REVIEW

Peer support interventions for breast cancer patients: a systematic review

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Abstract

Purpose Due to the clear efficacy of peer support as a means of improving emotional well-being and healthy behaviors in a highly cost-effective manner, this program is widely used. Controversy remains, however, with regard to its efficacy in breast cancer patients. Given the heterogeneity of peer support interventions, this review aimed to categorize, assess, and synthesize the existing evidence from randomized controlled trials (RCTs) to clarify the effects of different types of peer support on breast cancer patients.

Methods We searched Pubmed, EMBase, CENTRAL, CINAHL, PsychINFO, Chinese National Knowledge Infrastructure (CNKI) and Wanfang Data for English and Chinese language RCTs. The Cochrane Collaboration 'risk of bias' tool for systematic reviews was used to assess the methodological quality of each RCT.

Results Of the 1494 studies screened, 15 studies met eligibility criteria for inclusion, comprising 1695 breast cancer patients. Overall, there were more positive effects than invalid or negative effects across peer interventions, with notable exceptions: unmoderated and unstructured group peer support interventions as well as Internet-based models without peer training had no effect or adverse effects on proximal and distal outcomes. However, adding other peer roles to the peer support structure or using one-on-one models could significantly improve the patients' negative emotions. Peer education showed promising effects on stress management, quality of life, and healthy behaviors.

Conclusions This systematic review found that different types of peer support have different effects on outcomes for breast cancer patients. Web-based group peer support without peer training must be avoided or used with caution in the future. Peer education is recommended for breast cancer patient support models, given its excellent results and cost-effectiveness.

Keywords Peer support · Breast cancer patients · Depression · Systematic literature review

Introduction

Breast cancer is the most common gynecological malignancy, and recent treatment advances have dramatically improved the overall 5-year relative survival rate for this disease [1, 2]. Despite the fact that diagnosis is often accompanied by a good prognosis, both the diagnosis and treatment of breast cancer disrupt almost all aspects of a patient's life, and is often associated with psychosocial sequelae including depression, anxiety, and fear of recurrence [3, 4]. As healthcare budgets are generally limited, the psychosocial support needs of these patients have not been met, and their negative emotions and the resulting obesity [5, 6] can in turn promote the recurrence of breast cancer or even death [7–9].

Peer support refers to the approach whereby individuals with the same disease or condition meet in order to exchange information, share experiences, and encourage or help each other to overcome difficulties [10, 11]. Unlike professional help, peer support is based on a non-hierarchical relationship [12], and from the perspective of social comparison theory, interactions between individuals with the same disease are generally beneficial as they can help to establish a sense of normalcy by comparison [13]. The associated reciprocal process of giving and receiving can improve participants'

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emotions, quality of life, self-efficacy, and compliance with care management plans [14, 15]. Moreover, given the limited participation by health professionals, such peer support programs can provide psychosocial support or other health care services at a low cost, thereby reducing the cost of public health projects substantially [16, 17]. In recent years, peer support programs have been widely used in the context of chronic disease management [18–20], alcohol and substance abuse [21], and breast feeding [22], achieving good results in these settings.

Peer support programs for breast cancer patients have grown significantly in recent decades [23]. As a widely accepted mode of intervention for breast cancer patients [24], peer support has been confirmed to relieve patients' negative emotions, improve their quality of life and chemotherapy compliance, and address reproductive issues [25, 26]. However, recent studies have found that peer support is not effective as a means of improving patient depression, and that it may event reduce quality of life and increase emotional distress [14, 27, 28]. Given the considerable heterogeneity in the content of different forms of peer interventions, it would be unreasonable to evaluate the effectiveness of all peer interventions based solely on these results.

By reviewing of available reports, we determined that there were limited publications concerning the effect of peer support on breast cancer patients. Therefore, this review used a systematic approach to explore the effects of peer support on breast cancer patients. Given the unique advantages of interacting with peers with the same illness experience, we only cataloged studies in which peers suffered from breast cancer. By referring to the work of Ramchand et al. [15] and Hoey et al. [23], we classified the peer support interventions based on peer roles and delivering models in order to ensure maximal homogeneity of each type of intervention. The purpose of our review was to determine the effects of different types of peer support interventions and to provide guidance and reference for health workers who want to design and conduct such programs for this patient population in the future.

Methods

This review was reported in accordance with Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines.

Literature search

A systematic search of published literature was conducted using English and Chinese electronic databases, including Pubmed, EMBase, CENTRAL (the Cochrane central register of randomized controlled trials), CINAHL (Cumulative Index to Nursing and Allied Health Literature), PsychINFO, Chinese National Knowledge Infrastructure (CNKI) and Wanfang Data. There was no restriction on the date of publication, which was from inception to the date on which searches were run (June 2018).

Search strategies were customized to each database. For PubMed, search strategies used Medical Subject Headings (MeSH) coupled with free text terms to represent the definitions of Breast Cancer, Peer Support and Randomized Controlled Trials (RCTs). Varied strategies were employed as appropriate for the other surveyed databases.

Criteria for inclusion

The inclusion criteria were as follows: (1) English or Chinese language RCTs published in peer-reviewed journals or theses, (2) study participants were diagnosed with breast cancer (including metastatic breast cancer and recurrent breast cancer), (3) peers had been diagnosed with breast cancer, and (4) the main purpose of the program was to support breast cancer patients. Papers and theses meeting any of the following criteria were excluded: (1) reviews, editorials, or letters about a program, (2) intervention processes run by professionals, (3) not a specific peer support intervention, i.e., a comparison of peer education plus another intervention to peer education alone, and (4) the peer support was targeted at other people besides breast cancer patients (e.g., their family, caregivers, or friends).

Study selection

Two reviewers independently screened titles and abstracts against the inclusion criteria. Disagreements during the screening process were resolved by discussion and consensus within the pair, with a third independent reviewer discussing any other concerns as needed. Then, reviewer pairs reviewed the remaining full-text articles to confirm their eligibility following this same process.

Data extraction and quality

Data were extracted from the included studies for each of the following variables: author, year of publication, participant characteristics (e.g., sample size, diagnosis), peer training, intervention and control details, measures used, number and time of data point, key findings. Two reviewers independently extracted data from each included study, and another reviewer ensured the accuracy of extracted numerical data.

The Cochrane Collaboration's 'Risk of bias' tool for systematic reviews of interventions (v. 5.1.0) was used to assess the methodological quality of each RCT [29]. All included studies were assessed independently, and scores were achieved via consensus.

Statistical analysis

Because of the large number of outcomes and different measures, a quantitative meta-analysis was not performed. Therefore, we performed a best-evidence synthesis to identify the key results and limitations of the included studies.

Results

We retrieved 1494 citations from English and Chinese database searches. 122 full-text articles were reviewed, and 15 studies met the eligibility criteria. Full details of the search results are summarized in Fig. 1.

Study characteristics

A summary of the included papers and theses is provided in Table 1. All documents were published in this century and reported on quantitative (n = 13) or mixed methods including both qualitative and quantitative (n = 2). Note that the two papers by Napoles and colleagues [26, 30] both reported on data from a single sample.

