Received: 1 February 2017 | Revised: 21 September 2017 | Accepted: 23 October 2017

DOI: 10.1002/pon.4577

WILEY

REVIEW

Correlates of post-traumatic growth following childhood and adolescent cancer: A systematic review and meta-analysis

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Abstract

Objective: A growing number of children and adolescents are experiencing and surviving cancer. This review aims to identify the demographic, medical, and psychosocial correlates of perceived post-traumatic growth in individuals of any age who were affected by paediatric cancer. Findings will highlight protective factors that may facilitate post-traumatic growth, allowing for directed social support, intervention, and follow-up care.

Methods: A systematic search based on the key concepts "post-traumatic growth," "neoplasms," and "paediatric" retrieved 905 records from online databases: Embase, Ovid MEDLINE, PILOTS: Published International Literature on Traumatic Stress, PsycINFO, and Web of Science. Eligible studies were appraised as excellent quality with a high level of interrater reliability. The results of 18 studies were synthesised.

Results: After the removal of outliers, post-traumatic growth shared small, negative associations with time since diagnosis (r = −0.14) and time since treatment completion (r = −0.19), and small, positive associations with age at diagnosis (r = 0.20), age at survey (r = 0.17), post-traumatic stress symptoms (r = 0.11), and social support (r = 0.25). Post-traumatic growth was positively and moderately associated with optimism (r = 0.31).

Conclusions: Several findings were consistent with a comparable meta-analysis in adult oncology populations. Targeted social support, clinical intervention, and education may facilitate post-traumatic growth. Longitudinal research in individuals affected by childhood and adolescent cancer would allow an examination of the effects of predictive variables on post-traumatic growth over time.

KEYWORDS

adolescents, benefit finding, cancer, children, oncology, post-traumatic growth

1 | BACKGROUND

Every year, approximately 160 000 children and adolescents worldwide are diagnosed with cancer.[1] The incidence of paediatric cancer is increasing in industrialised nations. Coupled with greater rates of survival, there is a growing population of people who have experienced paediatric cancer.[1] As a result, there is an increased need for follow-up care as individuals transition from diagnosis to treatment and recovery.[1] The diagnosis of paediatric cancer, associated morbidity, and impact of treatment can lead to a range of psychosocial consequences, and may lead to the development of post-traumatic stress disorder.[1-4] Notwithstanding this, a number of studies have suggested that children and adolescents affected by cancer are no more likely to develop post-traumatic stress symptoms (PTSS) than are healthy peers.[5-7] In fact, several studies have found that compared with normative samples, children affected by cancer experience greater adjustment and quality of life, and lower anxiety and PTSS.[8-10]

Indeed, a growing body of research[11-13] is dedicated to the observation that some childhood cancer survivors experience perceived post-traumatic growth (PTG): positive psychological change resulting from the struggle with highly challenging life circumstances or trauma.[14] A range of theoretical perspectives have been developed to conceptualise perceived positive changes following

adversity.[15,16] In line with the majority of studies examined in the present review, Tedeschi and Calhoun's[17] paradigm of PTG has been utilised herein. They conceptualised the domains of PTG as greater appreciation for life and changed priorities, warmer and more intimate relationships with others, a greater sense of personal strength, recognition of new possibilities for one's life, and spiritual development.[18] Post-traumatic growth can be initiated by a major life crisis that challenges or even shatters the individual's perception of the world and the self.[14]

Post-traumatic growth represents a transformation of personal growth from pretrauma to post-trauma[14] and is independent of other psychosocial variables such as quality of life, hope, and resilience.[19] It has been argued that PTG and PTSS can coexist,[14,19] and among a small number of mixed findings, the majority of PTG research has indicated small, positive associations between these variables.[20-22] Meyerson's[11] systematic review found that, in paediatric populations, PTG was positively correlated (r = 0.27 to 0.49) with PTSS among 10 studies. There was a small, positive correlation (r = 0.13) between PTG and PTSS in Shand and colleagues'[20] meta-analysis of adult oncology populations. Together, this research[19,20,22,23] suggests that PTG and PTSS do not fall on opposite ends of a trauma-response continuum; they co-occur. Nonetheless, further research is required to clarify further the relationship between the 2 variables.

