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A SYSTEMATIC REVIEW OF THE EFFECTS OF INTERNET-BASED PSYCHOLOGICAL INTERVENTIONS ON EMOTIONAL DISTRESS AND QUALITY OF LIFE IN ADULT CANCER PATIENTS

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Abstract

The aim of the present systematic review is to evaluate the effects of web-based psychological interventions tested via randomized controlled trials (RCTs) on improving patient-reported psychological distress and quality of life (QOL) among adult cancer patients compared to control conditions and evaluate the quality of the intervention studies. We conducted this review using preferred reporting items for systematic reviews and meta-analysis (PRISMA) guidelines, searching five databases for RCT of web-based interventions for oncology patients that included a patient-reported psychological distress and/or QOL outcome. We assessed the quality of the included studies using the Effective Public Health Practice Project Quality Assessment Tool for Quantitative Studies. Our search identified nineteen RCTs involving 4084 patients diagnosed with primary cancer investigating web-based psychological interventions. Quality-wise, six studies received a "strong" rating, eight received a "moderate" rating and five of the studies received a "weak" rating. Evidence indicates mixed support for these interventions to improve psychological distress and QOL in cancer patients' samples. Web-based delivery format show potential in effective management of psychological distress and QOL in cancer patients. Still, due to heterogeneity in interventions tested and targeted populations, additional high-quality studies and further clarifications are needed for these treatments to be considered empirically supported treatments.

Keywords: cancer; e-health; quality of life; distress; systematic review

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Background

The National Comprehensive Cancer Network states that psychological distress is highly prevalent in cancer patients (NCCN, 2019; Mordenti et al., 2016) and it is associated with substantial decrease in quality of life (QOL) (Achimaș-Cadariu, Iancu, Pop, Vlad & Irimie, 2015; Jacobsen & Andrykowski, 2015) and with decreased satisfaction with care and with treatment (Mehnert et al., 2018). Distress is defined as a multi-determined unpleasant emotional experience of a psychological (cognitive, behavioral, emotional), social, and/or spiritual nature that may interfere with the ability to cope effectively with cancer, its physical symptoms and its treatment (NCCN, 2019). Distress extends along a continuum, ranging from common, normal feelings of vulnerability, sadness and fear, to issues that can become disabling, such as depression, anxiety, panic attacks, insomnia, social isolation, and spiritual crisis (NCCN, 2019).

Evidence supports face-to-face psychological interventions as an effective approach for adult cancer patients in all treatment stages - curative stage (Iancu et al., 2017; Hulbert-Williams, Beatty & Dhillon, 2018), advanced stage (Okuyma, Akechi, Mackenzie & Furukawa, 2017; Zimmerman, Burrell & Jordan, 2018;), palliative care (von Blanckenburg & Leppin, 2018) and survivorship stage (Duncan et al., 2017; Cillessesn, Johannsen, Speckens & Zacharaie, 2019) for dealing with distress (Tatrow & Montgomery, 2006; Sanjida et al., 2018) and/or quality of life (D`Egidio et al., 2017; Ye et al., 2018). These interventions either target a specific cancer type such as breast cancer (Jassim, Whitford, Hickey & Carter, 2015; Dawson, Madsen & Dains, 2016; D`Egidio et al., 2017), head and neck cancer (Calver, Tickle, Moghaddam & Biswas, 2018; Senchak, Fang & Bauman, 2019), lung cancer (Hseih & Hsiao, 2017), or a heterogenous diagnosis (Kalter et al., 2018; Sanjida et al., 2018). The interventions can be delivered both individually (Kalter et al., 2018) or in a group setting (Faller et al., 2013; Iancu et al., 2017). Cognitive-behavioral therapy (Tatrow & Montgomery, 2006; Ye et al., 2018) and Minfulness-based psychotherapy (Zhang et al., 2015; Cillessen et al., 2019) are the most often studied, with other approaches starting to be tested, such as ACT (Falsher, Weinrib, Azam & Katz, 2017; Hulbert-Williams et al., 2018). Some studies even focused on a specific population, such as Latino (McNulty, Kim, Thurston, Kim & Larkey, 2016) and the Chinese population (Yang et al., 2014).

