New York University School of Global Public Health

A Longitudinal Assessment to Assess the Effect of Physical Activeness on Social Anxiety among Individuals Who are Transitioning into Adulthood (TAS), From 2009 to 2015

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INTRODUCTION

Mental illness is one of the most common health conditions in the US and worldwide. More than 50% of the population will be diagnosed with mental illness at some point in their lifetime.[1] Social anxiety, one of the important components of mental health, can negatively affect individuals' functioning of life and general wellbeing.[2] For instance, people who experience social anxiety disorder are more likely to have fewer friends, have poorer academic performance, and less likely to be employed and get married.[3] Young adults are susceptible to social anxiety due to increased social responsibility and peer interaction as they transit into adulthood. As many factors could potentially affect one's perceived social anxiety, our project is interested in understanding the within-person and between-person variations in light physical activity change the trajectories of social anxiety as adolescents transitioning into adulthood.

Physical activity has shown to have a positive effect on one's social anxiety among different age groups. One study conducted by Strohle et al. revealed a significant association between physical activity and ratings of anxiety among college students. Low physical activity was associated with the highest ratings of anxiety compared to medium and high physical activity. This protective effect was also seen to be higher for men than for women.[4] Few studies also pointed out that the effect of physical activity on social anxiety depends on different domains, including the types of activity and the population subgroup.[4,5] For instance, females have shown to better respond to light physical activity and male respond better to intense physical activities. Even though there are ample related studies that have examined the relationship between physical activity and social anxiety, there is a limited number of longitudinal analyses investigating the trajectories of social anxiety during transition into adulthood.

Our project used Transition into Adulthood Supplement (TAS) data from the PSID database. The retrieved data were collected at four waves- year 2009, 2011, 2013, and 2015. We hypothesized that social anxiety would decrease over time. Moreover, people who are physically active will have an overall reduced social anxiety and people who become more physically active over time will have a reduced social anxiety trajectory.

METHODS

Data Source & Sample Design

The Panel Study of Income Dynamics (PSID) and its Transition into Adulthood Supplement (TAS) data was utilized to conduct the investigation. The PSID is based on longitudinal household survey data collected from 1968 to 2017 in the United States. Information

about families' health, demography, and economy (in their entirety and at the individual level) was collected and reported on the PSID. TAS data (2005–2017, n = 2702) is part of the PSID, but it aims to collect information about time, youth experiences, and the first interview as a PSID Reference Person and Spouse Partner (R-S/P).

For this study, only four waves were included in the analyses; these are from 2009, 2011, 2013 and 2015. Responses with “NA”, “do not know”, and “refused to answer” were treated as missing and were excluded from the analysis. A final sample with 362 observations with complete values for all variables of interest were used to conduct analyses.

Measures

Exposure

The exposure variable was the frequency of lite physical activity (*TA090779, TA110895, TA130928, TA150944).* The variable was based on the frequency of high or moderate activity for at least 10 minutes; the times a physical activity was performed was reported and was based on values ranging from 0 to 100. Hence, a binary variable (active/not active) was created to represent the exposure variable. Active was defined by responses with values higher or equal than 1. In terms of not active, it was defined by responses with values equal to 0.

Outcome

The outcome of interest was represented by mental health status; specifically, social anxiety (TA090978, TA111120, TA131212, TA151272) was examined. The variable social anxiety was constructed based on the average of all non-missing responses to the following questions: “How often nervous meeting others”, “How often feel shy?”, “How often feel self-conscious?” and “How often do you feel nervous performing?”. For the basis of the study, social anxiety was kept as continuous. Responses categorized as “do not know”, “NA” or “Refused” were considered as missing values and were excluded from the analysis.

Covariates

A total of six variables were examined as potential covariates, including employment, salary, health level, body mass index (BMI), race and education.

The employment variable (TA090136, TA11013, TA130136, TA150128) was treated as binary (unemployed/employed). If the response were (1) Working now, including military, (2) Only temporarily laid off; sick or maternity leave, then it was categorized as employed. If the response

consisted of (1) Retired, (2) Disabled, permanently or temporarily, (3) Keeping house, (4) Student, then it was unemployed.

Salary was based on responses to “How much earned last year” (before taxes or additional deductions were applied). The variable (TA090403, TA110483, TA130503, TA150512) was kept as continuous, ranging from 0 to 5,000,000 dollars.

Health level (TA090700, TA110788, TA130808, TA150821) was recoded into a new binary variable called good health (yes/no). If initial responses were (1) fair or (2) poor, then it will be categorized as no. In cases where responses were (1) excellent, (2) very good, (3) good it will be classified as yes.

Body mass index (TA090925, TA111057, TA131092, TA151132) was kept as a continuous variable ranging from 15.0 to 59.9.

The variable Race (TA090925) was recoded into three categories, “white”, “black” if Black, African-American, or Negro and “other” if American Indian, Asian, native Hawaiian or some other race.

Education was categorized as “no college”, “some college” and “college or higher”. If the response were: (1) less than a high school diploma, (2) GED, no college (3) High school graduate, no college, it will be categorized as no college degree. Some college degrees were based on (1) GED plus some college, (2) High school graduates plus some college. College was based on (1) GED plus Associate's degree, (2) High school graduate plus Associate's degree (3) GED plus Bachelor's degree, (4) High school graduate plus Bachelor's degree, (5) GED plus Master's degree (6) High school graduate plus Master's degree (7) GED plus Doctoral degree. In addition to (8) High school graduate plus Doctoral degree (9) GED plus Medical degree (10) High school graduate plus Medical degree (11) GED plus Law degree (12) High school graduate plus Law degree (13) GED plus other degree High school graduate plus other degree.

Data Analysis

Descriptive analyses were performed for the examination of each variable. Individual growth plots were conducted for the visualization of anxiety through all four waves. Then an ordinary least squares (OLS) regression model was conducted with their respective mean trajectory line.

Unconditional mean model

An unconditional mean model was conducted as a way to model intercepts. In addition, the intra-class correlation (ICC) was calculated.

Unconditional growth model

An unconditional growth model was performed to evaluate the growth parameters on person and time (waves).

Growth model with the main IV

A conditional model accounting only for the primary independent variable (active/no active) was conducted.

Growth model with main IV and covariates

A conditional model with all covariates (education, BMI, race, health level and salary) and the primary independent variable (active) was performed.

The likelihood-ratio test was conducted as a way to assess the goodness of fit between models. In addition, the Akaike information criterion (AIC) and the Bayesian information criterion (BIC) was conducted. All analyses were performed using STATA/SE 17.0.

RESULTS

Descriptive Analyses

In Table 1, the descriptive analyses reported the mean and standard deviations (sd) for continuous variables, and frequencies and percentages for categorical variables at each wave. The total sample is 362 participants. The outcome variable is Mental health- Social Anxiety. The anxiety score at wave 1 is 3.497, sd 1.465, range from 1-7, at wave 2, the mean is 3.442, sd 1.477; at wave 3, the mean is 3.384, sd 1.386; and at wave 4, the mean is 3.381, sd 1.438. At wave 1, there are 324 (89.50%) non-active and 38 (10.50%) active participants. Wave 2 has 272 (75.14%) non-active participants and 90 (24.86%) active; wave 3 has 210(58.01%) non-active and 152 (41.99%) active participants, and wave 4 has 140 (38.67%) not active and 222 (61.33%) active participants. The covariates are employment, salary, health score, BMI, race, and education level. For Employment at wave 1, there are 193(53.31%) unemployed and 169 (46.69%) employed; at wave 2, there are 151 (41.71%) unemployed and 211 (58.29%) employed; at wave 3, there are 103 (28.45%) unemployed and 259 employed; and at wave 4, there are 71 (19.61%) unemployed and 291 (80.39%) employed.

The mean salary for wave 1 is 4,741.5, sd 9903.9, range 0 to 150,000; for wave 2 mean is 5,097.3, sd 8,909.7, range 0 - 70,000; the mean salary for wave 3 is 6,376.1, sd 11,001.9, range 0-70,000; and wave 4 is 23,975, sd 20,701.9, range 0-130,000. Wave 1 has 114

(31.49%) individuals with poor health and 248 (68.51%) individuals with good health. Wave 2 has 126 (34.81%) individuals with poor health and 236 (65.19%) individuals with good health, wave 3 has 114 (31.49%) individuals reported having poor health and 248(68.51%) individuals reported having good health, and wave 4 has 122 (33.70%) individuals reported having poor health and 240 (66.30%) reported having good health. The mean BMI for wave 1 is 24.82, sd 4.82, range 16-43.8; wave 2 BMI mean is 25.65, sd 5.11, range 16.6-49.8; wave 3 BMI mean is 26.25, sd 5.42, range 16.4-46.8; and wave 4 is 27.22, sd 6.01, range 15.6 to 59.5. For Race, there are 200 (55.25%) Whites, 118 (32.60%) Black/African American, and 44(12.15%) other races. For education, there are 101 (27.90%) with no college degree, 251 (69.34%) with some college, and 10 (2.76%) college or higher degree.

Growth plot

Graphs 1-3 show the individual growth plots. Most individuals have an anxiety score below 4 at the first wave. Overall, no specific trend of increasing or decreasing is observed among the sample. This indicates that there is no huge change in anxiety scores across the waves. For the Individual OLS regression plot in graph 4, the overall fit mean trajectory line for anxiety level from wave 1 to 4 suggests limit change in anxiety scores. The fitted value shows that there is a horizontal line with no changes. However, anxiety scores increase from baseline to wave 3 from low score to high score, some show very slight decrease overtime, and some anxiety scores remain the same from baseline to wave 3.

