



Study Abroad Programs and Student Stress: An Animal Science Curriculum Case Study

J. L. Lawrence, M. Barrowclough, and D. W. Lugar

Department of Agriculture, Illinois State University

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Correspondence regarding this article should be addressed to D. Lugar, Department of Agriculture, Illinois State University, 301 N Main Street, Campus Box 5020, Normal, IL 61761. Email: dwlugar@ilstu.edu. Phone: 309-438-3881

Abstract

Study abroad programs increase a student's exposure to different cultures, traditions, and ways of life. While the benefits of participating in a study abroad program have been well documented, barriers, such as language, culture, and environment, may present themselves to program participants. Participants are introduced to a variety of new experiences both prior to and while abroad, which have the potential to introduce additional stress on students, in conjunction with the stress more typically experienced during a 'traditional' college experience. This study aims to quantify student stress prior to and while studying abroad in relation to their demographics and life experiences. Over a 12-day period in December 2022 in Mexico City, Mexico, students participated in an Animal Science focused study abroad program. Psychological and physiological stress data were collected in conjunction with student demographic and background characteristics. Data analysis showed that participant's perceived stress scores were higher prior to going abroad, than while abroad, and that a participant's ethnicity was a predictor of perceived stress ($P < 0.05$). However, physiological stress was not impacted by study abroad or demographic information ($P > 0.05$).

Keywords: animal science, heart rate variability, student stress, study abroad

Study abroad programs have been shown to provide a variety of academic and personal benefits to students. These benefits include exposure to a foreign language, development of cross-cultural skills and understanding, and enhancing the student's formal education (Smith & Mity, 2008). However, challenges while participating in these programs can and do arise that students must confront. For example, students may experience an increase in stress and anxiety associated with encountering differences in cultures, values, assumptions, and expectations when visiting their host country (Berry, 2005). Increases in stress and anxiety have been shown to lead to a decline in overall mental health (American Psychiatric Association). Previous studies have examined the relationship between student mental health and participation in study abroad programs (Hunley, 2010; Bathke & Kim, 2016). Hunley (2010) determined students that have "high functioning" mental health tend to continue having a high functioning mental health while abroad, resulting in a positive abroad experience. Conversely, students with lower mental health functioning prior to leaving tended to have a harder time abroad. Bathke and Kim (2016) found their participants had reported overall good mental health while studying abroad.

Students participating in study abroad programs have traditionally done so on a yearly or per-semester basis; typically beginning their program in either the Fall or Spring semester of the academic year. In recent years however, short-term study abroad (STSA) programs have seen an increase in popularity (Institute of International Education, 2022). Short-term study abroad is defined as having a duration of less than 8 weeks (Sanger & Mason, 2019). The present study utilized a STSA program.

Defining and Measuring Stress

Selye (1956) defined stress as “a response in order to maintain the state of stability or homology that the body has maintained against the stimulus to break the mental and physical balance and stability of the body.” Two forms of stress that are commonly investigated are psychological and physiological stress (Kogler et al., 2016). Psychological stress has been defined as a “particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being” (Lazarus & Folkman, 1984). Physiological stress, however, is the response of bodily systems to stress, and commonly includes a combination of increased heart rate, respiration rate, and production of steroid hormones, which includes cortisol that initiates a cascade of more systemic responses to stress (Chu et al. 2022). It is important to note the relationship between the two forms of stress. When a situation is perceived as stressful, individuals have a heightened level of physiological stress (Chu et al., 2022). Studies have shown that psychological stressors like speaking publicly, or some form of conflict, have been shown to increase blood pressure and heart rate, which are physiological stress symptoms (Kamarck & Lovallo, 2003). With defining different types of stress comes the challenge of determining how to best measure them (Kim et al., 2018).

