

BIOS 6312 - Modern Regression Analysis
Spring 2021
Lab #3

		Estimate	95% CI	p-value
1.	Intercept	3.95	(2.97, 4.93)	< 0.001
	a1c0	0.510	(0.396, 0.624)	< 0.001

2. $\hat{y} = \hat{\beta}_0 + (\hat{\beta}_1 * A1c_0)$

$$\hat{y} = 3.950697 + (.5102012 * 7.2)$$

$$\hat{y} = 7.62414564$$

Thus, the prediction interval is

$$\hat{y} \pm (1.96 * \hat{\sigma})$$

$$= 7.62414564 \pm 1.96(1.7418)$$

$$= [4.21, 11.0]$$

3. We assume that:

- Errors are pairwise independent.
- $E[Y|X = x]$ is linear in x.
- Errors are homoscedastic.
- Errors are normally distributed.

Residual-versus-predictor plot: The lowess curve lies about the line $y = 0$ which indicates that the plot does not provide evidence of a serious departure from linearity. There is little clear graphical evidence of heteroscedasticity, as the errors are distributed evenly about the lowess curve. This plot suggests possible right-skewness of the errors which would be evidence of a deviation from the normality assumption.

Residual-versus-fitted plot: The lowess curve mostly lies about the line $y = 0$ (except near the tails) which indicates that the plot does not provide evidence of a serious departure from linearity. There is little clear graphical evidence of heteroscedasticity, as the errors are distributed evenly about the lowess curve. This plot suggests possible right-skewness of the errors which would be evidence of a deviation from the normality assumption.

Quantile-quantile plot: Several of the points are markedly off the line $y = x$, and there is a peak and dip to the curve that both encompass a nontrivial amount of data. Thus, this plot provides graphical evidence of a departure from normally distributed errors.

		Estimate	95% CI	p-value
5.	Intercept	8.33	(8.16, 8.50)	< 0.001
	a1c0	0.510	(0.396, 0.624)	< 0.001

The interpretation of β_1 does not change. It is the mean difference in 6-month A1c between subgroups differing in baseline A1c by 1%. In model (1), β_0 is the mean 6-month A1c among the subgroup with a baseline A1c of 0. In model (2), β_0 is the mean 6-month A1c among the

subgroup with a baseline A1c of 8.584. The second model's interpretation is more clinically relevant, as an A1c of zero is probably very unlikely. For reference, a normal level is below 5.7%.

		Control		
		Estimate	95% CI	p-value
6.	Intercept	8.64	(8.38, 8.91)	< 0.001
	a1c0	0.592	(0.429, 0.754)	< 0.001
		REACH		
		Estimate	95% CI	p-value
	Intercept	7.97	(7.71, 8.24)	< 0.001
	a1c0	0.423	(0.274, 0.571)	< 0.001
		REACH + FAMS		
		Estimate	95% CI	p-value
	Intercept	8.04	(7.70, 8.40)	< 0.001
	a1c0	0.429	(0.169, 0.690)	0.001

7. Model 3:

β_0 : Mean 6-month A1c among the subgroup with a baseline A1c of 8.584 and who are in the control group.

β_1 : Mean difference in 6-month A1c between subgroups differing in baseline A1c by 1% and who are in the control group.

Model 4:

β_0 : Mean 6-month A1c among the subgroup with a baseline A1c of 8.584 and who received the REACH treatment.

β_1 : Mean difference in 6-month A1c between subgroups differing in baseline A1c by 1% and who received the REACH treatment.

Model 5:

β_0 : Mean 6-month A1c among the subgroup with a baseline A1c of 8.584 and who received the REACH+FAMS treatment.

β_1 : Mean difference in 6-month A1c between subgroups differing in baseline A1c by 1% and who received the REACH+FAMS treatment.

8. From models 3-5, we can determine whether or not the individuals in each treatment group displayed a significant association between their baseline A1c and their 6-month A1c. However, are not able to evaluate the association between 6-month A1c and treatment (we would need a treatment coefficient in order to do this). We also cannot compare the treatments with these models. We will learn how to do that in future lab sessions!

9. To obtain the coefficient estimates (the geometric means) in each model shown below, the Stata output was exponentiated.

	Control		
	Estimate	95% CI	p-value
Intercept	8.40	(8.17, 8.64)	< 0.001
a1c0	1.0669	(1.0494, 1.0849)	< 0.001

	REACH		
	Estimate	95% CI	p-value
Intercept	7.84	(7.58, 8.10)	< 0.001
a1c0	1.0504	(1.0322, 1.0690)	< 0.001

	REACH + FAMS		
	Estimate	95% CI	p-value
Intercept	7.85	(7.54, 8.18)	< 0.001
a1c0	1.0555	(1.0270, 1.0848)	< 0.001

Model 6:

e^{β_0} : Geometric mean 6-month A1c among the subgroup with a baseline A1c of 8.584 and who are in the control group.

e^{β_1} : Geometric mean ratio, comparing 6-month A1c between subgroups differing in baseline A1c by 1% and who are in the control group.

Model 7:

e^{β_0} : Geometric mean 6-month A1c among the subgroup with a baseline A1c of 8.584 and who received the REACH treatment.

e^{β_1} : Geometric mean ratio, comparing 6-month A1c between subgroups differing in baseline A1c by 1% and who received the REACH treatment.

Model 8:

e^{β_0} : Geometric mean 6-month A1c among the subgroup with a baseline A1c of 8.584 and who received the REACH+FAMS treatment.

e^{β_1} : Geometric mean ratio, comparing 6-month A1c between subgroups differing in baseline A1c by 1% and who received the REACH+FAMS treatment.