INVESTIGATING THE IMPACT OF COVID-19 ON THE FIRST YEAR EATS PROGRAM

An Undergraduate Research Scholars Thesis

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This project did not require approval from the Texas A&M University Research Compliance & Biosafety office.

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ABSTRACT

Investigating the Impact of COVID-19 on the First Year Eats Program

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First Year Eats (FYE) is a program at Texas A&M University developed to lessen food insecurity and its impact on college campuses. In its three years of development, students in the program have been provided with various cooking lessons that teach participants how to prepare simple meals in a dorm room and food resources such as ingredients and other grocery store items in a community kitchen. To assess the program's success, we have used student GPA as a measure of academic success and two surveys aimed at measuring mental health wellness. The Perceived Stress Scale (PSS) was used to measure stress levels, and the University Belonging Questionnaire (UBQ) was used to measure university belongingness. Students participating in the FYE learning community are compared with a population of learning community students not in the FYE program (NFYE). Three academic years of data, including the first, second, and current students participating in FYE, were investigated. The results of the combined dataset of

first- and second-year groups revealed that underrepresented minorities and first-generation students in FYE had a statistically significantly higher GPA than similar students not in the program during the Spring semester of their first year. This significant difference in GPA was not found during the students' Fall semester, suggesting that the FYE program played a role in improving academic performance.

The FYE program continues to play a role in academic success and mental health for participants, despite the COVID-19 pandemic. Current students in the program revealed a statistically significant higher Fall midterm GPA for students within FYE compared to NFYE students. This preliminary analysis also indicated that FYE was a factor in predicting midterm grades in Fall 2021. Regarding early PSS and UBQ survey analysis, FYE students in Fall 2021 had a higher level of belongingness than NFYE students. Although the findings were statistically insignificant, additional investigation into the Spring 2022 semester could reveal more about the program's impact on student mental wellness. Further study regarding the effects of remote learning and the pandemic could be investigated in the future for the improvements of the FYE program.

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NOMENCLATURE

FYE	First Year Eats
NFYE	Non-First Year Eats
GPA	Grade Point Average
PSS	Perceived Stress Scale
UBQ	University Belonging Questionnaire

1. INTRODUCTION

1.1 The Impacts of COVID-19 on Food Insecurity

The COVID-19 pandemic dramatically hit the United States in March 2020 and altered the lives of all university students. Additional stressors were added to students with the shift to remote and online-learning, self-isolation off-campus, and students who were lower-income suffered even greater anxiety with the loss of jobs and the increase or onset of food insecurity. One study revealed that prior to the pandemic, around 11% of US households were classified as food insecure, and by early summer of 2020, during the pandemic, food insecurity increased to between 18-35% (Reimold et al., 2021). A different study found this same increase in food insecurity but noted that food insecurity disproportionately affected the lower income communities. This studied found that by mid-March of 2020, only a few weeks into the pandemic in the United States, over 44% of low-income households experienced food insecurity. (Wolfson et al., 2021). Food shortages in stores, difficulty accessing food, and the increased price of foods during the beginning months of the pandemic exacerbated household efforts to maintain food security with the significant increase in job disruptions (Niles et al., 2020).

College students face additional challenges regarding food insecurity. The rise in unemployment and food insecurity led in an increase in unemployment benefits and expansions of food assistance programs, however, many college students did not qualify for the emergency assistance program. A study performed in August 2020 on college students reported that "despite 1 in 3 students being food insecure, less than 5% of students reported participation in food assistance programs" (Owens et al., 2020). Food insecurity often resulted in poorer academic performance for college students. Hunger is known to impact a person's ability to focus and

comprehend material, and because of being food insecure, students faced with hunger had a more difficult time performing in school. These students also demonstrate poorer mental health that further lowers academic performance (Martinez 2020).

1.2 The Impacts of COVID-19 on Mental Health

College students were directly impacted in the pandemic due to housing relocation uncertainty, and many students lost their student worker positions during the lockdown. In addition to the financial turmoil students faced, the additional stressors of continuing their education and being distanced from campus resources, professors, and a community of friends increased perceived stress and anxiety (Davitt et al., 2021). The COVID-19 pandemic worsened college student's mental health risk factors, especially in middle- and lower-income families, due to stress regarding financial instability and health concerns during the outbreak (Irawan et al., 2020). Sense of belonging has been shown in studies to significantly influence college students socially, psychologically, and academically. Involvement inside and outside of the classroom, engagement in university life, and relationships with peers and faculty have been shown to be fundamentally influential in a student's well-being and success in college. These studies have also consistently found that a weaker sense of belonging is correlated with poor mental and physical health. It is clear that social isolation and remote learning was associated with poor mental health and decreased motivation in colleges, and in addition to the lack of belongingness, "the COVID-19 pandemic exacerbated students' mental health risk factors, …, while simultaneously imperiling students' academic outcomes, putting their future prospects dependent on college retention in jeopardy" (Lederer, 2021).

1.3 The Purpose of the First Year Eats Program

The First Year Eats (FYE) program was designed to assist students from disadvantaged backgrounds and a history of food insecurity by providing a fully stocked pantry, individually prepared meals, and a variety of quick cooking classes. The combination of First Year Eats and a learning community that assists first-year students in their transition to college allows us to separate the effects of First Year Eats (including any food-based community) from the effects of greater community and belonging built due to participation in the general TAMU learning communities. Both aspects of tackling food insecurity and developing a sense of belonging among participants is expected to play a positive role to improve FYE student's academic success and retention. With the COVID-19 pandemic impacting the program a little over half-way through the first year and the entire second year, it is expected that the pandemic was a factor in the student's performance. It also changed how FYE was run. The open-access kitchen was closed to prevent the spread of the virus, but students were now able to sign-up for times to pick up grocery bags filled with snacks, easy meals, and ingredients to cook mug and crockpot meals. In addition to the grocery bags, the FYE coordinators would home cook meals and hand out tupperware meals to students once a week. FYE not only adjusted to the necessary changes due to the pandemic regarding safety and sanitation, but also enhanced the program to reach more students and have a deeper impact through thoughtful intentions to build connection. Our hope is that despite the continuation of the pandemic, the FYE program continues to improve student's academic success, while decreasing stress and increasing a sense of belongingness. As we study the current FYE cohort, we will also analyze previous years cohort and work to see if there were differences between the cohorts, possibly due to the pandemic. By identifying the significant positive impacts of our programs and other factors that contribute to student's

success, our goal is to expand this program across Texas A&M and other universities, while also working to implement new ways of improving academic performance by providing all students with the resources they need to be successful.

