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The effectiveness of online interventions for patients with gynecological cancer: An integrative review

Huicong Lin [a,1], Mingzhu Ye [b,1], Sally Wai-chi Chan [c], Jiemin Zhu [a,*], Honggu He [d]

[a] School of Medicine, Xiamen University, Fujian Province, PR China
[b] Department of Gynecology and Obstetrics, Zhongshan Hospital, Xiamen University, Fujian Province, PR China
[c] UON Singapore Campus, University of Newcastle, Australia
[d] Alice Lee Centre for Nursing Studies, Yong Loo Lin School of Medicine, National University of Singapore, Singapore

HIGHLIGHTS

- Online interventions have been increasingly used to promote health outcomes for patients with gynecological cancer.
- Online interventions were demonstrated to improve quality of life and body images for patients with gynecological cancer.
- Online interventions were reported to have inconclusive effects on symptom distress and social support.
- Online interventions were reported to have inconsistent effects on psychological well-being and sexual well-being.
- Studies with more rigorous designs and sufficient sample sizes are needed for further exploration.

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ABSTRACT

Objective. With advantages of easy accessibility and various multimedia interactivity formats, online interventions have been developed to improve health outcomes for patients with a variety of gynecological cancers, but evidence regarding their effectiveness for such patients is not well-understood. This review aimed to synthesize study findings that were published in English or Chinese regarding the effectiveness of online interventions on the quality of life, symptom distress, social support, psychological distress, sexual well-being, and body image in patients with gynecological cancer.

Methods. This integrative review adhered to five steps, including problem identification, literature search, quality appraisal, data analysis, and presentation. Ten electronic databases (MEDLINE, ScienceDirect, SpringerLink, PubMed, Wiley Online Journals, Web of Science, OVID, CINAHL Plus with Full Text, China National Knowledge Infrastructure, and Cochrane Library) were searched from the inception of each database to April 2019 in accordance with the rigid and explicit inclusion and exclusion criteria. Version 2018 of the Mixed Methods Appraisal Tool was used for the quality appraisal of the articles.

Results. Out of 276 articles, 24 potentially eligible articles were initially identified. A manual search retrieved an additional eligible three articles. After nine articles were excluded, ten quantitative, six qualitative, and two mixed-methods articles were finally included. Online interventions improved quality of life and body images in patients with gynecological cancer, but there were inconclusive effects on symptom distress, social support, psychological distress, and sexual well-being.

Conclusions. Online interventions have been increasingly used as clinically promising interventions to promote health outcomes among patients with gynecological cancer. Studies with more rigorous designs and sufficient sample sizes are needed to elucidate the effectiveness of such online interventions. Healthcare workers can incorporate existing or new online interventions into their routine care to improve health outcomes for patients with gynecological cancer.

1. Introduction

Globally, the incidence of various gynecological cancers (e.g. ovarian, cervix uteri, and uterine corpus cancer) was 6.6 to 13.1 per 100,000

* Corresponding author at: Department of Nursing, School of Medicine, Xiamen University, Room 222, Alice lee Building, Xiangan Campus, Xiamen University, Xiangan Nan Road, Xiangan District, Xiamen City, Fujian Province, PR China.
E-mail address: Jieminzhu@xmu.edu.cn (J. Zhu).
[1] Huicong Lin and Mingzhu Ye contributed equally.

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women, and the mortality rate was 1.8 to 6.9 per 100,000 women [1]. In China, the incidence and mortality rates for gynecological cancers have been steadily increasing, and gynecological cancers have become a major public health concern [2]. The common treatments for gynecological cancers are surgery, chemotherapy, or radiotherapy [3].

The impact of cancer diagnoses and treatments have profound impacts on the quality of life (QoL) of patients with gynecological cancer [4]. QoL is conceptualized as an overall well-being that consists of physical, social, and emotional well-being [5]. Patients might suffer various physical and psychological symptom distress including nausea, fatigue, pain, bowel complaints, urinary difficulties, depression, and anxiety [3,6–8]. Mamguem et al. [9] also reported that patients experienced low social support or low satisfaction with social support. Moreover, patients' sexual well-being and body image are closely related to their QoL [10]. Patients' sexual well-being may be impaired due to the damage of the vaginal mucosa and epithelium by radiation therapy, as well as insufficient lubrication caused by chemotherapy [11–13]. Some side effects of treatments such as the removal of female genitalia and alopecia might lead to poor body images [13]. All the above may lead to poor QoL for patients with gynecological cancer.

Various face-to-face psychoeducational interventions have been conducted for patients with gynecological cancer, and almost all interventions have been proved to be effective in promoting health outcomes [14]. However, geographical distances and scheduling issues pose challenges to the feasibility of clinical face-to-face interventions [15]. Compared with traditional interventions, online interventions have many prominent advantages, including easy accessibility [16], saving time [17], and the availability of various multimedia interactivity formats [18].

Many researchers have explored the effectiveness of online interventions on health outcomes for cancer patients. Two literature reviews indicated that online interventions had positive effects on cancer patients, such as improved QoL, increased social support, and reduced symptoms distress [19,20]. The two reviews only analyzed articles with randomized controlled trials (RCTs) or non-randomized trials, and each review only included one article that focused on gynecological cancers [19,20]. Another review reported that various online interventions were designed to enhance cancer patients' sexual outcomes, but most online interventions were in their pilot and feasibility stages [21]. This review included ten articles, and only two articles were targeted gynecological cancers [21].

