Cancer-related Posttraumatic growth and Posttraumatic stress disorder: how are they connected
and what are their correlates?

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Abstract

Purpose

Cancer is a stressful life event that can lead to specific posttraumatic reactions. Posttraumatic stress disorder (PTSD) and Posttraumatic growth (PTG) are two main posttraumatic reactions that are related to each other, and both have different correlates.

Methods

The linearity of the relationship between PTG and PTSD as well as the different socio-demographic, cancer-related, emotional and psychological correlates were analyzed in patients with cancer (N = 126).

Results

The relationship between PTG and PTSD was found to be more curvilinear than linear. PTSD was more strongly related to psychological factors (e.g., anxious preoccupation, hopelessness, resilience) while PTG was strongly related to existential factors (e.g., self-transcendence, religiosity).

Conclusion

The results show that cancer-related PTSD and PTG are specifically related constructs which are related differently to particular correlates.

Keywords: cancer, posttraumatic growth, posttraumatic stress disorder (PTSD), curvilinear relationship, correlates

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Introduction

Cancer is a serious life event that may be accompanied by treatment, treatment side effects, impaired physical health, loss of confidence and fear (Salsman et al., 2009). This level of stress can also have a negative effect on mental health (Nathan et al., 2018; Ng et al., 2017). Due to the unpredictable and uncontrollable nature of cancer, it may not only be perceived as highly stressful but also traumatizing (Leano et al., 2019). This can be to the point that posttraumatic stress disorder (PTSD) may develop (Abbey et al., 2014). PTSD is characterized by intrusive thoughts, nightmares, flashbacks, avoidance symptoms, negative affectivity, heightened arousal, changes in behavior and disrupted sleep (APA, 2013). On the other hand, the survival of a traumatic event can also lead to posttraumatic growth (PTG) (Dekel et al., 2012). PTG represents the positive psychological changes experienced as a result of managing a traumatic event (Tedeschi et al., 2018). Although PTG and PTSD have both been frequently studied in cancer survivors, some authors have expressed the need to raise awareness of PTSD (Leano et al., 2019) and look at it in relation to PTG (Ochoa Arnedo et al. al., 2019).

According to the PTG theory, a certain amount of distress is necessary in order for PTG to develop (Tedeschi & Calhoun, 1995). This suggests that there may be a relationship between PTSD and PTG and research has indicated that there is a link (Marziliano et al., 2020). However, it would be misleading to consider this relationship as linear (Shakespeare-Finch & Lurie-Beck, 2014). In other words, this does not mean that the more stress, the greater the PTSD a person experiences and the greater the posttraumatic growth will be. Rather, it seems more useful to

view the relationship between PTSD and PTG as curvilinear (Maarten et al., 2019). This means that a certain level of distress is needed for PTG to develop although if this level is too high and the presence of PTSD is already too severe, it may hinder the ability of adaptive coping needed for PTG development (Tiamiyu et al., 2016; Zebrack et al., 2015). In order to understand the relationship between PTSD and PTG, as well as for the clinical implications, it is important to know what factors are associated with them (Marziliano et al., 2020). PTSD and PTG are 2 independent constructs and are not opposites of one dimension. Thus, they can be associated with different variables in different ways (Shand et al., 2015). Cancer-related PTSD and PTG may be associated with various factors such as socio-demographic (e.g., age, gender, socio-economic status, education level), clinical (e.g., duration, treatment, advanced disease), social (e.g., social support), psychological (e.g., mental health, well-being, quality of life, coping strategies) and existential variables (e.g., spirituality, religiosity) (Casellas-Grau et al., 2016; Cordova et al., 2017; Dahl et al., 2016; Liu et al., 2020; Ochoa et al., 2017; Pranjic et al., 2016; Shand et al., 2015). The awareness of the common as well as different predictors can therefore help in choosing appropriate interventions when adapting to the situation associated with cancer (Casellas-Grau et al., 2017). Although PTSD and PTG have been found to share some correlates, there remains a gap in how they are linked and what their shared and different correlates are.

The aim of this study was to analyze the (non)linearity of the relationship between posttraumatic stress disorder and posttraumatic growth. It also aimed to explore which socio-demographic, cancer-related, emotional and psychological factor are related to posttraumatic growth and posttraumatic stress disorder and how these factors are related to these two cancer-related psychological changes.

