

Depression's Influence on Academic Performance

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Background

General Information and Context



Background



- What depression is and who it impacts
 - Lack of motivation, lack of energy, depressed mood, etc.
- Does Depression have an impact on students' academic performance?
- Measuring Depression => The PHQ-9 form

What is the PHQ-9 Form?

- ★ Who takes it?
- ★ When would someone take it?
- ★ How is it prompted?
- ★ Frequency?

PATIENT HEALTH QUESTIONNAIRE (PHQ-9)

ID #: _____ DATE: _____

Over the last 2 weeks, how often have you been
bothered by any of the following problems?
(use "✓" to indicate your answer)

	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself – or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed. Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead, or of hurting yourself	0	1	2	3

add columns + +

(Healthcare professional: For interpretation of TOTAL, please refer to accompanying scoring card).

TOTAL:

10. If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?	Not difficult at all	_____
	Somewhat difficult	_____
	Very difficult	_____
	Extremely difficult	_____

Data Set Description

Source, Variables, and Research Goals

A large white number 2 is centered over a square image. The image shows several dried, feathery reeds or grasses against a muted, brownish-grey background. The reeds are light tan and have a soft, textured appearance. The overall aesthetic is minimalist and natural.

Data Set



- Obtained from data sharing platform *Kaggle.com*, by Kane Rudolph
- Data collected via surveying U.S. Students with informed consent
- Total sample size of 352 students
 - 124 high schoolers, 204 undergraduates, and 24 graduate students
- 15 variables of interest
- Variable Modification
 - 'DepressionScore'
 - 'DepressionLevel'
 - 'Standing'
 - 'Stand.Bin'

Research Goals



- Primary Research Goal:
 - **How does a students PHQ-9 score affect academic performance?**

- How could other variables in our data set relate to a students depression level and academic performance?

Preliminary Data Visualization & Exploration

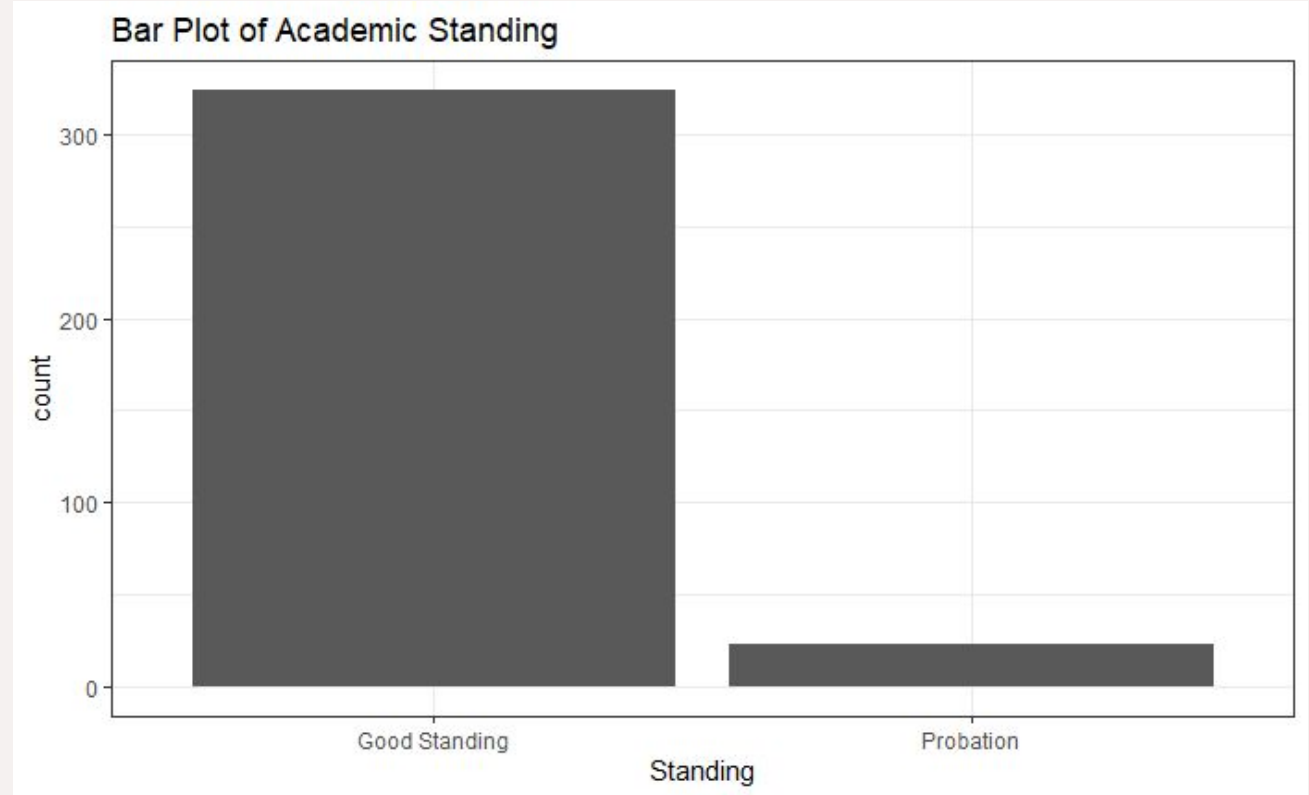
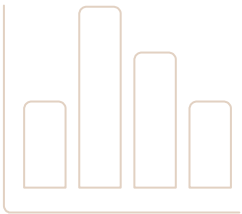
Let's Start with Descriptive and Univariate Plots



