Random and Systematic Error + Types of Bias Questions

1. A study assesses the prevalence of alcoholism by randomly visiting household and administering an interview that can detect this condition. Some of the participants don't understand some of the questions and just guess, providing random answers. Will this cause random or systematic error?

2. Most epidemiological studies use samples because they do not have access to an entire population. Does this mean that they are always vulnerable to random error?

3. Describe the defining characteristic of random error in epidemiology?

4. Forbes et al. investigated the validity of a rating instrument called interRAI to diagnose neurological conditions. InterRAI was intended for use in people receiving home care, long-term care, and mental healthcare. The investigators compared the data they collected through interRAI with data from presumably accurate-patient records. They reported excellent specificity but variable sensitivity, depending on the diagnosis. For example, for traumatic brain injury the specificity was 99% and the sensitivity was 22%.

- a. Would you anticipate bias in a prevalence estimate of traumatic brain injury?
- b. If so, in what direction?

5. The Canadian Community Health Survey (CCHS) is a large-scale initiative that includes both general health surveys and surveys that have more specialized content. In 2012, a mental-health-focused survey was conducted. This survey used a combination of an area frame and a random digit dialed (RDD) telephone frame. The survey collected data by interviewing some subjects face to face, and some subjects via telephone. Alcohol and drug dependence (among other disorders) were assessed in the survey. The greater social distance associated with telephone interviewing means that respondents were more willing to disclose their use of alcohol and drugs, thereby leading to a higher estimated prevalence of alcohol and drug dependence.

- a. Do you think that this could be an important cause of selection bias?
- b. Mental disorders tend to be stigmatized conditions. Stigmatization consists of negative attitudes and behaviors. Could fear of stigma result in selection bias in a study of this type? How?
- c. The response rate in this survey was about 70%. If the response rate had been 100% instead of 70%, could selection bias occur?

6. Another feature of the Canadian Community Health Survey (CCHS) is that its target population consists of household residents. People with severe dementia tend to live in institutions, rather than at home. People with dementia are therefore less likely to be selected into the CCHS than people without dementia. Will this cause selection bias in an estimate of dementia prevalence?

7. A study used physician-billing claims and hospitalization data (a type of administrative data) to estimate the prevalence of autoimmune inflammatory myopathy in the province of Alberta, both in the general population and in aboriginal populations. To be coded as having this condition, it was necessary to see a physician or be admitted to a hospital. Could this have caused selection bias?

8. Socioeconomic status (a concept combining several indicators of social status such as occupation and income) is a determinant of many health outcomes. Yet, socioeconomic status is also often associated with lower response rates in survey research. Describe at least 1 mechanism by which socioeconomic status could introduce selection bias into a prevalence estimate.

9. Weintrauben et al. used various scales to identify impulse-control disorders in their case-control study evaluating the association of these disorders with dopamine-agonist treatment in people with Parkinson's disease. One of these was the Minnesota Impulsive Disorders Interview, which was used to assess compulsive buying and sexual behavior. Such interviews can be embarrassing for respondents to complete, so they may try to withhold their reporting of certain behaviors.

- a. What sort of misclassification errors could embarrassment cause?
- b. What kind of bias would you expect from these errors?
- c. What direction of bias do you anticipate?

10. Case-control studies are considered vulnerable to recall bias.

- a. What subtype of misclassification bias underlies the phenomenon of recall bias?
- b. In what direction does the error associated with recall bias usually go?
- c. Can you think of a disease in which recall bias might make an association appear weaker than it actually is?