Descriptive statistics of intercept and slope

The sample means of the estimated intercepts and slopes in table 2&3 are intercept is 3.48 and the sample mean of the slope (wave) is -0.04**.** The sample variances of the estimated intercepts and slopes are 1.87 and 0.23, respectively. The correlation between the estimated intercepts and slopes is -0.51**.** There is a social anxiety score 3.5 on average at baseline and it appears to decrease by 0.041 for every increase in wave. The correlation between the intercept and slope indicates that youth who have a higher anxiety score at baseline have a decreasing trajectory over time. These results do not include the other covariates in the preliminary results.

Results of the models

In table 4, there are 4 models describing the relationship between the variables: unconditional mean model, unconditional growth model, model with main independent variable (IV), and model with all variables.

Model 1: Unconditional Mean Model

The fixed effects average anxiety score across all waves and individuals is 3.42. For random effects, the estimated between-person variance is 1.15, which indicates that individuals differ from each other in their anxiety. The estimated within-person variance is 0.93, which means the average of an individual's anxiety varies overtime.

The random effect suggests that there is room to add additional time-invariant and time-varying predictors. The ICC is 0.55, which means that 55% of the variance in anxiety is attributable to differences among individuals.

Model 2: Unconditional Growth Model

The fixed effects of the model suggests that the average anxiety score at wave 1 is 3.49. Anxiety score, on average, decreases at a rate of 0.04 (p=0.76) over time. However, the rate of change is not statistically significant, suggesting that the anxiety level has no significant change over time.

For random effect, there is a small level-2 residual variance in intercepts for all individuals, and a large, level-2 residual variance in slopes across all individuals. The estimated within-person variance is 0.8, and 9% of the variance is associated with the linear time. The difference between the true intercept and true slope is (-0.1, 0.04), and we conclude that the relationship between these two growth parameters is negative and weak and may not be different from zero.

Model 3: Model with Main IV

The third model is the model with main IV, the fixed effects is the average anxiety score for people with physical activity at wave 1 (3.48), and the coefficient for active is -0.03 (p=0.41), suggesting that the anxiety levels are not affected by if the subject is active or not. The active (intercept) have an average initial anxiety between people who are physically active and inactive are not significant. The active (slope), the average rate of change in anxiety between people who are physically active and not active is not significant. The random effects show a small level-2 residual variance in intercepts and a large level-2 residual variance in slope for all individuals. The correlation between slope and intercepts is small and negative. The within-person variance is 0.8, and the level-1 statistically significant residual indicates that there is no room for time varying covariates in the model.

Model 4: Full Model (with the Main IV and All the Covariates)

For the last model with the full model with the main IV and all the covariates, the estimated difference in anxiety score of an adolescent with high physical activity increased by 0.12 times more than those with low physical activity.

The random effects of the relationship between the two growth parameters is negative with an estimate of -0.0895 and is not different from zero although they are statistically significant. The level-2 residual variance in the intercepts across the individual of 1.24 showing no significance but the level-2 residual variance in slope across all individuals is small of 0.068 but significant. The anxiety score decreased at the rate of 0.20 for a white non-active adolescent compared to black and other races. The average anxiety score for non-active white adolescents at wave 1 is 3.55. As physical activity changes over time, the anxiety score among those who are active decreases by -0.04 ($p<0.53$), indicating that they are less likely to develop anxiety overtime. For race, the anxiety score for Black is -0.38 points lower than of White adolescents and the anxiety score for other races is 0.049 higher than of white adolescents.

The anxiety score for people with some college degree is 0.285 times lower than those with no college education ($p=0.046$). The anxiety score for people with a college or higher education is 0.221 times lower than those with no college education. For every 1 unit increase of salary, the anxiety score decreases by 1%. The anxiety scores for adolescents with good health status decreases by 0.16 times than adolescents with poor health status. People with good health have an 0.03 increase in anxiety score overtime. One unit increase in BMI is associated with 0.016 increase in anxiety score. However, the association is not significant ($p=0.195$). The anxiety score for employed workers is 0.09 times lower than those who are not employed. The log-likelihood, AIC, and BIC will determine the best fit model among the 4 models used. Model 2, the unconditional growth model has a better fit as it has the lowest AIC and BIC than the other models. Log-likelihood did not agree much as it is not the lowest, but based on AIC and BIC, model 2 is the best fit.

SUMMARY OF FINDINGS

Based on our analysis of the 4 models, we conclude that Model 2, the unconditional growth model, is the best fit model as it has the lowest AIC and BIC values. One point to note is that, even though Model 2 has the smallest AIC and BIC, the rate of change of the anxiety level is not significant, as suggested by the large significance level ($p=0.11$). In addition, the random effect of Model 2 suggests that there is a significant difference in the intercept and slopes across all individuals and there is room for more time varying covariates. Moreover, our hypothesis is not supported by our results. According to Model 2, the anxiety level overall

decreases over time at a rate of 0.04. However, this rate of change is not statistically significant. According to Model 3, the anxiety level is not affected by individuals' physical activity level over time. Same observation has been made in Model 4, where the estimated difference in anxiety score among adolescents with high physical activity and low physical activity is not significant from 2009 to 2015, when other covariates are taken into account.

One interesting point can be noted from our analysis. The within-person variance is significantly large, suggesting that there are more time-varying covariates can be added. For future studies, more time-varying covariate can be added to investigate the relationship between physical activity and social anxiety level among young adults.

REFERENCES

1. Kessler RC, Angermeyer M, Anthony JC, et al. Lifetime prevalence and age-of-onset distributions of mental disorders in the World Health Organization's World Mental Health Survey Initiative. *World Psychiatry*. 2007;6(3):168-176.
2. Jefferies P, Ungar M. Social Anxiety in young people: A prevalence study in seven countries. *PLOS ONE*. 2020;15(9). doi:10.1371/journal.pone.0239133
3. Wittchen HU, Fuetsch M, Sonntag H, Müller N, Liebowitz M. Disability and quality of life in pure and comorbid social phobia. findings from a controlled study. *European Psychiatry*. 2000;15(1):46-58. doi:10.1016/s0924-9338(00)00211-x
4. STRÖHLE ANDREAS, HÖFLER MICHAEL, PFISTER HILDEGARD, et al. Physical activity and prevalence and incidence of mental disorders in adolescents and young adults. *Psychological Medicine*. 2007;37(11):1657-1666. doi:10.1017/s003329170700089x
5. BROWN DAVIDR, WANG YOUDE, WARD ANN, et al. Chronic psychological effects of exercise and exercise plus cognitive strategies. *Medicine & Science in Sports & Exercise*. 1995;27(5). doi:10.1249/00005768-199505000-00021

APPENDIX I

Table 1: Descriptive Analyses of Mental Health (Social Anxiety) Score, Activeness, and All Covariates Across the 4 Waves Starting From 2009 to 2015; N = 362.

Variables	**N (%)**
Mean Mental Health Score -Social Anxiety (SD)	
2009	3.50 (1.46)
2011	3.44 (1.48)
2013	3.38 (1.39)
2015	3.38 (1.44)
Active 2009	
Yes	38 (10.5%)
No	324 (89.5%)
Active 2011	
Yes	90 (24.86%)
No	272 (75.14%)
Active 2013	
Yes	152 (41.99%)
No	210 (58.01%)
Active 2015	
Yes	222 (61.33%)

No	140 (38.67%)
Employed 2009	
Yes	169 (46.69%)
No	193 (53.31%)
Employed 2011	
Yes	211 (58.29%)
No	151 (41.71%)
Employed 2013	
Yes	259 (71.55%)
No	103 (28.45%)
Employed 2015	
Yes	291 (80.39%)
No	71 (19.61%)
Mean Salary (SD)	
2009	4,741.5 (9,904.0)
2011	5,097.3 (8,909.7)
2013	6,376.1 (11,002.0)
2015	23,975.2 (20,701.9)
Good health 2009	

Yes	248 (68.51%)
No	114 (31.49%)
Good health 2011	
Yes	236 (65.19%)
No	126 (34.81%)
Good health 2013	
Yes	248 (68.51%)
No	114 (31.49%)
Good health 2015	
Yes	240 (66.30%)
No	114 (31.49%)
Mean BMI (SD)	
2009	24.82 (4.82)
2011	25.65 (5.11)
2013	26.25 (5.42)
2015	27.22 (6.01)
Race 2009	
White	200 (55.25%)
Black	118 (32.6%)

Other	44 (12.15%)
Education 2009	
No College	101 (27.90%)
Some College	251 (69.34%)
College or Higher	10 (2.76%)

Table 2. Descriptive Statistics for Intercepts and Slopes of Social Anxiety Score Across the 4 Waves.

Variables	**Observations**	**Mean**	**SD**	**Min**	**Max**
Intercept	362	3.49	1.37	0.6	7.3
Slope	362	-0.041	0.48	-2	1.3

Table 3. Correlation Between Slope and Intercept of Social Anxiety Score Across the 4 Waves.

