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Review

Correlated factors of posttraumatic growth in patients with colorectal cancer: A systematic review and meta-analysis

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ABSTRACT

Objectives: This systematic review and meta-analysis aimed to identify and synthesize the factors correlated with posttraumatic growth (PTG) in patients with colorectal cancer (CRC).
Methods: PubMed, Web of Science, Embase, PsycINFO, CINAHL, Cochrane Library, China National Knowledge Infrastructure (CNKI), Wanfang database, China Science and Technology Journal Database (VIP) and SinoMed were searched for studies that reported data on the correlated factors associated with PTG in patients with CRC from inception to September 3, 2024. The methodological quality of the included studies was assessed via the Agency for Healthcare Research and Quality (AHRQ) methodology checklist and the Newcastle-Ottawa Scale (NOS). Pearson correlation coefficient (r) was utilized to indicate effect size. Meta-analysis was conducted in R Studio.
Results: Thirty-one eligible studies encompassing 6,400 participants were included in this review. Correlated factors were identified to be significantly associated with PTG in patients with CRC including demographic factors: residential area ($r = 0.13$), marital status ($r = 0.10$), employment status ($r = 0.18$), education level ($r = 0.19$), income level ($r = 0.16$); disease-related factors: time since surgery ($r = 0.17$), stoma-related complications ($r = 0.14$), health-promoting behavior ($r = 0.46$), and sexual function ($r = 0.17$); psychosocial factors: confrontation coping ($r = 0.68$), avoidance coping ($r = -0.65$), deliberate rumination ($r = 0.56$), social support ($r = 0.47$), family function ($r = 0.50$), resilience ($r = 0.53$), self-efficacy ($r = 0.91$), self-compassion ($r = -0.32$), psychosocial adjustment ($r = 0.39$), gratitude ($r = 0.45$), stigma ($r = -0.65$), self-perceived burden ($r = -0.31$), fear of cancer recurrence ($r = -0.45$); and quality of life ($r = 0.32$).
Conclusions: This meta-analysis identified 23 factors associated with PTG in CRC patients. Medical workers can combine those relevant factors from the perspective of positive psychology, further explore the occurrence and development mechanism of PTG, and establish targeted interventions to promote PTG.

What is known?

- The posttraumatic growth (PTG) perceived by cancer patients after treatment has attracted much attention from researchers.
- Multiple factors are correlated with the PTG of patients with colorectal cancer (CRC), and there are inconsistencies among several studies.

What is new?

- This comprehensive meta-analysis reveals 23 factors correlated with PTG in CRC patients, including five demographic factors, four disease-related factors, 13 psychosocial factors, and quality of life.
- This systematic review and meta-analysis provide evidence that can inform the development of future intervention strategies, thereby facilitating and enhancing PTG in patients with CRC.

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1. Introduction

Colorectal cancer (CRC) is the third most commonly diagnosed cancer and the second leading cause of mortality worldwide [1]. The burden of CRC is rapidly increasing, and the incidence of CRC is anticipated to rise to 3.2 million new cases and 1.6 million deaths by 2040 [2]. With early diagnosis and advances in treatment modalities prolonging the survival of individuals with CRC, an increasing number of survivors experience a wide range of physical, psychological, and socioeconomic effects that impact their overall well-being long after cancer treatment [3]. These effects include bowel dysfunction, changes in bowel movement related to defecation, sexual dysfunction, cognitive dysfunction, sleep disturbance, fatigue, and pain, which can lead to poor quality of life [4–6], impede the ability to return to work and increase financial burdens. For some patients, a stoma can pose a significant challenge concerning their body image and confidence, potentially leading to anxiety, depression, and social disengagement [7–9].

However, despite the adverse effects, a substantial body of literature illustrates the positive changes that many cancer patients perceive after their illness experience, also known as posttraumatic growth (PTG) [10]. PTG refers to the experience of positive change due to the struggle with highly challenging life crises [11]. Tedeschi et al. [12] perceived PTG as a process initiated by significant life challenges that disrupt core beliefs, involve emotional coping and cognitive restructuring and culminate in transformative growth. CRC can be considered a vital life challenge given its association with a high symptom burden, emotional distress, and an uncertain prognosis. In quantitative research, PTG levels are commonly measured via the PTG Inventory (PTGI) [13], which is a reliable scale that researchers widely use. This 21-item scale includes factors of new possibilities, relating to others, personal strength, spiritual change, and appreciation of life. Each item is rated on a 6-point Likert scale ranging from 0 (not at all) to 5 (significantly), with higher scores indicating higher PTG. Among Chinese patients with CRC, the mean PTG score ranges from (66.74 ± 13.9) to (76.78 ± 14.98) [14,15], considered moderately high. In the United States, the prevalence of moderate to high PTG levels was 71.30% [4]. In Germany, 46% of CRC survivors reported moderate-to-high PTG levels [16]. A previous study has indicated that PTG plays a positive regulatory role in the negative impact of symptoms on quality of life [4]. Different levels of PTG may affect CRC survivors' perceptions of their symptoms and promote a positive perspective on life. Higher levels of PTG have also been associated with returning to work [17]. Considering the beneficial effects of PTG on physio-psycho-social outcomes, a deeper understanding of the process of PTG and an exploration of the factors influencing PTG in patients with CRC are recommended [18]. Understanding the factors influencing PTG in patients with CRC may be beneficial for guiding health professionals in providing comprehensive and practical support to this unique patient population.

PTG is a complex and dynamic process that involves interactions among multiple factors. Numerous empirical studies conducted with patients with CRC have demonstrated the relationships between PTG and several variables, including demographic variables (e.g., sex, age, and education level), disease-related variables (e.g., stoma-related complications), and psychosocial variables (e.g., anxiety and depression). However, these studies still have inconsistencies that require summarization and clarification. For example, Redwood [19] reported a positive correlation between anxiety and PTG, whereas age was not significantly associated with PTG. In contrast, Salsman et al. [20] revealed a nonsignificant correlation between anxiety and PTG, yet age was negatively associated with PTG. To address these inconsistencies, this study employs a systematic review and meta-analysis to explore the factors correlated with PTG in patients with CRC. A meta-analysis can help resolve discrepancies by assessing collective evidence and identifying potential reasons for heterogeneity. This study aimed to inform clinical practice and help healthcare professionals better understand and support patients with CRC in their journey toward PTG.

2. Methods

A meta-analysis and systematic review were conducted to identify the correlated factors of PTG in patients with CRC. The protocol of this study was registered in PROSPERO (http://www.crd.york.ac.uk/prospero/) on May 22, 2023 (CRD42023425763). This study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (2020).

2.1. Search strategy

A comprehensive search was conducted in ten electronic databases, including PubMed, Web of Science, Embase, PsycINFO, CINAHL, Cochrane Library, China National Knowledge Infrastructure (CNKI), Wanfang, China Science and Technology Journal Database (VIP) and SinoMed. The search terms included subject headings such as "posttraumatic growth, psychological" and "colorectal neoplasms" as well as relevant free words. The published studies that reported primary data on the factors correlated with PTG in patients with CRC were identified. The search encompassed the period from the inception of each database to September 3, 2024. Additionally, the references of the included studies were manually searched to identify any additional relevant literature. The complete search terms and strategies are listed in Appendix A.

2.2. Eligibility criteria

The inclusion criteria were as follows: a) adult patients (aged ≥18 years old) with CRC diagnosis confirmed by pathology; b) measuring PTG using credible measurement tools, including the PTGI or a revised PTGI; c) measuring at least one correlated factor of PTG and reported the pearson correlation coefficient (r), t or F, which could be transformed into r; and d) observational studies, including cross-sectional studies, cohort studies, and case-control studies. The exclusion criteria were as follows: a) not in English or Chinese; b) conference abstracts or the full text was not available; c) duplicate publications or studies with identical data; d) methodology quality rating indicating low quality. Two researchers independently identified the articles according to the inclusion criteria, and disagreements were resolved by discussion. A third researcher was consulted if the two researchers could not reach a consensus.