2. METHODS

The FYE program has already shown its effectiveness and impact on academic success in participants through research done in previous years. By continuing to study new factors that play a role in academic success, as well as further analyzing improvements in students' sense of belongingness and decrease in overall perceived stress, we are further able to draw more significant conclusions and evaluate if COVID-19 was a factor in determining student performance. From the conclusions made, the program can continue to improve, and the validity of its success can help the program expand. The data collected for the investigation was done in two ways: (i) two individual surveys measuring perceived stress and belongingness and (ii) access to the student database containing demographic data, midterm, final, and cumulative GPAs for the student of interest. Following the data collection period, we were able to utilize the programming language, R, to complete our analysis through various statistical methods.

2.1 Measuring Perceived Stress and Belongingness

The first focus of our project was determining a method of measuring students' stress levels and sense of belongingness. In the previous years, the Perceived Stress Scale (PSS) and University Belonging Questionnaire (UBQ) were used to measure student stress and sense of belonging on campus, respectively. To maintain the uniformity of data collected from last year's cohort and the current cohort, we decided to continue using both the PSS and UBQ surveys, as they served as the most reliable and best candidates for our research interest.

The PSS, measuring stress levels, contains 10 questions and uses a 1 to 5 Likert Scale where a response of 1 represents "Never" and a response of 5 represents "Very Often." The questions in the PSS begin with the phrase "how often …" and student responses are in reference

to the extent to which they have felt or thought a certain way (Cohen, 1983). Because six of the questions on the survey are negatively stated, we opted to unify all the questions to a positive item score. For example, a response of 5 is representative of students feeling less stress and more in control and a response of 1 represents a feeling of high stress and less in control. For questions that were originally negatively stated, the response values were switched on the Likert Scale in that 5 = 1 and 4 = 2, etc. At the end of the PSS, we added eight demographic questions unrelated to stress. These questions gave us information on hours students were taking in school, working, and if they engaged in remote learning the previous year.

The UBQ, measuring sense of belonging, is 24 statements that uses a 1 to 4 Likert Scale, where 1 is "Strongly Disagree" and 4 is "Strongly Agree" to the statement given. The UBQ also separates the individual statements into factors that are specific within a student's sense of belonging. Factor 1 is related to "University Affiliation," Factor 2 is related to "University Support and Acceptance," and Factor 3 is regarding "Faculty and Staff Relations" (Slaten et al., 2017). Although the questions were not in order of the factors, the factors allow for the categorization of responses for analysis. Unlike the PSS, the UBQ did not have any negatively phrased statements, therefore a response of 4 is ideal and described as a strong sense of belonging.

In collaboration with the learning community program instructor, completion of the surveys was incorporated into the student's seminar class for a graded assignment or extra credit. This served as an incentive for as many students to complete the survey as possible, in addition to the monetary incentive through a random gift card drawing. Students in the participating learning communities included both those in FYE and those not in the program, thus allowing for a control group and a greater sample population size. The surveys were sent at the same time two

weeks into the Fall semester and two weeks into the Spring semester and closed ten days after opening. The survey responses in the Fall would tell us the student's starting point after the semester has settled down and before the program could impact the students. The period in between the beginning of the semester and the surveys' opening was to limit bias, like the stressors associated with adjusting to new schedules, classes, and people. The responses in the Spring would give us more information on how the student's stress levels and sense of belonging has changed after a semester of being in the program. After the surveys were closed, student responses were collected and organized in a large dataset that contained the demographic information and reported GPAs.

2.2 Measuring Academic Success

In addition to our PSS and UBQ analysis, academic success was also studied and measured in terms of each student's midterm and final semester GPA. The GPA data for participating students, both FYE and NFYE, was collected and given to us. The database also included essential information about the students and their demographics, thus allowing us to study other factors that contribute to student success. Of the data given, we predominantly studied their participation in FYE, race and ethnicity, zip code, gender, and first-generation status, while using their universal identification number (UIN) to coordinate combining datasets with the PSS and UBQ responses and additional GPA data. The combination of datasets was accomplished using the statistical computing program, R.

The zip code of students was used to predict estimated family income. Using a program written by a previous FYE researcher, the program utilized census data to predict estimated family income from the student's zip code and their race and ethnicity. Race and ethnicity were also combined into a new category of "underrepresented minority status." Students who

identified their ethnicity as “Hispanic or Latino” or their race as “Black” would be categorized as an underrepresented minority, and students who did not identify as the preceding would be categorized as not an underrepresented minority. We felt that it was appropriate to not categorize students who identified as “Two or More Races” as underrepresented minorities due to the lack of information regarding the student’s multiple races.

2.3 Master Analysis of All First Year Eats Cohorts

A problem encountered in previous years of research on FYE was needing a larger sample size to draw accurate conclusions about the program’s success. This problem led to our interest in the results of a combined master dataset containing all of the FYE and NFYE students from the first year of the program to the current, third, year. After reorganizing all three years of data, the variables we decided to utilize in our analysis were FYE status, first generation status, gender, income level, underrepresented minority status, and both the fall and spring semester midterm GPA and final semester GPA, if available. The same zip code program used for the current cohort data was utilized in the first- and second-year cohorts. Similarly, the new category of “underrepresented minority status” created for the new cohort of students was created for the first- and second-year cohorts. By utilizing a larger population size, the stratified groups of students would have a relatively large sample size to enable more accurate conclusions from the analysis.

2.4 Linear Regression Model

In addition to combining various datasets, the statistical language R was used for multiple methods of statistical analysis. Hypothesis testing, such as the t-test, was used in comparing mean GPA of various stratified groups within our dataset. Our main comparison groups were between FYE and NFYE students, which identified statistical significance in group differences.

One analysis tool used was a linear regression model which attempts to predict student GPA as a linear function of various explanatory variables. The general model is represented as Equation 2.1:

$$y_i = \beta_{0i} + \beta_{1i}x_{1i} + \beta_{2i}x_{2i} + \cdots + \beta_{ki}x_{ki} + e_i \qquad (2.1)$$

where y_i is the response variable that represents predicted GPA, β_0 is the intercept, β_k is the calculated slope coefficient for variable x_k, e_i represents random error, and k is the number of explanatory variables or factors included in the model. In interpreting the model coefficients, the β_k represents the mean change in response associated with a one-unit increase in variable k while holding all other variables constant.

The first model was focused on predicting GPA with student demographic factors. Model One contained five factors: FYE status, first-generation status, gender, family income level, and underrepresented minority status. This model is represented as Equation 2.2:

$$y_i = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \beta_4x_4 + \beta_5x_5 + e_i \qquad (2.2)$$

where β_1 was the coefficient for FYE status, β_2 was the coefficient for first-generation status, β_3 was the coefficient for gender, β_4 was the coefficient for family income level, and β_5 was the coefficient for underrepresented minority status.