Most studies were performed with patients with non-metastatic breast cancer (n = 6) [25–27, 30–32], while one study was specific to metastatic breast cancer [14] and one was specific to recurrence [33]. A few studies (28.6%) were performed among racial and ethnic minorities, with three

having been conducted among African American women [31, 34, 35] and one having been conducted among Spanish-speaking Latino American women [26, 30]. Only one study clearly demonstrated no training for peers [28], while four studies did not report whether peers were trained [9, 25, 27, 36]. The remaining nine studies reported that the training program lasted between 5 days and 3 months.

Study quality

Bias risks are shown in Figs. 2 and 3. All of the included studies described how the participants were randomized into either the control or comparison groups. Most studies were unclear with regard to whether allocation concealment or blinding of participants, personnel, or outcomes was performed. Due to differences between the two conditions in some variables assessed at baseline, nearly half of the studies had a high risk of other bias.

Descriptions of peer interventions

The interventions differed substantially across the 14 included studies. We identified five types of peer roles and six models of peer interventions according to the relevant definitions of Ramchand et al. [15] and Hoey et al [23]. Five types of peer roles were identified: peer supporter [14, 27, 28, 32, 35], peer educator [26, 30, 37, 38], peer counselor [31, 33, 34], peer facilitator, and peer case manager. Six

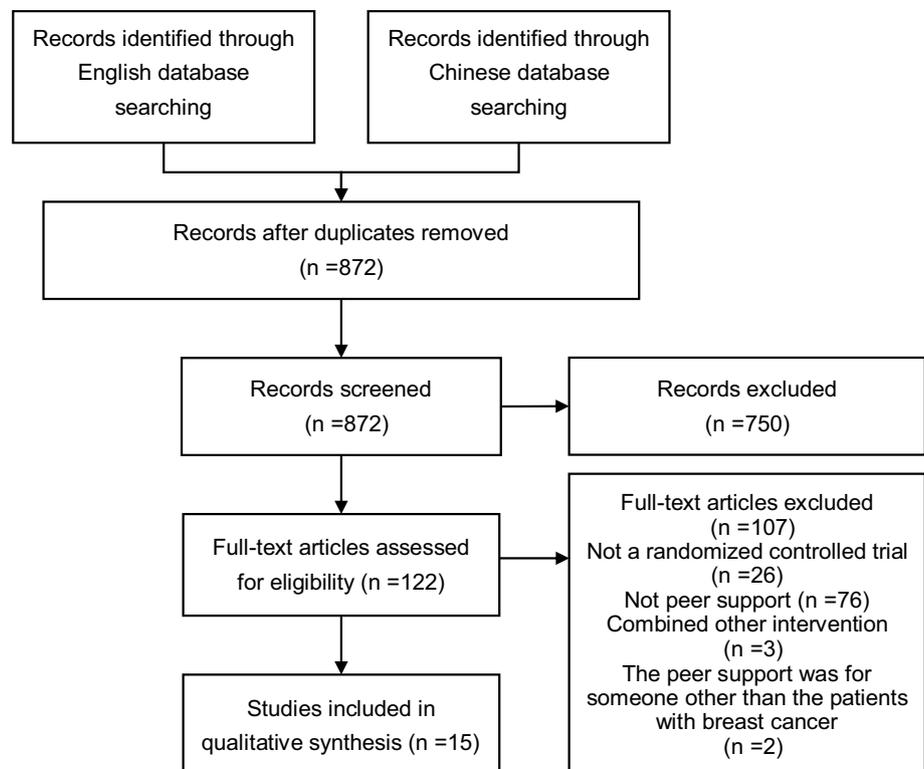**Fig. 1** The flow chart of literature selection

Table 1 Characteristics of the studies included in the review

Author (year) [reference]	Unit of analysis	Training for peers	Intervention	Control	Number and time of data points	Outcome measures	Key finding
Vilhauer et al. (2010) [14]	30 Women with metastatic breast cancer. (Immediate condition = 16, waitlisted condition = 14)	NR (not reported)	Participants wrote about negative and positive experiences and feelings to every member in the group via e-mail for 6 months	Participants waited for 2 months	At study entry and at monthly intervals subsequently	(1) ECOGPSS; (2) FACT-B; (3) MSPSS; (4) PANAS; (5) CES-D; (6) Participation Satisfaction (satisfaction questionnaires and interviews)	Women in two conditions were similar on the majority of psychosocial measures at Month 1 and 2 except for ECOGPSS
Schover et al. (2006) [31]	60 African American women with 0 to IIIA breast cancer (immediate condition = 29, waitlisted condition = 31)	Over 3 months including lectures, readings, role playing, research ethics, and discussion with a chaplain about spirituality in counseling	Participants met with peer counselors for three sessions using a detailed workbook, with each session lasting 60–90 min	Participants waited for 3 months	Baseline, after the waitlist period	(1) FACIT-Sp; (2) FSFI; (3) 7 items from the Breast Cancer Prevention Trial Menopause Symptom Checklist; (4) BSI-18; (5) 5 items assessing concerns about fertility, pregnancy, and health of offspring; (6) 25-item true/false knowledge test on the basis of the workbook; (7) A-DAS for participants in committed relationships; (8) 5 item dating subscale of CRES for single women	Knowledge of reproductive issues improved significantly from baseline to 3-month follow-up (P < 0.0001) in the immediate counseling group, as did emotional distress (P = 0.0047) and menopause symptoms (P = 0.0128). 81% rated the program very useful

Table 1 (continued)

Author (year) [reference]	Unit of analysis	Training for peers	Intervention	Control	Number and time of data points	Outcome measures	Key finding
Schover et al. (2011) [34]	297 African American women with breast cancer (Peer Counseling group = 152, Phone Counseling group = 148)	A 5-day counselor training conference including didactic material and experiential learning in supervised role plays	Participants met with peer counselors for three sessions during the 6-week treatment period, using a detailed workbook, with each session lasting 60–90 min	Participants were encouraged to call the counselor for up to 30 min to discuss issues in the workbook using a prepaid phone card	At baseline, after the 6-week treatment period, and at 6-month and 1-year follow-up	(1) FACIT-Sp; (2) A-DAS for women in committed relationships; (3) 5-item dating subscale of CARES for single women; (4) BSI-18; (5) FSFI; (6) 7 items from the Breast Cancer Prevention Trial Symptom Checklist; (7) 6 multiple-choice items from our previous surveys on having children after cancer; (8) 25-item true/false knowledge test for the SPIRIT pilot study; (9) Utilization of Reproductive Health Care	Both groups of women improved significantly in knowledge (P < 0.0001), decreased in distress (P < 0.0022), and had decreased hot flashes (P = 0.0063). Sexually active women had improved sexual function at 6-month follow-up, but not at 1 year
Salzer et al. (2010) [27]	78 women with stage I or II breast cancer (Intervention group = 51, Control group = 27)	Not report	Unmoderated, unstructured Internet peer-to-peer support groups	Internet-based educational control condition	Baseline, and 4- and 12-month post-baseline measurement	Primary outcome measures (1) HSCL-25; (2) FACT-B Secondary outcomes (3) IES; (4) POMS; (5) HHI; (6) SESES-C; (7) MOS	Participants in the Internet peer support condition tended to do worse over time on primary outcome measures of distress and well-being. There were no differences between groups on secondary outcomes of perceived social support, self-efficacy, or hope

