# Meta-analysis on the Impact of Positive Psychological Resources on Quality of Life in Cancer Patients

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**Research**

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# Abstract

**Purpose:** The main purpose of this study was to assess the evidence of the association between positive psychological resources and quality of life among cancer patients.

**Methods:** Electronic search was performed to retrieve articles from PubMed, Web of Science, CNKI and CBM (from inception to November 10, 2020). Summary correlation coefficient (*r*) values were extracted from each study, and 95% confidence intervals (95%CIs) were calculated by random-effect model. Subgroup and sensitivity analyses were performed to investigate potential heterogeneity.

**Results:** Forty-three articles were included in the present study. The pooled *r* for resilience was 0.52 (95%CI: 0.43, 0.62), hope 0.50 (95%CI: 0.44, 0.56), self-efficacy 0.54 (95%CI: 0.41, 0.63), self-esteem 0.45 (95%CI: 0.26, 0.64) and optimism 0.32 (95%CI: 0.17, 0.46). For subgroup analysis, the effects of hope and resilience varied with patients' age.

**Conclusion:** Our study indicated that cancer patients with high level of positive psychological resources tend to live a better quality of life. Therefore, interventions programs based on difference in age for cancer patients could be developed by increasing positive psychological resources in the future research.


# Introduction

Cancer has been ranked as the major cause of death in developed or less developed countries, which is known as the most important barrier of enhancing life expectancy. Although medical anti-cancer therapies, radio and surgical-oncology have improved, these in turn threaten both patients' mental health and quality of life. Previous studies indicate that patients suffering cancer feel more difficult in handling with the negative emotion and experienced a poorer quality of life during the disease-free survivor stage [1–3]. A number of side effects like aggressive cancer therapy, medical financial hardship, difficulties in accessing affordable medical health insurance and limited employment opportunities [4–7] are thought to be the main reason. Ultimately, cancer patients are vulnerable to threaten their physical and psychological well-being. However, a longitudinal study [8] reported that cancer survivors with high level psychological adaptation could better deal with the adversity in the course of disease, and had less psychiatric disorders, as well as better quality of life. Therefore, increasingly studies thought that positive psychological resources could help explain individual variation in quality of life in cancer survivors.

Positive psychological resources have been attached increasing attention to oncology field in the past 30 years. According to the literature review, resilience, hope, optimize, self-esteem and self-efficacy are defined as the important positive psychological variables in this field. Several studies showed that cancer patients with high level of resilience were more able to cope with disease adjustment and maintain mental health [5, 6, 8]. Resilience is considered as a developable capability characterized by a relatively stable psychological trait that reduces, adapts to and even overcomes the destructive impacts caused by adverse factors in the face of disasters or stressors. It is thought to be a certain promoting role in alleviating the negative impact of traumatic pressure on individuals and maintaining the normal psychological state of the body [9].

Snyder [10, 11] conceptualized hope as a positive motivational state based on inactively deprived sense of successful agency (achieving goals by available willpower and determination) and pathways (pursuing goals by creating alternative routines). Self-efficacy is defined as positive belief of individual competence to deal with adversities or achieve desired goals in the face of various stressful situations [12]. Furthermore, several studies have been confirmed that general self-efficacy has a bearing on cancer patients' adjustment and management [13, 14]. Optimism is a psychological trait that is considered as the degree of general expectation that positive outcomes will happen rather than bad things [15, 16]. Compared with pessimists, research in optimism stated that optimists are capable to adapt to and deal with the negative impacts of cancer by accepting the reality, placing the light and humors among cancer patients [17].

At present, an extensive body of research has found that positive psychological resources are associated with cancer survivors' quality of life and well-being. For instance, Li et al [18] found that hope and resilience were positively associated with quality of life in adult patients with bladder cancer. Besides, Chung et al [19] suggested that greater resilience was associated with better quality of life and lower depressive symptoms, and self-esteem was also significantly related to physical and psychological well-being in children with cancer. However, a small number of studies thought positive self-esteem and self-efficacy were not associated with quality of life [20, 21], or the association between them were pretty weak [22, 23]. Differences in demographic variables of participants, disease characteristics, measuring method and study quality have been considered to induce the variability in referred study.

In sum, the present study aims to conduct a meta-analytic review containing all studies with cancer patients, which would investigate associations between positive psychological resources and quality of life. A broad review of literatures has been reviewed and five positive psychological resources identified. Meta-analysis is adopted to identify which resources are associated with quality of life among cancer patients.

