

## Clinical Biostatistics

### Suggested Answers: Confidence Intervals

#### Exercise 1

- (a) *Are there any problems with the sampling method? What alternative methods might have been used? Would they solve the problem, if any?* This study asks people to volunteer. There may be a problem in that the sample of practitioners will not be representative. They may, for example, be more likely to think that their adverse events are low than are practitioners who do not volunteer. An alternative would be to take a representative sample of practitioners, if there is a suitable list of practitioners to sample from. This would solve the problem if all those sampled agreed to take part.
- (b) *Are there any problems with the data collection methods? What alternatives might have been used? Would they solve the problem?* The adverse events are recorded by the practitioners. This may lead to bias, because practitioners may tend to minimise adverse events. Also they will vary in their interpretation of what constitutes an event worth reporting. The alternative would be to ask the patients. This would make the study much more cumbersome, but might remove bias in the reporting. It would not prevent variability in what people regard as worth reporting, but we could argue that the patient's perception is the important thing anyway.
- (c) *The average age of the acupuncturists was 47 (range 27-71) years. The median number of consultations for a practitioner was 318, range 5-1,911. What does this tell us about the shapes of the distributions of age and number of consultations?*  
Age: the mean is close to the middle of the range (49 years) so the distribution should be roughly symmetrical, possibly very slightly skewed to the right. Number of consultations: The median is much closer to the lower limit than to the higher. This distribution will be pronouncedly skewed to the right. Some practitioners are reporting very few consultations. Either they do very little or are not reporting those that they do.
- (d) *Altogether, 43 "significant" events were reported, giving a rate of 14 per 10,000 (95% confidence interval 8/10,000 to 20/10,000). What does this mean?* In this sample, for every 10,000 consultations we have an average of 14 adverse events. This will not necessarily be true for all consultations. In the population which these consultations represent, we estimate that there are between 8 and 20 events per 10,000 consultations.
- (e) *According to accepted criteria, none (0/10,000 to 1.2/10,000) of these events was serious. Can we conclude that there is no risk of serious events?* No we cannot. Just because we have seen no serious events does not mean that there will never be one. The confidence interval tells us that the data are consistent with there being as many as 1.2 serious events per 10,000 consultations. In fact, there are several reports in the literature of hepatitis transmission being linked with acupuncture, though these are very rare.

- (f) *The authors say "14 per 10,000 of these minor events were reported as significant. These event rates are per consultation, and they do not give the risk per individual patient". Why do they not give the risk per individual patient? Because a patient might have many consultations. Thus the risk for a patient will be higher than these estimates.*
- (g) *The authors do not appear to draw any explicit conclusions. What would you conclude from this study? We can conclude that our best estimate of the risk of a serious event is between 0 and 1.2 per 10,000 consultations, although this may be biased, probably downwards, by our choice of practitioners. Minor events are quite common, estimated to be between 42 and 1,013 per 10,000 consultations (1,013 per 10,000 is 10%) but few of these are regarded as significant. (No confidence interval is given for the 14/10,000 "significant" proportion.)*

## Exercise 2

- (a) *Are there any problems with the sampling method? The intended sample, all professional acupuncturists who were members of the British Acupuncture Council and were practising in the United Kingdom, was a very good one. I do not think there would be any problems if they could get information from them all.*
- (b) *To what problems might the low response rate from the acupuncturists lead? There may be a problem in that the sample of acupuncturists will not be representative. Acupuncturists who refuse, for example, may be more likely to think that their adverse events are high than do those acupuncturists who agree to take part.*
- (c) *Are there any problems with the data collection methods? What alternatives could be used? Would they solve the problem?*

As in the first paper, the adverse events are recorded by the acupuncturists. This may lead to bias, because acupuncturists may tend to minimise adverse events. Also they will vary in their interpretation of what constitutes an event worth reporting. The alternative would be to ask the patients. This would make the study much more cumbersome, but might remove bias in the reporting. It would not prevent variability in what people regard as worth reporting, but we could argue that the patient's perception is the important thing anyway.

- (d) *The mean age of participants was 44.8 years (range 23-79 years), What does this tell us about the shape of the distribution of age? Would we expect the median age to be less than or greater than 44.8 years? The mean is noticeably lower than the middle of the range (51 years), suggesting that the distribution is skewed to the right. We have no way of knowing whether the 79-year-old is an isolated individual or represents a substantial tail of older acupuncturists. We would expect the median age to be less than the mean, as the distribution is skewed to the right.*

- (e) *Practitioners reported 43 minor adverse events, a rate of 1.3 (0.9 to 1.7) per 1,000 treatments. What is (0.9 to 1.7) and what does it tell us? This is the 95% confidence interval for the risk of an minor adverse event. It tells us that the risk of a minor adverse event in the population from which this sample is drawn is estimated to be between 0.9 and 1.7 per 1000 treatments.*
- (f) *The authors conclude that their data are consistent with an underlying serious adverse event rate of between 0 and 1.1 per 10,000 treatments. Is this a reasonable interpretation? Yes, I think it is.*
- (g) *The authors say that further research measuring patients' experience of adverse events is merited. What would this tell us that these papers do not? These papers tell us about the acupuncturists view of events. Patients might regard more incidents as important than do the acupuncturists, or they might regard fewer incidents as important.*