Correlations of Clinical Diagnostic Information and Demographic Information at Different Education Levels for OCD Patients

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Abstract

Chatacteristics of OCD patients are complicated. Their demographic information include a family history of OCD and education level, and their clinical diagnostic information include the occurrence of anxiety disorder and the Y-BOCS scores. In this paper, I examined how these factors are correlated. And more specifically, can education level and family history of OCD be used as factors to predict anxiety disorder? Is there a correlation between education level and Y-BOCS score? The findings showed that education level and family history of OCD cannot be used to predict anxiety disorder, and education level and Y-BOCS score are not correlated. The previous one is consistent with the results from other studies, but as another study shows, Y-BOCS score decreases with increasing education level. To further test the second finding, more studies are needed. And as this paper does not show any statistically significant correlation for these factors, genetic information may play a role. Future research could also look at the genes that associate with OCD.

Keywords: OCD, education level, family history of OCD, anxiety disorder, Y-BOCS score

Word count: 164

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Introduction

Obsessive-compulsive disorder (OCD) is a neuropsychiatric disease with obsessive thoughts and compulsive behaviors as its main clinical manifestations. Although patients experience these thoughts or impulses originate from themselves and try their best to resist, they are still unable to control them. The strong conflict between the two makes them feel great anxiety and pain, which affects their study, work, interpersonal communication and even daily life (NIMH, n.d.). However, Deacon and Abramowitz, in their (2005) study, questioned the classification of obsessions and compulsions, stating that the symptomatology of OCD cannot be simply broken down into these two categories of obsessive thoughts and compulsive behaviors. The cause of OCD is complex and inconclusive, but certain factors can increase the incidence of the disorder, such as genetics, childhood trauma, and temperament. Research shows that people who have a first-degree relative with OCD are more likely to develop OCD; people with childhood trauma are more likely to develop OCD; and people who had anxiety and depression in childhood are more likely to develop OCD (NIMH, n.d.). While OCD is common and takes a significant toll on sufferers, research shows that Cognitive Behavior Therapy (CBT) using Exposure Response Prevention (ERP) has proven to be highly effective in reducing symptoms in 12 to 15 sessions, and its therapeutic effect can last for about two years (Sulkowski et al., 2018).

The diagnosis and assessment of OCD comes from the Yale–Brown Obsessive-Compulsive Scale (Y-BOCS) introduced in 1989. The scale consists of 16 main items and is scored according to a five-step Likert scale, and the total score of the top 10 items is calculated. Among them, the first five items are used to measure symptoms and disorders related to obsession, and the last five items are used to measure symptoms and disorders related to compulsion (Moritz et al., 2002). In the case of a total score of 40

points, the higher the score, the more severe the symptoms: 0 to 7 points represent subclinical symptoms, 8 to 15 points represent mild symptoms, 16 to 23 points represent moderate symptoms, 24 to 31 points represent severe symptoms, 32 to 40 points represent extreme symptoms (Wootton & Tolin, 2016). Rosario-Campos et al. (2006) in their research also shows that the scores of each symptom dimension in the score, such as obsession score and compulsion score, are basically independent of each other and have no correlation with scores of other diseases such as anxiety and depression.

In terms of school students with OCD, approximately 3% of children in the United States have been diagnosed with obsessive-compulsive disorder. But in fact, it can be difficult to identify students with OCD because symptoms appear similar to those of some other mental disorders or illnesses (ADAA, n.d.). Research shows that children with OCD are more likely to have poor grades in school or to drop out of school prematurely (Pérez-Vigil et al., 2018). And children with OCD do significantly worse in mathematics (Negreiros et al., 2023). As far as education level is concerned, research has found that OCD symptoms are worst before the end of high school, but will improve significantly in college, so a reasonable speculation is that as education level increases, the symptoms of obsessive-compulsive disorder will decrease (Pérez-Vigil et al., 2018). At the same time, the results of a longitudinal twin experiment showed that obsessive-compulsive symptoms (OCS) aggravated anxiety sensitivity, and conversely, anxiety sensitivity also aggravated OCS. However, no direct relationship has been found between OCD and anxiety disorder (Krebs et al., 2020).