## Methods

# Study selection and procedures

According to the PRISM statement [24], the present meta-analysis was performed and was registered with PROSPERO (CRD42021228033). An electronic search was conducted to retrieve articles from PubMed, Web of Science, CNKI and CBM (from inception to November 10, 2020). In addition, relevant references were included by screening manually with no limitations in languages. Our meta-analysis used these search terms: ("neoplasms"[MeSH Terms] OR "tumor" [Title/Abstract] OR "cancer"[Title/Abstract] OR "oncology" [Title/Abstract] OR "leukemia"[Title/Abstract] OR "lymphoma"[Title/Abstract] OR "myeloma"[Title/ Abstract] OR "myelodysplastic syndrome"[Title/Abstract] OR "MDS"[Title/Abstract]) AND ("resilience"[Title/ Abstract] OR "hope"[Title/Abstract] OR "optimism"[Title/ Abstract] OR "self-efficacy"[Title/Abstract] OR "self-esteem" [Title/Abstract]) AND ("quality of life" [Title/Abstract] OR "life quality"[Title/Abstract]). Articles that explored the association of positive psychological resources with quality of life in cancer survivors have been included. But case reports, review articles, comments and letters have been excluded. Moreover, our study excludes duplicate publications on the same study participants.

The primary data of eligible articles were extracted by three authors independently. The primary data included the name of first author, the year of publication, study location, sample size, the mean age of participants, cancer types, and the measuring methods of quality of life, and Spearman and Pearson correlation coefficient (*r*).

Study quality was assessed by Joanna Briggs Institute (JBI) guidelines [25]. The JBI guidelines contain 10 items: purpose of the study, sampling method, characteristic description, reliability and validity of tool, authenticity of information, ethical issues, statistical analysis, statement of results and research value. It is scored from 0 to 2 (0 = “not meeting the requirements”, 1= “mentioned but not described in detail”, 2= “detailed and comprehensive description”), and the total score ranges from 0 to 20. When literature score > of the maximum total score 70%, it can be considered that the study quality is in a relatively high level. Two authors evaluated the study quality of included articles, and the third author solved disagreements in this meta-analysis.

# Statistical analysis

Heterogeneity was tested by Q statistic ($P < 0.05$ = heterogeneity) and inconsistency index ($I^2$ > 50%=heterogeneity) [26–28], and publication was tested by Egger method [29] ($P < 0.05$ = publication bias). Random-effect model was used rather than fixed-effect model due to high heterogeneity [30]. Subgroup analysis was used to find whether effects were related to the factors like participants group. In addition, sensitivity analysis was used to adjust for one possible atypical study.

R V4.0.2 was used to perform meta-analysis in this study.

# Results

Our meta-analysis retrieved 6205 results. A total of 6162 studies were excluded due to duplicate, review and meta-analysis, meeting, clinical trial, book and document, and based on title and abstract and full-text. Finally, there were 43 [1, 2, 18–23, 31–65] articles in our study (Fig. 1). All articles presented clear research purpose, sufficient research basis, authentic information, correct statistical analysis method, appropriate and correct statement of analysis result and research value. Only two articles adopted random sampling, and others used convenient sampling; 39 articles had clear inclusion and exclusion criteria; 41 articles clearly descripted characteristic of participants; 37 articles used measurement tools that were good reliability and validity; 19 articles indicated ethical issues (Table 1).

Table 1
Overview of included studies

| Study | Location | Sample size | Mean age (year) | Cancer type | Method of measuring life quality | Positive psychological resources | Study quality |
|---|---|---|---|---|---|---|---|
| Perez-Tejada et al 2021 [2] | Spain | 134 | 54.4 | Breast | QLACS | Self-esteem | 19 |
| Chung et al 2020 [19] | Hong Kong | 138 | 10.6 | Leukemia or Brain tumor or Lymphoma | PedsOL 3.0 | Resilience and self-esteem | 18 |
| Shen et al 2020 [31] | China | 121 | 47.01 | Breast | FACT-B | Hope and self-efficacy | 17 |
| Jiao et al 2020 [32] | China | 160 | NR | Colorectal | EORTC QLQ-C30 | Resilience | 18 |
| Zhang et al 2020 [33] | China | 230 | 56.13 | Oral | FACT-H&N | Hope | 19 |
| Groarke et al 2020 [34] | UK | 204 | 65.24 | Prostate | PORPUS-P | Resilience | 18 |
| Ho et al 2019 [35] | Hong Kong | 176 | 12.56 | Mixed | PedsOL 4.0 | Hope and self-esteem | 19 |
| Chen et al 2019 [36] | China | 100 | 45.65 | Cervical, endometrial, ovarian | FACT-G | Resilience | 18 |
| Clarke et al 2019 [37] | UK | 98 | 64 | Head and neck | UW-QoL | Resilience | 18 |
| Vidthya et al 2019 [23] | Malaysia | 953 | 46.45 | Mixed | WHOQOL-BREF | Self-esteem | 17 |
| He et al 2019 [38] | China | 284 | 49 | Lung, breast and liver | EORTC QLQ-C30 | Resilience | 18 |
| Sharour et al 2019 [39] | Jordan | 320 | 51.9 | Colorectal | FACT-C | Hope | 19 |

