Quiz 1 Solutions

Information for Question 1

There were 5842 men and women surveyed regarding whether or not they experience dizziness and if they used aspirin more than twice in the past two weeks. The data are presented below.

	aspirin use > 2 days in 2 weeks		
	Exposed	Unexposed	Total
Cases	443	774	1217
Noncases	1530	3095	4625
Total	1973	3869	5842
Risk	.2245312	.2000517	.2083191
	Point estimate		[95% Conf. Interval]
Risk difference	.0244795		.0021658 .0467931
Risk ratio	1.122366		1.012096 1.244649
Odds ratio	1.157796		1.014821 1.320917

chi2(1) = 4.75 Pr>chi2 = 0.0293

Question 1. Which is a valid interpretation of the RR from this table?

Select only one.

The risk of dizziness for someone not taking aspirin is 1.12 times the risk of dizziness for someone taking aspirin.

The risk of dizziness for someone not taking aspirin is 0.89 times the risk of dizziness for someone taking aspirin.

The risk of dizziness for someone taking aspirin is 1.16 times the risk of dizziness for someone not taking aspirin.

The risk of no dizziness for someone taking aspirin is 1.12 times the risk of no dizziness for someone not taking aspirin.

$$OR\left(D\ for\ \tilde{E}\ to\ E\right) = \frac{1}{OR\left(D\ for\ E\ to\ \tilde{E}\right)} = \frac{1}{1.12} = 0.89$$

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Information for Questions 2-3

In a study of 5888 adults, participants were questioned about their health status and their age (in years). The investigators were interested in knowing if health perceptions were associated with age. The data are below.

The authors wrote, "The likelihood of excellent health for adults older than 75 years of age was 0.68 times the likelihood of excellent health for adults 75 years of age or less ($X^2 = 21.7$, p-value < 0.001). Similarly, the likelihood of being older than 75 years of age for adults in excellent health was 0.74 times the likelihood of being older than 75 and not in excellent health ($X^2 = 24.1$, p-value < 0.001).

Excellent Health	Age > 75: no	Age > 75: yes	Total
no	3,309	1,789	5,098
yes	586	204	790
Total	3,895	1,993	5,888

Question 2. Which of the following best describes the sampling design?

Select one
Particpants were selected based upon their age classification, similar to a cohort study.
Participants were selected without regard to their health status or age level, similar to a cross-sectional study.
Particpants were selected based upon their health perceptions, similar to a case-control study.

Question 3. Which of the X^2 statistics quoted by the authors is correct?

Select one

The X^2 statistic equal to 21.7 is correct.
The X^2 statistic equal to 24.1 is correct.
Either is correct, depending upon which outcome measure is selected.
Neither value is correct.

The correct value for the X^2 statistic is 26.25. Additionally, performing hypothesis tests of either H_0: P[Excellent Health | Age > 75] = P[Excellent Health | Age $\leq$ 75], or H_0: P[Age > 75 | Excellent Health] = P[Age > 75 | Less than Excellent Health] should yield exactly the same test statistic and p-value. Also, the p-values would correspond exactly to the p-value of for the X^2 test of no association between Excellent Health and Age above.

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Question 4. Which of the following statements is correct, given this study design?

a. The odds of excellent health for adults older than 75 years of age was 0.644 times the odds of excellent health for adults 75 years of age or less.

b. The odds of being older than 75 years of age for adults in excellent health was 0.644 times the odds of being older than 75 years of age for adults not in excellent health.

Select one

Only (a) is correct
Only (b) is correct
Both (a) and (b) are correct
Neither (a) or (b) are correct

We know that the odds ratio of disease to exposure is equivalent to the odds ratio of exposure to disease.

Information for Questions 5-7

A case-control study studied the relationship between myocardial infarction (MI) and alcohol consumption. The results for the analysis between MI (yes/no) and alcohol consumption (drink = yes/no), stratified by gender, are shown below

```
cc mi drink, by(gender) bd

        gender   |       OR       [95% Conf. Interval]   M-H Weight
-----------------+-------------------------------------------------
        female   |   .8378712      .6236576   1.121533     53.04097 (exact)
        male     |   .7699251      .6100114   .9724208     84.36393 (exact)
-----------------+-------------------------------------------------
           Crude |   .9101247       .762101   1.086874              (exact)
    M-H combined |   .7961536      .6669638   .9503674
-------------------------------------------------------------------
Test of homogeneity (M-H)      chi2(1) =     0.21  Pr>chi2 = 0.6475
Test of homogeneity (B-D)      chi2(1) =     0.21  Pr>chi2 = 0.6475

                  Test that combined OR = 1:
                              Mantel-Haenszel chi2(1) =      6.40
                                                Pr>chi2 =    0.0114
```