However, accessibility and availability of treatment are often restricted and even when offered less than half of those experiencing clinically significant psychological distress choose to attend (Chirstensen, 2010; Brebach, Sharpe, Costa, Rhodes & Butow, 2016).

Internet-based interventions are an effective, acceptable and feasible way for providing psychological treatment (Beatty & Lambert, 2013; Donker et al., 2015; Andersson & Carlbring, 2017; Beukes, Andresson, Allen, Manchaiah & Baguley, 2018). Over 200 published studies have tested online interventions, and by some estimates 100 remain unpublished (Bending et al., 2018), attesting to the effectiveness in managing depression and anxiety (Cuijpers, Kleiboer, Karyotaki &

Riper, 2017; Josephine, Josefine, Philipp, David & Harald, 2017; Domhardt, Gleβlein, von Rezori & Baumeister, 2019;), stress (Heber et al., 2017, postpartum depression (Lau, Htun, Wong, Tam & Klainin-Yobas, 2017), insomnia (Seyffert et al., 2016), chronic physical health (Cuijpers, Van Straten & Andersson, 2008; Hedman, Ljótsson, Lindefors, 2012; Beatty & Lambert, 2013; Toivonen, Zernicke & Carlson, 2017; Mikolasek, Berg, Witt & Barth, 2018) and chronic fatigue in cancer survivors (Seiler, Klaas, Tröster & Fagundes, 2017).

Previous literature reviews that focused on oncology patients (Cuijpers et al., 2008; Leykin et al., 2012; Beatty & Lambert, 2013; McAlpine, Joubert, Martin-Sanchez, Merolli & Drummond, 2015; Slev et al., 2016; Post & Flanagan, 2016; Fridriksdottir, Gunnarsdottir, Zoëga, Ingadottir & Hafsteinsdottir, 2018; Corbett et al., 2018; Triberti, Savioni, Sebri & Pravettoni, 2019; Qan`ir & Song, 2019) attest to the promising potential of web-based intervention for cancer symptom management but could not draw definite conclusions due to high study heterogeneity. Questions concerning necessary intervention components, minimal required interaction with the intervention are still on the table (Fridriksdottir et al., 2018; Corbett et al, 2018, Qan`ir & Song, 2019).

Each of these reviews have explored different perspectives into the questions of the utility, acceptability and efficacy of this delivery modality. McAlpine et al., (2015) reported on cancer patients` use of online resources, finding unclear the overall benefits of online intervention. In their meta-review Slev et al., (2016) focused on the effects of eHealth use for cancer patients, and found evidence for perceived support, knowledge levels and information competence for cancer patients. They also established inconsistent findings for psychological wellbeing, depression, anxiety and QOL as patient outcomes. Corbet et al., (2018) investigated the acceptability of and engagement with web-based interventions in improving cancer patients` quality of life and have identified a gap between the intervention and the desired behavior change. Leykin et al., (2012) and Fridiksdottir et al., (2018) looked more specifically at the efficacy of web-based interventions, inquiring about their potential to improve well-being and symptom management, with the first study aiming at taking steps towards establishing best practices developing such a web-based intervention. Breast cancer patients were the specifically investigated by two reviews - Post et al., reported on survivorship interventions and Triberti et al., on the impact on quality of life of the online interventions. Qan`ir also reported on a more restricted population, investigating technology-based interventions for prostate cancer patients. Their review yielded insufficient evidence to support their effectiveness in improving health outcomes for this population.

Online interventions are rapidly evolving, and as such our study aims to update the evidence, as the previous review published in 2018 assessed studies published only up to 2015. Psychotherapy is the psychosocial intervention with the largest reported effects in patients with cancer (Kalter et al., 2018) and the internet will most likely assume a major role in the future delivery of psychotherapy to patients with health issues (Cuijipers et al., 2008). As such we see a need of a review focused on these specific types of online resources.

The purpose of this present article therefore is to update the evidence by (a) identifying web-based psychological interventions evaluated via RCT that aimed to improve patient-reported psychological distress and/or QOL among oncology patients, (b) evaluate the quality of the intervention studies and (c) evaluate if developed interventions have been efficient in improving psychological distress and/or QOL, as compared with control conditions in RCTs.