2.3. Quality assessment and data extraction

The 11-item checklist recommended by the Agency for Healthcare Research and Quality (AHRQ) [21] was employed to assess the methodological quality of cross-sectional studies. A score of 0–3 indicates low quality, 4 to 7 indicates moderate quality, and 8 to 11 indicates high Quality [22]. The Newcastle-Ottawa Scale (NOS) [23] was used to assess the methodological quality of cohort studies and case-control studies. The total score ranges from 0 to 9, with a higher score indicating high quality. A score of 7–9 is considered high quality, 4 to 6 is moderate quality, and less than 4 is low quality [22]. Two researchers conducted the evaluation independently, and any disagreement was resolved by discussion or consulting a third researcher. The following data were

independently extracted by two researchers via a data extraction form: the first author, publication year, country, study design, sample size, measurement tools used for PTG, PTG scores, factors correlated with PTG, and *r*, *t*, or *F*. In the cohort studies, only the effect size at the last time point was extracted.

2.4. Data synthesis and statistical analysis

A meta-analysis was conducted via R Studio (version 4.2.3) with the "metacor" package, and statistical significance was defined as $P < 0.05$. If studies did not report the *r* but reported *t* or *F*, they were converted to *r* according to the following formulas: $r = \sqrt{\frac{t^2}{t^2+df}}$; $r = \sqrt{\frac{F}{F+df}}$; $df = N - 2$ [24]. Since the *F* obtained from analysis of variance (ANOVA) did not directly provide information about the direction of *r*, the expected sign of *r* was inferred based on whether the group means exhibited an increasing or decreasing trend in a consistent pattern. In cases where such a pattern was not evident, the *F* was not converted into *r*, and the study was subsequently excluded from the meta-analysis [24]. Fisher's *z*-transformation for the *r* was employed to obtain standardized effect sizes. Fisher's *z*-transformed *r* is independent of the sampling variance and more closely follows a normal distribution, thus allowing for a more accurate estimation of the overall effect size and standard error [25]. The pooled *r* and 95% confidence intervals (*CI*s) were calculated in our meta-analysis utilizing these standardized effect sizes. Heterogeneity among the included studies was assessed via the *Q* test and I^2 statistic. If $I^2 > 50\%$ and $P < 0.05$, heterogeneity was considered significant, a random effects model was utilized; otherwise, a fixed effects model was employed. If sufficient data were available, subgroup analyses were conducted based on participants' stoma status, treatment phases, measurement tools of correlated factors, and study locations to explore potential sources of heterogeneity. A sensitivity analysis was conducted to evaluate the impact of each study on the combined effect size and assess the stability of the results. The analysis was performed by sequentially removing one study at a time and recalculating the summary fisher's *z*-transformed *r*. In meta-analyses that included more than two studies, publication bias was assessed using Egger's regression test, and $P < 0.05$ was considered significant.

3. Results

3.1. Selection of the included studies

A total of 566 studies were initially identified through the search. The duplicate records were removed by computer, and 348 records remained. We then screened the titles and abstracts and excluded 279 studies that did not meet the inclusion criteria. Afterward, we viewed the full texts of the remaining studies and removed 40 additional studies. After conducting a manual search of the references within the included studies, two additional studies meeting the inclusion criteria were identified and included. Eventually, 31 studies met the eligibility criteria for this study. The PRISMA 2020 flow diagram for the search and screening process is shown in Fig. 1.

3.2. Characteristics of the included studies

Thirty-one studies from five countries were included, including 24 from China [14,15,26–47], three from South Korea [48–50], two from the USA [20,51], one from the UK [19] and one from Germany [16]. Twenty-eight studies were cross-sectional studies, and three were cohort studies. The publication year of these studies ranged from 2009 to 2024, and a total of 6,400 participants were enrolled. These studies reported 31 factors correlated with PTG, measured using 28 tools. All included studies utilized either the PTGI or a revised version of the PTGI. The average PTG scores across these studies ranged from 13.70 to 89.60. Further details are presented in Appendix B.

3.3. Methodological quality of the included studies

Consensus was reached among the researchers regarding the methodological quality of the included studies, confirming their suitability for inclusion in the systematic review and meta-analysis. The methodological quality scores of the included cross-sectional studies ranged from 6 to 9 according to the AHRQ methodology checklist. All included cohort studies received a methodological quality score of 4, according to the NOS. Based on these scores, seven studies were classified as high quality and 24 as moderate quality. All studies appropriately addressed the target population and used credible measurement tools to assess PTG. The detailed results of the quality assessment can be found in Appendix C.

3.4. Correlated factors of posttraumatic growth in patients with colorectal cancer

3.4.1. Demographic factors

3.4.1.1. Sex. Thirteen studies [14,15,19,27,30,31,33,34,36,40,41,44,45] examined the relationship between sex and PTG. The summary effect revealed a nonsignificant positive association between PTG and male ($r = 0.05$, 95%*CI* [−0.03, 0.12], $P = 0.245$, $I^2 = 69.1\%$) (Table 1) (Appendix D, Fig. 1). Sensitivity analysis showed that Redwoo's study [19] obviously affected the summary effect. After excluding this study, the effect size was 0.07 (95%*CI* [0.03, 0.11], $P < 0.01$, $I^2 = 20.0\%$) (Appendix E, Fig. 1).

3.4.1.2. Age. Nine studies [15,19,20,27,31,34–36,45] examined the relationship between age and PTG. The summary effect indicated a nonsignificant negative association between age and PTG ($r = -0.06$, 95%*CI* [−0.16, 0.05], $P = 0.306$, $I^2 = 78.9\%$) (Table 1) (Appendix D, Fig. 2). Sensitivity analysis showed that the study of Liu et al. [35] obviously affected the summary effect. After excluding this study, the effect size was −0.09 (95%*CI* [−0.18, −0.00], $P = 0.044$, $I^2 = 61.9\%$) (Appendix E, Fig. 2).

3.4.1.3. Religious beliefs. Four studies [31,35,40,50] examined the relationship between religious beliefs and PTG. The summary effect revealed a nonsignificant association between PTG and religious beliefs ($r = 0.30$, 95%*CI* [−0.03, 0.58], $P = 0.078$, $I^2 = 97.1\%$) (Table 1) (Appendix D, Fig. 3). The results of the sensitivity analysis indicated that the overall effect size remained stable (Appendix E, Fig. 3).

3.4.1.4. Residential area. Seven studies [14,15,31,34,36,40,41] examined the relationship between residential areas and PTG. The summary effect revealed a positive association between PTG and living in urban areas ($r = 0.13$, 95%*CI* [0.03, 0.22], $P = 0.010$, $I^2 = 71.4\%$) (Table 1) (Appendix D, Fig. 4). The results of the sensitivity analysis indicated that the overall effect size remained stable (Appendix E, Fig. 4).

3.4.1.5. Marital status. Thirteen studies [14,15,27,30,31,33,34,36,40,41,44,45,47] examined the relationship between marital status and PTG. The summary effect revealed a significant positive association between PTG and being married ($r = 0.10$, 95%*CI* [0.07, 0.14], $P < 0.001$, $I^2 = 1.0\%$) (Table 1) (Appendix D, Fig. 5). The results of the sensitivity analysis indicated that the overall effect size remained stable (Appendix E, Fig. 5).

