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An Examination of the Association Between Post-traumatic Growth and Stress Symptomatology in Cardiac Outpatients

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Abstract

This study examined the association between post-traumatic growth (PTG), post-traumatic stress disorder (PTSD), and trauma-related factors in cardiac outpatients. Participants recruited from four cardiology clinics between November 2014 and July 2015 ($N = 52$, 69.2% men, $M_{age} = 65$ years) completed self-assessments of PTG and PTSD along with demographic, cardiac health index, and trauma-related factors. In total, 75% of the sample endorsed their cardiac event as traumatic, while 17.2% reported their cardiac event as their 'worst trauma'; those endorsing the latter did not significantly differ from those endorsing 'other traumas' as their worst. Chi-square analyses indicated that the lifetime traumas of experiencing loss or abandonment, witnessing trauma, and experiencing a natural disaster were significantly related to PTG factors of new possibilities, relating to others, and spirituality. Bivariate correlations on all PTSD symptom clusters and factors of PTG revealed the strongest associations between the PTG factors of spiritual change and appreciation of life. Lifetime PTSD symptoms, duration of negative reactions, and re-experiencing symptoms were found to be significantly associated with higher PTG, and a unique independent effect emerged with avoidance symptoms. Our results suggest that PTG may be associated with particular facets of PTSD symptomatology.

Keywords Post-traumatic growth · Post-traumatic stress disorder · Mental health · Cardiac disease · Trauma reactions

Sudden cardiac events and the onset of cardiovascular disease can be both stressful and traumatic, which may result in mental health issues such as anxiety (Huffman et al., 2006) and depression (Thombs et al., 2006). Post-traumatic stress disorder (PTSD) is a mental disorder arising from a traumatic experience, including an acute life-threatening illness, and is associated with a host of negative health consequences (Edmondson, 2014). Relationships between PTSD and sudden cardiac events such as a myocardial infarction, sudden cardiac surgery, and cardiac arrest are well established (Edmondson & Cohen, 2013; Spindler & Pedersen, 2005; Tedstone & Tarrier, 2003). In fact, approximately 15% of individuals meet the criteria for PTSD following a myocardial infarction (Spindler & Pedersen, 2005), emphasizing the importance of examining PTSD in this population.

Research has not only established comorbidity between cardiovascular disease and events and PTSD, but also demonstrates that PTSD may be a direct consequence of cardiac events, termed cardiac-disease-induced PTSD (i.e., clinically significant PTSD symptoms directly related to a cardiac event reported as their 'worst trauma'). Comorbidity studies suggest that rates of traditional PTSD (non-cardiac-induced) are elevated in both patients with chronic cardiovascular disease such as congenital heart disease, coronary heart disease, and chronic ischemic heart disease (e.g., Deng et al., 2016; Kang, Bullman, & Taylor, 2006; Vaccarino et al., 2013) and acute cardiac events such as myocardial infarction, acute coronary syndrome, and cardiac arrest (e.g., Edmondson et al., 2012; Remch, Laskaris, Flory, Mora-Mclaughlin, & Morabia, 2018; Rosman et al., 2016). With respect to cardiac-disease-induced PTSD, a recent review by Vilchinsky,

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Ginzburg, Fait, and Foa (2017) suggests that a unique presentation of PTSD may emerge from specific characteristics associated with cardiac disease. For example, cardiac-disease-induced PTSD is related to intrusive symptoms characterized by future-oriented thoughts and presents an internal and ongoing threat to the individual, whereas traditional PTSD symptoms focus on the past (e.g., Edmondson, 2014; Vilchinsky et al., 2017). PTSD post-cardiac events is not only a prominent predictor of poorer physical health, but can also have particularly deleterious effects on one's mental health and well-being. Thus, it is essential to examine both traditional forms of PTSD given its comorbidity in cardiac disease and events, and cardiac-disease-induced PTSD in this particular population.

Despite these studies demonstrating a relationship between PTSD and cardiovascular disease and events, recent research has also identified other salient post-traumatic ramifications including positive psychological changes, such as growth resulting from one's experience. Post-traumatic growth (PTG) theory posits that positive, meaningful psychological changes can occur as a result of struggling with a major life crisis (Tedeschi & Calhoun, 2004) including increased appreciation of life, greater sense of personal strength and self-understanding, renewed appreciation for intimate relationships, and positive spiritual changes (Tedeschi, Park, & Calhoun, 1998). PTG has been reported among individuals who have experienced a broad range of trauma, including adults suffering from medical conditions and injuries with varying severity (Garnefski, Kraaij, Schroevers, & Somsen, 2008; McCaslin et al., 2009). While the majority of research investigating PTG in the context of health has predominantly focused on cancer survivors and adults with HIV/AIDS (Barskova & Oesterreich, 2009), various studies indicate that there are high levels of PTG among individuals who have experienced cardiac events as well (Gangstad, Norman, & Barton, 2009; Garnefski et al., 2008). Further understanding PTG among cardiac outpatients is particularly important given that over one-third of the American population lives with some form of cardiovascular disease (American Heart Association, 2011) and PTG is shown to be associated with overall better mental health and physical health in those afflicted (Barskova & Oesterreich, 2009).

Although there is a growing body of research on PTG, there is a dearth of information examining the relationship between PTSD and PTG particularly among outpatients with cardiac disease or a history of cardiac events. Thus, the relationship between PTSD symptoms and PTG remains unclear. One narrative review of cross-sectional studies found there was no systematic relationship between PTG and PTSD among different trauma samples (Cordova, Cunningham, Carlson, & Andrykowski, 2001; Znoj, 1999; Zoellner & Maercker, 2006). Whereas other recent research suggests that a curvilinear relationship may exist, indicating higher levels of PTG among those with moderate levels of PTSD (Shakespeare-Finch & Lurie-Beck, 2014; Tsai, El-Gabalawy, Sledge, Southwick, & Pietrzak, 2015). Additionally, Bluvstein, Moravchick, Sheps, Schreiber, and Bloch (2013) found that when levels of PTG were elevated, it weakened relationships between PTSD symptoms and distress. Differences in these studies may relate to the varying populations of focus. Further, none of these aforementioned studies examined other trauma-related correlates such as symptomatology, lifetime traumas and PTG, or individual PTG factors in a cardiac sample. Finally, no studies to date have examined PTSD based on the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM–5*; American Psychiatric Association, 2013), which had a number of changes in diagnostic nomenclature compared to older versions, most notable, the inclusion of the symptom cluster of alterations in cognition and mood.

