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Review Article

Posttraumatic Growth in Cancer Patients: A Meta-analysis Study

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Abstract

Background: This meta-analysis study aimed to evaluate post-traumatic growth (PTG) in cancer patients.

Methods: We systematically searched for studies that reported PTG in cancer patients. Then, irrelevant studies were removed after the abstracts of articles were studied, and articles completely related to the research purpose were selected by examining the full texts of the articles. Finally, the articles that met the inclusion criteria were selected for analysis based on the criteria of critical evaluation.

Results: Of 21 articles, nine studies were performed on women, one study on men, and 11 studies on both sexes, and all of them used post-traumatic growth inventory (PTGI). The studies showed that the mean PTGI score was 60.72 and heterogeneity was not statistically significant (I2 = 0.0, heterogeneity = 0.998). The subgroups classified according to continents showed that the mean PTGI scores in Asia, Europe, and the United States were 61.40, 59.12, and 60.42, respectively.

Conclusion: Recognition of the psychological responses in cancer patients requires much more attention from health care professionals, and they should consider programs to enhance PTG in cancer survivors.

Keywords: Posttraumatic growth, Cancer, Meta-analysis

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Introduction

Cancer is one of the leading causes of death in developed and developing countries (1). In recent decades, cancer has increased worldwide. Studies showed that the number of cancer patients in developed and developing countries reached 6 million and 9.3 million in 2020, respectively (2). Cancer patients are subjected to prolonged and severe treatment regimens, as well as physical and psychological problems (3-6). Stress, depression, sleep and concentration disturbance, and anxiety are all associated with the disease and its treatment (7-10). Although the 5-year survival rate of cancer patients has improved and cancer treatment procedures are constantly evolving, most patients with cancer experience stress and pain during their treatment course soon after receiving a cancer diagnosis (11). While cancer-related stress may damage individual and family psychological health it may also cause positive psychological changes (4,12,13).

Cancer research has mainly focused on negative psychological changes, such as depression or distress (14), but post-traumatic growth (PTG) has been recognized and received much attention in psychology in recent years (15-17), which eliminates severe cognitive and emotional complications (18). Tedeschi and Calhoun coined the term posttraumatic growth to describe all of the positive changes in a person that occur because of stressful events and adversities (19-21). In general, PTG can be defined as the positive psychological, cognitive, and emotional changes that occur after surviving a life-threatening crisis (22,23). In addition, PTG is defined as a stronger sense of self and values, psychological maturity and empathy, interpersonal relationships, increased activity interaction, a sense of purpose, and increased future planning (24).

One of the topics in health psychology is the positive effects of psychological trauma on people who have experienced trauma, besides the factors that facilitate these positive effects (25). The concept of PTG is related to the positive consequences and the coping processes of post-traumatic life events (26). PTG is found in three main domains. First, people report changes in their life philosophy, for example, finding a new appreciation for each day of their life and recreating what really matters to them. Second, people's opinions change; for example, they have a stronger sense of personal flexibility and wisdom. Third, people believe that their relationships have improved in some way; for example, they now value

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their family and friends more and are happier with others (27-30).

Studies have shown the prevalence of positive changes in personal life and growth following cancer (21), and various studies have reported that positive changes in cancer survivors ranged between 60% and 90% (31,32). Cancer survivors have been studied in different populations, and some factors seem to associate with cancer. For example, the time period following a cancer diagnosis is critical because increased growth is associated with increased distress during short survival, and people diagnosed with cancer for a long time usually experienced more growth and well-being (16,21).

PTG is a positive psychological response to trauma that accelerates the healing process of cancer and leads to a better response to therapy, less avoidance, and an increased sense of hope, resilience, and well-being (33). Little information is available about PTG in adult cancer patients, so the authors of this meta-analysis study believe that this population deserves further investigation, which is one of the aims of the present study. In addition, previous research has focused primarily on the PTG predictor and has neglected the relationship between the various domains of PTG and clinical, demographic, and psychological variables (34). Thus, this study aimed to evaluate the PTG and its domains in a large sample of cancer patients and investigate the relationship between the five different domains of PTG and clinical, demographic, and psychological variables.

Methods

Study selection for meta-analysis

MOOSE (Meta-analysis Of Observational Studies in Epidemiology) checklist was used to perform the present meta-analysis. To this end, we systematically searched the databases of Medline, PubMed, Google Scholar, Scopus, and the Web of Science for studies that reported PTG in cancer patients before October 2017. We also reviewed references to retrieved articles to find additional relevant texts. Search was performed systematically with the medical titles: "Posttraumatic Growth [Text Word]) OR" posttraumatic growth, psychological "[MeSH Terms]) AND (" cancer "[Text Word]) OR (" malignancy "[Text Word]) OR (" carcinoma "[Text Word]) (" tumor "[Text Word])" neoplasms "[Text Word]) OR" neoplasms "[MeSH Terms]". The search was limited to observational studies on humans, and there were no language limitations.

Inclusion and exclusion criteria of studies

Studies with the following criteria were included in the meta-analysis: original studies, studies on people over 18 years of age, and studies in which PTGI-21 was applied. The 21-item instrument is on a 6-point Likert scale from zero (no change) to five (very large change) with five subscales of new possibilities (5 items), personal strength (4 items), spiritual change (2 items), appreciation of life (3 items), relating to others (7 items), and (4) studies examining PTG in cancer patients.