In this project, I explored the performance and some correlations of diagnostic information at different education levels based on the clinical diagnosis and other basic information of patients with OCD. The research questions include: (1) can education level and family history of OCD predict the likelihood of having anxiety disorder? (2) whether Y-BOCS score has some trends in different education levels.

Methods

I extracted this dataset about 1500 OCD patients' demographic information and clinical diagnostic data from kaggle.com. The dataset contains information like Patient ID, Age, Gender, Education Level, Previous Diagnoses, Family History of OCD, Y-BOCS Score for Obsessions, Y-BOCS Score for Compulsions, Depression Diagnosis, and Anxiety Diagnosis. I used R (R Core Team, 2022) for all the plotting and data analysis. All the packages used are listed in the footnote[1].

Results

Predict anxiety disorder with education level and family history of OCD

To use education level and family history of OCD as two factors to predict anxiety disorder, I set four education levels as x-axis and the y-axis shows the proportions of having and not having anxiety disorders within each education level. As shown in Figure 1, I divided the whole plot into two facets: one with a family history of OCD and one without a family history of OCD. To analyze Figure 1, prediction of anxiety disorder by education

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[1] R (Version 4.3.2; R Core Team, 2022) and the R-packages *apaTables* (Version 2.0.8; Stanley, 2021), *broom* (Version 1.0.5; Robinson et al., 2023), *car* (Fox et al., 2022; Version 3.1.2; Fox & Weisberg, 2019), *carData* (Version 3.0.5; Fox et al., 2022), *devtools* (Version 2.4.5; Wickham et al., 2022), *dplyr* (Version 1.1.4; Wickham, François, et al., 2023), *forcats* (Version 1.0.0; Wickham, 2023a), *ggplot2* (Version 3.4.4; Wickham, 2016), *ggsci* (Version 3.0.0; Xiao, 2023), *kableExtra* (Version 1.4.0; Zhu, 2024), *knitr* (Version 1.45; Xie, 2015), *lme4* (Version 1.1.35.1; Bates et al., 2015), *lubridate* (Version 1.9.3; Grolemund & Wickham, 2011), *Matrix* (Version 1.6.1.1; Bates et al., 2023), *papaja* (Version 0.1.2.9000; Aust & Barth, 2023), *psych* (Version 2.4.1; William Revelle, 2024), *purrr* (Version 1.0.2; Wickham & Henry, 2023), *readr* (Version 2.1.4; Wickham, Hester, et al., 2023), *readxl* (Version 1.4.3; Wickham & Bryan, 2023), *Require* (Version 0.3.1; McIntire, 2023), *scales* (Version 1.3.0; Wickham, Pedersen, et al., 2023), *shiny* (Version 1.8.0; Chang et al., 2023), *stringr* (Version 1.5.1; Wickham, 2023b), *tibble* (Version 3.2.1; Müller & Wickham, 2023), *tidyr* (Version 1.3.0; Wickham, Vaughan, et al., 2023), *tidyverse* (Version 2.0.0; Wickham et al., 2019), *tinylabels* (Version 0.2.4; Barth, 2023), *tinytex* (Version 0.49; Xie, 2019), and *usethis* (Version 2.2.3; Wickham et al., 2024)'