Due to substantial heterogeneity in study design, population, type of intervention and outcome, a systematic review is the best way to address these issues. To our knowledge, this is the first systematic review to specifically focus on psychological distress and QOL outcomes of web-based psychotherapy interventions.

Methods

Assessment of psychological distress and quality of life

According to the Patient-Centered Outcomes Research Institute, the patient perspective is increasingly critical in clinical decision making to communicate treatment benefit. To fulfill this role, instruments often in questionnaire form have been carefully designed and validated to quantify how one feels and functions, capturing information on health status from the patients 'perspective (Petrillo, Cano, McLeod & Coon, 2015; Rombach, Gray, Jenkinson, Murray & Rivero-Arias, 2018), without interpretation of the patient`s response by a clinician or anyone else (Gilbert, Selby & Velikova, 2017). PROMs (patient-reported outcome measures) provide a formal measurement of the subjective phenomena that make up the patient`s perception of symptoms, daily functioning and health-related quality of life (HRQOL) and they carry important information on care quality (Gilbert et al., 2017). This approach also facilitates the comparison among treatment groups to assess the effect of treatment and that corresponds with most of the clinical trials` objectives, design and data analysis (Deshpande, Rajan, Sudeepthi & Nazir, 2011). Multidimensional questionnaires that measure psychological distress, the impact on daily functioning and patient perception of their QOL and well-being were amongst the first PROMs used in oncology as secondary outcome measures in addition to cancer outcomes such as overall progression-free survival (Gilbert et al., 2017). The present review focuses on web-based psychotherapeutic interventions that include these constructs both as primary and secondary outcome.

Eligibility criteria

We selected for studies that reported on psychological interventions (Hodges et al., 2011) that were (1) theory-based, (2) fostered dynamic change and (3) progressive change and (4) part of a multilevel system. Psychological interventions, unlike psychoeducation and supportive interventions, directly target the psychological mechanisms of change necessary for the long-term improvement of psychological distress and quality of life in cancer patients (Moldovan, 2015).

Inclusion criteria.

(a) Participants: adults (>18 years), diagnosed with cancer, in curative treatment or survivorship phase.
(b) Interventions: web-based psychotherapeutic interventions defined as nonpharmacologic intervention using psychological procedures (psycho-education, coping skills training, counselling, relaxation and psychotherapy) that had a proposed mechanism as the way in which it is believed that the intervention brings about change in the desired outcome (e.g. belief change).
(c) Delivery: web-based format, including blended-therapy.
(d) Comparison: waitlist, placebo, usual-care, treatment-as-usual or standard-of-care conditions (Freedland, Mohr, Davidson & Schwartz, 2011).
(e) Outcomes: patient reported psychological distress and/or QOL, as primary or secondary outcome.
(f) Time: published any time before March 2019.
(g) Study design: randomized controlled trial.

Exclusion criteria.

(a) Participants: receiving palliative care or did not have a cancer diagnosis.
(b) Interventions: support and/or information/education and/or behavioral education only, without a psychotherapeutic component.
(c) Delivery: via mobile apps or other specialized devices.
(d) Outcome: did not include a patient-reported psychological distress of quality of life outcome measure.
(e) Study design: individual case reports, qualitative, descriptive or psychometric studies; were review articles, commentaries or book chapters.
(f) Language: published in languages other than English or Romanian.
(g) Current study: presented data that were showcased in another publication (eg, RCT phase I and phase II trials for which phase III trials were already available, if applicable).
(h) Publication: were not published in a peer-reviewed journal in manuscript form (eg, published abstract, theses and dissertations were excluded).

