Journal of Travel Research

Stress for Success: Potential Benefits of Perceived and Actual Stress While Cruising

Journal:	*Journal of Travel Research*
Manuscript ID	JTR-19-08-15.R3
Manuscript Type:	Empirical Research Articles
Keywords:	Cognitive Activation Theory of Stress, Benefits, Travel, Cruise, Heart rate, Stress

Abstract:	Understanding the effects of travel on the health of travelers could have profound effects on the tourism industry and behaviors of tourists. While psychometric analyses have suggested travel has the ability to relieve stress and improve one's overall well-being, scant research has utilized physiological data to examine the effects of travel on health. The current study, guided by the cognitive activation theory of stress (CATS), compared self-reported diaries and physiological data (using heart rate monitors) to examine the effects cruising has on both perceived and actual stress. Results empirically validate the use of CATS as a theoretical framework for understanding travelers' perceived and actual stress. Findings also inform specific guidance to both cruise management, on how to engineer cruise experiences based on stress, and individuals, on how to experience positive stress while traveling.

Stress for Success: Potential Benefits of Perceived and Actual Stress While Cruising

Understanding the effects of travel on the health of travelers could have profound effects on the tourism industry and behaviors of tourists. While psychometric analyses have suggested travel has the ability to relieve stress and improve one's overall well-being, scant research has utilized physiological data to examine the effects of travel on health. The current study, guided by the cognitive activation theory of stress (CATS), compared self-reported diaries and physiological data (using heart rate monitors) to examine the effects cruising has on both perceived and actual stress. Results empirically validate the use of CATS as a theoretical framework for understanding travelers' perceived and actual stress. Findings also inform specific guidance to both cruise management, on how to engineer cruise experiences based on stress, and individuals, on how to experience positive stress while traveling.

KEYWORDS: Stress, benefits, cognitive activation theory of stress, travel, cruise, heart rate

Stress for Success: Potential Benefits of both Perceived and Observed Stress While Cruising

Introduction

Recent research has unveiled the positive effects of travel and tourism activities on the perceived health and well-being of travelers (Chen, Petrick, and Shahvali 2016; Chen and Yoon 2018; Sirgy et al. 2011). Evidence suggests that prolonged vacations help individuals who work full-time in relieving their overall stress and increases their life satisfaction (Chen, Huang, and Petrick 2016). Many of these studies have been guided by bottom-up spillover theory (Chen and Yoon 2018; Sirgy et al. 2011) which suggests that various life domains (i.e., work, leisure, family) have an influence on overall satisfaction with life (Diener 1984). This theory can also be used to help explain the role that health in one domain can have on overall health. Accordingly, if travel experiences help to reduce stress during a vacation, these effects could carry over (spillover) and have lasting effects on a traveler's overall health. This possibility led Petrick and Huether (2013) to suggest that if travel were found to be healthy, it should be prescribed by doctors. Therefore, work is needed to better understand how travel can affect the stressors of daily life.

Literature across multiple fields has shown that perceptions of health can be positively related to physiological changes. Physiological research has revealed that stress results in increases in cardiovascular systems activity such as increased heart rate, breathing frequency, and blood pressure (De Kloet, Joëls, and Holsboer 2005). In particular, changes in heart rate have been shown to be reliable indicators of stress and anxiety (McDonald et al. 2019). Hence, the current study will use heart rate as a measurable proxy for stress.

While research has consistently shown that taking vacations has the ability to contribute to the subjective well-being of travelers (Chen and Petrick 2013; Fritz and Sonnentag 2006;

Gilbert and Abdullah 2004; Nawijn et al. 2013; Sirgy et al. 2011; Sonnentag and Fritz 2007), the evidence supporting the physiological benefits of travel have been scant. With a few exceptions, the existing research in the travel industry has been limited to psychological measurements of the effects of the environment on the travel experience instead of physiological data. In addition, most studies have relied solely on perceptions of health which can lead to a very unclear understanding of overall health (Shedler, Mayman, and Manis 1993). Hence, the current study aims to understand the effect that different vacation experiences have on both the perceived stress and physiological reactions associated with stress experienced by cruise travelers.

Literature Review

Stress has been defined as pressure or distress that is related to sources of strain (Ursin and Eriksen 2004). Feelings of stress can be perceived mentally and have physical effects on those experiencing it (Reme, Eriksen, and Ursin 2008). For the purpose of this study, mental stress will be termed "perceived stress" and physical stress will be termed "observed or actual stress."

As early as Cannon (1932), health researchers have suggested that just because an individual experiences stress, the implications are not necessarily harmful. Selye (1955) was one of the first to argue that stress should not always be avoided, for overcoming it can be beneficial. Yet, most of the theories used to understand occupational stress have ignored the potential positive benefits of adapting to stress. According to Meurs and Perrewe (2011, p.1044), "in our zeal to find the 'problems' of workplaces or individuals, stress researchers have neglected to consider the adaptive effects of stress." Ursin and Ericksen (2004) went as far as to argue that stress is necessary for the complex operations of our brain.

Despite potential benefits in some contexts, stress at work has been linked to health problems and associated higher health care costs in modern work environments (Goetzel et al. 1998; Sonnentag and Frese 2003). Job stress has been found to be increasingly associated with burnout (Demerouti et al. 2001; Garst, Frese, and Molenaar 2000) and job performance degradation in a variety of work domains (Jex 1998). Additionally, increased levels of stress can impact an employee's cognitive performance, well-being, occupational health, and job performance as well as the overall performance of a work team (Carayon and Hoonakker 2013).

Health Benefits of Travel

Vacations have been shown to relieve job stress and reduce absenteeism in the workplace (Westman and Etzion 2001). Chen, Petrick, and Shahvali (2016) utilized a panel of U.S. citizens to examine the effects tourism experiences have on perceptions of life satisfaction and recovery from stress. They revealed that even very short vacations (2 days or less) can aid people in recovery from work stress.

Similarly, Chen, Huang, and Petrick (2016) found that prolonged vacations (7 days or more) help individuals who work full-time in relieving stress from their work place and increase their life satisfaction. They further found that the benefits of shorter trips are more related to relaxation, while the effects on life satisfaction for longer trips is more related to detachment, mastery and control. This is in line with Chen (2018) who found that feeling relaxed and detached from work, being in control of what one does, and participating in challenging and learning activities assist in providing stress relief during leisure travel.

Additionally, Chen and Petrick (2016) employed three online panel studies and found that while relaxation and experiential benefits were more prevalent, respondents also felt they had health benefits from traveling. This study further found that individuals who perceived travel

to have health benefits were more likely to travel more frequently. Similarly, Chen and Yoon (2018) found that travelers who were more likely to seek novelty were more likely to perceive travel to have more personal benefits, and that persons who traveled more often were more satisfied with their lives. These findings suggest that travel can have prolonged and accumulative effects on the lives of those who travel; if strong and complementary evidence of health benefits of travel are found, the travel industry could use these results to increase travel behavior.

Theoretical Background

Conservation of resources theory suggests that resources lost due to life stressors can be regained by gathering and consuming positive resources (Hobfoll 1998). Thus, one way to recover from stress is to replenish the resources lost due to dealing with stress. With some of the primary motivations of travel being to "escape" and "relax" (Crompton 1979) it could be postulated that traveling helps relieve the stresses one procures from their work and daily lives. Hence, the replenishment of these resources should lead to improved health, well-being, and performance at work (Fritz and Sonnentag 2006). In fact, Cartwright and Cooper (1997) suggested that recovery from stress at work, and in daily lives can occur by taking breaks from work, including vacations.

Developed within the physiological health literature, the Cognitive Activation Theory of Stress (CATS) helps to explain how individuals receive, and process stress, including both the positive and negative effects incurred. Ursin and Ericksen (2004) revealed that CATS explains the stress process using four aspects/steps of stress including: 1) stress stimuli or stressors, 2) evaluation by the brain (appraisal), 3) responses to the stress (alarm), and 4) the individuals' feedback from the stress response (see Figure 1).

INSERT FIGURE 1

They argued that the situation surrounding the stress stimuli (step 1), including individual differences (i.e, their past experiences, personality, etc.) lead to a cognitive evaluation of the event (step 2). According to Ursin and Ericksen (2004), the stress experienced (step 3) is typically what is reported by employees as their perceived stress on questionnaires. They argue that the respondent is stating an appraisal of how the situation is affecting them, in comparison to expectations developed about the event incurred.

The response to the stress experience (step 3) can also include the physiological effects the individual feels prior to trying to adapt to the situation. Ursin and Ericksen (2004) argued that the effects of stress on the individual (i.e., perceived and observed) are both situational and individual dependent. Hence, variables related to situation and individual factors should also be examined.