Table 1 (continued)

Author (year) [reference]	Unit of analysis	Training for peers	Intervention	Control	Number and time of data points	Outcome measures	Key finding
Rosenzweig et al. (2011) [35]	24 African American with breast cancer and recommended chemotherapy (Intervention group = 13, Control group = 11)	The training included breast cancer education, empathetic communication, cultural sensitivity, and conduct of research studies using didactic lecture, role playing, and online educational modules	The intervention consisted of a 45-min face-to-face meeting with race-matched peer interventionist	Usual care	At baseline and three time points corresponding to chemotherapy completion: 50%, 75%, and 100%	(1) Days from chemotherapy recommendation to first chemotherapy; (2) Percentage of total doses prescribed or total dose received; (3) Overall adherence (at least 80%) of recommended chemotherapy in prescribed time frame	The intervention group demonstrated trends toward initiation of chemotherapy (100% vs. 82%), overall adherence to chemotherapy (92% vs. 73%), and percentage of total doses of chemotherapy received or prescribed (94% vs. 74%)
Napoles et al. (2018) [30]	151 primarily Spanish-speaking Latinas with non-metastatic breast cancer (Intervention group = 76, Control group = 75)	Three 8-h training sessions covering psychosocial issues among Latinas with breast cancer, the theoretical basis of Nuevo Amanecer, communication skills, cognitive-behavioral stress management skills, breast cancer and its treatment, and local community resources	An individualized Spanish-language 8-week intervention weekly included teaching women cognitive-behavioral coping skills, providing emotional support and informational resources, training in cognitive and behavioral stress management techniques, and modeling	Usual care	Baseline, 3-months, and 6-months	(1) Compañera (Interventionist) tracking form; (2) Fidelity ratings; (3) Program evaluation survey; (4) Debriefing by semi-structured interviews	80% of women completed six or more of eight sessions. 93% indicated the program helped them cope with breast cancer "quite a bit/extremely." Participants reported improved self-management skills and knowledge

Table 1 (continued)

Author (year) [reference]	Unit of analysis	Training for peers	Intervention	Control	Number and time of data points	Outcome measures	Key finding
Napoles et al. (2015) [26]	Idem	Idem	Idem	Idem	Idem	(1) FACT-B; (2) 3 scales from BSI: anxiety, depression, and somatization; (3) 7-item Intrusive Thoughts Scale, a subscale of the revised IES	Improvements in quality of life from baseline to 6 months were greater for the intervention than the control group on physical well-being ($P = 0.015$), emotional well-being ($P = 0.004$), breast cancer concerns ($P = 0.013$), and overall quality of life ($P = 0.03$. Decreases from baseline to 6 months were greater for the intervention group on depression and somatization
Lee et al. (2013) [32]	129 women with stage I–III breast cancer and having a propensity for anxiety or depression (Intervention group = 64, Control group = 65)	The 3 month training included one 2-day and 1-night program (16 h total) and two 1-day programs (16 h total) including lectures, group discussion, and role play	The patient and her support partner met once a week during the 6-week period by face-to-face or telephone, lasting at least 20 min	Usual care	At baseline and at 6 weeks after intervention	(1) The self-efficacy scale for self-management of breast cancer; (2) HADS; (3) Mini-MAC	There was a significant difference in changes in self-efficacy for self-management of breast cancer between the experimental and control groups; however, no significant changes were observed in anxiety, depression, or mental adjustment

Table 1 (continued)

Author (year) [reference]	Unit of analysis	Training for peers	Intervention	Control	Number and time of data points	Outcome measures	Key finding
Gotay et al. (2007) [33]	305 women with stage I, II, or IIIa breast cancer who experienced first recurrence after definitive surgical treatment (Intervention group = 152, Control group = 153)	The telephone hotline training included information about clinical trials and formats for their interaction	Patients received four to eight counseling/information sessions delivered by telephone at weekly intervals over a 1-month period, with one to two calls per week	Usual care	Baseline; 3 and 6 months	Primary outcomes (1) CARES-SF; (2) CES-D Psychosocial Predictors (3) 4 item social support scale, (4) Life orientation test; (5) A single three-point question found to correlate with recurrence of distress; (6) ASCS-SF; (7) a support services form regarding their use of community services and other assistance; (8) Telephone counseling evaluation form	No differences in distress or depressive symptoms at 3 months between the intervention and control groups
Giese-Davis et al. (2016) [39]	104 patients with stage I, II, or IV breast cancer (Intervention group = 52, Control group = 52)	The training included communication skills, active listening, and knowledge of the developmental stages of cancer, trauma recovery, and community resources with training materials	The pair met weekly by telephone, e-mail, or in person for up to 6 months including providing support, making connections to community resources, and recognizing trauma symptoms	Usual care	Baseline, 3 months, 6 months, and 12 months	Primary outcomes (1) FACT-B; (2) PCL-C Secondary outcomes (3) CBI; (4) LMAT; (5) CES-D; (6) BCRQ	The intervention significantly improved breast-cancer-specific well-being (P = 0.01, Cohen's d = 0.41) and maintained marital adjustment (P = 0.01, Cohen's = 0.45) more effectively than in the control group. Those with a peer counselor in the traumatic stressor group improved significantly more than controls with respect to well-being, trauma and depression symptoms, and cancer self-efficacy

Table 1 (continued)

Author (year) [reference]	Unit of analysis	Training for peers	Intervention	Control	Number and time of data points	Outcome measures	Key finding
Mens et al. (2016) [25]	180 women with stage I or II breast cancer (Peer support group = 60, Education group = 60, Control group = 60) 65 women with stage IV breast cancer, or a distant recurrence (Peer support group = 34, Control group = 31)	Not reported	Group meetings consisted of 1-h meetings for 8 consecutive weeks The education group meetings focused on providing patients with information about their disease as well as methods to manage their illness and its side effects The peer support group meetings focused on fostering purpose in life by providing participants with opportunities to support and care for one another	Usual care	Prior to being randomized (Time 1), 1–2 weeks after the group meetings ended (Time 2), and then again 6 months later (Time 3)	Primary outcomes (1) the mental health component score (MCS) and the physical health component score (PCS) from the SF-36 scale Additional measure (2) 10-item abbreviated version of CES-D Mediator measures (3) LET; (4) a breast cancer-specific confidence scale	The intervention group improved more with respect to life purpose and less depressive symptoms at Time 2. Cancer severity did not moderate these effects. None of the intervention effects were evident at time 3
Klemm et al. (2012) [28]	50 women with breast cancer (Moderated group = 24, Peer-led group = 26)	No training for peers	Peer-led groups were run by the subjects themselves for a period of 12 weeks, using asynchronous communication and open discussion, without the use of preselected topics or input from a moderator	Moderated groups were conducted in a semi-structured (psychoeducational) format for a period of 12 weeks using asynchronous communication by social workers	At baseline and again at 6, 12, and 16 weeks	(1) A personal profile form, including extent of participation in the online groups; (2) CES-D (cutoff score ≥ 16)	There were no significant differences in depressive symptoms by group or by extent of group participation. Moderated groups read and posted significantly more messages than did peer-led groups