To the best of our knowledge, there is no review that explored the effectiveness of online interventions that targeted patients with gynecological cancer. Although RCTs provide the best evidence of intervention outcomes, all types of study designs, including qualitative and quantitative, should be considered to gain a comprehensive insight into the impacts of online interventions [18,22]. Moreover, all aforementioned articles were published in English and none of them were conducted in China [19–21]. China has the largest population, and gynecological cancers are relatively prevalent among Chinese women [2]. The incorporation of articles that were published in Chinese or English will contribute to understanding the impacts of online interventions on patients with gynecological cancer from a global perspective [22].

The aim of this review was to synthesize articles that were published in English or Chinese regarding the effectiveness of the online interventions on the quality of life, symptom distress, social support, psychological distress, sexual well-being, and body image of patients with gynecological cancer.

2. Methods

2.1. Design

This study was an integrative review that combined quantitative and qualitative articles. This review followed the five steps suggested by Whittemore and Knafl [23]: problem identification, literature search, quality appraisal, data analysis, and presentation.

2.2. Search methods

Ten electronic databases were searched: MEDLINE, ScienceDirect, SpringerLink, PubMed, Wiley Online Journals, Web of Science, OVID, CINAHL Plus with Full Text, China National Knowledge Infrastructure, and Cochrane Library. We searched the articles from the inception of each database to April 2019. The search keywords included "gynaecology OR gynecology OR gynecological OR gynecologic OR cervix OR cervical OR uterine cervix OR endometrium OR endometrial OR uterine corpus OR uterine body OR ovary OR ovarian" AND "cancer OR tumor OR tumour OR neoplasms OR carcinoma OR malignancy" AND "web OR www OR online OR Internet OR connected health OR telehealth OR e-health OR m-health OR e-intervention OR e-technology OR computer OR mobile application OR mobile device" AND "intervention OR support OR teaching OR education OR interactive program OR system OR instruction."

The inclusion criteria of the articles were: 1) patients diagnosed with cervix uteri cancer, uterine corpus cancer, or ovarian cancer, 2) peer- or professional-led online interventions or combinations of these two types of interventions, with internet access via mobile phones, computers, or other mobile devices, 3) primary studies including the quantitative (such as RCTs, non-randomized trials, and one-arm pre-test/post-test studies), qualitative, or mixed methods designs, 4) evaluated or observed outcomes including QoL, symptom distress, social support, psychological distress, sexual well-being, and body image, 5) interventions with mixed types of cancer patients if the data for patients with gynecological cancer could be analyzed separately, and 6) either published in English or Chinese.

The exclusion criteria for the articles were: 1) combinations of multiple interventions, including face-to-face, telephone and online interventions, 2) online interventions that targeted screening, medical appointment, prevention, detection, self-examination, and genetic counseling, 3) interventions delivered via videos, CDs, DVDs, short messaging service, or telephone interactions without internet access, or 4) unpublished journal articles, protocols, theses, government reports, conference papers, posters, and reviews.

2.3. Search outcome

The article search and selection process of this review was based on the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines [24]. Two hundred and sixty records were originally identified in ten electronic databases. The reference lists of the reviews identified an additional 16 records. Thus, the initial article search identified 276 records. After 114 duplicates were removed, 162 articles were retrieved. Two authors (HL and JZ), who are bilingual in Chinese and English, screened the articles separately. In order not to leave out any relevant articles, two authors independently assessed the titles, abstracts, patients' characteristics, intervention descriptions, and outcome evaluations using the rigid and explicit inclusion and exclusion criteria. For the whole selection process, the five authors had regular online meetings to discuss dubious articles until they reached a consensus. After screening, 24 eligible articles were identified. A manual search retrieved an additional 17 articles, among which three were included after their eligibility assessment. The 27 full-text articles were reviewed by all authors, all of whom were bilingual in Chinese and English. Nine articles were excluded due to the following reasons: failure to separate the data of patients with gynecological cancer in mixed types of cancer patients ($n = 5$), combinations of multiple interventions including face-to-face, telephone, and online interventions ($n = 2$), and no targeted outcomes evaluated ($n = 2$). In the end, 18 articles (11 English articles and seven Chinese articles) were included (see Fig. 1). The 18 articles were originally classified into ten quantitative [25–34], four qualitative [35–38], and four mixed-methods [39–42] study designs. Classen et al. [25] and Wiljer et al. [38] reported different findings from the GyneGals program, and Erfani et al. [35] and Erfani