	Intercept	**Slope**
Intercept	1.00	
Slope	-0.52	1.00

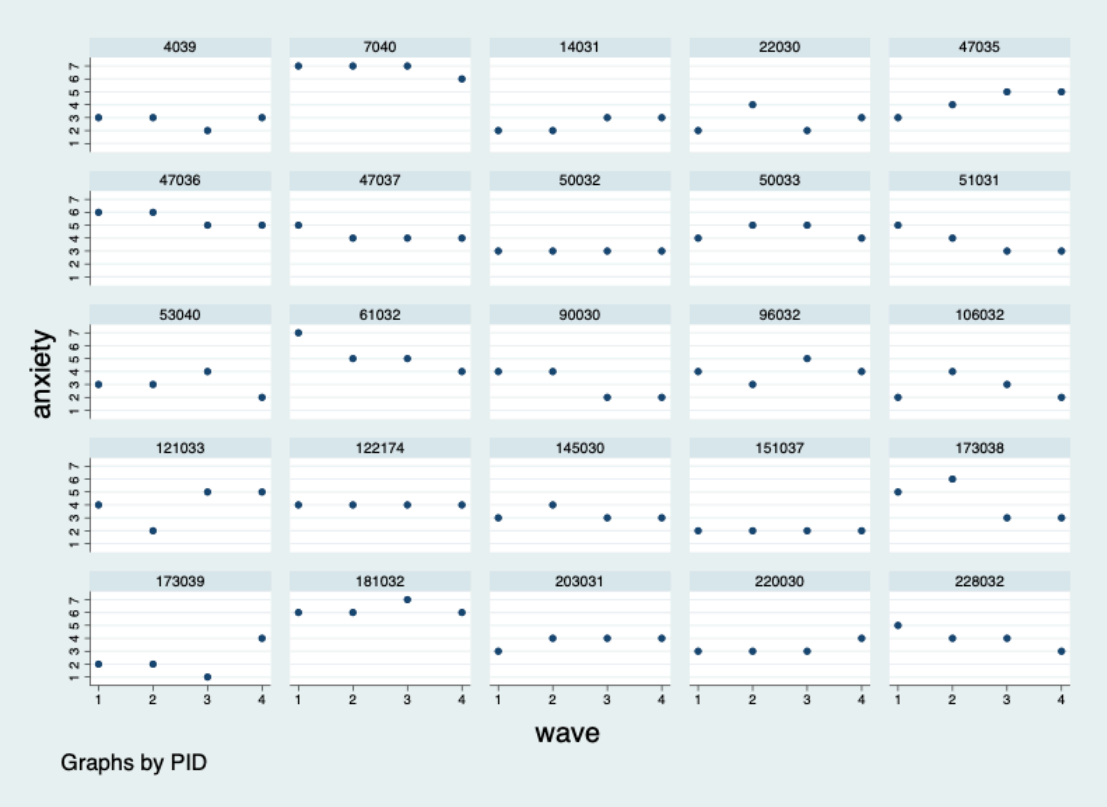
Table 4. Fixed and Random Effects of the 4 Different Models Along with Their Model Fit Measurements

Parameter	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Fixed Effects				
Constant	3.43 (0.00)	3.49 (0.00)	3.48 (0.00)	3.55 (0.00)

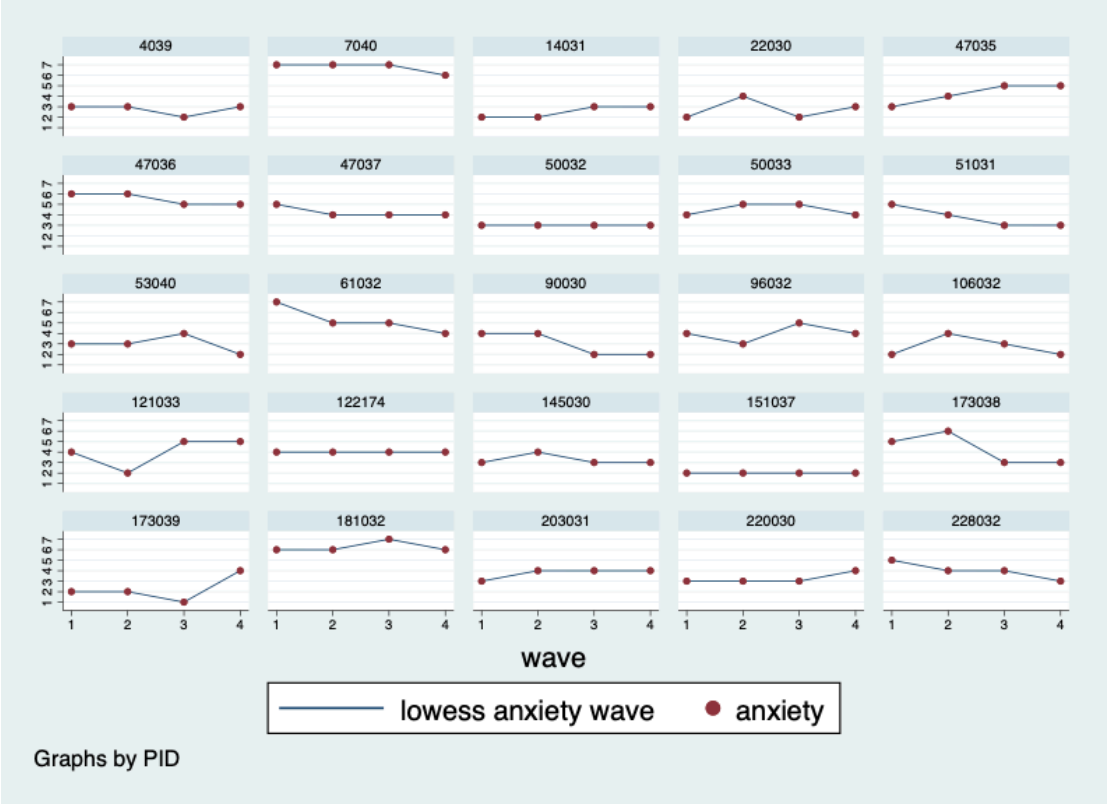
Wave		-0.04 (0.11)	-0.03 (0.41)	-0.20 (0.15)
Active				
No			1.00	1.00
Yes			-0.005 (0.97)	0.04 (0.76)
Active x Wave			-0.02 (0.75)	-0.04 (0.53)
Employed				
No				1.00
Yes				-0.09 (0.36)
Employed x Wave				0.008 (0.89)
Salary				-5.26e-07 (0.93)
Salary x Wave				1.20e-06 (0.56)
Good Health				
No				1.00
Yes				-0.16 (0.14)
Good Health x Wave				0.03 (0.58)
BMI				0.02 (0.20)
BMI x Wave				0.005 (0.34)

Race				
White				1.00
Black				-0.38 (0.007)
Other				0.05 (0.80)
Education				
No College				1.00
Some College				-0.29 (0.05)
College/Higher				-0.22 (0.57)
Random Effects				
Var (wave)	1.15	0.074	0.073	0.068
Var (cons)	/	1.31	1.31	1.25
Var (wave,cons)	/	-0.10	-0.10	-0.09
Var (residual)	0.93	0.80	0.80	0.80
Model Fit				
Log-Likelihood	-2324.4	-2313.8	-2313.6	-2303.0
AIC	4654.7	4639.6	4643.3	4645.9
BIC	4670.6	4671.3	4685.5	4751.5