Table 1 (continued)

Author (year) [reference]	Unit of analysis	Training for peers	Intervention	Control	Number and time of data points	Outcome measures	Key finding
Pan et al. (2018) [37]	90 women with breast cancer (Intervention group = 45, Control group = 45)	The training included communication skills, functional exercises, and knowledge of complications and nursing	Peer-led education groups were run once or twice a week during the 3-month period by face-to-face, telephone or Internet modes, including functional training methods and supervising each other to complete the functional exercise	Usual care	Baseline and post-intervention	(1) Breast cancer patients functional exercise compliance scale; (2) Incidence of complications (Edema of upper extremity, necrosis of skin flap, subcutaneous effusion and limb dysfunction)	Improvements in functional exercise compliance were greater for the intervention than the control group with respect to general compliance, physical exercise compliance, postoperative attention compliance, and initiative seeking help compliance (P < 0.05). The incidence of limb edema and limb movement disorders in the experimental group was lower than that in the control group (P < 0.05)
Fu et al. (2015) [38]	108 breast cancer patients receiving postoperative chemotherapy (Intervention group = 54, Control group = 54)	The training involved knowledge of breast cancer and its treatment, communication skills, and nutrition	The health education delivered by peers twice a week for 3 months included teaching women knowledge of breast cancer, treatment of adverse reactions, and nutrition	Usual care	Baseline and post-intervention	QLQ-C-C	There were statistically significant differences in overall quality of life, five functional dimensions (physical function, role function, cognitive function, emotional function, social function) and seven symptom dimensions (fatigue, pain, nausea, vomiting, insomnia, appetite loss, constipation, diarrhea) scores between both groups (P < 0.05)

Table 1 (continued)

Author (year) [reference]	Unit of analysis	Training for peers	Intervention	Control	Number and time of data points	Outcome measures	Key finding
Chen (2018) [36]	89 breast cancer patients with post-operative adjuvant therapy (Intervention group=45, Control group=44)	Not reported	Patients received at least 3 sessions delivered by peers during hospitalization including Tai Chi, mindfulness meditation, and similar activities	Usual care	Baseline and post-intervention	Connor-Davidson Resilience Scale-Chinese (CD-RISC-C)	There were statistically significant differences in the total psychological resilience scores and the scores of all dimensions between the two groups at discharge (P<0.05)

ECOGPSS the Eastern Cooperative Oncology Group Performance Status Scale, FACT-B the functional assessment of cancer therapy–breast cancer, MSPSS, the Multidimensional Scale of perceived social support, PANAS, the positive and negative affect schedule, CES-D the Center for Epidemiologic Studies Depression Scale, FACIT-Sp Spiritual well-being subscale of the functional assessment of chronic illness therapy, FSFI the female sexual function inventory, BSI-18 the brief symptom inventory-18, A-DAS the abbreviated form of the Dyadic Adjustment Scale, CRES the cancer rehabilitation evaluation system, HSCL-25 the Hopkins symptoms checklist, IES the Impact of Events Scale, POMS the profile of mood states, HHI the Herth Hope Index, SESES-C the Stanford Emotional Self-Efficacy Scale-cancer, MOS the medical outcomes study, HADS Hospital Anxiety and Depression Scale, Mini-MAC Mini-Mental Adjustment to Cancer Scale, CARES-SF cancer rehabilitation evaluation system–short form, ASCS-SF Short form of Antonovsky's sense of Coherence scale, PCL-C posttraumatic stress disorder Checklist-Civilian version, CBI the cancer behavior inventory, LMAT the Locke–Wallace marital adjustment test, BCRQ the breast cancer resources questionnaire, LET the life engagement test, QLQ-C-C quality of life questionnaire-core-Chinese, CD-RISC-C Connor-Davidson Resilience Scale-Chinese
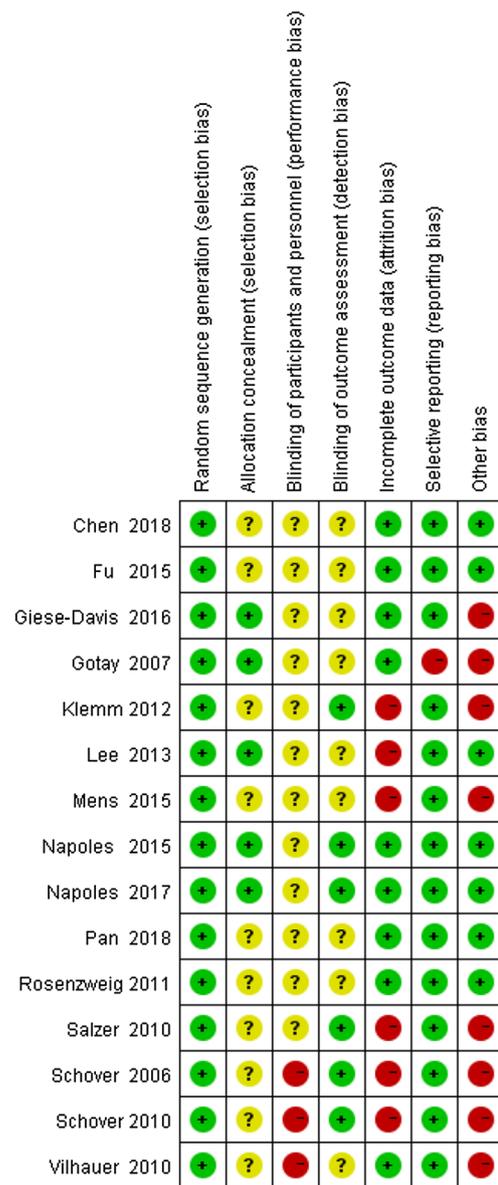

Fig. 2 Risk of bias summary: review authors' judgements regarding each risk of bias item for each included study

models of peer interventions were identified: one-on-one face-to-face [26, 30, 31, 34–36], one-on-one telephone [33], one-on-one Internet, group face-to-face [25], group telephone, and group Internet [14, 27, 28]. In most studies, peers held only a single role, and interventions were delivered via a single model as described above. However, in some interventions, peers acted in multiple roles and the programs contained multiple models; for example, in some instances the role of a peer supporter was coupled with that of a peer facilitator [25], peer case manager [39], or peer educator [36]. In some instances, one-on-one face-to-face was combined with one-on-one telephone [33], or both one-on-one telephone and one-on-one Internet [39], and group

Fig. 3 Risk of bias graph: review authors' judgements regarding each risk of bias item presented as percentages across all included studies
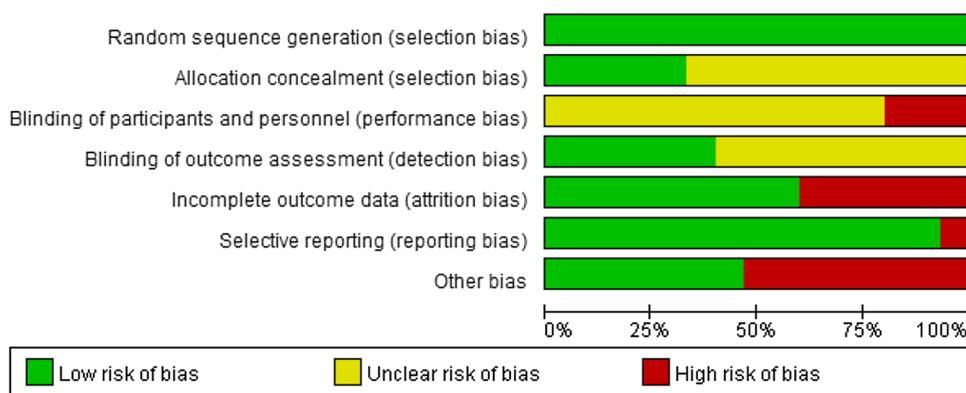
face-to-face was combined with both group telephone and group Internet [37, 38]. A brief description of the included studies is summarized in Table 1.