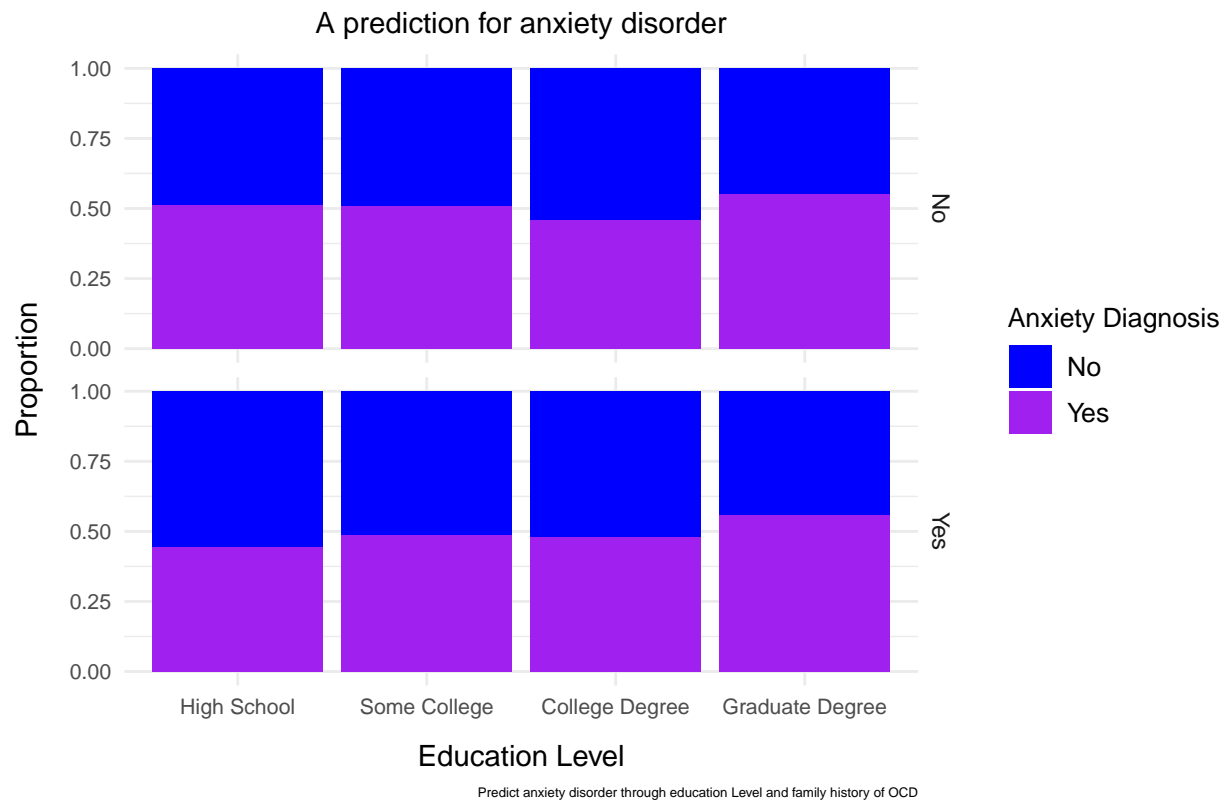Anxiety Diagnosis by Education Level and Family History of OCD
A prediction for anxiety disorder

Predict anxiety disorder through education Level and family history of OCD

Figure 1

Predict anxiety disorder through education level and family history of OCD

level and family history of OCD, I calculated the proportions of OCD patients from four

education levels with and without anxiety disorder in two cases: those with family history

of OCD and those without family history of OCD.

With a family history of OCD

The diagnosis rate of anxiety disorder is based on each education level. Within an

education level, the sum of the proportions of OCD patients diagnosed with anxiety

disorder and those without diagnosis of anxiety disorder is one. The proportions of anxiety

diagnosis for each education level for either having or not having a family history of OCD

are calculated. Table 1 is created to summarize the counts and proportions under the

situation of having a family history of OCD.

Table 1

Proportions of Anxiety Diagnosis by Education Level and Family History of OCD

Education.Level	Anxiety.Diagnosis	Count	Proportion
High School	No	97	0.56
High School	Yes	77	0.44
Some College	No	99	0.51
Some College	Yes	94	0.49
College Degree	No	97	0.52
College Degree	Yes	90	0.48
Graduate Degree	No	91	0.44
Graduate Degree	Yes	115	0.56

Note. Under the situation of having a family history of OCD

Table 1 shows the proportions of OCD patients with and without anxiety disorder across four education levels under the situation of having a family history of OCD. To compare proportions for having diagnosed with anxiety disorders within one education level, for the education level of high school, there were more people not diagnosed with anxiety disorder than having diagnosed with anxiety disorder. For the some college level, more people were not diagnosed with anxiety. For college degree level, more people were not diagnosed with anxiety disorder. And for graduate degree level, more people were diagnosed with anxiety disorder.