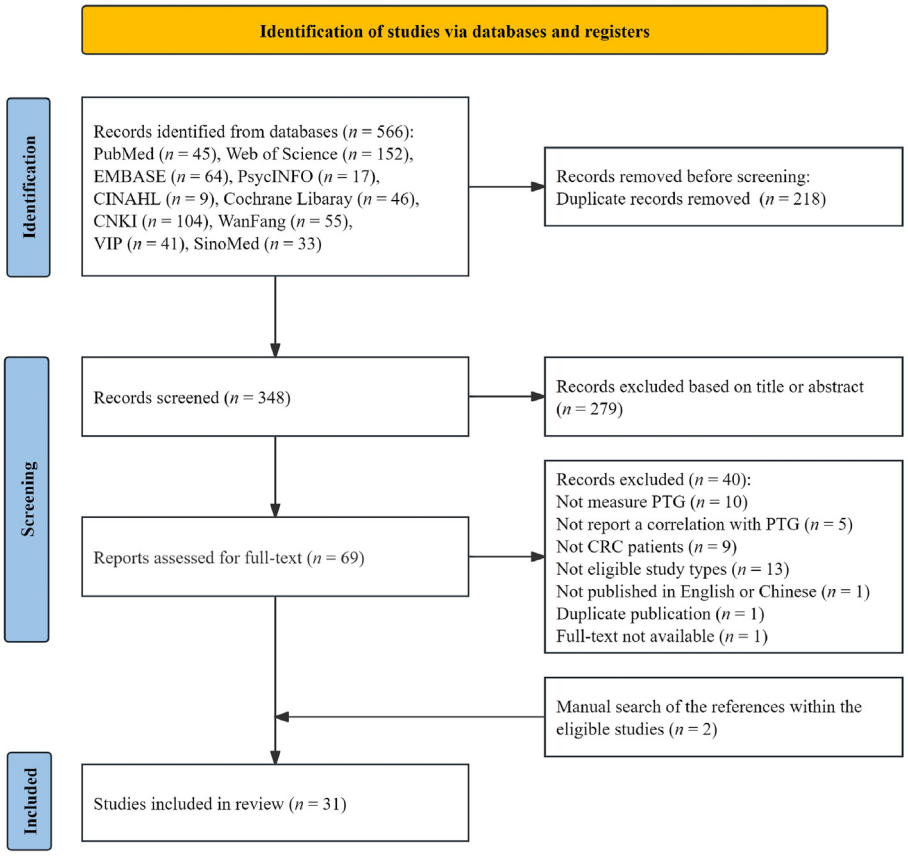

Fig. 1. Flow diagram of the literature selection.
PTG = posttraumatic growth. CRC = colorectal cancer.

Table 1
Meta-analysis of the correlated factors with posttraumatic growth in patients with colorectal cancer.

Correlated factors	No. of studies	Sample	Heterogeneity		*r*	95%*CI*	*P*	*P* (Egger's test)
			I^2 (%)	*P*				
Demographic factors								
Sex (male)	13	2,640	69.1	<0.001	0.05	−0.03, 0.12	0.245	0.655
Age	9	1,645	78.9	<0.001	−0.06	−0.16, 0.05	0.306	0.482
Religious beliefs	4	1,050	97.1	<0.001	0.30	−0.03, 0.58	0.078	0.629
Residential area	7	1,532	71.4	0.002	0.13	0.03, 0.22	0.010	0.546
Marital status	13	2,841	1.0	0.436	0.10	0.07, 0.14	<0.001	0.069
Employment status	6	1,079	50.0	0.075	0.18	0.12,0.24	<0.001	0.327
Education level	16	3,299	91.9	0.001	0.19	0.08, 0.30	0.001	0.747
Income level	11	2,701	18.9	0.263	0.16	0.12, 0.19	<0.001	0.410
Disease-related factors								
Time since surgery	4	1,001	33.0	0.214	0.17	0.11, 0.23	<0.001	0.149
Time since diagnosis	5	898	90.6	<0.001	0.19	−0.03, 0.39	0.098	0.449
Stoma-related complications	4	949	0.0	0.443	0.14	0.08, 0.20	<0.001	0.933
Psychosocial factors								
Confrontation coping	3	904	75.2	0.018	0.68	0.61, 0.75	<0.001	0.649
Avoidance coping	3	904	90.3	<0.001	−0.65	−0.75, −0.50	<0.001	0.770
Acceptance coping	3	904	90.7	<0.001	−0.19	−0.39, 0.03	0.094	0.887
Intrusive rumination	6	1,581	98.2	<0.001	−0.37	−0.66, 0.02	0.065	0.648
Deliberate rumination	7	1,905	97.9	<0.001	0.56	0.33, 0.73	<0.001	0.553
Social support	8	1,432	96.8	<0.001	0.47	0.26, 0.64	<0.001	0.165
Family function	3	757	85.1	<0.001	0.50	0.31, 0.65	<0.001	0.476
Resilience	10	1,578	90.0	<0.001	0.53	0.42, 0.63	<0.001	0.926
Self-efficacy	2	598	97.8	<0.001	0.91	0.74, 0.97	<0.001	–
Anxiety	3	280	93.9	<0.001	−0.11	−0.51, 0.33	0.631	0.931
Depression	3	280	85.5	<0.001	−0.14	−0.42, 0.17	0.375	0.910
Stigma	3	857	0.0	0.657	−0.65	−0.68, −0.60	<0.001	0.817
Self-perceived burden	2	239	28.5	0.237	−0.31	−0.42, −0.19	<0.001	–
Fear of cancer recurrence	2	397	87.7	0.004	−0.45	−0.64, −0.19	<0.001	–
Quality of life	3	841	92.8	<0.001	0.32	0.10, 0.52	0.006	0.568

3.4.1.6. Employment status. Six studies [14,15,31,41,44,45] examined the relationship between employment status and PTG. The summary effect revealed a significant correlation between PTG and being employed ($r = 0.18$, 95%*CI* [0.12, 0.24], $P < 0.001$, $I^2 = 50.0\%$) (Table 1) (Appendix D, Fig. 6). The results of the sensitivity analysis indicated that the overall effect size remained stable (Appendix E, Fig. 6).

3.4.1.7. Education level. Sixteen studies [14,15,20,27,30,31,33–36,40,41,44,45,47,50] examined the relationship between education level and PTG. The summary effect demonstrated a positive association between PTG and education level ($r = 0.19$, 95%*CI* [0.08, 0.30], $P = 0.001$, $I^2 = 91.9\%$) (Table 1) (Appendix D, Fig. 7). The results of the sensitivity analysis indicated that the overall effect size remained stable (Appendix E, Fig. 7).

3.4.1.8. Income level. Eleven studies [15,27,30,31,33–36,40,45,47] examined the relationship between income level and PTG. The summary effect revealed a positive correlation between PTG and income level ($r = 0.16$, 95%*CI* [0.12, 0.19], $P < 0.001$, $I^2 = 18.9\%$) (Table 1) (Appendix D, Fig. 8). The results of the sensitivity analysis indicated that the overall effect size remained stable (Appendix E, Fig. 8).

3.4.2. Disease-related factors

3.4.2.1. Time since surgery. Four studies [31,33,40,41] examined the relationship between PTG and Time since surgery. The summary effect revealed a positive correlation ($r = 0.17$, 95%*CI* [0.11, 0.23], $P < 0.001$, $I^2 = 33.0\%$) (Table 1) (Appendix D, Fig. 9). The results of the sensitivity analysis indicated that the overall effect size remained stable (Appendix E, Fig. 9).

3.4.2.2. Time since diagnosis. Five studies [14,20,34–36] examined the relationship between PTG and Time since diagnosis. The summary effect revealed a nonsignificant correlation ($r = 0.19$, 95%*CI* [−0.03, 0.39], $P = 0.098$, $I^2 = 90.6\%$) (Table 1) (Appendix D, Fig. 10). Sensitivity analysis showed that the study of Zhang et al. [14] obviously affected the summary effect. After excluding this study, the effect size was 0.28 (95%*CI* [0.13, 0.42], $P < 0.001$, $I^2 = 75.3\%$) (Appendix E, Fig. 10).

3.4.2.3. Stoma-related complications. Four studies [15,31,40,41] examined the relationship between stoma-related complications and PTG. The summary effect revealed a positive correlation ($r = 0.14$, 95%*CI* [0.08, 0.20], $P < 0.001$, $I^2 = 0.0\%$) (Table 1) (Appendix D, Fig. 11). The results of the sensitivity analysis indicated that the overall effect size remained stable (Appendix E, Fig. 11).

In addition, health-promoting behavior ($r = 0.46$, $P < 0.001$) [48] and sexual function ($r = 0.17$, $P < 0.05$) [50] were also reported to be correlated with PTG.

