REVIEW

The efficacy of psychosocial interventions on anxiety and depression in cancer caregivers: a network meta-analysis

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Abstract

Background Cancer caregivers often face substantial psychosocial burdens, which can lead to significant anxiety and depression. This network meta-analysis aimed to evaluate the relative efficacy of various psychosocial interventions in alleviating these symptoms.

Methods Following PRISMA guidelines, we conducted a systematic literature search for randomized controlled trials (RCTs) that evaluated psychosocial interventions for cancer caregivers. Data were synthesized using a network meta-analysis to compare the effects of different interventions on anxiety and depression.

Results A total of 35 trials involving 7 types of psychosocial interventions were included. Three interventions—meaning-centered psychotherapy (anxiety: MD = −5.48, 95% CI: −8.46 to 2.49; depression: MD = −5.13, 95% CI: −8.27 to −1.96), psychoeducation (anxiety: MD = −9.38, 95% CI: −13.76 to −4.94), and supportive therapy (anxiety: MD = −7.05, 95% CI: −11.12 to −3.05; depression: MD = −5.59, 95% CI: −9.83 to −1.36), showed significant efficacy in reducing anxiety and depression. Network meta-analysis indicated that these interventions were superior to control conditions in alleviating symptoms.

Conclusion Meaning-centered psychotherapy, psychoeducation, and supportive therapy are particularly effective in reducing anxiety and depression among cancer caregivers. Our findings support the implementation of these psychosocial interventions as part of routine care.

Keywords Cancer caregivers · Psychosocial interventions · Anxiety · Depression · Network meta-analysis

Introduction

Cancer is a global health crisis with profound consequences for both patients and their caregivers. As the second leading cause of death worldwide, it imposes immense physical, emotional, and financial burdens. According to the World Health Organization's 2020 report, nearly 20 million new cases of cancer were diagnosed globally, with 9.7 million cancer-related deaths occurring in China alone. These figures illustrate the extensive human suffering associated with this disease [1].

Numerous studies have demonstrated that the physical and psychological conditions of cancer patients significantly affect their caregivers, who face substantial psychosocial challenges as a result [2, 3]. The demands of caregiving and its financial burden are among the major stressors for caregivers, who sometimes experience even higher levels of depression and anxiety than the patients themselves. Poor prognoses and fears of losing a loved one often trigger reactions such as denial, fear, and anxiety in caregivers, which can ultimately lead to emotional distress and depression [4]. Additionally, the cost of cancer treatment is rising rapidly, placing financial strain on caregivers. Furthermore,

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caregivers rarely have the opportunity to receive comprehensive psychological support to help address their own mental health issues [5].

The negative impact of caregiving on mental health is well-documented. Caregivers often experience a decline in their own physical health and are at increased risk of developing depression and anxiety disorders [6, 7]. The emotional burden can be so overwhelming that it affects a caregiver's ability to provide care, potentially leading to early institutionalization of the patient or a reduction in the patient's quality of life [8, 9]. Moreover, the financial burden of caregiving should not be underestimated, as many caregivers are forced to reduce their working hours or quit their jobs entirely, leading to financial hardship and increased stress [10].

Psychosocial interventions have demonstrated potential for improving the psychological well-being of caregivers by providing education, encouraging emotional expression, and helping individuals develop cognitive and behavioral skills that will assist them in coping with their situation [11]. Current research on psychosocial interventions mainly focuses on caregivers of cancer patients across different cancer types and stages. Specific psychological problems experienced by caregivers are assessed and analyzed using various psychological assessment tools. Enhancing research on caregiver psychosocial interventions may help identify the most effective approaches, alleviate anxiety and depression, and improve the overall psychological health of caregivers [12, 13].

While numerous studies have investigated the effectiveness of psychosocial interventions for cancer caregivers, the results have been mixed. Some studies have found significant improvements in mental health outcomes, whereas others have reported minimal or no effects [14]. This variability may be due in part to differences in the types of interventions, sample characteristics, or assessment methods used across studies. Moreover, many of these studies have been limited by small sample sizes and a lack of long-term follow-up, making it challenging to draw definitive conclusions about the efficacy of these interventions [15].

Existing systematic reviews and meta-analyses evaluating psychosocial interventions for caregivers generally use standard meta-analysis methods, which have limitations. Compared with traditional meta-analysis, network meta-analysis allows researchers to synthesize data from different studies, even if those studies do not directly compare all treatments of interest. This approach provides a way to compare multiple treatments through indirect evidence, creating a network of comparisons [16]. By combining direct and indirect evidence, network meta-analysis can increase the statistical power of the analysis, leading to more precise and reliable conclusions. This is particularly beneficial when direct comparisons are limited or sample sizes are small

[17]. Additionally, network meta-analysis can identify gaps in comparative evidence, thereby guiding future research and helping to establish clinical guidelines for more informed decision-making by healthcare providers and patients [18].

The primary objective of this study is to assess the efficacy of different psychosocial interventions for cancer caregivers in reducing anxiety and depression. We conducted a comprehensive literature search, assessed the quality of the included studies, and performed a network meta-analysis to determine the relative effectiveness of different interventions. Through this work, we aim to contribute to the development of evidence-based guidelines for psychological support for cancer caregivers.

Methods

This study follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [19, 20] and the Cochrane Handbook for the Systematic Review of Interventions [21]. The protocol for this network meta-analysis has been registered with PROSPERO (CRD42023414904).

Data sources and searches

We searched PubMed, Cochrane Library, EMBASE, Web of Science, China National Knowledge Infrastructure (CNKI), and WANFANG DATA for eligible studies published before January 1, 2023; an updated search was performed in January 2024. The search was limited to studies published in Chinese and English due to the language proficiency of the research team.

Search terms used a combination of medical subject headings (MeSH) and free-text terms. Keywords related to the population (Caregivers, Cares, Spouse Caregivers, Family Caregivers) were combined with keywords related to disease type (Neoplasms, Tumors, Cancer), intervention type (psychotherapy; Psychosocial Intervention; Psychology, Clinical) and psychosocial problems (anxiety, depression). We adapted the search strategy for each database. References from relevant review articles were examined, as were the reference lists and forward citations of eligible articles and study protocols. The search terms and the algorithm utilized for searching in PubMed can be found in the supplementary materials (Supplementary Appendix A).

