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A systematic review of behavioral interventions for rural breast cancer survivors

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Abstract Rural breast cancer survivors (RBCS) are at greater risk for poorer health outcomes and face greater treatment barriers compared to their urban counterparts, necessitating behavioral interventions tailored for the unique needs of RBCS. A systematic review of studies examining behavioral interventions delivered to RBCS living in the United States from 2000 to 2020 was conducted following PRIMSA guidelines. Nineteen unique studies were included: eight randomized controlled trials, two matched-control studies, six pre-post intervention feasibility studies, and three post-intervention satisfaction studies. Thirteen interventions aimed to improve psychosocial support, three to improve weight management, and three to improve education. Results indicate interventions' feasibility and acceptability. Six out of eight intervention conditions reported favorable outcomes compared to control conditions, suggesting promise for efficacy. However, variability in intervention objective, duration, delivery, and follow-up timing, and small sample sizes prevent overarching conclusions. Research involving larger sample sizes, higher quality control groups, and longer follow-up data is needed.

Keywords Breast cancer survivor · Rural · Psychosocial intervention · Survivorship

Breast cancer is the most frequently diagnosed cancer (American Cancer Society, 2019). Over 12% of women will be diagnosed with breast cancer at some point in their lives, 83% of whom are expected to survive over 10 years (American Cancer Society, 2019). Breast cancer survivors experience a host of physical and psychological symptoms that can last decades after treatment (Runowicz et al., 2016), and rural cancer survivors are at an elevated risk for poor health outcomes following cancer treatment (Weaver et al., 2013a). For example, compared to urban cancer survivors, rural survivors are 39% more likely to report "fair" or "poor" health, and 66% more likely to experience health-related unemployment (Weaver et al., 2013b). Rural cancer survivors are specifically at greater risk for experiencing poorer mental health functioning (e.g., greater symptoms of anxiety and depression; Burris & Andrykowski, 2010), which has been associated with increased mortality (Batty et al., 2017; Giese-Davis et al., 2011; Liang et al., 2017). Rural breast cancer survivors, in particular, have been found to report greater cancer-related fears, higher need for help in carrying out their social roles (Girgis et al., 2000), poorer quality of life (Lyons & Shelton, 2004), and greater stigma related to their diagnosis (McGrath et al., 1999) compared to their urban counterparts. Additionally, rural residents, regardless of cancer diagnosis, are at greater risk for less healthy diets (Miller et al., 2012; Savoca et al., 2009), reduced physical activity (Schootman et al., 2013; Weaver et al., 2013b), and obesity (Jackson et al., 2005), all of which are associated with increased risk of cancer mortality (Calle et al., 2003; Protani et al., 2010). Indeed, rates of cancer death

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are declining more slowly in rural compared to urban areas (Henley et al., 2017).

In addition to differences in mental and physical health, rural breast cancer survivors face unique barriers to accessing care both during active treatment and into survivorship, including greater financial strain, having to travel great distances to be seen by oncology or supportive care providers, and receiving few receive referrals to mental health services (Bettencourt et al., 2007; Rogers-Clark, 2002; Gray et al., 2004). Additionally, though rural breast cancer survivors desire more information on survivorship (Bettencourt et al., 2007), rural cancer survivors are 20% less likely to report having received guidance on cancer follow-up care compared to their urban counterparts (Schootman et al., 2013), and the current delivery of survivorship care planning appears to be less effective among rural breast cancer survivors (DeGuzman et al., 2017). In light of this, Anbari et al. (2020) conducted a systematic review of studies published from 2007 to 2019 reporting on the experience of rural breast cancer survivors in order to inform future survivorship care interventions. This review highlights the unique needs of rural breast cancer survivors in each of five key areas outlined by the American Society of Clinical Oncology: breast cancer surveillance, screening for other cancer, managing physical and psychosocial late effects of cancer diagnosis and treatment, health promotion, and care coordination (Runowicz et al., 2016). Though this recent review underscores the need for tailored, personalized care to be delivered to rural breast cancer survivors, it did not explicitly review behavioral, psychosocial, or mental health interventions delivered to breast cancer survivors, and did not include several intervention studies on this topic that warrant attention (e.g., Befort et al., 2012, 2016; Collie et al., 2007; Gray et al., 2019; Hegel et al., 2011; Zhou et al., 2016).

The present systematic review examines studies of behavioral interventions offered to rural breast cancer survivors published since 2000. Behavioral interventions were defined as any intervention that encouraged survivors to carry out behaviors designed to effect change. This time frame was chosen because in 2001, the Institute of Medicine recommended using information technology to improve healthcare quality, noting this is particularly important for rural patients (IOM, 2001), and many interventions delivered to rural breast cancer survivors involve telehealth. Five years later, the Institute of Medicine published recommendations focused on improving care for cancer survivors (Hewitt et al., 2006). Thus, the majority of studies examining behavioral interventions for rural breast cancer survivors are likely to have been carried out in the past two decades.

Method

This review was conducted according to PRISMA 2009 guidelines for systematic reviews (Moher et al., 2009).

Eligibility criteria

Published studies were included if (1) they assessed a behavioral intervention (see Supplemental Table 1 for a complete list of search terms used); (2) explicitly recruited rural participants living in the United States of America; (3) included a sample of at least 20% rural breast cancer survivors, (4) were published in English, and (5) represented a unique data collection (i.e., secondary analyses are not included).

Search strategy

We searched Ovid MEDLINE, Ovid Embase, PubMed and PsycInfo databases for publications in English from January 1, 2000 to April 30, 2020. The following concepts were searched using subject headings and keywords as needed, “rural health”, “rural population”, “rural health services”, “rural”, “breast cancer”, “psychotherapy”, “behavior therapy”, “psychosocial interventions”, and “health behavior,” etc. The search terms were combined by “or” if they represented the similar concept, and by “and” if they represented different concepts. The detailed MEDLINE search strategy is shown in Supplemental Table 1.

All titles and abstracts of the literature search were screened by CR and DT, who discussed any differences in inclusion determinations until consensus was reached ($n = 7$). One author (CR) then screened all full-text articles determined to meet inclusion criteria based on title and abstract screen. Over 70% of the full-texts were also screened by one other co-authors (ET or DT). Discrepancies in inclusion determinations were discussed by the research team until consensus was reached ($n = 2$).

