

# A systematic review and meta-analysis on the effectiveness of web-based psychosocial interventions among patients with colorectal cancer

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## Abstract

**Aims:** To synthesize the effectiveness of web-based psychosocial interventions on self-efficacy, anxiety, depression, quality of life (QoL), non-specific psychological and cancer-specific distress among patients with colorectal cancer (CRC).

**Design:** A systematic review and meta-analysis.

**Data sources:** Six databases (PubMed, PsycINFO, Embase, Scopus, CINAHL and CNKI) were searched from inception to December 2021.

**Review methods:** Experimental/quasi-experimental studies involving patients with CRC for the improvement of aforementioned outcomes were included. Two reviewers screened and extracted the data, and assessed studies' methodological quality using risk of bias tools. Meta-analyses and narrative syntheses were performed.

**Results:** Nineteen studies consisting of 1386 participants were identified. Cognitive-behavioural therapy delivered online was the most common trialled web-based psychosocial intervention. Meta-analyses revealed no positive effect for self-efficacy (standardized mean difference 0.93, 95% CI: 0.52 to 1.35,  $p < .01$ ) and minimal benefit for QoL (mean difference [MD] 2.83, 95% CI: -0.31 to 5.98,  $p = .08$ ) but significant positive effects for anxiety (MD -2.23, 95% CI: -3.31 to -1.14,  $p < .01$ ) and depression (MD -2.84, 95% CI: -4.09 to -1.59,  $p < .01$ ) among CRC survivors in the intervention group as compared with the control group. Narrative synthesis suggested possible benefits in reducing distress.

**Conclusion:** Web-based psychosocial interventions are promising alternatives to conventional delivery methods in reducing patients' anxiety, depression and distress. However, evidence on self-efficacy and QoL remains inconsistent. More adequately powered, well-designed trials with targeted and theory-based interventions are required to ascertain findings.

**Impact:** By highlighting the potential of web-based psychosocial interventions in reducing anxiety and depression among CRC survivors, this review has put forth beneficial information supporting the use and acceptance of web-based care delivery in light of COVID-19 restrictions and nationwide lockdowns. Meanwhile, the paucity of empirical support reflects the necessity of more extensive research to test and improve other health outcomes.

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## KEYWORDS

colorectal cancer, meta-analysis, nursing, psychosocial intervention, randomized controlled trial, systematic review, web-based

## 1 | INTRODUCTION

In 2020 alone, colorectal cancer (CRC) accounted for approximately 1.9 million new cases and 900,000 deaths worldwide, and its outlook remains gloomy as numbers are projected to reach 3.2 million by 2040 (Xi & Xu, 2021). Over the years, despite enhanced prospects of its cure, CRC continues to be a common malignancy associated with considerable morbidity (Douaiher et al., 2017). Characterized by altered bowel habits, rectal bleeding or blood in stools, loss of appetite, persistent lethargy and unexplained weight loss (Holtedahh et al., 2021), this chronic, debilitating disease exerts longstanding and far-reaching impact on the individual's physical, mental and social well-being (Hildebrandt et al., 2019). Surgery is the first-line curative treatment for majority of the CRC survivors, yet it is mostly associated with pain, fatigue, disrupted lives and identity, apprehension and helplessness among many other challenges not limited to dietary restrictions, intolerance as well as bowel incontinence (Smith et al., 2018; Worster & Holmes, 2009). Likewise during radiation and chemotherapy, survivors experience neurological and sensory deficits alongside nausea, vomiting, loss of appetite and bodily weakness. Even after the active treatment phase, they are not spared from functional decline, loss of independence and the uncertainties of disease progression (Hildebrandt et al., 2019). Those with an ostomy contend with frequent stoma bag leakage, dislodgement, bleeding, obstruction, skin irritation, and often suffer from embarrassment, social stigmatization and low self-esteem (Sun et al., 2013).