GCGM = DISABKIDS Chronic Generic Measure. EORTC QLQ = European Organization for Research and Treatment of cancer quality of life, Questionnaire. EQ-5D = European Quality of Life-5 Dimensions. FACT-B = Functional Assessment of Cancer Therapy Breast cancer. FACT-BL = Functional Assessment of Cancer Therapy-Bladder. FACT-C = Functional Assessment of Cancer Therapy-Colorectal cancer. FACT-G = Functional Assessment of Cancer Therapy-General. FACT-H&N = Functional Assessment of Cancer Therapy-Head and Neck. FACT-Hep = Functional Assessment of Cancer Therapy-Hepatobiliary. FACT-L = Functional Assessment of Cancer Therapy-Lung. FLIC = Functional Living Index-Cancer. LASA = Linear Analogue Scale Assessment. MMQL-AF = Minneapolis-Manchester Quality of Life Instrument-Adolescent Form. MQOL = McGill Quality of Life Questionnaire. MQOL-C = Multidimensional Quality of Life Scale-Cancer. PedsQL = Pediatric Quality-of-Life. QLACS = Quality of Life in Adult Cancer Survivors. QLI = Quality-of-Life Index. QOL-CS = Quality of Life-Cancer Survivors. SF = Short Form. UW-QoL = University of Washington quality of life. WHOQOL-BREF = World Health Organization' s Quality of Life Questionnaire-Brief.

| Study | Location | Sample size | Mean age (year) | Cancer type | Method of measuring life quality | Positive psychological resources | Study quality |
|---|---|---|---|---|---|---|---|
| Gyeong et al 2019 [40] | Korea | 204 | 54.2 | Mixed | SF-36 | Self-efficacy | 18 |
| McAteer et al 2019 [41] | UK | 286 | 67 | Prostate | FACT-G | Self-esteem | 19 |
| Tonsing et al 2018 [21] | Singapore | 129 | 17.2 | Mixed | QoL-CSS | Self-esteem | 17 |
| Johansson et al 2018 [42] | Sweden | 39 | 71.7 | Colorectal | EORTC QLQ-C30 | Self-efficacy | 19 |
| Martins et al 2018 [43] | Portugal | 211 | 13.29 | Mixed | DCGM-12 | Hope | 19 |
| Omran et al 2018 [44] | USA | 341 | 57.9 | Mixed | MQOL-C | Self-efficacy | 18 |
| Chen et al 2018 [1] | China | 452 | 62.1 | Lung | SF-36 | Self-efficacy | 19 |
| Zhang et al 2017 [45] | China | 98 | 47.02 | Breast | FACT-B | Resilience | 19 |
| Koch et al 2017 [46] | Germany | 40 | 49.2 | Breast | FACT-B | Self-esteem | 19 |
| Finck et al 2017 [47] | Germany | 95 | 55.7 | Breast | EORTC QLQ-C30 | Optimism | 19 |
| Chen et al 2017 [48] | China | 273 | 46.91 | Breast | FACT-B | Resilience | 17 |
| Wang et al 2017 [49] | China | 206 | 54.6 | Mixed | QOL-CS | Self-efficacy | 17 |
| Thieme et al 2017 [22] | Germany | 354 | 61.2 | Breast and gynecological | EORTC QLQ-C30 | Optimism and self-efficacy | 17 |