The arousal felt by the stress has been argued to be the easiest to measure reliably and consistently (Ursin and Eriksen 2004). The tourism literature has often examined the perceived responses to events (Chen and Petrick 2016). However, research investigating the effects of travel on physiological changes attributed to stress are largely absent. While not directly a travel study, Ewert, Davidson, and Chang (2016) examined the effects that rappelling activities have on the observed stress measured as increased cortisol levels of participants. They revealed that even when participants experience observed stress, they might not acknowledge the stress to themselves or to others. They further found the largest impact on stress occurred in anticipation of rappelling, followed by the period immediately after rappelling, while the lowest stress was observed during the activity. These findings suggest that stress levels during a vacation might be highest while anticipating the vacation. Other studies have also used salivary cortisol to measure stress (Arora et al. 2010; Bedini et al. 2017).

Other physiological measurements of stress include electrodermal activity (Betti et al. 2017; Hellerud and Storm 2002; Posada-Quintero et al. 2018), EEG (Betti et al. 2017; Maddox et al. 2015), and brain activities measured via functional near-infrared spectroscopy (Al-Shargie et al. 2016; Rosenbaum et al. 2018). Heart rate and heart rate variability have also been shown to be valid metrics to measure stress in a variety of domains (Jones et al. 2015; Rieger et al. 2014). Complementing this strong evidence of positive correlations between heart rate with stress, the high prevalence and non-intrusiveness of heart rate monitors and sensors provide an opportunity to access convenient objective data to investigate stress in a variety of domains and contexts. In this study, we leveraged these benefits to investigate the effects of different situations on increases or decreases in heart rate.

The final stage of CATS is the individual's experience or feedback related to the experience. These responses generate either positive expectancies (coping/training), no expectancy (helplessness), or negative expectancies (hopelessness). Long-term feelings of helplessness or hopelessness can negatively affect the health of the individual, while coping/training can have positive effects on the individual (Ursin and Eriksen 2004).

Thus, CATS suggests that individuals' health can be threatened from long-term activation, and that short-term arousal has training effects (Meurs and Perrewé 2011). Meurs and Perrewé (2011) argued that if the training effects do not utilize too many resources in negotiating the stressor, the stressor typically has positive benefits to those who experience them. These positive benefits occur as the situation trains individuals' bodies and minds to better understand and cope with future stresses. Since the vast majority of stresses that occur in tourism settings are typically short-term and not intense, this suggests that stresses incurred during travel could have long-term positive effects on individuals.

Similarly, repetitive experiences with the same type of stressors allow individuals to learn over time that these stresses can be overcome (Meurs and Perrewé 2011). Meurs and Perrewé argued that this learning process "is part of an adaptive and beneficial system that has survived the test of evolution" (2011, 1049). Thus, repeated tourism experiences or activities likely incur a reduction in both perceived and observed stress to tourists, while more novel experiences or activities will likely incur increases in stress.

CATS further implies that worry can play a large role in the effects of stress (Meurs and Perrewé 2011). Research has found that worry related to a stressful event has a longer effect on stress (including elevated heart rate) than the actual event itself (Brosschot, Van Dijk, and Thayer 2007; Pieper et al. 2007). Thus, events/activities that cause one to worry while traveling likely have a more negative effect on one's health. A thorough review of CATS can be found in Ursin and Ericksen (2004, 2010). Due to the theory's ability to comprehensively understand how stress affects individuals, it was chosen to conceptually ground the current study.

Hypotheses

Understanding the physiological and psychological effects of travel is believed to be important as it could dramatically affect how and why people travel. Thus, the study's primary purpose was to determine how different activities on a vacation affect both the perceived and observed stress of cruise travelers. Secondary purposes included the identification of how situational factors affect these relationships. Since, it is believed this study is the first of its type to examine CATS and the effects of travel on the heart rate of those traveling, much of the study is exploratory in nature. Hence, the situational factors hypothesized below were chosen based on a thorough review of similar research and the authors' best approximation of factors that could affect stress (both observed and perceived) while traveling.

CATS suggests that stress experiences (step 1), lead to evaluation by the brain (step 2), which lead to stress responses (i.e., perceived and observed, in step 3; Ursin and Eriksen 2004). Step 1 can be operationalized as different experiences/activities during a vacation, while step 3 can be viewed as evaluations of perceived stress and observed stress (i.e., heart rate [HR]). It is therefore hypothesized that different *experiences will have varying effects on perceived stress and observed stress.*

In particular, research has found that worry related to a stressful event has a longer effect on stress (including elevated heart rate and perceptions of stress), than the actual event itself (Brosschot, Van Dijk, and Thayer 2007). Thus, the current study postulates:

H1: events more likely to cause "worry" will have a greater effect on both perceived (H1a) and observed stress (H1b) than those less likely to cause "worry."

Further, since heart rate can be raised not only by stress, but also by physical activity, it is postulated:

H2: Respondents' perceived stress will be more highly correlated to their observed stress (heart rate) in passive activities or experiences (those that include less physical exertion) than active ones.

Research has also found that repetitive experiences with stressful stimuli allow individuals to adapt and learn how to cope (Meurs and Perrewé 2011). It is thus proposed:

H3: Unique experiences will have greater perceived (H3a) and observed (via HR) stress (H3b) for individuals than common experiences.

H4: Experiences that are repeated throughout the cruise will have less perceived (H4a) and observed stress (H5b) at the end of the cruise, than the beginning of the cruise.

Surprisingly little research has examined correlations between heart rate and perceptions of stress. The research that has been conducted in this area is conflicting. Some past studies have found a relationship between heart rate and perceptions of stress (Dishman et al. 2000; Föhr et al. 2015), while others have found no relationship (Sneed et al. 2001. Further, heart rate variability (HRV) has been shown to be somewhat correlated, but this relationship is individual and situationally dependent (Lombardo and Vick 2019). Due to the conflicting prior results, it was postulated:

H5: Perceived stress will not be significantly correlated with observed stress.

CATS also proposes that situational factors will have varying effects on stress appraisals (perceived stress) and stress responses (observed stress; Ursin and Eriksen 2004). Situational factors most likely to affect stress are those that alter a situation from what is expected (Reme, Erikson, and Ursin 2008). To determine which situational factors were most likely to affect participants, the researchers reviewed the literature related to leisure activities and discussed with cruise management the factors which might cause deviance from cruisers' expectations. This exploratory process led the researchers to Hypotheses 6-10.

Since the participants were extremely likely to be consuming alcohol during their cruise, and that alcohol has consistently been found to have an effect on stress levels (Sayette 1993), it is proposed:

H6: The more intoxicated individuals perceive they are, the higher their perceived (H6a) and observed stress (H6b).

Also, cruising has long been associated with long lines and crowding, and crowding has consistently been found to affect leisure/touristic experiences (Kim, Lee, and Sirgy 2016); therefore it is posited:

H7: The more crowded individuals feel on a cruise, the higher their perceived (H7a) and observed stress (H7b).

Further, while cruising is typically a leisure experience, the participants were partaking in a study abroad (e.g., work) and that detachment from work has been found to relieve stress (Chen, Petrick,and Shahvali 2016); it is hence hypothesized:

H8: The more leisure-like (compared to work-like) activities are perceived to be, the lower the effects on perceived (H8a) and observed stress (H8b).

Excitement has also been found to be a key motivation for cruising (Hung and Petrick 2011) and to be highly correlated to travel stress (De Vos et al. 2013); hence it is postulated:

H9: The more exciting activities are perceived to be, the higher the perceived (H9a) and observed stress (H9b).

Also, novelty has consistently been found to be a primary motive of cruising (Hung and Petrick 2011) and to be an important aspect of travel experiences (Bello and Etzel 1985); therefore it is postulated:

H10; The more novel activities are perceived to be, the higher the perceived (H10a) and observed stress (H10b).

Ewert, Davidson, and Chang (2016), found that anticipation of stress has greater effect on the stress of participants than either during or after participation. It is therefore postulated:

H11: Both perceived (H11a) and observed stress (H11b) will be higher before starting a cruise, than during.

Research has also suggested that the longer vacations are, the more that both perceived and observed stress are reduced (Chen, Huang, and Petrick 2016). Thus, it was postulated:

H12: Both perceived (H12a) and observed stress (H12b) would be lower at the end of the cruise, than the beginning.

Methodology

This study collected information from 17 students who took part in a cruise vacation on a large commercial cruise line for 7 days (12 female, 5 male; mean age = 21.2 years, SD = .83 years) in August, 2018. All of the students were participating in a study abroad course with the vast majority studying tourism management, and 14 had never cruised before. The cruise was scheduled to depart from Galveston, TX, followed by: two days at sea; stops at Roatan, Honduras, and Cozumel (Mexico); a day at sea; and return to Galveston. Students' resting HR was taken at a meeting prior to the cruise and ranged from 80-92 beats per minute with an average of 86.7 and standard deviation of 4.5. Since HR's were within two standard deviations from the mean, it was postulated that no differences existed between students prior to the cruise. Further, all students were required to complete a medical form prior to cruising, and none had any conditions suggesting prior heart disease.