Taking into account the previously stated gaps in the literature, this study aimed to examine the relationship between trauma-related correlates, including PTSD symptomatology, and PTG in a sample of cardiac outpatients. Specifically, among cardiac outpatients, this study aimed to (1) evaluate whether participants who identify a cardiac event or disease as their 'worst trauma' differ from participants who identify other types of traumatic events as their 'worst trauma,' in terms of demographics, PTG, and PTSD symptomatology, (2) assess levels of PTG among particular trauma-exposed groups, and (3) examine the relationship between PTSD symptomatology and PTG.

Methods

Participants and Procedure

This study obtained ethical approval from the Institutional Review Board for Human Research at the Medical University of South Carolina.

Participants were recruited from four local outpatient cardiology clinics between November 2014 and July 2015 at the Medical University of South Carolina. Eligible participants were cardiac outpatients who either had chronic cardiovascular disease or experienced a cardiac event: sudden cardiac arrest, acute coronary syndrome, new onset heart failure, ST segment elevation myocardial infarction, and non-ST segment elevation myocardial infarction. Participants who indicated: (a) a history of a serious psychiatric illness characterized by having been hospitalized for a psychiatric disorder, (b) non-English speakers, (c) a history of chronic congestive heart failure, or (d) failed to complete over 50% of the survey were excluded from the study. We executed convenience sampling and participants who met inclusion criteria were first identified and approached by

clinic nursing staff to elicit interest in study participation during their initial clinic visit. Those who expressed interest were provided with an information form and subsequently asked to complete a self-report survey. The study utilized a waiver of informed consent because no protected health information was collected, and data were all restricted to the self-report participant forms. Exclusions were done at the statistical analysis stage (see below) to minimize confusion of participants and nursing staff and to limit clinic burden of determining eligibility.

Measures

Demographics

Participants completed a brief demographic questionnaire (age, sex, marital status, education, income, race, primary language, and employment) and a cardiac history form (i.e., number, type of cardiac health issue, and length of time since cardiac event).

Mental and Physical Health

The 4-item *Patient Health Questionnaire-4* (PHQ-4; Kroenke, Spitzer, Williams, & Löwe, 2009) was used to screen for depression and anxiety in the past two weeks. Participants indicated the degree to which they agreed with each self-evaluative statement using a 4-point scale (0 = *not at all*, 3 = *nearly every day*). Two items assessed depression and two items assessed anxiety, which were summed together to derive a total score for each. A cut-off score of greater or equal to three was used for descriptive purposes in order to identify probable clinically significant anxiety or depressive symptoms (e.g., García-Campayo et al., 2012; Löwe, Kroenke, & Gräfe, 2005). A total score was also analyzed continuously and entered as covariates in the analyses. The scale showed good reliability ($\alpha = 0.89$). Self-rated physical health was assessed by the question "Overall, how would you rate your health during the past month?" using a 6-point scale (1 = *very poor*, 6 = *excellent*).

Trauma Exposure and Effects

The *Trauma History Screen* (THS; Carlson et al., 2011) is a self-report measure that assesses the lifetime occurrence of 14 potentially traumatic events. Two additional items were included that assess for exposure to a cardiac event and other life-threatening illness or injury. A total score was computed to represent lifetime trauma exposure (0–16). Of the traumatic events listed, participants were subsequently asked to identify their worst traumatic experience and the duration of negative reactions assessed in months of their identified worst traumatic experience. We also categorized trauma exposure in two ways: (1) those who indicated exposure to each of the 16 traumatic events compared to those who did not indicate exposure to the specific traumatic event, and (2) those who indicated experiencing one or more cardiac events or cardiovascular disease as their worst traumatic event compared to those who experienced or witnessed other life-threatening or violent events.

Post-traumatic Stress Disorder

We derived lifetime PTSD using the *Post-Traumatic Stress Disorder Checklist-5* (PCL-5; Weathers et al., 2013), a 20-item measure corresponding with DSM-5 symptom criteria based on participants' worst reported traumatic event. While the questionnaire also assessed past month PTSD, in order to enhance statistical power and to capture any traumas experienced more generally throughout participants' lifetime, we focused on lifetime PTSD symptomology. Cronbach's alpha's showed good internal consistency of 0.92. As with previous versions of the PCL, a continuous symptom severity score is recommended (Weathers et al., 2013), particularly in smaller samples that would have fewer case rates, which ranges from 0 to 80. In addition, a cut-point of 33 or higher can be determined as probable PTSD (Weathers et al., 2013). We investigated primary symptoms of PTSD according to the DSM-5 by summing items 1–5 (Cluster B: re-experiencing), 6–7 (Cluster C: avoidance), 8–14 (Cluster D: alterations in cognitions and mood), and 15–20 (Cluster E: hyperarousal).

Post-traumatic Growth

We assessed PTG using the 10-item *Post-traumatic Growth Inventory-Short Form* (PTGI-SF; Cann et al., 2010). Similarly to the PCL-5, participants responded to questions pertaining to their growth based on their worst reported traumatic event. A total score was analyzed along with the five subscales/factors of PTG, which include (1) development of more intimate relationships (i.e., relating to others), (2) recognition of new possibilities or paths for one's life (i.e., new possibilities), (3) greater sense of personal strength (i.e., personal strength), (4) greater spiritual development (i.e., spiritual change), and (5) greater appreciation of life (i.e., appreciation of life). Authors of the PTGI-SF recommend the computation of a total score and recent research has also validated the use of the five factors in the short form that are parallel to the extended form (Cann et al., 2010). The individual PTGI-SF items in this study derived a Cronbach's alpha of 0.95. The total score ranged between 0 and 50 and factors ranged from 0 to 10. Continuous PTG scores were used in all regression analyses. As defined in previous research (Tsai et al., 2015), a dichotomous conceptualization of PTG was indicated when a participant

reported 'moderate' to 'very great' (i.e., score ≧ 3; Jansen, Hoffmeister, Chang-Claude, Brenner, & Arndt, 2011) on any of the items that were subsequently summed to create a total score for each of the five individual factors. The latter was included for descriptive purposes and to assess for differences between the trauma-exposed groups.

Data Analyses

A series of analyses were conducted using SPSS (Version 22.0) software. First, descriptive statistics were conducted for all primary variables among the sample. In line with aim 1, we conducted independent samples *t* tests to examine whether participants who reported a cardiac event or disease as their 'worst trauma' differed from participants who reported other types of traumatic events as their 'worst trauma' on a variety of demographic attributes, PTG, and PTSD symptomatology. To examine aim 2, we conducted ANOVAs to evaluate mean differences in PTG total score across all trauma-exposed groups. Trauma-exposed groups were dichotomous (i.e., indicated exposure versus did not indicate exposure), and Chi-square analyses were then conducted to examine whether individual PTG factor scores differed according to the various trauma-exposed groups (e.g., natural disaster) versus everyone else in the sample.