Data extraction

For each study determined to meet inclusion criteria, the following data were extracted: first author, year of publication, sample characteristics, number of participants, percent of participants residing in a rural area, design, outcome measures, intervention components, delivery method, intervention facilitator, intervention duration, assessment timing, and overall findings. Data on all studies was extracted by CR, and over half were double-extracted by DT to ensure consistency in data extraction.

Results

The literature search identified 584 records, 237 of which were duplicates, leaving 347 articles to screen. Title and abstract screening resulted in 31 full text articles screened for eligibility, 19 of which were determined to meet inclusion criteria for this review (Fig. 1).

Participants in interventions

Definitions of rurality varied by study. Ten studies assumed all participants were rural based on the rurality of the recruitment location (Angell et al., 2003; Belkora et al., 2006, 2012; Collie et al., 2007; Gisiger-Camata et al., 2016; Gustafson et al., 2005; Hegel et al., 2011; Linshaw et al., 2020; Sandgren et al., 2000; Williams & Shreir, 2004). Three studies used the US Department of Agriculture's Rural Urban Commuting Area zip codes (Befort et al., 2012, 2016; Gray et al., 2019), one used the US Department of Agriculture's Rural–Urban County Codes (Henry et al., 2010), one study used the US Health Resources and Services Administration's county designations (McCarthy et al., 2018), and three studies used US Census tract data in combination with travel time to medical treatment facility (Meneses et al., 2009, 2020; Schoenberger et al., 2016). One study defined participants as being rural if they reported a commute of more than 30 min to a cancer center (Zhou et al., 2016).

The samples for 13 out of the 19 reviewed intervention studies were comprised entirely of rural breast cancer survivors (Angell et al., 2003; Befort et al., 2012, 2016; Belkora et al., 2012; Collie et al., 2007; Hegel et al., 2011; Linshaw et al., 2020; McCarthy et al., 2018; Meneses et al., 2009, 2020; Sandgren et al., 2000; Schoenberger et al., 2016; Williams & Shreir, 2004), with one study consisting of all rural survivors, 60% of whom were breast cancer survivors (Belkora et al., 2006). All five studies that included non-rural

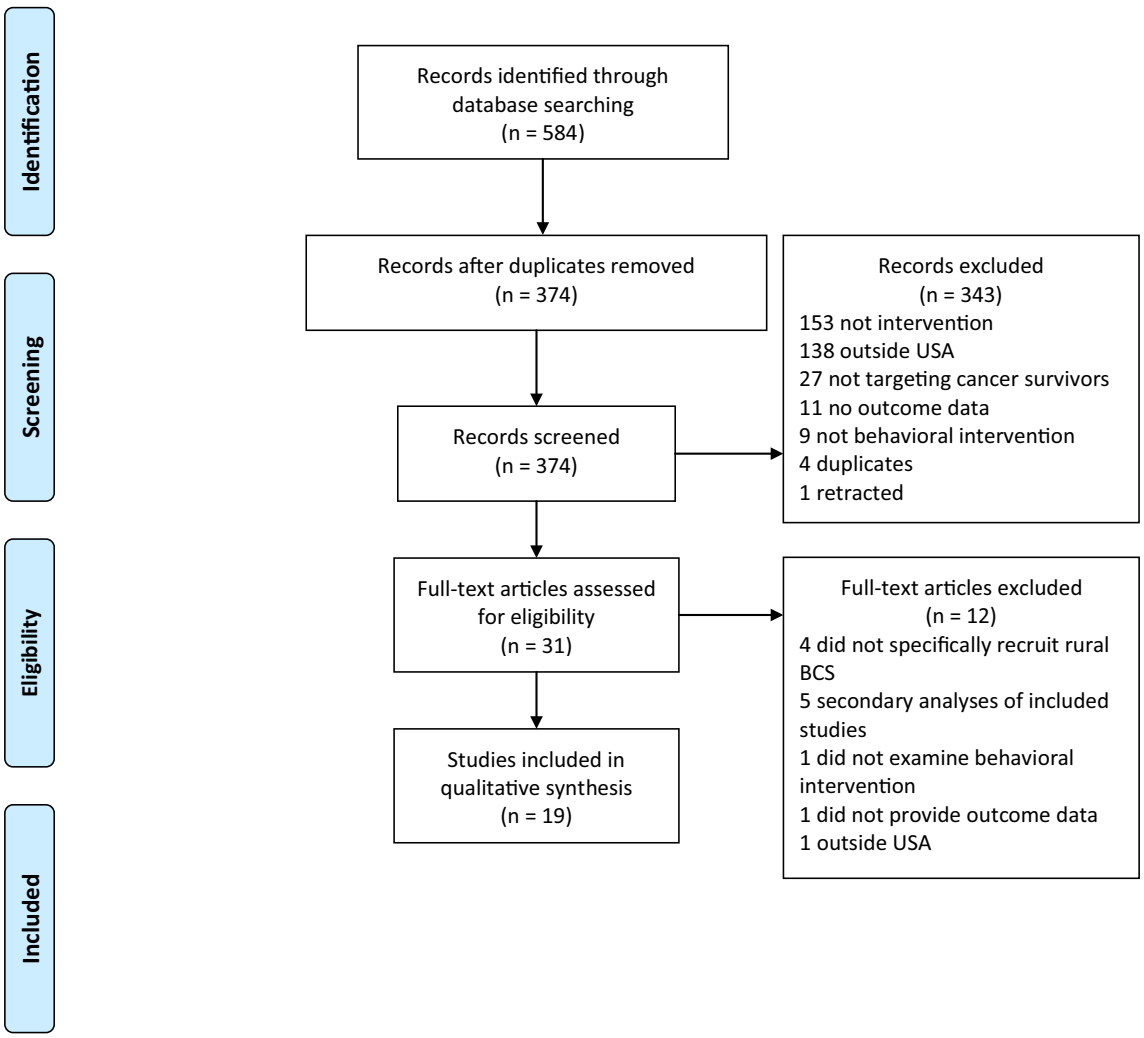

Fig. 1 PRISMA flow diagram

cancer survivors dichotomized participants into "rural" and "urban." Two studies included only one non-rural participant (Gisiger-Camata et al., 2016; Zhou et al., 2016), and thus did not distinguish between rural and urban in analyses. Among the remaining three studies, data from rural participants was examined separately (Gustafson et al., 2005), was compared directly to urban participants (Gray et al., 2019), or rural was examined as a moderator (Henry et al., 2010). Three studies included other cancer diagnoses (e.g., prostate, colorectal, blood), with 45% (Gray et al., 2019), 36% (Zhou et al., 2016), and 60% (Belkora et al., 2006) of their samples being breast cancer survivors (Table 1).