The students kept a diary of their activities (hourly) and wore a heart rate sensor during the cruise. Hence, there were 2,856 potential points of data (17 students x 7 days x 24 hours per day) for just the diaries. Thus, while the sample of respondents was small, the amount of data collected was somewhat large. Prior to the cruise, participants were given a heart rate monitor,

and given explicit information on how to use the monitor as well as how to record their activities in a daily diary. The heart rate sensor was a Motorola Moto 360 Sport smartwatch with a custom tool designed to monitor and document their heart rate continuously. While movement data was also recorded using accelerometer and gyroscope sensors, this report only documents the analysis using the heart rate data.

Data Collection and Analysis

During the course of the cruise, the participants recorded their activities and perceived stress level for every hour of the day (24 entries per day) in their diaries. The students were advised to record their diary data after each hour if possible, and at a minimum to complete diary information after lunch and dinner each day, and prior to going to sleep. Potential stressors included in the diary were generated based on CATS and a thorough review of the literature. The resultant variables included: the effect of strangers (Smith 2012), perceived crowding (Gramann 1982), alcohol (Arkwright et al. 1982), excitement (Reisinger and Mavondo 2005), perceived leisure versus work (Cassidy 1996), novelty (Gustafson 2014) as well as a subjective measure of perceived stress. An example of a diary with fictitious input is shown in Figure 2.

INSERT FIGURE 2

The questions to measure each variable were developed, based on the literature, by a former cruise director who also has a Ph.D. in tourism marketing. The items were purposefully made for ease of response, including single item scales to help respondents complete their 24-hour diaries. While multi-item scales would have increased the reliability of the results, it was believed they would have been too taxing on the respondents who needed to record a score for each variable in every waking hour. The questions were subsequently reviewed by three persons with extensive knowledge of the content area for validity. Two of the reviewers were doctoral

students and the other a Ph.D., all in the area of tourism marketing. This process led to minor editing of two survey questions and a change in the response choices for alcohol use.

The effects of strangers were measured by asking respondents to record a score denoting those around them from 1 "all strangers" to 7 "all friends" as well as by asking how many total people were around them. Alcohol consumption was measured on a scale from 1 "totally sober," 2 "slightly buzzed," 3 "buzzed," 4 "drunk," and 5 "wasted." Perceived crowding was assessed from 1 "not at all crowded" to 10 "extremely crowded." Similarly, excitement and perceived stress were measured from 1 "not at all" to 10 "extremely." Leisure was measured from 1 "not at all leisure" to 10 "fully leisure" while novelty was assessed from 1 "not at all novel" to 10 "extremely novel." Heart rate data was subsequently correlated with the diary data for analysis.

Guided by CATS, and in accordance with the above, this paper analyzes the cruise travel experience to ascertain the effects of various vacation activities on individuals perceived and observed (HR) stress. The study attempts to determine the relationship between heart rate (physiological data) and self-reported values of the various stressors (psychological data). It is anticipated that results could inform recommendations to the cruise travel industry for modifying the cruise travel itinerary to provide more beneficial travel experiences, and that individuals will be better equipped to understand the effects various travel activities have on their health.

Results

Prior to examining the hypotheses, researchers classified activities recorded in participant diaries into themes utilizing principles of Critical Incident Technique (Migacz, Durko, and Petrick 2016). Two researchers separately reviewed each of the recorded activities and categorized them into resultant themes. The resultant placement of items into themes was then

compared, resulting in an initial inter-judge agreement of 73.9% (2,061 of 2,790 correct). The two researchers then met to reach consensus on the themes to be used for the study. The researchers then recoded each of the items, using the same potential themes. This resulted in an inter-judge agreement of 97.1%. The remaining items of disagreement were then negotiated, until both judges agreed upon thematic placement for every item.

The final themes (n=12) for activities experienced by the respondents included: 1) active activities (i.e., walking, partaking in a scavenger hunt), 2) administrative, 3) classroom, 4) clubbing, 5) dining, 6) embarking, 7) contacting home, 8) lounging, 9) passive activities (i.e., watching a show), 10) personal time, 11) transportation, and 12) sleeping. While the students were sleeping, their HR monitors were charging; thus, sleeping was not included in the hypotheses. Unique to this cruise, the Captain announced in the afternoon of the expected last cruise day that the ship would not be able to return to its home port as planned, due to a hurricane. This moment led to 10 of the participants calling home, which is the activity themed as "contacting home."

The two researchers who separately categorized the themes also individually chose which of the 12 resultant activity themes would be declared "worry" (H1), "passive vs. active" (H2), "unique" (H3), and "prior to cruise (H10). The researchers had 100% agreement and, for the purposes of the hypotheses, "calling home" was deemed to be an event that would cause worry (H1). To further confirm "most unique," respondents were asked in a follow-up Qualtrics survey, "Of the following activities you participated in during your cruise, which was the MOST unique?" The respondents confirmed the researchers' classification as the majority (n = 11) stated "embarkation" was the most unique. It needs to be noted that with just a sample size of 10,

results related to "calling home" have very little statistical power. Hence the findings related to "calling home" are included, but generalization beyond the current results may be limited.

Further, active activities and clubbing were deemed "active" while lounging and passive activities were deemed "passive" (H2); embarkation was deemed a "unique" event (H3); and transportation to cruise and embarkation were deemed to be activities prior to the cruise (H10). These declarations were checked by a third researcher, who was also in 100% agreement.

MANOVA with post-hoc Tukey's t-tests were used to examine H1, H2, H3 and H10. For all analysis, $p < .05$ was deemed significant. Results of the MANOVA procedures revealed that different types of activities resulted in significant ($p. < .05$) differences in both perceived and observed (HR) stress (see Table 1).

INSERT TABLE 1

It was postulated in H1 that events likely to cause "worry" would have a greater effect on both perceived and observed stress. Post hoc Tukey's t-tests revealed that contacting home was found to have both moderate perceived stress (mean = 2.50) and observed stress (mean = 86.9). This was believed to have happened as calling their parents likely calmed the nerves of the students over the duration of the hour this activity took place. Looking at the data per minute, the students' HRs dropped significantly ($p < .05$) from when they were notified they would not be going home to when the next hour ended. This finding also likely should not be generalized due to the extremely small number of data points assessed ($n = 10$), though the per-minute data has some validity. Hence, H1a and H1b was rejected.

INSERT FIGURE 3

H3 proposed that unique activities (embarkation) would have both greater perceptions of and observed stress on the respondents. It was found that embarkation had the second highest observed (mean = 93.6) and perceived (mean = 4.48) stress (administrative activities had the highest perceived and observed stress). The mean for perceived stress was significantly ($p < .05$) higher than all activities other than "active" and "administrative," and the mean for observed stress was significantly ($p < .05$) higher than "lounging." Thus, H3a and H3b were accepted.

It was proposed in H2 that respondents' perceived stress would be more highly correlated to their observed stress in passive experiences when compared to active activities. As discussed above, passive activities and lounging were deemed "passive" and active activities and clubbing were deemed "active." Extremely low correlations were found between the perceived and observed stress for all four activities. The bivariate correlations were all not significant ($p > .05$) and were: lounging (.02), passive activities (-.16), active activities (.08), and clubbing (.19). Hence, H2a and H2b were rejected.

It was further postulated in H5 that perceived stress (for all activities) would not be significantly correlated with observed stress. It was found that the relationship between perceived and observed stress was not significant ($r = .05$, $p > .05$). A graph showing the averages by activity type for perceived and observed stress is shown in Figure 4. The figure reveals that stress fluctuated quite similarly between activities, suggesting a relationship. These findings are similar to Lombardo and Vick (2019), who found the relationship between HRV and perceived stress to be individually and situationally dependent.

INSERT FIGURE 4

The largest exception, and likely why the findings were not significant, was clubbing, and the only other large exception was passive entertainment. The data suggest that students felt less

stressed while "clubbing" and experiencing "passive entertainment" than their HR would suggest. This could be due to the students doing two of the activities that they likely enjoyed the most, and the perceptions of pleasure reduced their perceptions of stress. This is similar to McCraty et al. (1998) who found, that positive emotions can reduce HR and have positive physiological effects. Further, these findings might help explain why past research has had conflicting results when examining the relationships between heart rate and perceptions of stress (Dishman et al. 2000; Hewett et al. 2011). Thus, since the overall correlation was not significant, H5 was accepted.

H4 argued that repeated activities would have less observed and perceived stress over the duration of the cruise. Activities that had at least 100 data points, and were repeated over the course of the cruise, included: active activities, class activities, clubbing, dining, lounging, passive entertainment, personal time, and transportation to/from shore visits. Analysis (Pearson's R Correlation) of the repetitive activities over the duration of the cruise revealed that the only activity that showed a significant ($p > .05$) decrease in perceived stress as it was repeated during the cruise was transportation to and from port visits ($r = -0.394$, $p < .001$). Thus, H4a was accepted for "transportation" but rejected for all other repeated activities. None of the activities showed a significant ($p < .05$) decrease in observed stress as they were repeated during the cruise. Thus, H4b was rejected. This result is believed to have occurred as transportation was likely the most unique activity to the situation the students were in. It is unlikely that the participants have similar transportation experiences (i.e., tenders, lack of air-conditioned cabs, driving on left side of the road, etc.) in their daily lives, while the other activities are likely more routinized at home.

