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Spirituality as a Moderator Between PTSS and Cardiovascular Reactivity

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Abstract

Posttraumatic stress symptoms (PTSS) can be distressing and produce robust cardiovascular symptoms, such as increased heart rate and blood pressure, which have been implicated in higher risk of developing cardiovascular disease (CVD). Identifying factors that may reduce symptoms may suggest therapeutic strategies. One such potential factor is spirituality, given that spirituality is associated with both reducing PTSS and with preventing or improving CVD. We sampled 63 young college women who indicated being exposed to unwanted sexual contact. We asked them to write about their experience while we took heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) measures from baseline to pre-task, during task, and post-task. The participants were given a survey to assess spirituality. Results showed that PTSS was highly correlated with decreased DBP (blunted reactivity) but was not associated with increased reactivity. Spirituality was associated with decreases in HR at all points. Our findings further suggest that spirituality was not a significant moderator between PTSS and cardiovascular reactivity measures. We hope that this study will further shed light on the relationships between sexual trauma and cardiovascular health, as well as the role of spirituality as a therapeutic device.

Introduction

Posttraumatic Stress Disorder (PTSD) is a chronic psychiatric disorder characterized by intrusive thoughts and negative feelings, as well as physical arousal. Although some people may not be diagnosed with PTSD, they may experience symptoms of PTSD that are below clinical threshold but are still disturbing, referred to here as having posttraumatic stress symptoms (PTSS). Often for individuals with PTSS, the physical symptoms of arousal can be as disturbing as psychological symptoms, and they can have long-term impacts on both psychological and physical

health. One aspect of this physical arousal that often causes distress and can have severe consequences is cardiovascular reactivity. One theory suggests that impairments to the hypothalamic-pituitary-adrenal axis (HPA) provide evidence for long term clinically significant PTSS, and many pharmacological treatments for PTSD target this pathway. A meta-analysis conducted on cortisol, heart rate, and blood pressure as early markers for clinically significant PTSS risk found that heart rate reactivity to trauma cues was most strongly associated with reexperiencing and hyperarousal symptoms, and higher heart rate in the immediate aftermath of trauma was correlated with higher posttraumatic symptoms. This study also claimed that increases in diastolic blood pressure, or the force of blood in the circulatory system at rest, is associated with trauma cues. However, in their meta-analysis results, they found that blood pressure was not associated with symptom severity (Morris et al, 2016). Given the connection between cardiovascular reactivity and PTSS, it is possible that chronic PTSS can lead to cardiovascular disease.

Cardiovascular disease (CVD) is one of the most common diseases in the United States, with over 121.5 million people having some form of heart disease. It is a well-known fact that stress can lead to an increase in cardiovascular disease. For example, one population-based, sibling-controlled cohort study in Sweden found that a wide variety of stress disorders were robustly associated with CVD independent of familial background, history of somatic or psychiatric disease, or risk of CVD, and in fact were at risk for earlier onset of CVD (Song et al., 2019). Studies have further shown that PTSD specifically has been linked to increased risk and prevalence of cardiovascular disease such as hypertension, coronary heart disease, increased heart rate, and various other cardiovascular events (Akosile et al., 2018). Although the mechanism for this long-term disease reaction is not well understood, it has been reported that one part of

autonomic reactivity, the arterial baroreflex sensitivity (a measurement to quantify how much control the baroreflex has on heart rate), which has been shown to be impaired in veterans with PTSD may lead to this increase in cardiovascular disease. Exaggerated neurocirculatory reactivity is also independently associated with hypertension and CVD. It is also known that posttraumatic stress symptoms are characterized by inflammation that could further contribute to impaired CV reactivity. Studies have shown that with increasing symptom severity, there is an increase in CVD risk. A study found that those with severe clinically significant PTSS had higher inflammation, more baroreflex sensitivity impairment, higher heart rate, and exaggerated parasympathetic nervous system withdrawal when stressed, indicating possible mechanisms for the increase in CVD risk in this population (Fonkoue et al., 2020). Other studies have also shown an increase in blood pressure associated with PTSD in the veteran population (Paulus et al. 2013). But, one study showed that a population experiencing PTSD due to sexual trauma experienced decreased heart rate variability measures, and this may be due to a numbing response (Lee & Theus, 2012). A different review article also found that while exaggerated stress reactivity was common and indicated stress factors for cardiovascular disease, blunted stress reactivity was more correlated with PTS symptoms and greater illness frequency, as well as higher rates of disability (Turner et al., 2020).