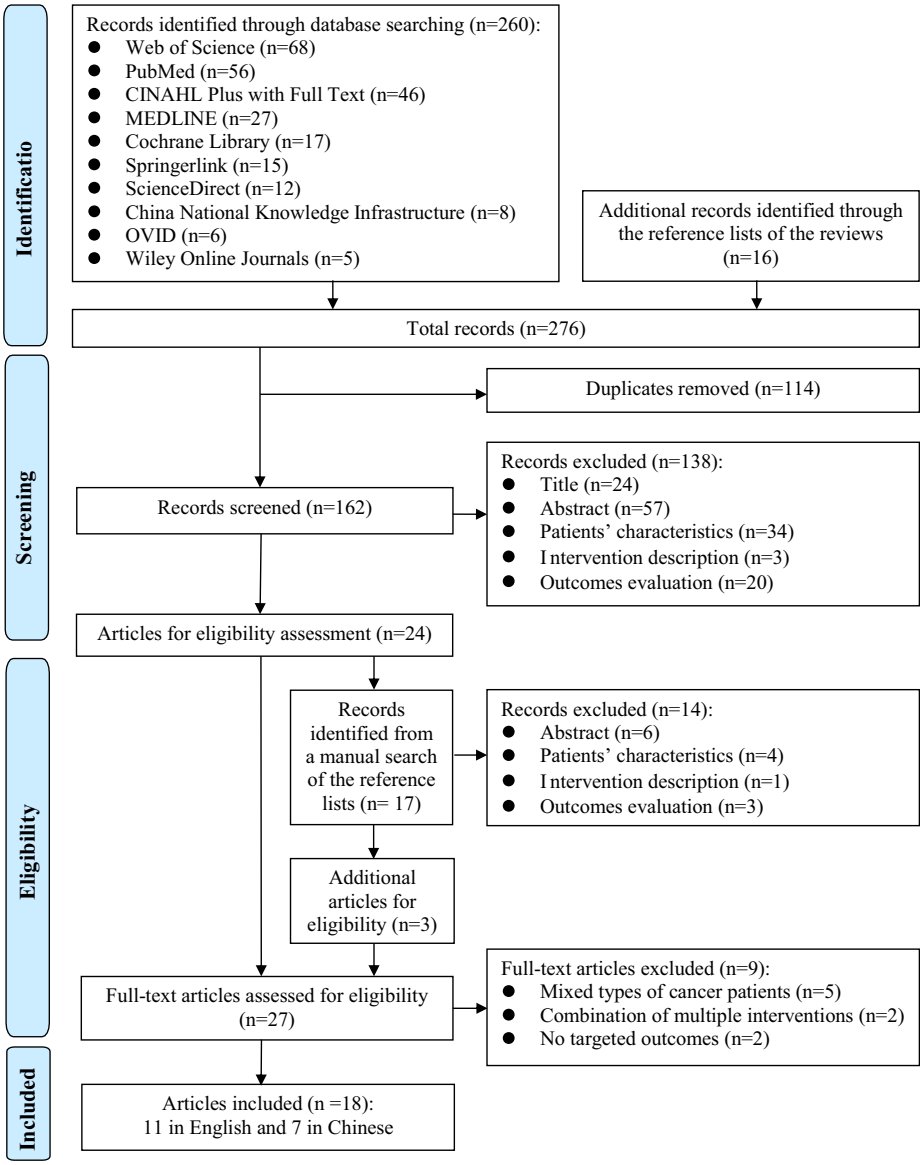

Fig. 1. Flow diagram of the article search and selection process

et al. [39] explored the different perspectives of the Ovarian Cancer Australia (OCA) Facebook. Thus, a total of 16 studies including 18 articles were identified in this review.

2.4. Quality appraisal

The evaluation of the quality of various original resources is a complicated process, and there are no golden criteria for quality appraisal [23]. Version 2018 of the Mixed Methods Appraisal Tool (MMAT) was used for quality appraisal, which can be used to appraise the quality of mixed-methods, quantitative (non-randomized trials and RCTs) and qualitative study designs [43,44]. First of all, two screening questions (whether the article has clear research questions and whether the collected data addresses the research questions) were used to determine the feasibility of using the MMAT. If "Yes" to both questions, each article would be appraised with five criteria according to its study design. Two researchers (HL and JZ) independently appraised the quality of the included articles and the other three researchers (MY, SC and HH) validated the quality appraisal outcomes. Two of the four articles with the mixed-methods study design were eventually appraised with the qualitative study criterion because only the qualitative parts of these articles were useful for this review [40,42]. Thus, six articles were appraised by the qualitative study criterion from the MMAT [35–38,40,42]. The quality appraisal of the 18 articles is shown in Table 1. All articles were included in this review because they met three and more criteria from the MMAT.

2.5. Data abstraction

Data extraction was carried out using the matrix method. A review matrix was used for a precise description and display of the 16 included studies, including study, author(s) (year, country), design, sample, theoretical framework(s), intervention, outcomes measured and findings (see Table 2).

2.6. Data synthesis

Data synthesis followed the sequence suggested by Whittemore and Knafl [23]: data reduction and display, data comparison, conclusion drawing, and data verification. The initial subgroup classification was conducted on the basis of study setting, cancer type, language published, and sample size. The domains of the matrix were compared

Table 1
Quality appraisal of the included articles.