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| Study | Location | Sample size | Mean age (year) | Cancer type | Method of measuring life quality | Positive psychological resources | Study quality |
|---|---|---|---|---|---|---|---|
| Hu et al 2016 [50] | China | 193 | NR | Liver cancer | FACT-Hep | Hope | 17 |
| Gong et al 2016 [51] | China | 265 | 50.24 | Cervical | WHOQOL-BREF | Hope | 18 |
| Li et al 2016 [18] | China | 365 | 63.76 | Bladder | FACT-BL | Resilience and hope | 19 |
| Wu et al 2015 [52] | Taiwan | 40 | 16.4 | Mixed | MMOL-AF | Resilience | 18 |
| Zhang et al 2015 [53] | China | 147 | 57.51 | Lung | FACT-L | Self-efficacy | 18 |
| Jun et al 2015 [54] | Korea | 205 | 54.8 | Mixed | EORTC QLQ-C30 | Self-esteem and resilience | 18 |
| Schofield et al 2015 [55] | Australia | 429 | 67 | Metastatic colorectal | EQ-5D | Hope | 18 |
| Ha et al 2014 [56] | Korea | 129 | 52.09 | Breast | FACT-B | Resilience | 18 |
| Ye et al 2014 [57] | China | 193 | 55.46 | Mixed | FACT-G | Hope | 18 |
| Yeung et al 2014 [58] | China | 238 | 55.7 | Mixed | QOL-CS | Self-efficacy | 17 |
| Sjoquist et al 2013 [59] | Australia | 126 | 62.1 | Ovarian | FACT-G | Hope | 17 |
| Wu et al 2013 [60] | China | 224 | 47.54 | Breast | FACT-B | Hope | 17 |
| Colby et al 2012 [61] | USA | 51 | 58.47 | Breast | FLIC | Optimism | 18 |
| Mystakidou et al 2012 [20] | Greece | 90 | 61.17 | Breast | LASA | Self-efficacy | 18 |

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| Study | Location | Sample size | Mean age (year) | Cancer type | Method of measuring life quality | Positive psychological resources | Study quality |
|---|---|---|---|---|---|---|---|
| Hass et al 2011[62] | USA | 73 | 60.12 | Breast | MQOL | Self-efficacy | 19 |
| Mazanec et al 2010 [63] | Frances | 163 | 58.24 | Mixed | FACT-G | Optimism | 17 |
| Wong et al 2007 [64] | Hong Kong | 334 | 64.66 | Lung | FACT-G | Optimism | 18 |
| Lee et al 2001 [65] | Taiwan | 150 | 44.8 | Breast | OLI-cancer | Self-esteem | 17 |

GCGM = DISABKIDS Chronic Generic Measure. EORTC QLQ = European Organization for Research and Treatment of cancer quality of life, Questionnaire. EQ-5D = European Quality of Life-5 Dimensions. FACT-B = Functional Assessment of Cancer Therapy Breast cancer. FACT-BL = Functional Assessment of Cancer Therapy-Bladder. FACT-C = Functional Assessment of Cancer Therapy-Colorectal cancer. FACT-G = Functional Assessment of Cancer Therapy-General. FACT-H&N = Functional Assessment of Cancer Therapy-Head and Neck. FACT-Hep = Functional Assessment of Cancer Therapy-Hepatobiliary. FACT-L = Functional Assessment of Cancer Therapy-Lung. FLIC = Functional Living Index-Cancer. LASA = Linear Analogue Scale Assessment. MMQL-AF = Minneapolis-Manchester Quality of Life Instrument-Adolescent Form. MQOL = McGill Quality of Life Questionnaire. MQOL-C = Multidimensional Quality of Life Scale-Cancer. PedsQL = Pediatric Quality-of-Life. QLACS = Quality of Life in Adult Cancer Survivors. QLI = Quality-of-Life Index. QOL-CS = Quality of Life-Cancer Survivors. SF = Short Form. UW-QoL = University of Washington quality of life. WHOQOL-BREF = World Health Organization' s Quality of Life Questionnaire-Brief.

# Resilience and quality of life

Twelve studies involving 2094 cancer patients examined the association of resilience with quality of life. The meta-analysis of these studies found a large and significant overall effect size of $r = 0.52$ with confidence intervals excluding zero (95%*CI*: 0.43, 0.62) (Fig. 2). In addition, the results of subgroup analysis indicated that the impact of resilience on quality of life was larger for studies based in children and adolescent with cancer ($k = 2$, $r = 0.68$, 95%*CI*: 0.53, 0.83) than adult with cancer ($k = 9$, $r = 0.49$, 95%*CI*: 0.44, 0.54) (Table 2).

Table 2
Subgroup analysis

| Subgroup | *k* | *r* (95%CI) | $I^2$ (%) | *P*-value |
|---|---|---|---|---|
| **Hope** | | | | |
| Participants | | | | 0.044 |
| Children or adolescent samples | 4 | 0.57 (0.49, 0.64) | 21.8 | |
| Adult samples | 7 | 0.48 (0.44, 0.52) | 68.0 | |
| **Resilience** | | | | |
| Participants | | | | 0.017 |
| Children or adolescent samples | 2 | 0.68 (0.53, 0.83) | 0.0 | |
| Adult samples | 9 | 0.49 (0.44, 0.54) | 80.9 | |
| **Self-esteem** | | | | |
| Participants | | | | 0.184 |
| Children or adolescent samples | 3 | 0.43 (0.33, 0.52) | 89.1 | |
| Adult samples | 6 | 0.35 (0.31, 0.40) | 95.8 | |

# Hope and quality of life

The meta-analysis of twelve studies involving 2853 patients with cancer, revealed a large and significant overall effect size of $r = 0.50$ with confidence intervals excluding zero (95%*CI*: 0.44, 0.56) (Fig. 2). In subgroup analysis, differences were found between the effects of hope for studies based in in children and adolescent group ($k = 4$, $r = 0.57$, 95%*CI*: 0.49, 0.64) as compared to adult group ($k = 7$, $r = 0.48$, 95%*CI*: 0.44, 0.52) (Table 2).