### 1.1 | Background

Psychological outcomes such as self-efficacy, anxiety, depression, distress and quality of life (QoL) are major determinants of overall health and well-being, and the need for evaluating these indicators cannot be further emphasized especially in the field of cancer (Simon et al., 2009). Self-efficacy is an important precursor to adaptive coping and adjustment to illness, yet existing evidence show that the level of self-efficacy among CRC patients is far from ideal (Johansson et al., 2018; Qian & Yuan, 2012). Because treatment for cancer is complex and multimodal, those with poor self-efficacy are in danger of higher risks for complications and side-effects (Sheetz et al., 2014; Slankamenac et al., 2017). Consequently, their mental well-being may suffer alongside the decline in physical health (Qian & Yuan, 2012). Earlier studies have cited the prevalence of anxiety and depression among CRC survivors to range between 1.0% to 47.2% and 1.6% to 57% respectively (Braamse et al., 2016; Medeiros et al., 2010; Peng et al., 2019), and up to 30% receiving chemotherapy treatment are diagnosed with

mild to moderate depression (Medeiros et al., 2010). Apart from such statistics, a significant proportion of them is plagued with traumatic stress symptoms exacerbated by their fear of cancer recurrence (Graça Pereira et al., 2012). The extent of psychological morbidity and impaired QoL within this population is substantial and worrying because of its grave implications. Several studies highlighted that poor psychological health not only impedes recovery. Instead, it may even accelerate disease progression (Foster et al., 2016; Trudel-Fitzgerald et al., 2020). This in turn impacts their caregivers by increasing their burden and diminishing their QoL (Cotrim & Pereira, 2008; Kershaw et al., 2015). Overtime, this leads to significant work-related productivity losses and premature mortality costs (Hanly et al., 2013).

Ever since the World Health Organization (WHO) announced the inclusion of psychosocial support as a mandatory component of cancer treatment (World Health Organization, 2021a), an increasing number of psychosocial interventions have been developed and tested for their effectiveness in mitigating or cushioning the detrimental effects of cancer. These non-pharmacological interventions often involve interpersonal relationships between and/or among individuals and trained healthcare professionals (Treanor et al., 2019), which are believed to be therapeutic as they build self-efficacy for coping and reshape cognitive expectancies and illness representations (Stanton et al., 2013). For CRC patients in particular, traditional psychosocial interventions such as psychoeducation, cognitive-behavioural therapy (CBT) and supportive counselling have generated some positive effects on mental health outcomes and QoL (Lim et al., 2013; Mosher et al., 2017; Son et al., 2018). However, little is known whether such effects are equivalent when delivered through internet-based online platforms (i.e. websites, mobile applications, virtual social networks), although these modalities have been thought to offer flexibility and overcome limitations from poor recruitment, high attrition and the lack of blinding (Heynsbergh et al., 2018). Moreover, few colorectal-specific reviews incorporating meta-analyses have been conducted to date. Evidence proposing the mechanism of psychosocial intervention that is effectual and desirable is scarce, with a lack of focus on self-efficacy as an examined outcome. With the current COVID-19 pandemic here to stay, the integration of interactive health communication technologies into clinical settings has become a growing priority. This paradigm shift underscores a pressing need to build a comprehensive health system through information, support and coaching, as well as facilitate treatment decision making, enhance patient-caregiver communication and promote lifestyle behaviour change remotely. Given the rise in telehealth research in recent years, this study will be the first to address a major gap by evaluating the effectiveness of web-based psychosocial interventions among CRC patients.

## 2 | THE REVIEW

### 2.1 | Aims

This review aimed to: (i) synthesize the effectiveness of web-based psychosocial interventions on self-efficacy, anxiety, depression, QoL and other psychosocial outcomes among patients with CRC; and (ii) explore attrition rates and satisfaction levels across the included studies.

### 2.2 | Design

This systematic review and meta-analysis was guided by the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al., 2021) and the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) statement (Page et al., 2021).