One method of physiological stress measurement is heart rate variability (HRV). Heart rate variability measures the time intervals between consecutive heart beats over a specified period (Shaffer & Ginsberg, 2017). Classifications of HRV readings include 24-hour, short term (5 minutes) and ultra-short term (<5 minutes; Shaffer & Ginsberg, 2017). In relation to stress, a lower HRV level has been shown to reflect a higher measure of stress (de Vries et al., 2021; Kim et al., 2018; Punita et al., 2016). When stress occurs, a physiological response is for one’s heart rate to increase. As heart rate increases, the time between heart beats becomes shorter and less variable, thus leading to decreases in HRV (McCraty & Shaffer, 2015).

A method for measuring psychological stress levels is the Perceived Stress Survey (PSS) developed by Cohen et al. (1983). The PSS is a “brief and easy-to administer measure of the degree to which circumstances in an individual’s life have been appraised as stressful” and has been shown to be both a reliable and valid measure of stress (Cohen et al., 1983). This survey has been used in a variety of studies as a measure of perceived stress, including student stress, stress levels in health care workers, and other populations as it continues to serve as a reliable test (Agius 1996; Örucü & Demir, 2009; Roberti et al., 2006; White et al., 2021).

The goal of this study was to examine both physiological and psychological stress levels of students participating in a STSA program. To the authors’ knowledge, few studies have researched STSA programs and their effects on student mental health and stress (Nguyen, 2017; Yamanaka et al., 2021). A potential benefit of this study is to identify stress levels in our student population and identify future research areas.

Methods

This study was conducted in December 2022 during a 12-day, undergraduate Animal Science study abroad program in Mexico City, Mexico hosted by the Illinois State University Department of Agriculture. The program included course lectures on many facets of the agriculture industry in Mexico, Spanish lessons, as well as agricultural and cultural excursions across Mexico City and surrounding areas. During a pre-departure meeting, students were informed of the study and provided a consent form that detailed the purpose and design of the study. Student participation was strictly voluntary with neither penalty nor reward provided for participation. All study procedures were approved by the Illinois State University Institutional Review Board, protocol #2022-172.

Study Participants

Summary statistics of study participants are shown in Table 1. All student participants were female and majoring in either Animal Science or Pre-Veterinary Medicine programs. While having all female participants is not reflective of the general population, it is common in study abroad programs to have a majority female participant population (Institute of International Education, 2023). Three participants were seniors, three were juniors, and one was a sophomore. The majority of participants had little to no experience with international travel, with one citing moderate experience. Of the seven participants, five identified as Caucasian and two identified as non-Caucasian/minority ethnicities.

Table 1

Animal Science Study Abroad in Mexico Program Student Demographics

Characteristic	# of Participants
Sex	
Female	7
Male	0
Ethnicity	
Caucasian	5
Non-Caucasian	2
Academic Classification	
Sophomore	1
Junior	3
Senior	3
Academic Program	
Animal Science	3
Pre-Veterinary Science	4
Level of International Experience	
None	5
Minor	2

Study Design and Implementation

This study was divided into two phases: prior to departure (PRE), and while abroad (ABRD). Data collected included psychological and physiological stress parameters. Psychological stress data were collected via a modified version of the PSS. This modification included changing the question text from “In the past month...” to “In the past 24 hours...” (see Figure 1). The survey consists of 10 Likert scale questions, with six “negative” questions and four “positive” questions. Questions were scored ranging from 0-4 and assigned based on the participants’ responses. An aggregate score was calculated by summing the 10 individual question scores, where the participant responses for the six “negative” questions remained the same, and the responses from the four “positive” questions were reversed.

Figure 1

Perceived Stress Scale

In the past week, how often have you been upset because of something that happened unexpectedly?
In the past week, how often have you felt that you were unable to control the important things in your life?
In the past week, how often have you felt nervous and stressed?
In the past week, how often have you felt confident about your ability to handle your personal problems?
In the past week, how often have you felt that things were going your way?
In the past week, how often have you found that you could not cope with all the things that you had to do?
In the past week, how often have you been able to control irritations in your life?
In the past week, how often have you felt that you were on top of things?
In the past week, how often have you been angered because of things that happened that were outside of your control?
In the past 24 hours, how often have you felt difficulties were piling up so high that you could not overcome them?