Search strategy

We followed the reporting items for systematic reviews and meta-analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff & Altman, 2009). We systematically searched for studies using the EBSCOhost, ProQuest, PubMed, and Web of Science interfaces to search CINAHL, PsycINFO, PubMed, and Web of Science databases. We discerned key terms to help identify the means of intervention delivery (eg, “web-based”, “e-health”, “online-intervention” and type of study design (eg, “randomized”) and to exclude studies focused on children and caregivers (eg, NOT "pediatric", "couples"). Final search terms used for the PubMed inquiry are delineated in Table 1. The final search strategy we used for PubMed we modified to enable searching within the EBSCOhost (CINAHL), ProQuest (PsycINFO), and Web of Science indexing systems. Our search was limited to English and Romanian language studies, and we did not restrict the timeframe. We conducted the final search of all four databases on April 1, 2019. We excluded from the search gray literature, such as conference abstracts and dissertations. We also conducted backward (eg, reviewing the references) and forward (eg, reviewing articles that have since cited these references) searches of relevant reviews (insert reviews).

Table 1. PubMed search strategy.

1	**cancer patient OR cancer survivor OR patients with cancer OR cancer OR neoplasm patient OR neoplasm OR tumor patient OR tumor survivor**
2	internet OR web OR cyber OR eTherapy OR internet intervention OR self-guided OR online intervention OR e-health
3	psychological distress OR cancer distress OR distress
4	quality of life OR health related quality of life OR HRQOL OR QOL
5	randomized controlled trial OR RCT OR randomized clinical trial OR randomized controlled trial OR randomised clinical trial OR randomized OR randomised
6	Child OR childhood OR children OR pediatric
7	Couple OR caregiver OR partner
	1 AND 2 AND 3 OR 4 AND 5 NOT 6 AND 7

Study selection

We complied a database of citations identified via each search in the additional databases (eg, CINAHL, PsychINFO, PubMed and Web of Science) and removed the duplicates from the central database automatically thus preserving data from the search in full. One author screened the initial database created for potential inclusion. We excluded studies at this stage mainly for being primary care medical studies or review articles/commentary. During the full-review phase, we deemed studies ineligible for not assessing psychological distress or quality of life as an intervention outcome, for providing only educational intervention and/or support and/or for the study design not being a RCT.

Data extraction

We selected from the studies the following information: study design, participant characteristics (sample size at baseline, post-intervention, and last follow-up assessment; type of diagnosis; mean time since diagnosis; mean age; percentage of women in the sample; country in which the study was conducted), intervention characteristics (aim of intervention, type of intervention, duration, primary targeted intervention outcome, brief description of the arms of the study/intervention and control groups), psychological distress and QOL measures and assessment intervals, results and reported compliance.

Risk of bias

We examined the methodological quality of the studies using the Effective Public Health Practice Project (EPHPP) Quality Assessment Tool for Quantitative Studies (McMaster Evidence Review & Synthesis Team, 2019). We rated each of the studies on the following criteria: (a) selection bias, (b) study design, (c) confounders, (d) data collection methods (e) withdrawals and dropouts, (f) intervention integrity and (h) analyses. For these seven criteria, we applied a rating of "strong", "moderate" or "weak" based on the EPHPP Quality Assessment Tool for Quantitative Studies Dictionary. Based on the total of each criterion rating, we assigned each study an overall global rating of "strong" (no component was rated as weak), "moderate" (only one component was rated as weak), or "weak" (two or more components were rated as weak). We summarized the information about intervention integrity and analysis in Table 2.

Data analysis

We used a narrative synthesis to summarize the results.

Results

Study selection

We identified a total of 907 articles from electronic searches, after de-duplication. From this pool of screened titles and abstracts, 70 citations met initial inclusion criteria and underwent full-text review. We identified further 12 potential studies from the reference lists of the initial full text reviewed. Ultimately, we included 19 studies across 21 articles in the review. Figure 1 illustrates study search identification and selection.

Over the last 14 years, 19 RCTs have been completed and reported in the literature assessing web-based psychological interventions with QOL and/or psychological distress as outcomes. Descriptions of the study characteristics, including participant and intervention characteristics, quality of studies and efficacy of the interventions about QOL and psychological distress follow.

Study characteristics

Table 4 reports the study characteristics, QOL and psychological distress outcomes of randomized controlled trials web-based interventions for cancer patients.

Participants characteristics

The 19 studies included 4084 participants (baseline sample range: 28 – 450) diagnosed with primary cancer. Nine studies investigated a specific cancer diagnosis (breast cancer, hematologic cancer, and prostate cancer) and ten studies focused on heterogenous cancer diagnosis. Twelve of the studies targeted cancer survivorship, five studies were aimed at the first 18 months after diagnosis and the three other studies recruited irrespective of the treatment stage of the participants.