Methods

Participants and Procedure

The study was carried out between November 2018 and February 2019. The research project “Cognitive-Existential Profile and Specifics of Posttraumatic Growth in Cancer Patients” (osf.io/4maz9/) was approved by the Ethics Committee at Trnava University. Participation in the study was voluntary, anonymous and participants were able to drop out of the study at any stage without consequences. The patients gave their informed consent to confirm taking part in the study. Data were collected online in combination with face to face. The basic criteria to participate were being aged 18 and over, being a patient with a cancer diagnosis, without a serious mental or physical condition and not being terminally ill.

Measures

The Posttraumatic growth inventory – short form (PTGI-SF; Cann et al., 2010) consists of a 10-items ($\Omega_{TOTAL} = .94$) which measures whether a traumatic event can also cause a positive change in the sense of positive growth. The PTGI-SF consists of 5 subscales (relating to others; new possibilities; personal strength; spiritual change; appreciation of life) although it is possible to work with it like a unidimensional measurement. The items are formulated as statements (e.g. “I changed my priorities about what is important in life.”) where participants use a 6 point scale to evaluate to what extent they experienced the change due to this traumatic event (from 0-5). A higher score indicates a higher level of growth.

PTSD was measured using the Posttraumatic Stress Disorder Checklist-5 (PCL-5; Weathers et al., 2013). It consists of 20 items formulated as statements ($\Omega_{TOTAL} = .91$). The items

assess the severity of PTSD symptomatology and map it directly onto the DSM-5 symptom criteria for PTSD (such as nightmares, flashbacks, etc.). The participant expresses the degree of intensity (from 0-4) for every single symptom he has felt in the last month (e.g. “Not at all”, “A little bit”, “Moderately”, “Quite a bit”, and “Extremely”). A higher score indicates a higher level of probable PTSD.

The Integration of Stressful Life Experiences Scale (ISLES; Holland et al., 2010) consists of 16 items that are focused on how a person adapts to stressful life events. It is used to measure human adaptation to stressful life events. The items are formulated as statements (e.g., “Since this event, the world seems like a confusing and scary place.”). The items measure two dimensions of integration of stressful life events: footing in the world ($\Omega_{TOTAL} = .91$) and comprehensibility ($\Omega_{TOTAL} = .75$). The respondent evaluates statements on a 5-point Likert scale (from 1-strongly disagree to 5-strongly agree). A higher score indicates higher resilience ($\Omega_{TOTAL} = .86$). A higher score also indicates a higher level of footing in the world and comprehensibility.

For this study, the instructions in the PTGI-SF, PCL-5, and ISLES were specified for the particular situation of cancer (e.g., “Since I having cancer, the world seems like a confusing and scary place.”).

Mini-Mental Adjustment to Cancer (Mini-MAC; Watson et al., 1994) consists of 29 items that are focused on how the patient copes with cancer in the sense of mentally adjusting to their disease. The questionnaire is comprised of 5 subscales which are aimed at measuring different behavioral and emotional states related to cancer (helplessness-hopelessness ($\Omega_{TOTAL} = .89$); cognitive avoidance ($\Omega_{TOTAL} = .70$); fatalism ($\alpha = .28$); anxious preoccupation ($\Omega_{TOTAL} = .75$);

fighting spirit ($\Omega_{\text{TOTAL}} = .64$)). The items are formulated as statements to which the respondent answers using a 4-point Likert scale (from 1 - strongly disagree to 4 - strongly agree).

The Brief Resilience Scale (BRS; Smith et al., 2008) is a short 6-item tool used to measure unitary resilience. It is useful in assesses the ability to recover from stress. The items are formulated as statements. The respondent evaluates these statements on a 5-point Likert scale (from 1-strongly disagree, to 5-strongly agree). A higher score indicates higher resilience ($\Omega_{\text{TOTAL}} = .86$).

The Self-Transcendence Measure-Brief (STM-B; Wong et al., 2017) consists of 10 items ($\Omega_{\text{TOTAL}} = .88$) that are based on Frankl's theory which is focused on measuring the motivation for self-transcendence (e.g., "What really matters in life is the contribution I have made to this world."). Respondents answer on a 4-point scale (from 0 – not at all, to 4 – a great deal).

A short version of The Centrality of Religiosity Scale (CRS-5; Huber & Huber, 2012) was used to measure religiosity. The questionnaire measures the importance of the presence of religious meaning in a person's life and consists of 5 items ($\Omega_{\text{TOTAL}} = .80$). For each item, the participant evaluates the frequency for example: "How often do you think about religious issues?". Items can be coded in the range from 1-5.

The emotional variables were measured by simple items, asking about perceived pain, anxiety (fear), sadness (depression), social isolation, loss of meaning and discomfort, and how these emotional states have recently influenced their life. The responses to these items are from 1 (never) to 9 (always).