To assess aim 3—the relationship between PTG and PTSD—bivariate correlations were conducted between specific PTSD symptom clusters and PTG factors along with total PTG. We then conducted linear regression models to examine the relationship between PTSD symptom clusters (individually) and PTG total score. The first bivariate model included total PTSD, duration of negative reactions, and PTSD symptom clusters all individually predicting PTG. This was followed by the second model controlling for gender, age, marital status, income, education, and ethnicity, and the third model controlling for all demographic variables and duration of negative reactions. Each of the covariates was selected based on past research that found ethnicity, income, education, age (Lowe, Manove, & Rhodes, 2013), marital status (Nenova, DuHamel, Zemon, Rini, & Redd, 2013), gender (Swickert & Hittner, 2009; Vishnevsky, Cann, Calhoun, Tedeschi, & Demakis, 2010), and duration of negative reactions (Bowman, 1999; Paris, 1999) to be significant predictors of PTG.

Consistent with recommendations of others (e.g., Perneger, 1998; Rothman, 1990), we did not adjust for multiple comparisons due to the risk of Type II error inflation, as well as the particular limitations of the *p* value in the case of small sample sizes. While the resulting loss of power for the statistical analysis is of considerable concern in some situations, applying a correction would be far too conservative in the study.

Results

Sample Characteristics

Participants were 84 cardiology patients seen in an outpatient clinic between November 2014 and June 2015. Following initial data collection, 32 participants were excluded from analyses due to a history of psychiatric hospitalization ($n = 2$), a history of heart failure ($n = 16$), or failing to complete over 50% of the survey ($n = 14$). This left a total of 52 cardiac participants eligible for inclusion in the study. Of the participants who had met the inclusion criteria, a small proportion of missing data on the PTGI-SF and PCL-5 was missing completely at random (MCAR) as indicated by non-significant findings on the Little's MCAR test. Therefore, we conducted a single imputation method using expectation maximization. Participants were predominantly male (69.2%) and ranged in age from 25 to 84 years ($M_{age} = 64.80$ years, $SD = 12.84$). The majority of the analyzed sample were educated, White, and married (see Table 1 for the sample characteristics).

Among the sample, 85.7% endorsed 'moderate' to 'very great' PTG on any of the PTGI-SF subscales (mean total PTG score = 35.25, $SD = 15.93$). For self-rated health, a majority of the sample rated their health as either very good (21.2%), good (30.8%), or fair (36.5%), while a small portion rated their health as excellent (5.8%), poor (1.9%), or very poor (3.8%). Descriptive statistics for the PTGI-SF, lifetime PTSD symptomatology, and mental health factors are described in Table 2.

Participants were exposed to a mean of 4.70 ($SD = 2.30$) traumatic events in their lifetime. They also reported experiencing a mean of 2.40 ($SD = 3.07$) cardiac events and reported an average of 60.64 ($SD = 71.31$) months since the occurrence of their cardiac event. In terms of cardiac event frequency, 51.2% of the sample experienced 1 cardiac event, 36.6% experienced 2–6 cardiac events, 2.4% experienced 7 to 10 cardiac events, and 4.9% experienced 11 or more cardiac events in their lifetime.

Cardiac Event as Worst Trauma Compared to Other Worst Traumas

In total, 75% ($n = 39$) of the sample endorsed their cardiac event as traumatic. Of this, 17.2% reported their cardiac event as their 'worst trauma.' Independent samples *t* tests indicated that there were no significant differences on PTG total in participants who reported their cardiac event as their worst trauma compared to those who did not report their cardiac event as their worst trauma, $t(30) = -0.82$, $p = .419$. Similarly, no differences on Lifetime PTSD were

Table 1 Sample characteristics and differences in PTG total score across sociodemographic variables

Variables					
ANOVA	*N*	%	*Mean*	*SD*	*F*
Location					0.40
Hospital 1	13	25	35.57	16.25	
Hospital 2	20	38.5	35.61	16.04	
Hospital 3	11	21.2	35.30	17.48	
Hospital 4	5	9.6	42.80	9.36	
Marital status					0.59
Single	7	13.5	40.96	17.86	
Married/common law	36	69.2	34.71	15.88	
Widowed/divorced/separated	9	17.3	32.14	15.15	
Annual income					0.47
Under $25,000	8	15.4	36.57	20.34	
$25,000–$50,000	12	23.1	37.47	14.04	
$50,000–$75,000	14	26.9	36.75	12.43	
Over $75,000	16	30.8	30.83	19.34	
Cardiac history					0.57
Cardiac arrest	2	3.8	48.50	2.12	
Myocardial infarction	7	13.5	36.00	17.40	
Heart failure	8	15.4	40.50	16.26	
Acute coronary syndrome	3	5.8	37.33	18.04	
Other	27	51.9	33.89	15.75	
T tests	*N*	%	*Mean*	*SD*	*t*
Gender					−0.61
Male	36	69.2	34.43	15.48	
Female	16	30.8	37.70	17.67	
Ethnicity					−0.20
White	44	84.6	35.38	15.68	
Other	7	13.5	36.67	18.65	
Education					0.35
≤ Grade 12	14	26.9	36.50	14.16	
Post-secondary	38	73.1	34.73	16.77	
Job status					−1.03
Employed	12	23.1	30.91	15.54	
Other	39	75.0	36.54	16.02	
Correlations	*N*		*Mean*	*SD*	*r*
Age	51		64.80	12.84	−0.08
Time since cardiac event (months ago)	43		60.64	71.31	−0.10
Number of cardiac events	41		2.39	3.07	0.10

One-way analysis of variance was conducted for location, marital status, and income. Independent samples *t* tests were used for gender, ethnicity, education, and job status

For categorical variables, *n* (%) is reported and for continuous variables the mean (standard deviations) of the actual variable is reported. Percentages may not always add up to 100 due to missings

p = n.s.

found between the above-mentioned groups, $t(28) = -0.48$, $p = .634$. Finally, no significant differences emerged on any of the demographic factors between groups.