Delivery of interventions

The 19 studies varied in terms of design, delivery, length, and intervention objective.

Design

Eight of the studies presented data from randomized controlled trials (RCT) (Angell et al., 2003; Befort et al., 2016; Belkora et al., 2012; Hegel et al., 2011; Meneses et al., 2009, 2020, Sandgren et al., 2000; Williams & Shreier, 2004), two reported on a quasi-experimental study that included a usual care control group (Gustafson et al., 2005; Henry et al., 2010), six presented data before and after an intervention in the absence of a control group (Befort et al., 2012; Collie et al., 2007; Gray et al., 2019; Linshaw et al., 2020; McCarthy et al., 2018; Zhou et al., 2016), and three reported only on post-intervention satisfaction data (Belkora et al., 2006; Gisiger-Camata et al., 2016; Schoenberger et al., 2016).

Delivery

Fifteen of the 19 studies reported on remotely-delivered interventions, including eight interventions delivered via telephone (Befort et al., 2012, 2016; Belkora et al., 2012; Gray et al., 2019; Hegel et al., 2011; Meneses et al., 2020; Sandgren et al., 2000; Schoenberger et al., 2016), three delivered via videoconference (Collie et al., 2007; McCarthy et al., 2018; Zhou et al., 2016), one delivered via interactive computer program (Gustafson et al., 2005), and three delivered via mail: a one-time home-based expressive writing intervention (Henry et al., 2010), an interactive workbook journal (Angell et al., 2003), and audiotapes (Williams & Schreier, 2004). Two studies reported on intervention delivered in-person at participants' cancer center (Linshaw et al., 2020; Meneses et al., 2009) and two on interventions delivered in community centers (Belkora et al., 2006; Gisiger-Camata et al., 2016). A group format was used in four of the remotely delivered interventions (Befort et al., 2012, 2016; Collie et al., 2007; Zhou et al., 2016) and two of the face-to-face interventions (Linshaw et al., 2020; Gisiger-Camata et al., 2016).

Length

Intervention length varied widely. The briefest intervention involved just one instance of writing about positive thoughts and feelings regarding their experience with breast cancer for 20 min at home (Henry et al., 2010). Three other interventions involved a single session, lasting 1 (Belkora et al., 2006, 2012) to 2 (Gisiger-Camata et al., 2016) hours. Three interventions involved providing participants with materials such as a workbook journal (Angell et al., 2003), educational audiotapes (Williams & Shreier, 2004), and an internet education and support program (Gustafson et al., 2005) for 3–4 months. Several interventions consisted of weekly 1-to-2 hour-long sessions over the course of 3 (Meneses et al., 2009), 4 (Zhou et al., 2016), 6 (Hegel et al., 2011; McCarthy et al., 2018), 8 (Collie et al., 2007; Linshaw et al., 2020), 16 (Sandgren et al., 2000) or 24 weeks (Befort et al., 2012). The longest interventions consisted of regular sessions over the course of 12 (Gray et al., 2019; Meneses et al., 2020; Schoenberger et al., 2016) and 18 (Befort et al., 2016) months.

Objective

Interventions were categorized into three objectives based on their components and outcomes: 13 studies were categorized as "psychosocial support" interventions, as their objective was to improve quality of life and emotional health (Angell et al., 2003; Collie et al., 2007; Gustafson et al., 2005; Hegel et al., 2011; Henry et al., 2010; Linshaw et al., 2020; McCarthy et al., 2018; Meneses et al., 2009, 2020, Sandgren et al., 2000; Schoenberger et al., 2016; Williams & Shreier, 2004; Zhou et al., 2016), three studies were categorized as "weight management" interventions, as their objective was to reduce weight and/or improve physical activity and diet (Befort et al., 2012, 2016; Gray et al., 2019), and three studies were categorized as "education" interventions, as their objective was to increase knowledge of survivorship care (Gisiger-Camata et al., 2016) or increase self-efficacy regarding treatment-related decisions (Belkora et al., 2006, 2012). Details on each study's intervention components and overall findings are provided for each objective category below. In each category, descriptions of RCTs are presented first, followed by matched control designs, then pre-/post-intervention feasibility studies.

Results of psychosocial support intervention studies

RCTs

Sandgren et al. (2000) found that ten 30-minute sessions of cognitive-behavioral-based telephone therapy was feasible

Table 1 Reviewed intervention studies for rural breast cancer survivors

Author	Sample	N	% Rural	Design	Outcome measures	Intervention components	Delivery method	Intervention facilitator	Intervention duration	Assessment timing	Overall findings
Psychosocial support interventions											
Sandgren et al. (2000)	Breast cancer survivors diagnosed ≤ 4 months prior	53	100%	RCT	Coping (active cognitive, active behavioral, avoidance), mood disturbance (POMS), quality of life (MOS)	**Intervention:** Therapy involving teaching problem solving, coping skills, cognitive restructuring, and relaxation strategies. **Control:** Usual Care (UC)	Telephone (Individual)	Clinical psychology MA candidates	4 months	Baseline 4 months 10 months	Treatment group reported higher mental health on MOS at 4 months than UC. UC reported fewer problems with physical role on MOS at 4 months and less stress (POMS) and greater mental health (MOS) at 10 month than treatment group.
Angell et al. (2003)	Breast cancer survivors ≤ 3 months post-diagnosis or ≤ 3 months post-treatment	98	100%	RCT	Posttraumatic Stress Checklist (PCL-S), mood disturbance (POMS), Coping (MAC and COPE)	**Intervention:** *One in Eight* interactive Workbook-Journal + packet of educational resources (WJ) **Control:** Packet of educational resources (UC)	Workbook (Individual)	N/A	3 months	Baseline 3 months	There were no group differences on any outcome. Subgroup analyses revealed that, among participants recruited from more rural sites, WJ participants reported significantly higher fighting spirit and lower behavioral disengagement than UC.
Williams and Schreier (2004)	Breast cancer patients undergoing chemotherapy	70	100%	RCT	Diary of side effects and use/effectiveness of self-care behaviors, anxiety (STAI)	**Intervention:** Two 20-minute audiotaped education sessions on nutrition, exercise, and relaxation; instructed to listen 1 day before prior to the start of a chemotherapy cycle **Control**: Usual Care (UC)	Audiotapes (Individual)	N/A	3 months	Baseline 1 month 3 months	Greater reduction in state anxiety for experimental group at 1 month follow up. No group differences in mean numbers of self-care behaviors. Experimental group reported greater effectiveness from self-care behaviors to reduce nausea at 1 month follow up relative to UC.