Based on the above-said criteria, out of 110 eligible articles, the following articles were excluded: 20 articles were done in the under-18-year-old population, 30 articles did not use the five domains of PTGI-21, 22 articles did not examine PTG in cancer patients, and 17 articles did not report the required information to calculate the standard error. Twenty-one articles met the inclusion criteria, of which ten were conducted in Asia, nine in Europe, and two in the United States.

Evaluation of the quality of studies and extracted information

Based on the pre-designed information extraction form, the following specifications were extracted and recorded for each of the studies included in the meta-analysis: publication reference (surname of the first author, year of publication, country of the study population), name of the study, sample size, age, sex, the point estimate, and confidence interval. Two members of the research team extracted the mentioned information independently, and disagreements were resolved by discussion and consultation with a third person acting as an arbitrator.

The BSA Medical Sociology Group guideline was used to evaluate the quality of the studies. This instrument contains seven items, each with a score of one or zero. The study with the highest methodological quality receives a score of seven, while the study with the lowest methodological quality receives a score of zero. In this method, studies with scores of 1-2, 3-5, and 6-7 are classified as low, medium, and high-quality studies, respectively.

Statistical analysis

Standard error and mean effect size were estimated via meta-analysis commands in STATA version 12. A forest plot was drawn to examine the mean PTG score in general and in subscales and its 95-percent confidence interval. Summary estimates of the mean PTG score and the corresponding confidence interval were calculated via the DerSimonian and Laird method (35), the fixed effect model, and the random effect model. The random effect model was used to examine study variability. Statistical heterogeneity of the mean PTG score between studies was assessed by Cochran's Q test and I^2 statistic (36). Heterogeneity was considered statistically significant if $I^2 \geq 50\%$ and $P \leq 0.05$ (37). The random effect model was used to collect the results of the studies (38) because this model considers the sample size of the study and the changes between the studies (38).

Results

Twenty-one independent studies, with participant

populations ranging from 31 to 906, were eligible for meta-analysis based on predefined criteria. Table 1 summarizes the main characteristics of the included studies (14,22,39-62). Ten studies were conducted in Asia (39-42, 44,45,53,54,60,61), nine in Europe (14,22,46,48-50,52,56,62) and two in the United States (43,47). Of the 21 articles reviewed, nine studies were done on women, one on men, and 11 on both sexes. Table 2 shows the results of the quality evaluation of studies based on BSA. All high-quality studies were included in this meta-analysis.

The main analysis

Figure 1 shows the results of each study along with their overall outcomes (forest plot). Studies showed the mean PTG of 60.72 (CI: 53.25, 68.20) and heterogeneity was not statistically significant ($I^2 = 0.0$, $P_{\text{Heterogeneity}} = 0.998$) (Figure 2). The subgroups including the continents showed that the mean PTG scores in Asia, Europe, and the United States were 61.40 (CI: 52.28 - 70.51), 59.12 (CI: 44.80-73.44), and 60.42 (CI: 28.64-92.19), respectively (Figure 3). In addition, 13 articles showed that the mean score of PTG in the subscale of new possibilities was 3.44 (CI: 2.16-4.73) (Figure 4). Twelve articles showed that the mean PTG scores in the subscales of "spiritual change", "relating to others", and "personal strength" were 4.91 (CI: 3.74-6.08), 13.72 (CI: 12.17-15.28), and 6.44 (CI: 4.55-7.93), respectively (Figures 5-7). For the "appreciation of life", this number was 7.53 (CI: 4.59-10.46) (Figure 8).

Discussion

PTG has been shown to occur following a range of traumatic experiences, and interest in this construct has increased exponentially in recent years (63). The present meta-analysis included twenty-one studies that investigated PTG. They all used PTGI (Post-Traumatic Growth Inventory), which is an instrument for assessing positive outcomes reported by people who have experienced traumatic events. This 21-item scale includes factors of new possibilities, relating to others, personal strength, spiritual change, and appreciation of life. The PTGI is modestly related to optimism and extraversion. (64) The scale appears to be useful in determining how successful individuals, coping with the aftermath of trauma, are reconstructing or strengthening their perceptions of self, others, and the meaning of events (23).

The overall mean PTG score was 60.72. In addition, Asians were reported to have the highest mean score. This score is slightly lower than the score in the study conducted in Korea in 2015 (53.3) (55) and higher than the scores in previous studies in India in 2010 (65). The mean score of breast cancer patients in New York in 2013 (66) was higher than that of the present study (56).