Models Two and Three were similar to Model One, but with additional explanatory variables. In addition to the factors already included in Model One, Model Two added the PSS mean score and UBQ mean score. Model Three further divided the UBQ scores into designated section means; that is, it accounted for the UBQ section 1 mean, section 2 mean, and section 3

mean. By performing linear regression analysis, factors that contribute a greater significance in predicting student GPA are determined.

2.5 Linear Discriminant Analysis and Multinomial Regression

Linear discriminant analysis (LDA) and logistic multinomial regression modeling were both performed using R as a method to attempt to extract patterns and classify specific survey questions together. LDA is a good classification method that relates numeric explanatory variables to a categorical class variable. Multinomial regression is like linear regression but where the response variable is categorical with more than two categories. It can also be viewed as a generalization of logistic regression. Rather than compiling the scores of all the questions in the PSS and the UBQ and using the mean score as a representation of the surveys, by performing a dimension reduction with LDA, we wanted to see if specific questions were correlated to other individual questions and if the individual questions could be used to predict student success. Both linear discriminant analysis and multinomial regression require the dependent variable to be categorical. Since our dependent variable is student GPA as a means to measure student success, we converted the GPAs into letter grade categories. A 4.0 GPA was classified as an A, between 3.0 and 3.99 was classified as a B, between 2.0 and 2.99 was classified as a C, and all grades below a 2.0 were classified as a D.

LDA was conducted first and performed on three different models. The first model was composed of the questions in the PSS survey, including questions that were rephrased and rescaled to a positive score. The second model involved the questions in the UBQ survey, and the third model involved the UBQ survey separated by the three sections rather than individual questions. The LDA function programmed in R was used for each model, and the dataset was broken down into a training and testing set. The training set was composed of 2/3 of the data and

used to train the linear discriminant model. This model was then used on the testing data to evaluate the accuracy of the fitted model by making predictions on the testing data. Accuracy was determined by using a classification matrix to calculate classification accuracy, sensitivity, and specificity. Accuracy is calculated as the number of correct grade predictions divided by the total number of predictions. Sensitivity refers to the true "positive" rate and calculated as the true positive predictions divided by the total positive predictions, where total positive prediction includes both true and false positives. Specificity refers to the true "negative' rate and is calculated by the number of correct negative predictions divided by the total number of negative predictions, where negative predictions include true and false negatives. In the context of multiple classes, classification calculations are more complicated and can be computed using a package and function in R.

Following linear discriminant analysis, we performed multinomial regressions to improve the classification accuracy of the discriminant models. Multinomial regression is another classification method that is an extension of logistic regression. As opposed to logistic regression, multinomial regression has dependent variables with more than two classes or categories. By adjusting for other variables, such as FYE participation, underrepresented minority and first-generation status, the goal of the multinomial model is to improve the classification accuracy that the linear discriminant model could not achieve without those additional variables. Equation 2.3 represents a general model for multinomial regression.

$$log\,[\frac{P(x)}{1-P(x)}] = \beta_{0i} + \beta_{1i}x_{1i} + \beta_{2i}x_{2i} + \cdots + \beta_{ki}x_{ki} + e_i \qquad (2.3)$$

Although similar to the multiple linear regression model, rather than a continuous dependent variable seen in linear regression models, the dependent variable for multinomial regression

model is categorical. In multinomial regression, the log odds are linearly related to the response variables, and each beta coefficient is a log relative risk. In the context of student success and letter grades, the coefficient for each variable gives a change in the log odds of a unit increase in the letter grade variable. For our multinomial model, an A is the default predicted variable, and every one unit increase in the dependent variable corresponds to a lower letter grade (i.e. 1 is a B, 2 is a C, and 3 is a D).

3. RESULTS

3.1 Analysis of 2020-2021 FYE Cohort

The first step of our analysis was understanding the impacts of the FYE program on the second cohort of students during Fall 2020 and Spring 2021. Comparative t-tests were performed on different stratified groups of students in the Fall 2020 semester and Spring 2021 semester individually. The significant t-tests we performed compared differences in GPA between FYE and NFYE students, underrepresented minority students and non-underrepresented minority students, and first-generation students and non-first-generation students. Gender comparisons between male and female students were tested as well, and the different income levels were compared; however, neither provided significant information as the differences between the groups was not notable.

In Fall 2020, the results of preliminary hypothesis testing did not reveal any defining results. FYE students performed better than NFYE students with an average 3.116 GPA compared to a 2.992 GPA; however, the difference was not statistically significant based on p-value and confidence level. From previous years of research and literature reviews, it is widely understood that “black and hispanic students tend to have lower grade point averages than their white student counterparts” and “first-generation college students also tend to have lower GPAs than students whose parents attended college” (Camelo & Elliott, 2019). In the Fall semester, we noted these results. Within FYE, non-underrepresented minority students performed better than underrepresented minority students and non-first-generation students performed better than first-generation students. Both the results were statistically significant and similar results were noted for the combination of students in FYE and NFYE.

The same analysis performed on the Fall 2020 grades was performed for the Spring 2021 semester and yielded more fruitful results. In the Spring semester, FYE students earned on average a 3.202 GPA, which was statistically significantly higher than NFYE students with an average of a 3.044 GPA. This difference was moderately significant with a p-value of 0.085; the results did indicate that the difference between NFYE and FYE GPA was greater than in the Fall 2020 semester. Analysis performed on first-generation and underrepresented minority students also revealed different results than the fall semester. Within FYE, although first-generation students performed lower than non-first-generation students with a 3.175 and 3.475 average GPA respectively, the difference was no longer statistically significant. Similarly, underrepresented minority students who averaged a 3.169 performed worse than non-underrepresented minority students who averaged a 3.495, but the results were not statistically significant. With knowledge that underrepresented minority students and first-generation students often have lower GPAs than their non-underrepresented and non-first-generation peers, as well as previous results from the fall semester, the statistical insignificance of these results is possibly evidence that the FYE program could close the academic gap between these students.

The problem that arose in stratifying students within the FYE sample is the sample size. When comparing underrepresented minority and first-generation students within FYE, only ten students were non-underrepresented minorities, and nine students were non-first-generation. A small sample size makes it difficult to draw conclusions on the analysis because of low statistical power and potentially unmet assumptions. Due to our sample size problem, we are not truly able to conclude that the FYE program closed the academic gap between first-generation and non-first-generation students nor underrepresented minorities and non-underrepresented minorities. To analyze the group from a separate angle, we performed hypothesis tests on first-generation

students as a whole and underrepresented minorities as a whole. In this test, from the group of first-generation or underrepresented minority students, we compared FYE and NFYE students. These tests revealed that FYE underrepresented students and first-generation students performed statistically significantly better than non-underrepresented minority students and first-generation students, respectively. Although we are not surprised by these results due to the overall conclusion that FYE students performed better than NFYE students, the statistical significantly higher GPA in FYE students for the stratified populations is a different way we can identify that the FYE program played a role in student academic performance.

