

REVIEW ARTICLE

Positive and negative outcomes of childhood cancer: is there a connection between posttraumatic stress and growth in childhood cancer survivors?

Veronika Koutná^{1*}, Marek Blatný¹

Authors' Affiliation:

1 - Institute of Psychology of the Czech Academy of Sciences; E-mails: koutna@psu.cas.cz; blatny@psu.cas.cz

* Corresponding author

Abstract:

Traumatic experiences can produce both posttraumatic stress (PTS) and posttraumatic growth (PTG). The relationship of PTS and PTG is not clear and can take form of positive, negative, curvilinear (“inverted U” shape) and no association. Specific form of the relationship may be influenced by the trauma type and age. This study aims to review research of the relationship of PTS and PTG in a sample of childhood cancer survivors. Database search resulted in 11 studies meeting inclusion criteria. The results of studies included in this review are organized according to four mentioned options. Although all of these options were supported by some studies, the most convincing amount of evidence was found for the options of weakly positive and no relationship between PTS and PTG. This result points out the possibility of co-existence of PTS and PTG which has important clinical application particularly in potential need for psychosocial support also in those who are able to find positive aspects of their traumatic experience.

Key words: posttraumatic stress, posttraumatic growth, childhood cancer survivors

1. Introduction

The probability of 5-year survival in pediatric oncology exceeds 80% today¹ and the advances in treatment of childhood cancer which led to relatively high proportion of patients reaching a long-term remission changed the paradigm of pediatric oncology. Former predominance of palliative and symptomatic therapy shifted to curative therapy.² With growing population of childhood cancer survivors,

the quality of life after successful completion of treatment became increasingly important and in 2015, regular longitudinal follow-up of psychosocial adaptation of childhood cancer survivors has been established as one of the Standards of care in Pediatric Oncology.^{3,4}

Despite a group of approximately 25-30% childhood cancer survivors dealing with some form of difficulties for example in the field of academic achievement,

employment, social relationships or self-esteem⁵, the existing research of psychosocial adaptation of childhood cancer survivors does not show an increased level of psychopathology or poor quality of life.^{6,7} Furthermore, not only do childhood cancer survivors usually adapt to this situation quite well, the majority of adolescent survivors of childhood cancer report at least one positive consequence of this experience.⁸ However, only a minority of childhood cancer survivors perceive this experience solely as positive or negative. The majority of them perceive positive and negative consequences simultaneously.⁹

This study aims to review psychosocial adaptation in childhood cancer survivors in terms of mutual relationship of negative outcomes represented by posttraumatic stress (PTS) and positive outcomes represented by posttraumatic growth (PTG).

2. Childhood cancer as traumatic experience

Childhood cancer is considered to be a stressful experience for both, the child patient and his/her parents or whole family. The 4th Edition of Diagnostic and statistical manual (DSM)^a explicitly listed life-threatening illness among experiences possibly inducing posttraumatic stress disorder (PTSD) characterized mainly by symptoms of re-experiencing, avoidance and increased arousal.¹⁰ Based on the DSM-IV classification, many studies investigated posttraumatic stress symptoms or fully developed PTSD in childhood cancer patients or survivors (for review please see Bruce¹¹ and Taïeb et al.¹²). Although the

^a In the more recent 5th Edition of DSM⁵⁰, life-threatening illness is not necessarily considered a traumatic experience possibly inducing PTSD (Criterion A). To fulfil this criterion, the diagnosis or treatment of life-threatening illness needs to be connected to any other adverse circumstances related to illness.⁵¹

results of these studies vary, with the exception of some risk groups including mainly CNS tumour survivors and survivors undergoing cranial radiation or intrathecal therapy, female survivors and survivors in younger age at diagnosis, the overall prevalence of PTSD or other negative psychological outcomes in childhood cancer survivors is not reported to be higher than in control/comparison groups.^{e.g. 12,13}

Posttraumatic stress or other forms of poor psychosocial adaptation (e.g. higher levels of depressive symptomatology, poor emotional well-being) are not the only outcomes investigated by studies focused on psychosocial adaptation to childhood cancer as a traumatic event. An increasing number of studies is focused on positive psychological outcomes of this experience in terms of posttraumatic growth.¹⁴ There are several terms and theoretical approaches to positive changes in the aftermath of traumatic event. Some authors use them interchangeably, some make a clear distinction between them. Park¹⁵ defines three basic concepts of positive change as a result of traumatic situations: (1) *Posttraumatic growth*; persistent radical and real positive changes that occur rarely. (2) *Stress-related growth*; real, but less dramatic changes that may fade away over time, occurring quite frequently and reflected in most studies of this issue. (3) *Perceived but non-veridical growth*; reported positive changes that are not presented in reality; occurring quite often. In her point of view, *benefit finding* is part of all three described options and can be defined as the perception of positive changes as a result of traumatic event which may or may not be true.¹⁵ Detailed description of all theoretical concepts of PTG is beyond the scope of this article, for more information please see for example

the work of Zoellner & Maercker¹⁶ or Park¹⁵.