The present meta-analysis has estimated the mean PTG score of 60.42 in the United States. Nine studies showed that the mean score of PTG was close to the study conducted on the caregiving of cancer patients in Portugal in 2013 (67). A descriptive study reported the mean PTG score of 74.83 following mastectomy in Europe (14), which is higher than that of the current study. While another study in Ireland in 2018 showed that the mean PTG score in patients with prostate cancer was 38.37, which is much lower than that of the present study (50). These results are due to the gender effect. Women obviously show much more PTG than men, which can be clarified in the scores of PTG in women with cancer or studies comparing men with women. In addition, the time period between the

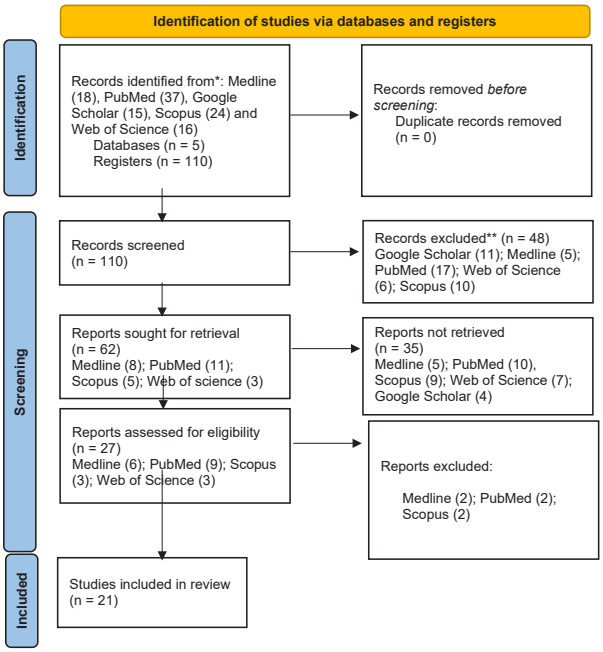

Figure 1. Flow diagram of the study.

Table 1. Characteristics of reviewed studies

Study	Time	Location	n	Design	Age	Gender	Presence of complication	Time since cancer diagnosis	PTGI*	95% CI	PTGI (MD±SD)
Stafford et al	2013	Asia	42	Pilot study	50.15 (10.0)	Female		Median and mean (SD) 33.1 w & 48.2 (47.0) w (5.9-236.0 w)			Pre-test (53.50±22.31) Post-test (68.22±16.16) Three-months-post-test (62.08±22.75)
Dong et al	2017	Asia	164	Observation	57.49 (9.88)	Male-Female	Yes: 63.91±12.16 No: 68.10±14.64	more than 12m	Female: 63.45±14.39 Male: 69.02±13.30 Married: 66.68±14.04 Not Married: 72.00±8.49	Range: 27-105	66.74 (SD: 13.99)
Ho et al	2011	Asia	50	Cross-sectional	60 (13.06)	Male-Female		3.6y (SD: 0.34)	Married: 53.15 (SD: 11.04) Not Married: mean=41.00 (SD=6.36)	29.85; 73.67	51.76±11.18
Baglama & Atak	2015	Europe	31	Descriptive	50.48 (11.59)	Female		past 5y and at least 3 m		54.9, 61.7	80.71 (SD:19.86)
Balfe et al	2016		197	Descriptive cross-sectional		Male-Female		1- 5 y	Female: 58.1±23.3 Male: 56.4±22.7 Married: 58.9±23.4 Not married: 54±22.8		MD: 58.2 (95%CI (69))
Heidarzadeh et al	2016	Asia	142	Descriptive correlation	68.4	Male-Female			Female: 69.67±14.5 Male: 67.2±14.9		70.27 (SD:12.43)
Cordova et al	2007	America	65	Cross-sectional	52.3 (9.3)	Female		9.4 m (SD: 6.4)		Range: 2–105	57.8±25.4
Sharma & Zhang	2017	Asia	120	Cross-sectional descriptive	51.92 (10.178)	Female		(60%) were newly diagnosed; between 1 m to 1 y			54.62 (SD:13.66).
Weiss	2004		96	Descriptive	54.2 (8.6)	Female		38.7 m (SD: 14.9)		Range: 1-105	57.9 (SD:24.5)
Silva et al	2012	Europe	50	Longitudinal study		Female					Time 2 treatment: (62.1±22.4) Time 3 survival: (63.3±21.2)
Nenova et al	2013	American	89	Randomized clinical trial	49.57 (10.53)	Male-Female				Range: 9-105	62.22 (SD: 21.06)
Cormio et al	2013	Europe	360		58.6	Male-Female		11 y			36.63 (SD: 25.64)
Lelorain et al	2010	Europe	307	Retrospective and cross-sectional	62.4 (7.9)	Female		10 y (SD: 2.8)			59.9 (SD: 20)