### 2.3 | Search strategy

Following the PICO (Population, Intervention, Control, Outcomes) format, MeSH headings, synonyms and all possible word form variations were identified, listed and added into the search for the respective concepts: population (CRC) and intervention (web-based, psychosocial interventions). The initial search on five English: PubMed, PsycINFO, Embase, Scopus, CINAHL and one Chinese electronic database: CNKI was performed on January 05, 2021. This search strategy was later reviewed by a senior medical librarian, revised and repeated. Databases were searched individually and sequentially, with results limited to English or Chinese language, published experimental/quasi-experimental studies from inception to December 08, 2021. The search strategy for each database is presented in Appendix S1.

### 2.4 | Eligibility criteria

Experimental/quasi-experimental studies involving (i) adults aged 18 years and above; (ii) patients diagnosed with CRC regardless of their treatment status; (iii) patients with a smartphone, tablet or internet access; (iv) web-based psychosocial interventions; and (v) psychosocial outcomes were included. Those involving (i) patients concurrently receiving antipsychotic pharmacological treatment and/or undergoing psychotherapy; (ii) dyadic or sexual outcomes were excluded.

### 2.5 | Selection process

The first author and the senior medical librarian performed the systematic search together using the final search strategy. Records were identified from the original database search and exported to EndNote 20, as detailed in Figure 1. After the removal of duplicates,

titles and abstracts of all records were screened independently by two reviewers (WSW and YJDC) according to the pre-defined criteria listed under Table 1. The same two reviewers compared their lists of relevant studies and thereafter retrieved all shortlisted studies in full-text for independent eligibility assessment. Selected eligible, full-text studies were compared between the two and discrepancies were resolved by consulting a third reviewer (SHL).

### 2.6 | Quality appraisal

The Cochrane risk of bias tool (RoB 2) and the Risk Of Bias In Non-randomized Studies - of Interventions (ROBINS-I) assessment tool were used to appraise studies' risk of methodological bias. Each of the included studies was independently assessed by two reviewers (WSW and YJDC). A third reviewer (HGH) who was a methodological expert supported decision-making in situations where an agreement could not be reached.

### 2.7 | Data extraction

Data were extracted independently using the Cochrane Effective Practice and Organization of Care (EPOC) data collection checklist by two reviewers (WSW and YJDC). Examples of data extracted include the type of study, population and setting, description of intervention components, outcomes and time-points of measurement, and key findings (mean and standard deviation of outcome scores at various time-points). Discrepancies in the extracted data were resolved through re-visitation of the original paper and other relevant studies (e.g. study protocol). Authors of studies with ambiguous or inadequate reporting were contacted for the retrieval of additional data.

### 2.8 | Data synthesis

A narrative, qualitative synthesis of the included studies was undertaken to describe clinical and methodological characteristics, strengths and limitations as well as the relevance of individual study findings in relation to their intended aims and interest (Campbell et al., 2020). Thereafter, meta-analyses were performed on three or more similar studies estimating common effects with combinable statistical continuous data where available (McKenzie et al., 2021). Following the inverse-variance approach described within the Cochrane Handbook of Systematic Reviews of Interventions' recommendation (Deeks et al., 2021), immediate post-intervention mean, standard deviation values and sample sizes were extracted and entered into the Review Manager 5.4 software to tabulate the effect size. Fixed effect models were used to analyse mean differences (MD) in outcomes measured by the same instrument while random effect models were used to pool standardized mean differences (SMD) in outcomes measured