	Mixed-methods	Quantitative non-randomized	Quantitative randomized controlled	Qualitative	S1	S2	C1	C2	C3	C4	C5
Erfani et al. [39]	√				Y	Y	Y	Y	Y	Y	Y
Kinner et al. [41]	√				Y	Y	Y	Y	Y	Y	Y
Li. [27]		√			Y	Y	Y	Y	Y	CT	CT
Liu and Liu. [30]		√			Y	Y	Y	Y	Y	CT	CT
Classen et al. [25]			√		Y	Y	Y	Y	Y	N	Y
Donovan et al. [26]			√		Y	Y	Y	Y	Y	N	Y
Li et al. [28]			√		Y	Y	Y	Y	Y	N	Y
Liang. [29]			√		Y	Y	Y	Y	Y	N	Y
Liu. [31]			√		Y	Y	Y	Y	Y	N	Y
Petzel et al. [32]			√		Y	Y	Y	Y	Y	Y	Y
Wang et al. [33]			√		Y	Y	Y	Y	Y	N	Y
Xie and Deng. [34]			√		Y	Y	Y	Y	Y	N	Y
Erfani et al. [35]				√	Y	Y	Y	Y	Y	Y	Y
Gill and Whisnant. [36]				√	Y	Y	Y	Y	Y	Y	Y
Graetz et al. [40]				√	Y	Y	Y	Y	Y	Y	Y
Sullivan. [37]				√	Y	Y	Y	Y	Y	Y	Y
Wiljer et al. [38]				√	Y	Y	Y	Y	Y	Y	Y
Wright et al. [42]				√	Y	Y	Y	Y	Y	Y	Y

Note. S = screening question, C = criterion of different study design, Y = yes, N = no, CT = cannot tell. This framework was based on the criterion of the Mixed Methods Appraisal Tool (MMAT) version 2018 [44].

and analyzed to identify differences and group similar data across articles. Ultimately, conclusions were drawn and verified through a further comprehensive analysis of these data.

3. Results

The 18 articles reported 16 studies. Of the 16 studies, seven were conducted in the United States [26,32,36,37,40–42], seven were conducted in mainland China [27–31,33,34], one was conducted in Canada [25,38], and one was conducted in Australia [35,39]. All studies were published between 2003 and 2019, and 75% (12/16) of the studies were published between 2016 and 2019 [27–35,39–42]. The majority of the patients recruited were highly educated (college or higher) in six studies [25,26,32,33,38,41,42].

Among all included studies, seven out of nine studies that were published in English targeted ovarian cancer [26,32,35–37,39–41], whereas five out of seven studies that were published in Chinese focused on cervix uteri cancer [27–30,33]. For all the included studies, the sum number of patients with ovarian cancer was 549, followed by cervix uteri cancer (n = 461) and uterine corpus cancer (n = 43). The mean age of patients with cervix uteri cancer was 44.39 years, with ovarian cancer being 48.73 years and uterine corpus cancer being 52.71 years.

All six qualitative articles [35–38,40,42] and two mixed-methods articles [39,41] were published in English. Two quantitative non-randomized articles were published in Chinese [27,30]. In eight RCT articles, three articles were published in English [25,26,32] and five were published in Chinese [28,29,31,33,34]. Only one RCT design blinded participants and caregivers through two separate websites with self-reported outcomes [32].

In this review, the sample sizes of ten quantitative articles [25–34] and the quantitative parts of the two mixed-methods articles [39,41] ranged from 19 to 154, among which the sample sizes of nine articles were less than 82 [25–29,32–34,41]. The sample sizes of six qualitative articles [35–38,40,42] and the qualitative parts of the two mixed-methods articles [39,41] ranged from five to 134. None of the included studies mentioned sample size calculation.

3.1. Intervention

The interventions were delivered via various online technological platforms including websites [25,32,36,38,41], a mobile application [40], social media platforms such as Facebook, WeChat, and QQ [27–31,33–35,39], a digital phenotyping platform [42], online message boards [26], and an online mailing list [37]. Online interventions could be accessed through various mobile devices (mobile phones, tablets or laptops) or computers.

Apart from one intervention that was led by peers in an unmoderated online discussion groups [37], the online interventions were led by healthcare providers who provided health information or consultations or managed patients' symptoms with built-in alerts in online platforms [25–36,38–42]. The online interventions involved group discussions [25,27–31,33–39,41], cancer-related knowledge provisions [25,27–31,33–35,38,39,41], tailored information corresponding to the patients' coping styles [32], symptom reports and managements [25,26,34,38,40,42], one-to-one health consultations [26,30], journal writing or sharing [33,41], a synchronous live chat [25,38], and videoconferences [41]. Four studies applied reminders to improve the engagement of the online interventions [25,26,32,38,40].

Six studies applied theoretical frameworks to guide their studies including the supportive-expressive group therapy theory [25,38], the representational approach [26], the social support theory, the social connectedness theory, the sociocultural theory, the social presence theory [35,39], the cognitive-behavioral stress management, the mindfulness-based stress reduction, the acceptance and commitment therapy [41], the social cognitive theory, cognitive-behavioral techniques [32], and the empowerment theory [33].

The duration of the online interventions varied across all studies, ranging from 30 days to six months [25–34,38,41,42]. In four studies, the durations of the interventions were not mentioned because the online interventions were still ongoing or the patients had been recruited from existing social media platforms or online groups to explore their experiences or perceptions of online support [35–37,39,40].