Reminders of trauma have been shown to cause spikes in cardiac functioning. There was heightened stress reactivity within clinically significant PTSS populations when looking at heart rate, skin conductance, and blood pressure when confronted with life stressors (McTeague et al, 2010; Hinrichs et al., 2017; Buckley, Holohan, Greif, Bedard, & Suvak, 2004). Some studies have shown that poor short-term cardiovascular reactivity can lead to increased long-term stress and CVD. Acute mental stress activates the sympathetic-adrenal-medullary axis, which results in

increased cardiovascular response (high heart rate and blood pressure). This response to acute stress has been shown to be more indicative of future hypertension, BP levels, and CVD risk than resting BP measurements. Repeated or chronic acute responses to mental stress, such as what is experienced in PTSS, has been linked to vasoconstriction, leading in alterations in cardiovascular responses. These alterations likely lead to the development of hypertension and CVD (Huang et al., 2013). There is further evidence that even at a young age, women can exhibit cardiovascular symptoms that are highly indicative of cardiovascular disease later in life. One study found that in a young adult female population, trauma severity was positively correlated with lower HDL levels, higher blood pressure, and greater total number of CVD risk factors in the absence of any other disease (Kibler et al., 2018). Given this evidence, we have reason to believe that cardiovascular measures assessed at a young age in response to stress are indicative of cardiovascular disease risk.

Given this relationship between posttraumatic stress and cardiovascular reactivity, it is helpful to examine moderators of reactivity. Identifying moderators may aid in the development and execution of therapeutic strategies. Spirituality is one variable that holds promise as a moderator. Spirituality has been correlated with lower risk of CVD (Hemmati et al., 2019). A meta-analysis studying religion/spirituality on physiological health markers found that many health markers (specifically blood pressure, C-reactive protein, and CV markers) were reduced in those who scored high in religion/spirituality. In another study, researchers found that spirituality resulted in lower perceived stress, subjective well-being, and lower heart rate/blood pressure reactivity (Shattuck & Muehlenbein 2020).

Spirituality has also been linked to better post-trauma functioning and is theorized to provide comfort and meaning to people in distress. There is a multitude of research supporting the

therapeutic effects of spirituality. One study examined longitudinal associations between spirituality and clinically significant PTS symptom severity among U.S. veterans undergoing treatment and found that spirituality factors at the start of the treatment were highly predictive of symptom severity at discharge (higher spirituality related to lower symptom severity). However, this study also found that spiritual struggle (negative religious coping) was associated with poorer health outcomes (Currier et al., 2015). Lee and Waters (2003) studied spirituality and trauma symptoms in a college sexual assault population and found that there was an inverse correlation (higher spirituality resulted in less reported symptoms). On the contrary, there are many studies indicating conflicting outcomes about the link between spirituality and PTSS. Some studies were found that for individuals that engaged in religious coping, they experienced higher PTSS recalling the trauma (especially those formally diagnosed with PTSD). Other studies in the meta-analysis showed no significant link between trauma symptoms and spirituality (Chen & Koenig, 2006). The studies that found no link or mixed links were all done in trauma populations that did not include the sexual trauma population, so further study is required to assess the link in this trauma population.

Based on this evidence, we predict that spirituality will act as a moderator between PTSS and cardiovascular reactivity. Spirituality has rarely been examined as a moderator of stress reactivity; there are some studies that indicate spirituality moderates the relationship between stress and psychological well-being, as well as stress and inflammation (Fabricatore et al., 2000; Tavares et al., 2018). Spirituality has also been shown to act as a mediator between trauma and clinically significant PTSS (Wortmann et al., 2011). However, to our knowledge there is no explicit moderation tested between PTSS and cardiovascular reactivity. Through this study we aim to examine its role as a moderator in this case. Spirituality for clinically significant PTSS has also

historically been studied in veteran populations, but not as much in the college student population. The following questions were tested:

1) Are spirituality, posttraumatic stress symptoms, and cardiac reactivity significantly related to each other? We predict that they will be, given the evidence on the links between the different factors separately (higher PTSS and higher reactivity, and higher spirituality and lower reactivity).
2) Is spirituality associated with lower levels of hyperarousal, as measured by HR and BP change from resting state to during the trauma reminder task? We predict that increased spirituality will be associated with lower levels of arousal.
3) Does spirituality moderate the relationship between PTSS and hyperarousal, as measured by HR and BP change from resting state to during the trauma reminder task? We predict that spirituality will moderate the relationship, and that increased spirituality will be a protective factor against physiological arousal.

