

THE IMPACT OF NATURAL DISASTERS ON ACADEMIC ACHIEVEMENT
AMONGST EMERGING ADULTS

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DEDICATION

I would like to dedicate this work to my parents, Mr. Lazaro Serrano and Mrs. Olga Lydia Serrano, without whose unwavering support and encouragement this undertaking would not have been possible. Thank you for your ongoing sacrifices; I may never be able to repay you, but I will try.

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ABSTRACT

Natural disasters are largely unexpected, and their disruptive nature can devastate people's homes, their finances, and their psychological well-being. Less, however, is known about the extent to which natural disasters can impact students' academic achievement levels. Previous studies on natural disasters and achievement have largely contributed contradictory results, which suggests the need for more robust methodologies. Focused on Hurricane Harvey, the present study sampled 646 college students that had been living in the Houston area during the hurricane. Baseline data were collected shortly after the hurricane and official semester GPA registrar records were collected pre- and post-Hurricane Harvey. With a comprehensive index of hurricane exposure and multiple relevant controls, this study assessed whether hurricane exposure adversely affects future levels of academic achievement. Our study results suggested that, after controlling for pre-hurricane achievement and demographics, hurricane exposure was not associated with post-hurricane academic achievement. Implications of this study and future directions for natural disaster research are discussed.

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The Impact of Natural Disasters on Academic Achievement Amongst Emerging Adults

Introduction

An estimated average of 210 million people worldwide are adversely affected by natural disasters every year (Center for Research on Epidemiology of Disasters (CRED), 2018). Additionally, the frequency of natural disaster occurrences has been high since the 1990s, with the CRED reporting 277 events in 1990, 432 in 2005, and 318 in 2017 (CRED, 2018). The year 2017 experienced a series of record-breaking natural disaster events, where 22 million people worldwide were injured, left homeless, or otherwise affected post-hurricane (EM-DAT, 2019) and, solely considering the United States, three different hurricanes cumulatively cost \$265 billion (NOAA, 2019). Natural disasters are destructive in many ways as they can damage property, finances, work/school stability, and one's overall sense of security, all of which can potentially adversely affect an individual's overall health and well-being. It is perhaps then no surprise that previous studies have linked disasters to psychological problems (Goenjian et al., 2001; Katz et al., 2002; Pina et al., 2008) and strained social ties and problems at work and school (Silverman & La Greca, 2002; Bonanno et al., 2010).

Still, what is surprising is that natural disaster research has not focused more attention on a disastrous event's potential impact on academic functioning. Given the extended period of academic life and the ramifications of an unsuccessful academic trajectory, it would be important to assess whether hurricane exposure can adversely affect academic achievement. One measure of school performance is student's grade point average (GPA), and higher grades/GPA have been linked to higher salary/income

(Roth & Clark, 1998; Strenze, 2007) and higher educational and occupational levels (Strenze, 2007). Evidently, threats to GPA, then, have the potential to adversely affect one's future education and job opportunities alike. However, very little is known currently about the extent to which natural disasters can impact academic functioning, especially among emerging adults.

Stress Theory

When faced with a natural disaster or other disruptive or traumatic event, individuals naturally appraise the event impact and then attempt to cope through the situation. According to stress theory, first proposed in 1984, psychological stress occurs when individuals perceive their available personal resources to be overwhelmed by exacting environmental demands (Lazarus, 1990).

Excessive levels of stress have been associated with symptoms of depression and posttraumatic stress (Goenjian et al., 2001), as well as with cognitive disorders in a recent review of the literature (Yaribeygi et al., 2017). Similarly, studies have also suggested that adverse life events can place children at an increased risk for autoimmune disease hospitalization (Dube et al., 2009), substance use (Felitti et al., 1998), suicide attempt (Felitti et al., 1998), and post-traumatic stress (McLaughlin et al., 2017). For its part, post-traumatic stress has been linked to several health conditions including, emotion dysregulation (Seligowski et al., 2015), arthritis (Qureshi et al., 2009), coronary heart disease (Vacarino et al., 2013), and disease mortality (Boscarino, 2008).

Based on these study results it is apparent that stressful events can adversely affect various life aspects, and it would be quite reasonable that in the face a natural disaster one might be unable to prioritize work and school productivity in favor of new

developing concerns (e.g., compromised finances, health, and well-being). It is instead possible that following a natural disaster, an individual may need to focus their cognitive resources on elements that are essential to survival and well-being. A potential byproduct of an adverse event could then be temporary or extended setbacks in academic achievement, as students may be unable to complete assignments, actively participate in class, or even attend regularly scheduled classes (assuming classes are still being held, and in the event of school closures, students may have difficulty managing such a disruption).

Previous Literature

Although not extensive, the existing trauma and achievement literature has placed a disproportionate focus on children and adolescents. It should also be noted that many of these previous studies have assessed group-level disaster data, assumed disaster exposure, relied on self-report data, and failed to consider pre-disaster achievement levels and other relevant controls. Among studies with children and adolescents, most have found lower academic achievement/IQ in certain domains for students who experience a natural disaster. Some of these studies have taken a group-level approach (Ward et al., 2008; Lamb, Gross & Lewis, 2013; Tatsuta et al., 2015; Gibbs et al., 2019) and assumed levels of exposure based on location sampling (Lamb, Gross & Lewis, 2013; Gibbs et al., 2019). Of these, Ward and colleagues (2008) directly compared hurricane-displaced students to non-displaced students, finding lower achievement among the displaced group (but score differences across displaced and nondisplaced groups demonstrated no statistically significant changes pre- and post-hurricane), while Tatsuta and colleagues (2015) compared child assessments administered before and after an earthquake event to

find lower verbal IQ (but not performance IQ) scores for students in the post-earthquake assessment group. Notably, Lamb and colleagues (2013) included pre-hurricane math test levels, and report that their most affected group experienced increases pre-hurricane, decreases during the hurricane, and increases post-hurricane (although not all study groups experienced the same trajectories). Fuller (2014) also assessed exposure levels based on location, along with math and reading tests, and found links between prenatal hurricane exposure and lower future test scores in the third grade.

