured covariates that are related to both selection into groups and the outcome.
4. PS methods control for selection bias in non-randomized studies by balancing all non-ignorable covariates between treatment groups. Non-ignorable covariates are those that contribute to the selection bias. That is, they are distributed differently between the treatment and control groups (e.g., 60% of those in the treatment group are women, but 40% of those in the control group are women) and they are related to the outcome (or dependent) variable. Under such conditions, the group differences between the covariates affect the treatment effect. PS methods attempt to equate these covariates between the treatment and control groups so that the only difference between the two groups is whether or not they received the treatment, thereby making the estimated treatment effect similar to what would be found in a randomized experiment.
5. PS methods might not sufficiently reduce selection bias if the assumptions are not met. The ignorable treatment assumption is met when all non-ignorable covariates are balanced between groups. However, researchers may not be able to balance all observed covariates with their propensity score model or they may not include all covariates in the model that contribute to selection bias. The latter is a common problem when researchers are unable to measure certain covariates (e.g., parents’ income) or they fail to recognize that certain variables influence selection bias (e.g., parents not having a car may influence whether or not their children attend preschool). The stable unit treatment value assumption is met when the assignment procedure does not affect the treatment effect (i.e., a quasi-experiment is just as unbiased as a randomized experiment) and the treatment implementation is consistent (i.e., all participants in the treatment group receive the same type and amount of treatment). The assumption of common support is met when the propensity scores are balanced between groups. While the end-goal of PS methods is to balance groups on covariates, in order to achieve this balance, we often need to have similar distributions of the propensity scores. If the propensity score distributions between the two groups are dissimilar, any adjusted treatment effect may be invalid or still biased.