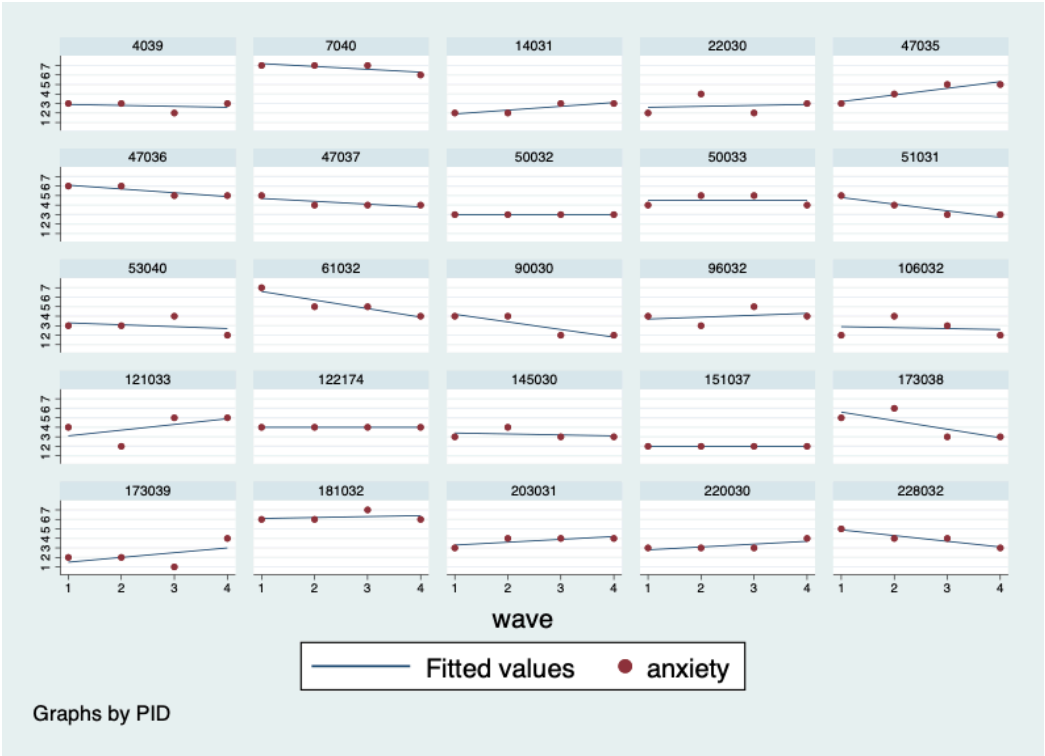
Graph 1. Empirical Growth Plots



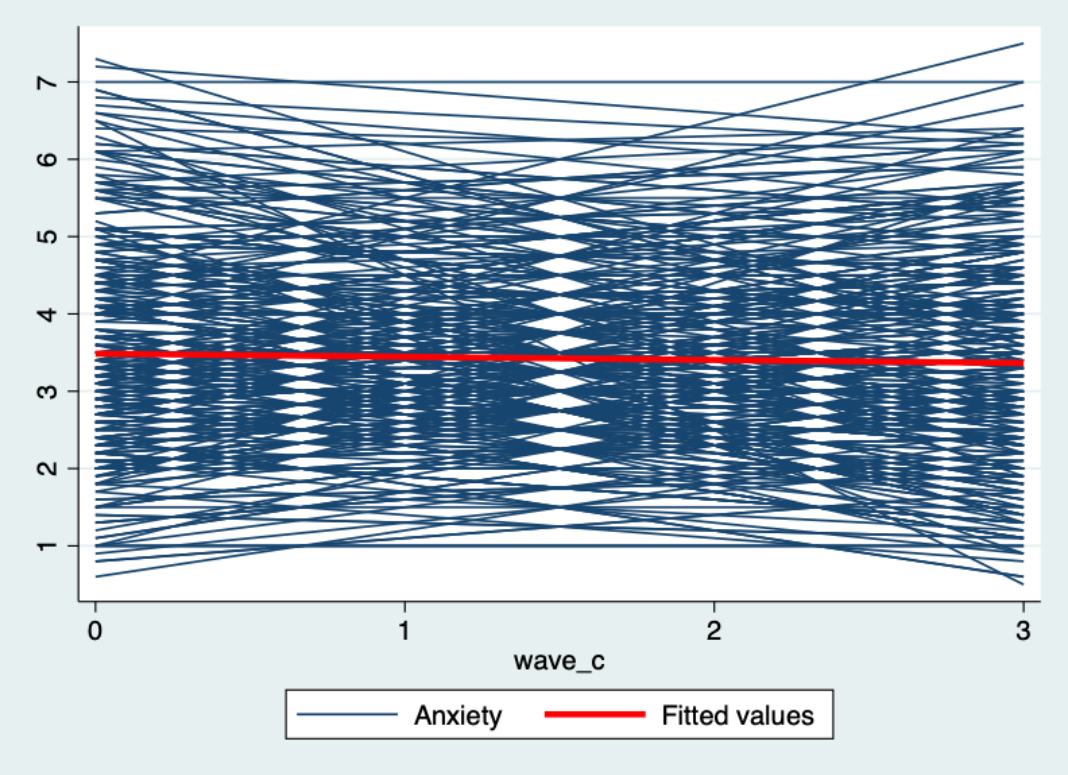
Graph 2. Non-Parametric Standardization Approach in Describing



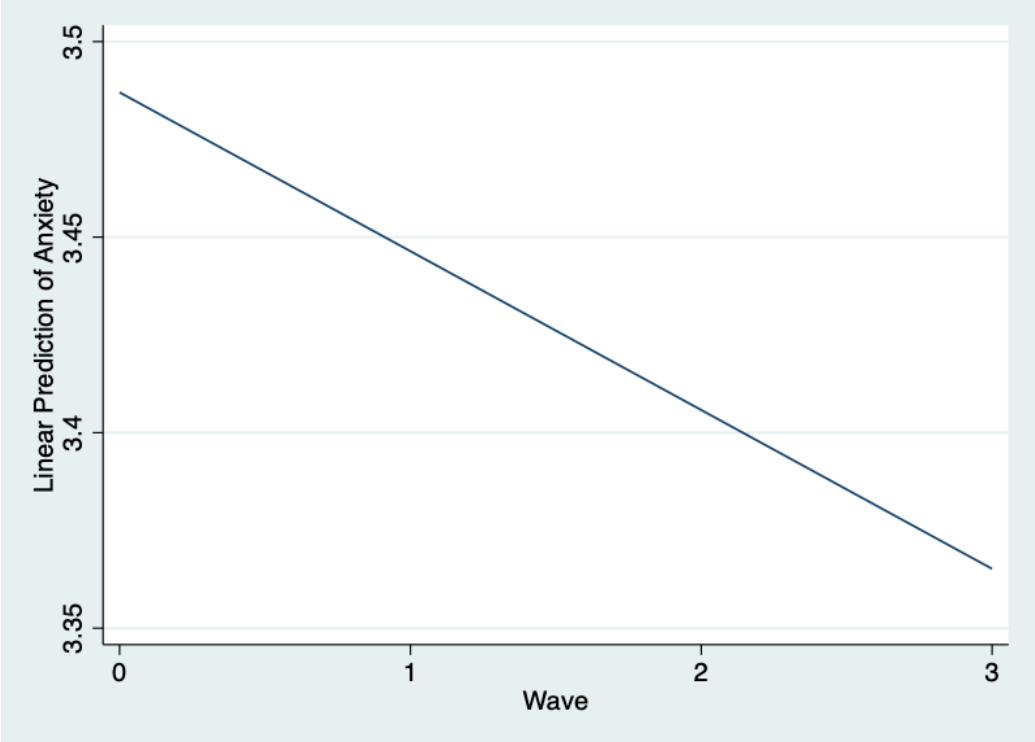
Graph 3. Parametric Standardization Approach in Describing



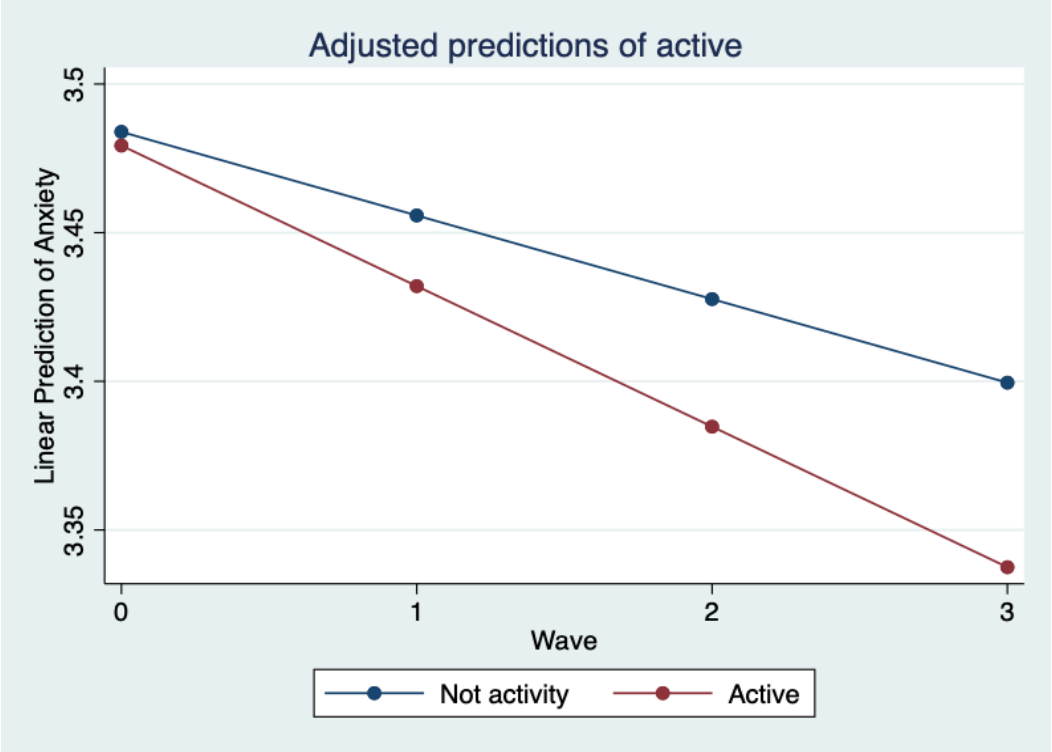
Graph 4. Overall Individual OLS Regressions Along with Mean Trajectory Line



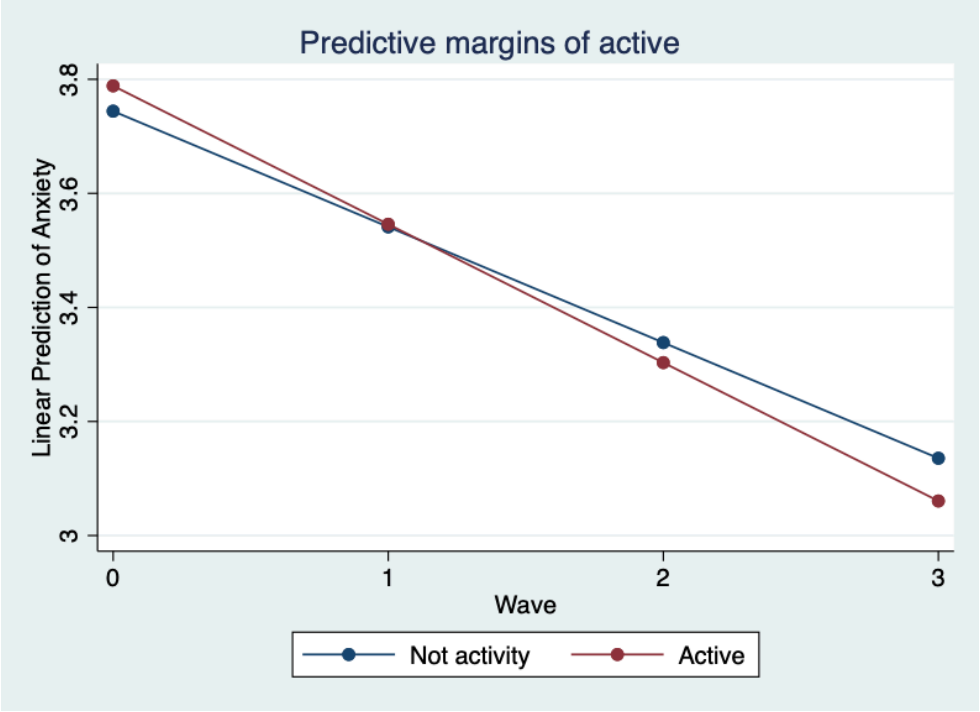
Graph 5. Linear Prediction of Social Anxiety Score Across the 4 Waves