3.4.3. Psychosocial factors

3.4.3.1. Coping strategies. Three studies [26,30,40] examined the relationship between coping strategies and PTG. The summary effect revealed a positive correlation ($r = 0.68$, 95%*CI* [0.61, 0.75], $P < 0.001$, $I^2 = 75.2\%$) (Table 1) (Appendix D, Fig. 12) between confrontation coping strategies and PTG, a negative correlation ($r = -0.65$, 95%*CI* [−0.75, −0.50], $P < 0.001$, $I^2 = 90.3\%$) (Table 1) (Appendix D, Fig. 13) between avoidance coping strategies and PTG, no significant association ($r = -0.19$, 95%*CI* [−0.39, 0.03], $P = 0.094$, $I^2 = 90.7\%$) (Table 1) (Appendix D, Fig. 14) between acceptance coping strategies and PTG. The results of the sensitivity analyses indicated that the overall effect size of confrontation coping strategies (Appendix E, Fig. 12) and avoidance coping strategies (Appendix E, Fig. 13) remained stable. Gao's study [30] significantly affected the summary effect of acceptance coping strategies, the effect size was −0.08 (95%*CI* [−0.16, 0.00], $P = 0.039$, $I^2 = 0.0\%$) (Appendix E, Fig. 14) after excluding this study.

3.4.3.2. Intrusive rumination. Six studies [19,30–32,34,38] examined the relationship between intrusive rumination and PTG, and the summary effect revealed a nonsignificant association ($r = -0.37$, 95%*CI* [−0.66, 0.02], $P = 0.065$, $I^2 = 98.2\%$) (Table 1) (Appendix D, Fig. 15). Sensitivity analysis showed that Redwood's study [19] obviously affected the summary effect. After excluding this study, the effect size was −0.48 (95%*CI* [−0.71, −0.16], $P = 0.005$, $I^2 = 98.0\%$) (Appendix E, Fig. 15).

3.4.3.3. Deliberate rumination. Seven studies [19,30–32,34,38,47] examined the relationship between deliberate rumination and PTG, and the summary effect revealed a highly positive association ($r = 0.56$, 95%*CI* [0.33, 0.73], $P < 0.001$, $I^2 = 97.9\%$) (Table 1) (Appendix D, Fig. 16). The results of the sensitivity analysis indicated that the overall effect size remained stable (Appendix E, Fig. 16).

3.4.3.4. Social support. Eight studies [15,19,30,33,34,41,49,50] examined the relationship between social support and PTG, and the summary effect revealed a significant positive correlation ($r = 0.47$, 95%*CI* [0.26, 0.64], $P < 0.001$, $I^2 = 96.8\%$) (Table 1) (Appendix D, Fig. 17). The results of the sensitivity analysis indicated that the overall effect size remained stable (Appendix E, Fig. 17).

3.4.3.5. Family function. Three studies [26,29,40] examined the relationship between family function and PTG. The summary effect revealed a positive correlation ($r = 0.50$, 95%*CI* [0.31, 0.65], $P < 0.001$, $I^2 = 85.1\%$) (Table 2) (Appendix D, Fig. 18). The results of the sensitivity analysis indicated that the overall effect size remained stable (Appendix E, Fig. 18).

3.4.3.6. Resilience. Ten studies [14,15,27–29,33,41–43,45] examined the relationship between resilience and PTG, and the summary effect revealed a significant positive correlation ($r = 0.53$, 95%*CI* [0.42, 0.63], $P < 0.001$, $I^2 = 90.0\%$) (Table 1) (Appendix D, Fig. 19). The results of the sensitivity analysis indicated that the overall effect size remained stable (Appendix E, Fig. 19).

3.4.3.7. Self-efficacy. Two studies [28,32] examined the relationship between self-efficacy and PTG, and the summary effect revealed a significant positive correlation ($r = 0.91$, 95%*CI* [0.74, 0.97], $P < 0.001$, $I^2 = 98.0\%$) (Table 1) (Appendix D, Fig. 20).

3.4.3.8. Anxiety and depression. Three studies [19,20,27] examined the relationships among anxiety, depression, and PTG. The combined effect revealed a nonsignificant correlation (anxiety: $r = -0.11$, 95%*CI* [−0.51, 0.33], $P = 0.631$, $I^2 = 93.9\%$) (Appendix D, Fig. 21); depression: $r = -0.14$, 95%*CI* [−0.42, 0.17], $P = 0.375$, $I^2 = 85.5\%$ (Appendix D, Fig. 22) (Table 1). The results of the sensitivity analysis indicated that the overall effect sizes remained stable (Appendix E, Figs. 20 and 21).

3.4.3.9. Stigma. Three studies [26,31,40] examined the relationship between stigma and PTG, and the summary effect revealed a negative correlation ($r = -0.65$, 95%*CI* [−0.68, −0.60], $P < 0.001$, $I^2 = 0.0\%$) (Table 1) (Appendix D, Fig. 23). The results of the sensitivity analysis indicated that the overall effect size remained stable (Appendix E, Fig. 22).

3.4.3.10. Self-perceived burden. Two studies [14,42] examined the relationship between self-perceived burden and PTG, and the

summary effect revealed a significant negative correlation ($r = -0.31$, 95%*CI* [−0.42, −0.19], $P < 0.001$, $I^2 = 28.5\%$) (Table 1) (Appendix D, Fig. 24).

3.4.3.11. Fear of cancer recurrence. Two studies [37,39] examined the relationship between fear of cancer recurrence and PTG, and the summary effect revealed a significant negative correlation ($r = -0.45$, 95%*CI* [−0.64, −0.19], $P < 0.001$, $I^2 = 87.7\%$) (Table 1) (Appendix D, Fig. 25).

The included studies also reported other psychosocial factors, including self-compassion ($r = 0.32$, $P < 0.001$) [36], psychosocial adjustment ($r = 0.39$, $P < 0.001$) [48], and gratitude ($r = 0.45$, $P < 0.01$) [47].

3.4.4. Quality of life

Five studies [16,45,46,49,51] examined the relationship between quality of life and PTG. Kim et al. [49] showed a positive correlation between PTG and psychological ($r = 0.367$, $P < 0.01$), social ($r = 0.198$, $P < 0.05$), and spiritual ($r = 0.348$, $P < 0.01$) well-being. Jiang's study [45] reported a positive correlation between PTG and physical ($r = 0.631$, $P < 0.001$) and psychological ($r = 0.472$, $P < 0.001$) well-being. Three studies [16,46,51] reported the correlation between PTG and overall quality of life, and the summary effect revealed a significant positive correlation ($r = 0.32$, 95%*CI* [0.10, 0.52], $P = 0.006$, $I^2 = 92.8\%$) (Table 1) (Appendix D, Fig. 26). Sensitivity analysis showed that the two studies [46,51] obviously affected the summary effect. After excluding the two studies, the effect size was 0.31 (95%*CI* [−0.08, 0.61], $P = 0.113$, $I^2 = 96.2\%$) and 0.23 (95%*CI* [−0.02, 0.46], $P = 0.070$, $I^2 = 84.3\%$) (Appendix E, Fig. 23).

3.4.5. Subgroup analyses

For those factors with heterogeneity, subgroup analyses were conducted based on participants' stoma status, treatment phases, measurement tools, and study locations to explore potential sources of heterogeneity. The detailed results are presented in Appendix F.

3.4.6. Publication bias

The publication bias of the included studies was evaluated via Egger's test, and all the results revealed no publication bias ($P > 0.05$) (Table 1).

4. Discussion

The purpose of this systematic review and meta-analysis was to identify factors correlated with PTG in patients with CRC. Thirty-one different studies reporting 31 different correlated factors were included. Meta-analyses were conducted on 26 different factors, all with sufficient data. The remaining five factors were presented in their original form because there were fewer than two studies available for analysis. Twenty-three factors, including five demographics, four disease-related factors, 13 psychosocial factors, and quality of life, were demonstrated to be correlated with PTG in patients with CRC.

