Chapter 11 Exercises

1. Consumption of sugar-sweetened beverages (SSBs) is hypothesized to increase the risk for childhood obesity. It is further hypothesized that SSBs increase the risk for obesity only among those with a genetic variant that dysregulates the metabolism of sugar in the blood. The gene is not associated with consumption of SSBs.

a. If the hypothesis is correct, what associations do you expect to see in your data after stratifying on genetic variant status?

b. Below are the data you collect, based on a prospective cohort study in which non-obese children were followed over 10 years. Children in the top 25th percentile of self-reported SSB consumption during the first year of the study were categorized as SSB consumers. All other children were categorized as non-SSB consumers. Blood was drawn from the children at enrollment, and all were tested for the presence of the genetic variant.

   Calculate the appropriate measures of the crude association between SSB consumption and obesity status, with 95% confidence intervals.

	Obese	Not obese	Total
SSB consumer	125	125	250
Non-SSB consumer	250	500	750
Total	375	625	1000

d. Calculate the association between SSB consumption and obesity status within strata of the genetic variant, with 95% confidence intervals.

Genetic variant present:

	Obese	Not obese	Total
SSB consumer	85	25	110
Non-SSB consumer	150	250	400
Total	235	275	510

Genetic variant absent:

	Obese	Not obese	Total
SSB consumer	40	100	140
Non-SSB consumer	100	250	350
Total	140	350	490

e. What do you conclude about the relationship of the genetic variant to the association between SSB consumption and obesity status?

f. Will you report the crude association between SSB consumption and obesity or the stratum-specific association? Why?

g. Using the stratified tables above, calculate the:
   i. Risk of obesity among those with the genetic variant who consume SSB (R_{G+SSB+})

   ii. Risk of obesity among those with the genetic variant who do not consume SSB (R_{G+SSB-})

   iii. Risk of obesity among those without the genetic variant who consume SSB (R_{G-SSB+})

   iv. Risk of obesity among those without the genetic variant who do not consume SSB (R_{G-SSB-})

h. Using the information above and the formula below, determine if there is interaction on the additive scale.
   $((R_{G+SSB+}) - (R_{G-SSB-})) =?= ((R_{G+SSB-}) - (R_{G-SSB-})) + ((R_{G-SSB+}) - (R_{G-SSB-}))$

i. Using the information above and the formula below, determine if there is interaction on the multiplicative scale. (Note that these risk ratios are different from the ones you calculated in the above stratified tables: these all have a common denominator).
   $((R_{G+SSB+})/(R_{G-SSB-})) =?= ((R_{G+SSB-})/(R_{G-SSB-}))*((R_{G-SSB+})/(R_{G-SSB-}))$

2. By the time your study ends, a new theory is circulating that childhood exposure to phthalates may be associated with obesity in adolescents. Luckily, you froze the blood samples you used to check for the genetic variant in your cohort study, so you can thaw them and measure phthalate levels. Unfortunately, the phthalate assay is extremely expensive, so you will only be able to analyze 180

samples. You randomly select 90 cases and 90 controls from your study population and obtain the following results:

	Obese	Not obese
High phthalates	30	18
Low phthalates	60	72
Total	90	90

a. Calculate the appropriate measure of association and 95% confidence interval.

b. You hypothesize that the association between phthalates and obesity will be stronger in children with a low familial SES, so you stratify your results. Calculate the association between SSB consumption and obesity status within strata of familial SES, with 95% confidence intervals.

High familial SES**:**

	Obese	Not obese
High phthalates	12	13
Low phthalates	20	25
Total	32	38

Low familial SES**:**

	Obese	Not obese
High phthalates	35	16
Low phthalates	23	36
Total	58	52

c. What do you conclude about the association between childhood phthalate exposure and adolescent obesity status?

d. Because we cannot use a difference measure to detect interaction on the additive scale in a case-control study, we must use the formula for assessing additive interaction using ratio measures. As above, you will need to create three odds ratios that share a common denominator. Using the information in the stratified tables above, generate new 2x2 tables in order to calculate the:

   i. Odds ratio of obesity comparing those with high SES and high phthalates to those with low SES and low phthalates (OR_{SES+P+})

	Obese	Not obese
High SES, high phthalates		
Low SES, low phthalates		
Total		

   ii. Odds ratio of obesity comparing those with high SES and low phthalates to those with low SES and low phthalates (OR_{SES+P-})

	Obese	Not obese
High SES, low phthalates		
Low SES, low phthalates		
Total		

   iii. Odds ratio of obesity comparing those with low SES and high phthalates to those with low SES and low phthalates (OR_{SES-P+})

	Obese	Not obese
Low SES, high phthalates		
Low SES, low phthalates		
Total		

h. Using the information above and the formula below, determine if there is interaction on the additive scale.
   $(OR_{SES+P+}) =?= (OR_{SES+P-}) + (OR_{SES-P+}) - 1$

ii. Using the information above and the formula below, determine if there is interaction on the multiplicative scale.
   $(OR_{SES+P+}) =?= (OR_{SES+P-})*(OR_{SES-P+})$