Table 1 (continued)

Author	Sample	N	% Rural	Design	Outcome measures	Intervention components	Delivery method	Intervention facilitator	Intervention duration	Assessment timing	Overall findings
Meneses et al. (2009)	Breast cancer survivors within 1 year of cancer diagnosis, and at least 1 month post primary treatment	53	100%	RCT	QOL (QOL-BC)	**Intervention**: Breast Cancer Education Intervention (BCEI): sessions focused on management of pain, psychosocial issues, and spiritual concerns related to cancer survivorship + written and audiotape material **Control**: Attention Control (AC)	Face-to-face + telephone (Individual)	Intervention nurse	4 weekly face-to-face sessions + 5 monthly follow up sessions (6 month intervention)	Baseline 3 months 6 months	Higher overall QOL from BCEI relative to AC at months 3 and 6 months.
Hegel et al. (2011)	Breast cancer patients undergoing chemotherapy	31	100%	RCT	QOL (SF-36), Health-related QOL (FACT-B), anxiety and depression (HADS), health behaviors	**Intervention**: Problem-solving and Occupational Therapy intervention (PST-OT) to improve participation restrictions **Control**: Usual Care (UC)	Telephone (Individual)	Occupational Therapists	6 weekly sessions	Baseline 6 weeks 12 weeks	Greater health-related QOL and lower anxiety from PST-OT relative to UC at 6 weeks, with differences in anxiety maintaining at the 12 weeks. No group differences in adherence to health behaviors (i.e., exercise, physical therapy, and stress management activities).
Meneses et al. (2020)	Breast cancer survivors ≤ 3 years after completing primary treatment	432	100%	RCT	Quality of life (SF-36 PCS, MCS). depressive symptoms (CES-D), mood disturbance (POMS), social support (MOS-SSS)	**Intervention:** Rural Breast Cancer Survivors (RBCS) Intervention Early Education and Support (EE-S): 4 education sessions on physical and psychosocial well-being, healthy self-management followed by 6 support calls **Control**: RBCS Support and Delayed Education (S-DE): 6 support calls followed by 4 education sessions	Telephone (Individual)	Oncology nurse	12 months	Baseline 3 months 6 months 9 months 12 months	S-DE reported higher MCS at 9 months and lower POMS at 6, 9, and 12 months compared to EE-S.

Table 1 (continued)

Author	Sample	N	% Rural	Design	Outcome measures	Intervention components	Delivery method	Intervention facilitator	Intervention duration	Assessment timing	Overall findings
Gustafson et al. (2005)	Low income breast cancer survivors within 1 year of diagnosis	229	63% n = 144	Matched control	Functional Assessment of Cancer Therapy-Breast (FACT B), Negative Emotions scale, Health Self-Efficacy, Participation in Health Care	**Intervention:** Access to computer, internet, and Comprehensive Health Enhancement Support System (CHESS) "Living with Breast Cancer" program + written materials covering computer and CHSS use **Control**: received copy of "Dr. Susan Love's Breast Book"	Access to CHESS, an internet-based support and information program (Individual)	N/A	4 months	Baseline 4 months	Greater participation in healthcare, information competency, functional wellbeing, perceived social support, and lower negative emotions among rural, low income Caucasian participants receiving CHESS (n = 144) compared to controls matched on ethnicity and income (n = 30).
Henry et al. (2010)	Breast cancer survivors 12 weeks after their first radiation therapy	80	52% n = 42	Matched control	Physical Health Questionnaire, depression (CES-D), mood disturbance (POMS)	**Intervention:** Expressive-writing on positive thoughts and feelings regarding their experience with breast cancer **Control**: Usual Care (UC)	In-home (Individual)	N/A	Single 20-minute expressive writing session	Baseline 3 months 9 months	Fewer physical symptoms, depressive symptoms, and mood disturbance at 3 months from expressive writing relative to UC, but not 9 months. Rural women showed slightly higher participation rates.
Collie et al. (2007)	Breast cancer survivors	27	100%	Pre/post feasibility pilot	Depression (CES-D), Posttraumatic Stress (PCL-S), Self-efficacy for coping with cancer (SEC), emotional expression (EE)	**Intervention:** Videoconference support group based on the Stanford Supportive-Expressive model (discussing dealing with physicians and nurses, making good use of social support, emotional expression) + workbook journal *One in Eight* **Control**: None	Video-conference (Group)	Licensed Clinical Social Worker	8 weekly sessions	Baseline 8 weeks	From pre- to post-intervention, participants reported significantly reduced CES-D and PTSD-S scores. No change was seen in SEC or EE.

Table 1 (continued)

Author	Sample	N	% Rural	Design	Outcome measures	Intervention components	Delivery method	Intervention facilitator	Intervention duration	Assessment timing	Overall findings
Zhou et al. (2016)	Breast, prostate and blood cancer survivors not undergoing active treatment 36% (n = 5) breast cancer survivors	14	93% n = 13[a]	Pre/post feasibility pilot	Satisfaction and perceived stress (PSS)	**Intervention**: Adapted Cognitive-Behavioral Stress Management **Control**: None	Video-conference (Group)	Study facilitators	4 weekly sessions	Baseline 4 weeks	From pre- to post-intervention, PSS did not change. 71% of participants reported the program to be helpful, 43% experienced problems related to the videoconferencing format, and 29% desired a longer intervention.
McCarthy et al. (2018)	Breast cancer survivors diagnosed and treated 1 month to 5 years ago	18	100%	Pre/post feasibility pilot	Diary-based sleep efficiency (SE), latency (SL), wake after sleep onset (WASO), total sleep time (TST) QOL (EORTC QLQ-C30), mental health (HADS), menopausal symptoms	**Intervention**: Cognitive Behavioral Therapy for Insomnia **Control**: None	Tele-conference (Individual)	Oncology nurses	6 weekly sessions	Baseline 6 weeks	From pre- to post-intervention all sleep indices, QOL, and menopausal symptoms significant improved. No change was seen in anxiety and depression (HADS).
Linshaw et al. (2020)	Breast cancer survivors ≤ 12 months post-breast cancer surgery	11	100%	Pre/post feasibility pilot	Satisfaction; quality of life (PROMIS-29 and PROMIS –Global) and mindfulness (MAAS)	**Intervention:** The Stress Management and Resiliency Training (SMART) - Relaxation Response and Resiliency Program (3RP) **Control:** none	Face-to-face (Group)	Mind–body medicine practitioner	8 weekly sessions	Baseline 8 weeks	Intervention determined feasible (> 80% of those enrolled completed) and acceptable (all participants reported high satisfaction). Trend toward improvement in anxiety depression, fatigue and sleep disturbance, and mindfulness from pre- to post-intervention.

