Solutions 4: Chance and bias

Question 1: Postnatal depression and infant growth in Goa, India

Question 1a: The sample consisted of women who attended an immunization clinic *and* who agreed to participate in the study. These women may not be representative of all women who give birth in Goa. They may differ from the wider population with respect to a variety of factors which may be associated with mental health, such as socioeconomic status, urban/rural residency, etc. It is also highly likely that mental health status itself is directly associated with attendance at an immunization clinic and agreement to participate in the study. If women suffering from postnatal depression were less likely to take their child to the clinic for immunization, the prevalence of depression would be lower among these women than among all women giving birth in Goa.

We cannot therefore conclude, without further information about the representativeness of this sample, that the prevalence of postnatal depression in Goa at 6-8 weeks is 22%.

Question 1b: Postnatal depression is associated with poor outcomes for both indicators of infant nutritional status. Women suffering from postnatal depression are 2.3 times more likely than women not suffering from depression to have underweight infants at 6 months, and 2.9 times more likely than non-depressed women to have short infants at 6 months.

A risk *ratio* of 1.0 (also known as the null value) by definition would mean the same risk in the groups we are comparing. In these examples, the 95% confidence intervals around both risk ratios exclude 1.0 – where there would be no difference between the weight of infants born to women suffering from post-natal depression compared to those not suffering from depression - so these results are unlikely to be due to chance.

Question 1c: 171 mothers/infants were recruited into the study, and outcome data is available for 142 of them (17% loss to follow-up). Loss to follow-up may have occurred for a number of reasons, including: death of the infant/mother (although this is a rare event), migration out of the area, temporary absence from the area, and mothers dropping out of the study. Several of these reasons may be associated with postnatal depression and/or infant nutritional status, and loss to follow-up could thus bias our estimates of the associations between postnatal depression and infant nutritional status in a variety of ways.

For example, if those women who were suffering from postnatal depression and had underweight children were more likely to drop out of the study (because of poor coping, fear of condemnation, etc), we may have <u>underestimated</u> the association between postnatal depression and infant underweight status. Similarly, if underweight infants have higher mortality, and this is associated with postnatal depression, this may also cause us to <u>underestimate</u> the association between postnatal depression and underweight status.

Question 1d: To assess the extent of selection bias (and thereby generalisability of the prevalence estimate), researchers could compare the demographics of clinic attendees with those of the wider population, to see if there are any obvious differences between them. To explore whether loss to follow-up may have introduced bias into the study, the researchers could use data collected from all participants at baseline to compare whether those lost to follow-up differed from those remaining in the study. They could look at a variety of variables including postnatal depression, infant birthweight, demographics, and other routinely recorded information or baseline survey data relating to the characteristics/health of the mother and infant. It would

also be useful to look at a breakdown of reasons for loss to follow-up along with additional information, for example medical records/cause of death data if the infant has died.

Question 1e: (i) Differential misclassification occurs when misclassification of exposure (depression in this case) is not equal between subjects that have or do not have the outcome. For instance, there may shame/stigma among respondents to self-report certain symptoms, particularly among women with underweight children, in which case misclassification would be differential. (ii) Non-differential misclassification occurs when an exposure or disease outcome classification is incorrect for equal proportions of participants in the compared groups. For instance, the symptoms may not be a comprehensive list of all symptoms experienced by depressed postnatal women, and the symptoms might arise for reasons other than depression. This could lead to misclassification among all respondents, irrespective of the outcome.

(iii) If misclassification was non-differential, then the mothers of underweight children will appear to be more similar to mothers of normal weight children (with regards to postnatal depression) than they really are. This would cause us to underestimate the association between postnatal depression and poor growth outcomes. This does not invalidate our observed associations – it means that they are in fact even stronger than these estimates suggest.

Question 2: Common mental disorders and infant nutrition in Pakistan

Question 2a: The response rate in this study is very high (as is the proportion of all infants in the population immunised and therefore eligible to be sampled for the study) and so selection bias is unlikely to be a big concern.

Question 2b: The confidence intervals do not include the null value of 1.0 and so the association between maternal CMD and infant undernutrition is unlikely to have been due to chance.

Question 2c: It is possible that mothers of undernourished infants recall their own symptoms differently from mothers of healthy infants, for example if they are looking to attribute their infant's poor nutritional status to some fault of their own. If this was the case, and they over-reported symptoms, the researchers would have overestimated the association between maternal CMD and poor nutritional status.

Recall bias with respect to a particular exposure (e.g. depression) would probably operate in different ways in different settings. For instance, in some countries it may be stigmatising to admit to depression and so there may be recall bias, whereas in other settings there may be no embarrassment in reporting symptoms of depression, and so less recall bias is likely.

- The researcher could apply to the local IRB to access participants' medical history of CMD.

- Ensure concise wording in SRQ-20 for easy interpret by everyone – e.g., "3 times/week" as opposed to "often/not often".

- structured the questionnaire in such a way that the event is in chronological order

Question 2d: While it is plausible that maternal CMD can affect infant nutrition (e.g. by affecting feeding/care), it is also plausible that infant ill health (including undernutrition) can affect maternal mental health. If the SRQ-20 only measures symptoms in the past month, the researchers may be capturing cases of CMD that actually occurred after (and perhaps because) the infant was already underweight. This would be a case of reverse causality.

Question 3

Question 3a: It is likely that recall bias occurred in this study: as people suffering from brain tumours were more likely to recall previous head trauma compared to controls.

Question 3b: It is likely that selection bias occurred in this study. The controls were patients affected by gastro-intestinal disorders, and so were likely to have reduced their coffee consumption. This meant that the exposure distribution of coffee consumption among the controls is lower than in the source population. This created a spurious association between coffee drinking and pancreatic cancer.

Question 4 (Optional question to do in your own time): Postnatal depression and infant weight in the UK

Question 4a: Relative to children born to women who did not have depression, children born to women affected by depression had 0.6 times the risk (40% lower risk) of being underweight after 12 months.

The confidence interval includes 1.0, which means it is possible that the observed effect was due to chance. This may be because there is no real effect, or because the sample size is too small to detect a meaningful difference.

The study may have also been subject to non-differential misclassification of exposure or outcome (or both), which would have biased the risk ratio towards the null value of 1.0.

Question 4b: The first study shows a strong effect of depression on undernutrition, though the confidence interval tells us the observed effect may be due to chance. The second study shows a weaker effect of depression on undernutrition, though this finding is less likely to be due to chance. In order to assess which study provides better information you would want to look at the details of the study to assess whether you think bias occurred, and whether potential confounders (Lecture 5) had been adjusted for.