**GER1000 2020 Sem 1**

**Quiz 1 and solutions**

1. In a study conducted in Finland, 89% of the males were right-handed. This shows that in the data of this study, maleness and right-handedness are positively associated.

(A) True

(B) False

*Explanation: To check for the association, we need information on the females, which is not given. In fact, 92% of the females were right-handed, so the association between maleness and right-handedness is negative. (Chapter 1 Unit 6, Slides 56-58)*

2. Suppose that among 10,000 adults who agree to participate in a study to find out whether having a fixed schedule for work-from-home benefits mental health, exactly 3,000 have “high income”, with annual income above $60,000. Five thousand of the adults are randomly assigned to the control group, and the rest go to the treatment group. Let E stand for “all 3,000 high income earners are in the control group”. Choose the best option.

(A) It is likely that E happens. This means that if the randomised assignment is repeated many times, E happens more than half the time.

(B) It is unlikely that E happens, but not impossible.

(C) It is impossible for E to happen.

*Explanation: Randomised assignment of a large number of subjects is very likely to result in two similar groups, in this case, having about 30% high earners in each group (Take 3000/10,000 x 100). So E is very unlikely, though not impossible. (Chapter 1 Unit 4, Slide 28)*

3. There is consistent evidence that poorer households are more at risk of Covid-19. A study on a Covid-19 vaccine puts 100,000 children with parental consent in the treatment group, while 300,000 children without parental consent are put in the control group. A month after the vaccine was given, infection rates of the groups are compared. Assume that, just like the polio situation, children from richer households are more likely to get parental consent. Which of the following is true about the study?

(A) It is biased against the vaccine, i.e., even if it is effective, this may not be apparent from the comparison.

(B) It is not biased at all; the comparison will accurately show the effect of the vaccine.

(C) It is biased in favour of the vaccine, i.e., even if it is harmful, this may not be apparent from the comparison.

*Explanation: This is the opposite of the NFIP study (Chapter 1 Unit 3). Here, the treatment group is at lower risk than the control group, as higher income households are more likely to provide parental consent. If the vaccine is useless, the treatment group will have a lower rate than the control group. If it is slightly harmful, it will still look good.*

4. An undercover recording operation in a university dormitory reveals that among the men, 40% use some swear words in normal conversations and that among the women, 4% do the same. Given that most of the dormitory residents are female, which is true about the overall rate of using some swear words in normal conversations in this dormitory?

(A) Less than 4%

(B) Between 4% and 22%

(C) Between 22% and 40%

(D) More than 40%.

*Explanation: The overall rate must be between 4% and 40%. Since there are more women than men, it is closer to 4% than 40%, and 22 = (4+40)/2 is the mid-point. (Chapter 1 Unit 8 Slide 4)*

**For questions 5 to 9, the first paragraph are all the same.**

5. Consider a study that intends to examine whether the colour red makes children act impulsively. A group of 500 children were assigned into two groups (Red and Green): group Red if the child came for a morning session, and group Green if the child came for an afternoon session. Each child was then led into a room that has a big button in the colour of their group and labelled “DO NOT PRESS ME!”. It was recorded whether the child presses the button within 10 minutes. Each child was then given a candy for participating.

Which of the following terms best describes the design of the study?

(A) Observational study

(B) Randomised observational study

(C) Non-randomised controlled experiment

(D) Randomised controlled experiment

*Explanation: This is a controlled experiment instead of an observational study, since participants did not self-select themselves into the two groups. The assignment of each child was determined by their choice to come in for a morning or afternoon session, which is not random. On a side note, in observational studies, participants cannot be assigned randomly into the groups, simply because the participants self-select into the groups by their inherent characteristics or existing behaviours. (Random assignment: Chapter 1 Unit 4, Slide 28; Controlled and observational: Chapter 1 Unit 6, Slide 59)*

6. Consider a study that intends to examine whether the colour red makes children act impulsively. A group of 500 children were assigned into two groups (Red and Green): group Red if the child came for a morning session, and group Green if the child came for an afternoon session. Each child was then led into a room that has a big button in the colour of their group and labelled “DO NOT PRESS ME!”. It was recorded whether the child presses the button within 10 minutes. Each child was then given a candy for participating.

Suppose 240 children were assigned to group Red, comprising 144 girls and 96 boys. Among the 260 children assigned to group Green, what is the ideal/expected number of girls after assignment to reduce the confounding effects of sex?