4.1. Demographic factors

This study revealed a nonsignificant correlation between PTG and sex difference, but this effect was not consistent across different patient populations. Considering the cultural differences among nations, male patients in China tend to report higher PTG, whereas in the UK, the trend is reversed. Previous studies in mixed samples of patients with CRC and other cancers have reported higher levels of PTG in females [10,52,53]. This phenomenon may be attributed to different societal and cultural expectations regarding gender roles. While this explanation provides some insights, it does not fully account for sex differences in all contexts. In summary, the relationship between sex differences and PTG remains unclear, and further research is needed to explore the underlying reasons. Additionally, the high heterogeneity across studies suggests that the results should be interpreted cautiously, considering potential confounding factors.

The findings of our study revealed a nonsignificant association between age and PTG in patients with CRC. This is inconsistent with previous findings in mixed cancer samples, which showed that age was negatively associated with PTG [52,53]. One reason for this association may be that a cancer diagnosis at a young age is more threatening than at an older age, thus, younger patients may have a greater potential to reappraise the meaning of life and experience PTG [11]. The subgroup analysis did not explain the high heterogeneity observed between studies, suggesting that the results should be interpreted with caution, taking into account potential confounding factors.

This study revealed a nonsignificant correlation between religious beliefs and PTG. Existing literature suggests that religious beliefs can influence levels of PTG [54]. Individuals who understand and deal with life stressors through a religious lens often have different views on traumatic events. For example, Buddhists may interpret traumatic events as karmic retribution for human wrongdoing [55]. However, not all forms of religious coping contribute to growth, negative religious coping can also lead to a decline in PTG [54], given the limited information from the included studies and the high heterogeneity observed, which suggests that the association between PTG and religious beliefs needs to be interpreted with caution.

This study revealed a positive correlation between education level and PTG. This can be attributed to patients with a higher level of education who tend to approach their illness from diverse perspectives and dedicate more time to contemplating the meaning of their lives. Moreover, higher levels of education are empirically related to enhanced social engagement and improved cognitive function [56], which can facilitate cognitive processes after a cancer diagnosis. Subgroup analysis indicated that participants' stoma status and treatment phases might influence heterogeneity between studies; however, this effect did not fully account for the heterogeneity, suggesting that other confounding factors should be considered.

This meta-analysis revealed that living in an urban area, having a higher monthly income, being married, and being employed correlated with greater PTG. Patients with these characteristics may face fewer financial barriers and concerns when accessing healthcare resources [57]. They are more likely to have sufficient time and capacity for cognitive restructuring and consciously regulate their self-perceptions and meaning of life. Married patients, on the other hand, may receive more support within their family environment, including understanding and assistance from their spouse and family members, who can help them derive meaning from their situation [58]. Employed patients may struggle to maintain social roles and daily structure, which could drive them to reinterpret the purpose of life after a cancer diagnosis.

4.2. Disease-related factors

This study revealed that time since surgery was positively associated with PTG. This finding aligns with previous results reported in breast cancer and head and neck cancer survivors [59,60]. According to the study of Tedeschi et al. [12], PTG results from a struggle in the aftermath of a trauma, as individuals need to continuously reappraise and reengage through traumatic events.

Consequently, PTG may gradually emerge and increase over time. However, our results did not find a significant correlation between time since diagnosis and PTG. Furthermore, subgroup analysis failed to reduce the heterogeneity among the studies; the results need to be interpreted with caution.

Stoma-related complications were found to be associated with less PTG. These complications can have detrimental effects on the physio-psycho-social functioning of patients, resulting in severe perceived burdens [48]. Stoma-related complications may cause physical discomfort, which may lead patients to focus more on dealing with physiological discomfort rather than on discovering positive changes and psychological growth. In addition, stoma-related complications may impose severe perceived psychological burdens on patients [61], leading to feelings of shame, embarrassment, or a loss of control, which can adversely affect PTG.

Conversely, sexual function and health-promoting behaviors were found to be positively associated with PTG. Research showed that having a stoma after surgery was associated with worse sexual problems for males [62]. Enhancement of sexual function may boost patients' confidence and overall quality of life, thereby promoting PTG. This positive association suggests that addressing and improving aspects of physical well-being could contribute to the PTG of CRC patients. In line with this, adopting healthy behaviors, such as regular exercise, a healthy diet, and disease self-management, may empower patients to better cope with the challenges posed by the disease and provide a foundation for PTG.

4.3. Psychosocial factors

Coping strategies are mechanisms that individuals employ to handle situations that overwhelm their capabilities [63]. This study revealed a positive association between confrontation coping and PTG, a negative association between avoidance coping and PTG, and a nonsignificant association between acceptance coping and PTG. These findings are consistent with those of a previous meta-analysis conducted with breast cancer patients [64]. Subgroup analysis indicated that the treatment phases of participants could partially explain the heterogeneity observed between studies. Patients who have undergone surgery within the past month exhibit a stronger positive correlation between confrontation coping and PTG, a stronger negative correlation between avoidance coping and PTG, as well as a stronger negative correlation between acceptance coping and PTG, compared to those who had their surgery more than a month ago. This may be because, in the early stages after surgery, patients focus their psychological resources on addressing their immediate physical and emotional needs. Coping strategies patients employ during this period can significantly influence the development of cognitive processing and meaning-making development. In contrast, patients who have undergone surgery more than one month ago may have developed more mature coping mechanisms [65]. Therefore, in the late postoperative period, the degree of cognitive processing may have a more significant impact on PTG than coping strategies.

Our results revealed a positive correlation between deliberate rumination and PTG, whereas intrusive rumination showed no correlation with PTG. These results are consistent with those of a previous meta-analysis that was conducted with participants who experienced traumatic or adverse events [66]. Earlier findings indicated that intrusive rumination often causes ongoing distress, whereas deliberate rumination, which involves comprehending the event and reconstructing one's beliefs, is related to PTG [67]. The subgroup analysis did not explain the high heterogeneity observed between studies. However, the results showed that the stoma status of participants may influence the relationship between PTG and rumination. Specifically, in patients with a stoma, intrusive rumination exhibited a stronger negative correlation with PTG, whereas deliberate rumination showed a stronger positive correlation with PTG. This pattern may be due to the fact that the changes in body image and daily care challenges following stoma surgery exacerbate the tendency to repeatedly recall negative aspects, which in turn affects the development of PTG. However, for those patients who successfully enter the stage of deliberate rumination, the challenges associated with living with a stoma might also catalyze discovering more profound meaning and positive changes in their lives.

The findings revealed a positive correlation between social support and PTG. This finding is consistent with previous findings in breast cancer patients [68]. As Tedeschi and Calhoun have discussed, social support is an essential factor in the process of PTG [11]. Supportive others can provide new perspectives and address patients' psychological needs, helping them to perceive the positive aspects of cancer [69]. Patients can enhance the process of cognitive reconstruction by sharing their personal experiences and inner feelings with others [11]. The subgroup analysis revealed that different treatment phases can partially explain the high heterogeneity between studies. Social support shows a stronger positive correlation with PTG in patients who have had surgery more recently compared to those with a longer time since surgery or long-term CRC survivors. According to the study of Ning et al. [70], social support provides an immediate sense of belonging and a foundation for narrative reconstruction, facilitating deeper cognitive processing. This early cognitive processing, stimulated by earlier social support, is instrumental in the process of PTG.

Additionally, the findings suggested a positive association between family function and PTG. The subgroup analysis indicated that the stoma status of participants could partially explain the high heterogeneity observed between studies. Family function exhibits a stronger positive correlation with PTG in patients with stoma. Treatment and the resulting symptoms of cancer increase patients' reliance on family members. Confronting the disease with supportive family members can foster a more profound connection with others for patients. Patients with a stoma may require increased family support to manage stoma care and the related psychological challenges in their daily lives. This ongoing need for support may enhance the positive correlation between family function and PTG.

Resilience was found to be positively correlated with PTG. This finding is by previous results reported in mixed cancer and breast cancer samples [71,72], suggesting that promoting PTG by improving psychological resilience is possible. The subgroup analysis indicated that the stoma status of participants could partially explain the high heterogeneity observed between studies. Resilience is a personality trait in which people recover easily and quickly from challenging events and can persist in overcoming adversities and obstacles [73]. Wan et al. [72] found that patients with greater resilience may be more likely to perceive personal growth, adopt new perspectives, and experience positive changes resulting from their cancer experience.