Inclusion and exclusion criteria

We searched eligible studies with full text according to the PICOS (population, interventions, comparators, outcomes, study design) selection criteria.

Population

The population consists of caregivers of patients with cancer.

Interventions and exposures

Psychosocial interventions included the following: cognitive-behavioral therapies (e.g., cognitive-behavioral therapy, cognitive therapy, and behavioral therapy); mindfulness-based interventions (e.g., mindfulness-based stress reduction and mindfulness-based cognitive therapy); acceptance-based interventions (e.g., acceptance and commitment therapy); and supportive therapy and/or psychoeducation interventions [22, 23–25]. Participants included in the control groups were not receiving psychological interventions, were continuing other treatments that did not include psychological interventions, or were on a waiting list [26, 27]. The specifics of each type of psychosocial interventions are presented in Supplementary Appendix B.

Outcomes

Changes in caregiver anxiety and depression scores and odds ratios from baseline to the end of the intervention, measured using a clinically validated and reliable caregiver psychological health measure, and adding follow-up data.

Study design

We included randomized controlled trials to assess the beneficial effects of the treatments.

Data selection and extraction

All the searched studies were imported into EndNote X9 to eliminate duplicate studies. Two reviewers independently screened all titles and abstracts identified by the searches and assessed the full texts of the remaining articles. When a study had been published in duplicate, we included the most informative and comprehensive version. Any discrepancies were settled by discussion or through adjudication by another two investigators from the review team.

A structured data extraction form was used to extract data from all the included studies. The extracted data included the author, year of publication, country where the study took place, participant characteristics, details of the interventions and their control groups, and outcomes (changes in depression and anxiety) [28]. If a study reported more than one post-treatment score (e.g., midway and follow-up), we chose the data at the assessment time-point immediately following the conclusion of the intervention phase.

Risk of bias assessment

The Cochrane risk of bias tool was used to assess the risk of bias in the included studies. Two researchers independently assessed the risk of bias. The tool covers six domains: selection bias (random sequence generation and allocation concealment), performance bias (blinding of participants and personnel), detection bias (blinding of outcome assessment), attrition bias (incomplete outcome data), reporting bias (selective reporting), and other bias. According to the Cochrane Handbook version 6.1.0 [29, 30], we graded the methodology of each study as having a low risk, high risk, or unclear risk of bias. Due to the nature of the non-pharmacological interventions, blinding of participants and personnel was not deemed possible, and we judged all included studies to be at high risk of performance bias. Discrepancies and uncertainties were resolved through discussions between the researchers [31]. Studies were not excluded because of the degree of bias. The assessment of bias risk for each included study is summarized in Supplementary Appendix C.

Statistical analyses

For the assessment of changes in depression and anxiety, we utilized the mean changes and standard deviations (SDs) as reported by the authors. In instances where data were presented as pre- and post-intervention measures, we employed methods outlined in the Cochrane Handbook to calculate both the mean change and SD for these alterations [32]. All outcomes were treated as continuous variables; therefore, network estimates from all outcome variables are expressed as mean differences (MD) accompanied by a 95% confidence interval (CI). Missing data were handled based on their extent and importance. Studies with substantial missing critical outcomes (e.g., anxiety and depression scores) were excluded. For those with minimal missing data, established statistical methods recommended by the Cochrane Handbook were applied to impute and estimate the missing effect sizes [29]. We adopted a threshold of $P < 0.05$ to denote statistical significance.

In the network meta-analysis, we drew network diagrams to present the available direct comparisons and describe the structure of the network. We used arm-based data and did our network meta-analyses within the Bayesian framework with hierarchical models to synthesize all available evidence. Gibbs sampling and Markov chain Monte Carlo (MCMC) methods were employed for Bayesian inference [33, 34]. Because of the anticipated heterogeneity, we considered both fixed-effects and random-effects models to pool

the network results. We selected the model with a better fit by comparing the posterior mean of residual deviance.

Data were analyzed using R software (version 4.3.1). We conducted a series of pairwise meta-analyses for all direct comparisons, followed by a network meta-analysis for both direct and indirect comparisons. In the network diagrams, the line between each node represents a direct comparison between two interventions. The width of each line indicates the number of studies reporting a comparison between the two interventions. We measured the level of heterogeneity with the I^2 statistic; an $I^2 < 50\%$ was considered to have no significant heterogeneity, in which case we used a fixed-effects model to calculate the pooled effect sizes. Otherwise, a random-effects model was used.

We estimated the ranking probability of each intervention using the surface under the cumulative ranking curves (SUCRA) [16], which ranged from 0 to 100%. A higher ranking probability indicates that the intervention has a better efficacy or acceptability ranking. We conducted sensitivity analyses by excluding unpublished data, studies that included patients already taking antidepressants, and studies with a high risk of bias rating to test the robustness of the results. We tested for publication bias with Egger's test. The network diagrams were produced using the "mvmeta" package in Stata (version 14).

Results

Quality of relevant studies

A total of 633 records were retrieved; after removing duplicate records, we screened a total of 601 potentially eligible articles found in our database search. We retrieved the full texts of 102 potentially eligible studies for further consideration and finally included 35 randomized controlled trials