(A) 130

(B) 144

(C) 156

(D) 170

*Explanation: In the ideal scenario, the proportion of girls would be the same in both groups, which is 60% of group Red. 60% of group Green would be 156 children. If randomised assignment was done, it can reduce the confounding effect of sex because it is more likely to have a similar proportion of sex in the two groups. (Chapter 1 Unit 4, Slide 28)*

7. Consider a study that intends to examine whether the colour red makes children act impulsively. A group of 500 children were assigned into two groups (Red and Green): group Red if the child came for a morning session, and group Green if the child came for an afternoon session. Each child was then led into a room that has a big button in the colour of their group and labelled “DO NOT PRESS ME!”. It was recorded whether the child presses the button within 10 minutes. Each child was then given a candy for participating.

Which of the following conclusions from analysing the data can establish that wearing spectacles (whether the child wears spectacles) is a confounder in this study?

(A) Wearing spectacles is positively associated with being in group Red and is negatively associated with pressing the button.

(B) Wearing spectacles is associated with being in group Red and is not associated with pressing the button.

(C) Wearing spectacles is not associated with being in group Red and is not associated with pressing the button.

(D) None of the above

*Explanation: A confounder is a third factor that is associated with both the exposure and response variables. The directions of the associations do not matter. (Chapter 1 Unit 7, Slide 63)*

8. Consider a study that intends to examine whether the colour red makes children act impulsively. A group of 500 children were assigned into two groups (Red and Green): group Red if the child came for a morning session, and group Green if the child came for an afternoon session. Each child was then led into a room that has a big button in the colour of their group and labelled “DO NOT PRESS ME!”. It was recorded whether the child presses the button within 10 minutes. Each child was then given a candy for participating.

The children were also asked if they like candies. The following table summarises the data. For instance, 22 children from group Red that pressed the button do not like candies.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Likes Candies | | Does Not Like Candies | |
|  | Red | Green | Red | Green |
| Pressed Button | 3 | 135 | 22 | 1 |
| Did not Press Button | 177 | 60 | 38 | 64 |

Is preference for candies associated with pressing the button in this study?

(A) Yes

(B) No

(C) There is insufficient information given to determine whether preference for candies is associated with pressing the button in this study.

*Explanation: (Rates and association: Chapter 1 Unit 6, Slide 58)*

*rate( like candies | pressed button ) = (3+135) / (3+135+22+1) = 0.857 (3 s.f.)*

*rate( like candies | did not press button ) = (177+60) / (177+60+38+64) = 0.699 (3 s.f.)*

*Since rate( like candies | pressed button ) > rate( like candies | pressed button ), liking candy positively associated with pressing the button. Another way to get this conclusion is to show that rate( pressing button | like candies ) = 0.368 > 0.184 = rate( pressing button | does not like candies )*

9. Consider a study that intends to examine whether the colour red makes children act impulsively. A group of 500 children were assigned into two groups (Red and Green): group Red if the child came for a morning session, and group Green if the child came for an afternoon session. Each child was then led into a room that has a big button in the colour of their group and labelled “DO NOT PRESS ME!”. It was recorded whether the child presses the button within 10 minutes. Each child was then given a candy for participating.

The children were also asked if they like candies. The following table summarises the data. For instance, 22 children from group Red that pressed the button do not like candies.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Likes Candies | | Does Not Like Candies | |
|  | Red | Green | Red | Green |
| Pressed Button | 3 | 135 | 22 | 1 |
| Did not Press Button | 177 | 60 | 38 | 64 |

Is preference for candies a confounder in this study?

(A) Yes

(B) No

(C) There is insufficient information given to determine whether liking candy is a confounder in this study

*Explanation: We have to check whether liking candy is associated to both the colour of the group and pressing the button. (Rates and association: Chapter 1 Unit 6, Slide 58; Confounding: Chapter 1 Unit 7, Slide 63)*

*rate( like candies | red ) = (3+177) / (3+177+22+38) = 0.75*

*rate( like candies | green ) = (135+60) / (135+60+1+64) = 0.75*

*Since rate( like candies | red ) = rate( like candies | green ), liking candy is not associated to the colour of the group, and is hence not a confounder in this study. Another way to get this conclusion is to show that rate( red | like candies ) = rate( red | does not like candies ) = 0.48.*