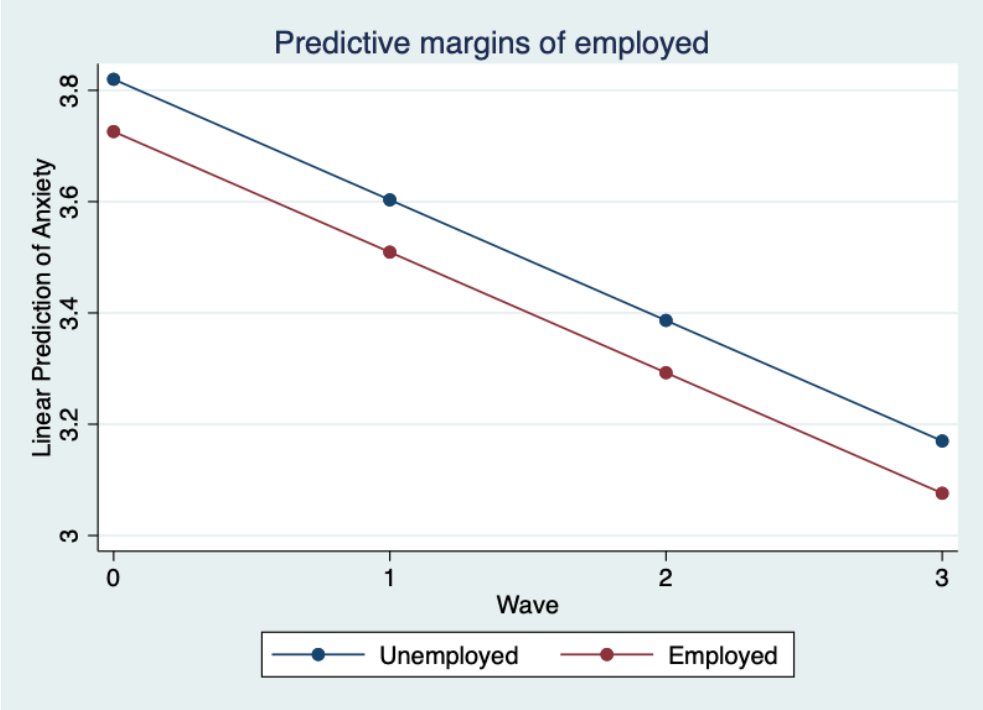
Graph 6. Linear Prediction of Social Anxiety Score Among Physical Active and Non-Active Individuals Across the 4 Waves (Model 3)



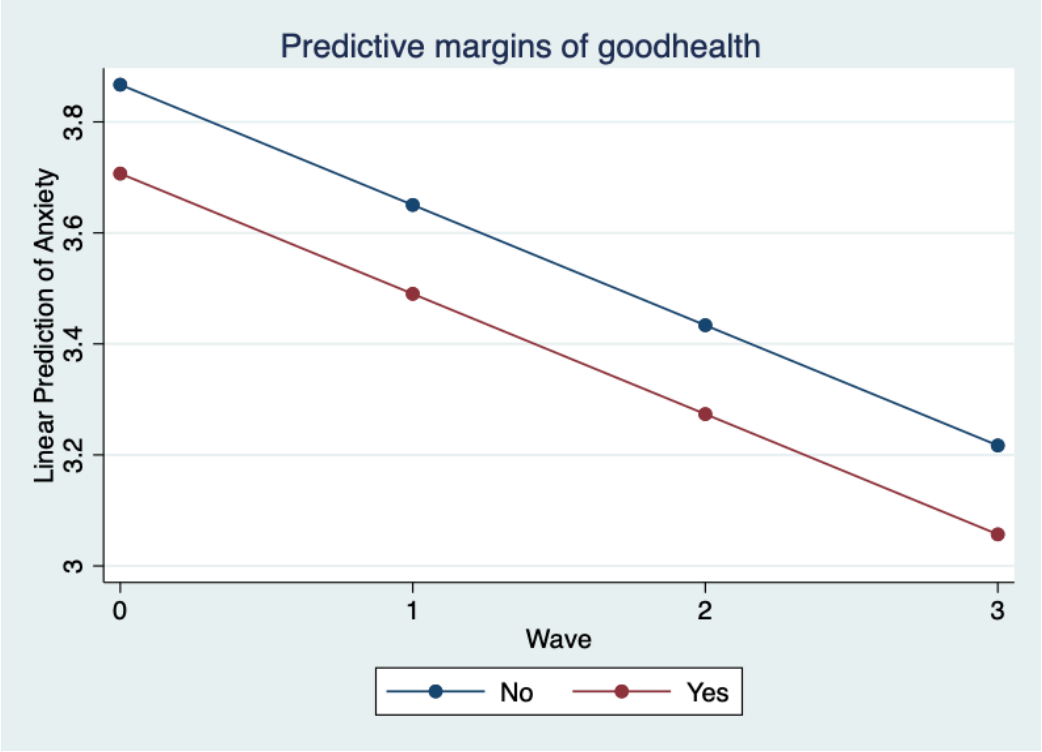
Graph 7. Linear Prediction of Social Anxiety Score Among Physical Active and Non-Active Individuals Across the 4 Waves (Model 4)



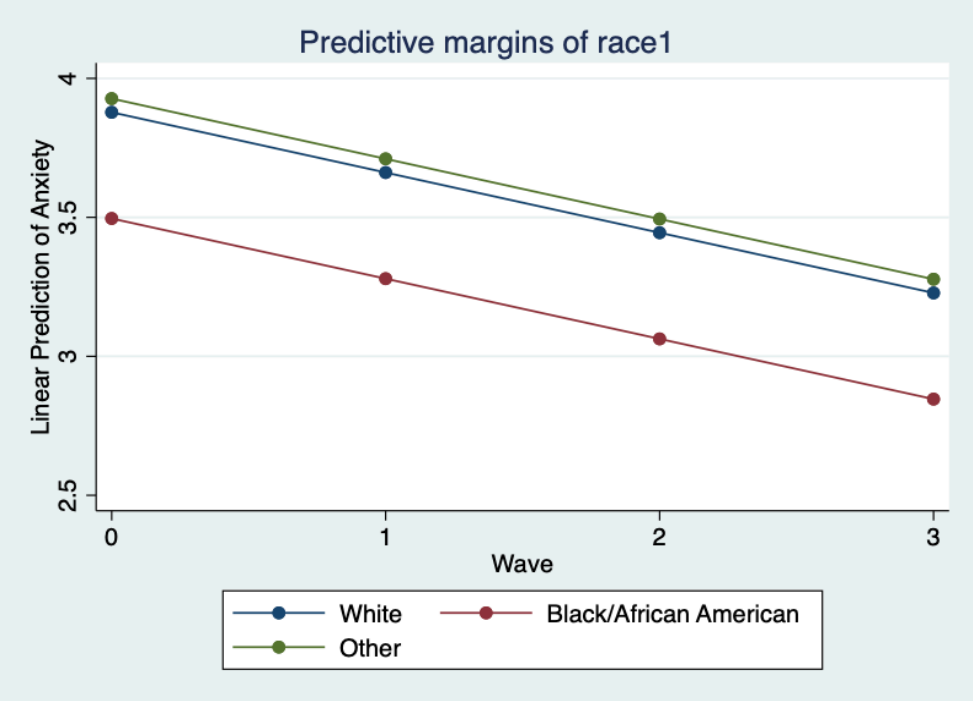
Graph 8. Linear Prediction of Social Anxiety Score Among Employed and Unemployed Individuals Across the 4 Waves (Model 4)



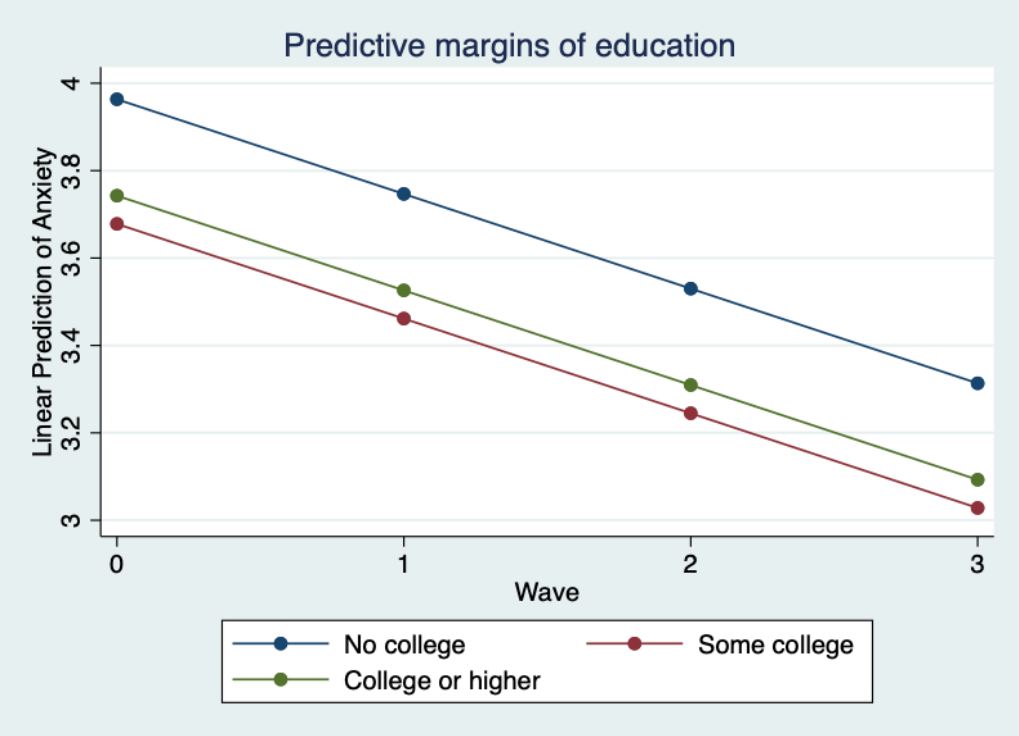
Graph 9. Linear Prediction of Social Anxiety Score Among Individuals With and Without Good Health Across the 4 Waves (Model 4)