# Self-esteem and quality of life

Nine studies, involving 2211 cancer patients, examined the relation between self-esteem and quality of life, and yielded a significant and medium overall effect size of $r = 0.45$ with confidence intervals excluding zero (95%*CI*: 0.26, 0.64) (Fig. 2). Differences were not found between the effects of self-esteem on quality of life in subgroup analysis (Table 2).

# Self-efficacy and quality of life

Eleven studies involving 2265 patients with cancer examined the association of self-efficacy with quality of life. The current meta-analysis of these studies yielded a significant and large effect size of $r = 0.54$ with confidence intervals excluding zero (95%*CI*: 0.41, 0.68) (Fig. 2).

# Optimism and quality of life

Five studies, involving 997 cancer patients, examined the relation between self-esteem and quality of life, and yielded a significant and medium overall effect size of $r = 0.32$ with all confidence intervals excluding zero (95%*CI*: 0.17, 0.46) (Fig. 2) and thus statistically significant.

# Sensitivity analysis and publication bias

Sensitivity analysis showed that all the pooled $r$ for quality of life in cancer patients were stable, which indicated that our results were reliable. The result of the Egger test indicated that there was publication bias in this meta-analysis (hope: $P = 0.733$; resilience: $P = 0.246$; self-efficacy: $P = 0.626$; self-esteem: $P = 0.545$; optimism: $P = 0.078$).

## Discussion

The purpose of the present study was to conduct a meta-analysis of empirical literatures on association of positive psychological resources with quality of life among cancer patients. Five positive psychological variables and cancer patients' quality of life were organized in the current study. The meta-analysis showed that cancer patients' quality of life was positively and significantly associated with hope ($r = 0.50$), resilience ($r = 0.52$), self-efficacy ($r = 0.54$), self-esteem ($r = 0.45$) and optimism ($r = 0.32$), which were consistent with previous theory [10, 66–69].

# Self-efficacy and quality of life among cancer patients

The meta-analysis presented that highly efficacious cancer patients tended to live a better quality of life throughout the course of suffering cancer. The result was consistent with previous study, for instance in a recent meta-analytic review by Andrea et al involving 3162 cancer patients, there was a large significant overall effect size of $r = 0.73$ for the association of self-efficacy with quality of life [70]. The reason could be highly efficacious cancer patients characterized by sense of agency or control may perceive some causal relationship between coping behaviors executed and certain desired outcomes, including level of type of quality of life [71]. Future research may benefit from addressing the question of how self-efficacy interacts with other factors to affect quality of life in cancer patients. For example, a study found that self-efficacy for coping moderated the effect of distress on quality of life among breast cancer patients [72].

# Resilience and quality of life in patients with cancer

Results from the meta-analysis indicated that highly resilient cancer patients could remain the better life quality, compared to low resilient individuals. Evidence suggests that high-resilient people strategically elicit positive emotions through the use of humor, relaxation techniques, and optimistic thinking in order to proactively cultivate their positive emotionality [68]. Then, positive emotionality emerges as the crucial element of resilience. It was found that resilience had indirect impact on cancer patients' quality of life by influencing social support, in addition to direct impact [45]. Besides, resilience was found to be associated with lower psychological distress and fatigue among patients and survivors with cancer [73].

Subgroup analysis indicated that the relationship between resilience and quality of life among cancer patients was affected by age. Correlation of adolescent or children sample was significantly larger

compared to adult sample, and the correlation of both groups was significant. Risks of loneliness and psychological distress rise with age for the elderly owing to the self-neglect and physical degradation, while resilience can effectively cope with these symptoms and enhance the quality of life, which was a crucial factor for successful aging [74, 75]. However, it was inconsistent with previous study [76]. The result of adolescent or children sample might be overweight or inaccurate due to the small number of this group ($k$ = 2). Thereby, future research may benefit from examining the effect of age on the association of resilience with quality of life.