Note. Participants were given this 10 question, 5 point Likert scale survey throughout the study prior to departure for the study abroad program and every day while abroad on the program. For each of these questions, they were asked to choose one of the following to describe which best described how they felt: 0 - never 1 - almost never 2 - sometimes 3 - fairly often 4 - very often. The survey was graded with the following criteria: To begin, the scores were reversed for questions 4, 5, 7, and 8. The scores were adjusted like this: 0 = 4, 1 = 3, 2 = 2, 3 = 1, 4 = 0. All scores were then summed together (reverse scores for 4, 5, 7, 8 and normal scores for 1, 2, 3, 6, 9, 10).

For example, a response in a “negative” question of 3, remained a 3 when the aggregate score was calculated; however, a response of 3 for a “positive” question was reversed, and replaced with 1 when calculating the aggregate score. Aggregated scores from the survey can thus range from a low of 0, which is reflective of little to

no perceived stress, to a high of 40, which is reflective of high perceived stress. Physiological stress data included heart rate and HRV parameters utilizing heart rate monitors (Polar H9, Polar Electro, Kempele, Finland). For this, participants were asked to sit and complete the PSS, while acclimating to a resting heart rate state. Heart rate monitors were then applied to student participants, where HRV data was collected over a 2.5 minute period utilizing the Elite HRV smart phone app (Elite HRV Inc., Asheville, NC, USA). The app provided breathing cues to participants during the collection period to ensure a steady heart rate. Collection of stress data took place 30 days, 9 days, and 2 days prior to departure and during all 12 days of the study abroad program. Data during ABRD were collected soon after participants awoke for the day and prior to departure.

Statistical Analysis

Data were analyzed utilizing the mixed procedure of SAS (version 9.4; Cary, NC 27513), where statistical significance was determined when $P \leq 0.05$. Two separate models were run; one with HRV as the dependent variable and one with PSS as the dependent variable. In both models the independent variables were ethnicity, international travel experience, phase of study, and two-way interactions of ethnicity by phase, and international experience by phase. Ethnicity included Caucasian and non-Caucasian levels, international experience included none and minor levels, and phase included PRE and ABRD levels. A repeated measures statement was included by day with participant as the subject. Tukey adjustments were utilized to look at the pairwise comparisons for significant interaction effects. Residual panels were analyzed for homogeneity of variance and normality of residuals.

Results

Participant PSS summary statistics are summarized in Table 2. The mean HRV was 45.86 ± 10.36 (standard deviation) with a minimum score of 19.00 and a maximum score of 89.00. The mean PSS score was 15.90 ± 6.88 (standard deviation) with a minimum score of 4.00 and a maximum score of 36.00.

Perceived stress model results are shown in Table 3. An effect was shown regarding phase on PSS, where participants’ scores were higher in the PRE phase (17.0 ± 1.9 ; LS mean \pm SE) than in the ABRD phase (13.2 ± 1.5 ; $P = 0.051$). Ethnicity was also found to have a significant effect, with Caucasian participants having higher PSS scores (20.6 ± 1.4) than non-Caucasian participants (9.5 ± 2.6 ; $P = 0.018$). Prior international experience had no effect on PSS scores ($P = 0.185$).