Trauma Exposure and PTG

Overall, 95.5% of the sample reported exposure to a traumatic event, while 4.5% ($n = 2$) did not endorse any

Table 2 Trauma and mental health characteristics of the sample

Variables		
	Mean (*SD*)	*Possible range*
Trauma characteristics		
PCL-5 score, lifetime	12.82 (17.03)	0–80
Cluster B: re-experiencing	3.75 (5.03)	0–20
Cluster C: avoidance	1.49 (2.46)	0–8
Cluster D: alterations in cognitions and mood	3.26 (5.30)	0–28
Cluster E: hyperarousal	3.94 (5.45)	0–24
Overall PTGI-SF score	35.25 (15.93)	0–50
PTGI-SF subscales		
Relating to others	7.43 (3.39)	0–10
New possibilities	6.50 (3.49)	0–10
Personal strength	7.19 (3.70)	0–10
Spiritual change	7.33 (4.01)	0–10
Appreciation of life	7.12 (3.53)	0–10
Mental health factor	*n* (%)	
Positive screen for current depression	8 (16.7)	–
Positive screen for current generalized anxiety	12 (24.5)	–
Categorical	N (%)	
Trauma exposure		
Illness or injury including cardiac event	41 (83.7%)	
Bad accident	13 (26%)	
Natural disaster	22 (44%)	
Abuse or assault	17 (34.7%)	
Witnessing trauma	23 (50%)	
Loss or abandonment	38 (76%)	
Other trauma	15 (31.3%)	

PTGI-SF post-traumatic growth inventory-short form

traumatic events. Other events participants endorsed as their worst trauma included the following lifetime traumatic exposure types: life-threatening illness or injury (2.9%), bad accident (8.6%), natural disaster (5.7%), abuse or assault (8.7%), witnessing trauma (2.9%), sudden loss or abandonment (48.6%), and 'other' events that made the respondent feel scared, helpless, or horrified (8.6%).

Independent samples *t* tests examining lifetime traumatic exposure type on total PTG did not yield any significant findings. Chi-square analyses indicated that (1) those who reported experiencing any loss or abandonment (not just as 'worst trauma') had a higher probability of endorsing New Possibilities ($\chi^2 = 4.01$, $p = .045$); (2) those who reported witnessing trauma had a higher probability of endorsing Relating to Others ($\chi^2 = 6.86$, $p = .009$); (3) those who reported experiencing a natural disaster had higher probability of endorsing levels of Spirituality ($\chi^2 = 4.11$, $p = .043$) compared to those who did not experience the traumatic event.

Relationship Between PTSD Clusters and PTG and Its Factors

Utilizing the cut-off score of 33 suggested by Weathers et al. (2013), 11.5% of participants met diagnostic criteria for Lifetime PTSD. Associations between PCL-5 lifetime PTSD symptoms and PTGI-SF total score and factors are seen in Table 3. Results indicated that all PTSD symptoms were significantly and independently associated with PTGI-SF total score. Additionally, all PTSD symptoms and duration of negative reactions were significantly correlated with PTGI-SF spiritual change and PTGI-SF appreciation of life factors.

Findings from linear regressions examining the relationship between PTSD symptom clusters and PTG are shown in Table 4. An assessment of the Kolmogorov–Smirnov test ($p = .200$), a visual inspection of the Normal Q–Q plot, and an examination of the skewness and kurtosis for PTG total (i.e., skewness < 3, kurtosis < 10; Weston & Gore, 2006)

Table 3 Bivariate correlations between specific lifetime PTSD primary symptoms, PTG total score, duration of PTSD symptoms, and individual factors

Post-traumatic growth						
PCL-5 lifetime PTSD symptoms	PTG factor 1: Relating to others	PTG factor 2: New possibilities	PTG factor 3: Personal strength	PTG factor 4: Spiritual change	PTG factor 5: Appreciation of life	Total PTG score
Cluster B: re-experiencing	0.26	0.26	0.37*	0.42**	0.40**	0.39**
Cluster C: avoidance	0.24	0.25	0.27	0.37*	0.41**	0.35*
Cluster D: alterations in cognition and mood	0.17	0.23	0.25	0.29*	0.37*	0.30*
Cluster E: hyperarousal	0.28	0.25	0.28	0.33*	0.38**	0.35*
Duration of PTSD symptoms	0.43	0.55*	0.50*	0.48*	0.57**	0.55*

PTG post-traumatic growth, *PCL-5* post-traumatic stress disorder checklist DSM-5, *PTSD* post-traumatic stress disorder

*$p < .05$; **$p < .01$

Table 4 Regression analyses examining the relationship between post-traumatic stress disorder (PTSD) and PTSD characteristics, and post-traumatic growth

PTG total						
Variable	Model 1		Model 2		Model 3	
	B	*SE B*	*B*	*SE B*	*B*	*SE B*
Lifetime PTSD	0.35**	0.13	0.41*	0.19	0.53	0.28
Duration of symptoms	0.20*	0.07	0.28*	0.10	–	–
Cluster B: re-experiencing	1.23**	0.43	1.51*	0.63	1.92	0.98
Cluster C: avoidance	2.24*	0.90	2.28	1.24	5.53**	1.41
Cluster D: alterations in cognition and mood	0.88*	0.43	0.85	0.59	1.32	0.92
Cluster E: hyperarousal	1.01*	0.41	1.01	0.55	1.28	0.90

Model 1: Bivariate linear regression between PTSD and PTG; Model 2: Multiple linear regression controlling for gender, age, marital status, income, education, and ethnicity; Model 3: Multiple linear regression controlling for sociodemographic variables and duration of suffering. Each variable was entered individually into the model with the specified covariates. When controlling for everything in one of the models, nothing emerged as significant and was not included

B unadjusted beta

*$p < .05$; **$p < .01$

yielded satisfactory univariate normality. Multicollinearity indexes indicated that multicollinearity was not an issue for each of our regression models (i.e., variance inflation factors < 10; tolerance values > 0.20; Field, 2009).

Results from the bivariate model revealed significant relationships between all PTSD symptom clusters and PTG. In the model adjusting for demographic variables, re-experiencing and duration of negative reactions emerged as significant predictors of PTG. When additionally controlling for duration of negative reactions in the most stringent model, only avoidance was significantly associated with PTG.

Sensitivity Analysis

Given that a proportion of cardiac outpatients did not report their cardiac history as traumatic (17.2%; $n = 5$), we conducted a sensitivity analysis to examine whether the results of all primary analyses differed among only participants reporting their cardiac history as traumatic, and significant trends across all findings remained consistent.