Some natural disasters are indeed so impactful that it could be reasonable to assume that most people sampled in a given location experienced severe/substantial amounts of disaster trauma. However, relying on location sampling can introduce significant limitations, like potentially assigning someone an incorrect exposure level (one that minimizes or inflates their true exposure level) by ignoring their individual exposure levels. Among studies that have measured individual levels of disaster exposure, the link between disaster exposure and achievement presents different results. La Greca, Silverman & Wasserstein (1998) assessed three types of hurricane exposure (scales: life-threatening events, perceived life threat, and loss and disruption) with repeated measured of academic skills (teacher and peer-rated) pre-hurricane and three months post-. Their results suggested that, controlling for pre-hurricane levels, none of their three disaster exposure measures were significantly correlated with academic skills (La Greca et al., 1998). Similarly, Weems and colleagues (2013) collected disaster measures (repeated for PTSD, test anxiety, and depression) 24 months post-hurricane and test scores 31 months post-hurricane, and generated two indices of hurricane exposure: “exposure experiences” (objective: *home badly damaged or destroyed* and subjective:

thought they might die during the storm) and “hurricane-related distress” (“*Overall how scared or upset were you during the hurricane?*”). Researchers Weems and colleagues (2013) also found no statistically significant correlations between hurricane exposure/distress and standardized test scores. It should be noted that Weems and colleagues (2013) administered a disaster exposure measure that combined objective and subjective items, which may explain the discrepant results.

Beyond the research on children and adolescents, the disaster literature has neglected the study of academic impacts among emerging adults (i.e., 18-25-year-olds), apart from a few exceptions described below. Emerging adulthood is a pivotal developmental stage that is depicted by changes in social roles (Roberts, Walton, & Viechtbauer, 2006). It is during the emerging adulthood stage that individuals can be most at-risk for large-scale negative experiences (as is the case of natural disasters). Indeed, college students themselves believe that natural disaster experiences affect their academics, with a large qualitative study reporting that in a hurricane-affected sample of college students (81% of whom had reported home damage), 74% of students felt their achievement levels had suffered post-disaster, and 36% had withdrawn from their post-disaster enrolled courses (Ladd, Gill, & Marszalek, 2007). Similarly, three months post-hurricane researchers Shwalb and Shwalb (2005) assessed a sample of displaced college students (and compared them to a nondisplaced sample) and found that a large percentage of students reported that the hurricane had affected their academics, led to lower academic motivation, and worries about academic finances (although whether or not group differences reached statistical significance for any of these was not discussed).

To date, only four studies have assessed the link between direct *disaster exposure*

and college achievement. First, based on a sample of 407 students, Ceyhan and Ceyhan (2007) surveyed college students six years after an earthquake event, prompting them to self-report data on some disaster experiences (e.g., level of houses damage, staying in tents or prefabricated houses) and GPA during the earthquake. The researchers found lower self-reported cumulative GPA among earthquake-exposed students (compared to students “not exposed”), but no statistically significant relationship between cumulative GPA and any of the standalone earthquake exposure items (e.g., level of house damage, losing a family member; Ceyhan & Ceyhan, 2007). Researchers Tahlil and Jones (2008) collected self-report data three years post-tsunami on disaster experiences (e.g., lost a family member, home damage) and on pre- and post-disaster GPA. The researchers found no statistically significant correlation between any tsunami exposure items and post-disaster GPA, and no statistically significant difference between pre- and post-tsunami GPA (Tahlil & Jones, 2008).

About a month following a post-tropical cyclone, researchers Doyle, Lockwood, & Comiskey (2017) collected self-report measures (including disaster exposure and semester GPA) on a sample of 281 college students. After controlling for demographic factors (sex, age, SES, and ethnicity (white/non-white)), Doyle and colleagues (2017) found that measures of objective disaster exposure (i.e., being displaced, having lost power, missed school when the university was open) and an index of psychological distress were not statistically significantly linked to post-disaster semester GPA. However, the researchers did find the following links: students that experienced more headaches (a standalone distress item) and more loss of academic motivation post-disaster both had a lower post-disaster semester GPA (Doyle et al., 2017). About 2.5

years post-hurricane, one dissertation assessed 233 college students' exposure levels with one item: "*As a college student, how severely impacted were you after Hurricane Katrina. (example: displaced, lost home/damaged home, parents lost home/damaged home, lost car, lost job, lost income, suffered injury, lost loved ones, or had relatives impacted)*" (on a scale from "no impact" to "great impact"), and asked participants to self-report on their academics during the semester of hurricane impact and the academic year that followed (being prompted to answer whether the hurricane had led to unfavorable test scores, a suffering of overall GPA, failing of college courses, or failed ability to concentrate or effectively learn; Coleman, 2009). Based on self-identified exposure levels, students were separated into "moderate impact" ($n = 126$) and "significant impact" ($n = 99$) groups, and the researcher found statistically significantly lower perceptions of post-hurricane academics (the previous four items combined) among students "significantly affected" (compared to those "moderately affected"; Coleman, 2009).

In sum, prior research results on academic achievement and natural disaster exposure have presented some contradictory results, which could potentially be due to several study limitations. Notably, most previous studies have not measured (or not controlled for) relevant confounds in their analyses. Primarily, because past academic performance is associated with future performance (Salanova et al., 2010), it is imperative to control for pre-disaster achievement levels. Of the studies reviewed here, only very few had measures of pre-disaster achievement, and only La Greca and colleagues (1998) report results controlling for pre-disaster academic skills. Another notable control is personality since college GPA has been linked primarily to

conscientiousness levels (even after controlling for high school GPA and intelligence; Poropat, 2009). Notably, of the natural disaster and achievement studies reviewed here, no study included personality, and many also did not include age, sex, and SES as control variables in their analyses (the few exceptions that include some demographic controls being: La Greca et al., 1998; Tatsuta, et al., 2015; Doyle et al., 2017; Gibbs et al., 2019). It is also important to control for age, sex, and SES, as higher GPA levels have typically been found among women and students that are older and from higher SES backgrounds (Baker, 2003; Walpole, 2003). Although, notably, Doyle and colleagues (2017) did report higher post-disaster GPA among younger students.

Another limitation of the previous literature is that studies that have included measures of direct disaster exposure (La Greca et al., 1998; Tahlil & Jones, 2008; Weems et al., 2013) have largely included small student samples, ranging from 92 to 233 (the exceptions to having small samples being Ceyhan & Ceyhan, 2007; Coleman, 2009; Doyle et al., 2017). Also, all studies that have used GPA as a measure of achievement have collected self-reports of GPA and many have collected this data multiple years after a disaster (the exception here being Doyle et al., 2017, having collected self-reported GPA in the month following the disaster). Along these lines, for the studies that assessed direct *disaster exposure* and college achievement years after the disaster took place (Ceyhan & Ceyhan, 2007; Tahlil & Jones, 2008; Coleman, 2009), it could also be the case that their participant samples were not exactly emerging adults at the time they experienced the initial impact of the disaster. Of these studies, only Ceyhan and Ceyhan (2007) reported participant ages during the disaster (17-27, $M = 21$), but none of these studies specify whether participants were enrolled in high school or college when the

disaster took place.