In their systematic review, Meyerson and colleagues[11] found that age and PTG were overall unrelated in paediatric mixed-trauma contexts. Nonetheless, several studies in paediatric oncological contexts indicated that PTG and age of diagnosis were positively correlated, whereas PTG and age at data collection were not.[21,24] Developmentally, older children and adolescents have superior comprehension, cognitive ability, and abstract thinking.[25] They are therefore better placed to comprehend the meaning of a cancer diagnosis and experience personal growth than their younger counterparts are. Further research is needed to clarify the relationship between PTG and age at both diagnosis and survey.

Cancer is argued to be a unique stressor by comparison with other serious illnesses and nonmedical traumatic events in young populations. Children and adolescents with cancer may experience painful symptomatology; invasive surgical procedures; treatment somatic side effects; altered physical appearance; reduced physical capability; neurocognitive deficits; decreased independence; separation from peer groups; disruptions to education; and uncertainty regarding increased risk of relapse, second malignancy, chronic medical conditions, and premature death.[1,15] Psychological sequelae may be dependent on cancer type; for example, enduring cancer-related anxiety was found to be more common in long-term survivors of Hodgkin disease, sarcomas, and bone tumours.[4] A number of researchers[13,26,27] have acknowledged that specific research is needed into the mechanisms that facilitate PTG and positive outcomes in the paediatric cancer context.

Over the past 5 years, 3 reviews have examined PTG in children. Two reviews did not focus exclusively on PTG and correlates following paediatric cancer. Meyerson and colleagues[11] synthesised PTG in children and adolescents across a wide range of trauma types, including serious illness, terror, natural disaster, and death of a parent; and Picoraro and colleagues[13] assessed PTG and correlates in the context of paediatric serious illness, including cancer, physical injury, and other serious childhood illnesses. Therefore, limited conclusions could be drawn about the impact of cancer in these mixed-trauma reviews. The utility of the Picoraro and colleagues'[13] review is further impacted by the limited description of the search strategy and systematic search used, limiting the readers' ability to appraise selection bias.[13] Qualitative reporting was used by all authors,[11,13,26] and the only review[26] to exclusively examine cancer as the trauma type was a narrative synthesis. One review[11] reported selected quantitative findings on PTG in children. To date, there has been no meta-analysis on the topic of PTG in children with cancer.

One systematic review and meta-analysis has been published on the correlates of PTG and PTSS following cancer among adults.[20] Shand and colleagues[20] compiled 116 articles and meta-analysed 48 studies relevant to PTG correlates. Results showed that PTG was correlated negatively with distress, and positively with social support, optimism, physical quality of life, spirituality, religious coping, and positive reappraisal.[20] This valuable piece of work requires duplication with a paediatric oncology population. The current review aims to build upon the findings of prior reviews to provide the best statistical estimates of the relationship between PTG and demographic, medical, and psychosocial variables. Understanding correlates of PTG may aid survivors, caregivers, social supports, clinicians, and services to optimise the occurrence of PTG.[28]

The research question is: What is the relationship between PTG and demographic, medical, and psychosocial correlates in individuals of any age who were affected by cancer in childhood or adolescence? The review will examine self-reported demographic factors, variables linked to the cancer diagnosis, retrospective measurement of perceived PTG, and psychosocial correlates. Specifically, these are as follows: cancer type and stage; cancer treatment status, type, duration, and intensity; age at diagnosis, treatment, and survey; time since diagnosis and treatment completion; gender; ethnicity; socio-economic status; PTSS; social support; quality of life; coping; optimism; happiness; positive and negative affect; hope; anxiety symptoms; depression symptoms; distress; and rumination.

2 | METHODS

This review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.[29] The methodology, selection criteria, and analyses were outlined in advance in a registered protocol.[30] Throughout this review, k refers to the number of studies and N refers to the number of participants.

2.1 | Selection criteria

Studies that examined PTG and relevant variables in participants of any age diagnosed with cancer during childhood or adolescence were potentially eligible for inclusion. The review took an inclusive approach to international age range definitions[31] and adopted the upper age

limit of 21 in the definitions of *adolescence* and *paediatric* throughout this review.