To analyze the effect of situational factors on perceived and observed stress, a regression analysis was performed with perceived stress and observed stress as the dependent variables and alcohol consumption (H6), crowdedness (H7), leisure (H8), excitement (H9), and novelty (H10) as the independent variables. Table 2 illustrates the results of the regression analysis for each of the situational factors.

INSERT TABLE 2

The perceived stress model (F = 68.9, 5 df) was significant (p. < .001) and explained 17.7% of the variance in perceived stress. It was revealed that leisure (b = -3.17), crowdedness (b = .244), novelty (b = .122) and alcohol (b = -.122) all were significantly (p < .001) predicted perceptions of stress. Thus, as expected, as perceptions of crowdedness and novelty increased, so did perceptions of stress. Further, also as expected, as perceptions of leisure and alcohol consumption increased, perceptions of stress decreased. Excitement was not found to be a good predictor of perceptions of stress. Hence H6a, H7a, H8a, and H10a were accepted and H9a was rejected.

The observed stress model (F = 2.33, 5 df) was also significant (p. < .05) but explained just 1.2% of the variance in observed stress. It was found that only excitement (b = .08) was significant (p < .05), and as expected, as the students perceived situations to be more exciting, HR/stress increased. Thus, H9b was accepted, while H6b, H7b, H8b and H10b were rejected. This result is unique, as excitement was the only variable not significant (p > .05) when predicting perceived stress. Combined, this result suggest that the situational factors which influence perceptions of stress and observed stress are quite different.

H11 suggested that both perceived and observed stress would be higher before the start of the cruise than during the cruise. Independent t-tests revealed that both participants' perceived (t

= 8.5, 1,620 df, p < .001) and observed stress (t = 5.9, 1,528 df; p < .001) were significantly higher before the cruise started (prior to 4 pm on Day 1) then after it started (after 4 pm on Day 1). It was found that the mean for perceived stress went from 4.32 before the cruise, to 2.23 after and that participants' average HR was 92.0 before the cruise started, and was 82.5 after it started. Hence, pre-cruise stress was higher before the cruise started than after. It should be noted that participants did not handle any of their luggage prior to the cruise and went directly from an air-conditioned bus to the air-conditioned terminal to embark the ship.

The final hypothesis (H12) proposed that both perceived and observed stress would be reduced during the duration of the cruise; this was analyzed with MANOVA and Tukey's post hoc t-tests. Results of the MANOVA procedures revealed that both perceived and observed (HR) stress was significantly different, during the duration of the cruise (see Table 3).

INSERT TABLE 3

For perceived stress, day 1 (mean = 3.3) had a significantly (p < .05) higher perceived stress rate than days 2 (mean = 2.1), 3 (mean = 1.7), 5 (mean = 2.3) and 6 (mean = 2.3). It was further found that day 7 (mean = 3.2) had the second highest level of perceived stress, and that stress was significantly higher than days 2 and 3. With the impending weather, and the known potential of not being able to get home when expected, it makes sense that day 7's and 6's perceptions of stress were elevated. Hence, H13a was partially accepted.

Similarly, it was found that day 1 (mean = 91.1) had a significantly (p < .05) higher observed stress rate than days 2 (mean = 86.2), 3 (mean = 86.1), 4 (mean = 82.3) and 6 (mean = 84.2). It was found that day 4 (a day in Roatan, Honduras) had the lowest observed HR, followed by day 6 (final day at sea). This is potentially because the majority of students had a peaceful

beach day in Honduras, and lounged much of day 6. Therefore, H13b was also partially accepted.

Conclusion and Discussion

Despite the exploratory nature of this study, to our knowledge, this is the first study investigating the difference between perceived and observed stress in the context of travel and therefore the findings have important implications for both theory and practice. Theoretically, the results suggest that CATS is an excellent conceptual framework for understanding both perceived and observed stress of travelers. As per the theory, it was found that stress stimuli (activities) had an effect on both perceived stress appraisals and physiological stress responses (HR). Additionally, situational variables (i.e., crowdedness, excitement, leisure, and novelty), were found to be related to these effects.

Likely most importantly, it was found that even though perceptions of stress tended to linger for a little while, observed stress (HR) was found to return to normal, even after the most stressful of events on a vacation. Much like a marathon runner, who continually extends workout distances and efforts to increase their heart's capacity to perform, the current results suggest that vacations can also strengthen our ability to handle stress. CATS calls this training and/or coping. The results also suggest that persons struggling with strain (i.e., helplessness or hopelessness) could greatly benefit from taking a cruise or similar vacation. The overall, revised conceptual model can be seen in Figure 5.

The results also offer specific guidance to cruise management and to travelers making decisions about their activities when they travel. Results revealed that activities that cause "worry" can have significant effects on perceived stress. Yet, even students who were told they would not be able to return home when expected were able to cope and avoid strain. This is

likely due to being consoled by family and their peers. The cruise line offered free Wi-Fi to all passengers so that they could easily contact home to discuss what was going on. The current results suggest that this would be a good policy for cruise lines to execute in similar situations.

It was also found that unique experiences (in particular embarkation), had a greater effect on stress, and that the stress created by activities diminished the more times the cruisers participated in them. This suggests that for first-time cruisers in particular, the process of getting on board is potentially the most stressful occurrence of the week. Since stress that occurs for a short period of time and with coping can be positive, this finding suggests the importance of onboarding passengers as quickly as possible, and, for passengers who are stressed, to participate in relaxing/calming activities as soon as they are on board. Examples of these types of activities would include having spa treatments as well as quiet areas to rest/lounge/eat available as soon as passengers board.

Results also revealed that different situations (i.e., crowded, work-related, exciting and novel), can significantly increase passengers' perceived stress. Crowdedness is likely to occur in show lounges, at dinner, and around pool areas, while work situations are likely caused by passengers trying to stay in contact with work from home. Further, exciting and novel experiences will likely be interpreted very differently by different cruisers. Since CATS suggests that stress which is quickly coped with is positive, cruise management should be aware of these types of situations on board their ships, and to make sure the duration is not too long (i.e., more than an hour), with stress reducing activities offered immediately thereafter.

It was further found that stress levels were highest prior to the start of the cruise, and that both perceived and observed stress fluctuated by day of the week. Chen, Huang, and Petrick (2016) suggested that the longer a vacation is, the less stressed visitors will be. This could have

been the case in the current study, had the respondents not been near a hurricane during the final two days of the cruise. It is possible that being on vacation minimized the stress of the situation, but it is not known. Future research should examine the effects of the same stressful events experienced between people on vacation and those in their normal environments.

Finally, this study found that perceived stress and physiological responses, as measured by HR, are not strongly correlated. This is in line with the majority of previous research that has found generally weak association between the two constructs (Cohen et al. 2000; Hansen, Johnsen, and Thayer 2003; Schlotz et al. 2008). In fact, studies have shown an inverse association between heart rate responsiveness and subsequent appraisal of stress (Oldehinkel et al. 2011). Despite such weak correlation, our study showed several similar trends for perceived stress and HR for several activities (Figure 4). For example, both observed HR and perceived stress were highest for administrative and embarkation and lowest for lounging. Given recent evidence suggesting the complementary nature of objective and subjective metrics (Föhr et al. 2015), there is hence believed to be value in measuring both regardless of poor correlations. However, future studies should examine activities in isolation to investigate the underlying causes for such trends and other discrepancies.

In our study we used HR (beats per minute) due to its practical advantages (for example, ease of data collection using commercial-of-the-shelf [COTS] smartwatches). However, more robust metrics such as Heart Rate Variability (HRV) in combination with self-reports have shown promise to provide complimentary and confirmatory data (Föhr et al. 2015;Schubert et al. 2009). While HRV sensors are generally more expensive, require special sensors, and are not used in COTS wearable devices, their efficacy in detecting stress (along with self-report measures) should be investigated in the travel domain. Other less practical but effective objective

stress detection metrics such as cortisol levels (Meland et al. 2015; Wolkow et al. 2016), skin conductance (Krantz, Glass, and Synder 1974), and skin temperature (Melin et al. 1999), while not be suitable for continuous monitoring in field studies, may be included in complex study designs that involve periodic measurements.

Heart rates that are deemed "normal" typically range from 60 to 100 beats per minute, while heart rates between 50 to 70 have been argued to be ideal (Shmerling 2017). While HR has been suggested to be an excellent indicator of actual stress in a multitude of different settings (Jones et al. 2015; Rieger et al. 2014) , there are multiple factors unrelated to stress that could elevate HR. In particular, active activities and clubbing could have elevated respondents' HR regardless of stress due to the involvement of physical activity (Shmerling 2017). In order to minimize this effect, students were asked not to wear their watches while working out, but almost certainly other activities had false elevations in HR. Future research should also incorporate accelerometer and gyroscope data to better understand what is causing changes in heart rate. Heart rate can also be elevated by: being nervous, using a stimulant (i.e., coffee), being pregnant, or poor physical fitness (Shmerling 2017). Future research should try to control for these and other factors.