The mechanism of finding positive aspects of traumatic experience has been described by cognitive process called rumination which may take two forms: intrusive and deliberate.¹⁷ *Intrusive rumination* is represented by repetitive negative unintentional thoughts whereas *deliberate rumination* is characterized by intentional re-thinking of traumatic situation. These positive psychological outcomes in childhood cancer survivors and their parents are commonly reported in the domains of meaning-making, appreciation of life, self-awareness, family closeness, increased psychological maturity, greater compassion and empathy, new values and priorities, new strengths and increased recognition of vulnerability and struggle.^{18,19}

3. Relationship of posttraumatic stress (PTS) and posttraumatic growth (PTG)

The relationship of PTS and PTG is intriguing but still unsolved research question. In the view of Tedeschi & Calhoun¹⁴, prominent authors in the field of PTG theory and research, PTS and PTG do not represent the opposite ends of the same continuum, which means that increase in one does not lead to decrease in the other. They describe PTS and PTG as two separate but related dimensions. Experiencing PTS may be a catalyst for the experience of PTG. The traumatic event usually disrupts the one's assumptions and worldview and this disruption may provide an opportunity for transformation leading to PTG.

Based on actual research, there are four different options of the specific type of relationship between PTS and PTG: positive, negative, curvilinear ("inverted U" shape) and no relationship.²⁰ According to the first option, PTG can be experienced

only in the presence of PTS, because distress is a necessary trigger of cognitive processing leading to growth. If the situation is not perceived as traumatic, PTG does not occur. The relationship of PTS and PTG is therefore positive.¹⁴ An opposite point of view perceives PTS as interfering with PTG and their relationship describes as negative.^{e.g. 21} The next option takes into consideration also a possibility of non-linear relationship and states that the relationship of PTS and PTG is curvilinear. In this option, the highest level of PTG occurs at middle level of PTS. This option assumes that certain level of PTS is necessary for PTG to occur, but above this level, PTS prevents PTG.^{20,22} This "cut-off point" where PTG begins to decline appears to be around the level of PTS indicating full PTSD diagnosis.²³ The last option considers PTS and PTG to be independent of each other.²⁴

This ambiguity in the relationship of PTS and PTG may be associated with the time lapse between the traumatic event and assessment and with the heterogeneity of measures used to assess both variables.²⁵ Both PTS and PTG may be assessed by several methods or measures. PTS can be assessed for example by self-report measures such as Impact of Event Scale or structured clinical interview. Different nature of methods based on questionnaires and interviews complicates the comparison of results obtained by these two approaches. Similarly, there are several possibilities for assessing PTG. There are questionnaires assessing only positive changes in the aftermath of trauma (e.g. Posttraumatic Growth Inventory or Benefit Finding Scale) and questionnaires assessing positive and negative changes simultaneously (e.g. Benefit and Burden Scale). These self-report measures of PTG face considerable critique questioning their validity.^{25,26} Research of PTS and PTG in childhood

trauma is further complicated by the use of parent-proxy reports which may be different from reports by children themselves. The relationship of PTS and PTG may also depend on the time of assessment. PTG reported after longer time interval from traumatic event may be more connected to the overall psychosocial adaptation.²⁸ Park²⁵ assumes that the relationship of PTG and the overall adaptation may be moderated by personality characteristics, available psychosocial resources, degree of perceived burden related to trauma and specific type of traumatic event. Calhoun & Tedeschi²⁹ further suggest that the relationship of these two variables may depend on their definition and operationalization and although this idea was noted more than 10 years ago, it still applies.

Up today, there is only one available meta-analysis devoted directly to the relationship of posttraumatic stress and growth. This meta-analysis by Shakespeare-Finch & Lurie-Beck³⁰ included 42 studies (N=11469) and examined the relationship of PTS and PTG in various traumatic experiences and various age groups. The results of this meta-analysis showed statistically significant linear relationship and even stronger curvilinear relationship. Nevertheless, this relationship seemed to be influenced by age and by the specific type of traumatic situation. The relationship of PTS and PTG was stronger for children than for adults and in the case of trauma represented by serious illness, the relationship was found to be weak or non-existent.

Besides this meta-analysis, there are also several other more general meta-analysis or review studies of various connections of PTS and PTG in different samples. The meta-analysis by Shand et al.³¹ was devoted to correlates PTS and PTG in adult cancer patients in general and 5 of included studies

examined also the mutual relationship of PTS and PTG. This study resulted in a weak positive relationship of PTS and PTG. The systematic review of PTG in people living with a serious medical condition by Barskova & Oesterreich³² identified seven studies assessing the relationship of PTS and PTG and concluded that most studies demonstrated a positive relationship. The systematic review of PTG in children and adolescents by Meyerson et al.³³ came to the same conclusion. Helgeson et al.²⁸ in their meta-analytic review of benefit finding and growth in survivors of life-threatening illness in adulthood found positive relationship between benefit finding and avoidant and intrusive thoughts about the illness.

