Predicting BMI in Adults Living in 5 Southern States

USING BRFSS 2021

SAMANTHA BAKER

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Subjects

- **Adults, ages 18 – 79**, who participated in the CDC's Behavioral Risk Factor Surveillance System (**BRFSS**) 2021 surveys
- Living in one of five Southern states that included the **Adverse Childhood Experiences (ACEs)** module to their BRFSS: **Alabama, Arkansas, Mississippi, South Carolina, and Virginia**
- Must have **completed BRFSS interview**
- Random sample of **1,200 subjects** meeting those criteria
  - Filtered to **1,126 subjects** with complete BMI data for analysis

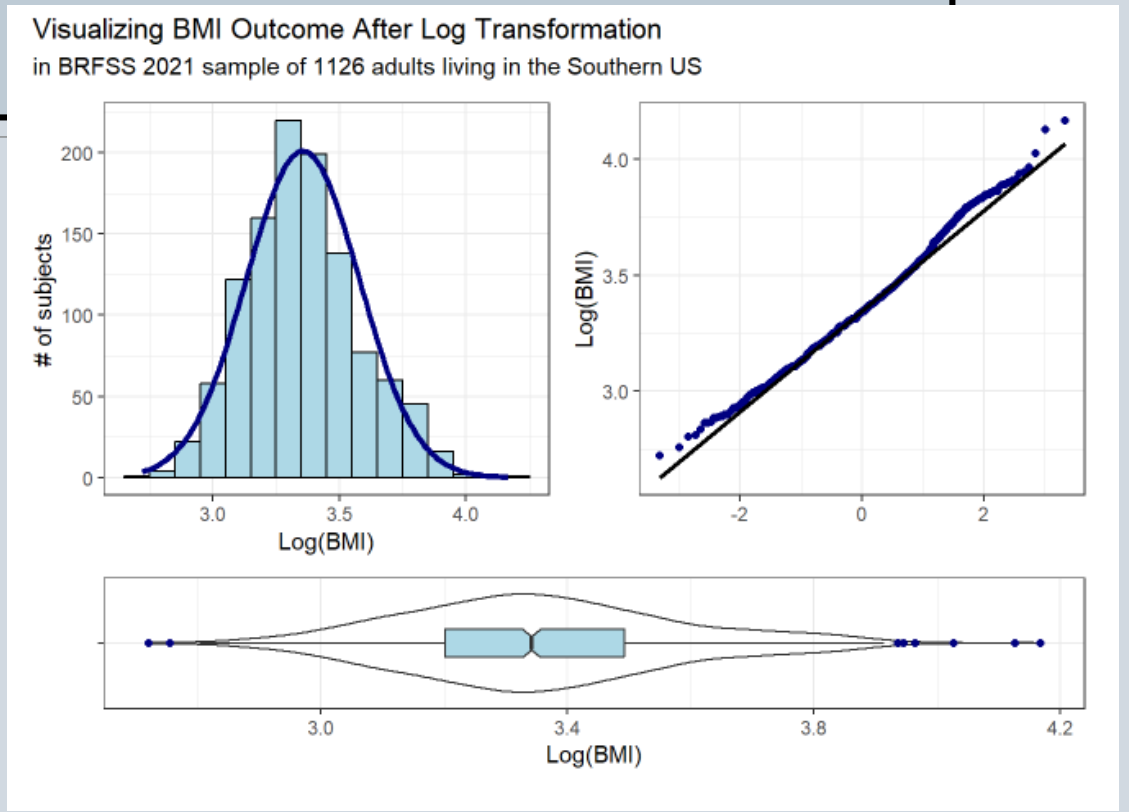
Characteristics		
Sex	M – 41.4% F – 58.6%	
Age Groups	**18 – 24:** 4.6% **25 – 29:** 3.7% **30 – 34:** 5.6% **35 – 39:** 5.0% **40 – 44:** 5.3% **45 – 49:** 6.8%	**50 – 54:** 8.2% **55 – 59:** 10.5% **60 – 64:** 12.2% **65 – 69:** 12.2% **70 – 74:** 14.4% **75 – 79:** 11.5%
State of Residence	Alabama – 15.1% Arkansas – 14% Mississippi – 18.2% South Carolina – 26.8% Virginia – 26%	

Research Question

“How effectively can we predict BMI using the number of ACEs exposures, self-reported poor mental health days, income level, and health insurance status in a sample of 1,200 BRFSS 2021 participants (ages 18-79) living in the Southern United States?”