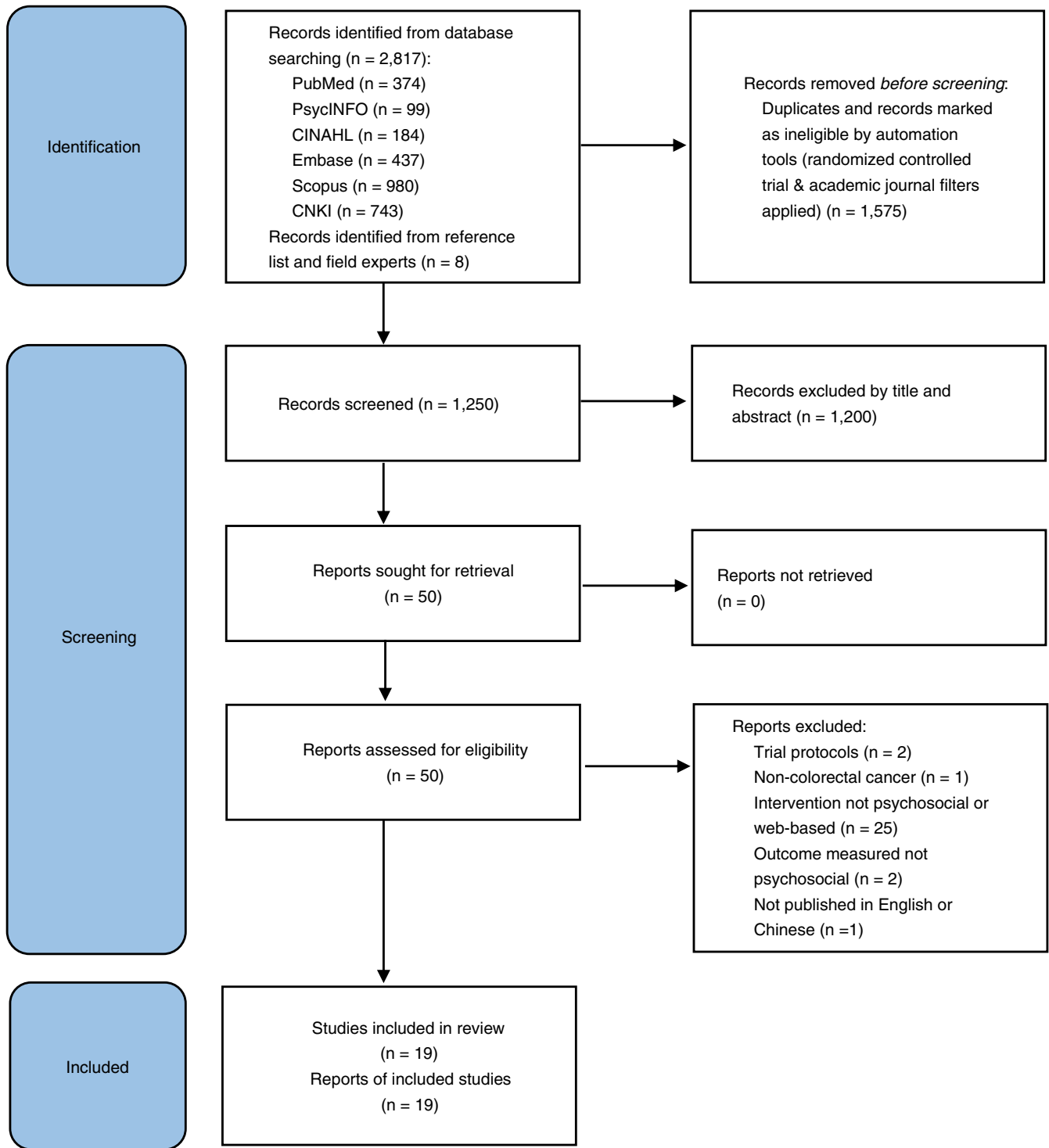


FIGURE 1 Selection flowchart for studies included in review

by different instruments. The extent of variation across studies are represented by  $I^2$  statistics of 25%, 50% and 75% which corresponds to small, moderate and high heterogeneity respectively. Effect sizes were determined using Cohen values of 0.2 (small), 0.5 (medium) and 0.8 (large). Sensitivity analysis was not required based on the authors' evaluation of the studies' risk of bias. Given the significant heterogeneity of the included studies, subgroup analysis was not performed.