To compare proportions for having diagnosed with anxiety disorders across education levels, OCD patients from high school level have the least proportion of patients diagnosed with anxiety disorder; patients from graduate degree level have the largest proportion of patients diagnosed with anxiety disorder. However, some college level

patients have larger proportion of patients diagnosed with anxiety than college degree patients. And because the total number of patients at each education level are different, it is hard to make a conclusion about whether education level can predict the occurrence of anxiety disorder because although there's an increase trend of diagnosis proportion with the increasing education level, there's a decrease in the proportion for the college degree level. Further statistical analysis is needed.

Without a family history of OCD

Table 2 is created to summarize the counts and proportions under the situation of not having a family history of OCD.

Table 2 shows the proportions of OCD patients with and without anxiety disorder across four education levels under the situation of not having a family history of OCD. To compare proportions for having diagnosed with anxiety disorders within one education level, for the education level of high school, there were more people diagnosed with anxiety disorder than not diagnosed with anxiety disorder. For the some college level, more people were diagnosed with anxiety disorder. For the college degree level, more people were not diagnosed with anxiety disorder. And for graduate degree level, more people were diagnosed with anxiety disorder.

To compare proportions for having diagnosed with anxiety disorders across education levels, graduate degree patients have the largest proportion of people diagnosed with anxiety disorder and college degree level patients have the smallest proportion of people diagnosed with anxiety disorder. In between, high school level patients have larger proportion of people diagnosed with anxiety disorder than some college level patients. Still, the total number of patients at each education level were not the same. Conclusion about education level predicts the occurrence of anxiety disorder is not supported in this case because with an increase in education level, the proportion first decreases then increases. Further statistical analysis is needed.

Table 2

Proportions of Anxiety Diagnosis by Education Level and

Family History of OCD

Education.Level	Anxiety.Diagnosis	Count2	Proportion2
High School	No	93	0.49
High School	Yes	97	0.51
Some College	No	99	0.49
Some College	Yes	102	0.51
College Degree	No	97	0.54
College Degree	Yes	82	0.46
Graduate Degree	No	76	0.45
Graduate Degree	Yes	94	0.55

Note. Under the situation of not having a family history of

OCD

Comparing the proportion for the same education level for having and not having a family history of OCD, within high school level, more OCD patients without a family history of OCD are diagnosed with anxiety disorder than those with a family history of OCD. Within some college level, more OCD patients without a family history of OCD are diagnosed with anxiety disorder than those with a family history of OCD. Within college degree level, more OCD patients with a family history of OCD are diagnosed with anxiety disorder than those without a family history of OCD. Within graduate degree level, more OCD patients with a family history of OCD are diagnosed with anxiety disorder than those without a family history of OCD. So, as the patterns are not consistent for each education level, the conclusion of family history of OCD predicts anxiety disorder is not supported. Further statistical analysis is needed.