4. Current study

It has already been noted above that the relationship of PTS and PTG may be influenced by age and/or the type of traumatic event, but none of currently available meta-analyses and review studies were focused on the relationship of PTS and PTG in the specific context of childhood cancer. Therefore, the aim of this study is to review research of PTS and PTG in childhood cancer survivors and classify the results with regards to four mentioned options of the relationship between PTS and PTG (positive, negative, curvilinear and no relationship).

Studies included in this review were selected upon the search of EBSCO and ScienceDirect databases using the terms “posttraumatic stress”, “posttraumatic growth”, “benefit finding”, “childhood cancer survivors” and “pediatric cancer”. In order to be included in this review, studies had to meet following criteria: (1) research sample consists of childhood cancer survivors or cancer patients diagnosed as children or adolescents; (2) methods includes standard measure of PTS and PTG

and assess their mutual relationship; (3) article was published in English. The literature lists of studies resulted from this search were scanned in order to identify other relevant studies.

5. Results

A total of 11 studies published between 2006 and 2017 met inclusion criteria and details along with results of these studies are presented in Table I. All of the studies included in this review assessed sample comprising of patients/survivors of wide range of childhood malignancies and none of them were focused only on some specific subgroup of diagnoses. In the study by Zebrack et al.³⁴ about the half of sample (51.5%) and in the study by Phipps et al.³⁵ about one third of the sample (36%) comprised of adolescents and young adults in active treatment, other studies included only childhood cancer survivors currently off-treatment. Some studies included childhood cancer patients/survivors with actual age (age at the time of assessment) ranging only up to adolescence or young adulthood^{8,35-40}, other included also older survivors^{21,24,34,41} but all studies are focused on patients/survivors diagnosed with cancer in childhood. The sample sizes ranged from 61³⁷ to 6162²⁴ childhood cancer survivors and with the exception of the study by Wilson et al.³⁷, samples of all studies were almost balanced with regard to percentage of boys and girls (males and females in adult samples). University of California Posttraumatic Stress Index for DSM-IV⁴², Posttraumatic Stress Diagnostic Scale⁴³, Posttraumatic Growth Inventory²² and Benefit Finding Scale for Children^{35,44} were the most widely used measures of PTS and PTG.

Results regarding the review of the relationship of PTS and PTG are organized according to four different options described above.

5.1. Positive relationship

The option of positive relationship which supposes that the presence of PTS is necessary for occurrence of PTG was supported by 4 studies. Barakat et al.⁸ found significant positive correlation of PTS and PTG. Furthermore, in the regression analysis predicting PTG, PTS was also significantly positively associated with PTG over and above age at diagnosis, perceptions of life threat and treatment intensity. In the study by Arpawong et al.³⁶ univariate analysis resulted in negative correlation of PTS and PTG, but multivariate regression analysis revealed also positive relationship of PTS and PTG. Wilson et al.³⁷ found significant positive correlation for PTG and overall PTS as well as individual clusters of intrusiveness, arousal and avoiding with the strongest relationship between PTG and intrusiveness. Significant associations of PTG and overall PTS and re-experiencing symptoms were found also in the study of Tremolada et al.³⁹, but after adjustments for multiple comparisons, only the relationship with re-experiencing remained significant. Klosky et al.²⁴ found also weak positive correlation of PTS and PTG, but according to the authors of this study, its significance is caused only by the very large sample size. Despite this correlation, Klosky et al. concluded that PTG and PTS might be considered to be independent.

5.2. Negative relationship

The option of negative relationship of PTG and PTS claims that PTS collide with the ability to find positive aspects of traumatic experience. The evidence of negative relationship was found in the study by Yi & Kim²¹, where elevated symptoms of posttraumatic stress led to lower levels of PTG. The only other support of negative relationship in studies included in this review was found in correlation analysis by

Arpawong et al.³⁶. However, multivariate regression analysis performed in the same study did not confirm this relationship.

5.3. Curvilinear relationship

The assumption of optimal level of PTS for occurrence of PTG was partially supported only by the results of Zebrack et al.³⁴, who found curvilinear relationship between specific domains of PTG and re-experiencing symptoms of PTS. Overall PTS was not associated to overall PTG.

5.4. No relationship

Independent nature of the relationship between PTS and PTG was described by 5 studies included in this review. Phipps et al.³⁵ found no correlation of PTG and overall PTS and its' symptoms scales. Overall PTS was unrelated to overall PTG also in the study by Zebrack et al.³⁴ Gunst et al.⁴¹ found no association of current PTS and current PTG, but positive association of current PTG with peri-trauma distress (conceptualized by retrospectively perceived amount of fear of death during treatment). The study by Tillery et al.³⁸ included childhood cancer survivors and healthy comparisons and the measures of PTS and PTG were referenced to self-identified most stressful life experience. When considering only the "childhood cancer survivors reporting about cancer-related traumatic event" part of the sample, the results of this study showed no association of PTS and PTG. Koutná et al.⁴⁰ reported also the non-significant correlation of PTS and PTG. Furthermore, despite the overall weak positive relationship of PTS and PTG, Klosky et al.²⁴ in the study with exceptionally large sample size (6162 childhood cancer survivors) suggested PTS and PTG to be independent²⁴, too.