Present Study

In efforts to disentangle prior inconsistent research findings, the present study aims to assess the relationship between hurricane exposure and academic achievement. This study is focused on the effects of Hurricane Harvey, which impacted the southern United States in August 2017. At an estimated \$125 billion in economic damages, Hurricane Harvey was one of the most damaging natural disasters in the United States, second only to Hurricane Katrina in 2005 (Blake & Zelinsky, 2018). At its peak, Hurricane Harvey stood as a category four hurricane with excessive amounts of rainfall and flooding. The extensive hurricane damages include estimated flooding of more than 300,000 structures and 500,000 cars, evacuation of 40,000 individuals, and the completion of 30,000 water rescues (Blake & Zelinsky, 2018). At least nineteen months after the initial hurricane impact, recovery was still taking place as the affected communities labored to restore damages and return to normalcy. For the current study, a college student sample was surveyed shortly after the initial impact of Hurricane Harvey.

Hypotheses

We hypothesized that hurricane exposure would predict academic achievement (semester GPA) while controlling for pre-disaster achievement levels. Specifically, we expected that the more exposed students were by the hurricane, the lower their semester GPA would be at the end of the semester.

In addition, as exploratory analyses, we assessed personality traits as moderators of the effect of hurricane exposure on academic achievement. It was expected that higher levels of conscientiousness and lower levels of neuroticism might weaken the negative

impact of hurricane exposure on academic achievement.

Novel Contribution

The present study made several novel contributions to the literature: (a) rather than assume degree of disaster exposure due to location or a single question, degree of hurricane exposure was objectively measured through a comprehensive combination of items, (b) as opposed to collecting GPA through self-report, official semester GPA records from the university registrar were collected, (c) semester GPA was also collected pre-disaster, allowing us to control for pre-existing levels of academic functioning in our analyses, (d) personality traits were measured and will be controlled for in the analyses. Lastly, (e) we focus on emerging adulthood, which constitutes a critical time period in development and has received little attention from the disaster literature.

Methods

Regression analyses were conducted to examine the link between hurricane exposure and semester GPA (for the semester during which Hurricane Harvey took place). Study measures were largely self-report, except for semester GPA, which was obtained from official university records (pre- and post-hurricane). Pre-hurricane semester GPA and several background demographic and personality factors were included as control variables.

Participants

A diverse sample of emerging adults was recruited from a large southern university from November to December 2017. A priori exclusionary criteria included insufficient: survey progress (having viewed less than 50% of the study pages, N = 69), survey duration (since the average length of the survey was 45 minutes, having submitted

a survey response taking 10 minutes or less or more than 2 hours, $N = 119$ additional cases), and attention checks (having failed more than 55% of the attention check questions, $N = 18$ additional cases). Based on these a priori exclusionary criteria, our cleaned data sample consisted of 646 students. Based on the cleaned data sample of 646 participants, the present study had 80% power to detect effects as small as $r = .11$, which is smaller than the average effect size found in psychology ($r = .21$; Richard, Bond Jr, & Stokes-Zoota, 2003).

There were, however, several participants who did not consent to the release of their official semester GPA records, and there were also cases where participants consented to release semester GPA, but their records could not be retrieved by the university registrar (e.g., these cases might include freshmen or transfer students with no Spring 2017 records at our university). Of our original pre-data cleaning sample, the university registrar retrieved semester GPA for 492 students in the Fall 2017 semester and 335 students in the Spring 2017 semester. Study respondents were majority female (72%), and their ages ranged from 18 to 55 ($M = 21.99$, $SD = 4.93$). Regarding race/ethnicity, 28% of respondents were Latino/a, 23% Asian-American, 21% Black and all other people of color, and 28% White/European American.

Procedure

Data were collected online via Qualtrics (a data collection website) shortly following the events of Hurricane Harvey (August 2017). Students from various SONA credit-eligible courses were invited to participate in this study to receive course credit as participation compensation. All adults 18 years or older that lived in the Houston area during Hurricane Harvey were eligible to participate in this study and data collection took

place from November 2017 to December 2017. Along with a consent to participate in this study, all participants were presented with the opportunity to contribute to this study by consenting to the release of their past and future semester GPA at our university. This was done to collect both pre- and post-hurricane official GPA records from the Office of the University Registrar. A disclaimer was included along with this consent to release GPA: “Whether or not you authorize our research team to retrieve your academic records will not affect your participation in the study. You can still participate even if you do not agree to authorize the research team to request your academic records from the Office of Registrar at the University of Houston.”

Measures

Demographics. Several background participant information was collected, including age, gender, race/ethnicity, and parental socioeconomic status (SES). We dummy coded Gender (0 = Male, 1 = Female) and, due to group distribution, race/ethnicity (measured: 1 = White/Caucasian, 2 = Latino/a or Hispanic, 3 = Native American/American Indian, 4 = Black/African-American, 5 = Asian/Asian American, 6 = Native Hawaiian/Pacific Islander, 7 = Multi-Race, 8 = Other, were recoded as three dummy variables (i.e., “Hispanic”, “Asian-American”, and “Black and all other people of color”), with White/European American as the reference group. Our parental SES measure included three items measuring parental education levels and household income. Parental education levels (i.e., “*What is the highest level of education completed by your mother/father?*”) were measured on a 5-point scale: 1 (Did not complete high school) to 5 (Some post-baccalaureate degree (any coursework above Bachelor’s degree (i.e., Master’s degree or Ph.D.)). Household income (i.e., “*What is the current annual*

household income (i.e., combined income of your home?)) was measured on an 8-point scale: 1 (Less than \$10,000) to 8 (\$100,000 or more). These three items measuring parental education levels and household income were first standardized and then averaged together to create a parental SES index.

Personality. Personality was assessed with the Big Five Inventory-2 (BFI-2; Soto & John, 2017), a 60-item measurement of the Big Five dimensions (i.e., Extraversion, Agreeableness, Conscientiousness, Negative Emotionality, and Openness). Example items include: *“I am someone who is efficient, gets things done”* and *“I am someone who is original, comes up with new ideas.”* Personality dimensions were measured on a 5-point Likert scale ranging from *“1 (strongly disagree)”* to *“5 (strongly agree)”*. Personality dimensions were each computed as an average of the 12 respective trait items ($\alpha = .79$ to $.88$).