Discussion

The main objective of this study was to examine the relationship between PTG and related trauma characteristics (e.g., type of trauma) in a sample of individuals exposed to a cardiac event or disease. To further understand the nature of the sample, we assessed participants' self-rated health, which revealed that 88.5% of the sample rated their health as very good to fair. This is slightly higher than what was found in an epidemiological study of Medicare beneficiaries who had primary total hip replacement for osteoarthritis (i.e., 88.1% rated health as very good to fair; Perruccio, Katz, & Losina,

2012). The main results of the study demonstrated that PTG is common among this sample, and that there is a significant relationship between elevated PTSD symptomatology and PTG. Additionally, the study found that traumatic event type did not impact PTG or PTSD levels. However, unique findings emerged with respect to type of lifetime trauma exposure, and PTG factors. Overall, the study was innovative in that (1) to the best of our knowledge, it represents the first investigation of trauma characteristics related to PTSD and their association with PTG in a cardiac sample; and (2) it is one of the first to examine PTG and PTSD symptomatology using contemporary DSM-5 diagnostic criteria for PTSD.

Our primary finding demonstrates that a significant proportion of cardiac outpatients (85.7%) met dichotomous criteria for PTG when compared to 50.1% using the same criteria in a population-based sample of U.S. veterans (Tsai et al., 2015). This is greater than what was found in participants after lung transplantation (50.8%; Posluszny et al., 2015), and in head and neck cancer survivors (10%; Holtmaat, Spek, Cuijpers, Leemans, & Verdonck-de Leeuw, 2017). The rates of PTG among this cardiac sample are promising given that higher levels of PTG are associated with overall objective health benefits (Affleck, Tennen, Croog, & Levine, 1987; Barskova & Oesterreich, 2009).

With regard to prevalence of trauma, 95.5% of the study's sample reported exposure to a traumatic event, while 4.5% did not endorse any traumatic event. This is higher than the lifetime trauma exposure (70.3%) reported by participants in a recent large cross-national epidemiologic study (Liu et al., 2017), as well as in a study by Kilpatrick et al. (2013) assessing trauma in a nationally representative U.S. sample of adults (89.7%). The high rate of exposure could be attributed to the fact that participants who did not complete the entire survey may have been less likely to have experienced trauma. It may also be related to the higher rates of trauma found among individuals with health problems (e.g., Boscarino, 2004; Spitzer et al., 2009). Thus, this estimate may be more in line with trauma exposure in medically ill or clinical populations. Although the majority of participants endorsed their cardiac event as "traumatic," a small proportion indicated it was their 'worst trauma.' One reason for this is that participants may have elevated levels of PTG based on their medical history rather than their reported 'worst trauma.' Relatedly, there were no significant differences between those endorsing cardiac event/disease as their 'worst trauma' compared to others in this particular sample. This finding stands in contrast with recent work by El-Gabalawy, Sommer, Edmondson, and Mota (2017), which found that illness-induced PTSD differed from other trauma-induced PTSD on a number of characteristics including age, sex, onset of first PTSD episode, as well as re-experiencing, avoidance, and hyperarousal symptoms. In El-Gabalawy et al. (2017), however, clinically significant PTSD was evaluated as opposed to worst trauma exposure, which may partially help to explain the discrepant findings.

Among PTGI-SF factors, Appreciation for Life and Spiritual Change were significantly associated with all PTSD symptoms. This finding is inconsistent with previous cardiac literature, which has found that the highest levels of PTG are related to the appreciation of life PTG factor, while spiritual change is consistently related to the lowest levels of PTG (e.g., Bluvstein et al., 2013; Karagiorgou & Cullen, 2016; Leung et al., 2010). Consistent with the demographics of the region and Charleston's and South Carolina's cultural propensity for religiosity, however, (National Park Service & U.S. Department of the Interior, n.d.), it is not surprising that participants reported particularly high levels of spiritual change following a challenging life crisis. In addition, greater spirituality in terminally ill older adults has been found to be inversely related to depression, perhaps serving as a buffer against it (McClain, Rosenfeld, & Breitbart, 2003).

In relation to lifetime PTSD symptomatology, results revealed that participants who endorsed their cardiac event as their worst trauma had a mean score of 12.4 ($SD = 14.94$), which is lower than the lifetime PTSD mean score reported in a large epidemiological sample of Chinese earthquake survivors, and in a study examining post-traumatic stress symptoms in women with sexual trauma (Fergus & Bardeen, 2016). It may be that the experiencing a cardiac event is perceived as less stressful than experiencing other types of trauma, and as a result, individuals are able to experience greater levels of PTG (Shakespeare-Finch & Armstrong, 2010).

The regression analyses revealed that duration of negative reactions from trauma and higher levels of re-experiencing symptoms were associated with higher levels of PTG. This is comparable to what was found in a study by Tsai et al. (2015) which demonstrated that re-experiencing was most strongly associated with PTG out of the five PTSD symptom clusters. These findings are also consistent with previous research showing that the occurrence of intrusive trauma-related thoughts is related to higher levels of PTG and benefit finding (Cann et al., 2010; Helgeson, Reynolds, & Tomich, 2006; Morgan & Desmarais, 2017; Tsai et al., 2015). One explanation is that continuous self-reflection and cognitive processing of a traumatic event may serve as precursors to PTG, leading individuals to seek meaning and a deeper understanding of the event as a way of processing the trauma (Tedeschi & Calhoun, 2004; Tsai et al., 2015). In contrast, those who do not experience the ruminative quality of re-experiencing the traumatic event might not experience this change in processing, reducing their ability to grow.

When additionally controlling for duration of negative reactions in the third model of the regression analyses, greater avoidance symptomatology emerged as the only

significant predictor of elevated levels of PTG. One reason for this finding may be related to the age of this sample which consisted over mostly adults 65 years of age or older. Older individuals may be more prone to handling specific life stressors such as physical illness by altering their expectations and perceptions in a way that allows them to maintain positive emotions and minimize negative ones. This is consistent with research showing that over 50% of older people rated their health as good or fairly good, despite having a limiting long-term illness (Evandrou, 2005). Thus, greater avoidance symptomatology could be adaptive and vary as a result of age.

Alternatively, recent evidence suggests that PTSD symptomatology may differ in cardiac contexts compared to PTSD related to traditional index traumas (e.g., sexual assault, military-related experiences) in terms of individual characteristics, which include being internal, ongoing, and future-oriented (Vilchinsky et al., 2017). This may result in unique associations with PTG, which is another possible explanation for differences in PTG found in the present study. Further research is warranted to understand the basis of these trends.

In terms of mean PTG scores among trauma types, results revealed that participants who experienced loss or abandonment had higher scores on the new possibilities PTG factor, those who witnessed trauma had higher levels of the higher scores on the relating to others PTG factor, and those who experienced a natural disaster had higher scores on the spirituality PTG factor compared to non-exposed groups. It may be that in order to cope with a loss, one must embrace the idea of starting over and being open to new experiences in order to grow from the particular experience. This is consistent with prior studies that found after a traumatic loss, individuals may seek to discover new possibilities in order to deal with life's challenges (Tedeschi & Calhoun, 2004). Witnessing a trauma may also serve as a reminder that life is short and, therefore, individuals may be motivated to establish deeper and more meaningful interpersonal connections to gain strength and support. With respect to the significant relationship between experiencing a natural disaster and spirituality, one explanation may be that in contrast to other traumatic events, a natural disaster is an experience that is beyond one's control, which may lead individuals to find comfort in the belief of a higher power.