Five the studies were conducted in the USA (Baker et al., 2010; Owen et al., 2005; Ritterband et al., 2012; Owen et al., 2017), seven in the Netherlands (van den Berg et al., 2015; Atema et al., 2017; Bruggeman-Everts et al., 2017; Willems et al., 2017; Hummel et al., 2017; van de Wal et al., 2017; Compen et al., 2018), three in Australia (Wootten et al., 2015; Beatty et al., 2018; Chambers et al., 2018), one in Germany (David et al., 2013), one in Switzerland (Bruggeman-Everts et al., 2017) and one in Canada (Zernicke et al., 2014). Participants` mean age ranged from 39 to 72 years old. Most studies had a high bias towards female gender, high education, white ethnicity and breast cancer diagnosis despite some of the researcher`s best efforts to recruit a more heterogenous cohort.

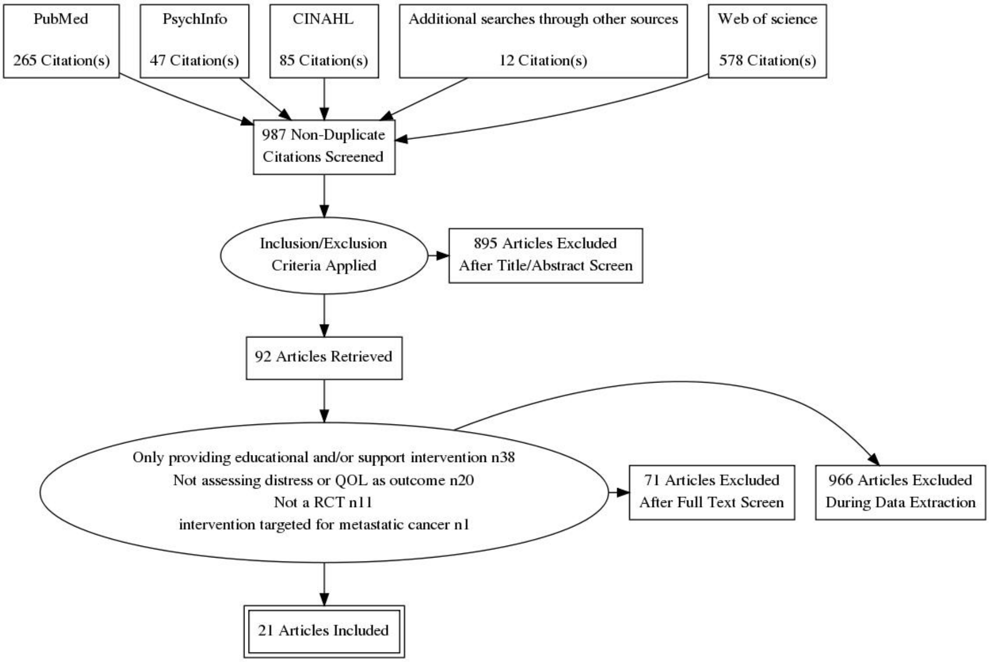

Figure 1. PRISMA Diagram. This figure illustrates study identification and selection.

Table 2. Participants characteristics – cancer type and stage of illness.

	Diagnosis			
	Breast cancer	Prostate cancer	Hematologic cancer	Heterogenic diagnosis
First 18 months after diagnosis	Baker, 2011 Carpenter, 2014			Beatty, 2016 Chambers, 2018 Urech, 2018
Survivors	Abrahams, 2017 Atema, 2019 Hummel, 2017 Owen, 2005 Van den Berg, 2015			Bruggeman – Everts, 2017 Owen, 2017 Ritterband, 2012 Van den Wal, 2017 Willems, 2017 Zernicke, 2014
Irrespective of treatment stage		Wooten, 2015	David, 2013	Compten, 2018

Intervention characteristics

As seen in Table 2, most interventions used Cognitive-Behavioral Therapy (CBT) or CBT components. Three interventions used Mindfulness-Based Cognitive Therapy (MBCT).