Table 1 (continued)

Author	Sample	N	% Rural	Design	Outcome measures	Intervention components	Delivery method	Intervention facilitator	Intervention duration	Assessment timing	Overall findings
Schoenberger et al. (2016)	Breast cancer survivors ≤ 3 years post- diagnosis and ≥ 6 months after completion of primary treatment	221	100%	Post-satisfaction study	Satisfaction and qualitative feedback	**Intervention**: Rural Breast Cancer Survivors (RBCS) Intervention: 4 education sessions on physical/psychosocial well-being, healthy self-management + 1 follow-up call to reinforce regular cancer surveillance, health/wellness activities, symptom management + 6 support calls to support self-management **Control**: None	Telephone (Individual)	Oncology nurse	4 weekly sessions + 1 follow-up session + 6 monthly support sessions	Baseline 12 months	At post-intervention, 94% indicated that the survivorship information was helpful in making health decisions 87% indicated it helped in communicating concerns to family oncology team. 66% indicated that the survivorship educational materials were provided at an appropriate time after treatment. Qualitative data suggested one-on-one interaction with the intervention nurses was the single most highly valued aspect.
Weight management interventions											
Befort et al. (2016)	Overweight or obese post-menopausal breast cancer survivors ≥ 3 months post-treatment	172	100%	RCT	Weight regain from 6 to 18 months	**Intervention**: Weekly counseling sessions on increasing physical activity and reducing caloric intake + two meal replacement shakes per day for 25 weeks + 26 biweekly counseling sessions on relapse prevention **Control**: Received intervention for first 25 weeks, then 26 biweekly mailed newsletters	Telephone (Group)	Registered dietitian or Psychologist	24 weekly sessions + 26 bi-weekly sessions	Baseline 6 months 18 months	Less weight regained (7.3 vs. 10.8 lbs.) and a greater proportion were below 5% of their baseline weight (75% vs. 58%) in intervention compared to newsletter condition.

Table 1 (continued)

Author	Sample	N	% Rural	Design	Outcome measures	Intervention components	Delivery method	Intervention facilitator	Intervention duration	Assessment timing	Overall findings
Befort et al. (2012)	Overweight or obese post-menopausal breast cancer survivors ≥ 3 months post-treatment	35	100%	Pre/post feasibility pilot	BMI, dietary intake (Nutritional Data System for Research software), physical activity (Minnesota Physical Activity Questionnaire), fatigue (BFI), blood biomarkers (insulin, leptin, adiponectin) depression (PHQ-9), body image (Body Image and Relationships Scale)	**Intervention**: Counseling sessions on increasing physical activity and reducing caloric intake + two meal replacement shakes per day **Control**: None	Telephone (Group)	Registered dietitian or Psychologist	24 weekly sessions	Baseline 6 months	From pre- to post-intervention, participants lost an average of 13% of their baseline weight. Participants also experienced a significant reduction in dietary intake, insulin and leptin, joint pain, depressive symptoms, and increase in physical activity and body image from baseline to 6 month follow up.
Gray et al. (2019)	Overweight breast, prostate, and colorectal cancer survivors 45% (n = 219) breast cancer survivors	487	33% n = 160	Pre/post feasibility pilot	SF-36 physical function subscale, basic and advanced lower extremity function (0–100), physical activity, BMI, and overall health quality-of-life	**Intervention**: Reach-out to ENhancE Wellness (RENEW): counseling and mailed materials promoting exercise, improved diet quality, and modest weight loss **Control**: none	Telephone (Individual)	Study counselors	15 sessions + 8 automated telephone prompts delivered 50 weeks	Baseline 12 months	From pre- to post-intervention, rural survivors reported significantly more favorable mean changes in physical functioning, physical health, and fewer adverse events compared to urban survivors. Rural survivors reported smaller increases in fruit and vegetable intake, and lower percentages achieved goal behavior for endurance exercise and intakes of fruit and vegetable and saturated fat compared to urban survivors.
Education											
Belkora et al. (2012)	Breast cancer survivors who accessed services at a rural community-based resource center and had upcoming medical appointment	67	100%	RCT	Decision self-efficacy, psychosocial and economic outcomes	**Intervention 1**: Consultation Planning in person **Intervention 2**: Consultation Planning via Telephone	Telephone (Individual)	Community health workers certified in Consultation Planning	1 h	Baseline Immediate Post-Intervention	Tele-CP was non-inferior to In-Person CP on all outcome measures, cost no more than In-Person CP, and was equally valued by patients.

Table 1 (continued)

Author	Sample	N	% Rural	Design	Outcome measures	Intervention components	Delivery method	Intervention facilitator	Intervention duration	Assessment timing	Overall findings
Belkora et al. (2006)	Patients at three rural community-based resource centers 60% (n = 40) breast cancer survivors	67	100%	Post-intervention satisfaction study	Satisfaction	**Intervention**: Consultation Planning structured interview that prompts patients to generate questions and concerns to share with their physician at their upcoming visit **Control**: none	Face-to-face (Individual)	Community health workers certified in Consultation Planning	1 h	Immediate Post-Intervention	Patients reported high satisfaction (8.67 on -10 to 10 scale). Breast cancer survivors reported higher satisfaction when meeting with a CP Provider who was a breast cancer survivor compared to meeting with CP Providers who did not have a history of breast cancer.
Gisiger-Camata et al. (2016)	Breast cancer survivors	68	98% n = 67	Post-intervention satisfaction study	Intervention satisfaction (acceptability and helpfulness)	**Intervention**: psychoeducation session lecture (tips on locating resources and managing symptoms) + discussion of emotional distress associated with survivorship (e.g., fear of recurrence) + written handouts **Control**: none	Face-to-face (Group)	Not stated	2 h	Immediate Post-Intervention	At post-intervention, 88.4% were interested in the information presented and 91% will use information learned

[a]Reported a > 30 min commute to closest cancer center

and acceptable, as 83% of patients stated that face-to-face interaction was not necessary, 94% stated they were "comfortable" or "very comfortable" with telephone therapy, and 88% found the intervention to be helpful weeks or months after it concluded. The treatment group reported significantly less stress and greater mental health than controls immediately after the intervention, but significantly greater stress and poorer mental health compared to controls 6 months later.