Table 1. Continued

Study	Time	Location	n	Design	Age	Gender	Presence of complication	Time since cancer diagnosis	PTGI*	95% CI	PTGI (MD±SD)
Kroemeke et al	2017	Europe	84	Descriptive and correlations	62.27 (8.38)	Female		10.20 y (7.91)			74.83 (SD: 16.58)
Walsh et al	2018		241	Descriptive	64.02 (7.76)	Male		1–2 years (n=103, 42.7%), 3–4 years (n=64, 26.6%), 5–10 years (n=74, 30.7%)		0.88–0.92	38.37 (SD: 26.68)
Tomich & Helgeson	2012	American	62	Cross-sectional study	62.58 (10.32)	Male-Female		2.30m (SD: 1.40)			3.37 (SD: 0.82)
Heidarzadeh et al	2014	Asia	452	Descriptive	46.2 (14.2)	Male-Female			Female: 69.15 (14.7) Male: 67.8 (14.5) Married: 68.46 (14.75) Not married: 69.05 (14.13)		68.6±14.6
Cormio et al	2017	Europe	540	Cross-sectional	57.08 (10.96)	Male-Female					41.40 (SD: 25.19)
Jeon et al	2015	Asia	100		41.07 (12.39)	Male-Female		31.35m (SD: 13.8)			Men (61.02, SD:25.20) Women (73.07, SD:18.10)
Tahory et al	2016	Asia	120	Descriptive	mean age (caregivers and patients)39.71 & 46.01	Male-Female		31.45m			60.7 (SD=18.8)
Jansen et al	2011	Europe	906	Case–control	72(9)	Male-Female		5.4 y (SD: 0.4)			2.0 (SD=1.1)
Shen et al	2015		141		70.7 (8.5)	Male-Female					47.42 (SD=27.44)
Steel et al	2008		120	Prospective	63.0	Male-Female					Patients with baseline (51±28) Patients in three months (46±27) Patients in six months (47±26) Caregivers in three months (47±25)
HO et al	2004	Asia	188		49.29 (0.622)	Male-Female					17.01±3.95
Cohen & Numa	2011	Europe	124		59.26 (10.01)	Female		12.5 y (SD: 7.3)			Volunteers: 69.86 (19.73) Non-volunteers: 70.72(15.02)
Gunst et al	2016		784	Cohort	30.4 (6.1)	Male-Female		13.7y (SD: 6.0)	Female: 23.58±7.90 Male: 22.31±7.87		

*PTGI 21-item was used in all of these studies.

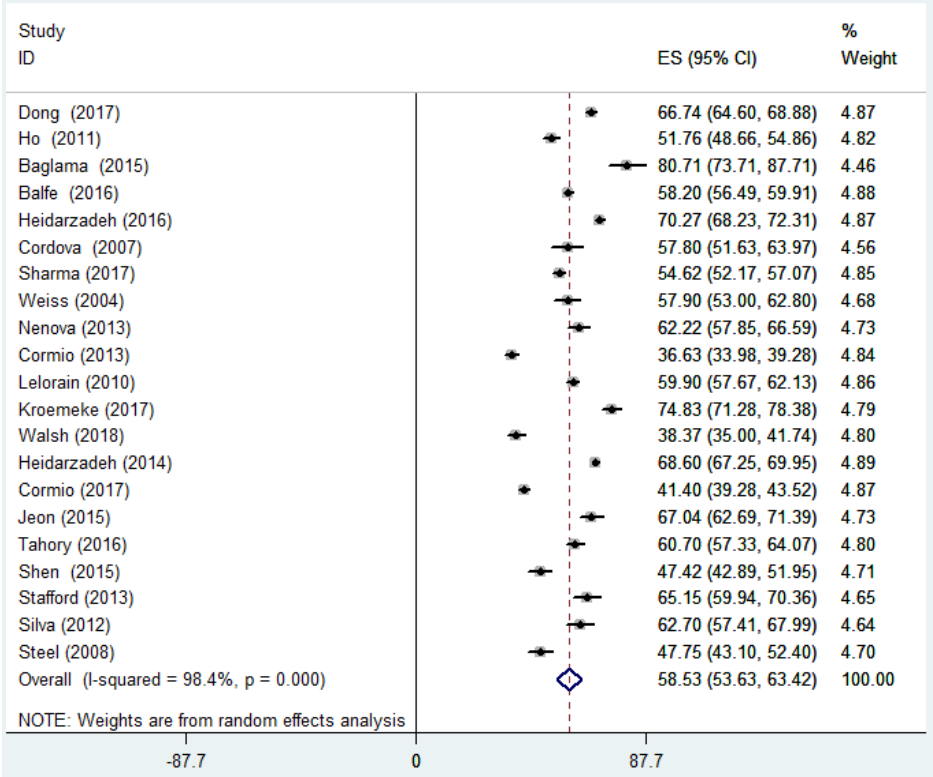

Figure 2. Forest plot of the PTG. The random-effects model was used to pool the overall mean and 95% confidence intervals (CIs). The diamond represents the pooled mean, and the squares and the horizontal lines, respectively, represent the mean and 95% CI of each study .