# Hope and quality of life in patients with cancer

The present meta-analysis indicated that cancer patients high in hope tended to show better health outcomes, such as quality of life. According to the theory of Snyder, hope is conceptualized as a positive motivational state based on interactively derived sense of successful agency (goal-directed energy) and pathways (planning to meet goals) [10, 11]. Rousseau [77] found that hope could be developed by learning to control one's symptoms, exploring one's faith, and strengthening interpersonal relationships. It was also found in another study that individuals full of hope reported significantly higher levels of personal adjustment and global life satisfaction, and less psychological distress [78]. Subgroup analysis indicated that the effect of hope varied with the change of patients' age. The impact of hope on quality of life was more significant on studies based in children and adolescent with cancer than adult suffering cancer. Furthermore, few studies aimed to explore the effect of hope on quality of life in children and adolescent with cancer. Therefore, future studies may benefit from efforts to increase or develop patients' levels of hope through psychological treatment, and focus on investigating the impact on children and adolescent with cancer.

# Optimism and quality of life in patients with cancer

The meta-analysis reported that optimistic patients lived a better quality of life among cancer patients. The optimistic attitude plays a crucial role in effectively coping with disease diagnosis, treatment and prognosis, as well as in enhancing quality of life [77]. Furthermore, comparing with pessimists, optimistic cancer patients reported greater survival rates a year after diagnosis [79]. Most of studies investigated the effect of optimism on quality of life in adult patients with cancer, but few studies examined the association among children and adolescent patients. Hence, future studies can benefit from examining the impact of optimism on quality of life in children and adolescent.

# Self-esteem and quality of life in cancer patients

Results of the current meta-analysis showed that the more self-esteem experience by cancer patients, the higher quality of life. many studies have indicated that patients with cancer had the low to moderate level of self-esteem [80–82]. Low self-esteem patients mean self-contempt, self-disappointment, self-rejection and lack self-respect for themselves. Based on the theory of Rosenberg [83], high level of self-esteem implies that they have high self-respect for who they are within limits, and do not assume that they are more superior in any way than anyone else. Cancer diagnosis has the tendency of affecting the patients' body image, which negatively results in changes in self-esteem. Even the easiest daily routine may be disrupted and patients need to be aware of these long-term consequences negatively influencing their level of self-esteem. The

results of subgroup analysis reported that the differences of age in the relationship between self-esteem and quality of life among cancer patients was non-existent, which was not similar to prior study [23]. The result might be overweight or inaccurate due to the small number of this group. Thus, further research should focus on the effect of age on the association of self-esteem with quality of life in cancer patients.

# Limitation

The present meta-analysis has some limitations. Firstly, a dearth of longitudinal study exists on positive psychological resources and quality of life among cancer patients. Although cross-sectional study is easier to perform, longitudinal study is more valuable in terms of answering questions concerning the long-term relations between positive psychological resources and quality of life in patients with cancer. Secondly, the subgroup analysis of the children or adolescent group and the adult group could not be performed for every meta-analysis in the present study with limitations of number of studies concerning the association of self-efficacy and optimism with quality of life among cancer patients. Hence, there is a need for additional research on the impact of self-efficacy and optimism on quality in children or adolescent with cancer. Besides, although our study has investigated each positive psychological resource individually, it is significant to recognize that some positive psychological variables may covary. For instance, individuals relatively full of hope tend to effectively buffer the impact of stressful and negative life events, and successfully their goals could be achieved so that they possess more resilience [84]. Thus, hope might trump the effects of resilience on quality of life. Moreover, the optimistic attitude inherent in hopeful individuals plays a crucial role in improving health-related quality of life. Therefore, further research may examine their covariation and unique and interactive relation with quality of life among cancer patients. Finally, most studies were written by English in the current study, which may lead to language bias. However, Thornton and Lee thought that there was similar bias in all meta-analysis that not review all studies. Therefore, despite of the limitations, our study's outcomes are reliable and warranted.

# Clinical implications

Although these five variables are defined in different models, they may affect mental health and quality of life among cancer patients by different mechanisms, they have two significant points in common. Namely, these constructs are positive coping styles or protective factors to fight cancers, and they are dynamic and developmental resources. Therefore, these variables could be increased though intervention in order to better improve quality of life in cancer patients. Furthermore, increasingly research have found that interventions based on positive psychological resources could cope with mental problems and enhance quality of life in cancer patients. For example, in randomized and controlled trail, Promoting Resilience in Stress Management (PRISM), a psychosocial intervention for adolescents and young adults with cancer, enhances resilience resources via four skills-based training sessions, compared to usual care (UC) may improve health-related quality of life, especially in psychosocial domains of wellbeing [85]. Hope is a positive psychological variable related to better quality of life that focuses on goal-oriented thinking. Carla et al [86] developed and tested Achieving Wellness After Kancer in Early life (AWAKE), a scalable 8-week app-based program consisting of educational videos, mood/activity tracking, and telephone-based coaching to promote hope and quality of life in young adult cancer survivors, which evidences that the AWAKE supports patients cope with cancer-related sequelae and reestablish goals across life domains after experiencing cancer. Evidence