Methods

Participants

Sixty-six participants were recruited for this study via the University of Connecticut's "Participant Pool", in which undergraduates complete a large survey at the beginning of the semester to see which studies they are eligible to participate in. Of those 66 participants, we used the data for 63 participants, due to a change in procedures after the first three participants to improve the validity of our cardiovascular data. Due to the COVID-19 pandemic, data collection was interrupted and only those 63 participants will be used for all data analysis. For this study, women who had experienced unwanted sexual contact while over the age of 18 were eligible through the participant pool. These students were invited to participate in our study and were informed that

they would be required to write about this experience with unwanted sexual contact during the consent process. This study was part of a larger study at UConn studying the relationship between PTS symptomology and physiological arousal, which was approved by UConn's Institutional Review Board.

Our sample consisted of women aged 18-24, with about 57.1% being 19 or 20 years old. The vast majority were heterosexual (79.4%), with one participant reporting homosexual orientation, six people reporting bisexual orientation, and five choosing "other/prefer not to say". For highest level of education completed, 31.7% indicated a high school diploma/equivalent, 66.7% indicated some college/tech/vocational school, and 1.6% were college graduates. Our sample consisted of mostly Whites (61.9%), Hispanic/Latino (17.5%), Asians (14.3%), Black or African Americans (7.9%), American Indian (3.2%), and 12.7% of them reported being mixed race. Employment status included those working part- time (22.2%) and students (76.2%), with 1.6% reporting "other" and specifying that they worked 3 jobs. Our sample was largely wealthy, with 23.8% having an income between 100-200k, 9.5% with an income above 200k, 19.05% between 50-99k, and 26.9% with an income below 50k. 13 participants did not report income. We screened for heart disease and cardiac events, and only two participants reported a heart condition while one reported a cardiac event. 95% of participants were nonsmokers.

Procedures

Participants were recruited based on the University screening questionnaire given to all students participating in a psychology course at the beginning of the semester. Participants who reported experiencing unwanted sexual contact over the age of 18 and were female were asked to participate in this study. In an email, these participants were told that they have been selected for this study because they indicated they have experienced a stressful life event without explicitly

mentioning sexual assault. This was done to avoid sampling bias towards people who are comfortable talking about the assault. After those students who desired to continue with the study arrived for a research visit, we informed them of the full procedure and that we would ask them to write about unwanted sexual contact. Participants were given the option to not participate before signing the consent form.

After consent was obtained, participants were asked to spend five minutes sitting down and working on a jigsaw puzzle, followed by heart rate and blood pressure measurements. Four measurements were taken while alternating arms and waiting one minute between each measurement. This was done to account for the fact that the act of getting blood pressure taken can be a stressor and skew results. After those four preliminary measurements, we took a fifth heart rate and blood pressure measurement that served as our baseline blood pressure measurement on the non-dominant arm. All following blood pressure and heart rate measures were taken from the non-dominant arm so that measurements would not be affected by the act of writing/moving. Participants were then asked to either fill out a survey or spend ten minutes writing about their assault experience. The order of these procedures was alternated for every other participant in order to prevent any habituation effects or mental preparation those who took the survey first may have engaged in before writing about their experience. In the survey, participants were asked to fill out demographic information, a health history form, a questionnaire about trauma history (THQ) and previous therapy experiences, the Posttraumatic Checklist-DSM-5 (PCL-5), the World Assumptions Scale (WAS), the Functional Assessment of Chronic Illness Therapy (FACIT) spiritual well-being non-illness scale. In the writing task, participants were asked to rate on a scale of 1-100 how threatening they experienced the event to be while it was happening, and how threatening they anticipate writing about the experience will be. Blood pressure and heart rate

measures were taken, and then the participant was asked to spend ten minutes writing about their assault experience. One minute into the task, blood pressure and heart rate measures were taken again. After the ten minutes was complete, blood pressure and heart rate measures were taken. The participant was also asked to rate how threatening the writing task truly was on a scale of 1-100. All participants, after these two procedures, were asked to spend another five minutes doing a jigsaw puzzle as a rest activity, and blood pressure/heart rate was taken after the five minutes. Two other scales were then used to determine how the individuals labelled the event, and any coping skills they utilized while writing. Height and weight measures were taken at the end to determine BMI.

Measures and Materials

Demographics questionnaire. We assess race, age, gender, employment status, and sexual orientation.

Posttraumatic Checklist, DSM-5 (PCL-5). The PCL-5 is a valid and reliable measure of PTSD symptoms (Blevins, Weathers, Davis, Witte, & Domino, 2015) from each diagnostic category including re-experiencing ("Repeated, disturbing dreams of the stressful experience"), avoidance ("Avoiding memories, thoughts, or feelings related to the stressful experience"), negative cognitions about one's self or the world ("Having strong negative feelings such as fear, horror, anger, guilt, or shame"), and hyperarousal ("Feeling jumpy or easily startled"). A total score is calculated ranging from 0-80, and mean scores from 0 (not at all) to 4 (extremely) are calculated for each sub-cluster of symptoms.