Test analysis

I applied the logistic regression model to analyze the effect of each individual education level and family history of OCD on predicting anxiety disorder. I also applied ANOVA to see the significance of education level as a whole.

```
Call:
glm(formula = Anxiety.Diagnosis ~ Education.Level + Family.History.of.OCD,
    family = binomial, data = data2)
```

```
Coefficients:
                             Estimate Std. Error z value Pr(>|z|)
(Intercept)                  -0.05936    0.11603  -0.512   0.6089
Education.LevelSome College   0.07854    0.14550   0.540   0.5893
Education.LevelCollege Degree -0.03043    0.14831  -0.205   0.8374
Education.LevelGraduate Degree 0.31656    0.14780   2.142   0.0322 *
Family.History.of.OCDYes     -0.05988    0.10369  -0.578   0.5636
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
(Dispersion parameter for binomial family taken to be 1)
```

```
    Null deviance: 2079.4  on 1499  degrees of freedom
Residual deviance: 2072.4  on 1495  degrees of freedom
AIC: 2082.4
```

```
Number of Fisher Scoring iterations: 3
```

```
Analysis of Deviance Table (Type II tests)


Response: Anxiety.Diagnosis
                        LR Chisq Df Pr(>Chisq)
Education.Level           6.8524  3    0.07675 .
Family.History.of.OCD     0.3336  1    0.56356
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The coefficient for having a family history of OCD is negative, indicating that it is less likely for OCD patients who have a family history of OCD to have anxiety disorder. However, this coefficient is not statistically significant as p-value is larger than 0.5. Similarly, as the p-values are larger than 0.5, the coefficients for high school level, some college level, and college degree level are all not statistically significant. So, these education levels and the family history of OCD are not useful predictors of anxiety disorder. The only p-value that is smaller than 0.05 is for graduate degree level. So, having a graduate degree appears to be a significant predictor of higher odds of anxiety disorder compared to all other