Statistical analysis

There was 5.8% missingness found in the sample (N = 126 patients). Missingness was looked at in the measured variables and 30.95% was the highest missingness found in certain variables. The missing data were imputed by multiple imputation (Van Burren & Groothuis-Oudshoorn, 2011) in the MICE package. The missing sociodemographic variables, variables related to cancer and cancer treatment, and other categorical variables were not imputed. For the imputation, 25 imputations with 10 iterations were chosen and the PMM (Predictive Mean Matching) method was used. Due to procedural error, Mini-MAC item no. 29 was missing and was imputed based on all Mini-MAC items from the dataset collected in the second data collection with 15 imputations and 10 iterations by PMM. A descriptive analysis, reliability analysis, correlations and analysis of differences (detailed results can be found in the supplementary materials) were computed on multiple imputed objects. For the purpose of Figure 1, the package *effectsize* (Ben-Shachar et al., 2020) was used to transform Cohen's *d* to Pearson's *r* in the categorical variables (gender, partnership, remission, relapse, and metastasis). For the Bayesian correlation, the *BayesFactor* package (Morey & Rouder, 2018) was used. Curvilinear regression was computed on the average PTG and PTSD items from the 25 imputed datasets and the best fitting model was chosen on AIC value. The linear and curvilinear regression models for PTG as a criterium and PTSD as a predictor were compared by ANOVA.

All results are reported as pooled estimates. All the analyses were carried out in R statistical software (R Core Team, 2021). The analytical code and data are available in the supplementary materials.

Results

Sample characteristics

From the effective sample ($N = 126$), 100 of the patients with cancer were female. Most of the patients were married (61.9%) with two children ($SD = 1.36$, range = 0-6) and had secondary school education (65.5%). The mean age of the cancer survivors was 64 ($SD = 8.74$) years old (range = 45-84) although a procedural error meant information about age was only available from 31% of them. Most of the participants were employed (41.4%), retired (27.6%) or retired due to invalidity (24.1%). About one third of the sample (48 cases) have cancer in the family anamnesis. The sample was heterogeneous from the perspective of the type of cancer. The most prevalent diagnosis was breast cancer (48 cases), followed by gastrointestinal cancer (17 cases), ovarian cancer (13 cases) and testicular cancer (8 cases). A detailed composition of the sample according to cancer type can be found in the supplementary materials. The average time since being diagnosed with cancer was 39 months ($SD = 34.46$, range = 2-148). About 65% patients were in cancer remission and 17 patients had survived one or more cancer relapses. About 64% of patients had received chemotherapy while 28 patients had had metastasis.

Descriptive statistics and correlations

Table 1 shows the descriptive statistics of the analyzed variables.

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Table 1

Descriptive statistics

Variable	<i>M</i>	<i>SD</i>	SE	Min	Max
1. Posttraumatic growth	26.73	14.51	1.29	0	50
2. PTSD	24.07	17.06	1.52	0	70
3. Helplessness-Hopelessness	16.60	6.29	0.56	9	36
4. Cognitive avoidance	12.02	2.48	0.22	4	16
5. Fatalism	12.21	2.01	0.18	5	16
6. Anxious preoccupation	14.23	3.37	0.30	7	23
7. Fighting spirit	16.08	2.84	0.25	8	20
8. Footing in the world	40.23	9.09	0.81	15	55
9. Comprehensibility	16.77	4.10	0.36	5	25
10. Resilience	20.10	4.51	0.40	6	30
11. Self-transcendence	26.57	7.00	0.62	5	40
12. Religiosity	16.52	5.91	0.53	5	28
13. Pain	3.58	2.33	0.21	1	9
14. Discomfort	3.62	2.34	0.21	1	9
15. Social isolation	2.55	2.08	0.19	1	9
16. Anxiety (fear)	4.09	2.55	0.23	1	9
17. Sadness (depression)	3.84	2.55	0.23	1	9
18. Loss of meaning	2.65	2.32	0.21	1	9

Note. Due to an inaccurate translation of item number 13 from MINIMAC in Slovak, 6 items were used instead of 7 items for the total score of anxious preoccupation

The relationship between PTG and PTSD

A moderately positive relationship was found between PTG and PTSD although this relationship cannot be perceived as linear (see Figure 1).

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Figure 1 *Relationship between Posttraumatic growth and Posttraumatic stress in patients with cancer*

Table 2 shows the results of comparison of linear and curvilinear regression between PTSD and PTG. Curvilinear regression model (Figure 2) fit the data better than linear regression model.

