

Math 45 - Quiz #3

(3 points) Consider the question: Are students less likely to do well on standardized test if their parents are less educated? To answer this question, we will use data for the two variables "parental education level" and "student standardized test score". Which variable is the explanatory variable? Explain your answer.

"Parental Education Level" is the explanatory variable

The question implies that "student standardized test scores" might depend on "parental education level".

Use this table to help answer questions #2 - 4.

		Parental Education Level			Row Total
		Less than high school	High school	Some college or more	
Student standardized test score	Basic	5,556,230	3,949,710	4,461,409	13,967,349
	Proficient	2,971,820	10,798,368	6,015,841	19,786,029
	Advanced	1,063,009	4,124,123	9,056,499	14,243,631
Column Total		9,591,059	18,872,201	19,533,749	47,997,009

2) (2 points) Explain the following percent in a sentence: $\frac{5,556,230}{9,591,059} = 57.9\%$

57.9% of students whose parents educational level is "less than high school" have performed at a "basic" level on a standardized test.

3) (3 points) Are students less likely to do well on standardized test if their parents are less educated? Which fractions should be compared to answer this question? (Of course we would convert these fractions to percentages to do the actual comparison, but just write down the fractions needed to compare.)

We would compare: $\frac{5,556,230}{9,591,059}$ (57.9%), $\frac{3,949,710}{18,872,201}$ (20.93%), $\frac{4,461,409}{19,533,749}$ (22.84%)

Or, even better: $\frac{1,063,009}{9,591,059}$ (11.08%), $\frac{4,124,123}{18,872,201}$ (21.85%), $\frac{9,056,499}{19,533,749}$ (46.36%)

As education level of parents increases, ~~their kids perform better~~ their kids perform better on standardized tests

4) (2 points) What percent of students in the study scored "basic"? Write the fraction and the percent.

$\frac{13,967,349}{47,997,009} \approx 29.1\%$

5)

This data is from a study on whether taking medication while one has a cold decreases the length of the cold. Here the variable *Medicine Taken* indicates whether the subject took medicine or not. The variable *Cold Length* indicates the duration of the subject's cold.

		<i>Medicine Taken</i>		
		No	Yes	Total
<i>Cold Length</i>	1-3 days	86	19	105
	4-7 days	16	79	95
Total		102	98	200

- a) (3 points) Suppose that a nurse is conducting interviews for a random sample of people in this study. What is the chance that the woman selected had a low weight baby? Write marginal, conditional or joint probability. Write your answer using probability notation and give both the fraction and the percentage.

marginal. $P(\text{Cold lasts 1-3 days}) = \frac{105}{200} \approx 52.5\%$

- b) (3 points) If a nurse randomly selects a person from this study who did not take any medicine, what is the probability that the person selected had a cold that lasted 1-3 days? Write marginal, conditional or joint probability. Write your answer using probability notation and give both the fraction and the percentage.

Conditional. $P(\text{Cold lasts 1-3 days} \mid \text{No Meds}) = \frac{86}{102} \approx 84.31\%$

- c) (3 points) If a nurse randomly selects a person from this study, what is the chance that the person selected had a cold that lasted 1-3 days and did take medicine? Write marginal, conditional or joint probability. Write your answer using probability notation and give both the fraction and the percentage.

Joint. $P(1\text{-3 days and Yes Meds}) = \frac{19}{200} = 9.5\%$

- d) (6 points) Is there an association between taking medicine and the length of a cold? (You will need two percentages here.) Write whether these are marginal, conditional or joint probabilities. Write your answers using probability notation and give both the fraction and the percentage. Additionally, answer the question with a complete sentence.

Conditional: $P(1\text{-3 days} \mid \text{No med}) \approx 84\% \quad (86/102)$
 $P(1\text{-3 days} \mid \text{Yes Meds}) \approx 19.4\% \quad (19/98)$

Yes. Based on this data, it seems that taking medication lengthens the cold! (How odd...!)

- 6) This table summarizes the real results for a survey of firefighters and other crisis responders (such as police, EMT, etc.) in the New York area.

	No alcohol problems	Moderate to severe alcohol problems	Totals
Participated in 9/11	793	309	1,102
Did not participate in	441	110	551
Totals	1,234	419	1,653

- a) (6 points) Do the firefighters and other "first responders" at the 9/11 crisis at the World Trade Center have a higher risk of alcohol-related problems? Support your answer with appropriate percentages. (Remember that the explanatory variable gives the denominators of your fractions.) Communicate your results in complete sentences.

$$\text{Compare: } \frac{309}{1102} \approx 28\% \quad \frac{110}{511} \approx 20\%$$

Yes. 28% of those who participated in 9/11 have alcohol problems while 20% of those who did not participate in 9/11 have alcohol problems. Firefighters who participated in 9/11 activities have a higher rate of alcohol problems than those who did not.