Eligible studies were required to

1. include participants diagnosed with cancer when they were younger than 21 years;
2. report participants' mean age or age range at diagnosis and at survey;
3. examine PTG with one of the following measures: Post-Traumatic Growth Inventory (PTGI)[18] and revisions for children,[25,32] Benefit Finding Scale[33] and revisions for children,[15,34] Benefit/Burden Scale for Children,[35] and Perceptions of Changes in Self Scale[36,37];
4. examine at least one demographic, medical, or psychosocial variable relevant to PTG;
5. use a cross-sectional design or use a longitudinal design with extractable data measured at one cross-sectional time point; and
6. report quantitative data.

Studies were excluded when age at diagnosis within the study sample spanned below and above 21 years old, or when participants with diseases other than cancer were included. Where possible, all searches were automatically limited to studies in English with human participants. Date restrictions were not applied in order to capture all studies related to PTG indexed in the relevant databases. It is difficult to systematically search for unpublished studies; if these were included, there would be no way of ensuring that all had been identified. Therefore, it was determined that including unpublished studies was beyond the scope of this review and that assessing publication bias was the preferred approach for addressing this issue. Manual exclusion criteria included unpublished research, qualitative research, conference abstracts and papers, case reports, dissertations, and reviews.

2.2 | Systematic search

The key concepts "post-traumatic growth," "neoplasms," and "paediatric" were selected in consultation with a research librarian to examine PTG in individuals who have been affected by paediatric cancer. With these key concepts, the following search terms were used in Ovid MEDLINE and adapted as necessary in order to meet the requirements of each database: (posttraumatic growth OR post traumatic growth OR benefit find* OR finding benefit* OR find benefit* OR PTG OR perception of change* OR perceptions of change* OR positive growth OR positive consequence* OR positive change* OR personal growth*) AND (neoplas* OR cyst* OR cancer* OR oncolog* OR tumour* OR tumor* OR carcinoma* OR malignan* OR melanoma* OR sarcoma* OR leukaemia* OR leukemia* OR neuroblastoma* OR rhabdomyosarcoma* OR retinoblastoma* OR osteosarcoma* OR ewing sarcoma* OR lymphoma* OR teratoma*) AND (young* OR child* OR adolesce* OR teen* OR preteen* OR youth* OR young adult* OR infan* OR paediatri* OR pediatri*). The first author conducted the systematic search on the April 19, 2016, in the following databases: Embase, Ovid MEDLINE, PILOTS: Published International Literature on Traumatic Stress, PsycINFO, and Web of Science.

2.2.1 | Data extraction and quality appraisal

The first author extracted descriptive data and effect sizes for the relationship between correlates and PTG. Correlates were selected on the basis of those most commonly reported in included studies, examined in prior research[12,24,38] and discussed in reviews.[11,13,20] Quality appraisal with interrater reliability was conducted to assess and potentially exclude studies with poor methodology or risk of bias.[39] The risk of bias based on methodological quality was assessed according to the Standard Quality Assessment Criteria for Evaluating Primary Research Papers from a Variety of Fields.[40] All articles were rated as excellent quality with an overall mean score of 0.97 (ranging from 0.9 to 1.0; see Table S2).[40] No studies were excluded or weighted on the basis of quality scores.

2.2.2 | Interrater reliability

To assess study selection interrater reliability, an independent research associate (J.M.) screened a randomly selected subset of 51 search results. There was an almost perfect (98%) agreement. Discussion resolved the single discrepancy. Quality appraisal interrater agreement was determined from a randomly selected subset of 2 eligible studies. There was 85% agreement between raters (see Tables S1 and S2).

2.3 | Data analysis

2.3.1 | Effect size

The primary effect size index used in the current meta-analysis was the Pearson product-moment correlation coefficient with 95% confidence interval.[41] Cohen's[42] suggested definitions of small (r = 0.1), medium (r = 0.3), and large (r = 0.5) effect sizes were used. When a correlation was not reported, t tests, means, and standard deviations were used to calculate an effect size.[39] A number of eligible studies[7,10,43-48] reported odds ratios, or used multivariate or regression analyses with variables of interest, but did not report all variables in a format that would allow an effect size to be computed. These authors were contacted for the missing information.