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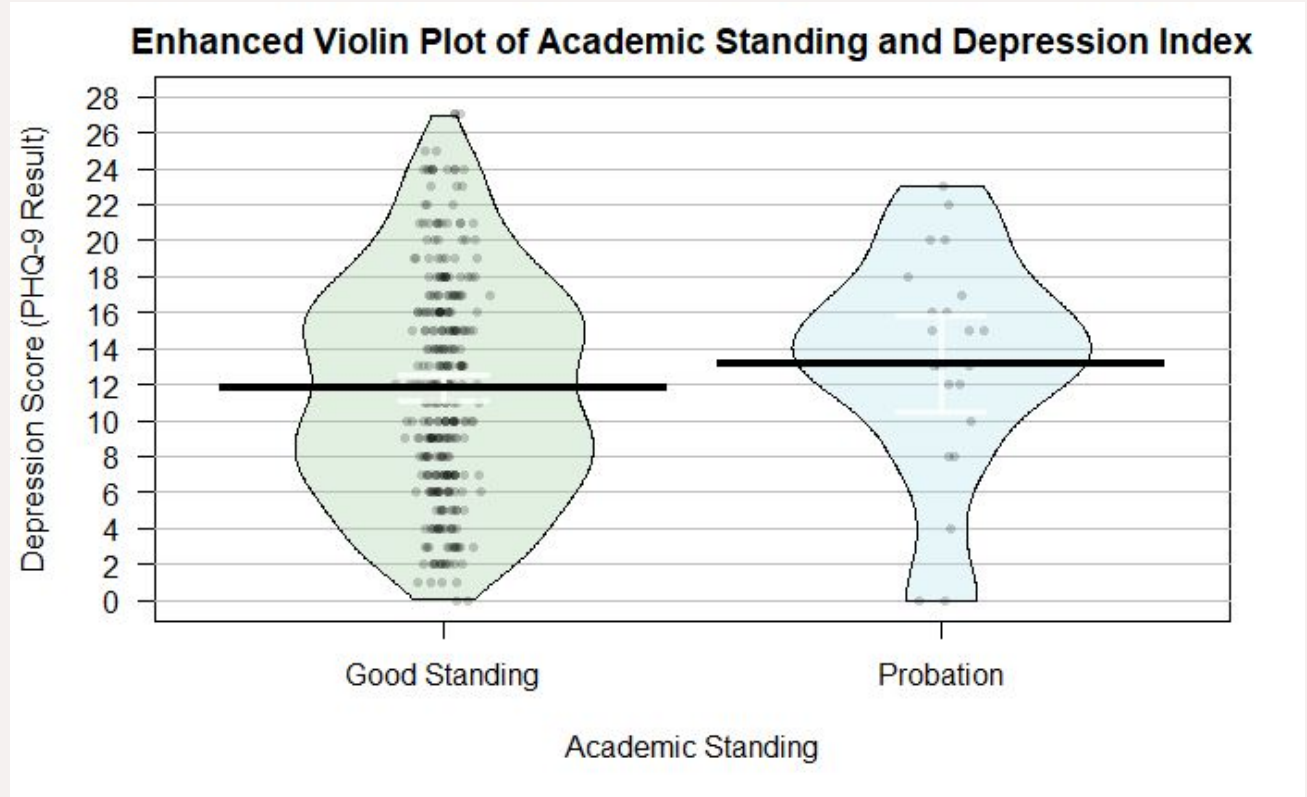
Initial Issues

- 324 students have good standing
- 23 students qualify for probation



Distribution within groups

- mean depression score for good standing is 11.81
- mean for probation is 13.17
- less observations = larger variability in probation group



Data Exploration

- ★ Cannot make valid maximum likelihood estimates about groups where we are missing data

Sex Variable

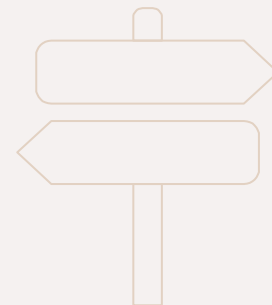
Standing	Sex	
	Female	Male
Good Standing	286	38
Probation	23	0

Age Variable

Standing	Age		
	18less	19to24	25above
Good Standing	36	157	131
Probation	0	14	9

Education Level

Standing	EduLevel		
	HighSchool	Bachelors	Masters
Good Standing	116	185	23
Probation	5	18	0



Unexpected Relationship...