There are a number of limitations that must be noted. First, the sample was based on convenience, which limited the sample size and resulted in several exclusions. It is critical for future research to evaluate a comprehensive sample of cardiac participants to identify whether these unique trends persist. Second, we only have documentation of the number of participants who started the questionnaire and did not complete it. While this likely reflects the number of participants who were included and approached, we do not have exact documentation of this, which may impact the external validity of the study. Third, while null findings regarding differences between those who indicated a cardiac event/disease as their worst trauma versus everyone else is likely related to the small number of participants that reported the cardiac event as their worst event, it is also possible that demographic differences simply do not exist between groups. Fourth, we did not include a measure of the severity of the cardiovascular illness/event, which may have impacted results. Fifth, we did collect additional information regarding participants' health history, and therefore understanding how these individuals compare to the general population is limited. Sixth, this study was cross-sectional and although some of our variables may speak to temporality, longitudinal designs are necessary to understand causal relationships. Additionally, these associations were only investigated within a cardiac sample, and future research should aim to evaluate whether these trends would differ when compared to non-cardiac samples. Further, the measures included in the study were self-report, which may have resulted in biased estimates.

In conclusion, experiencing a cardiac event or cardiovascular disease may be related to a number of psychological factors, which include both the experiences of post-traumatic stress and growth experiences. Findings from this preliminary study suggest that trauma-exposed populations, including those who have health conditions, may be linked to particularly high rates of PTG. Moreover, PTG is associated with severity of an index trauma such as lifetime PTSD symptoms and increased duration of negative reactions. Utilization of psychosocial interventions such as cardiac rehabilitation programs may also help increase PTG among cardiac populations and encourage them to pursue preventative healthcare (Leung et al., 2010). There are a number of future avenues for research. A thorough comprehension of PTG in this vulnerable population from all aspects will translate to important clinical implications for possible facilitation of growth and prevention as well as the reduction of negative health outcomes.

Compliance with Ethical Standards

Conflict of interest Kirby Magid, Renée El-Gabalawy, Anbukarasi Maran, and Eva R. Serber declare that they have no conflict of interest.

Ethical Approval All procedures were in accordance with the ethical standards of the institutional research committees and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent The study utilized a waiver of informed consent because no protected health information was collected, and data were all restricted to the self-report participant forms.

References

Affleck, G., Tennen, H., Croog, S., & Levine, S. (1987). Causal attribution, perceived benefits, and morbidity after a heart attack: An 8-year study. *Journal of Consulting and Clinical Psychology, 55*, 29–35. https://doi.org/10.1037/0022-006X.55.1.29.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington: American Psychiatric Publishing. https://doi.org/10.1176/appi.books.9780890425596.744053.

Barskova, T., & Oesterreich, R. (2009). Post-traumatic growth in people living with a serious medical condition and its relations to physical and mental health: A systematic review. *Disability and Rehabilitation, 31*, 1709–1733. https://doi.org/10.1080/09638280902738441.

Bluvstein, I., Moravchick, L., Sheps, D., Schreiber, S., & Bloch, M. (2013). Posttraumatic growth, posttraumatic stress symptoms and mental health among coronary heart disease survivors. *Journal of Clinical Psychology in Medical Settings, 20*, 164–172.

Boscarino, J. A. (2004). Posttraumatic stress disorder and physical illness: Results from clinical and epidemiologic studies. *Annals of the New York Academy of Sciences, 1032*, 141–153. https://doi.org/10.1196/annals.1314.011.

Bowman, M. (1999). Individual differences in posttraumatic distress: Problems with the DSM-IV model. *The Canadian Journal of Psychiatry, 44*, 21–33. https://doi.org/10.1177/070674379904400103.

Cann, A., Calhoun, L. G., Tedeschi, R., Taku, K., Vishnevsky, T., Triplett, K. N., et al. (2010). A short form of the posttraumatic growth inventory. *Anxiety, Stress and Coping, 23*, 127–137. https://doi.org/10.1080/10615800903094273.

Carlson, E. B., Smith, S. R., Palmieri, P. A., Dalenberg, C., Ruzek, J. I., Kimerling, R., … Spain, D. A. (2011). Development and validation of a brief self-report measure of trauma exposure: The Trauma History Screen. *Psychological Assessment, 23*, 463–477. https://doi.org/10.1037/a0022294.

Cordova, M. J., Cunningham, L. L. C., Carlson, C. R., & Andrykowski, M. A. (2001). Posttraumatic growth following breast cancer: A controlled comparison study. *Health Psychology, 20*, 176–185. https://doi.org/10.1037//0278-6133.20.3.176.

Deng, L. X., Khan, A. M., Drajpuch, D., Fuller, S., Ludmir, J., Mascio, C. E., … Kim, Y. Y. (2016). Prevalence and correlates of posttraumatic stress disorder in adults with congenital heart disease. *The American Journal of Cardiology, 117*, 853–857. https://doi.org/10.1016/j.amjcard.2015.11.065.

Edmondson, D. (2014). An enduring somatic threat model of posttraumatic stress disorder due to acute life-threatening medical events. *Social and Personality Psychology Compass, 8*, 118–134. https://doi.org/10.1111/spc3.12089.

Edmondson, D., & Cohen, B. E. (2013). Posttraumatic stress disorder and cardiovascular disease. *Progress in Cardiovascular Diseases, 55*, 548–556. https://doi.org/10.1016/j.pcad.2013.03.004.

Edmondson, D., Richardson, S., Falzon, L., Davidson, K. W., Mills, M. A., & Neria, Y. (2012). Posttraumatic stress disorder prevalence and risk of recurrence in acute coronary syndrome patients: A meta-analytic review. *PLoS ONE*, 7, e38915. https://doi.org/10.1371/journal.pone.0038915.

El-Gabalawy, R., Sommer, J., & Mota, N. (2017). *Understanding illness-induced PTSD: An epidemiological investigation of prevalence and correlates of a controversial diagnosis*. Poster presentation at the 33rd Annual International Society for Traumatic Stress Studies Conference, Chicago, IL.

