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University of York

Department of Health Sciences

Applied Biostatistics

Suggested answers to exercise: The analysis of cross-tabulations

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Question 1

(a) *What is meant by odds ratio 0.52 for runny nose and asthma and what does it tell us?* The odds of asthma is the number with asthma divided by the number without asthma, or the proportion with asthma divided by the proportion without asthma. The odds ratio is the odds of asthma among those with one episode of runny nose divided by the odds of asthma for those with two episodes of runny nose, so the odds of asthma in children with two episodes is half the odds in children with one episode. Asthma is less likely in children with two episodes of runny nose before age one.

(b) *What is meant by 95% confidence interval 0.29 to 0.92 and what further information does this provide?* We estimate that in the population which these children represent, the odds of asthma in children with two episodes of runny nose is between 0.29 and 0.92 times the odds in children with one episode of runny nose. Because the confidence interval does not include 1.0, the null hypothesis value, the difference is significant and we have sufficient evidence to conclude that episodes of runny nose are associated with a reduced risk of asthma.

(c) *What is meant by odds ratio 3.37 (1.92 to 5.92) for lower respiratory tract infections and wheeze?* In the sample, the odds of wheeze in children with 4 infections is 3.37 time the odds of wheeze in children with 3 infections. The confidence interval tells us that the ratio in the whole population is estimated to be between 1.92 and 5.92. The confidence interval does not include 1.0, so the difference is significant and we have evidence that in this population wheeze is more common in children with a history of 4 episodes of respiratory tract infections than in those with 3 episodes.

(d) *On a less statistical point, what is wrong with the way the conclusion is phrased?* The conclusion is that 'Repeated viral infections other than lower respiratory tract infections early in life ***may*** reduce the risk of developing asthma up to school age'. But we knew that before we did the study. They might as well conclude that there ***may*** be life on Mars. We know it is true, but the study doesn't change this knowledge. What they should conclude is that repeated viral infections other than lower respiratory tract infections early in life ***are*** associated with an increased risk of developing asthma up to school age. This may not be causal, of course.

Question 2

a) *What is meant by 'relative risk 5.30'?* This is the proportion of boys who reported riding a bicycle divided by the proportion of girls who reported riding a bicycle.

b) *What would the relative risk of riding bicycles be if boys and girls were equally likely to report riding bikes?* It would be 1.00. This is because the proportion of boys reporting bicycles and the proportion of girls reporting bicycles would be the same.

c) *Is there good evidence that younger children were less likely to walk to school than were older children?* Yes, there is. The confidence interval for the relative risk is 0.88, which is less than 1.00, and the 95% confidence interval is 0.83 to 0.94, which does not include 1.00, so the relative risk is significantly different from 1.00.

d) *Is there good evidence that children from poorer families were more likely to be accompanied by an adult than were children from more affluent families?* No, there isn't. The 95% confidence interval for the relative risk (0.32 to 0.48) does not include 1.00, but the risk of being accompanied is smaller for less affluent children, not greater. There is good evidence that children from poorer families were *less* likely to be accompanied by an adult than were children from more affluent families, as the authors say.

e) *Why must fewer than 20% of girls have reported riding bicycles?* The relative risk, boys over girls, is 5.3. The proportion of boys riding bikes can be 100% at most, so that for girls must be 100/5.3% at most. 100/5% = 20% , so 100/5.3% must be less than 20%. In fact, 19.8% of boys and 3.7% of girls reported riding bicycles in their most recent journey to play.