Outcome measurement

Almost all studies included standardized outcome instruments, although some administered questionnaires developed by researchers themselves regarding program evaluation or patients' behavior. Depression, the most common outcome of interest, was measured via the Center for Epidemiologic Studies Depression Scale (CES-D) [14, 25, 28, 33, 39], Hospital Anxiety and Depression Scale (HADS) [40] or the Hopkins Symptoms Checklist (HSCL-25) [27] in seven studies. Quality of life was the second common measure and was assessed using the Functional Assessment of Cancer Therapy-Breast Cancer (FACT-B) [14, 26–28, 39] or the Quality of life Questionnaire-Core-Chinese (QLQ-C-C) [38] in five studies. Emotional distress [14, 26, 27, 31, 34], self-efficacy [27, 32, 39], knowledge about breast cancer [30, 34], and utilization of support services [31, 33, 39] were also frequently measured in the indicated studies. In addition, certain studies were focused on specific aspects, such as sexual function [31, 34], functional exercise compliance [37], and chemotherapy compliance [35].

Synthesis of results

Peer supporter

Among the five studies describing peer support interventions, more than half explored the effectiveness of group Internet support programs, one study used one-on-one face-to-face model, and one study utilized the model combining one-on-one face-to-face and one-on-one telephone programs. The most common outcomes were: depression in four studies, and quality of life and emotional distress in two studies.

Contrary to what we expected, all RCTs of unmoderated and unstructured peer support intervention using the group Internet model without peer training revealed no differences, or even negative effects, in all outcomes as compared with control groups. Most outcomes in Salzer et al.'s study demonstrated no statistical significance (P > 0.05) [27]. However, the participants in the group Internet peer support condition tended to do worse than the control group over time by careful comparison of the data, and the p-values were close to 0.05. Rosenzweig et al. found the participants receiving one-on-one face-to-face intervention demonstrated better chemotherapy compliance than those in the corresponding Web-based educational control condition [35]. Lee et al. [40] found that peer support intervention delivered via one-on-one face-to-face and telephone models could significantly improve the self-efficacy of participants.

ECOGPSS, the Eastern Cooperative Oncology Group Performance Status Scale; FACT-B, the Functional Assessment of Cancer Therapy–Breast Cancer; MSPSS, the Multidimensional Scale of Perceived Social Support; PANAS, the Positive and Negative Affect Schedule; CES-D, the Center for Epidemiologic Studies Depression Scale; FACIT-Sp, Spiritual Well-Being Subscale of the Functional Assessment of Chronic Illness Therapy; FSFI, the Female Sexual Function Inventory; BSI-18, the Brief Symptom Inventory-18; A-DAS, the abbreviated form of the Dyadic Adjustment Scale; CRES, the Cancer Rehabilitation Evaluation System; HSCL-25, the Hopkins Symptoms Checklist; IES, the Impact of Events Scale; POMS, the Profile of Mood States; HHI, the Herth Hope Index; SESES-C, the Stanford Emotional Self-Efficacy Scale-Cancer; MOS, the Medical Outcomes Study; HADS, hospital anxiety and depression scale; Mini-MAC, Mini-Mental Adjustment to Cancer scale; CARES-SF, Cancer Rehabilitation Evaluation System–Short Form; ASCS-SF, Short form of Antonovsky's Sense of Coherence scale; PCL-C, posttraumatic stress disorder Checklist-Civilian version; CBI, the Cancer Behavior Inventory; LMAT, the Locke-Wallace Marital Adjustment Test; BCRQ, the Breast Cancer Resources Questionnaire;

LET, the Life Engagement Test; QLQ-C-C, Quality of life Questionnaire-Core-Chinese; CD-RISC-C, Connor-Davidson Resilience Scale -Chinese.

Peer educator

Of the three studies describing peer education interventions, one study utilized a one-on-one face-to-face model, while the others using multiple models (i.e., group, face-to-face, telephone, and Internet models). The most common outcome measured was quality of life in two studies. Similar to the findings of the peer support interventions, emotional distress and cancer-specific distress were also assessed.

Three studies demonstrated positive effects for most outcomes. Napoles et al. [26] found that the peer education intervention utilizing a one-on-one face-to-face model could significantly improve the participants' quality of life, emotional distress after 3 and 6 months, and breast cancer-specific distress after 6 months. The remaining two studies [37, 38] using group, face-to-face, telephone and Internet models revealed positive results for all outcomes (i.e., functional exercise compliance, incidence of complications, and quality of life).

Peer counselor

Among the three studies describing peer counseling interventions, two studies utilized a one-on-one face-to-face model, and another one used a one-on-one telephone model. Schover and colleagues [31, 34] conducted two similar studies by recruiting 60 and 297 participants, respectively. Both studies included spiritual well-being, emotional distress, and sexual function as outcomes of interest. In addition, Gotay et al. [33] measured emotional well-being, depressive symptoms, and support services.

As described above, Schover et al.'s two studies identified no statistical difference in any assessed outcomes over time with intervention using the one-on-one face-to-face model [31, 34]. Gotay et al. also found that the difference between the two groups for all assessed outcomes was not statistically significant, with the exception of that for the utilization of health services; specifically, the peer counseling group utilized significantly more services as compared with the control group, although this difference disappeared after 3 months [33].

Multiple roles

Among the three studies of peers acting in multiple roles, three studies used peer support coupled with peer facilitation, peer case management, and peer education, respectively, and the corresponding models were group face-to-face model; one-on-one face-to-face, telephone, Internet

model; and one-on-one face-to-face model. Three studies measured different aspects of mental health, except that depression was measured by two studies.

Mens et al. found that the intervention combining peer support and peer facilitation with a group face-to-face model was predictive of a greater sense of purpose in life and less depression in women with early and late stage breast cancer, and the effect of this peer intervention on depressive symptoms being mediated by this observed improvement in the sense of purpose in life [25]. Giese-Davis et al. [39] observed a positive effect on breast cancer-specific well-being and marital interaction in those participating in a peer intervention including peer support and peer case management. Chen et al. [36] found that peer support coupled with peer education in a one-on-one, face-to-face model clearly improved patients' mental resilience.