education levels. At the same time, because larger coefficient indicates a stronger effect on the outcome variable, the coefficient for graduate degree level of 0.31656 is relatively large compared to other coefficients. So, it has a stronger effect on predicting anxiety disorder compared to other education levels or family history of OCD. However, the overall fit of the model is not good, as indicated by the high null and residual deviance values, and the high AIC value. Therefore, it can be concluded that education level and family history of OCD are not able to be used to predict the occurrence of anxiety disorder.

The ANOVA results also showed that both education level and family history of OCD are statistically insignificant for predicting anxiety disorder.

Obsession and compulsion Y-BOCS scores for different education levels

The Y-BOCS score is divided into Y-BOCS score for obsession and Y-BOCS score for compulsion in this dataset. Firstly, I want to see if there is a correlation between these two types of Y-BOCS scores (Figure 2). Based on Figure 2, there is no correlation between these two types of Y-BOCS scores, so Y-BOCS score for obsession will not affect Y-BOCS score for compulsion, and the reverse is also true.
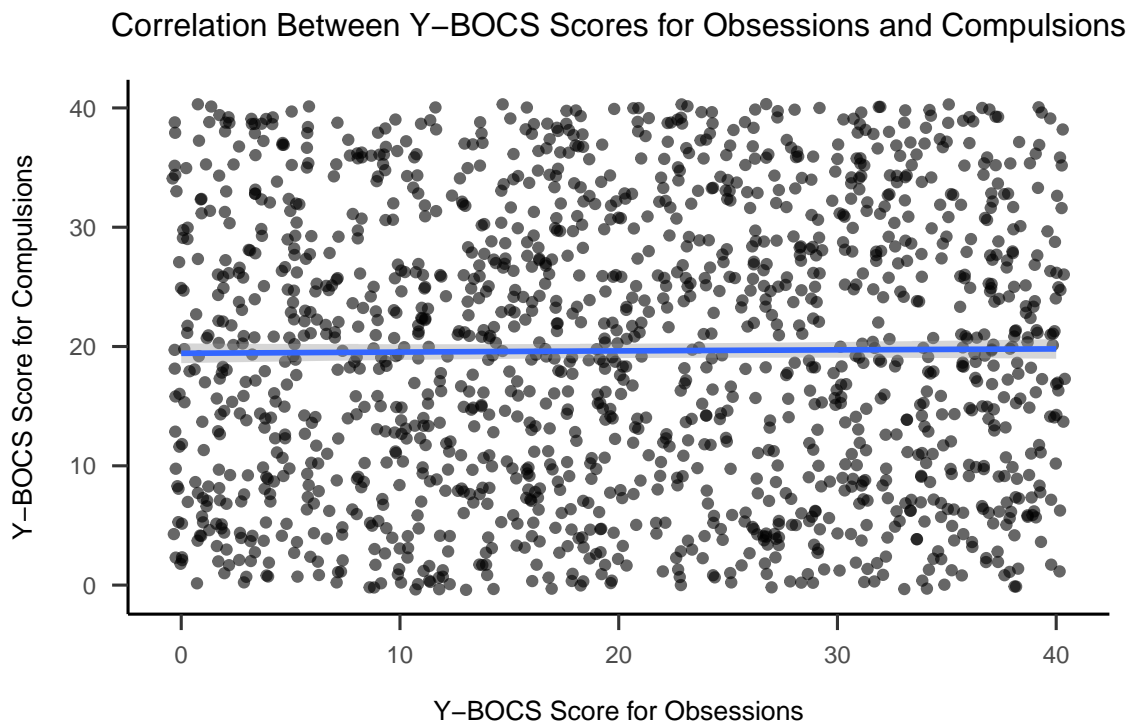
Correlation Between Y−BOCS Scores for Obsessions and Compulsions

Figure 2

Correlation between obsessions Y-BOCS-Score and compulsions Y-BOCS-Score

Next, to see Y-BOCS scores across education levels, I divided the plot into two facets: one for Y-BOCS compulsion score and one for Y-BOCS obsession score. Four education levels are grouped on x-axis and y-axis represents scores. I chose the boxplot to present scores because it shows minimum, mean, and maximum scores (Figure 3).

Y–BOCS Scores for Different Education Levels
Subdivided into obsession score and compulsion score
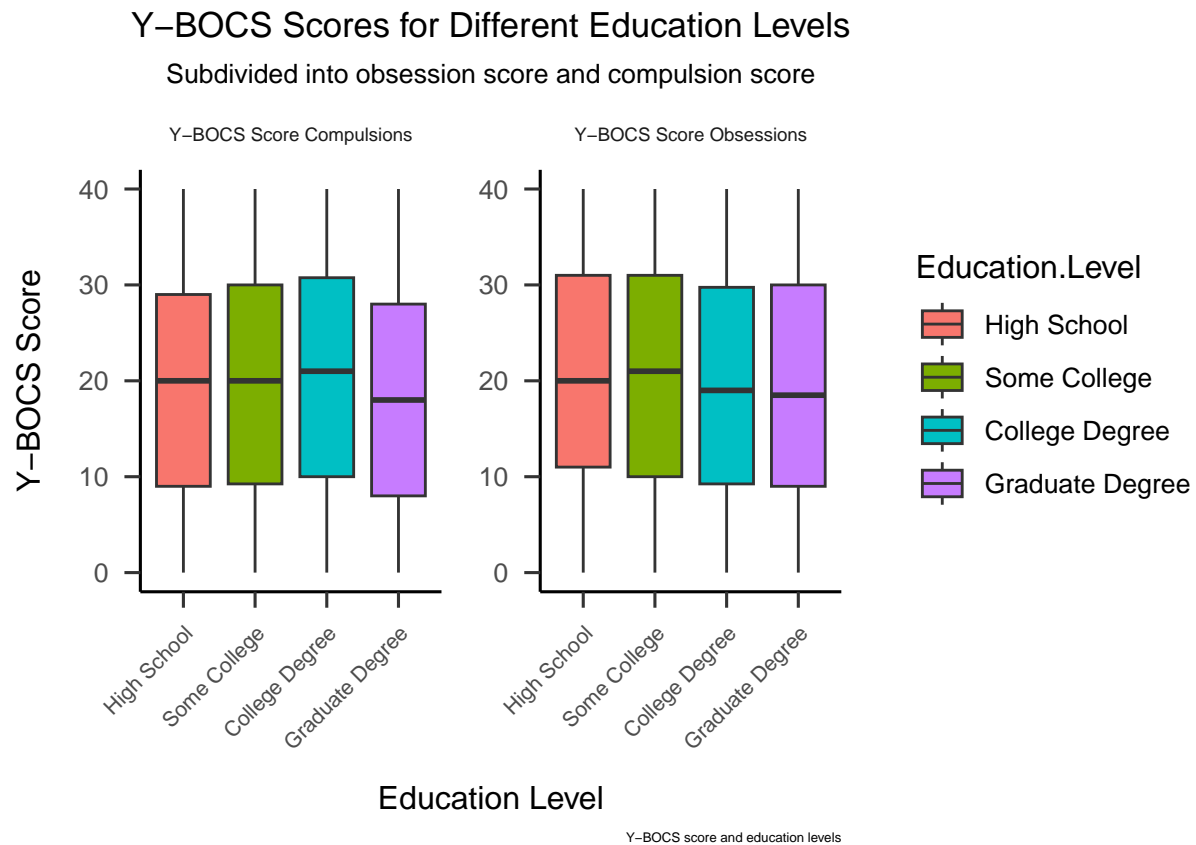
Figure 3

Y-BOCS score and education levels

Then, I made a general statistics summary for each box in the boxplot to show mean score, median score, minimum score, and maximum score values.