### 3 | RESULTS

A total of 2817 records were identified (Figure 1). Three relevant studies were identified from hand-searching reference lists of the included studies. Eventually, 19 studies were synthesized and critically appraised in the review, of which 10 were included in the meta-analysis. Nine studies were excluded from the meta-analysis due to reasons such as (i) the study only involved a single-arm ( $n = 2$ ),

TABLE 1 Eligibility criteria

Concepts	Description
Population	<p>Studies whose sample included:</p> <ul style="list-style-type: none"> <li>(i) adults aged 18 years old and above;</li> <li>(ii) patients diagnosed with colorectal cancer; and</li> <li>(iii) patients who have a smartphone, tablet or access to internet; regardless of whether they were receiving or had completed curative treatment were deemed eligible.</li> </ul> <p>Excluded studies were those conducted on:</p> <ul style="list-style-type: none"> <li>(i) patients who were concurrently receiving antipsychotic pharmacological treatment and/or undergoing psychotherapy</li> </ul>
Interventions	<p>Studies that involved a psychosocial intervention delivered via web-based modalities were included. Psychosocial interventions were defined as 'a non-pharmacological intervention that involved an interpersonal relationship between an individual or a group of individuals and one or more trained healthcare professionals' (Treanor et al., 2019). Some examples are: cognitive behavioural therapy, stress management, relaxation training, psychoeducation, psychotherapy, mindfulness, counselling, supportive therapy and social skills training.</p> <p>Web-based was defined as "the use of wireless technology to support the achievement of health objectives" (World Health Organization, 2021b). Such platforms include remote communication or consultation, online chat, forum discussion, decision support and aids or the propagation of health information through cell phones, tablets, computers, patient monitoring devices (wearable sensors) and personal digital assistants. Studies whose sole purpose was to collect data on symptom reporting, promote uptake of colorectal cancer screening or improve navigation were excluded</p>
Comparison	No selection criterion was set for this concept
Outcomes	<p>Studies that examined psychosocial outcomes such as self-efficacy, anxiety, depression, distress, quality of life were included. Those investigating cancer-specific clinical outcomes such as treatment side-effects or symptoms were also included, on the pretext that the intervention was psychosocial in nature</p> <p>Excluded studies were those whose focus was on reporting:</p> <ul style="list-style-type: none"> <li>(i) dyadic, or sexual outcomes (e.g. sex-related distress)</li> </ul>
Study design	This review included randomized controlled trials and quasi-experimental (including single-arm pretest-posttest) studies, both full-scale and pilot studies

(ii) CRC-specific data were unavailable ( $n = 3$ ); (iii) outcomes examined were unique and could not be combined with any other studies ( $n = 4$ ).

The key characteristics of each study are presented under Appendices S2–S4. Among these 19 studies, 12 were randomized controlled trials and 7 were quasi-experimental (among which 3 were single-group pretest-posttest studies). Eight were conducted

within Asia Pacific (Australia, China and Korea), six in Europe (Germany, Netherlands, Sweden, United Kingdom), three in America and two in the Middle East. All studies were published in English between 2013 and 2021. Only seven were specific to the CRC population (Avci et al., 2020; Giesler et al., 2017; Huang et al., 2021; Kim et al., 2018; Rahimi et al., 2021; Song et al., 2021; Xia, 2020). The remaining 12 studies were conducted on survivors of various cancer types but involved CRC patients as reported in their participants' clinical profiles. Approximately 1386 CRC patients across the 19 studies were involved. Three trials were conducted on newly diagnosed and early-stage cancer patients, five related to surgery, two on patients about to or receiving chemotherapy, two on patients in remission post-treatment, and seven did not specify.