Discussion

The goal of this systematic review was to evaluate the impact of peer support-based interventions on breast cancer patients. Our review identified mixed findings with regard to such interventions, consistent with the findings of other reviews that have evaluated the effects of peer support programs for patients with serious mental illness and adolescents with asthma [18, 41, 42]. Overall, there were more positive effects than invalid or negative effects for those participating in peer interventions, suggesting that these peer support interventions are useful for improving quality of life and reducing distress among breast cancer patients. Because peer support interventions are so heterogeneous, with the biggest difference in the role of peers and modes of delivery, we introduced peer role and delivery mode classification schemes based on previous work [15, 23].

The findings from this review suggest that unmoderated and unstructured group peer support interventions conducted online without peer training have no effect and may even have adverse effects on proximal outcomes (e.g., quality of life, distress, depression) of breast cancer patients [14, 27, 28], with two studies reporting that some distal outcomes (e.g., quality of life, cancer-specific distress) were worse in those subjected to these interventions [27, 28]. Kaplan et al. [43] reached similar conclusions when studying peer support approaches for patients with severe mental illness. It has been found that in the absence of guidance, supervision, or group structure, there were increases in insightful disclosures, expressions of anger and fear, and discussions about death and dying [14, 27], resulting in long-term adverse outcomes. Legg et al. also confirmed that beliefs that the peer intervention programs will encourage discussions about breast cancer and will involve exposure to negative stories about this malignant disease can prevent women from

participating in these groups [24]. Due to the lack of peer training, breast cancer-related information exchange may be incomplete, incorrect, or biased, and peer modeling may sometimes lead to negative outcomes in unstructured group settings [14, 27]. Furthermore, the effect of the Internet on peer support is controversial [44], likely because it is difficult to determine whether a participant is truly involved, or the extent to which a given participant truly received peer support [27], as some participants will read posts but never post themselves [28]. Further research into how the internet affects such support is thus needed. Additionally, Salzer et al. [27] believed that the inclusion criteria in their study, which only incorporated women diagnosed with early stage breast cancer in the past year, limited the potential benefit of such interventions as it prevented these women from learning and being supported by long-term survivors. According to the social comparison theory, these participants would be unable to derive hope through 'upward comparisons' with long-lived breast cancer survivors. Given these findings, a simple peer support intervention using a group Internet model without training may be not advisable for breast cancer patients, especially for those patients with similar disease stage and duration.

This study reaffirmed that peer support delivered via a one-on-one face-to-face model with peer training improved patients' compliance with chemotherapy and self-efficacy [32, 35]. Weber et al. [45] also confirmed that using this same mode of intervention for prostate cancer patients can significantly improve self-efficacy and reduce depression. This dyadic intervention is widely used in community peer support programs, and some studies indicate that such one-on-one support is a well-established modality for improving outcomes in people with a wide range of risk factors and diagnoses [15, 16, 23]. Other studies have also found that cancer patients prefer this one-on-one format, as they often find it easier to establish a harmonious relationship with a stranger than a group [27, 46]. Additionally, some research efforts have achieved good results by using peer support coupled with peer facilitation, peer case management, or peer education. Mens et al. [25] appointed facilitators in the peer support group in their study to ensure adherence and avoid deviation from the protocol, which achieved good results with respect to depression and life purpose, without regard for whether the patients were in early or late stages of breast cancer. One report also indicated that depressive symptoms, perceived stress, and cancer-related trauma were reduced in web-based support groups led by a facilitator who organized and assisted each discussion [47]. This strongly suggests that backward guidance, supervision, and group structure are important factors necessary to ensure the effectiveness of peer support.

As a component of traditional peer support programs, peer education is becoming increasingly popular and is widely used in the context of chronic disease management, disease prevention, and prison settings with evidence of excellent clinical and economic benefits [18, 48, 49]. Napoles et al. have demonstrated that cognitive-behavioral stress management programs can be offered by trained peers in community settings via a one-on-one, face-to-face model, rather than by mental health professionals in a cancer center, yielding good results [26, 30]. Other studies have also found that the use of group peer education can significantly improve patients' functional exercise compliance and quality of life [37, 38]. Ramchand et al. reviewed the impact of peer support on health promotion and confirmed that using peers as educators improved the knowledge, attitudes, beliefs, social health/connectedness, and engagement in general of participants [15]. Peer education is an effective and low-cost approach for chronic disease patients, as it can overcome the lack of available professional health workers, particularly in under-resourced settings. However, it is worth noting that all three studies included in this review with such an approach have trained their peer educators in relevant knowledge and skills. This emphasizes that the necessary knowledge and related training are key to ensuring the efficacy of peer education [18]. The remaining three studies explored the impact of one-on-one peer counseling on breast cancer patients' emotions, and their primary findings were not statistically significant. Other research into the efficacy of peer counseling has also been controversial [40, 50, 51], underscoring the need for more research to determine whether such interventions are applicable to breast cancer patients.

Finally, it is worth noting that peer support programs can have unique effects for racial and ethnic groups such as African Americans and Latinos. Due to limitations in English language proficiency, health insurance coverage, immigration stress, poor health literacy, poverty, and ethnic culture and cognition, these groups can suffer higher rates of cancer-related psychosocial morbidity and poorer quality of life than others, and as a result they can have several unique and unknown needs. Peer support programs can overcome these limitations, as they allow peers with the same cultural backgrounds and experiences to identify their true thoughts, emotions, and special needs in a timely manner, providing culturally-sensitive assistance. Research has confirmed that culturally competent peer support is an optimal delivery mechanism for ethnic groups [26].

There are limitations to our study. Our research included only randomized controlled trials, so the number of studies included was small, especially after classifying different types of peer support interventions, and there were many outcomes and measures that could not be quantified. Moreover, peer interventions are so heterogeneous that we cannot fully and accurately describe these with two categorization schemes, and this was further complicated by the fact that the description of peer support programs used in some

studies was very poor. Despite these limitations, the findings from this review may be helpful to community organizations, clinical providers, and policymakers in deciding what type of peer support interventions to use to promote the physical and mental health of breast cancer patients.

Conclusions

As a complement to traditional health care services, peer support programs are widely used, but the effects are controversial. This review explored the effects of different types of peer support programs on breast cancer patients. Overall, peer support has the potential to improve breast cancer patients' emotions, quality of life and treatment-related compliance. However, the existing evidence indicates that simple Web-based group peer support interventions without peer training are ineffective and are potentially harmful to patients' quality of life, mood, and daily activities. Health care workers should therefore avoid using this type of peer support for these patients, or that it should be used with caution. In the future, these results indicate that the use of peer support with multiple peer roles, or in which support is delivered in a one-to-one model are the best approaches to provide psychosocial assistance to this group of people and to thereby alleviate their negative emotions. Peer education is also recommended for disease management in order to improve their emotions and quality of life.

Currently, due to limited evidence, there is no firm recommendation in favor of peer support for breast cancer patients. More research with rigorous methodological design and reporting is needed in the future to provide superior and definitive evidence regarding the use of peer support for breast cancer patients.