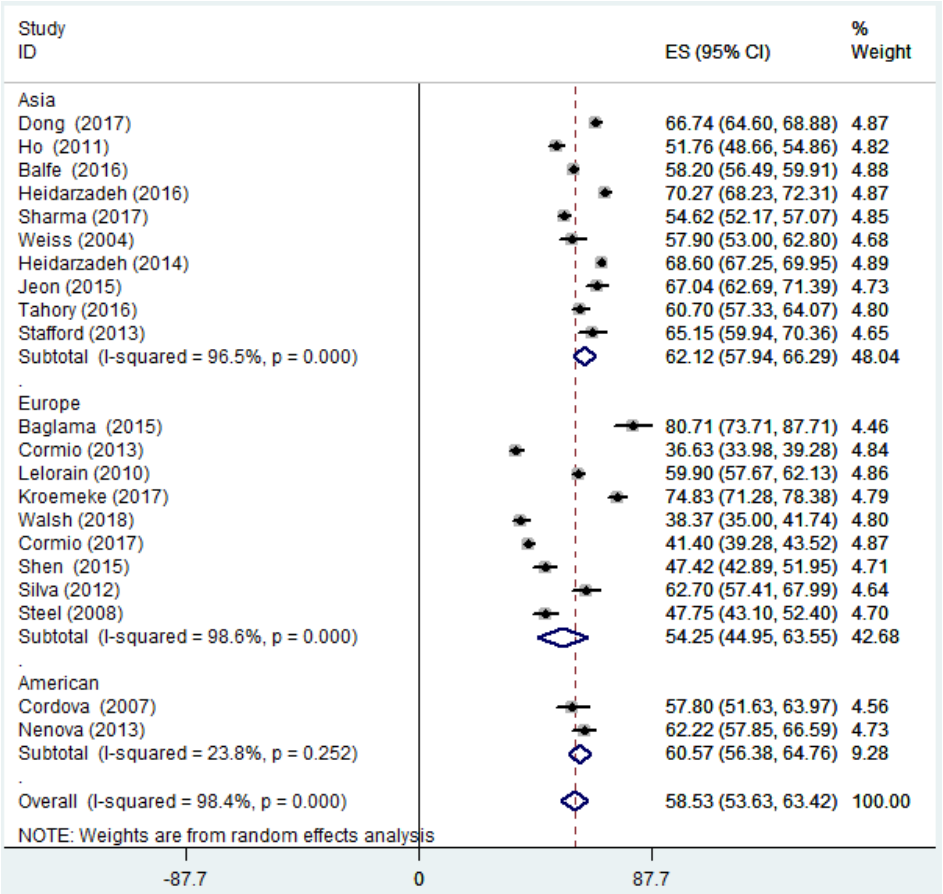

Figure 3. Forest plot of the PTG. Subgroup analysis based on area. The random-effects model was used to pool the overall mean and 95% confidence intervals (CIs). The diamond represents the pooled mean, and the squares and the horizontal lines, respectively, represent the mean and 95% CI of each study

Table 2. Methodological quality of studies included in the meta-analysis

Study	Appropriate research design? (Y/N)	Appropriate recruitment strategy? (Y/N)	Response rate? (Y/N) %	Is sample representative? (All similar populations) (Y/N)	Objective and reliable measures? (Y/N)	Power calculation/ justification of numbers? (Y/N)	Appropriate statistical analysis? (Y/N)	Quality indicators met (out of 7)
Stafford et al	Yes	Yes	Yes	Yes	No	Yes	Yes	6
Dong et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Ho et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Baglama & Atak	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Balfe et al	Yes	Yes	No	Yes	Yes	Yes	Yes	6
Heidarzadeh et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Cordova et al	Yes	Yes	No	Yes	Yes	Yes	Yes	6
Sharma & Zhang	Yes	Yes	Yes	Yes	No	Yes	Yes	6
Weiss	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Silva et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Nenova et al	Yes	Yes	No	Yes	Yes	Yes	Yes	6
Cormio et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Lelorain et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Kroemeke et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Walsh et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Tomich & Helgeson	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Heidarzadeh et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Cormio et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Jeon et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Tahory et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Jansen et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Shen et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Steel et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
HO et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Cohen & Numa	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Gunst et al	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7

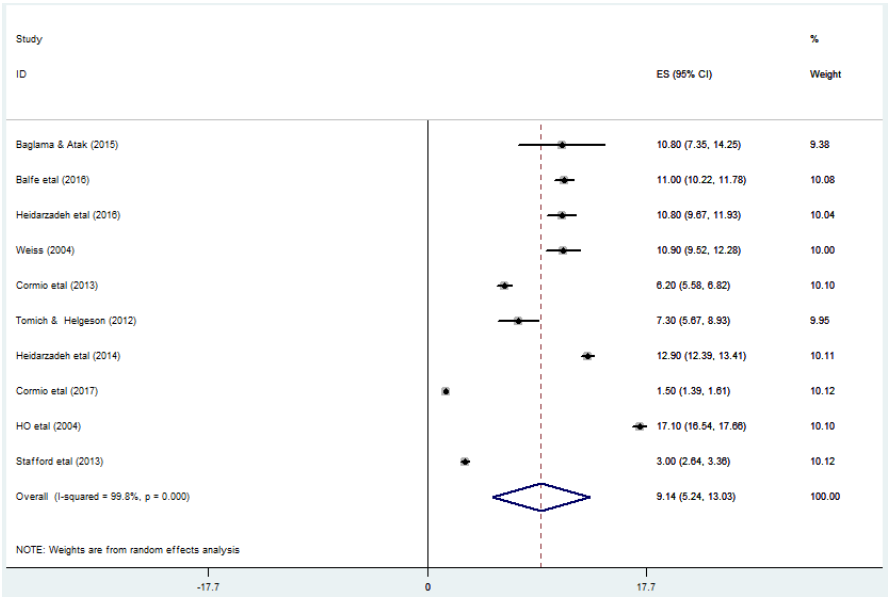

Figure 4. Forest plot of the "new possibilities" domain. The random-effects model was used to pool the overall mean and 95% confidence intervals (CIs). The diamond represents the pooled mean, and the squares and the horizontal lines, respectively, represent the mean and 95% CI of each study