Graph 10. Linear Prediction of Social Anxiety Score Among Different Races Across the 4 Waves (Model 4)



Graph 11. Linear Prediction of Social Anxiety Score Among Different education Levels Across the 4 Waves (Model 4)



APPENDIX II

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* Longitudinal Data Analysis *
* Final Project              *
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gen PID = (ER30001*1000) + ER30002

rename TA090136 employment1
rename TA110137 employment2
rename TA130136 employment3
rename TA150128 employment4

rename TA090403 salary1
rename TA110483 salary2
rename TA130503 salary3
rename TA150512 salary4

rename TA090700 health1
rename TA110788 health2
rename TA130808 health3
rename TA150821 health4

rename TA090779 activity1
rename TA110895 activity2
rename TA130928 activity3
rename TA150944 activity4

rename TA090924 hispanic1
rename TA111056 hispanic2
rename TA131091 hispanic3
rename TA151131 hispanic4

rename TA090925 race1
rename TA111057 race2
rename TA131092 race3
rename TA151132 race4

rename TA090989 bmi1
rename TA111131 bmi2
rename TA131223 bmi3
rename TA151283 bmi4

rename TA091008 education1
```

```
rename TA111150 education2
rename TA131241 education3
rename TA151301 education4

save final.dta
sort PID
keep PID employment1 employment2 employment3 employment4 salary1 salary2 salary3
salary4 health1 health2 health3 health4 activity1 activity2 activity3 activity4 race1
race2 race3 race4 bmi1 bmi2 bmi3 bmi4 education1

save final1.dta
use final1, clear
merge 1:1 PID using "anxiety.dta"
drop merge
sort PID
compress
order PID anxiety1 anxiety2 anxiety3 anxiety4 activity1 activity2 activity3 activity4
employment1 employment2 employment3 employment4 salary1 salary2 salary3 salary4
health1 health2 health3 health4 race1 race2 race3 race4 bmi1 bmi2 bmi3 bmi4 education1
save final_raw.dta

*** Recode ***
recode employment1 (1/2 = 1 "Employed")   ///
                       (3/7 = 0 "Unemployed") ///
                               (8 = .a "Other")       ///
                               (98 = .b "Don't Know") ///
                               (99 = .c "NA/Refused") ///
                               (missing = .)          ///
                               , gen(employed1)

recode employment2 (1/2 = 1 "Employed")   ///
                       (3/7 = 0 "Unemployed") ///
                               (8 = .a "Other")       ///
                               (98 = .b "Don't Know") ///
                               (99 = .c "NA/Refused") ///
                               (missing = .)          ///
                               , gen(employed2)

recode employment3 (1/2 = 1 "Employed")   ///
                       (3/7 = 0 "Unemployed") ///
                               (8 = .a "Other")       ///
                               (98 = .b "Don't Know") ///
                               (99 = .c "NA/Refused") ///
```

```
                              (missing = .)          ///
                              , gen(employed3)

recode employment4 (1/2 = 1 "Employed")   ///
                     (3/7 = 0 "Unemployed") ///
                              (8 = .a "Other")       ///
                              (98 = .b "Don't Know") ///
                              (99 = .c "NA/Refused") ///
                              (missing = .)          ///
                              , gen(employed4)

gen goodhealth1 = .
       replace goodhealth1 = 1 if health1 == 1|health1 ==2|health1==3
       replace goodhealth1 = 0 if health1 == 3|health1==4
label define gh 0 "No" 1 "Yes"
label values goodhealth1 gh

gen goodhealth2 = .
       replace goodhealth2 = 1 if health2 == 1|health2 ==2|health2==3
       replace goodhealth2 = 0 if health2 == 3|health2==4
label values goodhealth2 gh

gen goodhealth3 = .
       replace goodhealth3 = 1 if health2 == 1|health3 ==2|health3==3
       replace goodhealth3 = 0 if health2 == 3|health3==4
label values goodhealth3 gh

gen goodhealth4 = .
       replace goodhealth4 = 1 if health4 == 1|health4 ==2|health4==3
       replace goodhealth4 = 0 if health4 == 3|health4==4
label values goodhealth4 gh

recode race1 (1 = 1 "White")   ///
               (2 = 2 "Black/African American") ///
                  (3/7 = 3 "Other")       ///
                     (8 = .a "Don't Know") ///
                  (9 = .b "NA/Refused") ///
                     (missing = .)          ///
                  , gen(race1a)
drop race1
rename race1a race1

recode race2 (1 = 1 "White")   ///
```

```
                (2 = 2 "Black/African American") ///
                   (3/7 = 3 "Other")       ///
                      (8 = .a "Don't Know") ///
                   (9 = .b "NA/Refused") ///
                      (missing = .)          ///
                   , gen(race2a)
drop race2
rename race2a race2

recode race3 (1 = 1 "White")   ///
                (2 = 2 "Black/African American") ///
                   (3/7 = 3 "Other")       ///
                      (8 = .a "Don't Know") ///
                   (9 = .b "NA/Refused") ///
                      (missing = .)          ///
                   , gen(race3a)
drop race3
rename race3a race3

recode race4 (1 = 1 "White")   ///
                (2 = 2 "Black/African American") ///
                   (3/7 = 3 "Other")       ///
                      (8 = .a "Don't Know") ///
                   (9 = .b "NA/Refused") ///
                      (missing = .)          ///
                   , gen(race4a)
drop race4
rename race4a race4

recode education1 (1/3 = 1 "No college") ///
                  (4/5 = 2 "Some college") ///
                            (6/19 = 3 "College or higher") ///
                            (99 = .a "NA/DK/Refused") ///
                            (missing = .) ///
                            , gen(education)

recode activity1 (0 = 0 "Not activity") ///
                           (1/100 = 1 "Active")   ///
                           (998 = .a "DK")        ///
                           (999 = .b "NA/Refused") ///
                           (missing = .)          ///
                           , gen(active1)
```

```
recode activity2 (0 = 0 "Not activity") ///
                          (1/100 = 1 "Active")   ///
                          (998 = .a "DK")        ///
                          (999 = .b "NA/Refused") ///
                          (missing = .)          ///
                          , gen(active2)

recode activity3 (0 = 0 "Not activity") ///
                          (1/100 = 1 "Active")   ///
                          (998 = .a "DK")        ///
                          (999 = .b "NA/Refused") ///
                          (missing = .)          ///
                          , gen(active3)

recode activity4 (0 = 0 "Not activity") ///
                          (1/100 = 1 "Active")   ///
                          (998 = .a "DK")        ///
                          (999 = .b "NA/Refused") ///
                          (missing = .)          ///
                          , gen(active4)


mvdecode salary1, mv(9999998 =.a \ 9999999 =.b)
mvdecode salary2, mv(9999998 =.a \ 9999999 =.b)
mvdecode salary3, mv(9999998 =.a \ 9999999 =.b)
mvdecode salary4, mv(9999998 =.a \ 9999999 =.b)
label define sal .a "DK"              ///
                 .b "NA/Refused"
label values salary1 sal
label values salary2 sal
label values salary3 sal
label values salary4 sal


mvdecode bmi1, mv(99 =.a)
mvdecode bmi2, mv(99 =.a)
mvdecode bmi3, mv(99 =.a)
mvdecode bmi4, mv(99 =.a)
label define b .a "DK/NA/Refused"
label values bmi1 b
label values bmi2 b
label values bmi3 b
label values bmi4 b
```

```
mvdecode anxiety1, mv(9 =.a)
mvdecode anxiety2, mv(9 =.a)
mvdecode anxiety3, mv(9 =.a)
mvdecode anxiety4, mv(9 =.a)
label define a .a "DK/NA/Refused"
label values anxiety1 a
label values anxiety2 a
label values anxiety3 a
label values anxiety4 a

sort PID
keep PID anxiety1 anxiety2 anxiety3 anxiety4 active1 active2 active3 active4 employed1
employed2 employed3 employed4 salary1 salary2 salary3 salary4 goodhealth1 goodhealth2
goodhealth3 goodhealth4 bmi1 bmi2 bmi3 bmi4 race1 race2 race3 race4 education
order PID anxiety1 anxiety2 anxiety3 anxiety4 active1 active2 active3 active4
employed1 employed2 employed3 employed4 salary1 salary2 salary3 salary4 goodhealth1
goodhealth2 goodhealth3 goodhealth4 bmi1 bmi2 bmi3 bmi4 race1 race2 race3 race4
education

save final_data.dta, replace

drop if missing(anxiety1)
drop if missing(anxiety2)
drop if missing(anxiety3)
drop if missing(anxiety4)
drop if missing(active1)
drop if missing(active2)
drop if missing(active3)
drop if missing(active4)
drop if missing(employed1)
drop if missing(employed2)
drop if missing(employed3)
drop if missing(employed4)
drop if missing(salary1)
drop if missing(salary2)
drop if missing(salary3)
drop if missing(salary4)
drop if missing(goodhealth1)
drop if missing(goodhealth2)
drop if missing(goodhealth3)
drop if missing(goodhealth4)
drop if missing(bmi1)
```

```
drop if missing(bmi2)
drop if missing(bmi3)
drop if missing(bmi4)
drop if missing(race1)
drop if missing(education)