The current study was limited by only using a student sample, for one cruise, at one time. Future research should expand the sample to general passengers, and examine if differences exist between cruise lines, or time of year sailed. The study was further limited by using an aggregate average of HR over an hour, instead of utilizing HR data per second/minute. Future studies should examine these effects and also look at including measures of cortisol, which has also been suggested by CATS researchers as an effective way to examine stress.

Further, this study consisted entirely of seventeen young adults, with a median age of 21. Thus, future research should be extended to the general traveling public and have larger sample sizes to increase generalizability. Personal factors including gender, health, physical characteristics, and hereditary factors should also be controlled for. Further, the role of current health condition, and potential inherited conditions should be examined in future research.

It is also quite possible that since the participants were participating in a study abroad, which included classroom meetings, their experiences are not representative of typical cruise passengers. It is recommended that future studies examine differences in stress between passengers with different reasons for taking their cruise.

Additionally, as noted in the Data Collection and Analysis section, single item scales were used for recording the subjective ratings for the various stressors. Multiple item scales would have increased reliability of the measures and should be considered for use in future research studies. The results of this study were also limited to the stressors chosen and future research should consider other variables that could be measured. These might include: travel party makeup, weather, satisfaction, and involvement.

The study was also limited by studying stress effects for just one week. As proposed by Brosschot and Thayer (1998), duration is key when examining outcomes of stress. It is thus suggested that future research examine the effects that travel has on stress for longer durations of time. Future research should also be conducted longitudinally so that stress can be examined from prior to travel decision making through post experience, to better understand how planning and time have an effect on stress gains made/lost during travel.

Further, the activities and experiences examined, for the most part, included very temporary activation and arousal. Brosschot, Pieper, and Thayer (2005) argued that sustained

stress activation is necessary to threaten health, and that past research has failed to examine it. Future travel research should be conducted under more severe stressful situations, and should examine the post effects associated with it (i.e., coping, helplessness and hopelessness). These might include studies measuring the effects of extreme weather on vacation stress. The study was further limited by only utilizing an average HR per hour. Future research should examine HR *in situ*, immediately during activities, to more accurately assess the physiological stress of each activity.

Finally, future research should also examine the potential added stressors that COVID-19 might have on cruisers. In order to somewhat better understand pandemic effect, the current participants were asked the following, in a follow-up Qualtrics survey: "If you were faced with cruising this winter (2020), in comparison to when we cruised together, how likely would you be to go, knowing that COVID-19 is now a part of the world's environment" on a scale from 1 (I would be much less likely to cruise now), 2 (I would be somewhat less likely to cruise now), 3 (I would be just as likely to cruise now), 4 (I would be somewhat more likely to go on a cruise now), and 5 (I would be much more likely to cruise now). As a whole, the respondents (n = 16) were somewhat less likely to cruise now (mean = 2.5) with 10 respondents being less likely to go, 3 as likely to go, and 3 being more likely to go now.

A follow-up, open-ended question, asked respondents to state the main reason for their rating of the above. Some of the reasons participants stated they would be less likely to cruise in the future included: potential for family members to get sick, not wanting to wear a mask, and too many people in a confined space. Reasons participants stated for being more likely to go included: cleaning practices will likely be even better, lower prices, and first experience was so

positive. Certainly future research will be necessary in order to better understand the long-term effects COVID-19 will have on cruisers, and on the cruise industry.

References

Al-Shargie, Fares, Masashi Kiguchi, Nasreen Badruddin, Sarat C. Dass, Ahmad Fadzil Mohammad Hani, and Tong Boon Tang. 2016. "Mental Stress Assessment Using Simultaneous Measurement of EEG and FNIRS." Biomedical Optics Express 7 (10): 3882–98. doi:10.1364/BOE.7.003882.

Arkwright, P. D., L. J. Beilin, I. Rouse, B. K. Armstrong, and R. Vandongen. 1982. "Effects of Alcohol Use and Other Aspects of Lifestyle on Blood Pressure Levels and Prevalence of Hypertension in a Working Population." Circulation 66 (1): 60–66. doi:10.1161/01.CIR.66.1.60.

Arora, Sonal, Nick Sevdalis, Debra Nestel, Maria Woloshynowych, Ara Darzi, and Roger Kneebone. 2010. "The Impact of Stress on Surgical Performance: A Systematic Review of the Literature." Surgery 147 (3): 318-330.e6. doi:10.1016/j.surg.2009.10.007.

Bedini, Sarah, François Braun, Laurence Weibel, Michel Aussedat, Bruno Pereira, and Frédéric Dutheil. 2017. "Stress and Salivary Cortisol in Emergency Medical Dispatchers: A Randomized Shifts Control Trial." PLoS ONE 12 (5). doi:10.1371/journal.pone.0177094.

Bello, Daniel C., and Michael J. Etzel. 1985. "The Role of Novelty in the Pleasure Travel Experience." Journal of Travel Research 24 (1): 20-26.

Betti, Stefano, Raffaele Molino Lova, Erika Rovini, Giorgia Acerbi, Luca Santarelli, Manuela Cabiati, Silvia Del Ry, and Filippo Cavallo. 2017. "Evaluation of an Integrated System of Wearable Physiological Sensors for Stress Monitoring in Working Environments by Using Biological Markers." IEEE Transactions on Biomedical Engineering 65 (8): 1748–58.

Brosschot, Jos F., Suzanne L. Pieper, and Julian F. Thayer. 2005. "Expanding Stress Theory: Prolonged Activation and Perseverative Cognition." Psychoneuroendocrinology 30: 1043–49. doi:10.1016/j.psyneuen.2005.04.008.

Brosschot, Jos F., and Julian F. Thayer. 1998. "Anger Inhibition, Cardiovascular Recovery, and Vagal Function: A Model of the Link between Hostility and Cardiovascular Disease." Annals of Behavioral Medicine 20 (4): 326–32. doi:10.1007/BF02886382.

Brosschot, Jos F., Eduard Van Dijk, and Julian F. Thayer. 2007. "Daily Worry Is Related to Low Heart Rate Variability during Waking and the Subsequent Nocturnal Sleep Period." International Journal of Psychophysiology 63 (1): 39–47. doi:10.1016/j.ijpsycho.2006.07.016.

Cannon, Walter Bradford. 1932. The Wisdom of the Body. New York: W.W. Norton, Incorporated.

Carayon, Pascale, and Peter Hoonakker. 2013. "Organizational Design and Cognitive Work." In The Oxford Handbook of Cognitive Engineering, edited by John D. Lee, 216–25. Oxford: Oxford University Press.

Cartwright, Susan, and Cary L. Cooper. 1997. Managing Workplace Stress. Vol. 1. Thousand Oaks, CA: Sage.

Cassidy, Tony. 1996. "All Work and No Play: A Focus on Leisure Time as a Means for Promoting Health." Counselling Psychology Quarterly 9 (1): 77–90. doi:10.1080/09515079608256354.

Chen, Chun-Chu. 2018. "Examining Stress Relief Benefits of Tourism Experiences: A Study of American Workers." Tourism Analysis 23 (3): 421–26.

Chen, Chun-Chu, Wei-Jue Huang, and James F Petrick. 2016. "Holiday Recovery Experiences, Tourism Satisfaction and Life Satisfaction–Is There a Relationship?" Tourism Management 53: 140–47.

Chen, Chun-Chu, and James F. Petrick. 2013. "Health and Wellness Benefits of Travel Experiences: A Literature Review." Journal of Travel Research 52 (6): 709–19. doi:10.1177/0047287513496477.

Chen, Chun-Chu, and James F. Petrick. 2016. "The Roles of Perceived Travel Benefits, Importance and Constraints in Predicting Travel Behavior." Journal of Travel Research 55 (4): 509-522.

Chen, Chun-Chu, James F. Petrick, and Moji Shahvali. 2016. "Tourism Experiences as a Stress Reliever: Examining the Effects of Tourism Recovery Experiences on Life Satisfaction." Journal of Travel Research 55 (2): 150–60.

Chen, Chun-Chu, and Sukjoon Yoon. 2018. "Tourism as a Pathway to the Good Life: Comparing the Top–Down and Bottom–Up Effects." Journal of Travel Research 58 (5): 866-876. doi:10.1177/0047287518775282.

Cohen, Sheldon, Natalie Hamrick, Mirna Susana Pazmiño Rodríguez, Pamela June Feldman, Bruce S. Rabin, and Stephen B. Manuck. 2000. "The Stability of and Intercorrelations among Cardiovascular, Immune, Endocrine, and Psychological Reactivity." Annals of Behavioral Medicine : A Publication of the Society of Behavioral Medicine 22 (3): 171–79. doi:10.1007/BF02895111.