Angell et al. (2003) compared usual care to a Workbook-Journal (WJ) developed by a partnership between rural breast cancer patients, providers, and researchers. The authors determined the WJ to be feasible, as the study had an 83% recruitment rate and 98% retention rate, and acceptable, as 74% of women reported feeling emotionally supported by the WJ, though only 44% reported changing the way they coped as a result of the WJ. The intervention did not yield any main effects on study outcomes, but subgroup analyses indicated that the WJ was associated better coping strategies among women from more rural recruitment sites.

Williams and Schreier (2004) examined the effect of two audiotaped sessions that provided information on self-care behaviors to manage cancer-related side effects. These tapes were to be listened to one day prior to the start of participants' chemotherapy cycle. The authors determined the intervention to be feasible, as 62% of participants listened to the audiotapes two or more times, and acceptable, as participants rated the intervention an 8 out of 10 on a helpfulness scale. The experimental group reported using more self-care behaviors for nausea and anxiety at 1 month, and a greater reduction in anxiety compared to the usual care group. Additionally, fewer women in the experimental group reported difficulty sleeping at the 3 month follow up.

Hegel et al.'s RCT comparing usual care to six weekly 30–60 min individual telephone-sessions of Problem-Solving and Occupational Therapy intervention found the intervention to be feasible and acceptable, as 67% of approached

patients consented to participate, 81% of consented patients completed the intervention, and 92% of participants in the intervention condition reported being satisfied or very satisfied with the intervention (2011). Women in the intervention condition reported greater health-related QOL and lower anxiety compared to those in usual care at the 6 week follow up, with differences in anxiety maintaining at the 12 week follow up.

Meneses and colleagues' RCT compared the effect of attention control to a Breast Cancer Education Intervention (BCEI), shown to be effective at improving QOL among breast cancer survivors in previous studies (Meneses et al., 2007). BCEI consisted of three 60–90 min weekly face-to-face education and support sessions and 5 monthly follow up sessions (two in-person and three via telephone), along with supplemental written and audiotape materials. Authors determined the intervention to be feasible and acceptable, as 77% of patients approached agreed to participate in the study, 100% of whom completed the study. The intervention was determined to be effective, as BCEI participants reported higher QOL at 3 and 6 month follow up compared to attention control participants.

Schoenberger et al. modified the BCEI to use only telephone delivery instead of face-to-face to better meet the needs of rural breast cancer survivors. Schoenberger et al. (2016) refer to this intervention as the Rural Breast Cancer Survivors Intervention (RBCS), which consists of an intake assessment to establish rapport, four educational telephone calls, and six-monthly support calls to reinforce self-management of health behaviors. Participants were randomized to receive educational calls in either the first month or seventh month of participation. The intervention was acceptable, as 94% of participants reported that the survivorship information was helpful in making health decisions and 87% reported it helped them communicate concerns to their family and oncology team. Participants preferred receiving the educational calls early (i.e., month 1) as opposed to later (i.e., month 7).

Meneses et al. (2020) then conducted an RCT comparing RBCS with early education (calls delivered in month 1) versus delayed education (calls delivered in month 7). Delayed education resulted in significantly lower mood disturbance at all follows ups and mental health-related higher QOL at 9 months compared to early education.

Matched control designs

Gustafson et al. (2005) provided an internet-based Comprehensive Health Enhancement Support System (CHESS) program called "Living with Breast Cancer" to low income (250% below federal poverty line) Caucasian women in rural Wisconsin and low income African American women in urban Detroit. CHESS provides information (e.g., common questions and answers), support (e.g., facilitated small group discussions), and decision (e.g., health tracking and decision aids) services (Gustafson et al., 1993). The authors determined CHESS to be feasible among rural participants, as more rural than urban participants accessed CHESS each week, logging on 10–7 times per week and spending 3–4 h per week using the program. Rural participants spent more time using communication services and less time using information and decision services compared to urban participants. Authors compared rural participants to a matched control group (Caucasian and low income) from a previous study (Gustafson et al., 2001), and found CHESS was associated with significantly greater participation in healthcare, information competency, functional and emotional wellbeing, and perceived social support.

Henry et al. (2010) found that instructing women to write about positive thoughts and feelings regarding their experience with breast cancer for 20 min (Stanton et al., 2002) was feasible, particularly among rural breast cancer survivors, as 78% of rural patients approached consented to participate compared to 67% of urban patients. Just over half (58%) of participants reported feeling positive about their writing experience, suggesting moderate acceptability. Participants in the expressive writing condition reported fewer physical symptoms, fewer depressive symptoms, and less mood disturbance compared to those in a matched control group at the 3 month, but not 9 month follow up.

Pre-/post-intervention pilot studies

Collie et al. (2007) augmented the Workbook-Journal described above (Angell et al., 2003) with 8 weekly 2 h support groups delivered via videoconference at rural health facilities. The authors determined the intervention to be feasible and acceptable, as participants rarely missed sessions and reported an average of 8 on a 10-point satisfaction scale. Zhou et al. (2016) examined the feasibility of 4 weekly 60 min group Cognitive Behavioral Stress Management sessions (CBSM; adapted from Penedo et al. (2008)) delivered via videoconference. Participants attended the first session in person, at which time they were loaned a tablet, oriented to the videoconference software, and given an e-book. Authors determined that the intervention was feasible and acceptable, as 71% of participants reported the program to be helpful. Additionally, six of the 14 participants reported experiencing problems related to the videoconferencing format, including difficulties developing a connection to group members during videoconference sessions, wireless disruptions, and trouble concentrating. Thus, this small study suggests it is important to consider barriers to the success

of brief virtually-delivered group-based CBMS. McCarthy et al. (2018) examined the feasibility of 6 weekly 30–60 min sessions of individual Cognitive-Behavioral Therapy for Insomnia (CBT-I) delivered via videoconference. Authors determined the intervention was feasible, as 80% of eligible individuals agreed to participate and no sessions were cancelled due to technological difficulties.