The interaction between phase and ethnicity was found to be significant ($P = 0.019$; Figure 2), with Caucasian participants having higher PSS scores in the PRE phase compared to the ABRD phase. No discernable differences were detected between Caucasian participants in ABRD, non-Caucasian participants in PRE, or non-Caucasian participants in ABRD ($P \geq 0.268$). An interaction effect between international experience and phase was identified

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Table 2

Summary Statistics For Participant Heart Rate Variability (HRV) and Perceived Stress Survey (PSS)

Variable	N	Mean	Standard Deviation	Minimum	Maximum
HRV	99	45.87	10.35	19.00	89.00
PSS	99	15.90	6.87	4.00	36.00

Table 3

Ethnicity, Prior International Experience, and Phase effects on Participant Perceived Stress During Study Abroad

Variable	Coefficient	Standard Error	P-Value
Ethnicity			
Caucasian	20.6	2.6	0.020
Non-Caucasian	9.5		
International Experience			
None	17.3	2.6	0.185
Minor	12.8		
Phase			
Pre-Departure (PRE)	17.0	1.9	0.018
While Abroad (ABRD)	13.2		

Note. ¹Phase consisted of measurements prior to departure (PRE; 30, 9 and 2 days prior) and while abroad (ABRD; days 1-12).

($P = 0.020$; Figure 3), where participants with no prior abroad experience had higher PSS scores in the PRE (21.7 ± 1.72) than in the ABRD phase (13.0 ± 1.39 ; $P = 0.009$). No significant differences were shown between phases for participants who had prior abroad experience ($P = 0.147$).

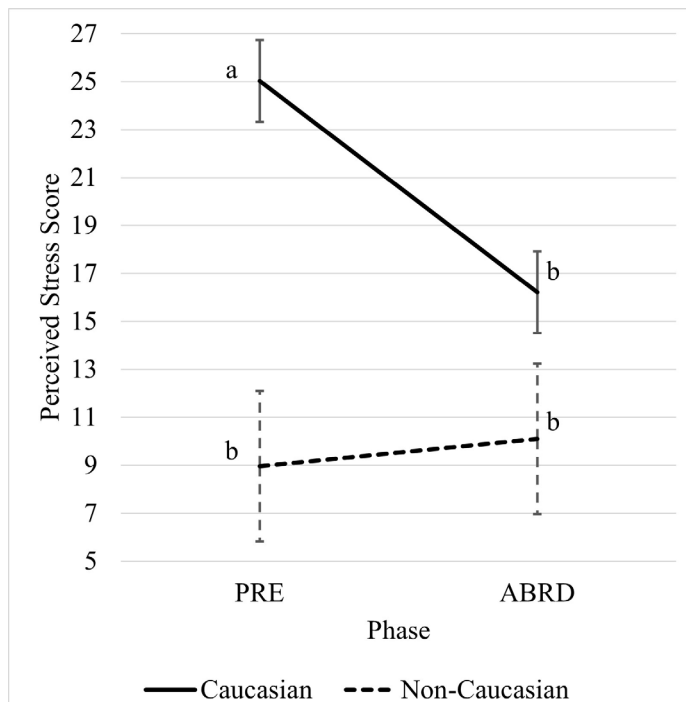
Model findings concerning participant HRV is shown in Table 4. Overall, no effects of phase, ethnicity, or international experience on HRV were identified ($P \geq 0.228$). Interaction between international experience and phase was also not significant ($P = 0.103$; Figure 4). There was an interaction effect of ethnicity by phase ($P = 0.021$; Figure 5), however, no discernable trends were observed ($P \geq 0.108$).

Discussion

Prior to leaving for the STSA program, participants were faced with a variety of stressors. This program overlapped with the university's final exam week, so the participants in this STSA were required to take their final exams early (prior to departure) or to take their finals while abroad. Taking their final exams early or abroad and working with their professor for coordination were potential stressors for our participants. Along with their schoolwork, participants were preparing to travel abroad, for some this being their first international experience. It is intuitive that these additional stressors would result in higher student stress levels in the PRE phase. This

Figure 2

Interaction Effect of Ethnicity by Phase on Perceived Stress on Study Abroad Participants



Note. This figure illustrates the interaction effect of ethnicity by phase on participant perceived stress. The PRE phase consisted of 30, 9 and 2 days prior to departure for the study abroad program, whereas the ABRD program consisted of days 1-12 while abroad. ab Letters that differ are statistically different from one another ($P < 0.05$).