3.2 Analysis of All FYE Cohorts

The first indication that the FYE program could close the academic gap between first-generation and non-first-generation students and underrepresented minorities and non-underrepresented minorities was in our analysis of the Spring 2021 grades. To combat the problem with a small sample size, we opted to combine the first FYE cohort during the Fall 2019 and Spring 2020 academic year and the second FYE cohort during the Fall 2020 and Spring 2021 academic year. By combining two datasets, the sample sizes for the stratified groups increased to a value greater than thirty, enabling a more robust assessment. The hypothesis test for first-generation students and underrepresented minorities was performed again where there were 57 non-first-generation students in FYE and 42 non-underrepresented students in FYE. After performing the analysis again, we could draw a stronger conclusion of the academic gap closing. In the Fall semester, the results were as expected in that first-generation and underrepresented minority students performed below non-first-generation and underrepresented minority students.

However, the spring semester revealed results we had hoped for. First-generation students earned on average a 3.304 GPA and non-first-generation students earned on average a

3.565 GPA. Again, first-generation students performed lower than non-first-generation students; however, the p-value was large and the difference in GPA is statistically insignificant. Underrepresented minorities earned an average of a 3.312 GPA which was less than non-underrepresented minorities who earned on average a 3.495 GPA. Similar to first-generation students, underrepresented students performed lower than non-underrepresented minorities; however, the p-value was again large, and the difference was statistically insignificant. With the master analysis combining both the first and second cohort and generating a large enough sample size for the hypothesis test, we can safely conclude that the FYE program plays a role in increasing the academic performance of underrepresented minorities and first-generation students and decreasing the difference between first-generation and non-first-generation students, as well as underrepresented minority and non-underrepresented minority students.

3.3 Perceived Stress and Belongingness Surveys

The PSS and UBQ results were collected for both the Fall and Spring semesters, and hypothesis testing was utilized to analyze the results. First, we compared the Spring semester results to the Fall semester results to identify how student stress levels and belongingness changed after a semester in college. Table 3.1 below displays the mean scores for the PSS, UBQ, and the UBQ separated into three different sections, as well as the p-value associated with the t-test to compare the Spring semester score with the Fall semester score. Both the PSS and UBQ were scored based on a 5-point Likert scale where a score of 5 is a positive score that indicates less perceived stress and a greater sense of belonging.

Table 3.1: PSS and UBQ Means for Fall and Spring Semester

Survey	Fall 2021	Spring 2022	P-Value
PSS	2.826	3.019	0.030
UBQ	3.052	3.189	0.037
UBQ Section 1	3.033	3.177	0.054
UBQ Section 2	3.245	3.357	0.087
UBQ Section 3	2.720	2.888	0.069

From the overall comparison, the PSS and UBQ revealed a strong statistical significance at a 95% confidence level for the Spring semester scoring greater than the Fall semester. This indicates that students in the spring semester had lower stress levels and a greater sense of belonging. When the UBQ was separated into separate sections, all three sections of the UBQ revealed moderate statistical significance at a 90% confidence level.

After analyzing the PSS and UBQ results for all students, we wanted to understand how the survey results differed between FYE and NFYE students. When comparing the FYE and NFYE students in the Fall semester, both groups had similar mean scores, and there was no statistical significance between the two groups. The same comparison was performed with the Spring semester results and revealed the same findings in that there were no significant differences between the groups. Another method of comparing the FYE and NFYE groups was understanding how the average survey scores for each group changed from the Fall semester to the Spring semester.

Table 3.2: Fall and Spring PSS and UBQ Survey Results for FYE and NFYE Students

NFYE/FYE – Survey	Fall 2021	Spring 2022	P-Value
FYE -- PSS	2.867	3.076	0.039
NFYE – PSS	2.758	2.868	0.545
FYE – UBQ	3.107	3.234	0.096
NFYE – UBQ	2.967	3.081	0.355

It can be seen in Table 3.2 that for both the PSS and UBQ surveys, FYE students' survey scores were significantly higher in the Spring semester than the Fall semester at a 95% confidence with the PSS survey and a 90% confidence with the UBQ survey. Although NFYE students both had increased survey results in the Spring semester for both the PSS and UBQ, the difference between semesters was not statistically significant. When the UBQ results were stratified into the three different sections, neither FYE nor NFYE students indicated a statistical difference between the Spring and Fall semester for section 1 or section 2. However, FYE students did reveal a significantly higher survey mean in the Spring semester for section 3 of the UBQ compared to the Fall semester. Section 3 of the UBQ corresponds to faculty and staff relations, and this statistical significance was not seen when comparing the Fall and Spring semester for NFYE students.

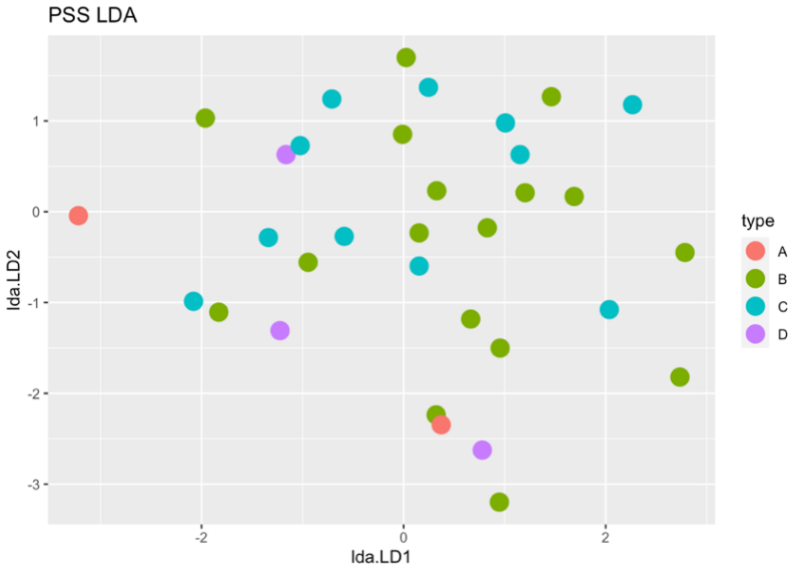
3.4 Linear Discriminant Analysis and Multinomial Regression

Using the Fall 2021 midterm grades for the current FYE cohorts, we performed linear discriminant analysis for the three models: PSS questions, UBQ questions, and UBQ sections. Table 3.3 displays the calculated classification accuracy of the entire model, and sensitivity and specificity of each letter grade for each discriminant model.