Compliance with ethical standards

Conflict of interest All authors declare that they have no competing of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

References

1. DeSantis CE, Lin CC, Mariotto AB, Siegel RL, Stein KD, Kramer JL, Alteri R, Robbins AS, Jemal A (2014) Cancer treatment and survivorship statistics, 2014. CA A Cancer J Clin 64(4):252–271. https://doi.org/10.3322/caac.21235

2. Ganz PA, Goodwin PJ (2015) Breast cancer survivorship: where are we today? Adv Exp Med Biol 862:1–8. https://doi.org/10.1007/978-3-319-16366-6_1

3. Maass SW, Roorda C, Berendsen AJ, Verhaak PF, de Bock GH (2015) The prevalence of long-term symptoms of depression and anxiety after breast cancer treatment: a systematic review. Maturitas 82(1):100–108. https://doi.org/10.1016/j.maturitas.2015.04.010

4. Dunn LB, Langford DJ, Paul SM, Berman MB, Shumay DM, Kober K, Merriman JD, West C, Neuhaus JM, Miaskowski C (2015) Trajectories of fear of recurrence in women with breast cancer. Support Care Cancer 23(7):2033–2043. https://doi.org/10.1007/s00520-014-2513-8

5. Kiecolt-Glaser JK, Habash DL, Fagundes CP, Andridge R, Peng J, Malarkey WB, Belury MA (2015) Daily stressors, past depression, and metabolic responses to high-fat meals: a novel path to obesity. Biol Psychiat 77(7):653–660. https://doi.org/10.1016/j.biopsych.2014.05.018

6. Jenkins I, Djuric Z, Darga L, DiLaura NM, Magnan M, Hryniuk WM (2003) Relationship of psychiatric diagnosis and weight loss maintenance in obese breast cancer survivors. Obes Res 11(11):1369–1375. https://doi.org/10.1038/oby.2003.185

7. Satin JR, Linden W, Phillips MJ (2009) Depression as a predictor of disease progression and mortality in cancer patients: a meta-analysis. Cancer 115(22):5349–5361. https://doi.org/10.1002/cncr.24561

8. Park J, Morley TS, Kim M, Clegg DJ, Scherer PE (2014) Obesity and cancer–mechanisms underlying tumour progression and recurrence. Nat Rev Endocrinol 10(8):455–465. https://doi.org/10.1038/nrendo.2014.94

9. Ligibel JA, Strickler HD (2013) Obesity and its impact on breast cancer: tumor incidence, recurrence, survival, and possible interventions. In: American Society of Clinical Oncology educational book American Society of Clinical Oncology Meeting, pp. 52–59. https://doi.org/10.1200/EdBook_AM.2013.33.52

10. Park HY, Kim MJ, Kim JY, Kim S, Choi JY, Kim JH, Jeong HY (2018) Could peer support programs be a good resource for managing the unmet needs of cancer patients? J Cancer Educ. https://doi.org/10.1007/s13187-018-1399-4

11. Munce SEP, Shepherd J, Perrier L, Allin S, Sweet SN, Tomasone JR, Nelson MLA, Guilcher SJT, Hossain S, Jaglal S (2017) Online peer support interventions for chronic conditions: a scoping review protocol. BMJ Open 7(9):e017999. https://doi.org/10.1136/bmjopen-2017-017999

12. Gidugu V, Rogers ES, Harrington S, Maru M, Johnson G, Cohee J, Hinkel J (2015) Individual peer support: a qualitative study of mechanisms of its effectiveness. Commun Ment Health J 51(4):445–452. https://doi.org/10.1007/s10597-014-9801-0

13. Solomon P (2004) Peer support/peer provided services underlying processes, benefits, and critical ingredients. Psychiatr Rehabil J 27(4):392–401

14. Vilhauer RP, McClintock MK, Matthews AK (2010) Online support groups for women with metastatic breast cancer: a feasibility pilot study. J Psychosoc Oncol 28(5):560–586. https://doi.org/10.1080/07347332.2010.504504

15. Ramchand R, Ahluwalia SC, Xenakis L, Apaydin E, Raaen L, Grimm G (2017) A systematic review of peer-supported interventions for health promotion and disease prevention. Prev Med 101:156–170. https://doi.org/10.1016/j.ypmed.2017.06.008

16. Fisher EB, Boothroyd RI, Elstad EA, Hays L, Henes A, Maslow GR, Velicer C (2017) Peer support of complex health behaviors in prevention and disease management with special reference to diabetes: systematic reviews. Clin Diabetes Endocrinol 3:4. https://doi.org/10.1186/s40842-017-0042-3

17. Venne VL, Hamann HA (2007) Successful use of peer educators for sharing genetic information. J Genet Couns 16(4):515–525. https://doi.org/10.1007/s10897-007-9087-2

18. Gatlin TK, Serafica R, Johnson M (2017) Systematic review of peer education intervention programmes among individuals with type 2 diabetes. J Clin Nurs 26(23–24):4212–4222. https://doi.org/10.1111/jocn.13991

19. Qi L, Liu Q, Qi X, Wu N, Tang W, Xiong H (2015) Effectiveness of peer support for improving glycaemic control in patients with type 2 diabetes: a meta-analysis of randomized controlled trials. BMC Public Health 15:471. https://doi.org/10.1186/s12889-015-1798-y

20. Patil SJ, Ruppar T, Koopman RJ, Lindbloom EJ, Elliott SG, Mehr DR, Conn VS (2018) Effect of peer support interventions on cardiovascular disease risk factors in adults with diabetes: a systematic review and meta-analysis. BMC Public Health 18(1):398. https://doi.org/10.1186/s12889-018-5326-8

21. Ford P, Clifford A, Gussy K, Gartner C (2013) A systematic review of peer-support programs for smoking cessation in disadvantaged groups. Int J Environ Res Public Health 10(11):5507–5522. https://doi.org/10.3390/ijerph10115507

22. Jolly K, Ingram L, Khan KS, Deeks JJ, Freemantle N, MacArthur C (2012) Systematic review of peer support for breastfeeding continuation: metaregression analysis of the effect of setting, intensity, and timing. BMJ 344:d8287. https://doi.org/10.1136/bmj.d8287

23. Hoey LM, Ieropoli SC, White VM, Jefford M (2008) Systematic review of peer-support programs for people with cancer. Patient Educ Couns 70(3):315–337. https://doi.org/10.1016/j.pec.2007.11.016

24. Legg M, Hyde MK, Occhipinti S, Youl PH, Dunn J, Chambers SK (2018) A prospective and population-based inquiry on the use and acceptability of peer support for women newly diagnosed with breast cancer. Support Care Cancer. https://doi.org/10.1007/s00520-018-4358-z

25. Mens MG, Helgeson VS, Lembersky BC, Baum A, Scheier MF (2016) Randomized psychosocial interventions for breast cancer: impact on life purpose. Psycho-Oncol 25(6):618–625. https://doi.org/10.1002/pon.3891

26. Napoles AM, Ortiz C, Santoyo-Olsson J, Stewart AL, Gregorich S, Lee HE, Duron Y, McGuire P, Luce J (2015) Nuevo Amanecer: results of a randomized controlled trial of a community-based, peer-delivered stress management intervention to improve quality of life in Latinas with breast cancer. Am J Public Health 105(Suppl 3):e55–e63. https://doi.org/10.2105/ajph.2015.302598