suggests that nurse-administered self-efficacy intervention given on five monthly occasions and designed to enhance patients' self-care self-efficacy have significantly higher scores on quality of life and self-care self-efficacy than the control group and significantly less symptom distress [87]. Besides, beauty care intervention [88] and Framed Portrait Experience intervention [89] are similar to enhance self-esteem and self-efficacy among cancer patients. Therefore, interventions based on positive psychology constructs should be emphasized and developed in the field of oncology psychology in order to treat psychological disorders and enhance quality of life.

# Conclusions

The current meta-analysis provided a comprehensive summary of the current literature on positive psychological resources and quality of life among cancer patients. Results of our study indicated that cancer patients with high level of positive psychological resources tend to live a better quality of life. The effects of resilience and hope on quality of life varied with patients' age. Finally, interventions programs for cancer patients could be developed by increasing positive psychological resources in the future research.

# Declarations

### Competing interests

The authors declare that there are no competing interests.


### Funding

There was no funding support.


### Ethical approval and informed consent

Not applicable

### Compliance with ethical standards

### Data availability

All data generated or analyzed during this study are included in this published article.

### Author contributions

XX. Zhao searched databases, selected studies, extracted information, assessed study quality, analyzed data, drafted, and revised manuscript. SQ. Tong contributed to study selection, data extraction and quality assessment. XX. Zhao and Y. Yang assessed study and revised manuscript. Y. Yang conceived the hypothesis, developed the study methods, and revised manuscript. All authors read and approved the final manuscript.