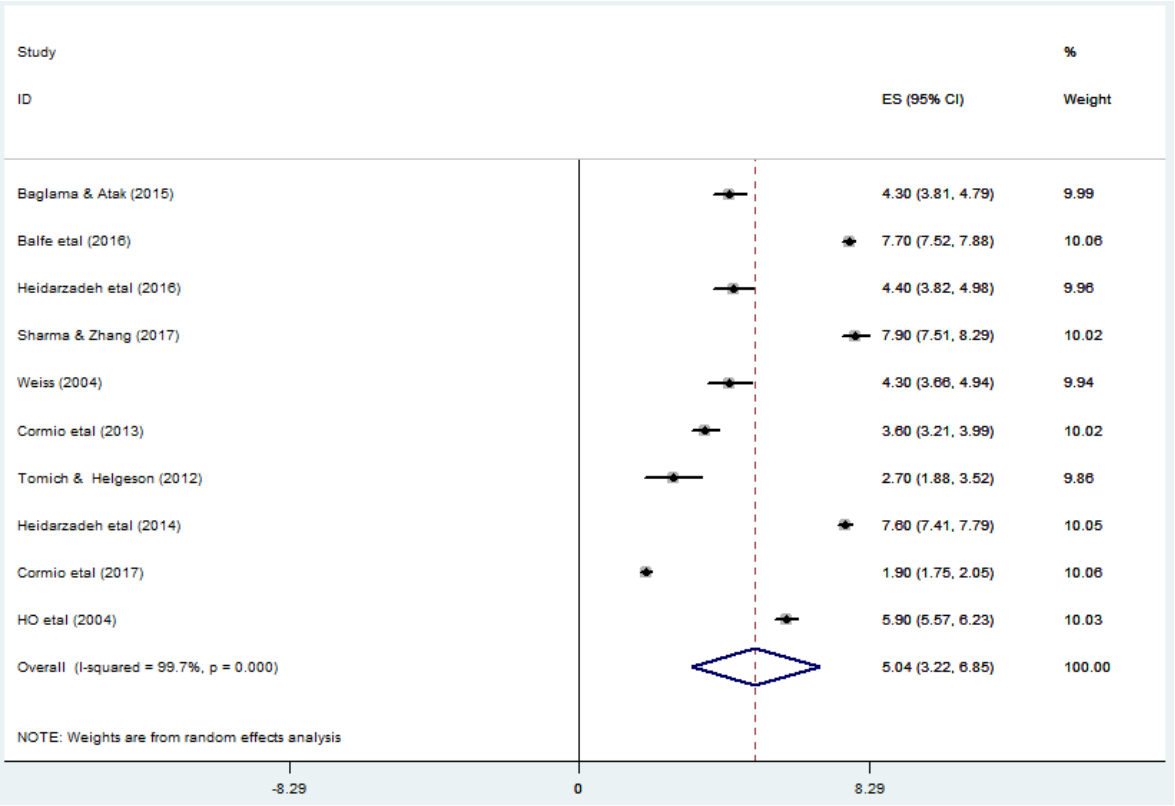

Figure 5. Forest plot of "spiritual change" domain. Subgroup analysis based on area. The random-effects model was used to pool the overall mean and 95% confidence intervals (CIs). The diamond represents the pooled mean, and the squares and the horizontal lines, respectively, represent the mean and 95% CI of each study.