Table 3.3: Accuracy, Sensitivity, and Specificity for Linear Discriminant Models

Discriminant Model	Accuracy	Sensitivity	Specificity
Model 1 (PSS)	42.42%	0.00% for A 58.82% for B 36.36% for C 0.00% for D	77.78% for A 36.36% for B 62.50% for C 87.50% for D
Model 2 (UBQ)	21.21%	50.00% for A 33.33% for B 0.00% for C 0.00% for D	60.00% for A 14.29% for B 46.67% for C 46.67% for D
Model 3 (UBQ Sections)	42.42%	0.00% for A 66.67% for B 16.67% for C 0.00% for D	73.68% for A 15.38% for B 80.00% for C 100.00% for D

From the table, it can be drawn that the accuracy for the discriminant models is low and the sensitivity and specificity of each letter grade for each model is varied. Figures 3.1 A-C are the linear discriminant plots for the PSS, UBQ, and UBQ section models, respectively.



A

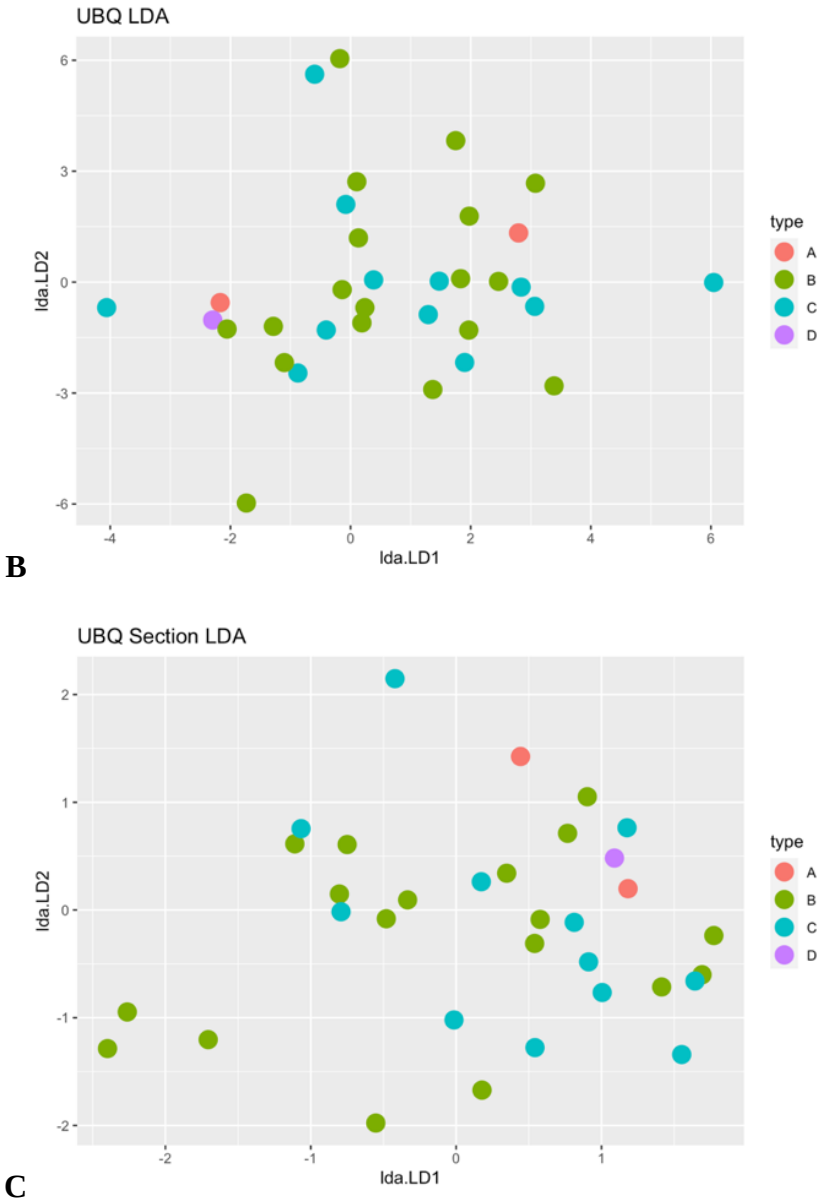


Figure 3.1: A) PSS – Model 1 LDA Plot B) UBQ – Model 2 LDA Plot C) UBQ Sections – Model 3 LDA Plot

None of the three LDA plots revealed any apparent clusters of points from the x-axis and horizontal view nor the y-axis or vertical view. With the lack of clusters and the low accuracy, the individual surveys are likely not good predictors of academic success on their own. By adjusting for other variables, we are able to improve the classification accuracy.

To adjust for other variables, such as FYE participation, first-generation, and underrepresented minority status, we performed a multinomial regression analysis. The first model we fitted using multinomial regression contained the additional variables without the survey questions. Table 3.4 contains the coefficient or log relative risk values for those variables and the specific grade letters in comparison to the default of earning an A. Table 3.5 contains the coefficients for the second model, which contains the additional variables and the PSS survey questions.

Table 3.4: Multinomial Regression Coefficients for Model 1

Grade	B	C	D
Intercept	1.32	0.21	-10.51
FYE	-0.58	-0.96	-0.42
FG	0.35	-0.93	10.97
URM	0.47	2.10*	-0.69

Table 3.5: Multinomial Regression Coefficients for Model 2

Grade	B	C	D
Intercept	2.45	2.70	-41.78**
FYE	-1.48	-1.81	1.17
FG	0.65	-0.84	28.91**
URM	0.51	1.73	-6.80
PQ 1	-0.47	-0.17	-1.23
PQ 2	0.38	1.06	-2.42
PQ 3	-0.76	-1.08	1.85
PQ 4	1.11**	0.63	3.11
PQ 5	-0.62	-0.74	-0.68
PQ 6	-0.32	-0.56	-1.99
PQ 7	0.18	0.11	3.63
PQ 8	0.20	-0.08	2.96
PQ 9	0.06	-0.07	-3.67*
PQ 10	-0.23	0.08	2.38

The third model was intended to include additional variables and the individual UBQ survey questions; however, after our attempt to fit this model, the results were unstable and are not shown. Table 3.6 is the coefficient table for the fourth and last model we fit and contained the additional variables and the UBQ sections rather than the individual questions.