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# Figures

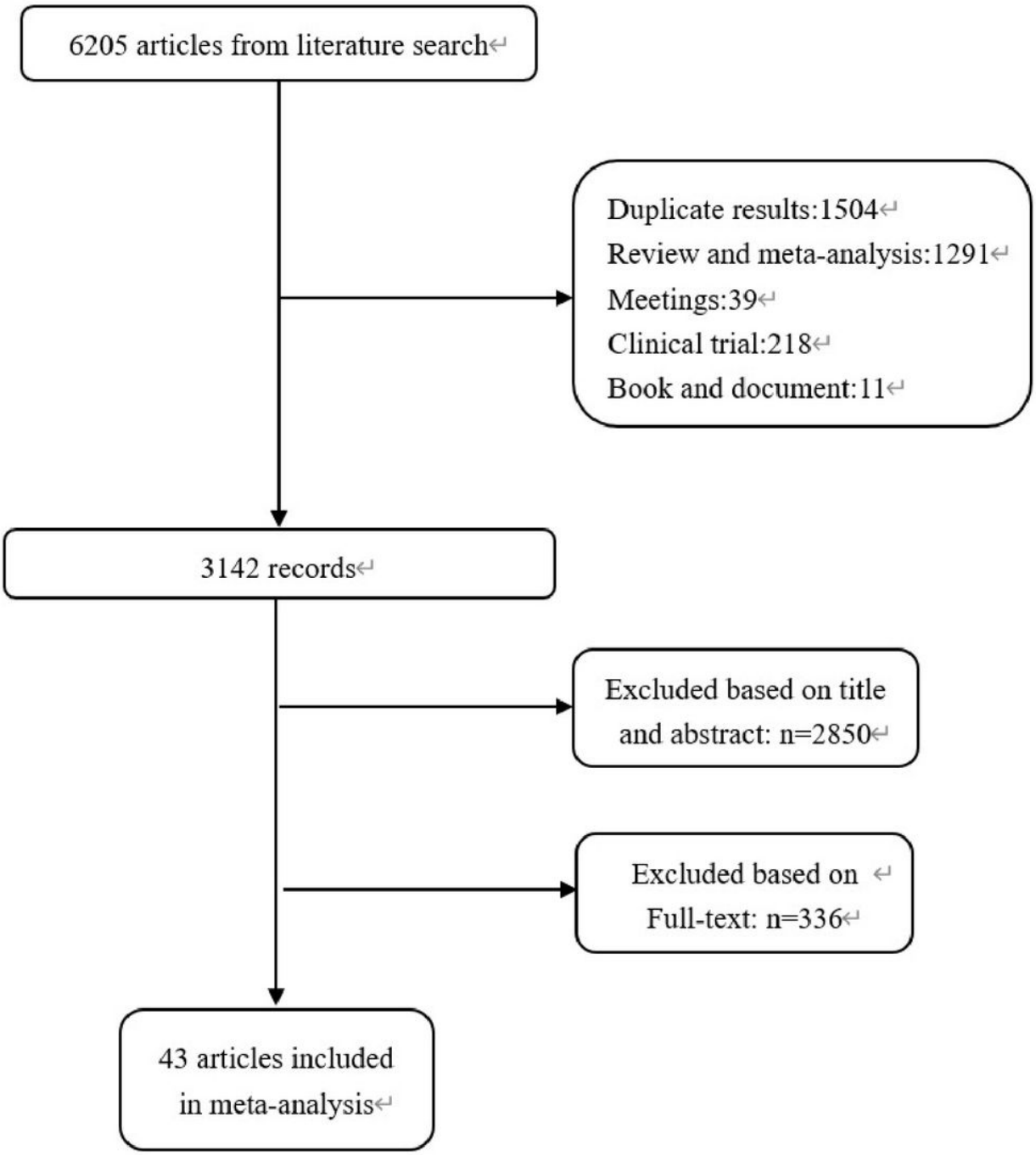
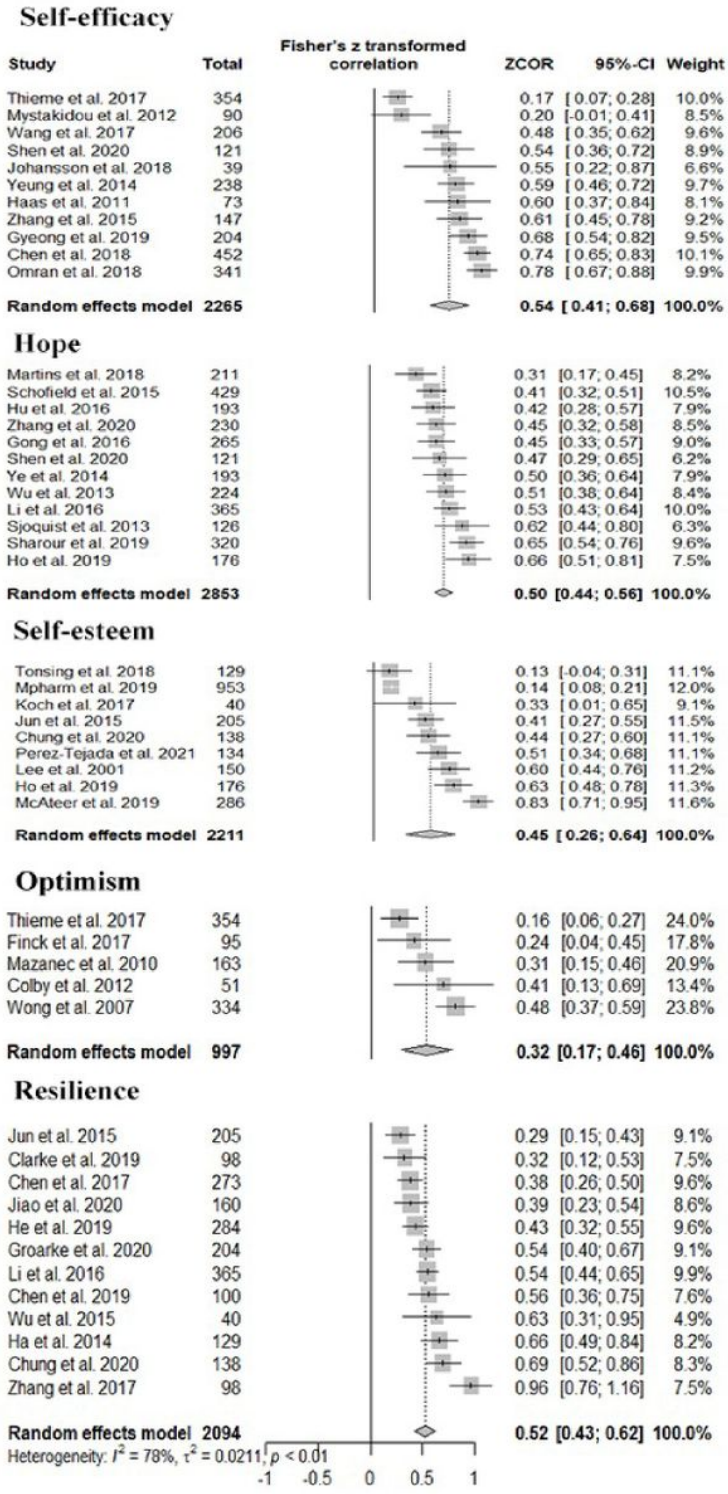



**Figure 1**

Study flow diagram




## Figure 2

Effect sizes of the correlation between five positive psychological resources and quality of life