The majority of the included studies did not report long-term effects after the completion of the online interventions. Seven studies only assessed outcomes at the completion of the interventions [27,28,30,31,33,34,41], and one study evaluated its outcomes in the middle and at the end of the intervention [29]. Only three studies did their outcome assessment within one month post-intervention [32], one and a half months post-intervention [26], and one month and five months post-intervention [25].

3.2. Intervention outcomes

In this review, the online interventions were assessed for their effectiveness on QoL, symptom distress, social support, psychological distress, sexual well-being and body image.

Table 2
Data abstraction of the included studies.

Study author(s) (year, (country)	Design	Sample	Theoretical framework (s)	Intervention	Outcomes measured	Findings
Study 1: The GyneGals program. Classen et al. [25] (2013, Canada)	RCT	27 patients with gynecological cancer: intervention (n = 13) and waitlist control (n = 14)	The supportive-expressive group therapy model	The GyneGals program (a twelve-week online support group) consisted of two websites: one discussion forum website with one topic per week and one educational material website covering the week's topic. Furthermore, the program also included a 90-minute synchronous live chat.	Sexually-related distress, depression, and anxiety were assessed at the baseline and at four and eight months.	There were no significant differences on any outcome variables between the two groups.
Study 1: The GyneGals program. Wiljer et al. [38] (2011, Canada)	Qualitative semi-structured interview	12 patients with gynecological cancer: intervention (n = 3) and waitlist control (n = 9)	Same as above	Same as above	The patients' using experiences with the GyneGals program and their perception of such program	The patients reported many benefits, including support from health specialists and improvements in emotional well-being, body images, feelings of sexuality, and comfort when discussing sexuality. Furthermore, the patients reported that their QoL was improved due to their acceptance and confidence gained from the online support groups.
Study 2: The WRITE Symptoms message board. Donovan et al. [26] (2014, United States)	Pilot RCT	65 patients with recurrent ovarian cancer: intervention (n = 33) and waitlist control (n = 32)	The representational approach	Written Representational Intervention to Ease (WRITE) Symptoms (an eleven-week educational intervention) was an online message board that a nurse and a patient worked on together to develop care plans or strategies for symptoms.	Distress and severity of symptoms were assessed at the baseline and two weeks and six weeks post-intervention.	Compared to the control group, the patients in the intervention group reported lower symptom distress and a trend for lower symptom severity at two weeks post-intervention.
Study 3: The OCA Facebook. Erfani et al. [39] (2017, Australia)	Mixed-method design: qualitative semi-structured interviews and quantitative surveys	Patients with ovarian cancer: semi-structured interviews (n = 25) and quantitative survey (n = 154)	The social support theory, the social connectedness theory, the sociocultural theory, and the social presence theory	The Ovarian Cancer Australia (OCA) Facebook (patients used it for >two months) provided patients with authoritative cancer-related information, promoted cancer-related awareness events, suggested positive health behaviors, and enabled patients to connect or exchange with each other.	For qualitative interview, the patients' using experiences with the OCA Facebook were explored. For quantitative surveys, social support and psychological well-being were assessed.	The patients reported that the OCA Facebook helped them to obtain social support as well as experience the good feeling of psychological well-being (happiness and satisfaction). The survey indicated that the OCA Facebook improved patients' social support, and enhanced their psychological well-being via social support.
Study 3: The OCA Facebook. Erfani et al. [35] (2016, Australia)	Qualitative semi-structured interviews	25 patients with ovarian cancer	Same as above	Same as above	The patients' using experiences with the OCA Facebook	The patients reported that the use of the OCA Facebook enhanced their social support and social connection and also improved their psychological well-being.
Study 4: The ovarian cancer health forum. Gill and Whisnant. [36] (2012, United States)	Qualitative research method	Patients with ovarian cancer (no specific number and other information)	NA	The ovarian cancer health forum was a website that provided patients with a place to discuss or post questions.	The patients' perception of the role that the ovarian cancer health forum played in management of ovarian cancer	The forum played a significant role in improving emotional well-being and establishing trust and support between the patients.
Study 5: The PCM application. Graetz et al. [40] (2018, United States)	Qualitative designs: a telephone interview and a group discussion	Five patients with ovarian cancer: telephone interviews (n = 2) and a group discussion (n = 3)	NA	An electronic, tablet-based Patient Care Monitor (PCM) application displayed discharge instructions and collected patients' self-reported symptoms. The symptoms reported were integrated to their electronic health records, and the health care team will carry out medical interventions if any report exceeded a	The patients' using experiences with the PCM and their perceptions of the role that the PCM played in care of gynecological cancer	The patients reported that the application was helpful for reporting their symptoms and improving doctor-patient communication and relationships, and they felt relieved and reassured about monitoring and checking their own post-operative symptoms.