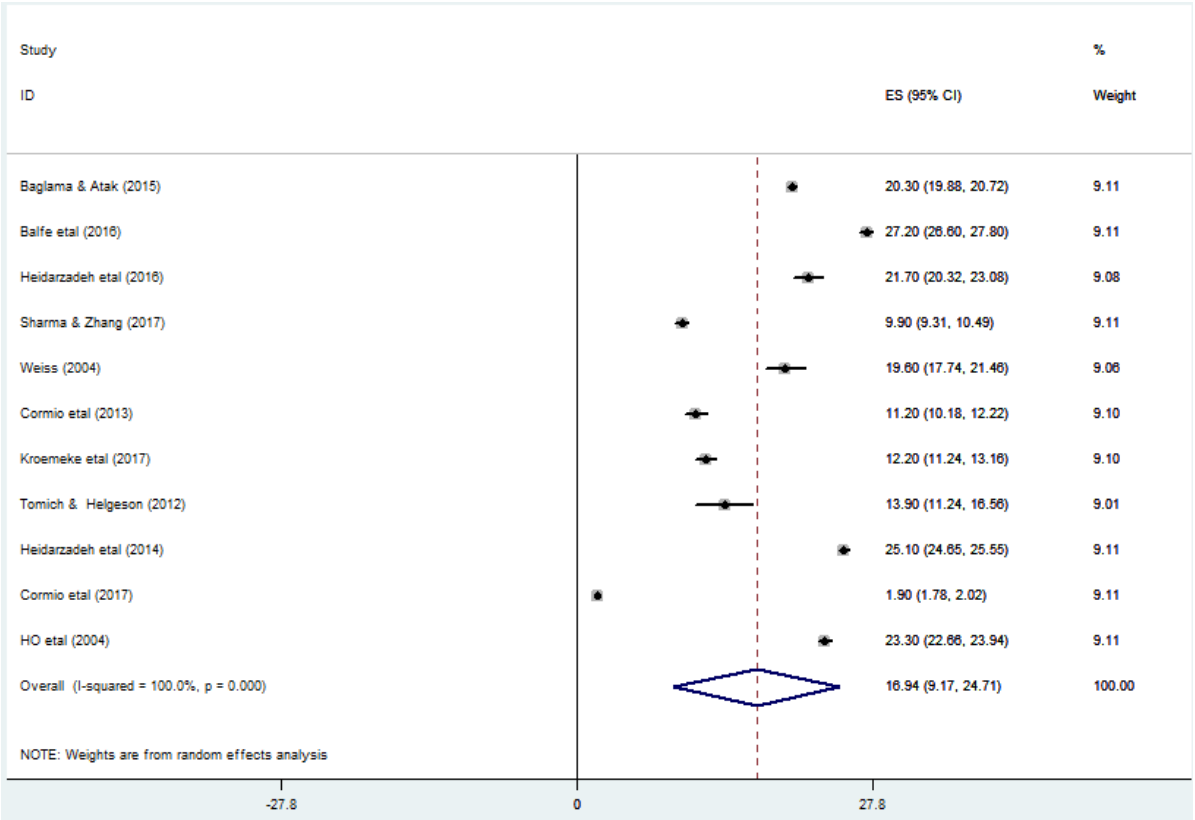

Figure 6. Forest plot of the "relating to others" domain. Subgroup analysis based on area. The random-effects model was used to pool the overall mean and 95% confidence intervals (CIs). The diamond represents the pooled mean, and the squares and the horizontal lines, respectively, represent the mean and 95% CI of each study.

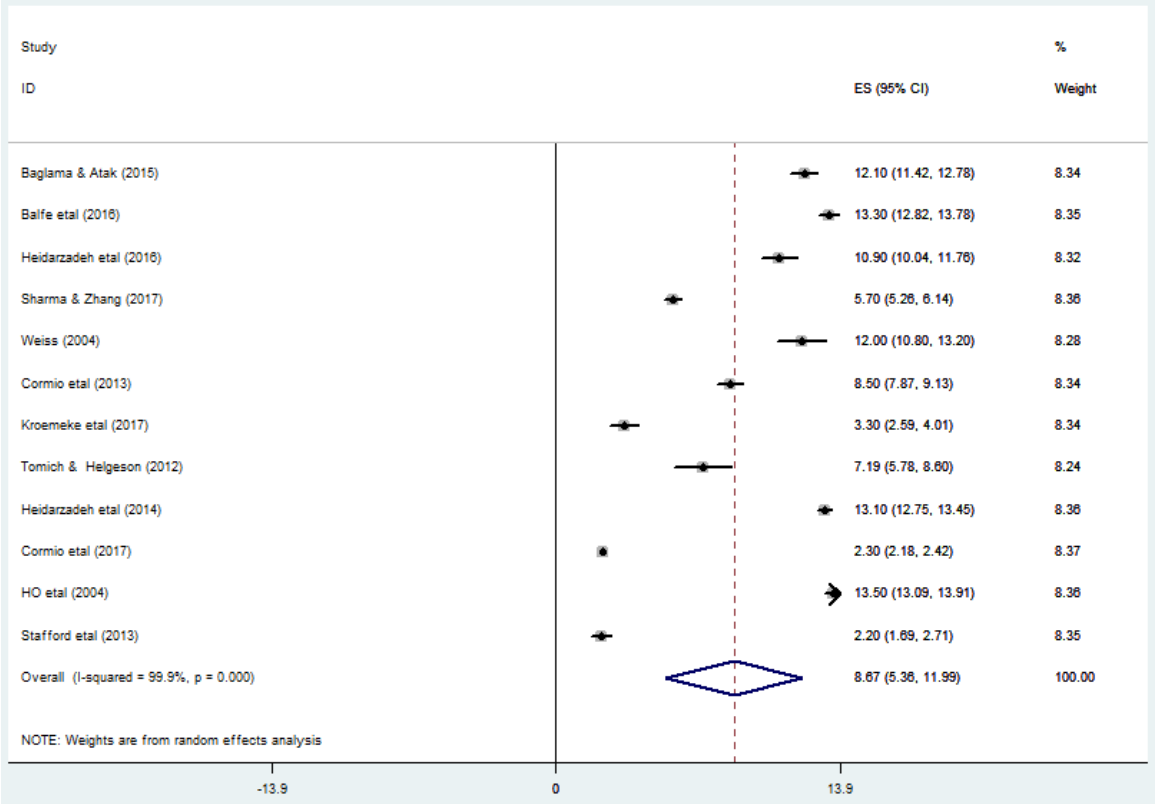

Figure 7. Forest plot of the "personal strength" domain. Subgroup analysis based on area. The random-effects model was used to pool the overall mean and 95% confidence intervals (CIs). The diamond represents the pooled mean, and the squares and the horizontal lines, respectively, represent the mean and 95% CI of each study