Various psychosocial interventions were trialled including psychoeducation, acceptance and commitment therapy-based (ACT) mindfulness, CBT, peer support, counselling and stress management. These interventions were delivered through mobile applications ( $n = 6$ ), websites, online portals or discussion forums ( $n = 10$ ) and blended modes ( $n = 3$ ), with the duration of the treatment period varying between 2 weeks and 6 months. Among studies with control groups ( $n = 16$ ), participants reportedly received either (i) no intervention ( $n = 13$ ) or a website with non-equivalent intervention contents ( $n = 3$ ).

Our primary outcome self-efficacy was evaluated in nine studies, albeit with different instruments both generic and disease-specific. Eleven studies measured anxiety, with the majority using the Hospital Anxiety and Depression Scale (HADS) and/or the State-Trait Anxiety Inventory (STAI). Depression was examined in 11 studies as well, either through HADS or other tools as presented under Appendices S5. Another commonly investigated outcome by 11 studies was QoL mainly measured by the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30).

### 3.1 | Risk of bias in included studies

As our review comprised of both randomized and non-randomized studies, the 12 RCTs were appraised for their methodological quality using the RoB 2 tool for RCTs while the remaining 7 quasi-experimental studies were assessed using the ROBINS-I tool in accordance to the Cochrane Handbook guidelines (Sterne et al., 2021). Among the 12 RCTs, all except two studies (83.3%) provided adequate descriptions of their random sequence generation process. These two studies stated the use of randomization but did not elaborate at length. Nine (75%) were rated low risk for allocation concealment, with the remaining 2 at an unclear risk due to missing or lack of information on whether the envelopes were sequentially numbered, opaque and sealed, and 1 at high risk because participants were grouped and the randomization of small numbers of groups may have rendered the intervention assignment predictable. Only three studies (25%) were deemed to be at low risk for performance bias, which was achieved by exposing control group participants to a similar website with

non-equivalent content, or not informing participants of the presence of another study arm. The rest were classified as unclear, while four studies were found to be at high risk as authors declared that participants could not be masked owing to the nature of the intervention and were therefore aware of their groupings. Eight of the studies (66.7%) had a low risk for detection bias, with 1 being unclear and the remaining 3 being high risk as a result of non-blinding and insufficient clarity on data collection methods which may have introduced assessor interference on the subjective outcomes measured. All 12 studies (100%) were judged to be at low risk of attrition bias with appropriate handling and analysis of missing data. Ten (83.3%) studies showed no deviations from their published protocols or registered clinical trial records, while two were at unclear risk due to the absence of protocol or clinical trial records for comparison. The risk of bias summary is shown in Figure 2, where the plus icon denotes a low risk, the query icon an unclear risk, and the minus icon a high risk of bias. The methodological quality of the other seven non-randomized studies measured by ROBINS-I tool is as shown in Figure 3.

Among the remaining 7 non-RCTs, three studies (42.9%) had a moderate risk of bias due to confounding because of significant baseline differences between the treatment and control groups and inappropriate group assignment based on the month or year of recruitment. One study (14.3%) had a serious risk of bias in this domain as a protocol amendment was submitted to include desirable characteristics that would facilitate intervention acceptance. Two studies (28.6%) were deemed to be at serious risk of selection bias due to the narrow eligibility window set by authors with the intent of maximizing participants' benefit from the intervention. For one study, the time frame for recruitment of participants allocated to the respective study arms did not coincide. Only one study (14.3%) demonstrated a serious risk of bias in the classification of interventions as the nature, duration, and contents of the intervention were not well-defined. Two studies (28.6%) had a moderate risk of bias due to deviations as inferred from the high dropout rate despite efforts from authors to eliminate this possibility. There was no information to determine the risk of bias in this aspect for one study as there was no protocol for comparison, limited description about the intervention or adherence rates. One study (14.3%) had a serious risk of bias due to missing data as there was a high attrition rate but no mention of how missing values were replaced or if they were excluded from the analysis. In terms of bias in the measurement of outcomes, four studies (57.1%) were rated moderate risk as they involved subjective outcomes which could have been easily influenced by the absence of blinding. Two (28.6%) were rated serious risk because of the lack of clarity on how subjective data was collected, which renders the accuracy of collected data questionable. None of the studies (0%) showed bias in the selection of the reported results.