FACIT-Spiritual Wellbeing- Non-Illness Version (FACIT-Sp-NI). The FACIT-Sp-NI assessed spiritual wellbeing in the forms of perceived meaning in life ("My life has been productive"), perceived peace in life ("I feel a sense of harmony within myself"), as well as faith ("I find

comfort in my faith or spiritual beliefs"). Mean scores are calculated from 0 (not at all) to 4 (very much). The study has been found to have strong validity and reliability (Peterman et al., 2002).

Short writing prompt. This prompt was created for the purpose of this study: "You indicated in a previous survey that you experienced unwanted sexual contact at some point while you were over the age of 18. Please write about this experience in as much detail as possible. If you have experienced more than one event of this type, please write about the event that you found to be the most distressing. You will be given 10 minutes to write about this event. Please write until you are instructed to stop. Do not be concerned with spelling, grammar, or sentence structure. Please do not include identifying information of yourself or others in what you write."

Physiological Measures. We will use an Omron blood pressure monitor to measure sympathetic nervous system responses, including heart rate and blood pressure. This instrument has been used in other studies measuring physiological stress responses (Healey, Mansell, & Tai, 2017; Kim & Kang, 2018). We used a Health O Meter professional dial scale to measure participant weight.

Data Analysis

For preliminary analyses, we computed descriptive statistics on each variable including means, standard deviations, and distributions. To examine relations between variables, we conducted a Pearson's r correlation coefficient analysis between PTSS (all subscales), spirituality (all subscales), and cardiovascular reactivity (HR, DBP, SBP) change from baseline to pre-task, during, and post-task.

To test whether spirituality moderates the relationship between PTSS and cardiovascular reactivity, we conducted moderation analyses. All moderation analyses were conducted in IBM's SPSS PROCESS macro. Simple moderation analyses followed Hayes' model 1. Model 1 tests

whether the relationship between the independent variable (IV) and dependent variable (DV) is affected by a third variable (i.e., moderator). This analysis was done for all cardiovascular reactivity change measures from rest to either pre-, during, or post-task. Regression analyses were run to see if spirituality predicts a change in cardiovascular reactivity after accounting for PTSS, and this was again done for all cardiovascular reactivity change measures. Extended decimal point placements are included when two decimal points do not convey significance effects based on a 95% confidence interval.

Results

Descriptive Statistics—Reactivity

Change in heart rate, diastolic blood pressure, and systolic blood pressure were measured from rest to pre-task, during task, and immediately post-task. The change from rest to pre-task was variable, with heart rate (HR) showing a decrease (-3.1774, SD= 7.47), systolic blood pressure (SBP) showing an increase (1.16, SD= 7.18), and diastolic blood pressure (DBP) showing a slight decrease (-.2903, SD= 6.6). From rest to during task, there was a net increase in HR (2.2381, SD= 9.01), SBP (2.9206, SD= 10.15), and DBP (3.41, SD= 10.51). From rest to immediately post task, measures varied from rest (HR: -.21, SD= 9.01, SBP: 1.67, SD= 10.25, DBP: 3.41, SD= 10.51) (See Table 2).

PTS Symptomology and Cardiac Reactivity

The PCL Total score was used to capture PTS symptoms. There were no significant correlations between PTS symptoms and HR changes throughout the study. The subscales also did not exhibit significant correlations between the PCL and HR. Symptom severity was also not significantly correlated with SBP (pre-task: $r=.130$, $p>.05$; rest to during task: $r=.071$, $p>.05$; rest to post-task:

r=-.004, p>.05). There were some significant relationships between symptom severity and DBP. Symptom severity was correlated with DBP change from rest to during task, showing that those with more PTSS show decreased change in DBP (r= -.400, p < .001). Every subscale of the PCL showed a similar negative correlation with DBP change from rest to during task (intrusions: r= -.363, p<.01, avoidance: r=-.249, p<.05, cognitions: r=-.345, p<.01, hyperarousal: r=-.369, p<.01). There were no other significant correlations between symptom severity and DBP (change from rest to pre-task r= -.083, p>.05; rest to post-task r= -.053, p>.05) (See Table 3).