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Table 2 (*continued*)

Study author(s) (year, (country)	Design	Sample	Theoretical framework (s)	Intervention	Outcomes measured	Findings
				predetermined threshold.		
Study 6: The Living WELL website. Kinner et al. [41] (2018, United States)	Mixed-methods design: one-arm trial and structured interviews	19 patients with ovarian cancer: one-arm trial (n = 19) and structured interviews (n = 19)	Cognitive behavioral stress management, mindful-ness-based stress reduction, and acceptance and commitment therapy	The Living WELL (Web Enhanced Lessons for Living for Ovarian Cancer Survivors) website (a ten-week online group intervention) consisted of four modules: the Daily Relaxation, the Daily Reflection, the Weekly Overview, and the Web Session. Additionally, there was a two-hour videoconference weekly.	Quality of life, mood states, sleep quality, and social support were assessed at the baseline and at ten weeks.	The one-arm trial indicated that ovarian cancer-specific quality of life was greatly improved. There were no significant improvements in mood states, social support, and sleep quality, but the interviews showed that the intervention reduced the patients' social isolation.
Study 7: The WeChat peer education platform. Li. [27] (2018, China)	Quantitative non-randomized design	80 patients with cervix uteri cancer: intervention (n = 40) and control (n = 40)	NA	The WeChat peer education platform (a three-month online intervention) consisted of the provision of scientific articles and a group chat where patients exchanged their own feelings with one another and shared successful treatment experiences.	Quality of life, hope, and happiness were assessed at the baseline and at three months.	The WeChat platform peer education significantly improved the patients' quality of life, hope, and subjective happiness.
Study 8: The WeChat extended care platform. Li et al. [28] (2017, China)	RCT	82 patients with cervix uteri cancer: intervention (n = 41) and control (n = 41)	NA	The WeChat extended care platform (a six-month online intervention) consisted of knowledge sharing and a group chat where doctors and nurses responded to the patients' questions.	Quality of life was assessed at the baseline and at six months.	The WeChat extended care platform significantly improved the patients' quality of life.
Study 9: The WeChat health education platform. Liang. [29] (2018, China)	RCT	60 patients with cervix uteri cancer: intervention (n = 30) and control (n = 30)	NA	The WeChat health education platform (a six-month online intervention) consisted of articles sharing, health consultations, and a group chat.	Anxiety and depression were assessed at the baseline and at one and six months. Quality of life was assessed at the baseline and at six months.	The WeChat health education platform significantly improved the patients' quality of life and reduced the patients' anxiety and depression.
Study 10: The WeChat health education platform. Liu and Liu. [30] (2019, China)	Quantitative non-randomized design	100 patients with cervix uteri cancer: intervention (n = 50) and control (n = 50).	NA	The WeChat health education platform (a six-month online intervention) consisted of one-to-one chats (doctor and patient) and a group chat (specific topics and knowledge sharing).	Anxiety, depression, and quality of life were assessed at the baseline and at six months.	The WeChat health education platform significantly improved the patients' quality of life and decreased their negative emotions.
Study 11: The WeChat extended care platform. Liu. [31] (2018, China)	RCT	100 patients with gynecological cancer: intervention (n = 50) and control (n = 50)	NA	The WeChat extended care platform (a two-month online intervention) consisted of information provision and health consultations.	Quality of life was assessed at the baseline and at two months.	The WeChat extended care platform significantly improved the patients' quality of life.
Study 12: The Together website. Petzel et al. [32] (2018, United States)	Pilot RCT	35 patients with ovarian cancer: intervention (n = 20) and control (n = 15)	The social cognitive theory and cognitive-behavioral techniques	The Together website (a 60-day tailored information online intervention) consisted of three components: a learning library with tailored information corresponding to patients' coping styles, distress self-monitoring, and medical information.	Psychological distress was assessed at the baseline and within one month post-intervention.	The Together website relatively improved the patients' psychological distress, but this difference was not significant.
Study 13: The OPML. Sullivan. [37] (2003, United States)	Qualitative research method	134 patients with ovarian cancer	NA	The Ovarian Problems Mailing List (OPML) was an interactive special online discussion group where subscribers (patients, relatives, friends, researchers, and physicians) discussed questions, provided emotional support, and responded to other people's queries.	The patients' using experiences with the OPML	The patients reported that they could safely express their negative emotions and feelings of body image, build relationships, and gain support from others in the online support group.
Study 14: The WeChat-assisted empowerment education. Wang et al. [33] (2019, China)	RCT	80 patients with cervix uteri cancer: intervention (n = 40) and control (n = 40)	The empowerment theory	The WeChat-assisted empowerment education platform (a three-month online intervention) consisted of a group chat, medical consultations, treatment	Anxiety, depression, quality of life, and sexual function were assessed at the baseline and at three months.	The WeChat-assisted education significantly improved the patients' quality of life and sexual function and decreased anxiety and depression.

Table 2 (*continued*)

Study author(s) (year, (country)	Design	Sample	Theoretical framework (s)	Intervention	Outcomes measured	Findings
				progress records, psychological consultations, and a nurse specialist service.		
Study 15: The HOPE. Wright et al. [42] (2018, United States)	Qualitative interviews	Ten patients with gynecological cancer	NA	The Helping Our Patients Excel (HOPE) study (a 30-day online intervention) consisted of wearable accelerometers, which assessed physical activity, and the digital phenotyping research platform called Beiwe, which collected patient-reported outcomes, stratified patients' responses, offered tailored symptom management strategies, and informed clinicians about high-risk symptoms.	The patients' using experiences with the HOPE	The patients reported that the intervention improved symptom management and facilitated communication between patients and clinicians.
Study 16: The online health education platforms. Xie and Deng. [34] (2017, China)	RCT	50 patients with ovarian cancer: intervention (n = 25) and control (n = 25)	NA	The online health education platforms (a three-month online intervention) consisted of a WeChat group chat and a QQ group where the health care team provided cancer-related knowledge, symptom management strategies, and social support.	Quality of life and emotion management were assessed at the baseline and at three months.	The online platform significantly improved the patients' quality of life and emotion management.