2.3.2 | Meta-analysis of main effects

To examine the association between PTG and demographic, medical, and psychosocial correlates, the effect sizes of relevant results from included studies were aggregated.[49] Prior to analysis, random-effects modelling was selected for utilisation on the basis of the methodology of included articles.[39,41] Effect sizes were calculated using Comprehensive Meta-Analysis software V3 by Biostat[50] when relevant data were available from at least 3 studies. Forest plots enabled the examination of the distribution of effects across studies.[39]

2.3.3 | Assessment of heterogeneity and publication bias

The I^2 statistic was produced for each analysis to determine whether the variation in study results was due to an expected level of chance alone (homogeneity), or whether there were genuine differences underlying the variability in results (heterogeneity).[51] Higgin's[51]

suggested variability could be described as low (I^2 = 25%), moderate (I^2 = 50%), and high (I^2 = 75%). Lower heterogeneity is preferable as it indicates higher consistency and generalisability of meta-analytic findings.

Publication bias was evaluated with Rosenthal's[52] and Orwin's[53] Fail-Safe N (N_{fs}). Small N_{fs} calculations indicate that results should be viewed with caution because there is an increased likelihood of unpublished studies with nonsignificant or trivial findings.[41,54]

2.3.4 | Subgroup and sensitivity analyses

Subgroup analyses of effects were conducted where there were 10 or more relevant studies. Studies were grouped according to PTG measurement tool (PTGI versus an alternative measure) and cancer type (cancer types across participants included leukaemia versus cancer types that did not). Treatment status was as follows: (1) had completed treatment, (2) were receiving treatment, or (3) mixed treatment status: a proportion of participants had completed treatment, and a proportion were in treatment.

On the basis of the methodology outlined by Viechtbauer and Cheung,[49] sensitivity analyses were run with the exclusion of all studies with a studentised residual larger than ±1.96 to formally inspect potential outliers. The difference in overall effect size was assessed.

3 | RESULTS

3.1 | Search results

The results of the systematic search are summarised in Figure S1. The following databases returned 905 search results: Embase (N = 22), Ovid MEDLINE (N = 219), PILOTS: Published International Literature on Traumatic Stress (N = 83), PsycINFO (N = 160), and Web of Science (N = 421). Duplicates (N = 4) were removed, and the remaining results were screened against the inclusion and exclusion criteria. In cases where authors had published multiple articles based on the same data, the original publication was included. An excluded erratum[55] referred to a study[56] not identified in the database search that additionally fit the criteria for inclusion. Twenty-three studies were eligible for inclusion. No further study was identified during reference list checking of eligible studies and relevant reviews.

Following data extraction and preliminary analyses, an email was sent to the authors of all 23 studies requesting unreported Pearson correlations for the specific variables measured in each study. Three authors provided additional relevant data[7,43,48]; one indicated that the data requested from 2 studies[7,57] were in fact from the same dataset. The more recent study[57] was excluded from the results. Therefore, 22 studies[7,10,12,15,21,27,34,43-48,56,58-65] were eligible for inclusion in the review. Four articles[10,44,46,65] were excluded because the reported data were not in a format that could be used to calculate an effect size.

3.2 | Study characteristics

The participant and study characteristics of included studies are summarised in Table S3. The 18 observational and cross-sectional studies included 8730 participants. The average age at diagnosis was 9.68 years (age range, 0-21 y), and females comprised 52% of the participants. Leukaemia represented 30% of the reported diagnoses, and chemotherapy was the most common form of treatment (73%). In 10 of the studies, all participants were younger than 21 years at time of survey. Most participants were recruited from a medical facility, and the average age at the time of survey was 17.92 years (reported age range of 7 to 53 y). Included studies were published between 2006 and 2016, and 48% of the studies were conducted in the United States or Canada.

3.3 | Correlates of post-traumatic growth

The results of 18 studies[7,12,15,21,27,34,35,43,45,48,56,58-64] were synthesised. Thirteen analyses were conducted for the relationship between PTG and the following correlates: gender, age at diagnosis, age at survey, time since diagnosis, time since treatment completion, socio-economic status, PTSS, social support, quality of life, optimism, pessimism symptoms, anxiety symptoms, and symptoms of depression (see Table 1). Figure S2 contains forest plots illustrating the distribution of effects between variables. Numbers were insufficient studies to synthesise the relationship between PTG and cancer type or stage; treatment type, duration, or intensity; ethnicity; coping; happiness; positive and negative affect; hope; distress; or rumination.