Spirituality and Cardiovascular Reactivity

The FACIT-Sp scale was used to measure spirituality, and this was correlated with cardiovascular reactivity measures. There were some significant correlations between the spirituality score and heart rate. Change from rest to pre-task (r=-.278, p<.05) for the total FACIT-Sp score was significant while the other two, rest to during task (r= -.238, p>.05) and rest to post-task(r= -.297 p>.05), were not statistically significant. The FACIT subscale measure for meaning showed a non-significant negative correlation with HR change from rest to post-task (r= -.246, p>.05). The peace subscale also showed significant negative correlations with all HR changes (rest to pre-task r= -.365, p<.01), rest to during task (r= -.302, p<.05), and rest to post-task (r= -.368, p<.01). There were no significant correlations between spirituality and SBP change from rest to pre-task (r= -.105, p>.05) rest to during task (r= -.097, p>.05) and rest to post-task (r= .010, p>.05). Similarly, there were no significant correlations between spirituality and DBP changes from rest to pre-task (r= -.007, p>.05) rest to during task (r- .240, p>.05), and rest to post-task (r= -.242, p>.05) (See Table 3).

Spirituality as a Moderator

We found that spirituality was not a significant moderator between PTSS and cardiac reactivity across all three measures (HR, SBP, DBP) at all intervals (pre-task, during, and post-task). Spirituality did not have a moderating effect from rest to pre-task (HR: p= .1134, SBP: p=.3905, DBP: p=.8723) (See Table 4, 5, and 6).

There was also no moderating effect from rest to during task for HR (p=.2738) or SBP (p=.6581) (See Table 7 and 8). The total moderation model for PTSS and DBP was significant for during task (p= .0071). However, the total model was significant despite details showing that direct effects and the moderation were not significant. A separate regression model was run showing that PTSS significantly predicted DBP change (See Table 13).

Spirituality further did not have a moderating effect from rest to post-task for HR (p=.3057) or SBP (p=.2466) (See Table 10 and 11). There was a significant moderation for DBP, and the total moderation model showed a significant effect (p=.048). However, this model was significant because both spirituality and PTSS directly predict DBP change from rest to post-task in the same direction (PTSS: p=.0464, spirituality: p=.0121). The interaction was not significant (p=.1428), so the variables were not influenced by each other to create a moderation effect (See Table 12).

Discussion

The descriptive statistics showed that there was a net increase in reactivity from rest to during the task (writing about the trauma), which shows that writing about and recalling their trauma did in fact increase cardiac reactivity in some ways, though not in others. The ways in which it did increase were expected, since writing about trauma is a stressor and has been shown to induce a measurable physiological stress response (King & Miner, 2000).

Our first hypothesis that PTSS, spirituality, and cardiac reactivity are significantly related to each other was not well supported. The PCL was not correlated significantly with most reactivity measures, although there were some significant correlations with DBP change, specifically from rest to during task, in which there was a dip in DBP values. This was surprising, considering most of the literature finds links between trauma and reactivity measures in general, and especially finds increases in DBP that can become predictors of heart disease (Huang et al., 2013). However, there is some contradictory evidence—Lee & Theus (2012) found that some people experiencing posttraumatic stress symptoms specifically in response to sexual trauma actually experience a blunted reactivity and decreased heart rate variability measures compared to those experiencing other types of trauma, and these results are concurrent with those findings. Although we did not see significant changes for most values, the strong correlation with dips in DBP indicate that this could be an area for more potential research.

Spirituality was only found to be significantly correlated with HR measures, with those scoring higher on our spirituality scale exhibiting lower HR reactivity at all points (pre-task, during task, and post-task). Spirituality did not have a significant correlation with any other reactivity measure. Although this does not quite support our hypothesis, the results here are not that surprising. Spirituality does not have a consistent relationship with PTS symptoms among many studies, although it has been shown to protect against cardiovascular reactivity (Chen & Koenig, 2006; Shattuck & Muehlenbein, 2020). It has also been shown by Huang et al. (2013) that women tend to be ‘cardiac’ reactors to stress, while men are ‘vascular’ reactors to stress, meaning that if women are ‘cardiac’ reactors, then they would likely see the most beneficial changes occur in their heart rate. However, trauma symptoms were not correlated with HR and were only

correlated with DBP as stated previously, so we cannot draw the conclusion that spirituality was mitigating HR reactivity.