6. Discussion

Following from the meta-analysis by Shakespeare-Finch & Lurie-Beck³⁰ the aim of this study was to review available literature concerning the relationship of posttraumatic stress and growth in a specific population of childhood cancer survivors. Database and literature lists search yielded 11 studies meeting inclusion criteria. Nine of these studies were published in the last 5 years indicating growing interest in this topic. Results of these studies were classified in concordance with four options describing the nature of PTS and PTG relationship: positive, negative, curvilinear and no relationship.

The options of negative and curvilinear relationship of PTS and PTG had not been convincingly supported by studies focused on childhood cancer patients or survivors. Although there are some studies indicating this forms of relationship for overall PTS and PTG or some of their aspects, based on the results of this review, it seems unlikely that the relationship of PTS and PTG could be described as negative or curvilinear. However, it should be noted that only some of included studies explicitly tested the option of curvilinear relationship. Some studies (e.g. Koutná et al.⁴⁰) analysed only linear forms of associations a couldn't rule out the curvilinear option.

The most convincing amount of evidence was found for the option of positive and no relationship. Positive relationship of PTS and PTG was supported by 4 studies and the study by Wilson et al.³⁷ found significant positive correlation for both PTG and overall level of PTS as well as PTG and all three PTS symptom clusters/subscales. Zebrack et al.³⁴ also reported significant relationship of PTG and re-experiencing symptoms while not with other symptoms of PTS. The symptoms of re-experiencing and intrusiveness may

reflect the process of rumination described by Tedeschi & Calhoun¹⁴ as a mechanism of cognitive processing potentially leading to PTG.

Calhoun et al.⁴⁵ found event-related rumination soon after traumatic experience to be positively associated with the level of perceived PTG. In conclusion, they offered a distinction between negative self-focused rumination producing negative psychosocial outcomes and neutral or constructive rumination leading to posttraumatic growth. It seems plausible, that repetitive thinking about traumatic experience and meaning making may be part of both, re-experiencing and rumination, and therefore it may be also associated to PTS and PTG. However, in this point, the time elapsed since traumatic experience may take a turn. Wilson et al.³⁷ included survivors in the mean time off-therapy 1.37 years and Zebrack et al.³⁴ included about the half of sample in active treatment. But there may be distinct outcomes of intrusive and deliberate rumination soon after traumatic experience and in a recent period of time. Taku et al.⁴⁶ in the study of rumination, distress and PTG in a sample of bereaved university students found that recent intrusive rumination leads to distress whereas deliberate rumination soon after traumatic event leads to PTG with coexistence of overall distress and PTG.

When considering the influence of time elapsed since the traumatic experience in cancer setting, there are other factors that needs to be taken into account. As noted for example by Sumalla et al.⁴⁷, in the context of cancer, it is complicated to identify what exactly represents the traumatic event and consequently it is also complicated to clearly define the onset and termination of this event. The trauma in cancer setting may be represented by the diagnosis itself, treatment procedures, fundamental changes

in previous way of life, fear of cancer recurrence etc. Therefore, time since the end of treatment which is commonly reported in studies doesn't have to represent relevant time frame for considering the influence of cognitive processing in terms of "soon after" and "recent".

Time elapsed since the traumatic experience raises also the question of course or trajectory of PTS and PTG in time. Although there is some evidence of decrease in PTS with time⁴⁸, systematic reviews of PTS in childhood cancer survivors^{11,12} concluded that cancer-related PTS are not connected to the time off-treatment. Given the overall good psychosocial adaptation of childhood cancer survivors reported in several studies^{e.g. 12,13} and levels of PTS comparable to controls except for some risk groups¹², time off-treatment may be correlate/predictor only in those survivors initially high in PTS and unrelated in those with generally low levels of PTS. With regard to trajectory of PTG, the results are far from conclusive, but there are also some indications of decrease with increasing amount of time since the end of treatment.^{e.g. 6,37} Supposing PTS and PTG are not stable in time, the relationship of PTS and PTG may depend on the specific timing of assessment.

The option of no relationship was directly supported by 5 studies and also by the conclusion of study by Klosky et al.²⁴, who found statistically significant positive relationship, but not the robust one and stated that PTS and PTG might be considered largely independent. The authors of this study with large sample size also mentioned an important notion about the influence of the sample size. *"If the true relationship between PTG and PTS in the cancer survivor population is weakly positive, smaller sample studies that vary around this are likely to vary between near*

zero and moderately positive.”^{24(p.882)}
Sample sizes of other studies included in this review range from 61 to 784 with the majority of studies reporting samples around one and two hundreds.

This review cannot offer conclusive answer to the question of the relationship of PTS and PTG in childhood cancer survivors, but upon its results, the independence or weak positive relation of PTS and PTG seems to be the most probable option. This conclusion is in line with the results of meta-analysis of Shakespeare-Finch & Lurie-Beck³⁰ who found non-existent or only weak positive relationship of PTS and PTG in traumatic experience represented by serious illness. Both options, independence or weak positive relationship of PTS and PTG in childhood cancer survivors, have important practical implications. These results mean that even the survivors who are able to find positive aspects of their cancer experience may suffer from distress and therefore they may need or benefit from psychological support. The other way round, the results also mean that the survivors suffering from distress may be able to perceive positive aspects simultaneously.