Self-efficacy was found to be positively correlated with PTG. Self-efficacy is a vital psychological resource that influences individuals' ability to cope with challenges and adversity [74]. Patients with a strong sense of self-efficacy are confident in their capabilities [75], which can enhance their motivation and determination to confront cancer. After successfully handling the negative emotions and symptoms that come with cancer, patients may be more likely to find they are stronger than before.

The findings revealed nonsignificant associations among anxiety, depression, and PTG. This finding is consistent with that of a previous meta-analysis [76]. Previous studies [76,77] have shown that anxiety, depression, and PTG can coexist, and positive

outcomes are separable and not dependent on the absence of mental illness. The subgroup analysis indicated that participants' treatment phases could partially explain the high heterogeneity between studies. In patients with a shorter time since surgery, anxiety and depression exhibited a significant negative correlation with PTG, which may mean that early emotional distress after trauma could hinder individuals from entering the cognitive restructuring stage [11]. Early postoperative anxiety and depression make it more difficult for patients to evaluate their experiences positively, thereby reducing the likelihood of PTG. In contrast, the coexistence of anxiety, depression, and PTG is more likely to occur in long-term CRC survivors.

This study revealed other psychological factors positively correlated with PTG in CRC patients, including self-compassion, psychosocial adjustment, and gratitude. Additionally, stigma, self-perceived burden, and fear of cancer recurrence were found to be negatively correlated with PTG in these patients. These results suggest that negative cognition and emotions associated with cancer may affect the development of PTG. Conversely, by strengthening positive psychological resources and facilitating psychosocial adjustment, it may be possible to promote the development of PTG.

4.4. Quality of life

Our results revealed a positive correlation between PTG and quality of life, more potent than that reported in a previous study on cancer samples [78]. The results of the subgroup analysis suggest that in patients at early post-treatment stages, the quality of life shows an even stronger positive correlation with PTG. However, cross-sectional studies cannot identify the possible mechanisms behind this relationship, as they cannot establish causality. The prevailing view regards PTG as a predictor of quality of life [79], but some scholars propose that the association between these two variables could be bidirectional [78].

5. Limitations

This study has several limitations: 1) due to the use of Pearson correlation coefficients as effect sizes for the meta-analysis, qualitative studies, which also reported factors related to PTG, were not included; 2) some of the included studies exhibited significant heterogeneity, and the sensitivity analysis demonstrated instability in some of the synthesized results; 3) due to the limited number of studies available for analysis, it was not possible to conduct subgroup analysis for some correlated factors; 4) most of the studies were conducted in China, which may have contributed to cultural bias; 5) the majority of the studies were cross-sectional, and the data cannot demonstrate the causal relationships between the correlated factors and PTG.

6. Conclusions

This meta-analysis explored 23 correlated factors of PTG in patients with CRC and indicated that PTG in CRC patients exhibits individual and cultural variations, with manifestations and correlated factors potentially differing across cultural backgrounds. Future research should extend to diverse cultural and geographical contexts to elucidate how cultural disparities influence the efficacy of PTG and intervention strategies among CRC patients. Furthermore, disease-related and psychosocial factors are likely to play significant roles in developing PTG in CRC patients. Consequently, future intervention strategies could enhance patient disease management and provide robust psychosocial support. Recognizing PTG as a long-term process, it is imperative for future research to conduct longitudinal studies to assess the enduring effects of various intervention strategies and to monitor the continuous growth of patients over time. Given the multifaceted nature of PTG, interdisciplinary collaboration should be fostered in future research. This collaboration should span across fields such as medicine, psychology, and sociology, among others, to develop more comprehensive and effective intervention strategies. Such an integrated approach will be instrumental in promoting PTG among CRC patients.

Data availability statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

CRediT authorship contribution statement

Dingyuan Wei: Conceptualization, Methodology, Investigation, Formal analysis, Writing - original draft. **Xue Wang:** Validation, Investigation, Resources. **Mengxing Wang:** Validation, Investigation. **Jiayan Wang:** Writing - review & editing. **Fangping Chen:** Visualization. **Luyang Jin:** Data Curation. **Xuemei Xian:** Conceptualization, Supervision, Project administration, Writing - review & editing.

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Declaration of competing interest

The authors have declared no conflict of interest.

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Appendices. Supplementary data

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References

[1] Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2021;71(3):209–49. https://doi.org/10.3322/caac.21660.

[2] Morgan E, Arnold M, Gini A, Lorenzoni V, Cabasag CJ, Laversanne M, et al. Global burden of colorectal cancer in 2020 and 2040: incidence and mortality estimates from GLOBOCAN. Gut 2023;72(2):338–44. https://doi.org/10.1136/gutjnl-2022-327736.

[3] Kesireddy M, Tenner L. Colon cancer survivorship in patients who have received adjuvant chemotherapy. Clin Colorectal Cancer 2023;22(4):361–74. https://doi.org/10.1016/j.clcc.2023.07.001.

[4] Sheikh-Wu SF, Anglade D, Gattamorta K, Downs CA. Relationships between colorectal cancer survivors' positive psychology, symptoms, and quality of life. Clin Nurs Res 2023;32(1):171–84. https://doi.org/10.1177/10547738221113385.

[5] Xian XM, Zhu CP, Chen YL, Huang BB, Xu DD. A longitudinal analysis of fatigue in colorectal cancer patients during chemotherapy. Support Care Cancer 2021;29(9):5245–52. https://doi.org/10.1007/s00520-021-06097-w.