Outcome : logBMI

- Body-Mass Index **(BMI)** measured in kg/m^2
- Increased BMI puts adults at higher risk for **hypertension, Type II Diabetes, sleep apnea, mental illnesses**, etc.
- Applied log transformation to BMI -> **logbmi** as outcome measure
- BMI previously **shown to be associated with adverse childhood experiences** (ACEs)
- Focusing on **Southern US states**
- **Exploring other predictors** to see their impact on BMI-ACEs relationship



N	Range	Mean	IQR	Median	SD
1126	15.18 – 64.56 kg/m^2	29.39 kg/m^2	24.56 – 32.89 kg/m^2	28.27 kg/m^2	6.87

Predictors for Linear Regression Model

Predictor Name	Numerical Summaries
acessum	Sum of reported adverse childhood experiences (ACEs) exposures (0 - 11).
incomecat	Income level – 5 categories *<15 to <25K* *25 to <35K* *35 to <50K* *50 to <100K* *100 to 200K+*
menthlth	Number of self-reported poor mental health days in the last 30 days (including stress, depression, emotional issues, etc.)
hlthpln	Does subject have health insurance (yes or no)

Predictors: Numerical Summaries for Linear Regression Model

Predictor Name	Predictor Description
acessum (no missing data)	**0 ACEs –** 39.7% **1 – 3 ACES –** 42.1% **4 – 6 ACES –** 14.5% **7+ ACES –** 3.8%
incomecat (235 missing values)	**Income level – 5 categories** *<15 to <25K* **(19.2%)** *25 to <35K* **(12.2%)** *35 to <50K* (**14.2%**) *50 to <100K* (**31%**) *100 to 200K+* (**23.4%**)
menthlth (15 missing values)	**Mean** – 4.6 days **Median** – 0 days
hlthpln (29 missing values)	**1122** with health insurance **49** without health insurance

ModelA: Main Effect Linear Regression

Prediction Equation:

$$\widehat{logbmi} = 3.3732 + 0.0077(acessum) - 0.0059(incomecat_{25\ to\ <35K}) - 0.0277(incomecat_{35\ to\ <50K}) - 0.0478(incomecat_{50\ to\ <100K}) - 0.0302(incomecat_{100\ to\ 200K+}) - 1e-04(menthlth) - 0.0118(hlthpln_{No\ Insurance})$$

modelA fit with my singly imputed data set

ModelA: Relationship between logbmi & Predictors

- **No particularly large effects** amongst coefficients
- **95% CIs all contain 0** except
  - acessum
  - incomecat50to<100K
- **acessum** estimated effect on logbmi of .008 with 95% CI (.001, .014)
- **incomecat50to<100K** estimated effect on logbmi of -.048 with 95% CI (-.087, -.009)

TERM	ESTIMATE	SE	LOW95	HIGH95	P
(Intercept)	3.373	0.019	3.336	3.410	0.000
acessum	0.008	0.003	0.001	0.014	0.021
incomecat25 to <35K	-0.006	0.027	-0.059	0.047	0.828
incomecat35 to <50K	-0.028	0.026	-0.078	0.023	0.282
incomecat50 to <100K	-0.048	0.020	-0.087	-0.009	0.017
incomecat100 to 200K+	-0.030	0.023	-0.074	0.014	0.182
menthlth	0.000	0.001	-0.002	0.002	0.918
hlthpInNo Insurance	-0.012	0.035	-0.081	0.058	0.740

ModelA: Quality of Fit & Validation Measures

- **Very poor performance** within sample according to R^2 and adjusted R^2 values

R2	ADJR2	SIGMA	AIC	BIC	NOBS	DF	DF.RESIDUAL
0.013	0.006	0.22	-179.9	-134.7	1126	7	1118

- **Even worse performance** after validation according to validated R^2 statistic

MODEL	VALIDATED R^2	VALIDATED MSE	AIC	BIC	DF
A	-.002	.0500	-179.9	-134.7	7

Next Steps

- **ModelA not an effective model** for predicting BMI

- Positive association between number of ACEs exposures and BMI

- Explore individual ACEs items rather than sum total of ACEs exposures and how that relates to BMI.
  - ACEs items vary in level of perceived severity (ex: living with a relative with mental illness vs sexual abuse) so it would be interested to see if/how those differences materialize for modeling BMI.

- Expand population of interest to include subjects from all states that added the ACEs module to 2021 BRFSS.
  - Does that change model performance?
  - Are there regional differences?

- Look more closely at access to healthcare and whether a subject with ACEs exposure has already been connected to resources to support their health and mental well being following a trauma.
  - Are there BMI differences between subjects with access to these resources vs subjects without access?

- Focus on ACEs exposure with younger populations (<18 years of age)