Hurricane Exposure. Hurricane exposure was objectively measured through a combination of items measuring degree of hurricane damage and hurricane-related stressors. Degree of hurricane damage was measured with four items, including damage to home and vehicle (adapted from Inui et al., 1998), inches of water in the home, and cost of flood damages. Participants reported damage to home and vehicle with the following items: *“How much damage did you have to your residence, as a result of Hurricane Harvey?”* and *“How much damage did you have to your vehicle (car or motorcycle), as a result of Hurricane Harvey?”* Based on a 4-point scale (1 = no damage to 4 = completely damaged), participants reported their damage to home ($M = 1.55$, $SD = .66$) and vehicle ($M = 1.36$, $SD = .74$). The number of inches of water in the home was measured with the following item: *“What was the highest level of water that entered your*

home due to Hurricane Harvey?” (in inches; $M = 1.85$, $SD = 6.41$). Due to a skewed distribution, a natural logarithm transformation was applied to the inches of home flooding item (which consisted of number of home flooding inches plus a constant of one) for the analyses. Lastly, participants reported the cost of damages with the following item: *“What was the cost of the material damages inflicted by the flood on your personal possessions (house, car, and other possessions)?”*. The response scale for cost of flood damages was as follows: 1 = \$0, 2 = Below \$500, 3 = \$500-\$5,000, 4 = \$10,000-\$25,000, 5 = \$25,000 - \$50,000, 6 = More than \$50,000, where a missing original range and unbalanced bins led to a scale recoding of: 1= \$0, 2= below \$500, 3= \$500-\$5,000, 4 = more than \$5,000 ($M = 1.84$, $SD = 1.02$).

Additionally, nine objective items from the hurricane-related stressors scale (Brodie et al., 2006; Chan & Rhodes, 2013) that presented no overlap with the aforementioned degree of damage items were also utilized. Participants were presented with the following prompt: *“indicate if you have experienced any of the following as a result of Hurricane Harvey.”* The nine checklist items included: had no fresh water to drink, no food to eat, lacked necessary medicine, lacked necessary medical care, had a family member who lacked necessary medical care, lacked knowledge of safety of your children (if any), lacked knowledge of safety of your other family members, death among family and/or friends, and lost a family pet. Affirmative checklist responses were summed to form the final stressor score ($M = .74$, $SD = 1.20$). The four hurricane damage items and the hurricane stressor score were each standardized and then averaged to formulate a hurricane exposure index.

Academic Achievement: Semester GPA Pre- and Post-Hurricane. For

participants that consented to the release of their grades, official semester GPA records were collected from the Office of the University Registrar. Semester GPA records were collected for the semester term prior to Hurricane Harvey (Spring 2017) and for the semester term during which Hurricane Harvey took place (Fall 2017).

Analytic Strategy

We first performed bivariate correlations between all study variables. Next, to obtain results above and beyond pre-hurricane achievement levels, we performed partial inter-correlations controlling for pre-hurricane academic achievement levels. In addition to correlations between the overall hurricane exposure index and the other study variables, we also provided correlations between each hurricane exposure item separately and the other study variables (we conducted these analyses for exploratory purposes, to see whether any particular exposure items included in the a priori determined hurricane index were more likely to drive the observed effects). All correlation analyses were performed using SPSS Version 25 (IBM Corporation, 2017).

The hypothesized negative association between hurricane exposure and academic achievement, as well as the moderating effects of personality (where high conscientiousness and low neuroticism were expected to mitigate this negative association), were tested using Mplus Version 6 (Muthén & Muthén, 1998–2010). Study hypotheses were tested using linear regression and full information maximum likelihood (FIML; Schafer & Graham, 2002) to address missing data. The following control variables were included in the analyses along with the hurricane exposure predictor: age, gender, race/ethnicity, parental SES, and pre-hurricane semester GPA (Spring 2017).

Next, as a robustness check, the association between hurricane exposure and

academic achievement was also tested, including personality traits, to assess whether results held above and beyond personality (in addition to aforementioned demographic controls). Due to the correlations between personality traits, two sets of analysis methods were performed: first, separate regression analyses were performed for each personality trait, and then all personality traits were included in one regression.

Results

Table 1 presents the means and standard deviations for all study variables as well as complete inter-correlations. Table 2 presents partial inter-correlations between study variables, controlling for pre-hurricane levels of academic achievement. Tables 3 and 4 present results from the regression analyses.

Inter-Correlations

Based on results from Table 1, hurricane exposure was associated with post-hurricane academic achievement $r = -.10$ ($p = .023$). Notably, as predicted (see “Previous Literature” section above), several potential confounds were statistically significantly associated with post-hurricane academic achievement. For example, Asian-Americans (relative to European Americans; $r = .16$, $p = .000$) and students scoring higher in conscientiousness ($r = .20$, $p = .000$), parental socio-economic status ($r = .12$, $p = .010$), and pre-hurricane achievement ($r = .53$, $p = .000$), all had higher post-hurricane achievement scores. In addition, students scoring higher on parental socio-economic status also had lower levels of hurricane exposure ($r = -.13$, $p = .001$).

Regarding individual hurricane exposure items, we found that damage to home ($r = -.11$, $p = .019$) and damage to vehicle ($r = -.13$, $p = .003$) were associated with post-hurricane academic achievement, while the other standalone items (i.e., inches of home

flooding, damage cost, hurricane stressors) did not reach statistical significance (r 's = -.02 - -.07). The majority of the standalone hurricane exposure items were similar in size (except for inches of home flooding), but it appears that the home and vehicle damage items were primarily driving the effect of the hurricane exposure index.

Table 2 presents partial correlations controlling for pre-hurricane achievement, where results were somewhat different compared to the bivariate correlations from Table 1. Particularly of interest, we found that once pre-hurricane academic achievement was controlled for, the association between hurricane exposure and post-hurricane academic achievement was the same magnitude, but it was no longer statistically significant ($r = -.10, p = .060$). Still, some of the aforementioned bivariate correlations persisted after controlling for pre-hurricane academic achievement levels. For example, students scoring higher in conscientiousness ($r = .15, p = .005$) had higher post-hurricane achievement scores, and those higher in parental socio-economic status had lower levels of hurricane exposure ($r = -.12, p = .025$).

Regarding individual hurricane exposure items, when controlling for pre-hurricane achievement, we found that only the association between damage to home ($r = -.12, p = .030$) and post-hurricane academic achievement persisted, while the other standalone items (i.e., vehicle damage, inches of home flooding, damage cost, hurricane stressors) did not reach statistical significance (r 's = -.03 - -.10).

Regression Analyses

Tables 3 and 4 present results for the regression analyses, where Model A controlled for demographic factors (i.e., age, gender, race/ethnicity, parental SES) and pre-hurricane GPA (Spring 2017). In addition to demographic factors and pre-hurricane

GPA controls, Models B-F in Table 3 each included one personality trait and Model G included all personality traits. Personality moderation effects can be found in Table 4 across Models B'-F'. The model fit was similar across statistical models, presenting an R^2 at or around .30.

Regarding our hypothesized negative association between hurricane exposure and post-hurricane academic achievement, the magnitude of this effect was similar to the correlational results, and like results from the partial correlations, hurricane exposure did not statistically significantly predict post-hurricane GPA once pre-hurricane GPA and demographic factors were controlled for ($\beta = -.07$, 95% CI[-.15, .01]). In raw metrics, this effect translated into an average prospective GPA decrease of .05 points. Because the continuous hurricane exposure measure was standardized, this (not statistically significant) effect is the equivalent of going from a 3.25 to a 3.20 GPA for every standard deviation increase in hurricane exposure.