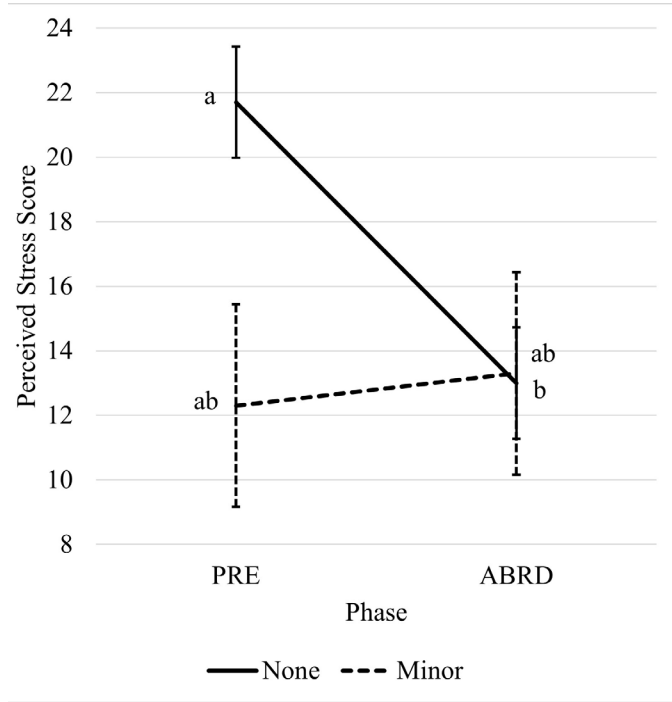
could be explained by the idea of anticipatory stress. Once the students were abroad, new stressors were introduced, associated with a different culture and experiences.

Prior studies have evaluated the idea of anticipatory stress. Vanderhasselt et al. (2014) reported that participants showed higher levels of pupillary responses in preparation for a difficult task than while they were completing the task. This aligns with the idea that when individuals have high anticipation for an event or task, their emotional load during the task itself is not as high. This is similar to what this study found, as participants showed higher psychological stress in the PRE stage compared to the ABRD stage. Similar results were found in Nasso et al. (2019), where participants perceived stress was higher prior to the stressor than during the stressful event. That study measured both psychological stress with self-reported surveys and physiological stress via HRV in four stages (baseline, anticipatory, interview preparation, and recovery). Their perceived stress results

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Figure 3

Interaction Effect of Ethnicity by Phase on Perceived Stress on Study Abroad Participants



Note. This figure illustrates the interaction effect of International Experience by phase on participant perceived stress. The PRE phase consisted of 30, 9 and 2 days prior to departure for the study abroad program, whereas the ABRD program consisted of days 1-12 while abroad. ab Letters that differ are statistically different from one another ($P < 0.05$).

Table 4

Ethnicity, Prior International Experience, and Phase Effects On participant Heart Rate Variability during Study Abroad

Variable	Coefficient	Standard Error	P-Value
Ethnicity			
Caucasian	48.0	18.0	0.250
Non-Caucasian	40.9		
International Experience			
None	48.3	18.3	0.228
Minor	40.7		
Phase			
Pre-Departure (PRE)	43.9	3.7	0.743
While Abroad (ABRD)	45.0		

Note. ¹Phase consisted of measurements prior to departure (PRE; 30, 9 and 2 days prior) and while abroad (ABRD; days 1-12).