Question 5. **After adjusting for gender**, the ratio of the odds of having a MI for drinkers compared to the odds of a MI for non-drinkers is

Select one
0.838
0.770
0.910
0.796 *This is the Mantel-Haenszel gender adjusted odds ratio.*
None of the above

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Question 6. Is there persuasive evidence that the association between MI risk and alcohol consumption is confounded by gender?

Select one
Yes
No

Question 7. Please justify your response in Question 6.

Gender is associated with alcohol consumption (i.e., women drink less alcohol than men on average), gender is causally associated with MI risk (women are at lower risk of MI than men) and gender is not likely to be in the causal path between drinking and having an MI. It is not unreasonable to believe that gender might confound the relationship between drinking and the risk of having an MI.

We observed that the unadjusted odds of having an MI for individuals that drink is 0.91 times the odds of having an MI for individuals that do not drink, while the gender stratified odds ratios are 0.84 and 0.77 for women and men, respectively. These stratum specific OR estimates are arguably similar to each other, relative to the unadjusted OR estimate. Additionally, the Mantel-Haenszel gender-adjusted OR estimate is 0.80 is not only noteably lower than the crude (unadjusted) OR estimate, the crude estimate would leads one to conclude that MI risk and alcohol consumption are not associated, while the gender adjusted OR estimate indicates that MI risk and alcohol consumption are associated. This evidence would lead one to conclude that gender confounds the relationship between MI risk and alcohol consumption.

One should not consider the test for the homogeneity of odds to assess whether gender is a confounder. Testing the homogeneity of odds is used to test whether gender modifies the association between MI risk and alcohol consumption. That addresses a different scientific question.

Question 8. Is there persuasive evidence that the effect of drinking on the odds of a MI varies by gender?

Select one

Yes. Using a 0.05 alpha-level test, the appropriate chi-square(df=1) test statistic value of 6.40 with a p-value = 0.0114 provides persuasive evidence that the odds ratios vary by gender.

No. Using a 0.05 alpha-level test, the appropriate chi-square(df=1) test statistic value of 0.21 with a p-value = 0.6475 indicates that there is not persuasive evidence that the odds ratios vary by gender.

Yes. The odds ratios for women and men differ (0.838, 0.770). The fact that the 95% confidence interval for men does not include the value 1.0 while the 95% confidence interval for the women does provides persuasive evidence that the odds ratios differ by gender.

The test of the homogeneity of odds is appropriate for investigating whether gender modifies the association between alcohol consumption and the risk of having an MI.

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Information for Questions 8-10

Individuals were surveyed on their willingness (1 = definitely willing, 0 = less than definitely willing) to participate in a HIV vaccine trial at two time points six months apart. The data are shown below.

	Time at 6 months		
Time at 0 months	Def. will	< def. will	Total
Definite willing	102	84	186
< def. willing	58	506	564
Total	160	590	750

Question 9. To test the null hypothesis that there is no association between the first and the second responses, the appropriate statistical test is

Select one
Pearson's chi-square test which has a $X^2 = 165.45$, p-value < 0.0001
McNemar's chi-square test which has a $X^2 = 4.76$, p-value = 0.0291.
Pearson's chi-square test which has a $X^2 = 12.86$, p-value < 0.001
None of these

The question asks for the hypothesis test for agreement between the first and second responses. The usual Pearson chi-square test addresses this question.

Question 10. To test the null hypothesis that the proportion of individuals definitely willing to participate in a HIV vaccine trial is the same at the two survey times is

Select one.
Pearson's chi-square test which has a $X^2 = 165.45$, p-value < 0.0001
McNemar's chi-square test which has a $X^2 = 4.76$, p-value = 0.0291.
Pearson's chi-square test which has a $X^2 = 12.86$, p-value < 0.001
None of these

This question asks you to investigate the association between willingness to participate in a HIV vaccine trial and time. McNemar's test for the paired binary can be used to address this question.