Crompton, John L. 1979. "Motivations for Pleasure Vacation." Annals of Tourism Research 6 (4): 408–24.

De Kloet, E. Ron, Marian Joëls, and Florian Holsboer. 2005. "Stress and the Brain: From Adaptation to Disease." Nature Reviews Neuroscience 6 (6): 463.

Demerouti, Evangelia, Arnold B. Bakker, Friedhelm Nachreiner, and Wilmar B. Schaufeli. 2001. "The Job Demands-Resources Model of Burnout." Journal of Applied Psychology 86 (3): 499–512. doi:10.1037/0021-9010.86.3.499.

De Vos, Jonas, Tim Schwanen, Veronique Van Acker, and Frank Witlox. 2013. "Travel and Subjective Well-Being: A Focus on Findings, Methods and Future Research Needs." Transport Reviews 33 (4): 421-442.

Diener, Ed. 1984. "Subjective Well-Being." Psychological Bulletin 95 (3): 542.

Dishman, Rod K., Yoshi Nakamura, Melissa E. Garcia, Ray W. Thompson, Andrea L. Dunn, and Steven N. Blair. 2000. "Heart Rate Variability, Trait Anxiety, and Perceived Stress among Physically Fit Men and Women." International Journal of Psychophysiology 37: 121-133.

Ewert, Alan, Curt Davidson, and Yun Chang. 2016. "The Body Doesn't Lie." Journal of Leisure Research 48 (4): 327–37. doi:10.18666/JLR-2016-V48-I4-6807.

Föhr, Tiina, Asko Tolvanen, Tero Myllymäki, Elina Järvelä-Reijonen, Sanni Rantala, Riitta Korpela, Katri Peuhkuri, et al. 2015. "Subjective Stress, Objective Heart Rate Variability-based Stress, and Recovery on Workdays among Overweight and Psychologically Distressed Individuals: A Cross-Sectional Study." Journal of Occupational Medicine and Toxicology 10 (1): 39.

Fritz, Charlotte, and Sabine Sonnentag. 2006. "Recovery, Well-Being, and Performance-Related Outcomes: The Role of Workload and Vacation Experiences." Journal of Applied Psychology 91 (4): 936.

Garst, Harry, Michael Frese, and Peter C. M. Molenaar. 2000. "The Temporal Factor of Change in Stressor–Strain Relationships: A Growth Curve Model on a Longitudinal Study in East Germany." Journal of Applied Psychology 85 (3): 417–38. doi:10.1037/0021-9010.85.3.417.

Gilbert, David, and Junaida Abdullah. 2004. "Holidaytaking and the Sense of Well-Being." Annals of Tourism Research 31 (1): 103–21.

Goetzel, Ron Z., David R. Anderson, R. William Whitmer, Ronald J. Ozminkowski, Rodney L. Dunn, Jeffrey Wasserman, and The Health Enhancement Research Organization (HERO) Research Committee. 1998. "The Relationship Between Modifiable Health Risks and Health Care Expenditures: An Analysis of the Multi-Employer HERO Health Risk and Cost Database." Journal of Occupational and Environmental Medicine 40 (10): 843.

Gramann, James H. 1982. "Toward a Behavioral Theory of Crowding in Outdoor Recreation: An Evaluation and Synthesis of Research." Leisure Sciences 5 (2): 109–26. doi:10.1080/01490408209512996.

Gustafson, Per. 2014. "Business Travel from the Traveller's Perspective: Stress, Stimulation and Normalization." Mobilities 9 (1): 63-83.

Hansen, Anita Lill, Bjørn Helge Johnsen, and Julian F. Thayer. 2003. "Vagal Influence on Working Memory and Attention." International Journal of Psychophysiology 48 (3): 263–74. doi:10.1016/S0167-8760(03)00073-4.

Hellerud, B. C., and H. Storm. 2002. "Skin Conductance and Behaviour during Sensory Stimulation of Preterm and Term Infants." Early Human Development 70 (1–2): 35–46.

Hewett, Zoe L., Lynda B. Ransdell, Yong Gao, Linda M. Petlichkoff, and Shelley Lucas. 2011. "An Examination of the Effectiveness of an 8-week Bikram Yoga Program on Mindfullness, Perceived Stress and Physical Fitness." Journal of Exercise Science and Fitness 9 (2): 87-92.

Hobfoll, Stevan E. 1998. Stress, Culture, and Community: The Psychology and Physiology of Stress. New York: Springer US.

Hung, Kam, and James F. Petrick. 2011. "Why Do You Cruise? Exploring the Motivations for Taking Cruise Holidays, and the Construction of a Cruising Motivation Scale." Tourism Management 32: 386-393.

Jex, Steve M. 1998. Stress and Job Performance: Theory, Research, and Implications for Managerial Practice. Thousand Oaks, CA: Sage.

Jones, Keaton I., F. Amawi, A. Bhalla, O. Peacock, John P. Williams, and Jonathan N. Lund. 2015. "Assessing Surgeon Stress When Operating Using Heart Rate Variability and the State Trait Anxiety Inventory: Will Surgery Be the Death of Us?" Colorectal Disease 17 (4): 335–41.

Kim, Dohee, Chong-Ki Lee, and Joseph Sirgy. 2016. "Examining the Differential Impact of Human Crowding Versus Spatial Crowding on Visitor Satisfaction at a Festival. Journal of Travel and Tourism Marketing 33 (3): 293-312.

Krantz, David S., David C. Glass, and Melvin L. Snyder. 1974. "Helplessness, Stress Level, and the Coronary-prone Behavior Pattern." Journal of Experimental Social Psychology 10 (3): 284-300.

Lombardi, Danielle Michelle, and Robert Stephen Vick. 2019. "Relationship between Heart Rate Variability and Perceived Stress in Healthy College-Aged Students." The FASEB Journal 33 (1): 741.2-741.2.

Maddox, Michael M., Asis Lopez, Sree Harsha Mandava, Aaron Boonjindasup, Sarayuth Viriyasiripong, Jonathan L. Silberstein, and Benjamin R. Lee. 2015. "Electroencephalographic Monitoring of Brain Wave Activity During Laparoscopic Surgical Simulation to Measure Surgeon Concentration and Stress: Can the Student Become the Master?" Journal of Endourology 29 (12): 1329–33. doi:10.1089/end.2015.0239.

McCraty, Rollin, Bob Barrios-Choplin, Deborah Rozman, Mike Atkinson, and Alan D. Watkins. 1998. "The Impact of a New Emotional Self-Management Program on Stress, Emotions, Heart Rate Variability, DHEA and Cortisol." Integrative Physiological and Behavioral Science 33 (2): 151–70. doi:10.1007/BF02688660.

McDonald, Anthony D., Farzan Sasangohar, Ashish Jatav, and Arjun H. Rao. 2019. "Continuous Monitoring and Detection of Post-Traumatic Stress Disorder (PTSD) Triggers Among Veterans: A Supervised Machine Learning Approach." IISE Transactions on Healthcare Systems Engineering 9 (3): 201–211. doi:10.1080/24725579.2019.1583703.

Meland, Anders, Kazuma Ishimatsu, Anne Marte Pensgaard, Anthony Wagstaff, Vivianne Fonne, Anne Helene Garde, and Anette Harris. 2015. "Impact of Mindfulness Training on Physiological Measures of Stress and Objective Measures of Attention Control in a

Military Helicopter Unit." The International Journal of Aviation Psychology 25 (3-4): 191-208.

Melin, Bo, Ulf Lundberg, Jens Söderlund, and Marianne Granqvist. 1999. "Psychological and Physiological Stress Reactions of Male and Female Assembly Workers: A Comparison Between Two Different Forms of Work Organization." Journal of Organizational Behavior 20 (1): 47-61.

Meurs, James A., and Pamela L. Perrewé. 2011. "Cognitive Activation Theory of Stress: An Integrative Theoretical Approach to Work Stress." Journal of Management 37 (4): 1043–68.

Migacz, Steven, Angela Durko, and James F. Petrick. 2016. "It was the Best of Times, it was the Worst of Times: The Effects of Critical Incidents on Cruise Passengers' Experiences." Journal of Tourism in Marine Environments 11(2/3): 123-136.

Nawijn, Jeroen, Ondrej Mitas, Yeqiang Lin, and Deborah Kerstetter. 2013. "How Do We Feel on Vacation? A Closer Look at How Emotions Change over the Course of a Trip." Journal of Travel Research 52 (2): 265–74.

Oldehinkel, Albertine J., Johan Ormel, Nienke M. Bosch, Esther M. C. Bouma, Arie M. Van Roon, Judith G. M. Rosmalen, and Harriëtte Riese. 2011. "Stressed out? Associations between Perceived and Physiological Stress Responses in Adolescents: The TRAILS Study." Psychophysiology 48 (4): 441–52. doi:10.1111/j.1469-8986.2010.01118.x.