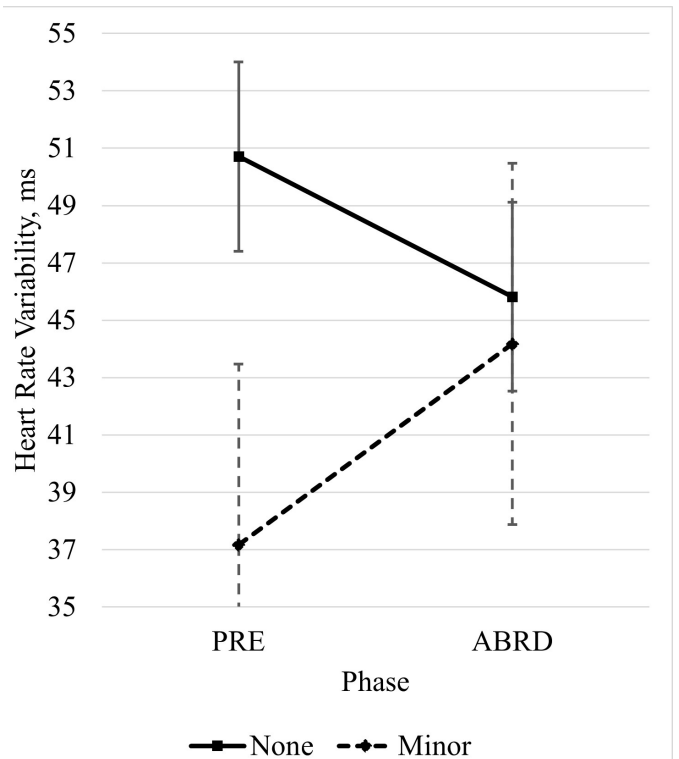
were similar to this study in that participants showed higher perceived stress leading to the event in question. However, physiologically, they found significantly lower HRV during their anticipatory and preparation stages than they did in the recovery stage, which is contrary to the results of this study.

A study completed by Dewey et al. (2018) looked at the relationship between general anxiety, classroom anxiety, and language proficiency during a semester long study abroad. This study measured cortisol levels in students three months prior to going abroad and 2 weeks prior to returning to the United States. They reported participants that had higher stress levels prior to leaving tended to have higher cortisol levels while abroad. They stated the anxiety or stress of studying abroad was comparable to those of moderate consistent stressors, not those of extreme stressors. This study by Dewey et al. (2018) reported physiological indications of stress, contradicting the results of this study.

An additional study completed by Denovan et al. (2019)

Figure 4

Interaction of International Experience by Phase on Heart Rate Variability



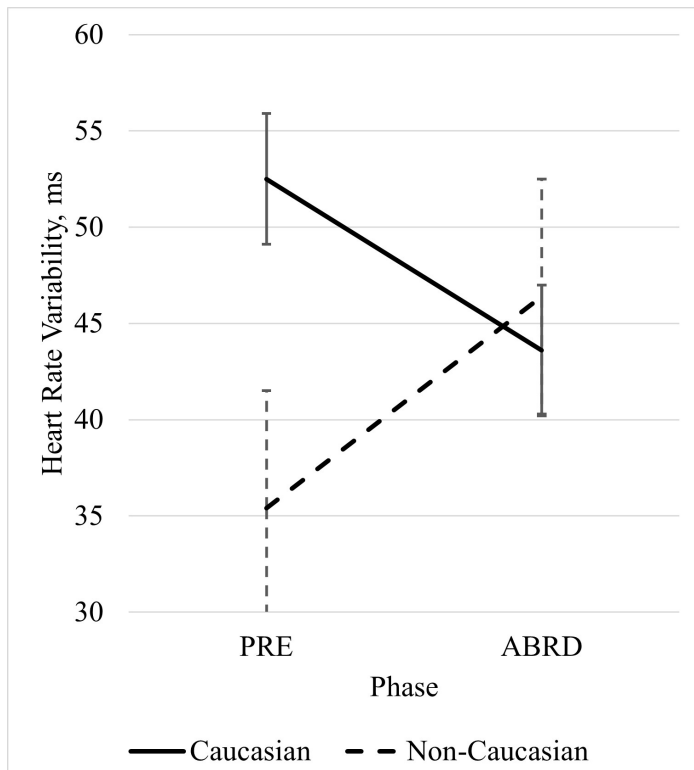
Note. This figure illustrates the interaction effect of International Experience by phase on participant Heart Rate Variability. The PRE phase consisted of 30, 9 and 2 days prior to departure for the study abroad program, whereas the ABRD program consisted of days 1-12 while abroad.