Fig. 1 Flow diagram of the search and selection of studies
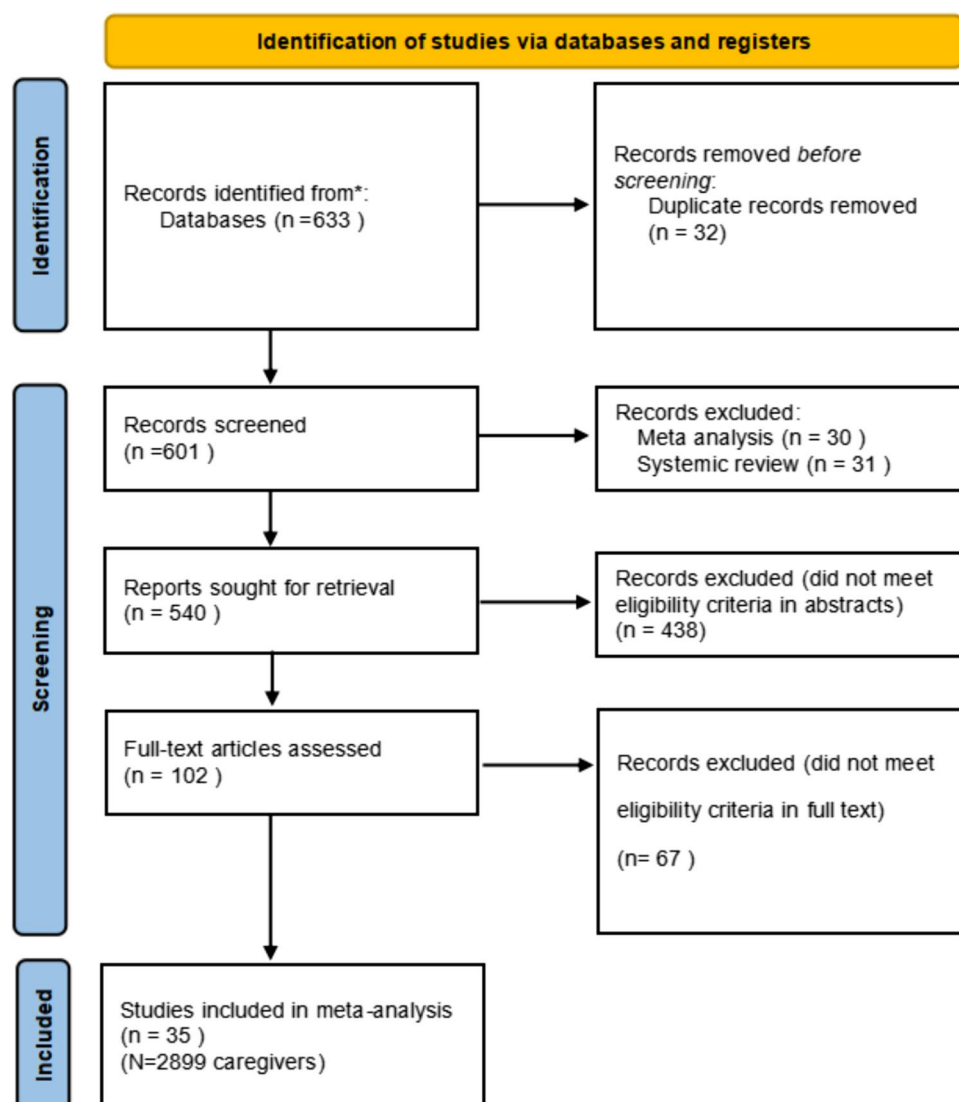
(with 2899 patients) involving seven psychological interventions. A PRISMA flow diagram (Fig. 1) outlines the selection process for studies included in the network meta-analysis as well as reasons for exclusion.

Baseline characteristics of included studies

The baseline characteristics of the included studies are shown in Table 1. The included studies were published prior to 2023. According to the studies' characteristics, the mean age of study participants was 43.39, ranging from 27.40 to 59 years, and men comprised 65.61% of the sample population. Of the 35 included studies, 9 studies conducted cognitive-behavioral therapy; 4 studies conducted psychoeducation; 5 studies conducted supportive therapy; 4 studies conducted couples therapy; 9 studies conducted meaning-centered psychotherapy; 3 studies conducted mindfulness-based interventions, and 1 study conducted music intervention.

Risk of bias of included studies

Generally, the randomized controlled trials included in the network meta-analysis showed an acceptable and relatively low risk of biases. A total of 9 studies (25.71%) were rated as low risk of bias, and 12 (34.28%) as high. According to the Cochrane Collaboration tool, the remaining 40% of the studies lacked information on key evaluation areas. Therefore, their risk of reporting bias was unclear.

Analyses of outcomes

Anxiety

Figure 2a displays the key findings of the network meta-analyses. Compared with the control groups, three psychological interventions were statistically significantly effective in reducing anxiety symptoms. They included meaning-centered psychotherapy (MD $= -5.48$, 95% CI (-8.46 to -2.49)), psychoeducation (MD $= -9.38$, 95% CI (-13.76 to -4.94)), and supportive therapy (MD $= -7.05$, 95% CI (-11.12 to -3.05)) (Fig. 2b). Based on the interval estimation of direct and indirect comparison, meaning-centered psychotherapy, psychoeducation, and supportive therapy were more effective than control groups. The ranking of the interventions and the comparison-adjusted funnel plots for the efficacy and acceptability networks are shown in Supplementary Appendix G, E. Relative effect sizes of different interventions according to network meta-analysis (Random model) are presented in Supplementary Appendix D.

Depression

The main findings of the network meta-analyses are shown in Fig. 3a. Compared with the control groups, two psychological interventions were statistically significantly effective in reducing depression symptoms. They included meaning-centered psychotherapy (MD $= -5.13$, 95% CI (-8.27 to -1.96)) and supportive therapy (MD $= -5.59$, 95% CI (-9.83 to -1.36)) (Fig. 3b). Based on the interval estimation of direct and indirect comparison, meaning-centered psychotherapy and supportive therapy were more effective than the control groups. The ranking of the interventions and the comparison-adjusted funnel plots for the efficacy and acceptability networks are shown in Supplementary Appendix G, E. Relative effect sizes of different interventions according to network meta-analysis (Random model) are presented in Supplementary Appendix D.

Analyses of subgroup outcomes

Subgroup analysis assessed the effects of cancer type and intervention duration on caregiver anxiety and depression. The results indicated that interventions longer than eight weeks were more effective in reducing anxiety. Specifically, supportive therapy showed significant efficacy in reducing anxiety symptoms when interventions lasted longer than eight weeks. Anxiety among caregivers often arises from uncertainty about the patient's future, and supportive therapy helps reduce this anxiety by promoting optimism and encouraging active involvement in the patient's care. The subgroup analysis also demonstrated that supportive therapy was the most effective intervention for reducing depressive symptoms, as it facilitated emotional expression, experience sharing, and problem discussion, helping caregivers find meaning in their caregiving role.