Table 2

Linear and curvilinear regression model of Posttraumatic growth (PTG) as a criterium and PTSD as a predictor

	B	SE	R ²	F	p	AIC
linear model			0.093	12.73	.0005	1024.293
PTSD	0.26***	0.07				
quadratic model			0.20	15.42	.000001	1010.423
PTSD	1.08***	0.21				
PTSD*PTSD	-0.02***	0.004				
Models comparison						
	Residual Df	Residual Sum of Square	Sum of Squares	F	p	
linear model	124	23863				
quadratic model	123	21039	2824	16.51	0.000086	

Note. *** indicates $p < .001$

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Figure 2 *Curvilinear relationship between Posttraumatic stress as predictor and Posttraumatic growth as criterium*

PTG and PTSD correlates

The values for cancer-related correlates of PTG ranged from $r = -0.3$ to $r = 0.22$, i.e., at the level of weak effects. The strongest correlate of PTG within this group of variables was cancer relapse (higher PTG rates were associated with cancer relapse). The cancer-related correlates of PTG ranged from $r = -0.20$ to $r = 0.33$, similar to PTSD, at the level of weak effects. The strongest correlate of PTSD was the presence of metastases.

All the emotional correlates were found to correlate more strongly with PTSD than PTG, with the exception of social isolation. In PTG, these correlates ranged from $r = 0.11$ to $r = 0.24$ while for PTSD it was from $r = 0.24$ to $r = 0.42$. Pain was found to be the strongest correlate of both PTG and PTSD. The strength of this correlation was moderately strong.

In terms of the personal (socio-demographic) correlates of PTG, these ranged from $r = -0.02$ to $r = 0.42$. The strongest correlate of PTG was being female. Within PTSD, the personal correlates ranged from $r = 0.03$ to $r = 0.23$. While being female was also the strongest correlate of PTSD, this correlation was almost 2-times weaker than it was for PTG.

Within the psychological correlates, weaker effects were found for PTG (ranged from $r = -0.16$ to $r = 0.34$) than for PTSD (ranged from $r = -0.62$ to $r = 0.61$). The strongest positive correlates of PTG were self-transcendence and cognitive avoidance, both of which were moderately strong. In PTSD, the strongest negative correlate within this group of variables was footing in the world while the strongest positive correlate was helplessness-hopelessness. Both of these were correlated with PTSD with a strong level of effect size. There were also moderate negative relationships with PTSD found in resilience and comprehensibility and moderate positive relationships with anxious preoccupation.

The biggest differences in the strength of the examined correlates of PTG and PTSD were found within the psychological variables. In particular, a higher level of PTSD was more strongly related to a higher level of helplessness-hopelessness, anxious preoccupation and a lower level of footing in the world, resilience and comprehensibility. On the other hand, higher PTG was more strongly associated with higher levels of self-transcendence, cognitive avoidance, fatalism and fighting spirit. Within this group of variables, the most significant differences in the level of directionality of the relationships with correlates were also found (Figure 1) (See the supplementary materials for correlations with their 95% confidence interval and Bayes factor (BF_{10})).

Figure 3 *Cancer-related, emotional, personal, and psychological correlates of posttraumatic growth and PTSD. (Note. categorical variables were coded as: gender - male = 0, female = 1; partnership - without partner = 0, with partner = 1; remission - in treatment = 0, in remission = 1; cancer relapse - without relapse = 0, with relapse = 1; metastasis - without metastasis = 0, with metastasis = 1).*

Discussion

The aim of this study was to determine the relationship between PTSD and PTG as well as the character of this relationship in terms of linearity. Furthermore, it aimed to find out how these two posttraumatic reactions differ in relation to selected personal (socio-demographic), cancer-related (clinical), emotional and psychological factors. A moderately strong positive relationship was found between PTSD and PTG although this was curvilinear rather than linear. In terms of the cancer-related correlates, the strongest correlate for PTG was cancer relapse. In other words, a higher level of PTG was seen in patients who had had a cancer relapse. For PTSD, the strongest correlate was the presence of metastases where there was a higher level of PTSD in patients who have cancer metastases. Within the socio-demographic variables, gender was found to be the strongest correlate. Both PTSD and PTG were higher in females although the relationship between being female and PTG was stronger than between being female and PTSD. All the variables within the emotional factors, except social isolation, showed stronger relationships with PTSD than PTG. The greatest differences in the relationships with PTSD and PTG, not only at the level of strength but also in the direction of the relationships, were found in the psychological variables. In particular, a higher level of helplessness-hopelessness and anxious preoccupation, and a lower level of footing in the world, resilience and comprehensibility were more strongly associated with a higher level of PTSD than with PTG. On the other hand, a higher level of PTG was more strongly associated with a higher level of self-transcendence, cognitive avoidance, fatalism and fighting spirit.