Post-intervention satisfaction studies

Linshaw et al. (2020) examined the feasibility of 8 weekly 2 h group sessions of a mindfulness-based intervention delivered face-to-face. The study had an 85% retention rate, suggesting feasibility, but only a 23% recruitment rate, due to the sessions only being offered one time per week. All participants stated they would recommend the intervention to a friend, and felt the face-to-face nature of the intervention was important to the group dynamics.

Results of weight management intervention studies

RCTs

All participants in Befort et al. 2016 study completed a group phone-based weight loss intervention (Phase 1), consisting of 24 weekly 60 min group conference calls focused on increasing physical activity and reducing caloric intake plus two meal replacement shakes per day. Participants who lost at least 5% of their entry weight during Phase 1 (90% of participants) were randomized to either continued group phone counseling, which entailed 26 bi-weekly group conference call sessions focused on relapse prevention using problem-solving and reviewed nutrition, exercise, behavioral, and survivorship topics or a newsletter condition, which entailed receiving 26 bi-weekly educational newsletters. Compared to participants in the newsletter condition, participants in the intervention condition regained less weight and a greater proportion were below 5% of their baseline weight. A secondary analysis of this study suggests that participants felt that the accountability, group support, and convenience of the intervention were critical to their success (Fazzino et al., 2016).

Pre-/post-intervention pilot studies

The above described study was based on a promising pre/post intervention study conducted by Befort et al. (2012) which examined the effect of 24 weekly 60 min group phone counseling sessions similar to those described above. Authors determined the intervention to be feasible, as 83% of eligible approached patients consented. Gray et al. (2019) examined the effect of a personalized workbook and telephone counseling intervention referred to as Reach-out to ENhancE Wellness (RENEW) on rural versus urban participants. Though the original RENEW trial did not specifically report outcomes for rural participants (Morey et al., 2009), approximately 33% of the sample was classified as rural. Gray et al. (2019) pooled the outcomes of all participants randomized to receive the RENEW intervention immediately and those randomized to receive it after a 12 month delay, and compared the outcomes of rural and urban participants. Results indicated that rural participants reported more favorable outcomes on physical functioning and physical health-related QOL compared to urban participants. However, urban participants reported greater increases in fruit and vegetable intake, and a higher percentage of urban participants achieved their goals related to endurance exercise, fruit and vegetable intake, and saturated fat intake compared to rural participants. No urban–rural differences were observed in physical activity or BMI outcomes.

Results of education intervention studies

RCTs

Belkora et al. (2012) determined that the effect of telephone-delivered Consultation Planning (CP) was comparable to in-person CP on decision self-efficacy, preparation to make a decision, anxiety, and satisfaction and was associated with lower cost. CP involves typing out the client's medical questions, prompting clients to elaboration on their questions, categorizing questions, and providing a copy of the question list to clients to share with their doctor at their upcoming visit (Belkora et al., 2009). Notably, this manuscript did not did not include a no-intervention control group, making it difficult to determine the effect of CP on study outcomes compared to not receiving CP.

Post-intervention satisfaction studies

Prior to conducting the above RCT, Belkora et al. (2006) determined face-to-face CP to be highly satisfactory for rural participants ($M = 8.7$ on a -10 to $+10$ scale). CP providers' survivorship status moderated results, with breast cancer survivors reporting higher satisfaction from CP with providers who were also breast cancer survivors than with providers who did not have a history of breast cancer. Gisiger-Camata et al. (2016) found that patients reported high satisfaction following a 2 h face-to-face group-based education session titled "Reach Out to Rural Breast Cancer Survivors": 88% were interested in the information and 91% planned to use the information presented. Some participants (17%) reported preferring online support, and authors noted that delivery of a similar survivorship education program in an electronic format may be more sustainable.

Discussion

This systematic review determined that only 19 studies examining behavioral interventions for rural breast cancer survivors living in the United States have been published in the last 20 years: eight RCTs (Angell et al., 2003; Befort et al., 2016; Belkora et al., 2012; Hegel et al., 2011; Meneses et al., 2009, 2020; Sandgren et al., 2000; Williams & Schreier, 2004), two matched control studies (Gustafson et al., 2005; Henry et al., 2010), six pre-/post-intervention feasibility studies (Befort et al., 2012; Collie et al., 2007; Gray et al., 2019; Linshaw et al., 2020; McCarthy et al., 2018; Zhou et al., 2016), and three post-intervention satisfaction studies (Belkora et al., 2006; Gisiger-Camata et al., 2016; Schoenberger et al., 2016). Two of the RCTs compared two active treatments (Belkora et al., 2012; Meneses et al., 2020), making it difficult to draw conclusions about efficacy in the absence of treatment. However, six of the eight studies that included a no-treatment or active control group reported favorable outcomes for the intervention examined, including a greater reduction in mood disturbance (Henry et al., 2010), anxiety (Hegel et al., 2011; Williams & Schreier, 2004), and depression (Henry et al., 2010), and greater health-related QOL (Hegel et al., 2011; Meneses et al., 2009), functional and emotional wellbeing (Gustafson et al., 2005), use of self-care behaviors (Williams & Schreier, 2004) and weight loss (Befort et al., 2016) compared to a control group at follow up. However, two interventions did not lead to improved outcomes compared to a control group (Angell et al., 2003; Sandgren et al., 2000). The interventions examined in these eight controlled studies varied widely in objective, duration, and follow up timing, making it impossible to draw overarching conclusions about optimally effective interventions for rural breast cancer survivors. Furthermore, with the exception of two studies (Befort et al., 2016 (n = 167); Gustafson et al., 2005 (n = 174), the sample sizes of the eight controlled studies were small, ranging from 31(Hegel et al., 2011) to 98 (Angell et al. 2003). Additionally, only three reviewed studies included follow up time points that extended beyond the end of the intervention, ranging from 6 weeks (Hegel et al., 2011) to 6 (Sandgren et al., 2000) and 9 (Henry et al., 2010) months after the intervention ended. Thus, adequately powered studies examining these interventions long-term effects are needed.