```
# A tibble: 8 x 7
  Score_Type        Education.Level mean_score median_score min_score max_score
  <chr>             <fct>                <dbl>        <dbl>     <int>     <int>
1 Y.BOCS.Score..Com~ High School          19.7           20         0        40
2 Y.BOCS.Score..Com~ Some College         20.0           20         0        40
3 Y.BOCS.Score..Com~ College Degree       20.2           21         0        40
4 Y.BOCS.Score..Com~ Graduate Degree      18.5           18         0        40
5 Y.BOCS.Score..Obs~ High School          20.6           20         0        40
```

```
6 Y.BOCS.Score..Obs~ Some College        20.6      21        0       40

7 Y.BOCS.Score..Obs~ College Degree      19.5      19        0       40

8 Y.BOCS.Score..Obs~ Graduate Degree     19.5      18.5      0       40

# i 1 more variable: sd_score <dbl>
```

To compare the mean score value across different education levels, it is found that mean scores vary slightly for education levels within both compulsion score and obsession score. The mean score for compulsions ranges from 18.49 to 20.25, while for obsessions, it ranges from 19.48 to 20.60. This suggests that there might be some differences in symptom severity based on education level, although the differences are relatively small.

Overall, while there are slight variations in mean and median scores across education levels within each score type, the differences are relatively small. Additionally, the variability in Y.BOCS.Score does not appear to vary significantly across education levels for both scores as the standard deviations are relatively consistent. Further statistical analysis are required to be conducted to formally assess whether there are statistically significant differences in Y.BOCS.Score across education levels within each score type.

Test analysis

I applied ANOVA test to test for significant differences in Y-BOCS scores across four education levels.

```
                Df Sum Sq Mean Sq F value Pr(>F)
Education.Level  3    461   153.6   1.099  0.348
Residuals     1496 209106   139.8
```

```
                Df Sum Sq Mean Sq F value Pr(>F)
Education.Level  3    699   233.1   1.681  0.169
Residuals     1496 207416   138.7
```

For Y-BOCS obsession score, the p-value is $p() = 0.35$, indicating that there is no significant difference in Y-BOCS score across four education levels at the 0.05 significance level, leading to fail to reject the null hypothesis.

For Y-BOCS compulsion score, the p-value is $p() = 0.17$, also no significant difference in Y-BOCS score across four education levels, and the null hypothesis is failed to be rejected.

In both cases, since the p-values are greater than 0.05, fail to reject the null hypothesis. This suggests that there are no statistically significant differences in Y.BOCS.Score across education levels within Obsessions or Compulsions.

Discussion

This project investigated the association of education level with clinical diagnostic information like Y-BOCS score and anxiety disorder, and demographic information like family history of OCD for OCD patients. Main findings included 1. neither education level nor family history of OCD can be used as factors in predicting anxiety disorder. 2. there is no correlation between Y-BOCS compulsion score and Y-BOCS obsession score. 3. Y-BOCS score does not associate with education level. The previous two findings are consistent with findings from other studies: there is no correlation between OCD and anxiety disorder(Krebs et al., 2020); and subgroups of Y-BOCS scores are independent of each other(Rosario-Campos et al., 2006). For the third finding, Pérez-Vigil et al. (2018) found in their study that OCD symptoms decreased with increasing education level, which meant that Y-BOCS score also decreased, so there might be an association with education for Y-BOCS score. More studies should be done to further test this finding.

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