Previous studies examining the relationship between PTSD and PTG have differed in findings in terms of strength, direction and linearity of this relationship (Marziliano et al., 2020). Some studies have noted a positive link between PTSD and PTG (e.g., Dougal et al., 2017) while

others claim a negative relationship between them (e.g., Arpawong et al. 2013). The results of the current study indicate that the relationship between PTSD and PTG is moderately positive although this relationship is curvilinear rather than linear. This is also in line with the findings of other authors (e.g., Kleim & Ehlers, 2009; Shakespeare-Finch & Lurie-Beck, 2014) as well as the PTG theory (Tedeschi & Calhoun, 2004). According to the PTG theory, it is not only necessary to survive trauma but also to experience a certain level of distress that starts and facilitates the process of PTG. However, an overly high rate of PTSD is maladaptive and can block the process of PTG. In other words, an individual with too high a level of PTSD does not have the cognitive capacity to restructure e.g., core belief, which could form the basis for PTG. Therefore, the relationship between these constructs appears to be curvilinear rather than linear. As part of the interventions aimed at cancer survivors, it seems appropriate to screen the severity of PTSD as very severe levels can have a negative effect on the development of PTG. On the other hand, mild to moderate levels of PTSD seem to be an important factor in PTG. Thus, in the process of facilitating PTG in cancer patients, it is important to consider the extent and severity of posttraumatic symptoms.

It is not only the knowledge about the relationship between PTG and PTSD which is important to understand these posttraumatic reactions in cancer patients better, but also the knowledge about what their correlates are. Knowledge about which other factors correlate with PTSD and PTG is important in the process of applying appropriate subsequent interventions. As such, it could be possible to manage PTSD symptoms better and facilitate PTG at the same time. In this study, several cancer-related, personal, emotional and psychological correlates were examined. The aim was to look for which factors are significantly related to PTSD and/or PTG in patients with cancer. The most important group of correlates were psychological factors in terms

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of strength and direction of relationships. Psychological variables in cancer survivors have also been shown to be very important in the development of PTG (Casellas-Grau et al., 2017). In this study, variables that can be included in adaptive coping strategies such as fighting spirit, fatalism, and cognitive avoidance, were identified as strong correlates of PTG within the group of psychological factors. In addition to these coping strategies, self-transcendence and religiosity were also identified as important in the context of PTG. It is important to take into account that PTG is not a direct consequence of a traumatic event and is not present in all patients with cancer. The development of PTG is related to several factors. It has been found that the psychological variables related to adapting to a cancer-related situation play an important role in many aspects. Cancer patients who use adaptive coping strategies often communicate more about their condition, are more motivated to treat it and have a higher belief that they can overcome this situation (Silva et al., 2012). It is the positive psychological variables that strengthen the development of PTG. This is also reflected in the fact that a higher rate of rather maladaptive variables contributes to the development and maintenance of PTSD (Levine et al., 2005; Whitaker et al., 2008; De Padova et al., 2021) in patients with cancer. In this study, these were mainly higher levels of helplessness-hopelessness and anxious preoccupation and a lower level of footing in the world, resilience and comprehensibility.

Limitations

The study also has some limitations that reduce the generalizability of the findings. The design of the study was cross-sectional and thus it is not possible to clarify how the relationship between PTSD and PTG is in the context of time. Cancer-related posttraumatic reactions develop over time so using a longitudinal design could be useful. Measuring the same correlates of PTSD

and PTG at various points in time could also assess the stability of these relationships. Secondly, while the sample was heterogeneous from the point of view of the different cancer types leading to a reduction of selection bias, it could also lead to a decrease in internal validity. It is also necessary to take into account that other factors may play a role in the development of cancer-related posttraumatic reactions (other personality factors, other life events, perception of stress, etc.) which were not examined in this study. Finally, self-reported measures were used in the study and thus the responses could have been influenced by the patients' condition at the time of data collection.

Conclusion

The relationship between PTSD and posttraumatic growth seems to be more curvilinear than linear. For posttraumatic growth to be present, it is necessary for a level of posttraumatic stress symptoms to also be present. Very low or non-existent levels of PTSD symptoms as well as very high levels of PTSD symptoms are related to very low posttraumatic growth. PTSD and PTG were found to be related differently to different factors. PTSD was strongly related to psychological factors while PTG was strongly related to existential factors. Knowledge about the relationship between PTSD and PTG in addition to their shared and differentiating correlates can be helpful in preparing adaptive stress-growth balance interventions (Ochoa Arnedo et al., 2019).

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