Table 3.6: Multinomial Regression Coefficients for Model 4

Grade	B	C	D
Intercept	-3.63	-1.64	-14.97**
FYE	-0.38	-0.87	-0.23
FG	-0.20	-1.34	11.75**
URM	1.25	2.83**	0.69
Sec 1 Mean	2.73**	3.35**	2.89
Sec 2 Mean	-1.54	-3.04**	-4.26**
Sec 3 Mean	0.60	0.56	2.63**

When looking at the coefficient tables, values with a single asterisk represent statistically significant coefficients with p-values between 0.05 and 0.1. Coefficients with a double asterisk represent statistically significant coefficients with p-values less than 0.05. The statistical significance of each coefficient represents the contribution of that predictor variable in the multinomial model. As explained in the methods section, the coefficients in the multinomial models represent the log relative risk associated with the variable. By exponentiating these coefficients, we are able to convert the values to a relative risk scale. Negative coefficient values indicate a reduced risk for earning the corresponding grade than the default grade of an A. Likewise, positive coefficient values indicate an increased risk. For example, when we look at Table 3.4 on model 1, the conclusion we can draw from the table is that the risk of a C is 8.2 (or $e^{2.1}$) times greater for underrepresented minorities than for non-underrepresented minorities.

The results from the multinomial regression analysis were varied, therefore, making it hard to draw strong conclusions regarding the models and coefficients in the model. A reason for this problem was due to the sample size of the dependent variable categories. From the group of students that completed the surveys, only 12 students earned an A, 52 students earned a B, 21

students earned a C, and 5 students earned a D or an F. The only letter grade that was large enough to assume normality and make the proper assumptions to conduct the multinomial analysis was letter grade B, as the other letter grades were well below a suggested minimum of 30 students. Thus, our multinomial regression results should be viewed as approximate.

3.5 Analysis of Current FYE Cohort

At the completion of the Fall 2021 semester, we were able to perform preliminary analysis on the third FYE cohort. Within a single semester, we found that the FYE program played a role in student academic success. Similar to the analysis on the 2020-2021 FYE second student cohort, basic hypothesis testing and modeling was performed to identify statistical significance between the GPAs of different groups of students. In Fall 2021, FYE students earned on average a 3.176 GPA compared to NFYE students earning on average a 2.902. Figure 3.2 below displays a side-by-side box plot comparing the FYE and NFYE students.

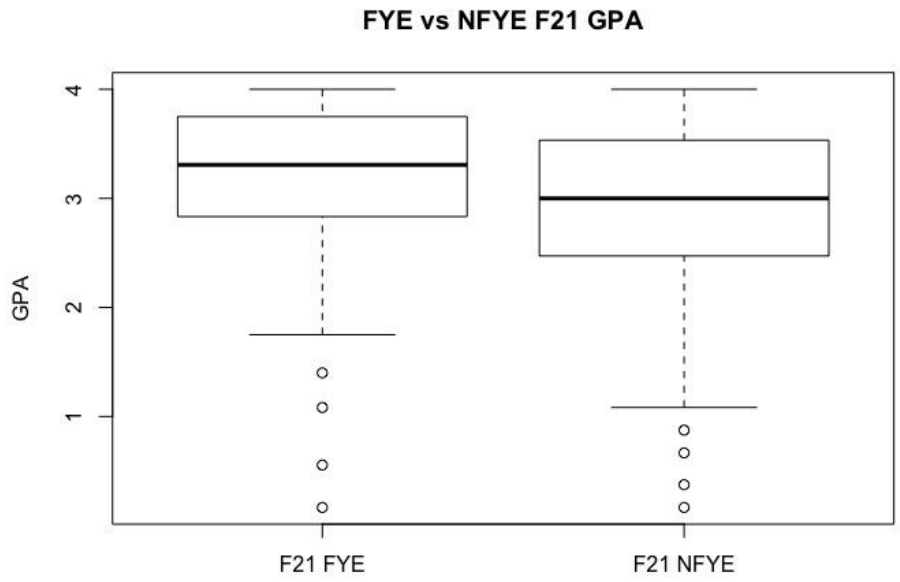


Figure 3.2: Fall 2021 Boxplot of FYE and NFYE

From the figure and statistics, FYE students performed statistically significantly higher than NFYE students with a small p-value of 0.001 and confidence level of 99%. From the box plots, it can be noted that the range between GPAs for FYE students was much smaller than the range of NFYE GPA. Despite a large overlap of the box plots, the small p-value could be an indication of a small standard error. Previous years revealed that the FYE program played a role in improving students' academic success after a full year in the program. However, for the first time since its pilot in Fall 2019, the FYE program is seen to have made an impact in student academic success in just one semester.

Stratification of different student populations also revealed unique findings that indicate the positive impact of the FYE programs. Although hypothesis testing was performed to compare student genders and income levels, neither of the stratifications of the population revealed any significant differences between the groups. We once again focused on first-generation and underrepresented minority students within the FYE program. After performing a series of t-tests for the groups, we were able to note that, although first-generation students earned a 3.128 average GPA, which was lower than non-first-generation students with a 3.281 average GPA, the difference between the two groups was small, and the p-values indicated statistical insignificance. Interestingly, underrepresented minority students within FYE performed better than non-underrepresented minority students in Fall 2021. Although the difference was very small and not statistically significant with underrepresented minorities earning a 3.186 average GPA and non-underrepresented minorities earning a 3.145 average GPA, this was the first semester in all of FYE history in which underrepresented minorities within FYE performed better than non-underrepresented minorities within FYE.

The third cohort of FYE was different than the previous two FYE cohorts in how participants were selected. In previous years, students offered to participate in the program were all residing in a single residence hall. For the third cohort, students no longer needed to live in a specific residence hall; students in three specific learning communities, Century Scholars, Greater Texas Foundation, and Gen1, were offered the option to opt into the FYE program. Opening the program to more students allowed for a more diverse set of students and a greater number of students to voluntarily participate as a FYE participant. Because of this change in the FYE population make-up, stratifying the students within the FYE program did not yield a small sample size dilemma. Non-first-generation students within FYE made up of 43 students and non-underrepresented minorities in FYE was made up of 32 students. We were able to safely assume population normality due to a sufficient sample size in both cohorts, and confidently make out that the FYE program is playing a positive role in student academic performance and increasing the performance of underrepresented minorities and first-generation students.

3.6 Linear Regression Models

A predictive linear regression model was used with GPA as a response variable. Predictive linear regression models are used to identify if a specific factor contributes to predicting GPA. The first regression model we fitted is seen in Table 3.7 and contains the student demographic coefficients, such as FYE, FG, URM, etc. status. The estimates shown next to each coefficient, also referred to as factors, represents the magnitude in which each coefficient plays in predicting the Fall final GPA for the current FYE cohort. Positive estimates indicate a positive contribution, while a negative estimate indicates a negative contribution. Further interpretation of the table is in understanding the p-values associated with each estimate. Small p-values, below 0.05, reveal that the coefficient plays a large role in the predictive model, while larger p-values

show that the coefficient does not play a large role in the model. From our first model, it is noted that we estimate an average increase in final GPA of 0.293 points for students in FYE as compared to students not in FYE, holding all other variables constant.

