

**Biostatistics 140.654
Fourth Term, 2021
April 12, 2021**

Quiz 1 SOLUTION

The purpose of this quiz is to assess your knowledge of the course materials covered during the first two weeks of class and covered in Problem Set 1.

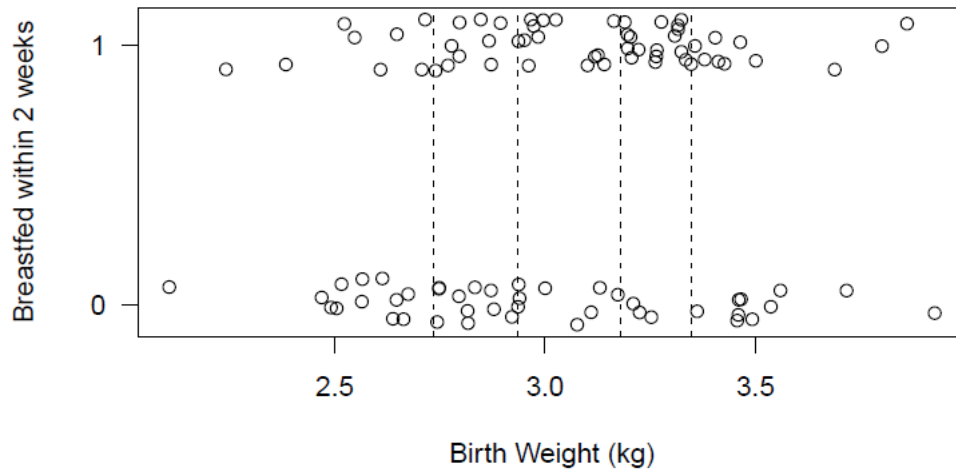
Instructions:

- **This is an open book quiz; you may consult your course notes and handouts.**
- **You should not discuss this quiz with any other student during Monday April 12th.**
- **This quiz is designed to be completed in 20-30 minutes.**
- **You can use calculators or R on your computer for arithmetic. But you should NOT use the 'glm' function in R to compute estimates of logistic regression coefficients.**
- **You may provide your solution by editing the word version of this quiz, annotating the pdf version of this quiz or writing your solution on paper and submitting a picture of your solution.**

By signing my name, I enter agree to abide by the instructions above and the Johns Hopkins University School of Public Health Academic Code:

Name (Print): _____

Signature: _____



1. In the figure above, you will find a display of data from a set of 100 Nepali infants showing whether each infant began breastfeeding within the first 2 weeks (1 – yes, 0 – no; jittered) against the child's birth weight (kg). Vertical lines are drawn at roughly the quintiles of birth weight. Use these data to estimate the coefficients in a simple logistic regression model.

Report:

- a. The logistic regression equation and your approximate estimates of the coefficients in your model.

Strata	BW (midpoint)	N	# Y = 1	Pr(Y=1)	Log(Pr(Y=1)/(1- Pr(Y=1)))
1	2.42	20	8	0.40	-0.41
2	2.84	20	9	0.45	-0.20
3	3.06	20	13	0.65	0.62
4	3.26	20	17	0.85	1.73
5	3.64	20	10	0.5	0.00

Data simulated as: $\text{Log}(\text{Pr}(Y=1)/(1-\text{Pr}(Y=1))) = 0 + 1 (\text{BW} - 3)$

Using the data above: $\text{Log}(\text{Pr}(Y=1)/(1-\text{Pr}(Y=1))) = 0.3 + 0.8 (\text{BW} - 3)$

- b. The approximate predicted probability of breast feeding within 2 weeks for a child with birth weight of 2 kg

$$\text{Exp}(0.3 + 0.8 (2 - 3)) / (1 + \text{Exp}(0.3 + 0.8 (2 - 3))) = 0.38$$

- c. Your findings in a sentence or two for a public health journal. Be numerate, eliminate jargon to the extent possible.

In a sample of Nepali newborns with birthweights ranging from roughly 2 to 4kg, we observe a positive relationship between being breastfed and birthweight. For newborns who weight 2 kg, we estimate that 38% will be breastfed and the odds of breastfeeding increase by a factor of 2 (i.e. $\exp(0.8) = 2.22$) per kg increase in birthweight.

2. Below find two 2x2 tables showing: whether or not a person spent more than \$1000 on medical services (Y), whether the person has a major smoking cause disease (mscd=1) or not (mscd=0), and age group.

Age < 65			Age ≥ 65		
MSCD			MSCD		
Y	0	1	Y	0	1
0	5436	119	0	2647	280
1	2028	323	1	1878	881

The scientific question is whether the mscd effect on risk of an expenditure above \$1,000 is the same for persons younger than 65 vs. older.

- a. Conduct an analysis to answer this question.

Age < 65:

$$\log(\text{OR}) = \log[(323 \times 5436) / (119 \times 2028)] = 1.98$$

$$\text{Var}(\log(\text{OR})) = 1/323 + 1/5436 + 1/119 + 1/2028 = 0.012$$

Age ≥ 65

$$\log(\text{OR}) = \log[(881 \times 2647) / (280 \times 1878)] = 1.58$$

$$\text{Var}(\log(\text{OR})) = 1/881 + 1/2647 + 1/280 + 1/1878 = 0.0056$$

Diff: $1.98 - 1.58 = 0.40$

Var(DIFF) = $0.012 + 0.0056$

Se(DIFF) = 0.13

95% CI: $0.40 - 2 * 0.13, 0.40 + 2 * 0.13 \rightarrow (0.14, 0.66)$

- b. Write a sentence or two to report your findings to a public health audience. Be numerate. Avoid jargon!**

Among persons at least 65 years of age, the odds of a big expenditure are an estimated 4.85 times greater for persons with a MSCD vs. those without. Whereas, for persons under 65 years of age, the odds of a big expenditure are an estimated 7.24 times greater for persons with a MSCD vs. those without. Accounting for the sample size and variation in the data, these estimates indicate that the odds ratio of a big expenditure comparing persons with and without a MSCD is greater for persons under 65 years of age (ratio of odds ratios: 1.49, 95% 1.15 - 1.93).