Our third hypothesis that spirituality moderates the relationship between PTSS and hyperarousal, as measured by HR and BP change from the resting state to pre-task, during, or post the trauma reminder task was also not well supported. One moderation model was significant for a moderating effect of spirituality on reactivity from rest to during task for DBP, but the details of the model show that the moderation effect here was unlikely. The total moderation model was significant despite direct effects and the moderation in the model not being significant. In order to explore why this is the case, we ran a separate regression model, where PTS significantly predicted DBP change. This suggests that our moderation model was just underpowered to detect effects given the small sample size. There was another significant result for DBP in the moderation models that showed that our total moderation model was significant for spirituality as a moderator from rest to post-task, but this was due to spirituality and PTSS having separately direct effects on DBP change to post-task and enhancing the stress response extinction, and was not due to a moderating effect. In our search, we were unable to find the role of spirituality as a moderator between trauma symptoms and cardiovascular reactivity. However, given that the relationship between spirituality and PTSS is mixed, and that we were unable to find consistent relationships between PTSS/spirituality and spirituality/cardiovascular reactivity, we may have been unable to see any clear moderation effect (Chen & Koenig, 2006).

As a follow up, we wanted to see if spirituality predicted changes in cardiac reactivity after accounting for PTSS. We found that it did, but only for the DBP change from rest to post-task, so it appears that spirituality may be a protective factor for cardiac reactivity extinction as measured by DBP. While it is unclear why this may be the case, spirituality has been associated with

reduced activity of brain regions that may affect the HPA axis, resulting in lowered reactivity and thus potentially faster extinction (Frodl & O'Keane (2013); Kern et al., 2008; McClintock, 2019). More research in this area is required to test this hypothesis.

Conclusion

This study had various limitations which likely affected our results. Due to the COVID-19 pandemic, our data collection was cut short and we ended up with a small sample size, therefore we may be underpowered to detect significant effects. Our sample was mostly homogenous, with a large portion of participants reporting to be white, upper-middle class females, which reduces the generalizability of our data. This analysis also did not control for whether or not participants discussed their trauma in therapy or received treatment, which could greatly impact reactivity if they received effective therapy. BMI and physical health history, two important factors for studying physiological reactivity, were also not controlled for, although data was obtained. It is possible that BMI and various health problems could account for some discrepancies in reactivity correlations. Our health history questions only asked for previously diagnosed cardiovascular health issues and did not ask specifically for other conditions that could potentially affect the results. Although we did ask for a list of current medications, this data was not considered in our analysis. And though we screened for PTSS, we did not screen for any other psychological disorder or symptoms (such as anxiety or depression) that may be confounding variables in reactivity and PTSS.

Having PTSS may increase to clinically significant levels of symptoms in the form of PTSD, so finding factors that may moderate severity or provide relief is necessary for clinical purposes. Although spirituality has been shown to alleviate effects of trauma in some studies, our study did not show any strong link between spirituality levels and arousal, and it further did not

show any moderating link between symptom severity and arousal. Based on this study, spirituality does not seem to be a promising treatment for relieving the biological aspect of the affliction. In the future, it would be useful to test this question in a larger sample size and see what other variables may moderate the relationship between stress and reactivity in this population. The relationship between spirituality and PTSS also needs to be further defined, and its role as a moderator should be explored with these variables.

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Tables and Figures

Table 1.

Demographics

DEMOGRAPHICS	VALID PERCENT	TOTAL (N) PARTICIPANTS
AGE		63
18	15.9	10
19	33.3	21
20	23.8	15
21	14.3	9
22	11.1	7
24	1.6	1
RACE		63
WHITE	61.9	39
BLACK	7.9	5
ASIAN	14.3	9
LATINX	17.5	11
AM INDIAN	3.2	2
MIXED	12.7	8
HOUSEHOLD INCOME		63
<50K	26.9	17
51K-99K	19.05	12
100K-200K	23.8	15
>201K	9.5	6
NOT SPECIFIED	20.6	13
WORKING STATUS		63
PART-TIME	22.2	14
STUDENT	76.2	48
OTHER	1.6	1
SMOKING STATUS		63
NON-SMOKING	95.2	60
SMOKING	4.8	3
SEXUAL ORIENTATION		63
HETEROSEXUAL	79.4	50
HOMOSEXUAL	1.6	1
BISEXUAL	9.5	6
OTHER	4.8	3
PREFER NOT TO SAY	4.8	3

Note: Participants were put into any race category they selected, so the percentage sums to greater than 100%.

Table 2.

Descriptive Statistics: Model Summaries for Moderation Effects

	N	Minimum	Maximum	Mean	Std. Deviation
HR Change Rest to Pre-task	62	-24.00	12.00	-3.1774	7.47789
HR Change Rest to During task	63	-19.00	35.00	2.2381	9.01202
HR Change Rest to Post-task	62	-22.00	26.00	-.2097	9.97889
SBP Change Rest to Pre-task	62	-17.00	22.00	1.1613	7.18193
SBP Change Rest to During task	63	-37.00	34.00	2.9206	10.15096
SBP Change Rest to Post-task	62	-21.00	40.00	1.6774	10.24579
DBP Change Rest to Pre-task	62	-16.00	15.00	-.2903	6.60945
DBP Change Rest to During task	63	-33.00	30.00	3.4127	10.51364
DBP Change Rest to Post-task	62	-24.00	41.00	.4194	8.94894
Valid N (listwise)	60				

Table 3.