Other notable results from Table 3, controlling for pre-hurricane academic achievement and demographics, include: Asian-American students (compared to their European American counterparts) had higher post-hurricane GPA ($\beta = .11$, 95% CI[.01, .21]), and this effect persisted across models controlling for all personality traits. The trait of conscientiousness also surfaced as a strong predictor of post-hurricane GPA ($\beta = .14$, 95% CI[.06, .22]), and this effect also persisted across Model G (including all personality traits). Apart from conscientiousness, no other personality trait demonstrated a statistically significant association with post-hurricane academic achievement. As seen in Table 4, no statistically significant personality moderation effects were found.

Discussion

Following a large-scale natural disaster, this study focused on the impact of hurricane exposure on academic achievement based on a diverse sample of college students. Although baseline data were collected shortly after Hurricane Harvey, official registrar records of pre- and post-hurricane academic achievement were also collected, which allowed us to control for pre-existing levels of achievement in our analyses.

Previous studies on achievement following a natural disaster have arrived at different conclusions, which could be due to some acute limitations in their respective methodologies. The present study aimed to address prior limitations by including a large, diverse sample, pre-hurricane achievement levels, official university registrar GPA records, controlling for relevant confounds, adopting an individual difference approach, and measuring hurricane exposure with a comprehensive index.

The primary goal of this study was to assess whether hurricane exposure predicted semester GPA shortly after a hurricane (i.e., Fall 2017, 4 months post-disaster). Compared to the association between disaster exposure and distress, the link between disaster exposure and achievement has garnered very little attention. Nevertheless, natural disasters often adversely impact students, teachers, and parents (e.g., class cancellations, schools closing temporarily or shut down, school clean-up/reconstructions), which means they may potentially affect academic achievement. Disaster-imposed school disruptions can also, directly and indirectly, impact economic growth through missed classes and work opportunities across students, teachers, and administrators. And so, acquiring a better understanding of the degree to which natural disasters might impact academic achievement levels can better equip researchers to develop future intervention programs and raise awareness of this potential issue and what

steps might help offset some negative disaster consequences.

Implications

Our study results suggested that hurricane exposure is associated with post-hurricane academic achievement levels, although this link was not statistically significant after controlling for pre-hurricane achievement levels. As such, support was not found for our main hypothesis of interest. Instead, our results were similar to findings from researchers Ceyhan and Ceyhan (2007), who found no statistically significant links between earthquake exposure and self-reported GPA. In addition, it was predicted that high levels of conscientiousness and low levels of neuroticism might buffer the negative link between hurricane exposure and academic achievement. Study results, however, did not support these predictions either as none of the personality moderation effects demonstrated statistically significant effects.

There could be several reasons for these results. First, our study results may suggest that students can exhibit academic resilience in the face of a large-scale hurricane, and hurricane exposure may not adversely affect college grades to a significant degree. Another possibility is that hurricane exposure may adversely affect college grades if we were to consider a longer period of time, which is to say that the data collection window for the present study (i.e., Fall 2017 semester GPA, 4 months post-disaster) may have been too short to be able to detect an effect. As such, in order to fully understand the relationship between disaster exposure and academic achievement, future studies should aim to survey large samples that assess post-disaster achievement across longer periods of time (e.g., one-year post-disaster). Should future research suggest that disaster exposure can adversely affect achievement levels, then a potential avenue for future

research would be to identify the critical at-risk time period post-disaster for academic achievement and develop intervention programs to raise awareness and offer additional support to disaster-exposed students. Academic performance can carry strong implications for a student's future (e.g., medical and graduate school acceptance, internship/scholarship eligibility, employment opportunities), and so if there is a possibility that natural disasters can adversely affect academic achievement, then research in this area should be important to consider.

Limitations

Although the present study has several strengths, there are also some limitations. First, although our baseline data of demographic and personality factors was collected promptly after Hurricane Harvey, there is still a possibility that the time period leading up to the hurricane and/or the time period in between initial hurricane strike and data collection may have affected study variables of interest (e.g., socioeconomic status, personality traits). Thus, future studies should aim to collect pre-disaster measures when possible, as the present study was able to do for pre-disaster achievement levels. Our study also focused on emerging adults, and although our university student body is diverse and composed of older and 'non-traditional' students (e.g., commuting students, part-time or full-time employees, and spouses and parents) this is not a representative population sample, and therefore, results should not be generalized.

Lastly, there is also a possibility that our race/ethnicity variable (recoded as three dummy variables (i.e., "Hispanic", "Asian-American", and "Black and all other people of color")) may not be ideally scored. Specifically, previous studies (Kao & Thompson, 2003; Sakamoto, Goyette & Kim, 2009; Hsin & Xie, 2014) have identified that different

sub-cultures within the broader Asian-American category present differences in socio-economic status (SES) within the U.S. (e.g., sharp differences across poverty rates, parental education, or college attainment). Despite these Asian-American sub-culture differences, some studies found that regardless of sub-culture, Asian Americans outperformed European Americans in academic achievement (Chen & Stevenson, 1995; Hsin & Xie, 2014). Nevertheless, there might still be differences in hurricane exposure between different Asian-American sub-cultures. Thus, future studies should try to avoid grouping Asian-Americans from different regions as they may not share similar socio-economic backgrounds); unfortunately this was not possible for the current study given that Asian race/ethnicity was measured as “Asian/Asian American”, precluding us from distinguishing between Asian-Americans from different regions. Additionally, it is also uncertain whether our collected sample would have rendered subgroup sample sizes large enough to statistically differentiate between Asian-Americans from different regions.

Conclusion

Based on a large sample of college students who were exposed to Hurricane Harvey, the present study found that hurricane exposure did not predict post-hurricane academic achievement above and beyond pre-hurricane achievement levels and demographic factors. Additionally, high levels of conscientiousness and low levels of neuroticism did not weaken the negative association between hurricane exposure and post-hurricane achievement, as no personality moderation effects were identified. Considering prior research linking chronic stress to compromised health and well-being, it might be reasonable to also expect a stressful life event, the likes of a natural disaster, to further limit the resources one has available to dedicate towards self-actualization (e.g.,

being able to actively focus and continue working on academics). As such, our study results may be surprising, but they may also carry a positive connotation. Although further research is needed, it is possible our study results suggest that (at least 4 months post-hurricane) college students demonstrated academic resilience following a large-scale hurricane. And while no personality interaction effects were identified, it is still possible that students relied on other resources that allowed for their academics to withstand the impact of Hurricane Harvey.