Table 3.7: Linear Regression Model Estimates and P-Values for Model 1

Coefficients	Estimate	P-Value
Intercept	2.969	0.000
FYE	0.293	0.013
FG	-0.212	0.094
URM	0.010	0.954
Gender	0.173	0.123
Family Income	-0.016	0.790

The second predictive linear model we fitted included all the demographic coefficients from the first model, but also considered the PSS and UBQ survey means as factors in predicting student success. Both the PSS and UBQ survey means were selected based on the Spring surveys as it was representative of a complete Fall semester, just as the response variable of the final Fall grades represented a complete Fall semester. The estimates and p-values for the second model is displayed in Table 3.8 and reveal that, although FYE participation is no longer a significant factor in predicting GPA, the Spring PSS survey was a significant positive factor in predicting GPA.

Table 3.8: Linear Regression Model Estimates and P-Values for Model 2

Coefficients	Estimate	P-Value
Intercept	2.182	0.000
FYE	0.218	0.150
FG	-0.228	0.156
URM	-0.216	0.340
Gender	0.029	0.844
Family Income	-0.046	0.561
Spring PSS Mean	0.296	0.006
Spring UBQ Mean	0.099	0.457

The last predictive model we were interested in fitting is like model 2 with the demographic coefficients and survey responses, but rather than the UBQ survey being represented by a single mean score, it was spliced into the three distinct sections of the surveys to be individual coefficients in the model. The three sections represent university affiliation, university support and acceptance, and faculty and staff relations, respectively.

Table 3.9: Linear Regression Model Estimates and P-Values for Model 3

Coefficients	Estimate	P-Value
Intercept	1.618	0.003
FYE	0.201	0.165
FG	-0.351	0.028
URM	-0.212	0.324
Gender	-0.015	0.915
Family Income	-0.075	0.331
Spring PSS Mean	0.264	0.010
Spring UBQ Section 1 Mean	-0.446	0.012
Spring UBQ Section 2 Mean	0.837	0.000
Spring UBQ Section 3 Mean	-0.097	0.335

Table 3.9 displays the estimates and p-values for the third model. From this table, we can identity that FYE is no longer a significant factor in the predictive model as it was in the first model, however, first-generation status, the PSS survey, and sections 1 and 2 of the UBQ surveys are significant factors in predicting student GPA. Unique to the third model, the first-generation and section 1 of the UBQ survey are represented by negative estimates, thus meaning that those coefficients reduce the predicted GPA instead of contributing to a higher GPA. Other significant coefficients, such as section 2 of the UBQ survey and the PSS survey, had positive estimates and contributed positively to the model.

4. CONCLUSION

This year has brought many new findings that revealed promising results regarding the success of the FYE program. When comparing FYE and NFYE students, we observed that the program has increased student academic success, decreased student stress levels, and improved their sense of belongingness.

4.1 Discussion

In the beginning of our analysis, we conducted an exploratory analysis on the second FYE cohort in Fall 2020 and Spring 2021. This was the first full academic year during the COVID-19 pandemic, and most students were taking classes virtually while limiting most social interactions due to quarantine and social distancing requirements. With the unprecedented experience of the pandemic, no one knew how academic success or student wellness would be impacted, especially students who already struggle with the difficulties of food insecurity. The FYE program needed to make accommodations to ensure students in the program were able to receive what they needed. The community kitchen was shifted from a single dorm kitchen to a community pantry located at a separate building to ensure all students were getting equal access to food and sanitation was monitored regularly throughout the kitchen. Due to the shift from a kitchen to a pantry, meals were being homecooked by FYE team members and delivered to students every week in addition to individualized grocery bags containing snacks and quick meals for each student to pick-up.

Despite the shift in college education due to the pandemic, the FYE program continued to play a role in student academic success. In the Spring 2021 semester, FYE students significantly performed higher than NFYE students, which was a difference greater than the one seen in the

Fall 2020 semester. Underrepresented minorities in FYE also performed better than underrepresented minorities in NFYE – a unique finding in the Spring semester. Along with that, the Spring 2021 semester also allowed the FYE program to get a glimpse of their role in closing the gap between first-generation and underrepresented minority students. As mentioned in the previous results section, we have seen historically and in literature, that first-generation and underrepresented minorities perform lower than non-first-generation and non-underrepresented minorities students. Yet, in the Spring 2021 semester, the difference between non-first-generation students and first-generation students in FYE as well as non-underrepresented minorities and underrepresented minority students in FYE were not significant. This is evidence that students in the FYE program have closed the gap of academic difference between certain stratified groups.

The problem that the Spring 2021 results had was a small sample size. Due to the inability for us to assume normality and the small population size in the stratified groups, we were unable to confidently draw the conclusion that the FYE program improved the performance of underrepresented minority and first-generation students. To solve this problem, we combined both the first and second cohort of FYE students. While the second cohort of students experienced an entire year under the COVID-19 pandemic, the first cohort of students had their Spring 2020 semester cut short and with a dramatic shift in living due to the beginning of the pandemic in March 2020. Remarkably, combining both cohorts of students produced the same promising results that the FYE program closed the gap between first-generation and underrepresented minority students, as well as FYE students performing better than NFYE students. These findings with a greater sample size allowed us to confidently draw the

conclusion that the FYE program play a role in improving student GPA after a year in the program and was able to close the gap between certain groups of students.

Following our analysis on last year's cohort, we shifted focus towards this year and the current FYE cohort. Incredibly, the FYE students performing significantly better than NFYE students within a single semester. In addition to that, first-generation students within FYE continued to maintain a similar GPA to non-first-generation students within FYE and indicating a continual closing of the gap for first-generation students. Underrepresented minority students revealed a greater finding in that FYE underrepresented minority students performed higher than non-underrepresented students in FYE. All three of these main findings of the preliminary analysis on the current FYE students are unique to the program and shine a light on the program's improvement throughout the years.

When analyzing the PSS and UBQ surveys, more novel findings were discovered. The overall PSS and UBQ improvement from the fall to spring semester is a sign that student wellness is improvement in a single semester. Although the FYE and NFYE students did not differ among each other for either the PSS or UBQ surveys nor the fall or spring semester, increases in the scores found in the FYE students as opposed to the NFYE students is notable. The increase in PSS and UBQ score for FYE students from fall to spring semester for FYE students, but not NFYE students, may indicate that the FYE program is playing a role in decreasing student stress level and increasing student sense of belonging that is unseen outside of the program.