The results of this review may be confounded by several limitations. The search criteria for identifying relevant articles were based upon the term “childhood cancer survivor”, which is quite broad age category. It can include respondents in the mean age around 14 as well as 30. In fact, the age range in the study by Klosky et al.²⁴ reached up to 53 years. It is obvious that this heterogeneity in age composition might affect the results.

Shakespeare-Finch & Lurie-Beck³⁰ suggested stronger relationship of PTS and PTG in children than in adults, but wide age ranges in studies included in this review complicate this comparison. With growing number of relevant studies, future attempts to review and clarify the relationship of PTS and PTG in childhood cancer survivors should try to restrict the age range for example by dividing the broad term “childhood cancer survivors” into meaningful age groups. Similarly, this review includes also two studies with part of the sample being still in the phase of active treatment. It is in line with the concept of cancer survivorship defined as living with, through, and beyond a cancer diagnosis⁴⁹ but with regard to PTS and PTG, timing of assessment early after diagnosis, during active treatment or several months/years off-treatment may represent fundamental distinction. Furthermore, in the studies concerning only survivors off-treatment, there is also relatively wide range in time lapse after the treatment completion. Given the theoretical notions about the influence of timing in the development and course of PTS and PTG described above, these factors could also confound the results.

Conflicts of interest: The authors declare no conflict of interest.

Acknowledgments: This work was supported by the Czech Republic’s support for long-term strategic development of research organization (RVO: 68081740).

Table 1: Review of studies assessing the relationship of PTS and PTG in childhood cancer survivors

Study	Sample	Measures	Analysis	Results
Barakat et al. (2006) ⁸	150 CCS 52% females actual age: m=14.7 years (SD=2.4, range 11-19.3 years) time off-treatment: m=5.3 years (SD=2.9)	Perceptions of Changes in Self scale from the Impact of Traumatic Stressors Interview Schedule Impact of Events Scale- Revised	correlation regression analysis	PTG and PTS positively correlated for survivors r=0.35 p<0 .005 PTS significantly associated with PTG over and above age at diagnosis and illness-specific appraisals (β=0.25, p<0.005).
Phipps, Long, Ogden (2007) ³⁵	199 CCS 48% females actual age: m=12.35 years (SD=3.4, range: 7-18) 36% in active treatment 64% off-therapy 53% off therapy > 5 years	UCLA_PTSD BFSC	correlation	No relation was found between benefit finding and PTS (r=-0.00)
Arpawong et al. (2013) ³⁶	94 CCS 48% females actual age: m=14.8 years (SD=2.74, range 11-21) within 6 months of completing cancer therapy	UCLA_PTSD modified version of PTGI	correlation regression analysis	Univariate analysis: negative relationship of PTG and PTS (r=-0.23, p=0.03) Multivariate analysis: PTG was positively associated with PTS (T=2.48; p<0.05)
Klosky et al. (2014) ²⁴	6162 CCS 52% females actual age: m=31.6 years (SD=7.6, range 18-53) time off-treatment: not provided time since dg: m=23.1 years (SD=4.5)	PSDS PTGI	correlation	Statistically significant positive correlation (r=0.11 p<0.001), but results do not indicate robust relationship of PTS and PTG

Yi & Kim (2014) ²¹	225 CCS 41.5% females actual age: m=21.95 years (SD=4.76, range 15-38) 14.5% recurrence time off-treatment: not provided time since dg.: m=12.03 years (SD=5.94, range 2-29)	PSDS PTGI	correlation regression analysis	Linear effect of PTS on PTG, negative relationship (r=-0.14, p<0.05): greater levels of PDS were related to lower levels of PTGI no evidence of curvilinear relationship
Zebrack et al. (2015) ³⁴	165 cancer patients diagnosed as adolescents and young adults 46.1% females actual age: m=22.8 years (SD=8.8, range 13-39 years) 51.5% in treatment 48.5% off-treatment	PSDS PTGI	regression analysis	no significant linear or non-linear relationship of overall PTS and PTG; curvilinear relationship of re-experiencing and personal growth and new possibilities dimensions of PTG: both increased significantly with higher levels of re-experiencing, but only up to a specific point. Predicting "new possibilities" by re-experiencing: linear term: $\beta=0.47$; p=0.04 quadratic term: $\beta=-0.10$; p=0.008 Predicting "personal strength" by re-experiencing: linear term: $\beta=0.46$; p=0.007 quadratic term: $\beta=-0.08$; p=0.005
Gunst et al. (2016) ⁴¹	784 adolescent cancer survivors 51.5% females actual age: m=30.42 years (SD=6.07) time off-treatment: m=13.67 (SD=6.02)	PSDS PTGI	correlation	no association of PTG and current PTS, but current PTG significantly positively associated to the retrospectively perceived amount of fear of death during treatment (distress during treatment). r=0.02; non-significant
Wilson et al. (2016) ³⁷	61 CCS 36.1% females actual age: m=11.59 years (SD=3.38, range 7-18) time off-therapy: m=1.73 (SD=1.47, range 2 weeks-5 years)	Children's Revised Impact of Event Scale Benefit and Burden Scale for Children	correlation regression analysis	positive relationship of PTS and PTG Correlation of PTG and: overall PTS: r=0.40, p<0.01 intrusiveness: r=0.40, p<0.001 avoidance: r=0.28, p<0.05 arousal: r=0.31, p<0.05