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Appendix A: Study Scales

The Big Five Inventory–2

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement.

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree

I see myself as someone who...

- | | |
|--|---|
| <p>1. ___ Is outgoing, sociable.</p> <p>2. ___ Is compassionate, has a soft heart.</p> <p>3. ___ Tends to be disorganized.</p> <p>4. ___ Is relaxed, handles stress well.</p> <p>5. ___ Has few artistic interests.</p> <p>6. ___ Has an assertive personality.</p> <p>7. ___ Is respectful, treats others with respect.</p> <p>8. ___ Tends to be lazy.</p> <p>9. ___ Stays optimistic after experiencing a setback.</p> <p>10. ___ Is curious about many different things.</p> <p>11. ___ Rarely feels excited or eager.</p> <p>12. ___ Tends to find fault with others.</p> <p>13. ___ Is dependable, steady.</p> <p>14. ___ Is moody, has up and down mood swings.</p> <p>15. ___ Is inventive, finds clever ways to do things.</p> <p>16. ___ Tends to be quiet.</p> <p>17. ___ Feels little sympathy for others.</p> | <p>18. ___ Is systematic, likes to keep things in order.</p> <p>19. ___ Can be tense.</p> <p>20. ___ Is fascinated by art, music, or literature.</p> <p>21. ___ Is dominant, acts as a leader.</p> <p>22. ___ Starts arguments with others.</p> <p>23. ___ Has difficulty getting started on tasks.</p> <p>24. ___ Feels secure, comfortable with self.</p> <p>25. ___ Avoids intellectual, philosophical discussions.</p> <p>26. ___ Is less active than other people.</p> <p>27. ___ Has a forgiving nature.</p> <p>28. ___ Can be somewhat careless.</p> <p>29. ___ Is emotionally stable, not easily upset.</p> <p>30. ___ Has little creativity.</p> <p>31. ___ Is sometimes shy, introverted.</p> <p>32. ___ Is helpful and unselfish with others.</p> <p>33. ___ Keeps things neat and tidy.</p> |
|--|---|

34. ___ Worries a lot.
35. ___ Values art and beauty.
36. ___ Finds it hard to influence people.
37. ___ Is sometimes rude to others.
38. ___ Is efficient, gets things done.
39. ___ Often feels sad.
40. ___ Is complex, a deep thinker.
41. ___ Is full of energy.
42. ___ Is suspicious of others' intentions.
43. ___ Is reliable, can always be counted on.
44. ___ Keeps their emotions under control.
45. ___ Has difficulty imagining things.
46. ___ Is talkative.
47. ___ Can be cold and uncaring.
48. ___ Leaves a mess, doesn't clean up.
49. ___ Rarely feels anxious or afraid.
50. ___ Thinks poetry and plays are boring.
51. ___ Prefers to have others take charge.
52. ___ Is polite, courteous to others.
53. ___ Is persistent, works until the task is finished.
54. ___ Tends to feel depressed, blue.
55. ___ Has little interest in abstract ideas.
56. ___ Shows a lot of enthusiasm.
57. ___ Assumes the best about people.
58. ___ Sometimes behaves irresponsibly.
59. ___ Is temperamental, gets emotional easily.
60. ___ Is original, comes up with new ideas.

Degree of Damage

1. How much damage did you have to your residence as a result of Hurricane Harvey?
 1. No damage.
 2. Able to be inhabited with some repairs
 3. Damaged (hardly possible to inhabit)
 4. Completely damaged

2. How much damage did you have to your vehicle (car or motorcycle) as a result of Hurricane Harvey?
 1. No damage.
 2. Able to be driven with some repairs
 3. Damaged (hardly possible to drive)
 4. Completely damaged

3. What was the highest level of water that entered your home due to Hurricane Harvey? ____ (in inches)

4. What was the cost of the material damages inflicted by the flood on your personal possessions (house, car, and other possessions)?
 - 1 = \$0
 - 2 = Below \$500
 - 3 = \$500-\$5,000
 - 4 = \$10,000-\$25,000
 - 5 = \$25,000 - \$50,000
 - 6 = More than \$50,000

Hurricane-Related Stressors

For the following items indicate if you have experienced any of the following as a result of Hurricane Harvey: (Yes/No)

1. no fresh water to drink
2. no food to eat
3. lacked necessary medicine
4. lacked necessary medical care
5. had a family member who lacked necessary medical care
6. lacked knowledge of safety of your children (if any)
7. lacked knowledge of safety of your other family members
8. death among family and/or friends.
9. lost a family pet

Table 1. *Inter-correlations Between Study Variables*

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9
1. GPA (Post-hurricane; Fall '17)	3.20	.71	-	-	-	-	-	-	-	-	-
2. GPA (Pre-hurricane)	3.19	.69	.53	-	-	-	-	-	-	-	-
3. Age	21.99	4.93	-.02	-.02	-	-	-	-	-	-	-
4. Female	.72	-	.06	.07	.05	-	-	-	-	-	-
5. Latino/a	.28	-	-.08	-.18	.02	.04	-	-	-	-	-
6. Asian-American	.23	-	.16	.17	-.21	-.06	-.35	-	-	-	-
7. Black & All Other	.21	-	-.03	-.03	.05	.01	-.33	-.29	-	-	-
8. Parental SES	.001	.80	.12	.14	-.14	-.11	-.42	.11	.05	-	-
9. Home Damage	1.55	.66	-.11	-.01	.02	-.02	-.02	-.01	.02	-.08	-
10. Vehicle Damage	1.36	.74	-.13	-.09	-.02	-.02	.07	-.07	-.04	-.11	.45
11. Inches of Flooding	1.85	6.41	-.02	.01	.06	-.01	.04	-.04	-.01	-.07	.62
12. Cost of Damages	.84	1.02	-.06	-.01	.08	.01	.06	-.09	-.05	-.10	.70
13. Hurricane Stressors	.74	1.20	-.07	-.03	.04	.05	.03	-.05	.02	-.11	.32
14. Hurricane Exposure Index	.002	.74	-.10	-.03	.05	.00	.05	-.07	-.01	-.13	.83
15. Extraversion	3.21	.67	.05	.05	.15	-.01	-.06	-.04	.10	.03	.01
16. Agreeableness	3.68	.57	.06	.04	.13	.08	.01	-.09	.02	.01	.01
17. Conscientiousness	3.52	.63	.20	.14	.19	.11	.04	-.08	.05	-.09	.02
18. Neuroticism	2.93	.72	-.08	-.08	-.13	.15	-.03	.10	-.09	.00	.03
19. Openness	3.72	.58	.03	-.03	.10	-.05	-.07	-.07	.09	.06	.03