In subgroup analysis, this study analyzed the effects of cancer type and duration of the psychological intervention on caregiver anxiety and depression. Network meta-analysis can be done when the intervention duration exceeds eight weeks. The main findings of the network meta-analyses are shown in Fig. 4a. Compared with the control groups, one psychological intervention was statistically significantly effective in reducing anxiety symptoms: supportive therapy (MD $= -9.56$, 95% CI (-17.35 to -2.15)) (Fig. 4b).

Discussion

To our knowledge, this study represents the first network meta-analysis to evaluate the effectiveness of different psychosocial interventions in reducing anxiety and depression among cancer caregivers. Previous studies with similar inclusion criteria did not employ a network meta-analysis

Table 1 Baseline characteristics of included studies

Study (author, year)	Area	Males n (%)	Intervention	Control	Sample size Intervention	Sample size Control	Delivery medium	Outcomes
Kurtz et al., 2005	USA	110 (46.6%)	Cognitive-behavioral therapy	Usual care	118	119	Face-to-face	Depression
Zeng et al., 2011	China	50 (49.0%)	Psychoeducation	Usual care	50	52	Online	Anxiety, depression
Lai et al., 2011	Taiwan	0 (0%)	Music intervention	Usual care	17	17	Online	Anxiety, depression
Jia et al., 2012	China	Not stated	Supportive therapy	Usual care	62	58	Online	Anxiety, depression
Meng et al., 2013	China	Not stated	Psychoeducation	Usual care	55	55	Online	Anxiety, depression
Anna et al., 2013	USA	2 (5.4%)	Cognitive-behavioral therapy	Usual care	23	14	Online	Anxiety
Boele et al., 2013	UK	36 (30.5%)	Cognitive-behavioral therapy	Usual care	80	40	Online	Anxiety, depression
Fegg et al., 2013	Germany	40 (30.1%)	Meaning-centered psychotherapy	Usual care	67	60	Face-to-face	Depression
Hoda et al., 2015	USA	39 (100%)	Cognitive-behavioral therapy	Usual care	20	19	Face-to-face	Anxiety, depression
Borjalilu et al., 2016	Iran	0 (0%)	Supportive therapy	Wait-List Control	21	21	Face-to-face	Anxiety, depression
Xu et al., 2017	China	67 (35.4%)	Mindfulness-based interventions	Usual care	94	95	Online	Anxiety, depression
Li et al., 2017	China	Not stated	Mindfulness-based interventions	Usual care	45	46	Online	Anxiety, depression
Yang et al., 2017	China	Not stated	Supportive therapy	Usual care	30	30	Online	Anxiety, depression
Jiang et al., 2017	China	48 (50.0%)	Psychoeducation	Usual care	48	48	Online	Anxiety, depression
Wang et al., 2017	China	11 (9.2%)	Meaning-centered psychotherapy	Usual care	60	60	Online	Anxiety, depression
Schellekens et al., 2017	The Netherlands	19 (43.2%)	Mindfulness-based interventions	Usual care	21	23	Online	Anxiety, depression
Milad et al., 2017	Iran	48 (60.0%)	Cognitive-behavioral therapy	Usual care	40	40	Online	Anxiety, depression
Huang et al., 2018	China	40 (50.0%)	Cognitive-behavioral therapy	Usual care	40	40	Online	Anxiety, depression
Liang et al., 2018	China	19 (25.0%)	Meaning-centered psychotherapy	Usual care	38	38	Online	Anxiety, depression
Applebaum et al., 2018	USA	12 (14.3%)	Meaning-centered psychotherapy	Usual care	42	42	Face-to-face	Anxiety, depression
Nicolaisen et al., 2018	Denmark	Not stated	Couples therapy	Usual care	102	96	Online	Anxiety, depression
Yin et al., 2019	China	55 (47.4%)	Supportive therapy	Usual care	58	58	Online	Anxiety, depression
Pan et al., 2019	China	Not stated	Psychoeducation	Usual care	30	30	Online	Anxiety, depression
Luo et al., 2019	China	49 (50.0%)	Meaning-centered psychotherapy	Usual care	49	49	Online	Anxiety, depression
Liu et al., 2019	China	41 (42.7%)	Meaning-centered psychotherapy	Usual care	48	48	Online	Anxiety, depression
Zhang et al., 2020	China	35 (50.0%)	Meaning-centered Psychotherapy	Usual care	35	35	Online	Anxiety, depression
Ren et al., 2020	China	19 (31.7%)	Meaning-centered psychotherapy	Usual care	30	30	Online	Anxiety, depression
Xiu et al., 2020	China	75 (47.8%)	Cognitive-behavioral therapy	Mindfulness-based interventions	81	76	Face-to-face	Anxiety, depression
Chen et al., 2021	China	72 (100%)	Couples therapy	Usual care	36	36	Online	Anxiety, depression
Kelly et al., 2021	USA	10 (34.5%)	Cognitive-behavioral therapy	Usual care	15	14	Face-to-face	Anxiety, depression
Xie et al., 2022	China	43 (69.4%)	Supportive therapy	Usual care	31	31	Online	Anxiety, depression
Sylvie et al., 2022	Canada	2 (6.1%)	Couples therapy	Wait-List Control	16	17	Face-to-face	Anxiety, depression
Daniela et al., 2022	Germany	18 (30.0%)	Couples therapy	Wait-List Control	30	30	Face-to-face	Anxiety, depression
Maru et al., 2022	Canada	8 (21.1%)	Cognitive-behavioral therapy	Usual care	19	19	Online	Anxiety, depression
Applebaum et al., 2022	USA	5 (9.1%)	Meaning-centered psychotherapy	Usual care	30	25	Face-to-face	Anxiety, depression