Despite the limitations of the reviewed studies, information on potentially effective intervention elements can be gleaned. Specifically, lessons can be learned from the content, duration, and delivery method of the interventions. Regarding the content, studies reviewed fell into three categories of intervention objectives that clearly align with the health disparities experienced by rural breast cancer survivors. Specifically, rural breast cancer survivors experience poorer mental (Burris & Andrykowski, 2010) and physical health (Jackson et al., 2005; Miller et al., 2012; Savoca et al., 2009; Schootman et al., 2013; Weaver et al. 2013a, b) and lack knowledge about post-treatment care (DeGuzman et al., 2017; Schootman et al., 2013) compared to their urban counterparts, suggesting interventions targeting psychosocial support, weight control, and education tailored for rural breast cancer survivors are needed. Indeed, reviewed studies that included both urban and rural survivors found that rural breast cancer survivors derived the same or greater benefit from the intervention, compared to their urban counterparts (Gray et al., 2019; Gustafson et al., 2005; Henry et al., 2010). Rural breast cancer survivors may be especially interested in engaging in (Henry et al., 2010; Gustafson et al., 2005) and completing (Meneses et al., 2009; Angell et al. 2003) behavioral interventions following cancer treatment. Thus, future research examining rural interventions targeting psychosocial support, weight management, and education is likely feasible and potentially effective.

Regarding intervention duration, interventions with the objective of providing psychosocial support may require a minimum of 6 weeks to effect change. Indeed, most psychosocial interventions for breast cancer survivors consist of 6–12 weekly sessions (CBT-I; Aricò et al., 2016; Johnson et al., 2016; CBSM; Stagl et al., 2015) ACT; Fashler et al., 2018; MBSR; Cramer et al., 2012). However, one study found that 10 therapy sessions did not lead to improved outcomes (Sandgren et al., 2000), whereas another found that a single 20 min episode of expressive writing led to improved quality of life 3 months later (Henry et al., 2010), suggesting the necessary intervention duration may depend somewhat on content. Additionally, providing survivors with a Workbook/Journal was not sufficient to effect change (Angell et al., 2003), though augmenting it with eight support group sessions did lead to improved outcomes (Collie et al., 2007). Interestingly, two other relatively "hands off" interventions (listening to audiotaped sessions (Williams & Schreier, 2004) and accessing an internet-based education/support program (Gustafson et al., 2005) did lead to improved outcomes, suggesting an interventionist may not be necessary to improve psychosocial outcomes. Interventions with the objective of improving weight management may require considerably longer duration. The length of the weight management interventions reviewed here (e.g., 6–18 months; Befort et al., 2012, 2016; Gray et al., 2019) is consistent with other weight loss interventions delivered to breast cancer survivors. Twelve of 15 weight loss interventions for breast cancer survivors reviewed by Playdon et al. (2013) lasted for 6 months or longer. Thus, interventions aiming to improve weight management may need to be relatively lengthy. Lastly, single session interventions with the objective of improving knowledge about survivorship care lead to increased satisfaction, though none of the reviewed education-focused interventions included a no-intervention

control group. Thus, future research should examine the effectiveness of very brief education-focused interventions.

Regarding the delivery method, of the 19 interventions reviewed, only three involved face-to-face delivery (Gisiger-Camata et al., 2016; Linshaw et al., 2020; Meneses et al., 2009). Two studies of in-person interventions discussed concerns about long-term sustainability of face-to-face delivery, in light of the relatively high cost and logistical complexity compared to remote delivery (Gisiger-Camata et al., 2016; Meneses et al., 2009). Indeed, one of these interventions (Meneses et al., 2009) was subsequently adapted to include only telephone contact, which resulted in high patient satisfaction (Schoenberger et al., 2016) and improved mood (Meneses et al., 2020). Thus, telephone and/or videoconference delivery methods may be ideal for rural breast cancer survivors who commonly report distance to cancer centers as a barrier to care (Bettencourt et al., 2007; Charlton et al., 2015; Probst et al., 2007). Additionally, six of the reviewed studies were delivered in a group format (Befort et al., 2012, 2016; Collie et al., 2007; Gisiger-Camata et al., 2016; Linshaw et al., 2020; Zhou et al., 2016), four of which were delivered via telephone or videoconference. Qualitative feedback from these studies revealed that survivors appreciated the support from other group members, though survivors also expressed high satisfaction with individually delivered interventions. Group-delivered interventions may further enhance cost effectiveness, and these studies suggest that they can be feasibly delivered using telehealth technology. Finally, the interventions reviewed were delivered by a wide variety of professionals, including psychologists (Befort et al., 2012, 2016), psychology trainees (Sandgren et al., 2000), oncology nurses (McCarthy et al., 2018; Meneses et al., 2009, 2020; Schoenberger et al., 2016), dieticians (Befort et al., 2012, 2016), occupational therapists (Hegel et al., 2011), social workers (Collie et al., 2007), and community health workers (Belkora et al., 2006, 2012). Research in non-cancer populations suggest that behavioral interventions delivered by providers with relatively little experience can achieve promising outcomes (Stanley et al., 2014; Walsh et al., 2019). Thus, future studies of interventions for rural breast cancer survivors may need to consider nontraditional providers in order to maximize feasibility and cost effectiveness.

There are several limitations to acknowledge. First, there was considerable heterogeneity in the reviewed interventions in terms of intervention objective, duration, delivery method, and outcomes, as well as some heterogeneity in the samples, as six studies included non-rural survivors and/or survivors of other types of cancer. Additionally, eight of the reviewed studies did not include a control group, and those that did were underpowered due to small sample sizes. Furthermore, only three studies included any follow up data that extended beyond the immediate end of the intervention. Thus, this systematic review is unable to draw broad conclusions about the efficacy of behavioral intervention for rural breast cancer survivors. Additionally, reviewed studies were limited to those conducted in the United States, as other countries' healthcare systems may result in different behavioral intervention needs among rural breast cancer survivors. This limits generalizability of these findings to other countries. Lastly, it is possible that, despite authors' thorough review of databases, some relevant studies may have been missed.

Conclusion

This systematic review identified 19 studies of interventions delivered to rural breast cancer survivors over the past two decades. Results suggest that rural breast cancer survivors are interested in participating in, are generally satisfied with, and are likely to derive considerable benefit from behavioral interventions that target improving psychosocial support, weight management, and survivorship knowledge. Additionally, these interventions can be delivered remotely, via telephone or videoconference, can involve group or individual format, and can be delivered by providers from wide range of disciplines. Considering the prevalence of breast cancer and the demonstrable needs of rural cancer survivors, more research into effective interventions to improve quality of life, weight management, and survivorship knowledge among rural breast cancer survivors is needed. Larger sample sizes, higher quality control groups, and longer follow up data are needed to accomplish this goal.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Human and animal rights This is a systematic review study. Thus, no ethics approval is required.

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