3.4 | Demographic, medical, and psychological correlates

Gender (1 female, 2 male) was not related to PTG. Results indicated small, significant, positive associations between PTG and age at both diagnosis and survey. There were small, significant, negative associations between PTG and time since both diagnosis and treatment, indicating that greater recency of diagnosis or treatment completion was associated with greater PTG. Measurements of socio-economic status as defined by paternal or parental income, paternal or parental education level, and formal socio-economic measurements were combined as measures of socio-economic status across studies.[66] Results indicated that socio-economic status and PTG were unrelated. There were medium, significant, positive associations between PTG and both social support and optimism. Post-traumatic stress, depression, pessimism, anxiety, and quality of life did not correlate with PTG.

3.5 | Further analyses

3.5.1 | Heterogeneity

There were high, significant levels of true heterogeneity (ie, high variability) detected across studies in the associations between PTG and the following correlates: age at diagnosis, age at survey, socio-economic status, social support, quality of life, and depression symptoms (see Table 1), indicating that these results should be viewed with caution. Moderate, significant levels of heterogeneity were also detected in the correlations between PTG and gender, PTSS, and optimism. There was low, nonsignificant variability between studies testing the associations between PTG and time since diagnosis, time since treatment completion, pessimism, and anxiety.

TABLE 1 Meta-analytic results for the relationships between correlate variables and post-traumatic growth

Demographic, Medical, and Psychological Variables	k	N	Effect Size	95% CI		Rosenthal's	Orwin's	
			r	Lower	Upper	N_{fs}	N_{fs}	I^2, %
Gender	12	2085	−0.00	−0.08	0.08	0	1	63.00***
Age at diagnosis	12	1875	0.29***	0.17	0.39	376	53	82.36***
Age at survey	11	2053	0.22*	0.04	0.38	201	28	93.18***
Time since diagnosis	7	1463	−0.14***	−0.21	−0.08	39	14	31.48
Time since treatment completion	6	657	−0.19***	−0.27	−0.12	28	18	0.00
Socio-economic status	8	1113	−0.10	−0.27	0.07	9	5	86.96***
PTSS	12	7686	0.08	−0.00	0.16	71	14	74.18***
Social support	5	980	0.46*	0.06	0.74	178	32	96.86***
Quality of life	3	209	0.10	−0.25	0.43	0	6	84.16**
Optimism	5	1014	0.31***	0.19	0.41	88	21	59.50*
Pessimism symptoms	3	318	−0.11	−0.27	0.05	0	4	43.38
Anxiety symptoms	4	443	−0.07	−0.19	0.04	0	3	28.17
Depression symptoms	3	211	−0.26	−0.52	0.03	10	17	76.10**

Abbreviation: PTSS, post-traumatic stress symptoms.

k, number of studies; N, number of participants; *r*, Pearson correlation coefficient; I^2, I^2 statistic; N_{fs}, Fail-Safe N.

*$P < .05$.

**$P < .01$.

***$P < .001$.

3.5.2 | Publication bias

Rosenthal's and Orwin's N_{fs} estimates tested for publication bias (see Table 1). On the basis of N_{fs} calculations, there was an increased likelihood of unpublished studies with nonsignificant or trivial findings in the associations between PTG and the following correlates: gender, socio-economic status, quality of life, pessimism, and anxiety symptoms; and these results should be viewed with caution. There was no evidence of publication bias in the following correlates of PTG: age at diagnosis, age at survey, time since diagnosis, time since treatment completion, PTSS, optimism, social support, and symptoms of depression.

3.5.3 | Subgroup analysis

Subgroup analysis tested the relationships between PTG and gender, age at diagnosis, and PTSS (see Table 2). The associations between PTG and age at diagnosis ($Q(3) = 49.87$, $P < .001$) was significantly larger in those who were receiving treatment compared with those who had completed treatment and other subgroups. An important