Lastly, we generated linear regression, linear discriminant, and multinomial regression models as a method to identify if specific factors contributed more to predicting student GPA and student success. Although the linear discriminant models and multinomial models did not

reveal any apparent clusters of questions or factors that contributed towards predicting student letter grades, the linear regression models did find a few factors that significantly contributed to the overall prediction of student GPA. When the surveys were not included in the model, the FYE program played a significant and positive role towards GPA; therefore, indicating that the program does play a positive role in student academic success. In the model including the surveys, the PSS and second section of the UBQ regarding university support and diversity played a positive role in predicting student GPA. Although the FYE program was no longer a significant factor when including the surveys, the knowledge that the FYE program could improve student belongingness and decrease student stress levels is another method that the program continues to improve student wellness and student academic success by doing so.

Overall, we can see that despite the COVID-19 pandemic hitting in the middle of the first FYE cohort, impacting the entire second FYE cohort, and the slow transition towards post-pandemic life in the third FYE cohort, the FYE program has continued to improve the academic success of students while decreasing student stress levels and increasing their sense of belongingness. A transition to remote learning and social distancing forced the program to make adjustments to the program, which not only allowed the continuation of the program during unprecedented times, but also led to the continual improvement and refinement of the program itself. In a period of time where many things in the world stopped and others declined in performance, the FYE program stood the test of time and remained an integral part in improving the success of FYE students.

4.2 Future Direction for First Year Eats

During the development and preliminary studies of the FYE program's impact on students, our focus was predominantly first-year impacts on students. As the program is heading

into a fourth year and three different groups of students, it would be interesting to see if the FYE program made an impact on students after their first year. Using GPA data of students into their sophomore and junior year, by comparing the differences between FYE and NFYE students, it is possible to see if students continue to perform higher than NFYE students after they graduate from the program. Understanding the long-term impacts of the FYE program would reveal if students were utilizing the skills learned their first year while in the program and could also shed light on if NFYE students are able to catch back up and perform better or equal to FYE students.

Another suggestion I have for future research on the program is understanding what aspect of the FYE program do students believe is the most helpful and determining if specific participation in certain or all of the activities within the FYE program plays a role in students' academic success and GPA improvements from the Fall to Spring semester. Some students in FYE participate and engage in all FYE activities and opportunities, while others only participate in a few or one. It would be interesting to see which activities or opportunities play a more important role in a positive trend towards improving student GPA, lowering stress levels, or increasing belonging, and which may not contribute as much as expected. By understanding this, the FYE program can better allocate funds towards the more effective opportunities or refine the parts of the program that are not contributing as much as the team hoped.

4.3 Final Words

The FYE program is continually making a difference in the lives of students, and it is with gratitude to the program founders, directors, instructors, and student team members. The hard work that each member has contributed towards improving the program, extending outreach, and incorporating better ways to access and cater towards every student need is why FYE has continued to grow. The transition to college is already difficult and removing the

additional stress of food insecurity is a way to help those in need succeed with fewer barriers. The FYE program has not only helped students find comfort in knowing where they can find their next meal during their first year and access to help after they graduate the program but has also provided students with a supportive community of peers in similar situations and mentors who can continue to guide them. As the program continues to improve and develop, I hope that the other campuses across the country begin to develop a program similar to FYE and make efforts towards providing every student in need with the resources they deserve to flourish in college.

REFERENCES

Camelo, K., & Elliott, M. (2019). Food Insecurity and Academic Achievement Among College Students at a Public University in the United States. *Journal of College Student Development*, *60*(3), 307-318. https://doi.org/10.1353/csd.2019.0028

Cohen, S. K., Tom; Mermelstein, Robin. (1983). A Global Measure of Perceived Stress. *Journal of Health and Social Behavior*, *24*(4), 385-396.

Davitt, E. D., Heer, M. M., Winham, D. M., Knoblauch, S. T., & Shelley, M. C. (2021). Effects of COVID-19 on University Student Food Security. *Nutrients*, *13*(6). https://doi.org/10.3390/nu13061932

Irawan, A. W., Dwisona, D., & Lestari, M. (2020). Psychological Impacts of Students on Online Learning During the Pandemic COVID-19. *KONSELI : Jurnal Bimbingan dan Konseling (E-Journal)*, *7*(1), 53-60. https://doi.org/10.24042/kons.v7i1.6389

Lederer, A. M., Hoban, Mary T., Lipson, Sarah K., Zhou, Sasha, Eisenberg, Daniel. (2021). More Than Inconvenienced: The Unique Needs of U.S. College Students During the COVID-19 Pandemic. *Health Education & Behavior*, *48*(1), 14-19. https://doi.org/10.1177/1090198120969372

Martinez , S. M., Frongillo, Edward A., Leung, Cindy, Ritchie, Lorrene. (2020). No food for thought: Food insecurity is related to poor mental health and lower academic performance among students in California's public university system. *Journal of Health Psychology*, *25*(12), 1930-1939. https://doi.org/10.1177/1359105318783028

Niles, M. T., Bertmann, F., Belarmino, E. H., Wentworth, T., Biehl, E., & Neff, R. (2020). The Early Food Insecurity Impacts of COVID-19. *Nutrients*, *12*(7). https://doi.org/10.3390/nu12072096

Owens, M. R., Brito-Silva, F., Kirkland, T., Moore, C. E., Davis, K. E., Patterson, M. A., Miketinas, D. C., & Tucker, W. J. (2020). Prevalence and Social Determinants of Food Insecurity among College Students during the COVID-19 Pandemic. *Nutrients*, *12*(9). https://doi.org/10.3390/nu12092515

Reimold, A. E., Grummon, A. H., Taillie, L. S., Brewer, N. T., Rimm, E. B., & Hall, M. G. (2021). Barriers and facilitators to achieving food security during the COVID-19 pandemic. *Prev Med Rep*, *23*, 101500. https://doi.org/10.1016/j.pmedr.2021.101500

Slaten, C. D., Elison, Z. M., Deemer, E. D., Hughes, H. A., & Shemwell, D. A. (2017). The Development and Validation of the University Belonging Questionnaire. *The Journal of Experimental Education*, *86*(4), 633-651. https://doi.org/10.1080/00220973.2017.1339009

Wolfson, J. A., Garcia, T., & Leung, C. W. (2021). Food Insecurity Is Associated with Depression, Anxiety, and Stress: Evidence from the Early Days of the COVID-19 Pandemic in the United States. *Health Equity*, *5*(1), 64-71. https://doi.org/10.1089/heq.2020.0059