Tillery et al. (2016) ³⁸	253 CCS reporting about cancer or non-cancer related event upon their own choice 48.6% females actual age: m=12.61 years (SD=2.88, range 8-17) time off-treatment: not provided 182 healthy comparisons	UCLA_PTSD Benefit Finding/Burden Scale for Children	correlation	Entire sample: positive association (r=0.17, p<0.001) Youth with cancer reporting on cancer: non-significant association (r=0.15, p=0.08) Youth with cancer reporting a non-cancer event: positive association (r=0.26, p<0.01) Healthy comparisons: positive association (r=0.20, p<0.01). PTS and PTG appear to be relatively independent constructs, and their relation is dependent on contextual factors.
Tremolada et al. (2016) ³⁹	223 adolescents and young adults cancer survivors 44.8% females actual age: m= 19.33 years (SD=3.01, range: 15–25) time off-therapy: m=9.64 years (SD = 4.17, range: 5–24)	The Post-traumatic Stress Disorder Symptom Check-List The Personal Growth Inventory	correlation	Positive associations between PTG and overall PTS (r = 0.15; p = 0.02) and between PTG and re-experiencing (r = 0.24; p = 0.0001). No significant association between PTG and Avoidance and Hyper-arousal symptoms criteria. After adjustments for multiple comparisons (significant only p≤0.01), significant only the association between PTG and the Re-experience of PTS.
Koutná et al. (2017) ⁴⁰	120 CCS 50.8% females actual age: 11-25 years time off-treatment: m=7.7 years (range 4-12.5)	UCLA_PTSD BFSC	correlation	No significant association between PTG and PTS r=0.05; non-significant

Note: CCS=childhood cancer survivors; UCLA_PTSD= University of California Posttraumatic Stress Index for DSM-IV; PSDS= Posttraumatic Stress Diagnostic Scale; PTGI= Posttraumatic Growth Inventory; BFSC= Benefit Finding Scale for Children

7. References

1. Howlader N, Noone AM, Krapcho M, Garshell J, Miller D, Altekruse SF, Kosary CL, Yu M, Ruhl J, Tatalovich Z, Mariotto A, Lewis DR, Chen HS, Feuer EJ CK (eds). Childhood cancer by site: Incidence, Survival and Mortality. In: *SEER Cancer Statistics Review 1975-2012*. Bethesda, MD: National Cancer Institute; 2012. https://seer.cancer.gov/archive/csr/1975_2012/results_merged/sect_28_childhood_cancer.pdf. Accessed October 10, 2017.
2. Oeffinger KC, Robison LL. Childhood Cancer Survivors, Late Effects, and a New Model for Understanding Survivorship. *JAMA*. 2007;297(24):2762-2764. doi:10.1001/jama.297.24.2762.
3. Lown EA, Phillips F, Schwartz LA, Rosenberg AR, Jones B. Psychosocial Follow-Up in Survivorship as a Standard of Care in Pediatric Oncology. *Pediatr Blood Cancer*. 2015;62(S5):S514-S584. doi:10.1002/pbc.25783.
4. Wiener L, Kazak AE, Noll RB, Patenaude AF, Kupst MJ. Standards for the Psychosocial Care of Children With Cancer and Their Families: An Introduction to the Special Issue. *Pediatr Blood Cancer*. 2015;62(S5):S419-S424. doi:10.1002/pbc.25675.
5. Patenaude AF, Kupst MJ. Psychosocial Functioning in Pediatric Cancer. *J Pediatr Psychol*. 2005;30(1):9-27. doi:10.1093/jpepsy/jsi012.
6. Eiser C, Hill JJ, Vance YH. Examining the psychological consequences of surviving childhood cancer: systematic review as a research method in pediatric psychology. *J Pediatr Psychol*. 2000;25(6):449-460. doi:10.1093/jpepsy/25.6.449.
7. Blatný M, Kepák T, Vlčková I, et al. Quality of Life of Childhood Cancer Survivors: Handicaps and Benefits. *Československá psychologie*. 2011;55(2):112-125.
8. Barakat LP, Alderfer MA, Kazak AE. Posttraumatic Growth in Adolescent Survivors of Cancer and Their Mothers and Fathers. *J Pediatr Psychol*. 2006;31(4):413-419. doi:10.1093/jpepsy/jsj058.
9. Lehmann V, Gronqvist H, Engvall G, et al. Negative and positive consequences of adolescent cancer 10 years after diagnosis: An interview-based longitudinal study in Sweden. *Psychooncology*. 2014;23(11):1229-1235. doi:10.1002/pon.3549.
10. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*. Washington, D.C.: American Psychiatric Association; 1994.
11. Bruce M. A systematic and conceptual review of posttraumatic stress in childhood cancer survivors and their parents. *Clin Psychol Rev*. 2006;26(3):233-256. doi:10.1016/j.cpr.2005.10.002.
12. Taïeb O, Moro MR, Baubet T, Revah-Lévy A, Flament MF. Posttraumatic stress symptoms after childhood cancer. *Eur Child Adolesc Psychiatry*. 2003;12(6):255-264. doi:10.1007/s00787-003-0352-0.
13. Noll RB, Kupst MJ. Commentary: The