Total Correlations

		HR Change Rest to Pre-task	HR Change Rest to During task	HR Change Rest to Post-task	SBP Change Rest to Pre-task	SBP Change Rest to During task	SBP Change Rest to Post-task	DBP Change Rest to Pre-task	DBP Change Rest to During task	DBP Change Rest to Post-task
PCL_Total	Pearson Correlation	.160	.140	.125	.130	.071	-.004	-.083	-.400***	-.053
PCL_ Intrusions	Pearson Correlation	.133	.148	.065	.132	.050	.034	-.036	-.363**	-.078
PCL_ Avoidance	Pearson Correlation	.079	.186	.183	-.010	.159	.056	-.088	-.249*	.018
PCL_ Cognitions	Pearson Correlation	.110	.114	.083	.142	.037	-.070	-.149	-.345**	-.123
PCL_Hyper-arousal	Pearson Correlation	.196	.077	.140	.112	.058	.013	-.009	-.369**	.042
FACIT_SP_ total	Pearson Correlation	-.278*	-.238	-.244	-.105	-.097	.010	-.007	.240	-.242
FACIT_SP_ meaning	Pearson Correlation	-.239	-.171	-.246	-.133	-.173	-.082	-.067	.212	-.166
FACIT_SP_ peace	Pearson Correlation	-.365**	-.302*	-.368**	-.134	-.074	-.040	-.086	.167	-.221
FACIT_SP_ faith	Pearson Correlation	-.076	-.123	.006	-.057	-.029	.113	.102	.206	-.205

Note: Total correlations between PTSS (PCL) or spirituality (FACIT_SP) and cardiovascular changes (HR, SBP, DBP) from rest to pre, during, and post task. 5 minutes post-task was not used in correlation analysis since values were similar to immediate post task change analyses.
*p< .05
**p< .01
***p< .001

Moderation Models

Rest to Pre-Task

Table 4.

HR CHANGE

MODEL SUMMARY	R	R-sq	MSE	F	p	
	0.3192	0.1019	47.674	2.0798	0.1134	
MODEL						
	Coefficient	Se	t	p	LLCI	ULCI
CONSTANT	-2.6609	4.7371	-0.5617	0.5766	-12.1544	6.8326
PCL_ TOTAL	0.1515	0.126	1.2024	0.2344	-0.101	0.4041
FACIT_SP_ TOTAL	-0.1285	2.0861	-0.0616	0.9511	-4.3091	4.0522
INT_1	-0.0807	0.0678	-1.19	0.2392	-0.2166	0.0552

Note: Moderation effects of spirituality on PTSS and HR change rest to pre-task

Table 5.

SBP CHANGE

MODEL SUMMARY	R	R-sq	MSE	F	p	
	0.2297	0.0528	46.5066	1.021	0.3905	
MODEL	Coefficient	se	t	p	LLCI	ULCI
CONSTANT	-3.2565	4.6788	-0.696	0.4893	-12.6331	6.12
PCL_ TOTAL	0.1894	0.1245	1.5218	0.1338	-0.06	0.4389
FACIT_SP_ TOTAL	1.8999	2.0604	0.9221	0.3605	-2.2292	6.029
INT_1	-0.1008	0.067	-1.5043	0.1382	-0.235	0.0335

Note: Moderation effects of spirituality on PTSS and SBP change rest to pre-task

Table 6.

DBP CHANGE

MODEL SUMMARY	R	R-sq	MSE	F	p	
	0.1123	0.0126	46.5722	0.234	0.8723	
MODEL						
	Coefficient	Se	t	p	LLCI	ULCI
CONSTANT	2.4445	4.6821	0.5221	0.6037	-6.9387	11.8277
PCL_ TOTAL	-0.0556	0.1246	-0.4464	0.6571	-0.3052	0.194
FACIT_SP_ TOTAL	-0.6034	2.0618	-0.2927	0.7709	-4.7355	3.5286
INT_1	0.0056	0.067	0.083	0.9341	-0.1288	0.1399

Note: Moderation effects of spirituality on PTSS and DBP change rest to pre-task

Rest to During Task

Table 7.