Note. RCT = randomized controlled trial, NA = not applicable.

3.2.1. Quality of life

Nine studies showed that the online interventions improved patients' QoL. In five RCTs and two non-randomized trials that were conducted in China, the intervention groups reported better scores for QoL than the control groups [27–31,33,34]. In one mixed-methods study, the one-arm trial indicated that the online intervention improved ovarian cancer-specific QoL significantly [41]. In the qualitative part of one study, the patients reported that their QoL was improved due to their acceptance and confidence gained from the online support groups [38].

3.2.2. Symptom distress

Four studies reported inconsistent results regarding the effectiveness of online interventions on symptom distress. In one RCT, the intervention group reported significantly lower symptom distress and a trend for lower symptom severity [26]. In two qualitative studies, the patients reported the benefit of reporting, tracking, and managing symptoms [40,42]. However, in one mixed-methods study, the one-arm trial indicated that sleep quality had not changed after the intervention [41].

3.2.3. Social support

Seven studies reported inconsistent results regarding the effectiveness of online interventions on social support. In four qualitative studies [36,37,40,42] and the qualitative part of one study [38], the patients indicated that the online interventions improved their social support. In one study, the quantitative part indicated that the online intervention significantly improved patients' social support [39], and the qualitative part showed that the intervention enriched social connections and enhanced social support [35,39]. However, in one mixed methods study, although the qualitative structured interviews indicated that the online intervention provided patients with opportunities to connect one another and reduce social isolation, the one-arm trial showed that the score of social support did not significantly increase [41].

3.2.4. Psychological distress

Eleven studies reported inconsistent results for the effectiveness of online interventions on psychological well-being. In five quantitative studies that were conducted in China, the intervention groups reported lower scores of anxiety and depression [29,30,33], higher scores of hope and happiness [27], and improved emotion managements than control groups [34]. In one RCT, the online intervention relatively improved patients' psychological distress, but this difference was not significant [32]. In two qualitative studies, the patients showed that the online interventions helped them better express their emotions [36,37]. In one study, the qualitative part showed that the online intervention improved patients' psychological well-being [35,39], and the quantitative part indicated that the online intervention enhanced psychological well-being via social support [39]. However, in one mixed-methods study, the one-arm trial indicated no significant decrease in depression and other negative mood states [41]. Additionally, in one study, the patients reported improved emotional well-being in the semi-structured interviews [38], but the scores of the anxiety and depression did not reach a significant difference in the RCT [25].

3.2.5. Sexual well-being

Two studies showed inconsistent results for the effectiveness of online interventions on sexual well-being. In one RCT, the intervention group reported higher scores on sexual desire, sexual arousal, vaginal lubrication, orgasm, and sexual satisfaction than the control group [33]. However, in one study, the RCT indicated no significant difference between the two groups on reducing sexual distress [25], but the qualitative interview reported that the online intervention improved feelings of sexuality and that the patients felt more comfortable discussing sexual problems [38].

3.2.6. Body image

Two studies showed that the online interventions were effective in improving patients' body image. In one qualitative study, the patients reported that the online community helped them to express their feelings of body image (such as weight loss and hair loss) [37]. In the

qualitative part of one study, the patients believed that the online intervention improved their feelings of body image [38].

4. Discussion

This review explored the effectiveness of online interventions on various health outcomes for patients with gynecological cancer. A total of 16 studies were identified, and 75% (12/16) of the studies were published between 2016 and 2019, which may suggest that online interventions for this group are rapidly growing in recent years.

The majority of the patients recruited were highly educated (college or higher) in six studies [25,26,32,33,38,41,42]. However, due to a lack of prior health resources and knowledge, less educated patients may need online interventions more to obtain extra health consultations and information [45]. Different strategies should be addressed to make online resources easily understandable and more acceptable for less educated patients, such as the use of pictures, short story videos, and plain languages [46].

Cancer type in the reviewed studies differed between western countries and mainland China. Seven out of nine studies that were published in English targeted ovarian cancer [26,32,35–37,39–41], while five out of seven studies that were published in Chinese focused on cervix uteri cancer [27–30,33]. In the future, cervix uteri cancer in China may be better prevented and controlled with the increasing prevalence of human papillomavirus (HPV) vaccine and screening [47].

All the included studies that were conducted in China applied the quantitative design, and none had been published in English. However, the qualitative research approach is indispensable to explore patients' perceptions on the benefits and challenges of online interventions [48], and the integration of both quantitative and qualitative data will provide a holistic view of whether and how online interventions can improve patients' health outcomes [49]. To achieve global dissemination and recognition, publishing papers in English will help Chinese studies to become more readable and quotable internationally [50].