EduLevel	Age		
	18less	19to24	25above
HighSchool	33	70	18
Bachelors	3	98	102
Masters	0	3	20

- ★ Expected students in 18 or less age groups to be mostly high schoolers...



Methods

Data Collection & Statistical Methods

A large white number 4 is centered over a square image. The image shows several dried reeds or grasses with feathery heads, set against a soft, out-of-focus background. The entire slide has a light beige background with a darker beige horizontal band across the middle.

Model Selection

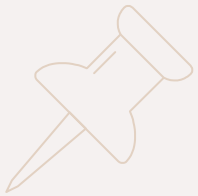


- Binary Response => Modeled with Logistic Regression
- Exploratory models:
 - Full Additive model: large p-values
 - Model Selection: ‘MuMIn’ (Barton, 2022), fit all possible two-way interactions
- Final Model:

$$\log\left(\frac{\hat{\pi}}{1-\hat{\pi}}\right) = -3.30492 + 0.06797x_D + 2.53250 * I_{Job=PartTime} - 0.60706 * I_{Job=FullTime} - 0.23327(x_D * I_{Job=PartTime}) + 0.04044(x_D * I_{Job=FullTime})$$

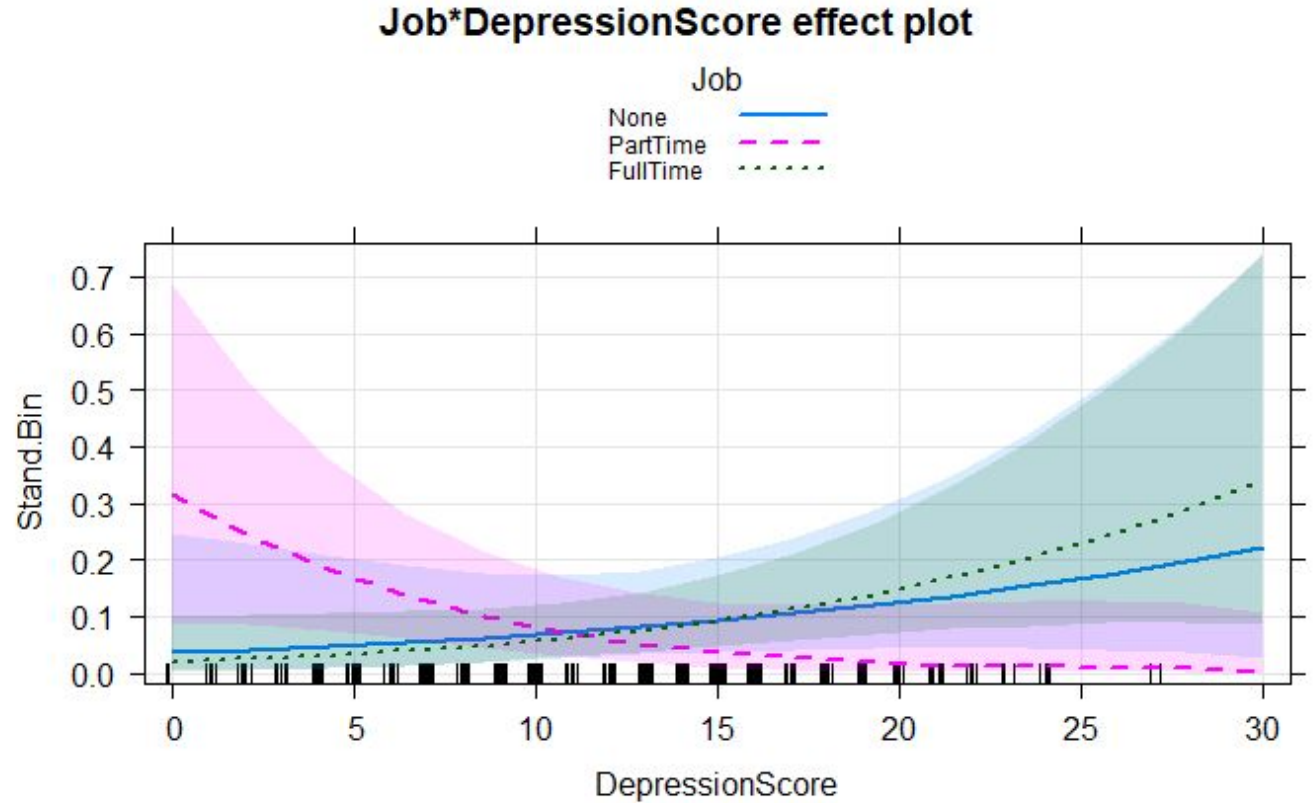
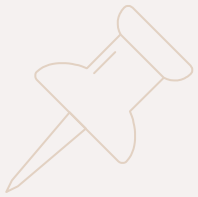
Effects Plot