- psychological impact of pediatric cancer hardiness, the exception or the rule? *J Pediatr Psychol*. 2007;32(9):1089-1098. doi:10.1093/jpepsy/jsm049.
14. Tedeschi RG, Calhoun LG. "Posttraumatic Growth: Conceptual Foundations and Empirical Evidence." *Psychol Inq*. 2004;15(1):1-18. doi:10.1207/s15327965pli1501_01.
 15. Park CL. Overview of theoretical perspectives. In: *Medical Illness and Positive Life Change: Can Crisis Lead to Personal Transformation?*. Washington: American Psychological Association; 2009:11-30. doi:10.1037/11854-001.
 16. Zoellner T, Maercker A. Posttraumatic growth in clinical psychology - A critical review and introduction of a two component model. *Clin Psychol Rev*. 2006;26(5):626-653. doi:10.1016/j.cpr.2006.01.008.
 17. Calhoun LG, Tedeschi RG. The Foundations of Posttraumatic Growth: An Expanded Framework. In: *Handbook of Posttraumatic Growth: Research & Practice*. Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers; 2006:3-23.
 18. Duran B. Posttraumatic Growth as Experienced by Childhood Cancer Survivors and Their Families. *J Pediatr Oncol Nurs*. 2013;30(4):179-197. doi:10.1177/1043454213487433.
 19. Parry C, Chesler MA. Thematic Evidence of Psychosocial Thriving in Childhood Cancer Survivors. *Qual Health Res*. 2005;15(8):1055-1073. doi:10.1177/1049732305277860.
 20. Levine SZ, Laufer A, Hamama-Raz Y, Stein E, Solomon Z. Posttraumatic growth in adolescence: Examining its components and relationship with PTSD. *J Trauma Stress*. 2008;21(5):492-496. doi:10.1002/jts.20361.
 21. Yi J, Kim MA. Postcancer Experiences of Childhood Cancer Survivors: How Is Posttraumatic Stress Related to Posttraumatic Growth? *J Trauma Stress*. 2014;27(4):461-467. doi:10.1002/jts.21941.
 22. Tedeschi RG, Calhoun LG. The Posttraumatic Growth Inventory: Measuring the positive legacy of trauma. *J Trauma Stress*. 1996;9(3):455-471. doi:10.1007/BF02103658.
 23. Butler LD, Blasey CM, Garlan RW, et al. Posttraumatic Growth Following the Terrorist Attacks of September 11, 2001: Cognitive, Coping, and Trauma Symptom Predictors in an Internet Convenience Sample. *Traumatology*. 2005;11(4):247-267. doi:10.1177/153476560501100405.
 24. Klosky JL, Krull KR, Kawashima T, et al. Relations between posttraumatic stress and posttraumatic growth in long-term survivors of childhood cancer: A report from the Childhood Cancer Survivor Study. *Health Psychol*. 2014;33(8):878-882. doi:10.1037/hea0000076.
 25. Park CL. The notion of growth following stressful life experiences Problems and prospects. *Psychol Inq*. 2004;15(1):69-76.
 26. Coyne JC, Tennen H. Positive Psychology in Cancer Care: Bad Science, Exaggerated Claims, and Unproven Medicine. *Ann Behav Med*. 2010;39(1):16-26. doi:10.1007/s12160-009-9154-z.
 27. Tennen H, Affleck G. Assessing