Evandrou, M. (2005). Health and social care (Chap. 6). In A. Soule, P. Baab, M. Evandrou, S. Balchin, & L. Zealy (Eds.), *Focus on older people (focus on series)* (pp. 51–66). Basingstoke: Palgrave Macmillian.

Fergus, T. A., & Bardeen, J. R. (2016). Main and interactive effects of mental contamination and tolerance of negative emotions in relation to posttraumatic stress symptoms following sexual trauma. *Journal of Psychopathology and Behavioral Assessment, 38*, 274–283. https://doi.org/10.1007/s10862-015-9511-0.

Field, A. (2009). *Discovering statistics using SPSS*. Thousand Oaks: Sage.

Gangstad, B., Norman, P., & Barton, J. (2009). Cognitive processing and posttraumatic growth after stroke. *Rehabilitation Psychology, 54*, 69–75. https://doi.org/10.1037/a0014639.

García-Campayo, J., Zamorano, E., Ruiz, M. A., Pérez-Páramo, M., López-Gómez, V., & Rejas, J. (2012). The assessment of generalized anxiety disorder: Psychometric validation of the Spanish version of the self-administered GAD-2 scale in daily medical practice. *Health and Quality of Life Outcomes, 10*, 114. https://doi.org/10.1186/1477-7525-10-114.

Garnefski, N., Kraaij, V., Schroevers, M. J., & Somsen, G. A. (2008). Post-traumatic growth after a myocardial infarction: A matter of personality, psychological health, or cognitive coping? *Journal of Clinical Psychology in Medical Settings, 15*, 270–277. https://doi.org/10.1007/s10880-008-9136-5.

Helgeson, V. S., Reynolds, K. A., & Tomich, P. L. (2006). A meta-analytic review of benefit finding and growth. *Journal of Consulting and Clinical Psychology, 74*, 797–816. https://doi.org/10.1037/0022-006X.74.5.797.

Holtmaat, K., Spek, N., Cuijpers, P., Leemans, C., & Verdonck-de Leeuw, I. (2017). Posttraumatic growth among head and neck cancer survivors with psychological distress. *Psycho-Oncology, 26*(1), 96–101. https://doi.org/10.1002/pon.4106.

Huffman, J. C., Smith, F. A., Blais, M. A., Beiser, M. E., Januzzi, J. L., & Fricchione, G. L. (2006). Recognition and treatment of depression and anxiety in patients with acute myocardial infarction. *American Journal of Cardiology, 98*, 319–324. https://doi.org/10.1016/j.amjcard.2006.02.033.

Jansen, L., Hoffmeister, M., Chang-Claude, J., Brenner, H., & Arndt, V. (2011). Benefit finding and post-traumatic growth in long-term colorectal cancer survivors: Prevalence, determinants, and associations with quality of life. *British Journal of Cancer, 105*, 1158. https://doi.org/10.1038/bjc.2011.335.

Kang, H. K., Bullman, T. A., & Taylor, J. W. (2006). Risk of selected cardiovascular diseases and posttraumatic stress disorder among former World War II prisoners of war. *Annals of Epidemiology, 16*, 381–386. https://doi.org/10.1016/j.annepidem.2005.03.004.

Karagiorgou, O., & Cullen, B. (2016). A comparison of post-traumatic growth after acquired brain injury or myocardial infarction. *Journal of Loss and Trauma, 21*, 589–600. https://doi.org/10.1080/15325024.2016.1161427.

Kilpatrick, D. G., Resnick, H. S., Milanak, M. E., Miller, M. W., Keyes, K. M., & Friedman, M. J. (2013). National estimates of exposure to trauamtic events and PTSD prevalence using DSM-IV and DSM-5 criteria. *Journal of Traumatic Stress, 26*, 537–547. https://doi.org/10.1002/jts.21848.

Kroenke, K., Spitzer, R. L., Williams, J. B., & Löwe, B. (2009). An ultra-brief screening scale for anxiety and depression: the PHQ–4. *Psychosomatics, 50*, 613–621. https://doi.org/10.1016/S0033-3182(09)70864-3.

Leung, Y. W., Gravely-Witte, S., Macpherson, A., Irvine, J., Stewart, D. E., & Grace, S. L. (2010). Post-traumatic growth among cardiac outpatients: Degree comparison with other chronic illness samples and correlates. *Journal of Health Psychology, 15*, 1049–1063. https://doi.org/10.1177/1359105309360577.

Liu, H., Petukhova, M. V., Sampson, N. A., Aguilar-Gaxiola, S., Alonso, J., Andrade, L. H., … Kawakami, N. (2017). Association of DSM-IV posttraumatic stress disorder with traumatic experience type and history in the World Health Organization World Mental Health

Surveys. *JAMA Psychiatry, 74*, 270–281. https://doi.org/10.1001/jamapsychiatry.2016.3783.

Löwe, B., Kroenke, K., & Gräfe, K. (2005). Detecting and monitoring depression with a two-item questionnaire (PHQ-2). *Journal of Psychosomatic Research, 58*, 163–171. https://doi.org/10.1016/j.jpsychores.2004.09.006.

Lowe, S. R., Manove, E. E., & Rhodes, J. E. (2013). Posttraumatic stress and posttraumatic growth among low-income mothers who survived Hurricane Katrina. *Journal of Consulting and Clinical Psychology, 81*(5), 877–889. https://doi.org/10.1037/a0033252.

McCaslin, S. E., De Zoysa, P., Butler, L. D., Hart, S., Marmar, C. R., Metzler, T. J., & Koopman, C. (2009). The relationship of posttraumatic growth to peritraumatic reactions and posttraumatic stress symptoms among Sri Lankan University students. *Journal of Traumatic Stress, 22*, 334–339. https://doi.org/10.1002/jts.20426.

McClain, C. S., Rosenfeld, B., & Breitbart, W. (2003). Effect of spiritual well-being on end-of-life despair in terminally-ill cancer patients. *Lancet, 361*, 1603–1607. https://doi.org/10.1016/S0140-6736(03)13310-7.

Morgan, J. K., & Desmarais, S. L. (2017). Associations between time since event and posttraumatic growth among military veterans. *Military Psychology, 29*, 456–463. https://doi.org/10.1037/mil0000170.

National Park Service, & U.S. Department of the Interior. (n.d.). *Charleston's historic religious and community buildings*. Retrieved from https://www.nps.gov/nr/travel/charleston/text.htm.

Nenova, M., DuHamel, K., Zemon, V., Rini, C., & Redd, W. H. (2013). Posttraumatic growth, social support and social constraint in hematopoietic stem cell transplant survivors. *Psycho-Oncology, 22*(1), 195–202. https://doi.org/10.1002/pon.2073.