*** Descriptive Analyses ***
summarize anxiety*

/*


    Variable |        Obs        Mean    Std. dev.       Min        Max
-------------+---------------------------------------------------------
    anxiety1 |        362    3.497238    1.464726          1          7
    anxiety2 |        362    3.441989    1.476765          1          7
    anxiety3 |        362    3.383978    1.386147          1          7
    anxiety4 |        362    3.381215    1.438867          1          7
*/

tab1 active*
/*

-> tabulation of active1

   RECODE of |
   activity1 |
  (H23B FREQ |
     OF LITE |
    PHYSICAL |
ACTIVITY-HW) |      Freq.     Percent        Cum.
-------------+-----------------------------------
Not activity |        324       89.50       89.50
      Active |         38       10.50      100.00
-------------+-----------------------------------
       Total |        362      100.00

-> tabulation of active2

   RECODE of |
   activity2 |
  (H23B FREQ |
     OF LITE |
```

```
    PHYSICAL |
ACTIVITY--HW |
           ) |      Freq.     Percent        Cum.
-------------+-----------------------------------
Not activity |        272       75.14       75.14
      Active |         90       24.86      100.00
-------------+-----------------------------------
       Total |        362      100.00

-> tabulation of active3

   RECODE of |
   activity3 |
  (H23B FREQ |
     OF LITE |
    PHYSICAL |
ACTIVITY--HW |
           ) |      Freq.     Percent        Cum.
-------------+-----------------------------------
Not activity |        210       58.01       58.01
      Active |        152       41.99      100.00
-------------+-----------------------------------
       Total |        362      100.00

-> tabulation of active4

   RECODE of |
     active4 |
  (RECODE of |
   activity4 |
  (H23B FREQ |
     OF LITE |
    PHYSICAL |
ACTIVITY--HW |
           ) |      Freq.     Percent        Cum.
-------------+-----------------------------------
Not activity |        140       38.67       38.67
      Active |        222       61.33      100.00
-------------+-----------------------------------
       Total |        362      100.00


*/
```

```
tab1 employed*
/*

-> tabulation of employed1

  RECODE of |
employment1 |
        (E1 |
 EMPLOYMENT |
 STATUS 1ST |
   MENTION) |      Freq.     Percent        Cum.
------------+-----------------------------------
 Unemployed |        193       53.31       53.31
   Employed |        169       46.69      100.00
------------+-----------------------------------
      Total |        362      100.00

-> tabulation of employed2

  RECODE of |
employment2 |
        (E1 |
 EMPLOYMENT |
 STATUS 1ST |
   MENTION) |      Freq.     Percent        Cum.
------------+-----------------------------------
 Unemployed |        151       41.71       41.71
   Employed |        211       58.29      100.00
------------+-----------------------------------
      Total |        362      100.00

-> tabulation of employed3

  RECODE of |
employment3 |
        (E1 |
 EMPLOYMENT |
 STATUS 1ST |
   MENTION) |      Freq.     Percent        Cum.
------------+-----------------------------------
 Unemployed |        103       28.45       28.45
   Employed |        259       71.55      100.00
```

```
------------+-----------------------------------
      Total |        362      100.00

-> tabulation of employed4

  RECODE of |
employment4 |
        (E1 |
 EMPLOYMENT |
 STATUS 1ST |
   MENTION) |      Freq.     Percent        Cum.
------------+-----------------------------------
 Unemployed |         71       19.61       19.61
   Employed |        291       80.39      100.00
------------+-----------------------------------
      Total |        362      100.00

*/

summarize salary*
/*

    Variable |        Obs        Mean    Std. dev.       Min        Max
-------------+---------------------------------------------------------
     salary1 |        362    4741.536    9903.978          0     150000
     salary2 |        362    5097.301    8909.688          0      70000
     salary3 |        362    6376.105    11001.98          0      70000
     salary4 |        362    23975.24    20701.86          0     130000

*/

tab1 goodhealth*
/*
-> tabulation of goodhealth1

goodhealth1 |      Freq.     Percent        Cum.
------------+-----------------------------------
         No |        114       31.49       31.49
        Yes |        248       68.51      100.00
------------+-----------------------------------
      Total |        362      100.00

-> tabulation of goodhealth2
```

```
goodhealth2 |      Freq.     Percent        Cum.
------------+-----------------------------------
         No |        126       34.81       34.81
        Yes |        236       65.19      100.00
------------+-----------------------------------
      Total |        362      100.00

-> tabulation of goodhealth3

goodhealth3 |      Freq.     Percent        Cum.
------------+-----------------------------------
         No |        114       31.49       31.49
        Yes |        248       68.51      100.00
------------+-----------------------------------
      Total |        362      100.00

-> tabulation of goodhealth4

goodhealth4 |      Freq.     Percent        Cum.
------------+-----------------------------------
         No |        122       33.70       33.70
        Yes |        240       66.30      100.00
------------+-----------------------------------
      Total |        362      100.00


*/

summarize bmi*
/*
    Variable |        Obs        Mean    Std. dev.       Min        Max
-------------+---------------------------------------------------------
        bmi1 |        362    24.81547    4.815313         16       43.8
        bmi2 |        362    25.65442    5.112783       16.6       49.8
        bmi3 |        362    26.25304    5.421135       16.4       46.8
        bmi4 |        362    27.21519    6.014306       15.6       59.5

*/

tab race1
/*
   RECODE of race1 (L7 |
```

```
      RACE MENTION #1) |      Freq.     Percent        Cum.
-----------------------+-----------------------------------
                 White |        200       55.25       55.25
Black/African American |        118       32.60       87.85
                 Other |         44       12.15      100.00
-----------------------+-----------------------------------
                 Total |        362      100.00


*/

tab education
/*
        RECODE of |
       education1 |
         (HIGHEST |
 EDUCATION LEVEL) |      Freq.     Percent        Cum.
------------------+-----------------------------------
       No college |        101       27.90       27.90
     Some college |        251       69.34       97.24
College or higher |         10        2.76      100.00
------------------+-----------------------------------
            Total |        362      100.00

*/

*** Reshape ***
reshape long anxiety active employed salary goodhealth bmi, i(PID) j(wave)
xtset PID wave

** Individual Growth Plots ***
graph twoway scatter anxiety wave in 1/100, by(PID) ylabel(1(1)7) xlabel(1(1)4)
graph twoway (lowess anxiety wave)(scatter anxiety wave) in 1/100, by(PID)
ylabel(1(1)7) xlabel(1(1)4)
graph twoway (lfit anxiety wave)(scatter anxiety wave)in 1/100, by(PID) ylabel(1(1)7)
xlabel(1(1)4)
*** OLS ***
preserve
gen wave_c=(wave-1)
tab wave_c
egen grp=group(PID)
generate p2=.
forvalues i = 1/362 {
```

```
  quietly regress anxiety wave_c if grp==`i'
  quietly predict p
  quietly replace p2=p if grp==`i'
  quietly drop p
 }
graph twoway (scatter p2 wave_c, msym(i) connect(L))(lfit anxiety wave_c,
ylabel(1(1)7) xlabel(0(1)3) lc(red) lwidth(thick) legend(lab (1 "Anxiety")))


*** Statistics ***
statsby _b[_cons] _se[_cons] _b[wave_c] _se[wave_c] (e(rmse)^2) e(r2), by(PID)
saving(final_data2): regress anxiety wave_c
clear all
use final_data2
list, clean
rename _stat_1 intercept
rename _stat_3 slope
save final_data2, replace

** Descriptive statistics of individual regression estimates
sum  intercept slope
/*
    Variable |        Obs        Mean    Std. dev.       Min        Max
-------------+---------------------------------------------------------
   intercept |        362    3.487017    1.371403         .6        7.3
       slope |        362   -.0406077     .484991         -2        1.3


*/

** Correlation between estimated intercepts and slopes (SLIDE 10)
correlate intercept slope
/*
             | interc~t    slope
-------------+------------------
   intercept |   1.0000
       slope |  -0.5151   1.0000

*/


mixed anxiety|| PID:,  var  mle
/*
```

```
. mixed anxiety|| PID:,  var  mle

Performing EM optimization ...

Performing gradient-based optimization:
Iteration 0:   log likelihood = -2324.3614
Iteration 1:   log likelihood = -2324.3614

Computing standard errors ...

Mixed-effects ML regression                     Number of obs     =      1,448
Group variable: PID                             Number of groups  =        362
                                                Obs per group:
                                                              min =          4
                                                              avg =        4.0
                                                              max =          4
                                                Wald chi2(0)      =          .
Log likelihood = -2324.3614                     Prob > chi2       =          .

------------------------------------------------------------------------------
     anxiety | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
       _cons |   3.426105   .0617056    55.52   0.000     3.305164    3.547046
------------------------------------------------------------------------------

------------------------------------------------------------------------------
  Random-effects parameters  |   Estimate   Std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
PID: Identity                |
                  var(_cons) |   1.145782   .1029365      .9607948    1.366387
-----------------------------+------------------------------------------------
               var(Residual) |   .9302487   .0399208      .8552055    1.011877
------------------------------------------------------------------------------
LR test vs. linear model: chibar2(01) = 518.23        Prob >= chibar2 = 0.0000

*/

estat icc
/*
Intraclass correlation

------------------------------------------------------------------------------
                       Level |        ICC   Std. err.     [95% conf. interval]
```

```
------------------------------+------------------------------------------------
                          PID |     .55191    .025534      .5015067     .601269
------------------------------------------------------------------------------

*/
estat ic
/*
Akaike's information criterion and Bayesian information criterion

-------------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df        AIC        BIC
-------------+-----------------------------------------------------------------
           . |      1,448          .  -2324.361       3   4654.723   4670.557
-------------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.

*/
est store model_0


*** Unconditional Growth Model ***
mixed anxiety wave_c || PID: wave_c, cov(un)
/*

Performing EM optimization ...