### 3.2 | Effectiveness of web-based psychosocial interventions on self-efficacy

Nine studies examined the effect of web-based psychosocial interventions on self-efficacy in this review; however, two were

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)
Beatty 2019	+	+	+	+	+	+
Chambers 2018	+	+	?	+	+	+
Duffecy 2013	?	-	?	+	+	+
Giesler 2017	?	?	?	+	+	+
Hauffman 2020	+	+	?	+	+	+
Murphy 2020	+	+	-	+	+	+
Rahimi 2021	+	+	+	+	+	+
van der Hout 2020	+	+	-	-	+	+
van de Wal 2017	+	+	-	?	+	+
Wang 2018	+	?	?	-	+	?
Wright 2021	+	+	-	+	+	+
Xia 2020	+	+	+	-	+	?

FIGURE 2 Risk of bias summary for randomized controlled trials (n = 12)

single-group pretest-posttest studies (Dragomanovich et al., 2021; Northouse et al., 2014) and thus were excluded from the meta-analysis. Participants' self-efficacy was evaluated using several instruments including the National Institutes of Health Patient Reported Outcomes Measure Information System (NIH PROMIS), Cancer Behaviour Inventory-Brief form (CBI-B), General Self-Efficacy scale (GSE), Stoma Self-Efficacy Scale (SSES), and a modified Korean self-efficacy scale. Our meta-analysis involving 1002 CRC participants from 7 studies showed significant differences between the groups' self-efficacy (SMD 0.93, 95% CI: 0.52 to 1.35,  $p < .01$ ), favouring the control over the experimental group. However, a substantially high level of heterogeneity was also found to be present ( $I^2 = 89%$ ,  $p < .01$ ; Figure 4a).



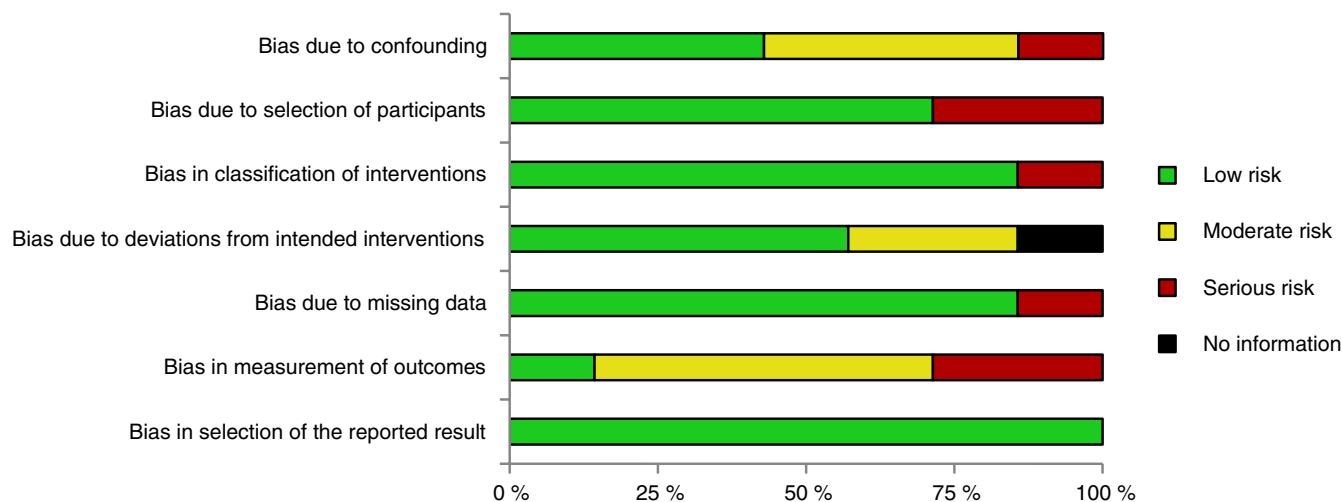


FIGURE 3 Risk of bias summary for non-randomized intervention studies ( $n = 7$ )