TABLE 2 Results of subgroup analyses

	Gender				Age at Diagnosis				Post-traumatic Stress Symptoms			
	Effect Size	95% CI			Effect Size	95% CI			Effect Size	95% CI		
Subgroup	k	r	Lower	Upper	k	r	Lower	Upper	k	r	Lower	Upper
Treatment status		$Q(2) = 2.50$				$Q(3) = 49.87^{***}$				$Q(2) = 1.85$		
Completed treatment	6	−0.02	−0.10	0.14	7	0.21***	0.13	0.28	7	0.07	−0.10	0.24
Receiving treatment	...				1	0.74***	0.64	0.82	...			
Mixed treatment status	2	−0.05	−0.17	0.07	2	0.25***	0.13	0.36	3	0.03	−0.10	0.16
Not reported	3	0.07	−0.02	0.15	2	0.26*	0.08	0.43	2	0.13***	0.06	0.20
Cancer type		$Q(1) = 0.00$				$Q(1) = 2.50$				$Q(2) = 0.70$		
Included leukaemia	7	0.02	−0.05	0.08	8	0.32***	0.16	0.47	8	0.09	−0.04	0.22
Did not include leukaemia	4	0.01	−0.15	0.17	4	0.18***	0.12	0.25	3	0.02	−0.21	0.24
Not reported	...				...				1	0.11***	0.09	0.14
PTG measurement		$Q(1) = 0.08$				$Q(1) = 0.015$				$Q(1) = 2.26$		
PTGI	5	0.03	−0.02	0.9	6	0.30*	0.07	0.51	5	−0.00	−0.15	0.14
Non-PTGI	6	0.00	−0.08	0.08	6	0.29***	0.22	0.35	7	0.14*	0.03	0.24

Abbreviations: PTG, post-traumatic growth; PTGI, Post-Traumatic Growth Inventory.

k, number of studies; *r*, Pearson correlation coefficient; *Q*, *Q* value.

*$P < .05$.

**$P < .01$.

***$P < .001$.

caveat should be noted: this finding was based on a single study.[58] Although methodologically sound, this result was an outlier, perhaps because it was the only included study with 100% of participants in treatment at the time of study. This likely explains why there was a large, significant, positive correlation between PTG and age at diagnosis (r = 0.74, 95% CI, 0.64-0.82, P < .001) for those who were receiving treatment. Results indicated that the relationships between other correlates and PTG were not significantly different on the basis of subgroup membership.

3.5.4 | Sensitivity analyses

Relevant analyses were rerun after excluding studies with a residual weight larger than ±1.96, as shown in Table 3. All analyses showed smaller effect sizes after the exclusion of large residuals, with the exception of the relationship between PTSS and PTG. After the exclusion of large residuals, there was a small, significant, positive association between PTG and PTSS (r = 0.11, 95% CI, 0.08-0.14, P = .000). There was no evidence of publication bias in this correlation.

4 | DISCUSSION

The aim of this article was to review the associations between demographic, medical, and psychological variables and PTG in individuals of any age who were affected by cancer in childhood. Overall, there were small, positive correlations between PTG and age at both diagnosis and at survey. Post-traumatic growth shared small, negative correlations with time since diagnosis and treatment completion. Social support and optimism were moderately correlated with PTG. After the removal of outliers, PTG shared small, positive associations with PTSS and social support.

Several findings were comparable with Shand and colleagues'[20] meta-analytic results of PTG in adult oncology populations, including the positive relationships between PTG, and PTSS, social support, and optimism.

4.1 | Correlates of post-traumatic growth

Results indicated that participants who were older when surveyed, or older when diagnosed with cancer, were more likely to experience PTG. These findings may reflect increases in abstract thinking after the age of 11 or 12.[67] The capacity for the cognitive processes necessarily involved in the development of PTG, contemplation of philosophical concepts, meaning-making, and the development of personal values typically emerges during adolescence.

There are inconsistent findings in the literature about how PTG is affected by the age at which the trauma occurs. In light of inconsistent review findings, Meyerson and colleagues[11] suggested that PTG is independent of age in children and adolescents who have experienced a range of trauma types. In the adult PTG literature, age and PTG have typically been negatively correlated.[20,68] On the basis of the results of paediatric and adult mixed-trauma PTG research, PTG may take a curvilinear trajectory, plateauing during adolescence or early adulthood.[11] The combined results of the present review, and those of Shand and colleagues'[20] review, supports this finding in oncological contexts. Further longitudinal research is needed to clarify the trajectory of PTG in oncology populations over time.