Petrick, James F., and David Huether. 2013. "Is Travel Better than Chocolate and Wine? The Benefits of Travel: A Special Series." Journal of Travel Research 52 (6): 705–8.

Pieper, Suzanne, Jos F. Brosschot, Rien van der Leeden, and Julian F. Thayer. 2007. "Cardiac Effects of Momentary Assessed Worry Episodes and Stressful Events." Psychosomatic Medicine 69 (9): 901. doi:10.1097/PSY.0b013e31815a9230.

Posada-Quintero, Hugo F., John P. Florian, Alvaro D. Orjuela-Cañón, and Ki H. Chon. 2018. "Electrodermal Activity Is Sensitive to Cognitive Stress under Water." Frontiers in Physiology 8: 1128. doi:10.3389/fphys.2017.01128.

Reisinger, Yvette, and Felix Mavondo. 2005. "Travel Anxiety and Intentions to Travel Internationally: Implications of Travel Risk Perception." Journal of Travel Research 43 (3): 212–25. doi:10.1177/0047287504272017.

Reme, Silje Endresen, Hege R. Eriksen, and Holger Ursin. 2008. "Cognitive Activation Theory of Stress--How Are Individual Experiences Mediated into Biological Systems?" Scandinavian Journal of Work, Environment & Health 34 (6): 177.

Rieger, Annika, Regina Stoll, Steffi Kreuzfeld, Kristin Behrens, and Matthias Weippert. 2014. "Heart Rate and Heart Rate Variability as Indirect Markers of Surgeons' Intraoperative Stress." International Archives of Occupational and Environmental Health 87 (2): 165–74. doi:10.1007/s00420-013-0847-z.

Rosenbaum, David, Mara Thomas, Paula Hilsendegen, Florian G. Metzger, Florian B. Haeussinger, Hans-Christoph Nuerk, Andreas J. Fallgatter, Vanessa Nieratschker, and Ann-Christine Ehlis. 2018. "Stress-Related Dysfunction of the Right Inferior Frontal Cortex in High Ruminators: An FNIRS Study." NeuroImage: Clinical 18 (January): 510–17. doi:10.1016/j.nicl.2018.02.022.

Sayette, M. A. 1993. "An Appraisal-Disruption Model of Alcohol's Effects on Stress Responses in Social Drinkers." Psychological Bulletin 114 (3): 459-476.

Schlotz, Wolff, Robert Kumsta, Irmgard Layes, Sonja Entringer, Alexander Jones, and Stefan Wüst. 2008. "Covariance Between Psychological and Endocrine Responses to Pharmacological Challenge and Psychosocial Stress: A Question of Timing." Psychosomatic Medicine 70 (7): 787. doi:10.1097/PSY.0b013e3181810658.

Schubert, C., M. Lambertz, R. A. Nelesen, W. Bardwell, J. B. Choi, and J. E. Dimsdale. 2009. "Effects of Stress on Heart Rate Complexity: A Comparison between Short-term and Chronic Stress." Biological Psychology 80 (3): 325-332.

Selye, Hans. 1955. "Stress and Disease." The Laryngoscope 65 (7): 500–514.

Shedler, Jonathan, Martin Mayman, and Melvin Manis. 1993. "The Illusion of Mental Health." American Psychologist 48 (11): 1117.

Shmerling, R.H. 2017. "How's Your Heart Rate and Why it Matter." Harvard Health Publishing: Harvard Medical School. Published August 2017. Last modified March 25, 2020. https://www.health.harvard.edu/heart-health/hows-your-heart-rate-and-why-it-matters

Sirgy, M. Joseph, P. Stephanes Kruger, Dong-Jin Lee, and Grace B. Yu. 2011. "How Does a Travel Trip Affect Tourists' Life Satisfaction?" Journal of Travel Research 50 (3): 261–75.

Smith, Valene L. 2012. Hosts and Guests: The Anthropology of Tourism. Philadelphia: University of Pennsylvania Press.

Sneed, Nancee V., Melodie Olson, Beth Bubolz, and Nancy Finch. 2001. "Influences of a Relaxation Intervention on Perceived Stress and Power Spectral Analysis of Heart Rate Variability." Progress in Cardiovascular Nursing 16 (2): 57-79.

Sonnentag, Sabine, and Michael Frese. 2003. Stress in Organizations. In Handbook of Psychology, edited by I. B. Weiner. Wiley Online Library. doi:10.1002/0471264385.wei1218

Sonnentag, Sabine, and Charlotte Fritz. 2007. "The Recovery Experience Questionnaire: Development and Validation of a Measure for Assessing Recuperation and Unwinding from Work." Journal of Occupational Health Psychology 12 (3): 204.

Ursin, Holger, and Hege R. Eriksen. 2004. "The Cognitive Activation Theory of Stress." Psychoneuroendocrinology 29 (5): 567–92.

Ursin, Holger, and Hege R. Eriksen. 2010. "Cognitive Activation Theory of Stress (CATS)." Neuroscience and Biobehavioral Reviews 34 (6): 877–81. doi:10.1016/j.neubiorev.2009.03.001.

Westman, Mina, and Dalia Etzion. 2001. "The Impact of Vacation and Job Stress on Burnout and Absenteeism." Psychology & Health 16 (5): 595–606.

Wolkow, Alexander, Brad Aisbett, Sally A. Ferguson, John Reynolds, and Luana C. Main. 2016. "Psychophysiological Relationships between a Multi-component Self Report Measure of Mood, Stress and Behavioural Signs and Symptoms, and Physiological Stress Responses during a Simulated Firefighting Deployment." International Journal of Psychophysiology 110: 109-118.

Table 1
MANOVA/ANOVA of Activity Type

		Perceived Stress	Observed Stress
Activity	N	Mean	Mean
Lounging	174	1.86 [a]	81.8 [a]
Passive Activities	107	2.21 [a, b]	87.8 [a, b]
Classroom	64	2.23 [a, b]	87.9 [a, b]
Personal Time	151	2.24 [a, b]	84.2 [a]
Clubbing	69	2.26 [a, b]	89.8 [a, b]
Dining	222	2.29 [a, b]	87.0 [a, b]
Contacting Home	10	2.50 [a, b]	86.9 [a, b]
Active	61	2.70 [a, b]	86.8 [a, b]
Transportation	66	3.95 [b, c]	88.2 [a, b]
Embarking	21	4.48 [c]	93.6 [b]
Administrative	18	5.50 [c]	95.6 [b]
F Value		8.681	5.496
p Value		< .001	< .001

Note: For ANOVA, df = 10; MANOVA: Wilks's Lambda = .868, F value = 6.95, and p < .001
Activites with different letters, represent significant (p. < .05) differences in Tukey's t-tests

Table 2
Situational Factors Prediction of Perceived and Observed Stress

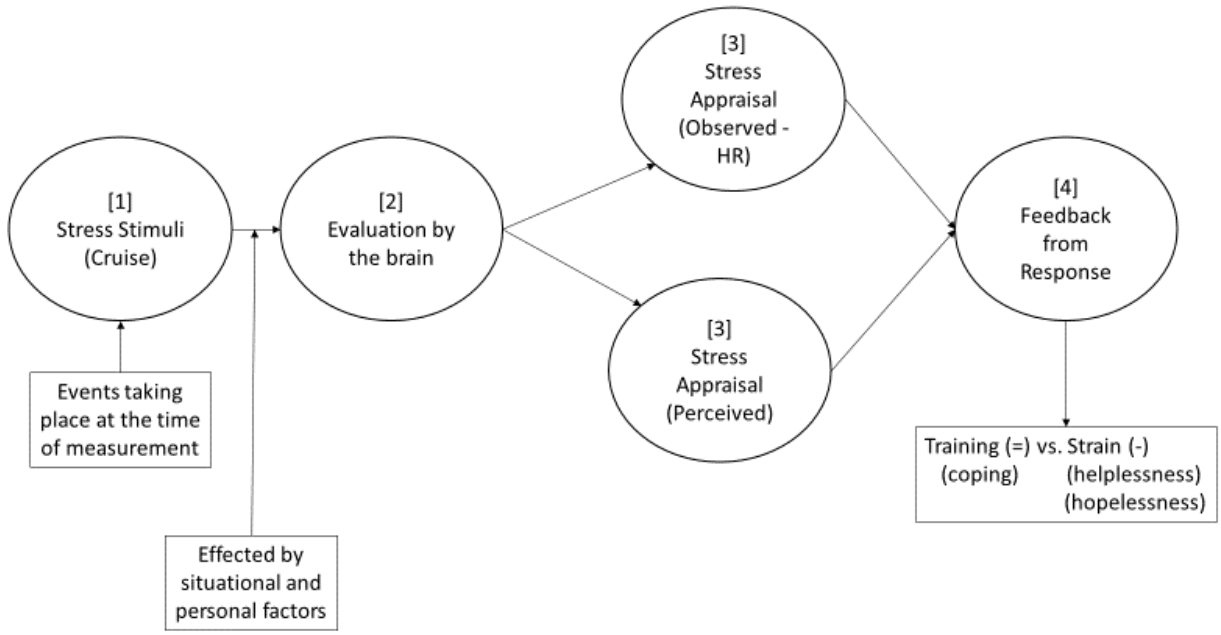
	Perceived Stress		Observed Stress	
Situational Factor	Beta	p value	Correlation Factor	p value
Alcohol Consumption	-0.122	<.001	-0.030	>.05
Crowdedness	0.244	<.001	.055	>.05
Leisure	-3.17	<.001	-.044	>.05
Excitement	0.030	>.05	0.084	<.05
Novelty	0.122	<.001	-.018	>.05