looked at perceived stress scores among university students in the United Kingdom. The average age of their participants ranged from 18-23 and consisted of 300 women and 224 men. They found overall PSS scores averaged 19.8 ± 6.4 , which was higher than the average scores reported by Cohen et al. (1994) that found an average score of 14.2 ± 6.2 for ages 18-29. Denovan et al. (2019) concluded that their population had high stress levels. In relation to this study, the reported results of the PRE phase had an average score of 17.0 ± 1.9 , which was closer to those reported by Denovan,

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Figure 5

Interaction of Ethnicity by Phase on Heart Rate Variability



Note. This figure illustrates the interaction effect of Ethnicity by phase on participant Heart Rate Variability. The PRE phase consisted of 30, 9 and 2 days prior to departure for the study abroad program, whereas the ABRD program consisted of days 1-12 while abroad. xy Letters that differ tend to differ from one another ($P < 0.10$).

and the ABRD average score of 13.2 ± 1.5 which was closer to those reported by Cohen et al. (1994). With this in mind, participants from this study had scores considered high in both the PRE and ABRD stage. When split by ethnicity, the scores for Caucasian participants averaged 20.6 ± 1.4 , which was closer to those found by Denovan (2019), while non-Caucasian participant's average scores of 9.5 ± 1.6 were closer to those found by Cohen et al. (1994). In this case the results of the Caucasian participants fell within the high stress range and the non-Caucasian participants did not.

However, the NH Department of Administrative Services (2020), which has been cited by others (Torales et al., 2020; Vives et al., 2022), states that scores ranging from 0-13 are considered low stress, 14-26 are considered moderate stress, and 27-40 are considered high stress. With this scale in mind, the PRE scores (17.0 ± 1.86), ABRD scores (13.2 ± 1.5), and the Caucasian participant scores (20.6 ± 1.4) would fall within the moderate stress category, and the non-Caucasian scores (9.5 ± 2.6) would fall within the low stress category. Non-Caucasian participants in this study were from higher populated areas based on the demographic surveys. This may serve as an explanation for the lower stress felt by the participants with the program being held in Mexico City, a very large metropolitan area.

Heart Rate Variability, a measure of the autonomic nervous system, has been studied previously. Most studies have seen a response in HRV when introduced to different

stressors (Kim et al., 2018). A study by Michels et al. (2013) found that low HRV might serve as an indicator for stress in children. Another study by Lucini et al. (2002) looked at HRV prior to an examination in college students, and found that mild, real-life stressors can have effects on cardiovascular homeostasis. Taelman et al. (2011) found that HRV can be sensitive to any change in mental or physical state.

This study's results were different from all of these in that there were no significant differences between the events in question. The differences between this study and others could be for a variety of reasons. Participants in this study may have not been physiologically stressed prior to and while abroad or may have had the same stress levels prior to and while abroad. Heart rate variability can be difficult to categorize due to differences between individuals. The authors of this study believe that future research on physiological stress while studying abroad is warranted. With additions to the current methods, other methods could be used to determine physiological stress levels and take individuality, as well as baseline stress, more into account.

Summary

In summary, participants felt they were more stressed prior to departure than they were abroad, with ethnicity and international experience playing a significant role in the level of stress that was felt. No significant differences in physiological stress were identified. Limitations of this study included a small sample size and unbalanced participant demographics. Future research is needed on student stress and study abroad in different program lengths and locations, as well as in more diverse student populations.

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