In this review, less time since diagnosis and treatment completion was associated with greater PTG. Linley and Joseph[23] suggested that links between PTG and rumination, intrusions, and avoidance were indicative of the cognitive processing necessary for PTG. This may form an explanatory model for the way the passing of time since a stressful event and PTG are related. For example, internal states such as cognitive processing, rumination, reflection, meaning-making, and fluctuations in affect may plausibly peak during and soon after significant life events such as receiving a cancer diagnosis or completing a final treatment, and reflect the process of successfully dealing with the associated PTSS. Subsequently, natural decline in internal reactions, the passage of time, and competing environmental factors may contribute to decreases in PTG over time. However, results are generally mixed in terms of the association between time since traumatic event and PTG, with negative[21] or nonsignificant associations.[69,70] High variability between participants on measures of time since diagnosis or treatment (eg, reported time since diagnosis ranged from 3 mo to 37 y) should be taken into consideration when interpreting the results of the current meta-analysis.

After the removal of outliers, the present meta-analysis revealed a small, significant, positive correlation between post-traumatic stress and PTG. These findings are in line with PTG theory, which suggests that PTSS and PTG share triggers and underlying processes.[14,17,19]

TABLE 3 Sensitivity analysis: meta-analytic results for relationships between correlates and post-traumatic growth with outliers excluded

Demographic, Medical, and Psychological Variables	k	N	Effect Size r	95% CI Lower	95% CI Upper	Rosenthal's N_{fs}	Orwin's N_{fs}	I^2, %
Age at diagnosis	10	1516	0.20***	0.15	0.25	128	32	0.00
Age at survey	9	1306	0.17**	0.07	0.27	92	16	76.85***
Socio-economic status	6	942	−0.04	−0.11	0.02	0	…	0.00
PTSS	9	7217	0.11***	0.08	0.14	73	11	5.88
Social support	4	872	0.25***	0.12	0.37	178	32	96.86***

Abbreviation: PTSS, post-traumatic stress symptoms.

I^2, I^2 statistic; k, number of studies; N, number of participants; r, correlation; N_{fs}, Fail-Safe N.

*P < .05.

**P < .01.

***P < .001.

By definition, the struggle with trauma is necessary for the development of PTG. For example, as a result of leukaemia, a teen may experience intrusive memories and distress, as well as greater appreciation for life and spiritual development. Joseph and Hefferon[16] argue that as distinct constructs, post-traumatic stress triggers PTG, and in turn PTG reduces post-traumatic stress. The results of 1 meta-analysis[22] suggested that in adult mixed-trauma settings, PTSS and PTG may follow a curvilinear pathway, depending on age and trauma type. Further research is recommended[11,22,60] to clarify the nature and trajectory of the complicated[22] relationship between post-traumatic stress and PTG, both in paediatric contexts and across the lifespan.

Consistent with past research, greater social support and optimism were associated with greater PTG in individuals affected by childhood or adolescent cancer.[11,13,20,26,58] Social support is an integral aspect of the PTG theoretical framework put forward by Tedeschi and Calhoun in 2004.[14] It has been argued that optimism is distinct from PTG, and that optimism facilitates PTG by motivating coping styles and redirecting attention from uncontrollable threats to positive appraisals.[14,71] Plausibly, PTG may share a bidirectional relationship with social support and optimism, or increases in PTG may in fact lead to increases in social support and optimism.

4.2 | Clinical implications

This review revealed a positive association between PTG and both optimism and social support, which is valuable information for individuals, caregivers, community, and clinicians. Arguably, one of the most important forms of social support for a child or adolescent with cancer is the relationship with immediate family members. Ekim and Ocakci[58] found that adolescents with cancer experienced more support from family than from friends and that older adolescents drew greater support from friends than do younger adolescents. They recommended that health professionals plan social support interventions for adolescents with cancer, including with family and friends, and in support groups.[58]

Several studies have been published on interventions targeting social support. Kazak and colleagues[72] evaluated a 1-day cognitive behavioural and family therapy-based therapeutic intervention for adolescent survivors of childhood cancer, and their immediate family members. The intervention was deemed helpful by all and facilitated alternative perspective-taking, peer support, and in-depth family discussion about cancer and its impact. At 6-month follow-up, post-traumatic stress and anxiety had reduced, although it was not possible to evaluate time as a confounding factor without a control group.[72] Elad and colleagues[73] evaluated an 8-day adventure jeep trip for young survivors of adolescent cancer. Content analysis of video footage and interviews conducted throughout the trip indicated that self-confidence, independence, and social contacts were improved. Importantly, at 1-year follow-up, social connection was maintained, with participants arranging outdoor adventure activities, social events, and discussion groups.