- positive life change: In search of meticulous methods. In: *Medical Illness and Positive Life Change: Can Crisis Lead to Personal Transformation?*. Washington, DC, US: American Psychological Association; 2009:31-49. doi:10.1037/11854-002.
28. Helgeson VS, Reynolds KA, Tomich PL. A meta-analytic review of benefit finding and growth. *J Consult Clin Psychol.* 2006;74(5):797-816. doi:10.1037/0022-006X.74.5.797.
 29. Tedeschi RG, Calhoun LG. The foundations of posttraumatic growth: New considerations. *Psychol Inq.* 2004;15(1):1-18.
 30. Shakespeare-Finch J, Lurie-Beck J. A meta-analytic clarification of the relationship between posttraumatic growth and symptoms of posttraumatic distress disorder. *J Anxiety Disord.* 2014;28(2):223-229. doi:10.1016/j.janxdis.2013.10.005.
 31. Shand LK, Cowlshaw S, Brooker JE, Burney S, Ricciardelli LA. Correlates of post-traumatic stress symptoms and growth in cancer patients: a systematic review and meta-analysis. *Psychooncology.* 2015;24(6):624-634. doi:10.1002/pon.3719.
 32. Barskova T, Oesterreich R. Post-traumatic growth in people living with a serious medical condition and its relations to physical and mental health: A systematic review. *Disabil Rehabil.* 2009;31(21):1709-1733. doi:10.1080/09638280902738441.
 33. Meyerson DA, Grant KE, Carter JS, Kilmer RP. Posttraumatic growth among children and adolescents: A systematic review. *Clin Psychol Rev.* 2011;31(6):949-964. doi:10.1016/j.cpr.2011.06.003.
 34. Zebrack B, Kwak M, Salsman J, et al. The relationship between posttraumatic stress and posttraumatic growth among adolescent and young adult (AYA) cancer patients. *Psychooncology.* 2015;24(2):162-168. doi:10.1002/pon.3585.
 35. Phipps S, Long AM, Ogden J. Benefit Finding Scale for Children: preliminary findings from a childhood cancer population. *J Pediatr Psychol.* 2007;32(10):1264-1271. doi:10.1093/jpepsy/jsl052.
 36. Arpawong TE, Oland A, Milam JE, Ruccione K, Meeske KA. Post-traumatic growth among an ethnically diverse sample of adolescent and young adult cancer survivors. *Psychooncology.* 2013;22(10): 2235-44. doi:10.1002/pon.3286.
 37. Wilson JZ, Marin D, Maxwell K, et al. Association of Posttraumatic Growth and Illness-Related Burden With Psychosocial Factors of Patient, Family, and Provider in Pediatric Cancer Survivors. *J Trauma Stress.* 2016;29(5):448-456. doi:10.1002/jts.22123.
 38. Tillery R, Howard Sharp KM, Okado Y, Long A, Phipps S. Profiles of Resilience and Growth in Youth with Cancer and Healthy Comparisons. *J Pediatr Psychol.* 2016;41(3):290-297. doi:10.1093/jpepsy/jsv091.
 39. Tremolada M, Bonichini S, Basso G, Pillon M. Post-traumatic Stress Symptoms and Post-traumatic Growth in 223 Childhood Cancer Survivors: Predictive Risk Factors. *Front Psychol.* 2016;7:1-12. doi:10.3389/fpsyg.2016.00287.
 40. Koutná V, Jelínek M, Blatný M, Kepák T. Predictors of Posttraumatic Stress and

- Posttraumatic Growth in Childhood Cancer Survivors. *Cancers*. 2017;9(3):26. doi:10.3390/cancers9030026.
41. Gunst DCM, Kaatsch P, Goldbeck L. Seeing the good in the bad: which factors are associated with posttraumatic growth in long-term survivors of adolescent cancer? *Support Care Cancer*. 2016;24(11):4607-4615. doi:10.1007/s00520-016-3303-2.
42. Steinberg AM, Brymer MJ, Decker KB, Pynoos RS. The University of California at Los Angeles post-traumatic stress disorder reaction index. *Curr Psychiatry Rep*. 2004;6(2):96-100. doi:10.1007/s11920-004-0048-2.
43. Foa EB, Cashman L, Jaycox L, Perry K. The validation of a self-report measure of posttraumatic stress disorder: The Posttraumatic Diagnostic Scale. *Psychol Assess*. 1997;9(4):445-451. doi:10.1037/1040-3590.9.4.445.
44. Michel G, Taylor N, Absolom K, Eiser C. Benefit finding in survivors of childhood cancer and their parents: Further empirical support for the Benefit Finding Scale for Children. *Child Care Health Dev*. 2010;36(1):123-129. doi:10.1111/j.1365-2214.2009.01034.x.
45. Calhoun LG, Cann A, Tedeschi RG, McMillan J. A correlational test of the relationship between posttraumatic growth, religion, and cognitive processing. *J Trauma Stress*. 2000;13(3):521-527. doi:10.1023/A:1007745627077.
46. Taku K, Calhoun LG, Cann A, Tedeschi RG. The Role of Rumination in the Coexistence of Distress and Posttraumatic Growth Among Bereaved Japanese University Students. *Death Stud*. 2008;32(5):428-444. doi:10.1080/07481180801974745.
47. Sumalla EC, Ochoa C, Blanco I. Posttraumatic growth in cancer: Reality or illusion? *Clin Psychol Rev*. 2009;29(1):24-33. doi:10.1016/j.cpr.2008.09.006.
48. Stuber ML, Kazak AE, Meeske K, et al. Predictors of posttraumatic stress symptoms in childhood cancer survivors. *Pediatrics*. 1997;100(6):958-964.
49. National Coalition for Cancer Survivorship. Defining Cancer Survivorship. <http://www.canceradvocacy.org/news/defining-cancer-survivorship/>. Published 2014. Accessed November 10, 2017.
50. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*. Arlington, VA: American Psychiatric Association; 2013.
51. Kangas M. DSM-5 Trauma and Stress-Related Disorders: Implications for Screening for Cancer-Related Stress. *Front Psychiatry*. 2013;4(OCT):2-4. doi:10.3389/fpsy.2013.00122.