[6] Han CJ, Saligan L, Crouch A, Kalady MF, Noonan AM, Lee LJ, et al. Latent class symptom profiles of colorectal cancer survivors with cancer-related cognitive impairment. Support Care Cancer 2023;31(10):559. https://doi.org/10.1007/s00520-023-08031-8.
[7] Lin WJ, Yoon S, Zhao Y, Seow-En I, Chok AY, Tan EKW. Patient-reported unmet supportive care needs in long-term colorectal cancer survivors after curative treatment in an Asian population. Asian J Surg 2024;47(1):256–62. https://doi.org/10.1016/j.asjsur.2023.08.108.
[8] Lim CYS, Laidsaar-Powell RC, Young JM, Kao SCH, Zhang YH, Butow P. Colorectal cancer survivorship: a systematic review and thematic synthesis of qualitative research. Eur J Cancer Care 2021;30(4):e13421. https://doi.org/10.1111/ecc.13421.
[9] Carlile A, McAdam T. The long-term and late effects of the diagnosis and treatment of colorectal cancer. Ulster Med J 2023;92(2):98–102.
[10] Liu ZZ, Thong MSY, Doege D, Koch-Gallenkamp L, Bertram H, Eberle A, et al. Prevalence of benefit finding and posttraumatic growth in long-term cancer survivors: results from a multi-regional population-based survey in Germany. Br J Cancer 2021;125(6):877–83. https://doi.org/10.1038/s41416-021-01473-z.
[11] Tedeschi RG, Calhoun LG. Target article: "posttraumatic growth: conceptual foundations and empirical evidence". Psychol Inq 2004;15(1):1–18. https://doi.org/10.1207/s15327965pli1501_01.
[12] Tedeschi R, Shakespeare-Finch J, Taku K, Calhoun L. Posttraumatic growth: theory, research, and applications. New York: Routledge; 2018.
[13] Tedeschi RG, Calhoun LG. The posttraumatic growth inventory: measuring the positive legacy of trauma. J Trauma Stress 1996;9(3):455–71. https://doi.org/10.1007/BF02103658.
[14] Zhang CS, Gao RT, Tai JD, Li YW, Chen S, Chen L, et al. The relationship between self-perceived burden and posttraumatic growth among colorectal cancer patients: the mediating effects of resilience. BioMed Res Int 2019;2019:6840743. https://doi.org/10.1155/2019/6840743.
[15] Dong XL, Li GP, Liu CL, Kong LH, Fang YY, Kang XF, et al. The mediating role of resilience in the relationship between social support and posttraumatic growth among colorectal cancer survivors with permanent intestinal ostomies: a structural equation model analysis. Eur J Oncol Nurs 2017;29:47–52. https://doi.org/10.1016/j.ejon.2017.04.007.
[16] Jansen L, Hoffmeister M, Chang-Claude J, Brenner H, Arndt V. Benefit finding and post-traumatic growth in long-term colorectal cancer survivors: prevalence, determinants, and associations with quality of life. Br J Cancer 2011;105(8):1158–65. https://doi.org/10.1038/bjc.2011.335.
[17] Sekely A, Zakzanis KK. The relationship between post-traumatic growth and return to work following mild traumatic brain injury. Disabil Rehabil 2019;41(22):2669–75. https://doi.org/10.1080/09638288.2018.1476598.
[18] Wang ZM, Chen X, Zhou JR, Lin CY, Luo HM, Li QP. Feasibility and preliminary effect of a couple-based posttraumatic growth intervention for colorectal cancer couples: a randomized controlled pilot study. Clin Psychol Psychother 2023;30(6):1433–45. https://doi.org/10.1002/cpp.2884.
[19] Redwood K. An exploration of gender differences in post-traumatic growth in survivors of colorectal cancer. University of Southampton; 2015.
[20] Salsman JM, Segerstrom SC, Brechting EH, Carlson CR, Andrykowski MA. Posttraumatic growth and PTSD symptomatology among colorectal cancer survivors: a 3-month longitudinal examination of cognitive processing. Psycho Oncol 2009;18(1):30–41. https://doi.org/10.1002/pon.1367.
[21] Rostom ADCCA. Celiac disease. Rockville (MD): Agency for Healthcare Research and Quality (US); 2004. https://www.ncbi.nlm.nih.gov/books/NBK35156/.
[22] Liu Y, Zhang L, Li X, Luo A, Guo S, Liu X, et al. Prevalence and risk factors of frailty in older adults with diabetes: a systematic review and meta-analysis. PLoS One 2024;19(10):e309837. https://doi.org/10.1371/journal.pone.0309837.
[23] GA Wells Bsdo. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses.https://www.ohri.ca/programs/clinical_epidemiology/oxford.asp.
[24] Cheung M. Applied meta-analysis for social science research by N. A. card. Struct Equ Model A Multidiscip J 2013;20:704–7. https://doi.org/10.1080/10705511.2013.824795.
[25] van Aert RCM. Meta-analyzing partial correlation coefficients using Fisher's z transformation. Res Synth Methods 2023;14(5):768–73. https://doi.org/10.1002/jrsm.1654.
[26] Rong Dan S. Investigation of posttraumatic growth and influencing factors in patients with permanent colostomy after rectal cancer surgery. Shanxi Med J 2021;50(22):3125–7. https://doi.org/10.3969/j.issn.0253-9926.2021.22.009 [in Chinese)].
[27] Hua G, Qinyan S, Xiaojing HU. Relationship between posttraumatic growth and psychological resilience in patients with rectal cancer. China Journal of Health Psychology 2021;29(7):969–73. https://doi.org/10.13342/j.cnki.cjhp.2021.07.003 [in Chinese)].
[28] Jie Y, Chunlan L. Study on mediating effect of psychological resilience on posttraumatic growth and self-care self-efficacy in colorectal cancer patients. Tianjin Nursing 2020;28(4):388–91. https://doi.org/10.3969/j.issn.1006-9143.2020.04.003 [in Chinese)].
[29] Xiao YY, Sui WQ, Xie KS, Li SL, Li XQ, Wen JY. Status and relationships between post traumatic growth, psychological resilience and family resilience of colorectal cancer patients. Mod Clin Nurs 2018;17(7):19–24.
[30] Gao L. Analysis of posttraumatic growth status and related factors in colorectal cancer patients undergoing colostomy. Jinzhou: Jinzhou Medical University; 2020 [in Chinese)].
[31] Tian L. The correlations among ruminant meditation, stigma and post-traumatic growth in patients with coloretal cancer. Zhengzhou. Henan University; 2021 [in Chinese)].
[32] Yao L, Yu WJ, Liu N, Zhang AH. Path analysis of self-care self-efficacy and rumination on posttraumatic growth in patients with colorectal cancer. Mod Prev Med 2019;46(7):1321–4. 1344. (in Chinese).
[33] Wang S, Chen Y, Fu T, Zhang LM. Effect of psychological resilience and social support on posttraumatic growth in patients with colorectal cancer. J Nurs Adm 2019;19(1):6–10 [in Chinese)].
[34] Ji M. Related research of rumination, perceived social support and post-traumatic growth in coloretal cancer patients. Yanbian. Yanbian University; 2019 [in Chinese)].
[35] Ruihua L, Shuying L, Haiyan X. Correlation analysis of posttraumatic growth and self-efficacy in colorectal cancer patients. J Qilu Nurs 2020;26(22):14–7. https://doi.org/10.3969/j.issn.1006-7256.2020.22.005 [in Chinese)].
[36] Wang ZN, Fan YD, Fu MH, Xing YM, Cai BX, Lin XM. Influencing factors for posttraumatic growth level in patients undergoing chemotherapy for colorectal cancer and its correlation with self-compassion level. Guangxi Med J 2022;44(21):2511–5. https://doi.org/10.11675/j.issn.0253-4304.2022.21.11 [in Chinese)].
[37] Chen SS, Yao HX, Chen Y. Analysis on the current situation and influencing factors of fear of cancer recurrence in patients with colorectal cancer undergoing chemotherapy. Chinese Journal of General Practice 2022;20(1):148–51. https://doi.org/10.16766/j.cnki.issn.1674-4152.002299 [in Chinese)].
[38] Liu N, Yao L, Zhang A. Mediating role of event-related rumination in post-traumatic stress symptom and posttraumatic growth among colorectal cancer patients. Nursing Journal of Chinese People's Liberation Army. 2019;36(10):17–20 [in Chinese)].
[39] Sun L. The correlation between fear of cancer recurrence and disease perception and posttraumatic growth in patients with colorectal cancer. Dalian: Dalian Medical University; 2021 [in Chinese)].
[40] Liu P. Relevant research among stigma, family function, coping modes and posttraumatic growth in patients with enterostomy. Tianjin: Tianjin University of Traditional Chinese Medicine; 2020 [in Chinese)].
[41] Qian LY, Xu P, Li C. The mediating role of psychological resilience in the relationship between social support and posttraumatic growth of patients with permanent intestinal stoma in colorectal. PSY 2024;19(3):48–51. https://doi.org/10.19738/j.cnki.psy.2024.03.012 [in Chinese)].
[42] Zhang XY, Tao T, Wang LG, Gao WB. Relation of post-traumatic growth and self-perceived burden with psychological resilience in patients with rectal cancer. Chin Ment Health J 2022;36(6):496–500.
[43] Wang P, Chao JX, Qin YN. Analysis of resilience and posttraumatic growth in patients with rectal cancer undergoing low rectal sphincter preservation surgery. Heilongjiang Medicine and Pharmacy 2022;45(3):174–5. https://doi.org/10.3969/j.issn.1008-0104.2022.03.082 [in Chinese)].
[44] Zhou Q. Relationship between posttraumatic growth, positive psychological characters and childhood adversity in colorectal cancer survivors. Jinan: Shandong University; 2014 [in Chinese)].
[45] Liqing J. Relationship between resilience, posttraumatic growth and quality of life inpatients with advanced colorectal cancerand family caregivers. Wuxi: Jiangnan University; 2023 [in Chinese)].
[46] Wang SQ, Song JY. Study on the correlation between resilience and post traumatic growth and quality of life among colostomy patients. Chin Nurs Manag 2017;17(6):840–4.
[47] Pan BY, He XX, Zhang M, Chen R. Mediating role of rumination in the relationship between gratitude and posttraumatic growth in elderly colostomy patients. J Nurs Sci 2017;32(14):84–7.
[48] Sun H, Lee J. Psychosocial adjustment in Korean colorectal cancer survivors. J Korean Acad Nurs 2018;48(5):545–53. https://doi.org/10.4040/jkan.2018.48.5.545.
[49] Kim H, Son H. Moderating effect of posttraumatic growth on the relationship between social support and quality of life in colorectal cancer patients with ostomies. Cancer Nurs 2021;44(3):251–9. https://doi.org/10.1097/NCC.0000000000000887.
[50] Kim Y, Kim Y, Kwak Y. Factors associated with post-traumatic growth in male patients with rectal cancer: a cross-sectional study. Eur J Oncol Nurs 2021;54:102028. https://doi.org/10.1016/j.ejon.2021.102028.
[51] Sheikh-Wu SF, Anglade D, Gattamorta K, Xiao CH, Downs CA. Positive psychology mediates the relationship between symptom frequency and quality of life among colorectal cancer survivors during acute cancer survivorship. Eur J Oncol Nurs 2022;58:102136. https://doi.org/10.1016/j.ejon.2022.102136.
[52] Caspari JM, Raque-Bogdan TL, McRae C, Simoneau TL, Ash-Lee S, Hultgren K. Posttraumatic growth after cancer: the role of perceived threat and cognitive processing. J Psychosoc Oncol 2017;35(5):561–77. https://doi.org/10.1080/07347332.2017.1320347.
[53] Morris BA, Shakespeare-Finch J. Cancer diagnostic group differences in post-traumatic growth: accounting for age, gender, trauma severity, and distress. J Loss Trauma 2011;16(3):229–42. https://doi.org/10.1080/15325024.2010.519292.
[54] Büssing A, Kerdar SH, Akbari ME, Rassouli M. Perceptions of spiritual dryness in Iran during the COVID-19 pandemic. J Relig Health 2021;60(5):3347–71. https://doi.org/10.1007/s10943-021-01360-0.
[55] Jin YC, Liu DY, Li JY. Promoting factors of post-traumatic growth, model and