27. Salzer MS, Palmer SC, Kaplan K, Brusilovskiy E, Ten Have T, Hampshire M, Metz J, Coyne JC (2010) A randomized, controlled study of Internet peer-to-peer interactions among women newly diagnosed with breast cancer. Psycho-Oncol 19(4):441–446. https://doi.org/10.1002/pon.1586

28. Klemm P (2012) Effects of online support group format (moderated vs peer-led) on depressive symptoms and extent of participation in women with breast cancer. Comput Inf Nurs 30(1):9–18. https://doi.org/10.1097/NCN.0b013e3182343efa

29. Higgins JPT, Altman DG (2008) Assessing risk of bias in included studies. In: Higgins JPT, Green S (eds) Cochrane handbook for systematic reviews of interventions, edition. Wiley, Chichester, pp 187–241

30. Napoles AM, Santoyo-Olsson J, Stewart AL, Ortiz C, Garcia-Jimenez M (2018) Evaluating the implementation of a translational peer-delivered stress management program for spanish-speaking Latina breast cancer survivors. J Cancer Educ 33(4):875–884. https://doi.org/10.1007/s13187-017-1202-y

31. Schover LR, Jenkins R, Sui D, Adams JH, Marion MS, Jackson KE (2006) Randomized trial of peer counseling on reproductive health in African American breast cancer survivors. J Clin Oncol 24(10):1620–1626. https://doi.org/10.1200/jco.2005.04.7159

32. Lee R, Lee KS, Oh EG, Kim SH (2013) A randomized trial of dyadic peer support intervention for newly diagnosed breast cancer patients in Korea. Cancer Nurs 36(3):E15–E22. https://doi.org/10.1097/NCC.0b013e3182642d7c

33. Gotay CC, Moinpour CM, Unger JM, Jiang CS, Coleman D, Martino S, Parker BJ, Bearden JD, Dakhil S, Gross HM et al (2007) Impact of a peer-delivered telephone intervention for women experiencing a breast cancer recurrence. J Clin Oncol 25(15):2093–2099. https://doi.org/10.1200/jco.2006.07.4674

34. Schover LR, Rhodes MM, Baum G, Adams JH, Jenkins R, Lewis P, Jackson KE (2011) Sisters peer counseling in reproductive issues after treatment (SPIRIT): a peer counseling program to improve reproductive health among African American breast cancer survivors. Cancer 117(21):4983–4992. https://doi.org/10.1002/cncr.26139

35. Rosenzweig M, Brufsky A, Rastogi P, Puhalla S, Simon J, Underwood S (2011) The attitudes, communication, treatment, and support intervention to reduce breast cancer treatment disparity. Oncol Nurs Forum 38(1):85–89. https://doi.org/10.1188/11.onf.85-89

36. Chen Z (2018) The effect of peer education on the psychological resilience of breast cancer patients. Jilin Med J 39(03):580–582

37. Pan X, Yuan Q (2018) Effect of peer education on functional compliance of postoperative chemotherapy patients with breast cancer. Chin J Health Care Nutr (7):3

38. Fu B, Wu J, Li H, Cao M (2015) Influence of peer education on quality of life of breast cancer receiving postoperative chemotherapy. Chin Nurs Res 29(29):3639–3641

39. Giese-Davis J, Bliss-Isberg C, Wittenberg L, White J, Star P, Zhong L, Cordova MJ, Houston D, Spiegel D (2016) Peer-counseling for women newly diagnosed with breast cancer: a randomized community/research collaboration trial. Cancer 122(15):2408–2417. https://doi.org/10.1002/cncr.30036

40. Lee CHM, O'Leary J, Kirk P, Lower TA (2018) Breastfeeding outcomes in Washington state: determining the effect of loving support peer counseling program and characteristics of participants at WIC Agencies. J Nutr Educ Behav 50(4):379–387. https://doi.org/10.1016/j.jneb.2017.09.002

41. Kew KM, Carr R, Crossingham I (2017) Lay-led and peer support interventions for adolescents with asthma. Cochrane Database Syst Rev 4:CD012331. https://doi.org/10.1002/14651858.CD012331.pub2

42. Stubbs B, Williams J, Shannon J, Gaughran F, Craig T (2016) Peer support interventions seeking to improve physical health and lifestyle behaviours among people with serious mental illness: a systematic review. Int J Ment Health Nurs 25(6):484–495. https://doi.org/10.1111/inm.12256

43. Kaplan K, Salzer MS, Solomon P, Brusilovskiy E, Cousounis P (2011) Internet peer support for individuals with psychiatric disabilities: a randomized controlled trial. Soc Sci Med (1982) 72(1):54–62. https://doi.org/10.1016/j.socscimed.2010.09.037

44. McCaughan E, Parahoo K, Hueter I, Northouse L, Bradbury I (2017) Online support groups for women with breast cancer. Cochrane Database Syst Rev 3:CD011652. https://doi.org/10.1002/14651858.CD011652.pub2

45. Weber BA, Roberts BL, Resnick M, Deimling G, Zauszniewski JA, Musil C, Yarandi HN (2004) The effect of dyadic intervention on self-efficacy, social support, and depression for men with prostate cancer. Psycho-Oncol 13(1):47–60. https://doi.org/10.1002/pon.718

46. Boyes A, Turon H, Hall A, Watson R, Proietto A, Sanson-Fisher R (2018) Preferences for models of peer support in the digital era: a cross-sectional survey of people with cancer. Psycho-Oncol. https://doi.org/10.1002/pon.4781

47. Winzelberg AJ, Classen C, Alpers GW, Roberts H, Koopman C, Adams RE, Ernst H, Dev P, Taylor CB (2003) Evaluation of an internet support group for women with primary breast cancer. Cancer 97(5):1164–1173. https://doi.org/10.1002/cncr.11174

48. Medley A, Kennedy C, O'Reilly K, Sweat M (2009) Effectiveness of peer education interventions for HIV prevention in developing countries: a systematic review and meta-analysis. AIDS Educ Prev 21(3):181–206. https://doi.org/10.1521/aeap.2009.21.3.181

49. Bagnall AM, South J, Hulme C, Woodall J, Vinall-Collier K, Raine G, Kinsella K, Dixey R, Harris L, Wright NM (2015) A systematic review of the effectiveness and cost-effectiveness of peer education and peer support in prisons. BMC Public Health 15:290. https://doi.org/10.1186/s12889-015-1584-x

50. Bosire R, Betz B, Aluisio A, Hughes JP, Nduati R, Kiarie J, Chohan BH, Merkel M, Lohman-Payne B, John-Stewart G et al (2016) High rates of exclusive breastfeeding in both arms of a peer counseling study promoting EBF among HIV-infected Kenyan women. Breastfeed Med 11(2):56–63. https://doi.org/10.1089/bfm.2015.0071

51. Quintiliani LM, Whiteley JA (2016) Results of a nutrition and physical activity peer counseling intervention among nontraditional college students. J Cancer Educ 31(2):366–374. https://doi.org/10.1007/s13187-015-0858-4