Table 1. *Inter-correlations Between Study Variables Cont'd*

	10	11	12	13	14	15	16	17	18	19
1. GPA (Post-hurricane; Fall '17)	-	-	-	-	-	-	-	-	-	-
2. GPA (Pre-hurricane)	-	-	-	-	-	-	-	-	-	-
3. Age	-	-	-	-	-	-	-	-	-	-
4. Female	-	-	-	-	-	-	-	-	-	-
5. Latino/a	-	-	-	-	-	-	-	-	-	-
6. Asian-American	-	-	-	-	-	-	-	-	-	-
7. Black & All Other	-	-	-	-	-	-	-	-	-	-
8. Parental SES	-	-	-	-	-	-	-	-	-	-
9. Home Damage	-	-	-	-	-	-	-	-	-	-
10. Vehicle Damage	-	-	-	-	-	-	-	-	-	-
11. Inches of Flooding	.44	-	-	-	-	-	-	-	-	-
12. Cost of Damages	.61	.62	-	-	-	-	-	-	-	-
13. Hurricane Stressors	.21	.22	.27	-	-	-	-	-	-	-
14. Hurricane Exposure Index	.73	.78	.86	.54	-	-	-	-	-	-
15. Extraversion	-.03	.03	.01	-.06	-.01	(.85)	-	-	-	-
16. Agreeableness	-.05	.02	.02	-.09	-.02	.23	(.79)	-	-	-
17. Conscientiousness	-.06	.06	.04	-.08	-.01	.42	.44	(.84)	-	-
18. Neuroticism	.09	-.02	.05	.13	.08	-.45	-.32	-.47	(.88)	-
19. Openness	.05	.02	.06	-.01	.04	.35	.35	.28	-.15	(.82)

Note: N = 326-646. Bold font indicates statistical significance at $p < .05$. SES = socioeconomic status. Cronbach's alphas are provided in parentheses on the diagonal. Gender and race were coded as follows: gender (0 = male, 1 = female), Race/Ethnicity (0 = White/European American 1 = Latino/a; Asian-American; Black & All Other).

Table 2. *Partial Inter-correlations Between Study Variables- Controlling for Pre-hurricane GPA*

	1	2	3	4	5	6	7	8	9
1. GPA (Post-hurricane; Fall '17)	-	-	-	-	-	-	-	-	-
2. Age	-.02	-	-	-	-	-	-	-	-
3. Female	.03	.05	-	-	-	-	-	-	-
4. Latino/a	.02	.02	.05	-	-	-	-	-	-
5. Asian-American	.09	-.21	-.07	-.33	-	-	-	-	-
6. Black & All Other	-.02	.05	.02	-.34	-.29	-	-	-	-
7. Parental SES	.05	-.13	-.12	-.41	.09	.05	-	-	-
8. Home Damage	-.12	.02	-.02	-.02	-.01	.02	-.08	-	-
9. Vehicle Damage	-.10	-.02	-.01	.06	-.06	-.05	-.10	.45	-
10. Inches of Flooding	-.03	.06	-.01	.05	-.04	-.01	-.07	.62	.44
11. Cost of Damages	-.06	.08	.01	.06	-.08	-.05	-.10	.70	.61
12. Hurricane Stressors	-.07	.04	.06	.02	-.05	.02	-.11	.32	.21
13. Hurricane Exposure Index	-.10	.05	.01	.04	-.07	-.01	-.12	.83	.73
14. Extraversion	.03	.15	-.01	-.05	-.05	.10	.02	.01	-.02
15. Agreeableness	.05	.13	.08	.02	-.10	.02	.00	.01	-.04
16. Conscientiousness	.15	.19	.10	.07	-.11	.06	-.11	.02	-.05
17. Neuroticism	-.05	-.13	.16	-.04	.11	-.09	.01	.03	.08
18. Openness	.06	.10	-.05	-.07	-.06	.09	.06	.03	.05

Table 2. *Partial Inter-correlations Between Study Variables- Controlling for Pre-hurricane GPA Cont'd*

	10	11	12	13	14	15	16	17
1. GPA (Post-hurricane; Fall '17)	-	-	-	-	-	-	-	-
2. Age	-	-	-	-	-	-	-	-
3. Female	-	-	-	-	-	-	-	-
4. Latino/a	-	-	-	-	-	-	-	-
5. Asian-American	-	-	-	-	-	-	-	-
6. Black & All Other	-	-	-	-	-	-	-	-
7. Parental SES	-	-	-	-	-	-	-	-
8. Home Damage	-	-	-	-	-	-	-	-
9. Vehicle Damage	-	-	-	-	-	-	-	-
10. Inches of Flooding	-	-	-	-	-	-	-	-
11. Cost of Damages	.62	-	-	-	-	-	-	-
12. Hurricane Stressors	.22	.27	-	-	-	-	-	-
13. Hurricane Exposure Index	.78	.86	.54	-	-	-	-	-
14. Extraversion	.03	.02	-.06	-.01	-	-	-	-
15. Agreeableness	.02	.02	-.09	-.02	.23	-	-	-
16. Conscientiousness	.06	.04	-.08	.00	.42	.44	-	-
17. Neuroticism	-.01	.05	.12	.07	-.45	-.31	-.46	-
18. Openness	.02	.06	-.01	.04	.35	.35	.28	-.15

Note: Bold font indicates statistical significance at $p < .05$. SES = socioeconomic status. Gender and race were coded as follows: gender (0 = male, 1= female), Race/Ethnicity (0 = White/European American 1 = Latino/a; Asian-American; Black & All Other).

Table 3. *Regression Analyses Predicting Post-Hurricane Academic Achievement (Fall 2017)*

Predictors	Model A		Model B		Model C		Model D	
	β	95% CI for β	β	95% CI for β	β	95% CI for β	β	95% CI for β
Hurricane Exposure Index	-.07	[-.15, .01]	-.07	[-.15, .01]	-.07	[-.15, .01]	-.07	[-.14, .01]
Age	.01	[-.07, .09]	.01	[-.07, .08]	.01	[-.07, .08]	-.01	[-.09, .07]
Female	.05	[-.03, .13]	.05	[-.03, .13]	.05	[-.03, .13]	.04	[-.03, .12]
Latino/a	.07	[-.03, .18]	.07	[-.03, .18]	.08	[-.03, .18]	.07	[-.03, .18]
Asian-American	.11	[.01, .21]	.11	[.01, .21]	.12	[.02, .21]	.12	[.02, .22]
Black & All Other	.04	[-.05, .13]	.04	[-.06, .13]	.04	[-.05, .13]	.03	[-.07, .12]
Parental SES	.07	[-.02, .16]	.07	[-.02, .16]	.07	[-.02, .16]	.09	[.00, .18]
GPA (Pre-hurricane)	.51	[.43, .59]	.51	[.43, .59]	.51	[.43, .59]	.49	[.40, .57]
Extraversion	—	—	.02	[-.06, .10]	—	—	—	—
Agreeableness	—	—	—	—	.04	[-.04, .12]	—	—
Conscientiousness	—	—	—	—	—	—	.14	[.06, .22]
Neuroticism	—	—	—	—	—	—	—	—
Openness	—	—	—	—	—	—	—	—
R^2	.30		.30		.30		.32	