intervene. Adv Psychol Sci 2014;22(2):304. https://doi.org/10.3724/sp.j.1042.2014.00304.
[56] Du CG, Miyazaki Y, Dong XQ, Li MT. Education, social engagement, and cognitive function: a cross-lagged panel analysis. J Gerontol B Psychol Sci Soc Sci 2023;78(10):1756–64. https://doi.org/10.1093/geronb/gbad088.
[57] Wilt JK, Siminoff LA, Thomson MD. Pre-diagnosis symptoms, attributed causes, and healthcare seeking assets of younger colorectal cancer survivors. J Cancer Educ 2023;38(6):1932–8. https://doi.org/10.1007/s13187-023-02363-z.
[58] Lee S, Ma C, Zhang S, Ou FS, Bainter TM, Niedzwiecki D, et al. Marital status, living arrangement, and cancer recurrence and survival in patients with stage III colon cancer: findings from CALGB 89803 (alliance). Oncol 2022;27(6):e494–505. https://doi.org/10.1093/oncolo/oyab070.
[59] Wang AWT, Chang CS, Chen ST, Chen DR, Hsu WY. Identification of posttraumatic growth trajectories in the first year after breast cancer surgery. Psycho Oncol 2014;23(12):1399–405. https://doi.org/10.1002/pon.3577.
[60] Hamdan NA, Abd Hamid N, Leong Bin Abdullah MFI. A longitudinal investigation of posttraumatic growth and its associated factors among head and neck cancer survivors. Psycho Oncol 2022;31(3):504–11. https://doi.org/10.1002/pon.5835.
[61] Jeanne A, Schaefer RHM. Life crises and personal growth. In: Carpenter Bruce N, editor. Personal coping: theory, research, and application; 1992. p. 144–70. London.
[62] Liu XR, Tong Y, Li ZW, Liu F, Liu XY, Zhang W, et al. Do colorectal cancer patients with a postoperative Stoma have sexual problems? A pooling up analysis of 2566 patients. Int J Colorectal Dis 2023;38(1):79. https://doi.org/10.1007/s00384-023-04372-2.
[63] Taylor SE, Stanton AL. Coping resources, coping processes, and mental health. Annu Rev Clin Psychol 2007;3:377–401. https://doi.org/10.1146/annurev.clinpsy.3.022806.091520.
[64] Wan X, Huang HT, Peng QW, Zhang YM, Hao JW, Lu GL, et al. The relation between coping style and posttraumatic growth among patients with breast cancer: a meta-analysis. Front Psychol 2022;13:926383. https://doi.org/10.3389/fpsyg.2022.926383.
[65] Lashbrook MP, Valery PC, Knott V, Kirshbaum MN, Bernardes CM. Coping strategies used by breast, prostate, and colorectal cancer survivors: a literature review. Cancer Nurs 2018;41(5):E23–39. https://doi.org/10.1097/NCC.0000000000000528.
[66] Allen N, Hevey D, Cogley C, O'Keeffe F. A meta-analysis of the association between event-related rumination and posttraumatic growth: the event-related rumination inventory and the posttraumatic growth inventory. J Trauma Stress 2022;35(6):1575–85. https://doi.org/10.1002/jts.22875.
[67] Cann A, Calhoun LG, Tedeschi RG, Triplett KN, Vishnevsky T, Lindstrom CM. Assessing posttraumatic cognitive processes: the event related rumination inventory. Hist Philos Logic 2011;24(2):137–56. https://doi.org/10.1080/10615806.2010.529901.
[68] Ma XJ, Wan X, Chen CR. The correlation between posttraumatic growth and social support in people with breast cancer: a meta-analysis. Front Psychol 2022;13:1060150. https://doi.org/10.3389/fpsyg.2022.1060150.
[69] Joseph S, Murphy D, Regel S. An affective-cognitive processing model of posttraumatic growth. Clin Psychol Psychother 2012;19(4):316–25. https://doi.org/10.1002/cpp.1798.
[70] Ning J, Tang XF, Shi HL, Yao DP, Zhao ZQ, Li J. Social support and posttraumatic growth: a meta-analysis. J Affect Disord 2023;320:117–32. https://doi.org/10.1016/j.jad.2022.09.114.
[71] Knauer K, Bach A, Schäffeler N, Stengel A, Graf J. Personality traits and coping strategies relevant to posttraumatic growth in patients with cancer and survivors: a systematic literature review. Curr Oncol 2022;29(12):9593–612. https://doi.org/10.3390/curroncol29120754.
[72] Wan X, Huang HT, Peng QW, Yu NX, Zhang YM, Ding YM, et al. A meta-analysis on the relationship between posttraumatic growth and resilience in people with breast cancer. Nurs Open 2023;10(5):2734–45. https://doi.org/10.1002/nop2.1540.
[73] Cooper AL, Brown JA, Rees CS, Leslie GD. Nurse resilience: a concept analysis. Int J Ment Health Nurs 2020;29(4):553–75. https://doi.org/10.1111/inm.12721.
[74] Bandura A. Self-efficacy: toward a unifying theory of behavioral change. Psychol Rev 1977;84(2):191–215. https://doi.org/10.1037//0033-295x.84.2.191.
[75] Bourne MJ, Smeltzer SC, Kelly MM. Clinical teacher self-efficacy: a concept analysis. Nurse Educ Pract 2021;52:103029. https://doi.org/10.1016/j.nepr.2021.103029.
[76] Long LJ, Phillips CA, Glover N, Richardson AL, D'Souza JM, Cunningham-Erdogdu P, et al. A meta-analytic review of the relationship between posttraumatic growth, anxiety, and depression. J Happiness Stud 2021;22(8):3703–28. https://doi.org/10.1007/s10902-021-00370-9.
[77] Li J, Sun YH, MacCallum F, Chow AYM. Depression, anxiety and post-traumatic growth among bereaved adults: a latent class analysis. Front Psychol 2021;11:575311. https://doi.org/10.3389/fpsyg.2020.575311.
[78] Liu ZZ, Doege D, Thong MSY, Arndt V. The relationship between posttraumatic growth and health-related quality of life in adult cancer survivors: a systematic review. J Affect Disord 2020;276:159–68. https://doi.org/10.1016/j.jad.2020.07.044.
[79] Onyedibe MCC, Blickle P, Schmidt ME, Steindorf K. Posttraumatic growth and health-related quality of life in cancer survivors: does fatigue moderate the link? Stress Health 2024;40(2):e3299. https://doi.org/10.1002/smi.3299.