Separated
by students'
employment
levels.



Effects Plot

Different levels of employment superimposed on one plot.



Model Coefficient Interpretations

Model Coefficients and Interpretations



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Interpretations



- Intercept
- Depression score
- Part time job indicator
- Full time job indicator

Interactions:

- Depression score and part time job
- Depression score and full time job

$$\log\left(\frac{\hat{\pi}}{1-\hat{\pi}}\right) = -3.30492 + 0.06797x_D + 2.53250 * I_{Job=PartTime} - 0.60706 * I_{Job=FullTime} - 0.23327(x_D * I_{Job=PartTime}) + 0.04044(x_D * I_{Job=FullTime})$$

Model Coefficient Estimates and Confidence Intervals on the Response Scale

	Estimate	95% CI Lower Bound	95% CI Upper Bound
(Intercept)	0.03670216	0.002905629	0.2530766
DepressionScore	1.07033487	0.931920639	1.2377777
Job = Part Time	12.58493415	0.963519540	231.1870373
Job = Full Time	0.54495135	0.035224234	10.4751672
DepressionScore:PartTimeJob	0.79193628	0.631427794	0.9702319
DepressionScore:FullTimeJob	1.04127021	0.872376878	1.2419959

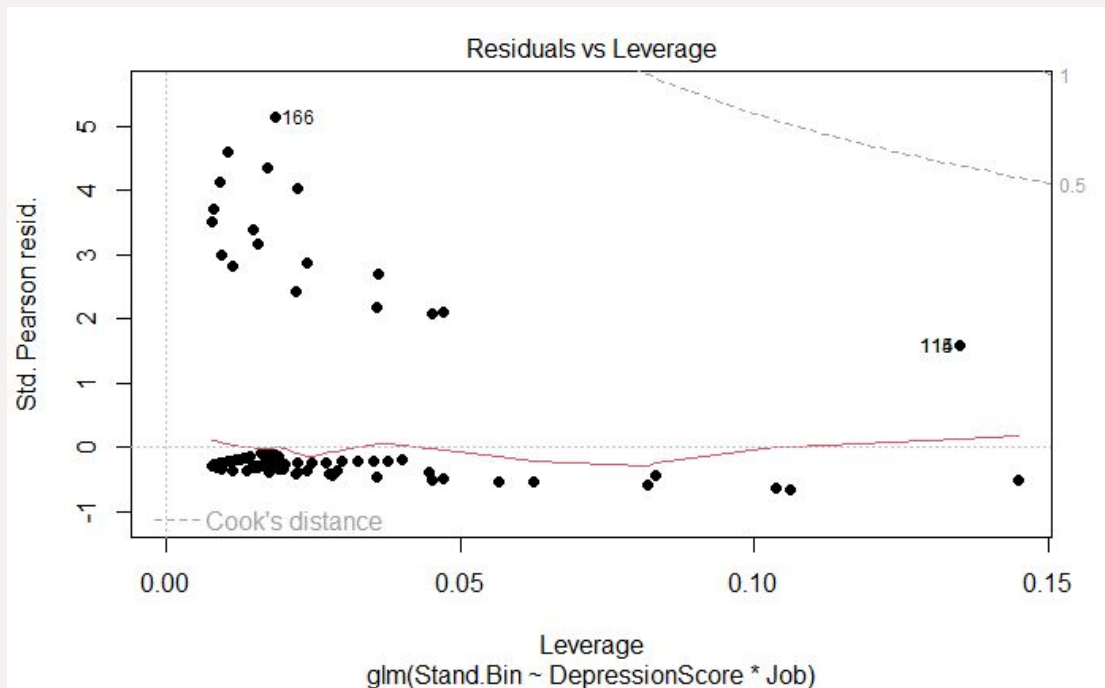
Model Diagnostics

Binary Response -

Most diagnostics
not applicable

Only Relevant Plot:

Residual vs. Leverage



No points with Cook's Distance greater than 0.5
=> No evidence of influential points



Model Assessment

Goodness of Fit & Prediction Ability

A decorative image on the right side of the slide. It features a large, white, serif number '6' centered over a photograph of several tall, dry reeds or grasses. The background of the image is a solid, muted brown color. The reeds are light brown and have a feathery texture at the top. The overall aesthetic is minimalist and naturalistic.