HR CHANGE

MODEL SUMMARY	R	R-sq	MSE	F	p	
	0.2579	0.0665	82.3905	1.3299	.2738	
MODEL						
	Coefficient	se	t	p	LLCI	ULCI
CONSTANT	3.6433	6.2107	0.5866	0.5598	-8.7984	16.085
PCL_ TOTAL	0.1264	0.1656	0.7633	0.4485	-0.2053	0.458
FACIT_SP_ TOTAL	-0.7741	2.7423	-0.2823	0.7788	-6.2677	4.7195
INT_1	-0.0657	0.0891	-0.7374	0.4639	-0.2442	0.1128

Note: Moderation effects of spirituality on PTSS and HR change rest to during task

Table 8.

SBP CHANGE

MODEL SUMMARY	R	R-sq	MSE	F	p	
	0.1674	0.028	109.0568	0.5382	0.6581	
MODEL						
	Coefficient	se	t	p	LLCI	ULCI
CONSTANT	9.5467	7.1455	1.336	0.1869	-4.7675	23.8609
PCL_ TOTAL	-0.1645	0.1905	-0.8638	0.3914	-0.5461	0.217
FACIT_SP_ TOTAL	-3.7719	3.1551	-1.1955	0.2369	-10.0923	2.5485
INT_1	0.1054	0.1025	1.0277	0.3085	-0.1	0.3108

Note: Moderation effects of spirituality on PTSS and SBP change rest to during task

Table 9.

DBP CHANGE

MODEL SUMMARY	R	R-sq	MSE	F	p	
	0.4391	0.1928	97.8767	4.4583	.0071	
MODEL						
	Coefficient	Se	t	p	LLCI	ULCI
CONSTANT	8.0141	6.7693	1.1839	0.2415	-5.5466	21.5747
PCL_ TOTAL	-0.2197	0.1804	-1.2174	0.2286	-0.5811	0.1418
FACIT_SP_ TOTAL	1.3005	2.989	0.4351	0.6652	-4.6872	7.2882
INT_1	-0.0148	0.0971	-0.1524	0.8794	-0.2094	0.1798

Note: Moderation effects of spirituality on PTSS and DBP change rest to during task

Rest to Post- Task

Table 10.

HR CHANGE

MODEL SUMMARY	R	R-sq	MSE	F	p	
	0.2513	0.0631	88.9247	1.2353	0.3057	
MODEL						
	Coefficient	Se	t	p	LLCI	ULCI
CONSTANT	6.7897	6.5477	1.037	0.3043	-6.3323	19.9118
PCL_ TOTAL	-0.0405	0.1732	-0.2341	0.8158	-0.3876	0.3065
FACIT_SP_ TOTAL	-3.4729	2.861	-1.2139	0.23	-9.2066	2.2608
INT_1	0.0352	0.0926	0.3802	0.7053	-0.1504	0.2209

Note: Moderation effects of spirituality on PTSS and HR change rest to post-task

Table 11.

SBP CHANGE

MODEL SUMMARY	R	R-sq	MSE	F	p	
	0.2682	0.0719	104.9612	1.4204	0.2466	
MODEL						
	Coefficient	se	t	p	LLCI	ULCI
CONSTANT	12.5102	7.1137	1.7586	0.0842	-1.746	26.7664
PCL_ TOTAL	-0.3691	0.1881	-1.962	0.0548	-0.7461	0.0079
FACIT_SP_ TOTAL	-5.3334	3.1083	-1.7158	0.0918	-11.5626	0.8959
INT_1	0.2052	0.1006	2.0393	0.0462	0.0035	0.4069

Note: Moderation effects of spirituality on PTSS and SBP change rest to post-task

Table 12.

DBP CHANGE

MODEL SUMMARY	R	R-sq	MSE	F	p	
	0.3644	0.1328	76.1045	2.8075	0.048	
MODEL						
	Coefficient	se	t	P	LLCI	ULCI
CONSTANT	17.1188	6.0574	2.8261	0.0066	4.9794	29.2582
PCL_ TOTAL	-0.3264	0.1602	-2.0373	0.0464	-0.6474	-0.0053
FACIT_SP_ TOTAL	-6.8649	2.6468	-2.5937	0.0121	-12.1692	-1.5606
INT_1	0.1274	0.0857	1.4868	0.1428	-0.0443	0.2992

Note: Moderation effects of spirituality on PTSS and DBP change rest to post-task

Table 13.

Regression Model of DBP Change to During Task

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.434[a]	.188	.174	9.74925	.188	13.440	1	58	.001
2	.439[b]	.192	.164	9.80813	.004	.306	1	57	.583

a. Predictors: (Constant), PCL_Total

b. Predictors: (Constant), PCL_Total, FACIT_SP_total