- b) (3 points) How much greater is the risk of moderate to severe alcohol problems for those who participated in the 9/11 rescues? Communicate the meaning of your answer in a sentence.

$$28\% - 20\% = 8\%$$

The firefighters who participated in 9/11 are about 8% more likely to suffer from alcohol problems than those who didn't, based on this data.

- c) (3 points) What is the relative risk of alcohol-related problems? Communicate the meaning of your answer in a sentence.

$$\frac{28}{20} = 1.4$$

The firefighters (& first responders) who participated in 9/11 are 1.4 times more likely to have alcohol problems, based on this data.

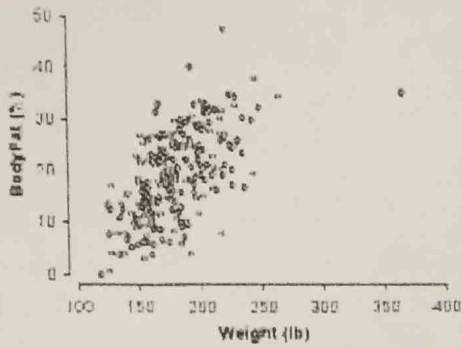
- d) (3 points) What is the percent increase in risk of alcohol-related problems if someone was involved in the rescue efforts? Communicate the meaning of your answer in a sentence.

$$\frac{28-20}{20} = 0.4$$

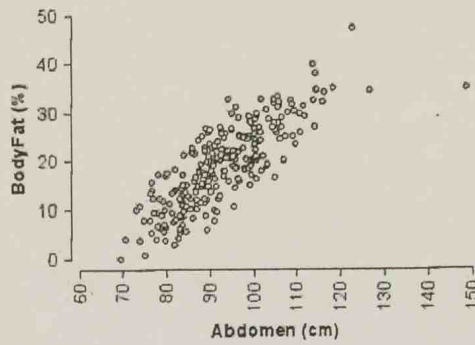
There is about a 40% increase in risk for those who participated in 9/11.

7) Here we have measurements from 252 men. Body Fat is the percentage of a man's weight that comes from fat, as opposed to muscle. Weight is measured in pounds. Abdomen is a measurement (cm) around the body at the stomach.

a) (7 points) Which measurement, weight or abdomen, is a better predictor of the percent of body fat? Support your answer using the scatterplot, s_e and r^2 . (Use all 3 or you will NOT get full credit!)



Simple linear regression results:
 Dependent Variable: BodyFat
 Independent Variable: Weight
 $\text{BodyFat} = -12.052 + 0.1744 \text{ Weight}$
 Sample size: 252
 R (correlation coefficient) = 0.6124
 Estimate of error standard deviation: 6.6290
 $r^2 = 37.50\%$



Simple linear regression results:
 Dependent Variable: BodyFat Independent Variable: Abdomen
 $\text{BodyFat} = -39.023 + 0.6282 \text{ Abdomen}$
 Sample size: 252
 R (correlation coefficient) = 0.8148
 Estimate of error standard deviation: 4.8610
 $r^2 = 66.39\%$

Abdomen is a better predictor of body fat, based on the given data & statistics. First, the scatterplot for abdomen vs Body Fat looks more linear and the points are less scattered. Additionally, the standard error is smaller for abdomen/Body fat than for weight/bodyfat. Lastly, r^2 is larger

b) (4 points) Calculate two predictions for the percentage of body fat of a man who weighs 175 pounds and has an abdomen measurement of 100 cm. Show your work. Which prediction do you think is more accurate? Why?

(weight) $\text{Body fat} = -12.052 + 0.1744(175) = 18.468\%$
 (abdomen) $\text{Body fat} = -39.023 + 0.6282(100) = 23.797\%$

The abdomen prediction is probably more accurate since it is the better predictor (see part a).

abdomen/body fat than weight/body fat. Thus, abdomen is a better predictor of Body fat

c) (4 points) What percentage of the total variation in body fat is explained by weight? By abdomen measurement? What other variables could explain the variation we see in men's body fat percentages?

weight: $r^2 = 37.50\%$ Abdomen: $r^2 = 66.39\%$

Weight explains 37.5% of the variation in Body fat, while the abdomen measurement explains 66.39% of the variation in body fat.

Other variables that could explain men's body fat; age, nutrition, exercise