Other important forms of social support for oncological populations may include camps for children with cancer, aerobic classes, age-appropriate support groups, online networks, survivor day picnics, family retreats, and the facilitation of storytelling.[14,16,74] A systematic review of psychological therapies for children, adolescents, and adults affected by cancer indicated that group therapy, education, counselling, and cognitive behavioural therapy can be tentatively recommended for a range of medium- and long-term psychosocial outcomes.[75] Psychological treatment and psychotherapy may have important implications for the improvement of optimism in addition to improved interpersonal relationships. Clay and colleagues[28] argue that introducing PTG into clinical work with young people and their families may build self-esteem and encourage a solution-focussed cognitive style. There remain minimal services for young people who have experienced cancer, despite evidence suggesting that services, programmes, and enhanced social support have potential to decrease PTSS and promote PTG in this population.[74] There is a pressing need for further research on the efficacy of a range of treatments.

4.3 | Limitations of existing research and future directions

This review is characterised by a number of shortcomings. Unpublished studies were not sought for inclusion; however, among significant findings, there was no evidence of publication bias. The majority of effect sizes were small. Appraisal of perceived personal growth is problematic owing to inaccuracy in retrospective report and bias to depict the most recent version of oneself in a favourable light.[76] The average age at data collection was 18 years; therefore, the reliability of recall would be similar to that found in studies on adults. Several authors[77,78] have illustrated that perceptions of growth as measured by the PTGI were not related to measured pretrauma to posttrauma growth. These results suggest that retrospective measurements of perceived PTG may inaccurately represent growth over time.

This review involved a systematic and comprehensive search of the literature. However, key methodological limitations in published work affected conclusions made in the review. Many studies did not quantitatively report findings, or report analyses in a format that provided an effect size. Therefore, the reported effects may not be representative of existing research in this area.

There were no differences in subgroup analysis between PTGI and other measures of PTG in children and adolescents. Further research that indicates how specific cancer and treatment types, intensities, and prognoses relate to PTG would be useful.[20] Although subgroup analyses suggested a trend in which the positive association between PTG and age at diagnosis was greater in those receiving treatment at the time of survey, more research is required on how treatment status may affect PTG.

This review highlighted the need for more research on correlates of PTG. Correlations between PTG and depression, anxiety, pessimism, and quality of life were nonsignificant; this may reflect small sample sizes. Prior research in children with mixed-trauma types suggests that PTG correlates negatively with depression, distress, anxiety, and rumination.[11,13] Although rumination is a vital part in the theoretical framework of PTG,[14] it was measured infrequently. Future research could address other potential correlates: hope, happiness, and positive affect. In adults affected by cancer, PTG is moderately and positively associated with positive reappraisal, spirituality, and religious coping[20];

however, it remains unknown whether these results are replicable in paediatric populations.

Almost unanimously, reviewers in this field of research call for further longitudinal research of PTG and relevant correlates to be conducted. Findings would facilitate understanding of common PTG trajectories in children and across the lifespan, in addition to the influence of predictive variables.

5 | CONCLUSIONS

This meta-analysis investigated the correlates of PTG in childhood and adolescent cancer survivors. Provision of social support and encouragement of an optimistic outlook were identified as factors that might facilitate PTG and could be incorporated into personal support, group events, intervention, and education. Further research with improved methodology in this area would be valuable. Longitudinal studies are needed to depict the trajectory of PTG and interrelationships of predictive variables and PTG over time. Findings would contribute to growing literature on how to facilitate PTG in the paediatric oncology population.

ACKNOWLEDGEMENTS

The authors would like to thank John Mingoia and Nathan Harrison for their assistance with interrater reliability and reverse coding, respectively.

CONFLICT OF INTEREST

The authors have declared no conflict of interest. No funding was received.

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How to cite this article: Turner JK, Hutchinson A, Wilson C. Correlates of post-traumatic growth following childhood and adolescent cancer: A systematic review and meta-analysis. *Psycho-Oncology*. 2018;27:1100–1109. https://doi.org/10.1002/pon.4577