Fig. 2 Network graph (**a**) and forest plot of network meta-analysis results (**b**) for anxiety outcomes
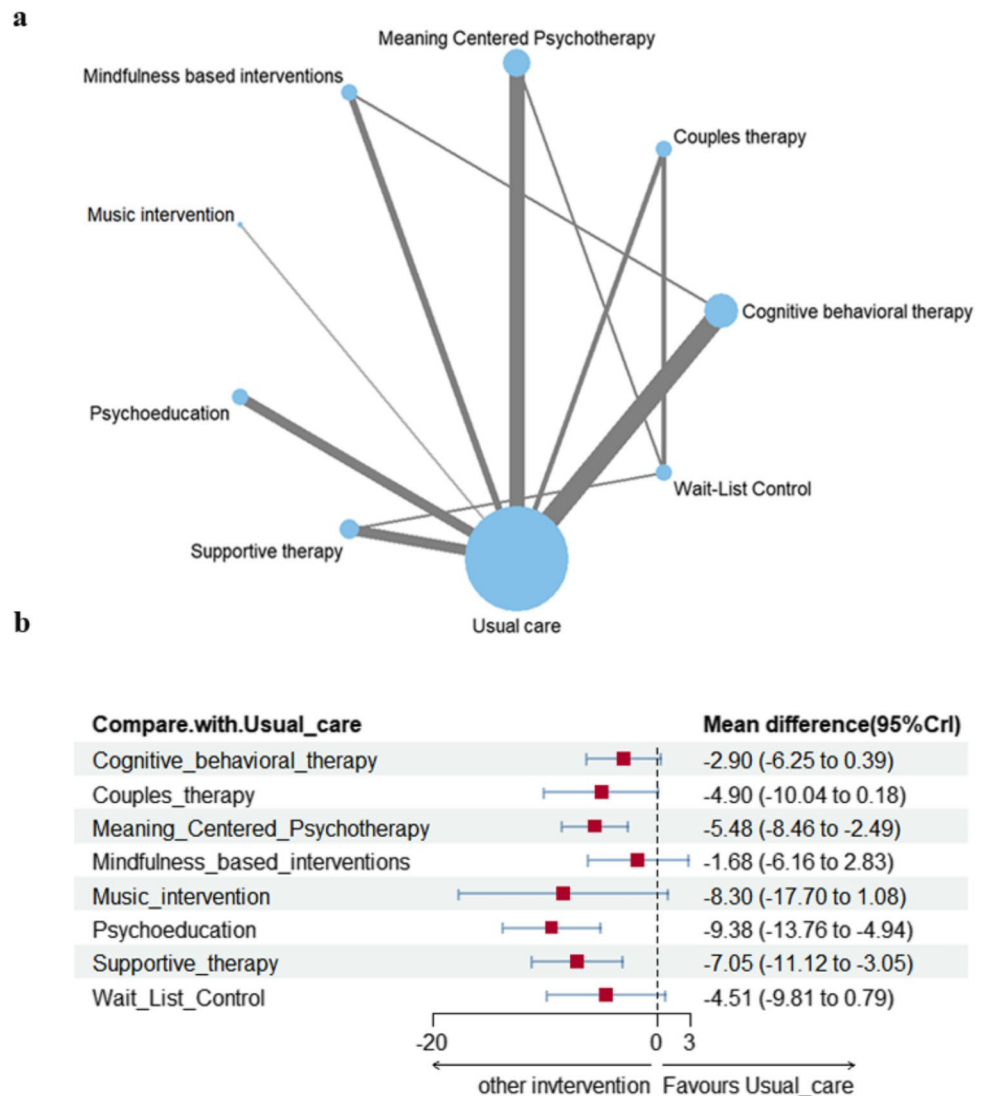

approach. Results of the meta-analysis are shown in Supplementary Appendix F. Our results indicate that psychoeducation, supportive therapy, and meaning-centered psychotherapy are particularly effective in alleviating anxiety and depression. These interventions were found to be superior to control conditions, such as usual care or wait-list controls.

The effectiveness of psychoeducation may be attributed to its focus on providing caregivers with accurate information, empowering them with knowledge about cancer and caregiving, and equipping them with coping skills to address challenges effectively. By reducing fear of the unknown, psychoeducation helps alleviate anxiety and depression [2]. It is possible that psychoeducation also enhances caregivers' sense of control and self-efficacy, which are crucial factors in managing stress and preventing burnout. Providing caregivers with clear guidelines and resources can help them feel more competent in managing their caregiving roles, as

well as reducing the feelings of helplessness and isolation that can contribute to psychological distress.

Supportive therapy ranked second in terms of effectiveness among the seven non-pharmacological interventions. This intervention focuses on the mental state of caregivers, who often face significant physical, emotional, and material burdens, which can then lead to fatigue, anxiety, depression, and other symptoms [4, 11]. Supportive therapy provides emotional encouragement, facilitates the expression of feelings, and fosters a supportive environment for sharing experiences. The support offered through these therapies helps caregivers feel less isolated in their caregiving journey and offers a sense of community, which can be a powerful antidote to depression and anxiety. In addition, supportive therapy may provide an outlet for emotional release, allowing caregivers to process their feelings in a safe space without fear of judgment.

Fig. 3 Network graph (**a**) and forest plot of network meta-analysis results (**b**) for depression outcomes