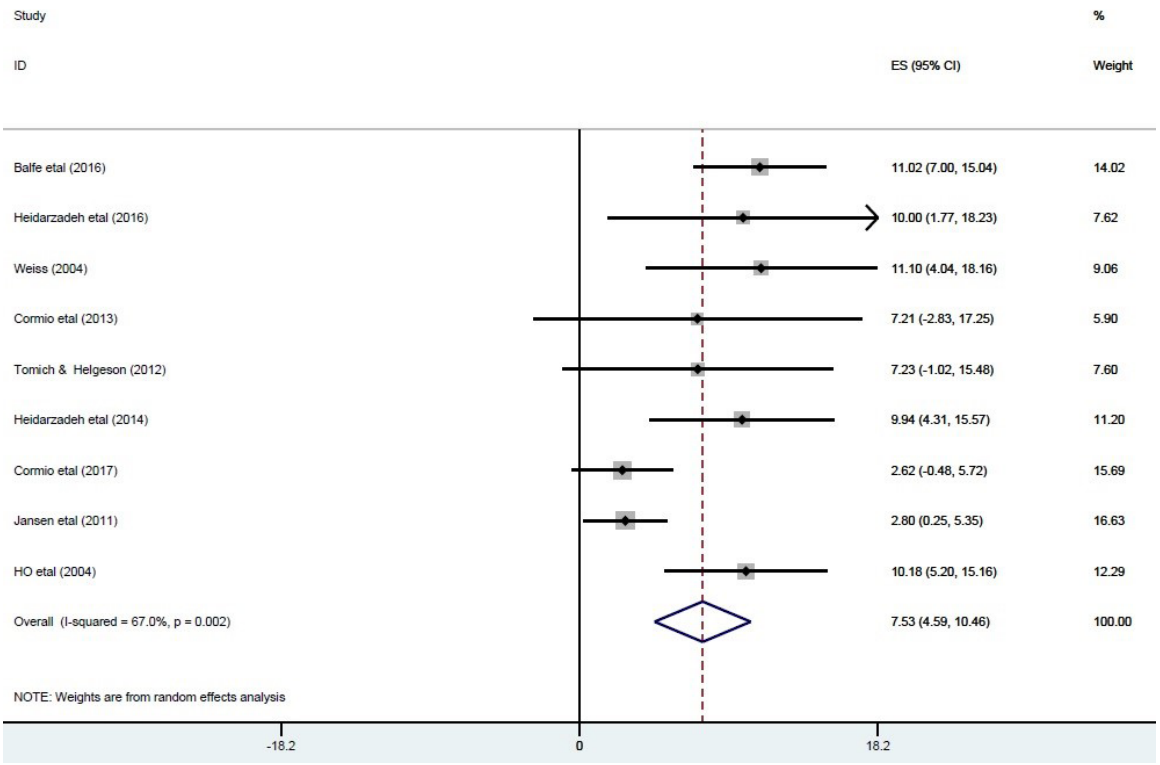

Figure 8. Forest plot of the "appreciation of life" domain. Subgroup analysis based on area. The random-effects model was used to pool the overall mean and 95% confidence intervals (CIs). The diamond represents the pooled mean, and the squares and the horizontal lines, respectively, represent the mean and 95% CI of each study .

diagnosis of cancer (baseline) and measuring PTG was different in these studies. It can be observed in the study of Steel et al (62), which measured these changes over time.

Thirteen studies analyzed the domains of PTG and showed that the mean score in the subscale of "new possibilities" was close to the study conducted in Korea in 2015 (64). Two studies in New York in 2013 (47,66) reported higher scores than the present study, while studies conducted in Italy (52) and Germany (55) showed lower scores.

Twelve articles showed that the mean score of "spiritual change" was consistent with the studies conducted by Baglama & Atak in Europe in 2015, Heidarzadeh in Asia in 2016, and Weiss in Europe in 2006 (22,45,60). Balfe et al and Sharma & Zhang in Asia (42,44) reported higher scores, and Cormio et al and Walsh et al in Europe (50,52) reported lower scores.

The mean score of "relating to others" was consistent with the results of studies by Cormio et al, Kroemeke et al in Europe, and Tomich & Helgeson in the United States (14,16,48,51). Ho et al, Thombre et al (65), Balfe et al (42), Heidarzadeh et al in Asia, and Weiss (45) in Europe reported higher scores.

Furthermore, the mean score of "personal strength" was close to the studies of Cormio et al (48) and Tomich & Helgeson (51) in the United States. Baglama & Atak (22) in Europe, Balfe et al (42), Heidarzadeh et al, Ho et al (41) in Asia, and Weiss (45) in Europe reported higher scores. However, Sharma & Zhang (44) and Stafford et al (39) in Asia, and Kroemeke et al (14) and Cormio et al (52) in Europe reported lower scores than the present study.

Conclusion

The results of this study showed that cancer patients might experience positive psychological changes. Recognition of the PTG, worsening of psychological problems of cancer patients, and improvement of their life quality demand the Ministry of Health to pay much more attention to treatment programs in hospitals. It is necessary to establish and reinforce supportive institutions and build a culture of adapting to all kinds of psychological problems in these patients.

Authors' Contribution

Conceptualization: MAF, Methodology: AH, Validation: AA, Formal Analysis: AH, Investigation: AH, Resources: MAF, Data Curation: AH, Writing—Original Draft Preparation: AH, MAF, Writing—Review and Editing: AA, Visualization: AH, Supervision: MAF, Project Administration: MAF, Funding Acquisition: MAF.

Conflict of Interests

The authors report no conflict of interest.

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