Paris, J. (1999). *Nature and nurture in psychiatry: A predisposition-stress model of mental disorders*. Washington, DC: American Psychiatric Press.

Perneger, T. V. (1998). What's wrong with Bonferroni adjustments. *Bmj, 316*, 1236–1238. https://doi.org/10.1136/bmj.316.7139.1236.

Perruccio, A. V., Katz, J. N., & Losina, E. (2012). Health burden in chronic disease: Multimorbidity is associated with self-rated health more than medical comorbidity alone. *Journal of Clinical Epidemiology, 65*(1), 100–106. https://doi.org/10.1016/j.jclinepi.2011.04.013.

Posluszny, D. M., Dougall, A. L., Johnson, J. T., Argiris, A., Ferris, R. L., Baum, A., … Dew, M. A. (2015). Posttraumatic stress disorder symptoms in newly diagnosed participants with head and neck cancer and their partners. *Head & neck, 37*, 1282–1289. https://doi.org/10.1002/hed.23760.

Remch, M., Laskaris, Z., Flory, J., Mora-McLaughlin, C., & Morabia, A. (2018). Post-traumatic stress disorder and cardiovascular diseases: A cohort study of men and women involved in cleaning the debris of the world trade center complex. *Circulation: Cardiovascular Quality and Outcomes, 11*, e004572. https://doi.org/10.1161/CIRCOUTCOMES.117.004572.

Rosman, L., Ford, J., Whited, A., Cahill, J., Lampert, R., Mosesso, V. … Sears, S. (2016). Compound risk: History of traumatic stress predicts posttraumatic stress disorder symptoms and severity in sudden cardiac arrest survivors. *European Journal of Cardiovascular Nursing, 15*, 372–379. https://doi.org/10.1177/1474515115587165.

Rothman, K. J. (1990). No adjustments are needed for multiple comparisons. *Epidemiology, 1*, 43–46. https://doi.org/10.1097/00001648-199001000-00010.

Shakespeare-Finch, J., & Armstrong, D. (2010). Trauma type and posttrauma outcomes: Differences between survivors of motor vehicle accidents, sexual assault, and bereavement. *Journal of Loss and Trauma, 15*, 69–82. https://doi.org/10.1080/15325020903373151.

Shakespeare-Finch, J., & Lurie-Beck, J. (2014). A meta-analytic clarification of the relationship between posttraumatic growth and symptoms of posttraumatic distress disorder. *Journal of Anxiety Disorders*. https://doi.org/10.1016/j.janxdis.2013.10.005.

Spindler, H., & Pedersen, S. S. (2005). Posttraumatic stress disorder in the wake of heart disease: Prevalence, risk factors, and future research directions. *Psychosomatic Medicine, 67*, 715–723. https://doi.org/10.1097/01.psy.0000174995.96183.9b.

Spitzer, C., Barnow, S., Völzke, H., John, U., Freyberger, H. J., & Grabe, H. J. (2009). Trauma, posttraumatic stress disorder, and physical illness: Findings from the general population. *Psychosomatic Medicine, 71*(9), 1012–1017. https://doi.org/10.1097/PSY.0b013e3181bc76b5.

Swickert, R., & Hittner, J. (2009). Social support coping mediates the relationship between gender and posttraumatic growth. *Journal of Health Psychology, 14*(3), 387–393. https://doi.org/10.1177/1359105308101677.

Tedeschi, R., & Calhoun, L. (2004). Posttraumatic growth: Conceptual foundations and empirical evidence. *Psychological Inquiry, 15*, 1–18. https://doi.org/10.1207/s15327965pli1501.

Tedeschi, R., Park, C. L., & Calhoun, L. G. (1998). *Posttraumatic growth: Positive changes in the aftermath of crisis*. Mahwah: Lawrence Erlbaum. https://doi.org/10.1176/appi.ajp.157.10.1712.

Tedstone, J. E., & Tarrier, N. (2003). Posttraumatic stress disorder following medical illness and treatment. *Clinical Psychology Review, 23*, 409–448. https://doi.org/10.1016/s0272-7358(03)00031-x.

Thombs, B. D., Bass, E. B., Ford, D. E., Stewart, K. J., Tsilidis, K. K., Patel, U. … Ziegelstein, R. C. (2006). Prevalence of depression in survivors of acute myocardial infarction. *Journal of General Internal Medicine, 21*, 30–38. https://doi.org/10.1111/j.1525-1497.2005.00269.x.

Tsai, J., El-Gabalawy, R., Sledge, W. H., Southwick, S. M., & Pietrzak, R. H. (2015). Post-traumatic growth among veterans in the USA: Results from the National Health and Resilience in Veterans Study. *Psychological Medicine, 45*, 165–179. https://doi.org/10.1017/S0033291714001202.

Vaccarino, V., Goldberg, J., Rooks, C., Shah, A. J., Veledar, E., Faber, T. L., ... & Bremner, J. D. (2013). Post-traumatic stress disorder and incidence of coronary heart disease: A twin study. *Journal of the American College of Cardiology, 62*, 970–978. https://doi.org/10.1016/j.jacc.2013.04.085.

Vilchinsky, N., Ginzburg, K., Fait, K., & Foa, E. B. (2017). Cardiac-disease-induced PTSD (CDI-PTSD): A systematic review. *Clinical Psychology Review*. https://doi.org/10.1016/j.cpr.2017.04.009.

Vishnevsky, T., Cann, A., Calhoun, L. G., Tedeschi, R. G., & Demakis, G. J. (2010). Gender differences in self-reported posttraumatic growth: A meta-analysis. *Psychology of Women Quarterly, 34*, 110–120. https://doi.org/10.1111/j.1471-6402.2009.01546.x.

Weathers, F. W., Litz, B. T., Keane, T. M., Palmieri, P. A., Marx, B. P., & Schnurr, P. P. (2013). *The PTSD checklist for DSM-5 (PCL-5)*. National Center for PTSD. https://doi.org/10.1037/t02622-000.

Weston, R., & Gore, P. A. (2006). A brief guide to structural equation modeling. *The Counseling Psychologist, 34*, 719–751. https://doi.org/10.1177/0011000006286345.

Znoj, H. J. (1999). *European and American perspectives on posttraumatic growth: A model of personal growth: Life challenges and transformation following loss and physical handicap*. Boston, MA: Annual convention of the American Psychological Association.

Zoellner, T., & Maercker, A. (2006). Posttraumatic growth in clinical psychology: A critical review and introduction of a two component model. *Clinical Psychology Review, 26*, 626–653. https://doi.org/10.1016/j.cpr.2006.01.008.