Table 3
MANOVA/ANOVA By Day

		Perceived Stress	Oberved Stress
	N	Mean	Mean
Day 3	158	1.72 [a]	86.1[a, b]
Day 2	195	2.05 [a,]	86.1[a, b]
Day 5	103	2.29 [a, b]	88.1 [b, c]
Day 6	103	2.34 [a, b]	84.2 [a, b]
Day 4	152	2..57 [a, b, c]	82.3 [a,]
Day 7	100	3.16 [b, c]	86.6 [a, b, c]
Day 1	152	3.26 [b, c]	91.1 [c]
F Value		7.74	7.24
p Value		< .001	< .001

Note: For ANOVA, df = 6; MANOVA: Wilks's Lambda = .913, F value = 74, and p < .001
Days with different letters, represent significant (p. < .05) differences in Tukey's t-tests

Figure 1. The Cognitive Activation Theory of Stress



*Adapted from Ursin and Ericksen (2004)

Figure 2. Example of Participant Diary

Student			text = be specific	1 all strange to 7 all friends	# with you	1 to 5	1 to 10 max	1 to 10 max	1 to 10 max	1 to 10 max	1 to 10 max
FP3	**Day**	**Hour**	**Activity**	**strangers vs friends**	**# people**	**alcohol**	**crowdedness**	**excitement**	**stress**	**leisure**	**novelty**
	1	11	Attended pre-cruise meeting and got the watch.	1	23	1	5	10	10	8	10
	1	12	Rode bus to port, checked in luggage and changed roommates.	1	4	1	10	10	10	10	10
	1	13	Explored ship, bought lanyard and looked for drinks.	2	1	1	10	10	9	10	10
	1	14	Hung out in room and set our stuff down.	2	1	1	0	10	5	10	10
	1	15	Completed a safety drill with everyone onboard and then went back to room to change for the pool.	2	200	1	10	8	9	1	10
	1	16	Arrived at the pool, got a drink, did a dance in front of everyone, then layed out by the pool.	4	100	1	10	10	1	10	10
	1	17	Continued to layout at the pool.	4	25	1	10	10	1	10	10

Figure 3. Heart rate Immediately after Cruise Was Extended

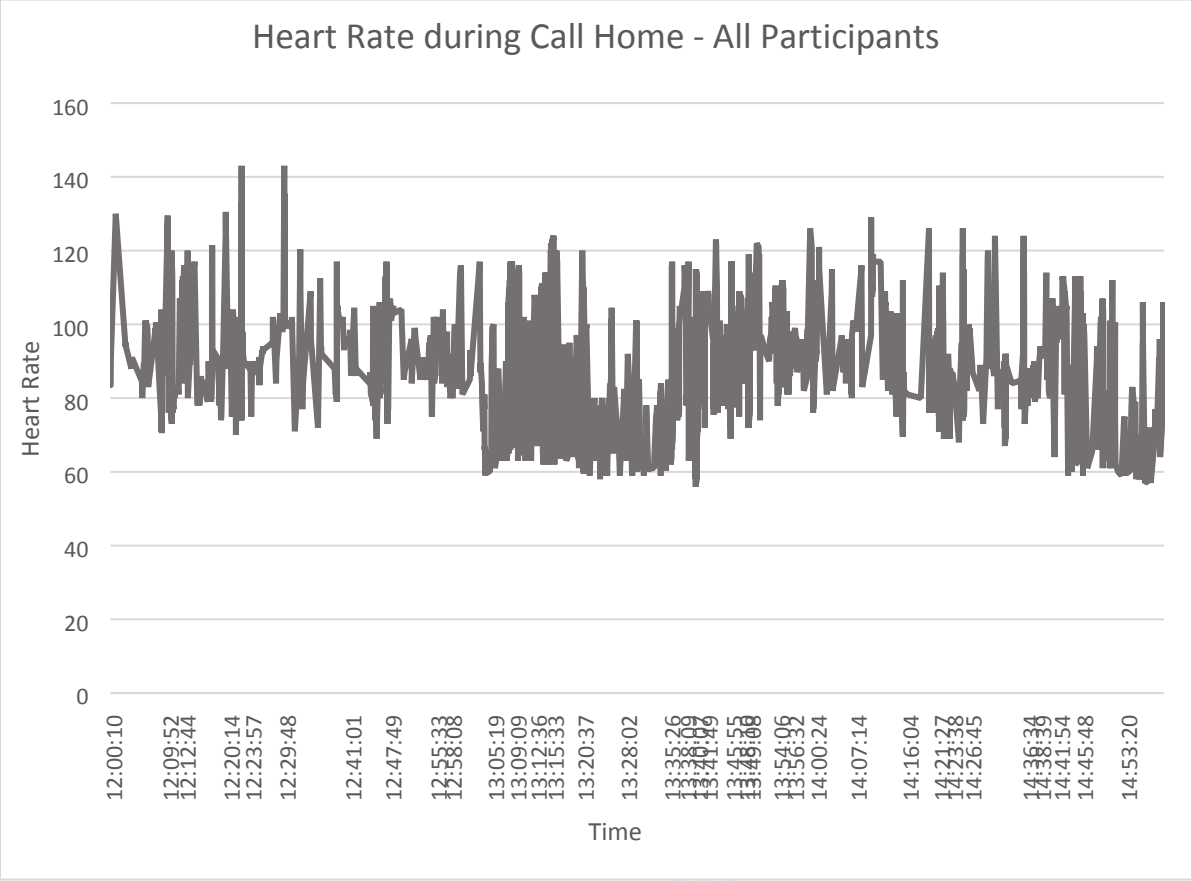


Figure 4. Relationships between Perceived and Observed Stress

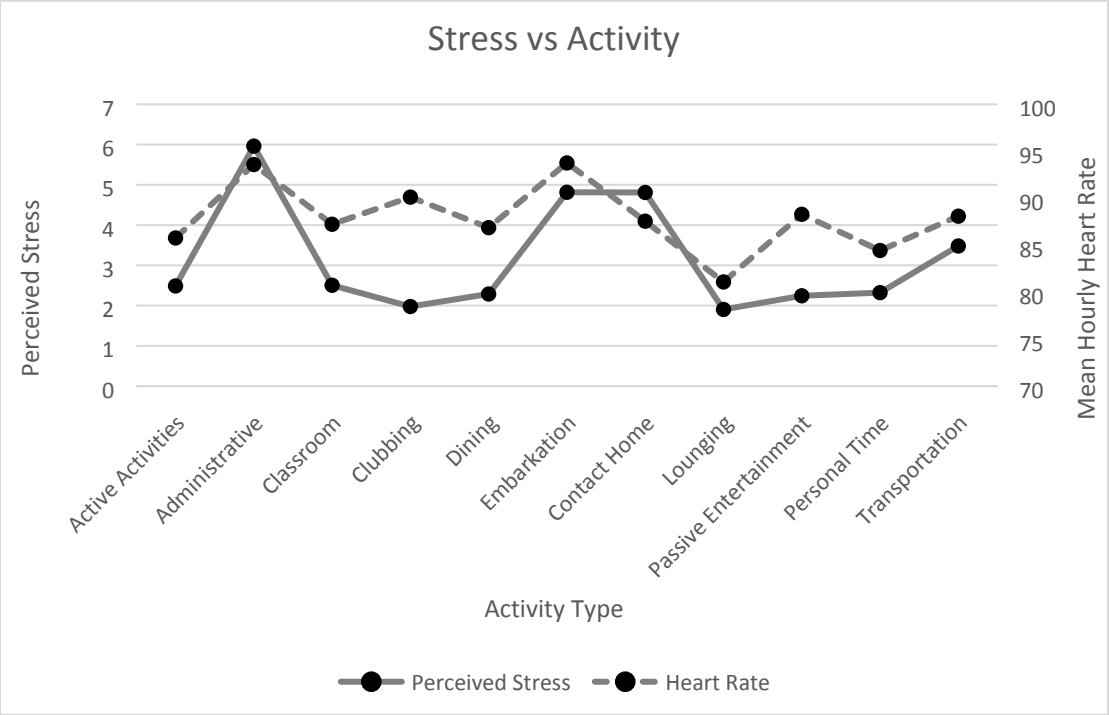


Figure 5. Final Conceptual Model