There were only three RCTs that were published in English [25,26,32], among which only one RCT applied the blinding design by using two separate websites in order to blind their participants and caregivers [32]. Using a RCT is the most rigorous method to determine the causal relationship between intervention and outcome [51]. The blinding design may reduce the risk of exaggerating the effects of online interventions [52] and should be carefully considered in the future.

None of the included studies described their sample sizes with power calculations, and the sample sizes of the majority of the quantitative studies were less than 82 [25–29,32–34,41]. Sample size calculation can determine the rational and optimal number of participants [53]. A justifiable and adequate sample size can reach statistical power and yield reliable conclusions [54].

Most existing studies (12/16) did not integrate prompts or reminders in the designs of their online interventions. Prompts and reminders are innovative methods to trigger the use of the online interventions [32], which are deemed essential in future online interventions to increase their engagement [18,55].

Most studies (10/16) did not apply theoretical frameworks to guide the designs and assessments of their online interventions. Using a theoretical framework will help to better understand and explain the reasons for the success and failure of an online intervention [56], thus enhancing the practicability and credibility of such interventions across different countries and cultures [22].

Evidence on the optimal duration of online interventions remains understudied. No study explored how different durations of the same online intervention might affect health outcomes. Follow-up evaluations of online interventions were limited, which hampers the demonstration of the long-term effects of such online interventions. Only three studies in the review evaluated post-intervention effects, ranging from one month to five months post-intervention [25,26,32]. There is a need to explore the optimal duration and the long-term effect of online interventions for patients with gynecological cancer in existing and future studies.

QoL is a primary indicator for patients with gynecological cancer because diagnoses and treatments often entail significant impairments in QoL [57]. Although five RCTs and two non-randomized trials that were conducted in China reported the positive effects of the online interventions on QoL, limited studies ($n = 2$) that were published in English in this review reported such effect. Only the one-arm trial [41] and the qualitative part of one study [38] explored the effects of online interventions on QoL in western countries. Reliance on one-arm trial or the qualitative research design instead of a RCT may reduce the robustness of findings [58].

The effectiveness of online interventions on symptom distress and social support remained inconsistent in this review. A variety of the included studies reported that online interventions decreased symptom distress [26,40,42] and increased social support [35–40,42]. In one mixed-methods study, the structured interviews indicated that the online intervention reduced social isolation, while the one-arm trial on 19 patients reported non-significant improvement in sleep quality and social support [41]. The lack of a control group makes the findings less convincing due to the interference of the potential confounding factors [59]. Inadequate sample sizes may limit the statistical power [54].

The effectiveness of online interventions on psychological well-being remained inconclusive in this review. Although the psychological well-being of the patients improved in eight studies [27,29,30,33–37,39], there were no significant differences in three studies [25,32,41]. There was a large variation on the psychological outcomes measured across all included studies [25,27,29,30,32–37,39,41]. Even for the same psychological outcomes such as depression, six studies applied different instruments [25,29,30,32,33,41]. One study used a self-designed instrument to evaluate the effect of the online intervention on psychological well-being [39]. It is difficult to compare results across studies without the standardized outcome measurement instruments [60]. Future studies should apply standardized instruments to evaluate the effects of their online interventions on psychological well-being.

Although sexual well-being and body image are crucial indicators of QoL for patients with gynecological cancer [61], limited studies were found in this review that assessed the effect of online interventions on the two outcomes. Only two studies explored the effects of the online interventions on sexual well-being [25,33,38], but two RCTs reported inconsistent effects [25,33]. In one study, the qualitative interview reported improved feelings of sexuality [38], but the RCT indicated no significant difference between the two groups on reducing sexual distress [25]. Only two studies reported that their online interventions improved their patients' body image, but they were not RCTs [37,38]. However, online interventions provide anonymous communication channels, which make it easier and comfortable for patients to talk about private problems, especially for patients with gynecological cancer [37,38]. Future studies with more rigorous designs should focus more on the impacts of online interventions on sexually well-being and body image.

There were some limitations in this review. Although cervix uteri, uterine corpus, and ovarian cancer are the three most common gynecological cancers, studies regarding other gynecological cancers such as vulvar cancer were omitted in this review. Moreover, this review only included articles that were published in English or Chinese, and articles that were published in other languages were excluded. In addition, this review only focused on six health outcomes to test the effectiveness of online interventions; hence, the number of article may have been narrowed. To achieve a more comprehensive picture, future reviews can include articles with other gynecological cancers and other health outcomes, as well as those that are published in other languages to assess the effectiveness of online interventions on patients with gynecological cancer.

This review suggests that online interventions have been increasing used as clinically promising interventions to promote health outcomes

among patients with gynecological cancer. Future studies can apply rigorous designs and sufficient sample sizes to elucidate the effectiveness of online interventions. Healthcare workers can incorporate existing or new online interventions into their routine care to improve health outcomes for patients with gynecological cancer.

CRediT authorship contribution statement

Huicong Lin: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing - original draft. **Mingzhu Ye:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing - original draft. **Sally Wai-chi Chan:** Project administration, Supervision, Validation, Writing - review & editing. **Jiemin Zhu:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Funding acquisition, Project administration, Supervision, Validation, Writing - review & editing. **Honggu He:** Project administration, Supervision, Validation, Writing - review & editing.

Declaration of competing interest

The authors declare no conflicts of interest.

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