The findings are presented in the figure above.
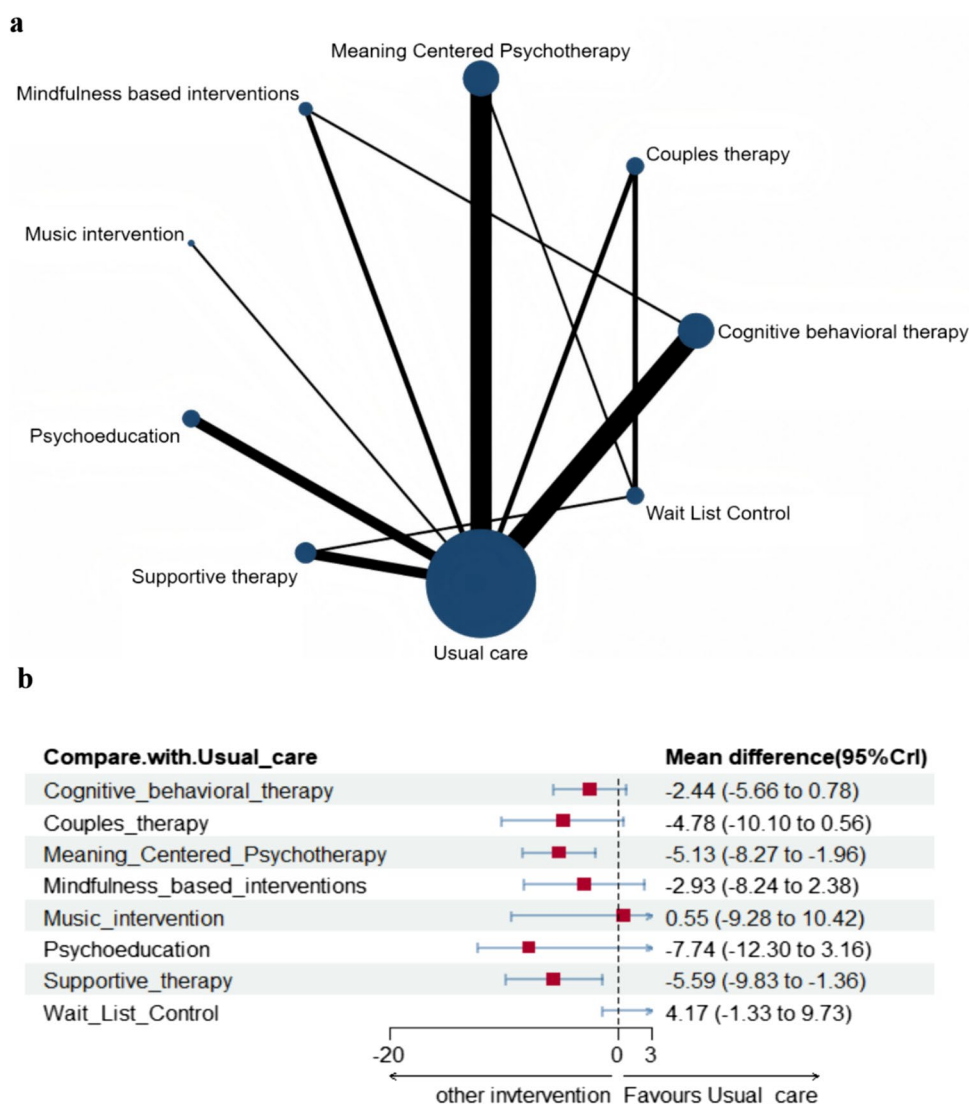
Meaning-centered psychotherapy ranked third in effectiveness. It is a type of psychotherapy that focuses on enhancing spiritual well-being, fostering a sense of meaning, and improving quality of life. Meaning-centered psychotherapy aims to increase caregivers' well-being and sense of purpose, thereby reducing anxiety and depression. Given the long duration of cancer treatment, caregivers often experience prolonged psychological distress. Meaning-centered psychotherapy helps caregivers connect with their sense of purpose, thereby enhancing their outlook on life and overall mental health [35]. Meaning and purpose are particularly important for caregivers, as they can provide a sense of fulfillment and motivation that then allows caregivers to continue in their roles despite the challenges they face. Through meaning-centered interventions, caregivers may also learn to find positive aspects of their caregiving experience, such as personal growth and increased resilience, which also contribute to improved mental health outcomes.

The findings of this study have important implications for clinical practice. Healthcare providers should be aware of the psychosocial needs of cancer caregivers and consider incorporating psychoeducation, supportive therapy, and meaning-centered psychotherapy into routine care. Caregivers often go unnoticed in the healthcare system, as the focus is primarily on the patient. However, providing targeted interventions for caregivers can significantly improve their quality of life, which ultimately benefits the patient as well. Healthcare professionals should also be encouraged to receive specialized training so that they can deliver these psychosocial interventions effectively. Tailoring interventions to the specific needs of caregivers based on the type of cancer, the stage of illness, and cultural considerations may further enhance their effectiveness.

Furthermore, interventions such as psychoeducation can be adapted to digital platforms, allowing caregivers to access resources and support remotely. Given the increasing use