The causal process targeted by the intervention was rarely described specifically. Health worry, regret (Wootten et al., 2015), mindfulness (Zernicke et al., 2014) were described as mediators for distress and personal control as mediator for QOL (Willems et al., 2017). Several moderators were investigated by previous literature, even though most studies were not powered to study moderators of intervention effects. Their relevance is unclear, as most are investigated in small sample trials. In a large meta-analysis of 22 RCT, Kalters et al., (2017) found that the effects of psychotherapy on emotional functioning may be moderated by cancer type, finding consistent with Triberti et al., (2019). There is also the importance of matching the intervention to the unique characteristics of the participants, meating their idiosyncratic needs that are mostly determined by the treatment stage and type of cancer (Slev et al., 2016; Corbett et al., 2017; Triberti et al., 2019;). Patients` experience using the computer and their computer abilities are also predictive of the utility of the intervention (Corbert et al., 2017) as are the patients` attitudes and predisposition towards such an intervention (Triberti, 2019). Of the reviewed studies, psychological functioning (Owen et al., 2017), neuroticism (Compen et al., 2018) and age and gender (Abrahams et al., 2017; Chambers et al., 2018) and were investigated as potential moderators for the intervention. Age was also considered a moderator by a previous review, Corbert et al., (2017) suggesting that old is not always a barrier to use when users have good computer skills. At the same time, recruitment was a difficult step in the reviewed interventions. Even though most authors tried to recruit a heterogenous sample, most participants were white, educated women, diagnosed with breast cancer, which might unwillingly skew the findings. This group is the most willing to be recruited in such interventions due to their enhanced awareness (Beatty et al., 2016) and increased social media network (Bruggeman-Everts et al., 2017; Campbell-Enns & Woodgate, 2017).

There was marked variability in both the content and procedural aspects of the intervention, as shown in Tabel 4. All the interventions were delivered via Internet on personal computers and used email reminders for the participants. Five interventions were predominantly self-guided (i.e., only email feedback/prompts on homework), five interventions had tailorable content to the patients` needs. The interventions varied extensively on how much support the users received from a psychotherapist. Some interventions offered multiple components, such as information/psychoeducation, forums, and some offered blended therapy. The interventions also ranged in duration and number of modules, from four weeks to six months, and from four to twenty modules. Procedural elements also varied with respect to incrementally releasing materials (one module/week), to releasing all materials simultaneously.

All the studies included a PRO measure of QOL and of psychological distress that had been validated for the oncology setting. Psychological distress was assessed in a total of sixteen studies. In half of these is was the primary outcome (Owen et al., 2005; van den Berg et al., 2015; David et al., 2013; Wootten et al., 2015; Beatty et al., 2018; Chambers et al., 2018; Owen et al., 2017; Compten et al., 2018) and a secondary outcome in the other half (Abrahams et al., 2017; Atema et al., 2017; Ritterband et al., 2012; Zernicke et al., 2014; Bruggeman-Everts et al., 2017, Hummel et al., 2017; van de Wal et al., 2017). Most of the studies (n=7) used the Hospital Depression and Anxiety Scale (HADS) (Mitchell, Meader & Symonds, 2010) to measure psychological distress. Brief Symptom Inventory (BSI) (Grassi, Caruso, Mitchell, Sabato & Nanni, 2018) (n=3), Impact of Events Scale (IES) (Salsman, Schalet, Andrykowski & Cella, 2015) (n=3), Distress Thermometer (DT) (Cutillo et al., 2017) (n=3) were also used to assess psychological distress. Other instruments that were used were the Depression Anxiety Stress Scale (DASS) (Sharp, O`Leary, Kinnear, Gavin & Drummond, 2016) (n=2), Posttraumatic Stress Scale (PSS-SR) (Foa, Riggs, Dancu & Rothbaum, 1993), Supportive care need survey (SCNS-SF 34) (Boyes, Girgis & Lecathelinais, 2009), Symptom Checklist (SCL-90) (Lambert et al., 1996), Profile of Moods States (POMS) (Curran, Andrykowski & Studts, 1999) and Calgary Symptoms of Stress Inventory (CSOSI) (Carlson & Thomas, 2007).