Performing gradient-based optimization:
Iteration 0:   log likelihood =  -2313.962
Iteration 1:   log likelihood = -2313.8224
Iteration 2:   log likelihood = -2313.8223

Computing standard errors ...

Mixed-effects ML regression                     Number of obs     =      1,448
Group variable: PID                             Number of groups  =        362
                                                Obs per group:
                                                              min =          4
                                                              avg =        4.0
                                                              max =          4
                                                Wald chi2(1)      =       2.54
Log likelihood = -2313.8223                     Prob > chi2       =     0.1107

------------------------------------------------------------------------------
```

```
     anxiety | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
      wave_c |  -.0406077   .0254553    -1.60   0.111    -.0904993    .0092838
       _cons |   3.487017   .0719797    48.44   0.000     3.345939    3.628094
------------------------------------------------------------------------------

------------------------------------------------------------------------------
  Random-effects parameters  |   Estimate   Std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
PID: Unstructured            |
                 var(wave_c) |      .0736   .0193794      .0439289    .1233118
                  var(_cons) |   1.312167   .1425186      1.060565    1.623457
           cov(wave_c,_cons) |    -.10021   .0412167     -.1809932   -.0194268
-----------------------------+------------------------------------------------
               var(Residual) |   .8048338   .0423011      .7260526    .8921632
------------------------------------------------------------------------------
LR test vs. linear model: chi2(3) = 537.87                Prob > chi2 = 0.0000

Note: LR test is conservative and provided only for reference.

*/
estat ic
/*
Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df        AIC        BIC
-------------+---------------------------------------------------------------
           . |      1,448          .  -2313.822       6   4639.645   4671.312
-----------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.

*/
est store model_1

predict m2
graph twoway (line m2 wave_c, sort), xlabel(0 1 2 3) xtitle("Wave") ytitle("Linear
Prediction of Anxiety")


*** Model with main iv***
mixed anxiety c.wave_c##i.active || PID: wave_c, var cov(un)
/*
```

```
Performing EM optimization ...

Performing gradient-based optimization:
Iteration 0:   log likelihood = -2313.7814
Iteration 1:   log likelihood = -2313.6389
Iteration 2:   log likelihood = -2313.6387

Computing standard errors ...

Mixed-effects ML regression                     Number of obs     =      1,448
Group variable: PID                             Number of groups  =        362
                                                Obs per group:
                                                              min =          4
                                                              avg =        4.0
                                                              max =          4
                                                Wald chi2(3)      =       2.92
Log likelihood = -2313.6387                     Prob > chi2       =     0.4047

------------------------------------------------------------------------------
     anxiety | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
      wave_c |  -.0281218   .0337904    -0.83   0.405    -.0943499    .0381062
             |
      active |
     Active  |   -.004613   .1382685    -0.03   0.973    -.2756143    .2663884
             |
      active#|
    c.wave_c |
     Active  |  -.0191531   .0609228    -0.31   0.753    -.1385596    .1002535
             |
       _cons |   3.483908   .0755466    46.12   0.000     3.335839    3.631976
------------------------------------------------------------------------------

------------------------------------------------------------------------------
  Random-effects parameters  |   Estimate   Std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
PID: Unstructured            |
                 var(wave_c) |   .0732015    .019363      .0435877    .1229353
                  var(_cons) |   1.312227   .1425334        1.0606    1.623551
           cov(wave_c,_cons) |  -.0997825   .0411931     -.1805195   -.0190456
-----------------------------+------------------------------------------------
               var(Residual) |   .8049338   .0423098      .7261367    .8922817
------------------------------------------------------------------------------
```

```
LR test vs. linear model: chi2(3) = 538.17                Prob > chi2 = 0.0000

Note: LR test is conservative and provided only for reference.

*/
estat ic
/*
. estat ic

Akaike's information criterion and Bayesian information criterion

------------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df        AIC        BIC
-------------+----------------------------------------------------------------
           . |      1,448          .  -2313.639       8   4643.277   4685.501
------------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.

*/

est store model_2

margins active, at(wave_c = (0(1)3))
marginsplot, noci xtitle("Wave") ytitle("Linear Prediction of Anxiety")


*** Model with all varibles***
gen wave_employ = (employed*wave_c)
gen wave_salary = (salary*wave_c)
gen wave_gh = (goodhealth*wave_c)
gen wave_bmi = (bmi*wave_c)

mixed anxiety c.wave_c##i.active i.employed wave_employ c.salary wave_salary
i.goodhealth wave_gh c.bmi wave_bmi i.race1 i.education|| PID: wave_c, cov(un) var mle
/*
Performing EM optimization ...

Performing gradient-based optimization:
Iteration 0:   log likelihood = -2303.1363
Iteration 1:   log likelihood = -2302.9505
Iteration 2:   log likelihood = -2302.9502
Iteration 3:   log likelihood = -2302.9502
```

```
Computing standard errors ...

Mixed-effects ML regression                     Number of obs     =      1,448
Group variable: PID                             Number of groups  =        362
                                                Obs per group:
                                                              min =          4
                                                              avg =        4.0
                                                              max =          4
                                                Wald chi2(15)     =      24.68
Log likelihood = -2302.9502                     Prob > chi2       =     0.0544

------------------------------------------------------------------------------
       anxiety | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
---------------+--------------------------------------------------------------
        wave_c |  -.2028571   .1407296    -1.44   0.149     -.478682    .0729678
               |
        active |
       Active  |   .0444116   .1466551     0.30   0.762    -.2430271    .3318504
               |
        active#|
      c.wave_c |
       Active  |  -.0397811   .0638925    -0.62   0.534    -.1650082     .085446
               |
      employed |
     Employed  |  -.0939453    .103028    -0.91   0.362    -.2958765    .1079859
   wave_employ |   .0084029   .0600663     0.14   0.889    -.1093248    .1261307
        salary |  -5.26e-07   5.63e-06    -0.09   0.926    -.0000116    .0000105
   wave_salary |   1.20e-06   2.06e-06     0.58   0.561    -2.85e-06    5.25e-06
               |
    goodhealth |
           Yes |  -.1601466   .1083901    -1.48   0.140    -.3725873     .052294
       wave_gh |    .030848   .0554929     0.56   0.578     -.077916     .139612
           bmi |   .0167924   .0129442     1.30   0.195    -.0085777    .0421625
      wave_bmi |   .0045993   .0047873     0.96   0.337    -.0047837    .0139823
               |
         race1 |
Black/Afric..  |   -.381965   .1423482    -2.68   0.007    -.6609624   -.1029676
         Other |   .0492992    .193154     0.26   0.799    -.3292758    .4278741
               |
     education |
 Some college  |  -.2851924   .1426495    -2.00   0.046    -.5647803   -.0056046
College or ..  |  -.2206474   .3884948    -0.57   0.570    -.9820832    .5407884
               |
```

```
         _cons |   3.552324   .3604571     9.86   0.000     2.845841    4.258807
------------------------------------------------------------------------------

------------------------------------------------------------------------------
  Random-effects parameters  |   Estimate   Std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
PID: Unstructured            |
                 var(wave_c) |    .068093   .0191575      .0392304    .1181904
                  var(_cons) |   1.246463   .1385488      1.002456    1.549864
           cov(wave_c,_cons) |  -.0895319   .0407899     -.1694787   -.0095851
-----------------------------+------------------------------------------------
               var(Residual) |   .8042357    .042323      .7254186    .8916162
------------------------------------------------------------------------------
LR test vs. linear model: chi2(3) = 515.10                Prob > chi2 = 0.0000

Note: LR test is conservative and provided only for reference.


*/
estat ic
/*
. estat ic

Akaike's information criterion and Bayesian information criterion

------------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df        AIC        BIC
-------------+----------------------------------------------------------------
           . |      1,448          .   -2302.95      20     4645.9   4751.459
------------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.

*/

est store model_3

margins active, at(wave_c = (0(1)3))
marginsplot, noci xtitle("Wave") ytitle("Linear Prediction of Anxiety")

margins employed, at(wave_c = (0(1)3))
marginsplot, noci xtitle("Wave") ytitle("Linear Prediction of Anxiety")

margins goodhealth, at(wave_c = (0(1)3))
```

```
marginsplot, noci xtitle("Wave") ytitle("Linear Prediction of Anxiety")

margins race1, at(wave_c = (0(1)3))
marginsplot, noci xtitle("Wave") ytitle("Linear Prediction of Anxiety")

margins education, at(wave_c = (0(1)3))
marginsplot, noci xtitle("Wave") ytitle("Linear Prediction of Anxiety")

margins, at(wave_c = (0(1)3) salary = (0(5000)15000))
marginsplot, noci xtitle("Wave") ytitle("Linear Prediction of Anxiety")

margins, at(wave_c = (0(1)3) bmi = (15.6(10)59.5))
marginsplot, noci xtitle("Wave") ytitle("Linear Prediction of Anxiety")

*** Model Fit
lrtest model_0 model_1
lrtest model_1 model_2
lrtest model_2 model_3
/*
. lrtest model_0 model_1

Likelihood-ratio test
Assumption: model_0 nested within model_1

 LR chi2(3) =  21.08
Prob > chi2 = 0.0001

Note: The reported degrees of freedom assumes the null hypothesis is not on the
      boundary of the parameter space. If this is not true, then the reported
      test is conservative.

. lrtest model_1 model_2

Likelihood-ratio test
Assumption: model_1 nested within model_2

 LR chi2(2) =   0.37
Prob > chi2 = 0.8323

. lrtest model_2 model_3

Likelihood-ratio test
Assumption: model_2 nested within model_3
```

```
LR chi2(12) =  21.38
Prob > chi2 = 0.0451

*/
```