Fig. 4 Network graph (**a**) and forest plot of network meta-analysis results (**b**) for anxiety subgroup (≥ 8 weeks)
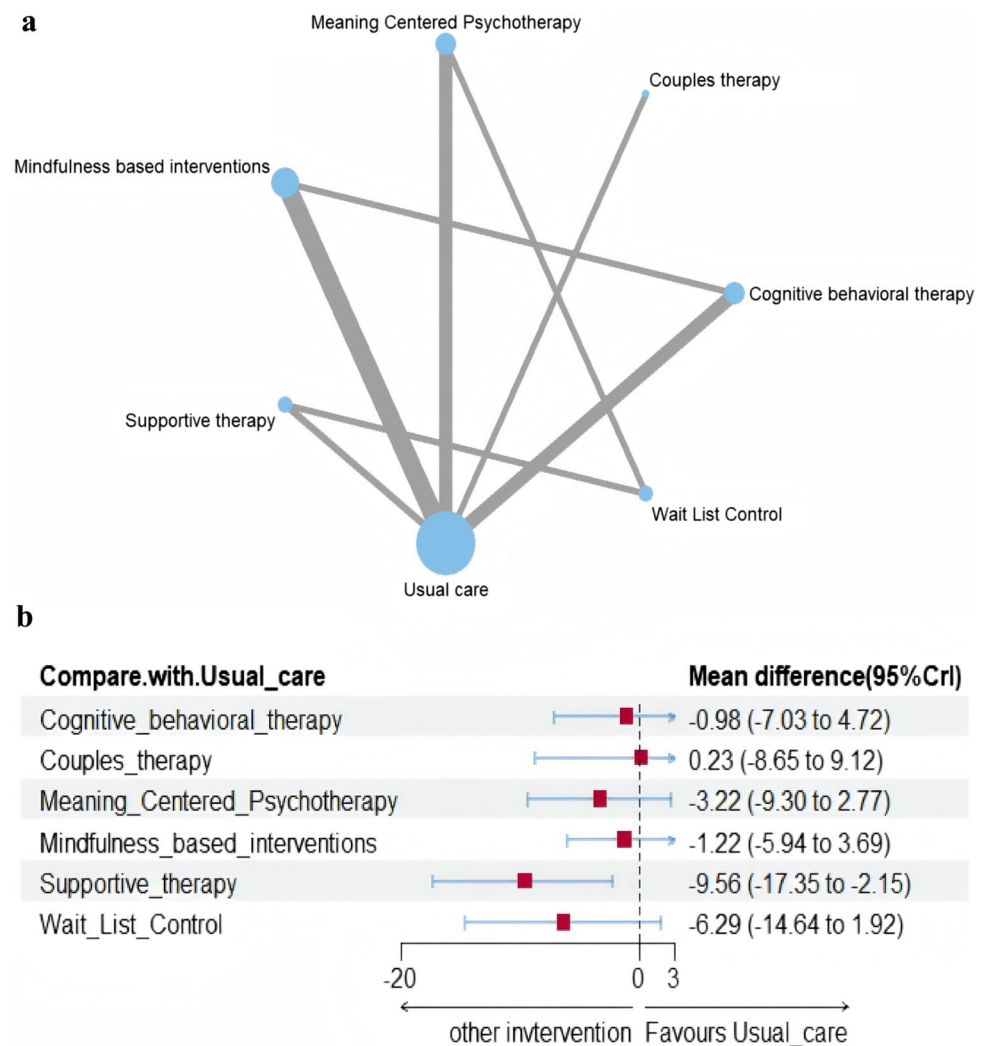
of telehealth and online interventions, future studies should explore the feasibility and effectiveness of delivering these therapies through digital means, especially for caregivers who have limited access to healthcare facilities or face time constraints.

Our findings are consistent with earlier meta-analyses that showed psychosocial interventions are generally beneficial for caregivers. However, by using network meta-analysis, we were able to compare multiple interventions simultaneously, offering a more comprehensive view of their relative effectiveness [16]. Unlike previous studies that often relied on direct comparisons between two interventions, this approach allowed us to integrate evidence from both direct and indirect comparisons, thereby increasing the robustness of our findings. It is important to note that our results differ from some prior meta-analyses regarding the efficacy of cognitive-behavioral therapy (CBT) and mindfulness-based interventions, which were not found to be as effective as psychoeducation, supportive therapy, and meaning-centered psychotherapy. This discrepancy may be due to differences

in study quality, intervention formats, or population characteristics, highlighting the need for more high-quality research in this area.

A major strength of this study is the use of network meta-analysis, which allowed for a comprehensive synthesis of data and the simultaneous comparison of multiple interventions. This approach provided more robust and reliable estimates than traditional meta-analysis, particularly in identifying the most effective psychosocial interventions for reducing anxiety and depression in cancer caregivers [16]. Additionally, the similarity between different psychotherapy protocols often makes it challenging to distinguish between interventions, which the network meta-analysis approach helps to address.

However, it is noteworthy that previous studies have reported inconsistent findings regarding some psychosocial interventions, particularly cognitive-behavioral therapy (CBT) and mindfulness-based interventions. These discrepancies may be attributed to methodological differences across studies, such as variations in study design, sample

sizes, intervention duration, delivery formats (individual vs. group), and differences in participant characteristics including caregiver burden levels and cultural background. Such heterogeneity underscores the need for further high-quality research to clarify the effects of these interventions in diverse caregiver populations.

It is important to acknowledge that this study has some limitations. First, we included studies from China, which, while they improved the comprehensiveness of the analysis, had overall lower methodological quality and incomplete descriptions of methods and outcomes; this could have introduced bias and variability in the results [15]. The variability in measurement tools for anxiety and depression used across studies may have also contributed to the heterogeneity observed in the network meta-analysis. Standardizing outcome measures in future research would allow for more accurate comparisons between studies. Moreover, due to the subjective nature of psychological outcomes, the lack of blinding in most trials may have led to an overestimation of intervention effects. Addressing these methodological issues in future research will be essential in confirming the effectiveness of these interventions. Additionally, due to the limited availability of detailed data in the included studies, subgroup analyses were restricted to cancer type and intervention duration. This limitation may have constrained the exploration of other potentially relevant factors.

Future research

Future studies should focus on exploring the long-term effects of psychosocial interventions for caregivers, as many existing studies lack long-term follow-up data. It is crucial to determine whether the benefits of interventions like psychoeducation, supportive therapy, and meaning-centered psychotherapy are sustained over time. Moreover, future research should aim to include diverse caregiver populations to gain insight into how to tailor interventions to the unique needs of different groups. Additionally, digital interventions, such as mobile applications, offer innovative ways to make psychosocial support more accessible. Research on their feasibility and efficacy could significantly enhance support for caregivers, particularly those in underserved areas.

Conclusions

This network meta-analysis provides evidence that psychoeducation, supportive therapy, and meaning-centered psychotherapy are effective in reducing anxiety and depression among cancer caregivers. These interventions should be integrated into routine cancer care to support caregivers and improve their quality of life, and thereby ultimately benefit patients as well. Future research should continue optimizing

these interventions and exploring technological innovations to improve their accessibility.

Data availability All data relevant to the study are included in the article or uploaded as online supplemental information.

Declarations

Ethics approval This study is a systematic review of available literature and did not involve direct access to participants of the primary research studies included. Research ethics approval was therefore not required.

Competing interests The authors declare no competing interests.

Patient and public involvement Patients and/or the public were not involved in the design, conduct, reporting, or dissemination plans of this research.