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Assessing Model Fit

Hosmer and Lemeshow Goodness of Fit Test -

Determines how well the model fits our data

How well do our observed number of students on academic probation match the expected number of students on academic probation?

Hosmer and Lemeshow goodness of fit (GOF) test

```
data:  obs, expected  
X-squared = 5.135, df = 8, p-value = 0.7431
```

Assessing Model Predictive Ability

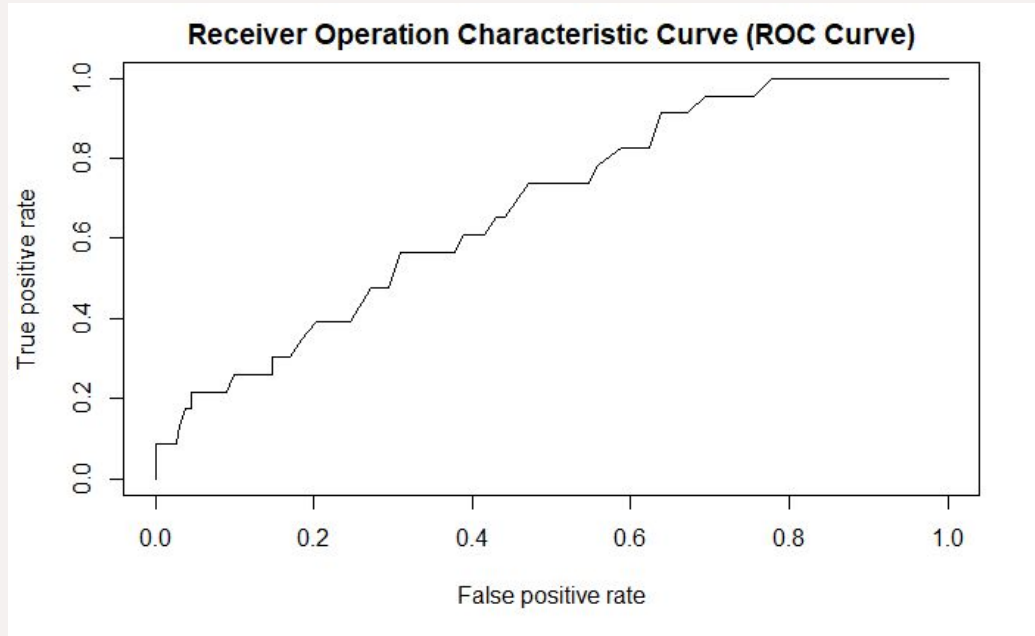
True Positive Rate -

How often a student on academic probation was predicted to be on academic probation

False Positive Rate -

When a student is predicted to qualify for probation, but is actually in good standing

Area Under the Curve = 0.6784



Discussion & Conclusion

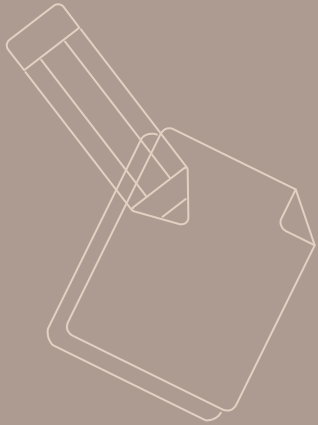
Scope of Inference & Suggestions for Further Research



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Returning to the Research Question

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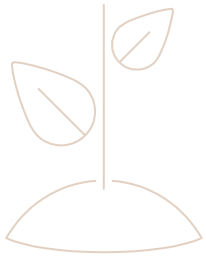
- * Depression score not useful tool in predicting likelihood of academic probation
- * May still be a relationship, more data needed
- * Both unemployed and students who work full time
=> positive relationship
- * Students who work part time
=> negative relationship

Scope of Inference



- This was an observational study conducted via survey
- **No** way to **randomly assign** students to job or depression score
 - No causal inferences
- **No random sampling** was present
 - Generalizability limitations

Limitations and Looking Forward



- Potential for response bias
- Fundamental differences between sample and population
- Gather GAD-7 results
 - What is the GAD-7?
 - Interaction?
- Random sampling

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Questions?