Table 3. Regression Analyses Predicting Post-Hurricane Academic Achievement (Fall 2017) Cont'd

Predictors	Model A		Model E		Model F		Model G	
	β	95% CI for β	β	95% CI for β	β	95% CI for β	β	95% CI for β
Hurricane Exposure Index	-.07	[-.15, .01]	-.07	[-.15, .01]	-.07	[-.15, .01]	-.07	[-.14, .01]
Age	.01	[-.07, .09]	.003	[-.07, .08]	.004	[-.07, .08]	-.01	[-.08, .07]
Female	.05	[-.03, .13]	.06	[-.02, .14]	.05	[-.03, .13]	.04	[-.04, .12]
Latino/a	.07	[-.03, .18]	.07	[-.04, .17]	.08	[-.03, .18]	.07	[-.03, .18]
Asian-American	.11	[.01, .21]	.11	[.02, .21]	.11	[.01, .21]	.12	[.02, .21]
Black & All Other	.04	[-.05, .13]	.03	[-.06, .13]	.03	[-.06, .13]	.03	[-.07, .12]
Parental SES	.07	[-.02, .16]	.07	[-.02, .16]	.07	[-.02, .16]	.09	[.00, .18]
GPA (Pre-hurricane)	.51	[.43, .59]	.50	[.42, .58]	.51	[.43, .59]	.48	[.40, .57]
Extraversion	—	—	—	—	—	—	-.05	[-.14, .05]
Agreeableness	—	—	—	—	—	—	-.02	[-.11, .07]
Conscientiousness	—	—	—	—	—	—	.17	[.07, .27]
Neuroticism	—	—	-.05	[-.13, .03]	—	—	.01	[-.09, .11]
Openness	—	—	—	—	.05	[-.03, .12]	.03	[-.06, .11]
R^2	.30		.30		.30		.32	

Note: These analyses used a FIML estimation based on N = 646. Bold font indicates statistical significance at $p < .05$. β s represent standardized regression coefficients. SES = socioeconomic status. Gender and race were coded as follows: gender (0 = male, 1= female), Race/Ethnicity (0 = White/European American 1 = Latino/a; Asian-American; Black & All Other).

Table 4. Regression Analyses Predicting Post-Hurricane Academic Achievement with Personality Interactions

Predictors	Model A		Model B'		Model C'		Model D'	
	β	95% CI for β	β	95% CI for β	β	95% CI for β	β	95% CI for β
Hurricane Exposure Index (HEI)	-.07	[-.15, .01]	-.07	[-.15, .01]	-.07	[-.15, .01]	-.07	[-.14, .01]
Age	.01	[-.07, .09]	.01	[-.07, .08]	.01	[-.07, .08]	-.01	[-.08, .07]
Female	.05	[-.03, .13]	.05	[-.03, .13]	.05	[-.03, .13]	.05	[-.03, .12]
Latino/a	.07	[-.03, .18]	.08	[-.03, .18]	.08	[-.02, .18]	.08	[-.03, .18]
Asian-American	.11	[.01, .21]	.11	[.01, .21]	.12	[.02, .22]	.12	[.03, .22]
Black & All Other	.04	[-.05, .13]	.04	[-.06, .13]	.04	[-.05, .14]	.03	[-.06, .12]
Parental SES	.07	[-.02, .16]	.07	[-.02, .16]	.07	[-.02, .16]	.09	[.00, .18]
GPA (Pre-hurricane)	.51	[.43, .59]	.51	[.43, .59]	.51	[.43, .59]	.48	[.40, .56]
Extraversion	—	—	.02	[-.06, .10]	—	—	—	—
Extraversion x HEI	—	—	-.02	[-.10, .06]	—	—	—	—
Agreeableness	—	—	—	—	.05	[-.03, .13]	—	—
Agreeableness x HEI	—	—	—	—	-.04	[-.12, .03]	—	—
Conscientiousness	—	—	—	—	—	—	.14	[.06, .22]
Conscientiousness x HEI	—	—	—	—	—	—	-.03	[-.11, .04]
Neuroticism	—	—	—	—	—	—	—	—
Neuroticism x HEI	—	—	—	—	—	—	—	—
Openness	—	—	—	—	—	—	—	—
Openness x HEI	—	—	—	—	—	—	—	—
R^2	.30		.30		.30		.32	

Table 4. Regression Analyses Predicting Post-Hurricane Academic Achievement with Personality Interactions Cont'd

Predictors	Model A		Model E'		Model F'	
	β	95% CI	β	95% CI	β	95% CI
Hurricane Exposure Index (HEI)	-.07	[-.15, .01]	-.07	[-.15, .01]	-.08	[-.15, .00]
Age	.01	[-.07, .09]	.004	[-.07, .08]	.01	[-.07, .08]
Female	.05	[-.03, .13]	.06	[-.02, .14]	.05	[-.03, .13]
Latino/a	.07	[-.03, .18]	.07	[-.04, .17]	.08	[-.03, .18]
Asian-American	.11	[.01, .21]	.11	[.02, .21]	.11	[.02, .21]
Black & All Other	.04	[-.05, .13]	.03	[-.06, .12]	.04	[-.06, .13]
Parental SES	.07	[-.02, .16]	.07	[-.02, .16]	.07	[-.02, .16]
GPA (Pre-hurricane)	.51	[.43, .59]	.50	[.42, .58]	.51	[.43, .59]
Extraversion	—	—	—	—	—	—
Extraversion x HEI	—	—	—	—	—	—
Agreeableness	—	—	—	—	—	—
Agreeableness x HEI	—	—	—	—	—	—
Conscientiousness	—	—	—	—	—	—
Conscientiousness x HEI	—	—	—	—	—	—
Neuroticism	—	—	-.05	[-.13, .03]	—	—
Neuroticism x HEI	—	—	.002	[-.07, .08]	—	—
Openness	—	—	—	—	.04	[-.03, .12]
Openness x HEI	—	—	—	—	.03	[-.05, .10]
R^2	.30		.30		.30	

Note: These analyses used a FIML estimation based on N = 646. Bold font indicates statistical significance at $p < .05$. β s represent standardized regression coefficients. HEI = Hurricane Exposure Index.

SES = socioeconomic status. Gender and race were coded as follows: gender (0 = male, 1 = female), Race/Ethnicity (0 = White/European American 1 = Latino/a; Asian-American; Black & All Other).