References

1. World Health Organization. (2020). *Cancer fact sheet*. Retrieved from https://www.who.int/
2. Stenberg U, Ruland CM, Miaskowski C (2010) Review of the literature on the effects of caring for a patient with cancer. Psychooncology 19(10):1013–1025

3. McCorkle R, Yost LS, Jepson C, Malone D, Baird S, Lusk E, Pulliam J (1993) A cancer experience: relationship of patient psychosocial responses to pain. Cancer 71(S3):1678–1689

4. Braun M, Mikulincer M, Rydall A, Walsh A, Rodin G (2019) Hidden morbidity in cancer: Spouse caregivers. J Clin Oncol 25(30):4829–4834

5. Given BA, Given CW, Sherwood P (2011) The challenge of quality cancer care for family caregivers. Semin Oncol Nurs 28(4):205–212

6. Adelman RD, Tmanova LL, Delgado D, Dion S, Lachs MS (2014) Caregiver burden: A clinical review. JAMA 311(10):1052–1059

7. Schulz R, Beach SR (1999) Caregiving as a risk factor for mortality: the Caregiver Health Effects Study. JAMA 282(23):2215–2219

8. Northouse LL, Katapodi MC, Song L, Zhang L, Mood DW (2012) Interventions with family caregivers of cancer patients: meta-analysis of randomized trials. CA: A Cancer Journal for Clinicians 60(5):317–339

9. Williams AL, McCorkle R (2011) Cancer family caregivers during the palliative, hospice, and bereavement phases: a review of the descriptive psychosocial literature. Palliat Support Care 9(3):315–325

10. Choi S, Seo J (2019) Analysis of caregiving burden among family caregivers of terminal cancer patients. Psychooncology 28(6):1308–1314

11. Myers JE, Sweeney TJ (2014) Wellness counseling: the evidence base for practice. J Couns Dev 92(4):437–447

12. Honea NJ, Brintnall R, Given B, Sherwood P, Colao DB, Somers SC, Northouse LL (2008) Putting evidence into practice: nursing assessment and interventions to reduce family caregiver strain and burden. Clin J Oncol Nurs 12(3):507–516

13. Dionne-Odom JN, Azuero A, Lyons KD, Hull JG, Tosteson T, Li Z, Bakitas MA (2015) Benefits of early versus delayed palliative care to informal family caregivers of patients with advanced cancer: outcomes from the ENABLE III randomized controlled trial. Journal of Clinical Oncology 33(13):1446–1452

14. Hudson P, Trauer T, Kelly B, O'Connor M, Thomas K, Zordan R, Summers M (2015) Reducing the psychological distress of family caregivers of home-based palliative care patients: short-term effects from a randomised controlled trial. Psychooncology 24(2):120–127

15. Adams R, Hill A, Watson E (2020) The quality of reporting in randomized trials: An analysis of cancer caregiver interventions. J Clin Nurs 29(21–22):4304–4312

16. Salanti G, Ades AE, Ioannidis JPA (2011) Graphical methods and numerical summaries for presenting results from multiple-treatment meta-analysis: an overview and tutorial. J Clin Epidemiol 64(2):163–171

17. Hagedoorn M, Sanderman R, Bolks HN, Tuinstra J, Coyne JC (2008) Distress in couples coping with cancer: a meta-analysis and critical review of role and gender effects. Psychol Bull 134(1):1–30

18. Booth, A., Sutton, A., & Papaioannou, D. (2021). Systematic Approaches to a Successful Literature Review (3rd ed.). Sage.

19. Hutton B, Salanti G, Caldwell DM et al (2015) The PRISMA extension statement for reporting of systematic reviews incorporating network meta-analyses of health care interventions: checklist and explanations[J]. Ann Intern Med 162(11):777–784

20. Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ, 372, n71.

21. Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group (2009) Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med 6(7):e1000097

22. Mehta A, Chan LS (2008) Understanding of the concept of "total pain": a prerequisite for pain control. J Hosp Palliat Nurs 10(1):26–32

23. Lewis FM, Fletcher KA, Cochrane BB (2008) The family's functioning with newly diagnosed breast cancer in the mother: The development of an explanatory model. J Behav Med 31(5):443–454

24. Kelly BJ, Fraze T, Hornik RC, Hallman WK, Schwartz JS (2010) The Internet as a health information source: findings from the Health Information National Trends Survey. Arch Intern Med 170(3):291–300

25. Revenson TA, Majerovitz SD (1991) Spouses' support provision to chronically ill patients. J Soc Pers Relat 8(2):223–237

26. Pinquart M, Sörensen S (2006) Helping caregivers of persons with dementia: Which interventions work and how large are their effects? Int Psychogeriatr 18(4):577–595

27. Reblin M, Uchino BN (2008) Social and emotional support and its implication for health. Curr Opin Psychiatry 21(2):201–205

28. de Moor JS, de Moor CA, Basen-Engquist K, Kudelka AP, Cohen L (2006) Optimism, distress, and quality of life in gynecologic cancer survivors. Cancer 106(3):527–536

29. Higgins J P. Cochrane handbook for systematic reviews of interventions. Version 5.1. 0 [updated March 2011]. The Cochrane Collaboration[J]. www. cochrane-handbook. org, 2011.

30. Higgins, J. P. T., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (2019). Cochrane Handbook for Systematic Reviews of Interventions (2nd ed.). Wiley.

31. Furukawa TA, Salanti G, Atkinson LZ et al (2016) Comparative efficacy and acceptability of first-generation and second-generation antidepressants in the acute treatment of major depression: protocol for a network meta-analysis[J]. BMJ Open 6(7):e010919

32. Furukawa TA, Barbui C, Cipriani A et al (2006) Imputing missing standard deviations in meta-analyses can provide accurate results[J]. J Clin Epidemiol 59(1):7–10

33. Li Q, Loke AY (2013) A literature review on the mutual impact of the spousal caregiver–cancer patients dyads: 'Communication', 'reciprocal influence', and 'caregiver–patient congruence.' Eur J Oncol Nurs 17(4):380–389

34. van Valkenhoef G, Lu G, de Brock B, Hillege H, Ades AE, Welton NJ (2012) Automating network meta-analysis. Research Synthesis. Methods 3(4):285–299

35. Applebaum AJ, Buda KL, Schofield E et al (2018) Exploring the cancer caregiver's journey through web-based Meaning-Centered Psychotherapy[J]. Psychooncology 27(3):847–856