### 3.3 | Effectiveness of web-based psychosocial interventions on anxiety

Eleven studies reported findings on anxiety, of which 4 were measured by the HADS, 2 by the STAI and 1 each by the NIH PROMIS, Depression Anxiety Stress Scales (DASS), Generalized Anxiety Disorder Scale and the Self-rating Anxiety Scale (SAS). One study employed both the HADS and STAI-S (Hauffman et al., 2020).

#### 3.3.1 | Anxiety measured by the HADS

Of the five studies measuring anxiety by the HADS anxiety (HADS-A) subscale, two were excluded from the meta-analysis as one was a single-group study (Børøsdund et al., 2019) while data were not available for the other study (Murphy et al., 2020). We used the fixed effects model to pool data from the remaining three studies involving 86 and 91 participants in the experimental and control groups respectively. Our forest plot (Figure 4b) revealed that web-based psychosocial interventions significantly reduced anxiety (MD  $-2.23$ , 95% CI:  $-3.31$  to  $-1.14$ ,  $p < .01$ ) and was not statistically significant for heterogeneity ( $I^2 = 0\%$ ,  $p = .41$ ).

#### 3.3.2 | Anxiety measured by State-Trait Anxiety Inventory (STAI-S)

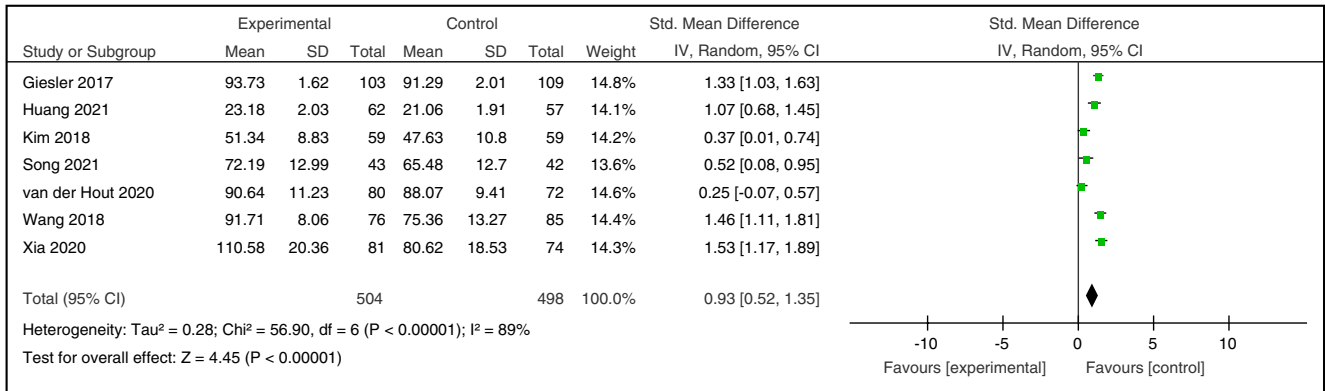
Three studies used the STAI-S instrument instead and data were similarly pooled for a meta-analysis using the fixed effects model. A total of 127 and 147 participants from the respective experimental and control groups were involved and our results showed positive intervention effects on anxiety reduction similar to that of HADS-A (MD  $-7.18$ , 95% CI:  $-8.61$  to  $-5.76$ ,  $p < .01$ ), despite significantly high heterogeneity ( $I^2 = 91\%$ ,  $p < .01$ ; Figure 4c).

### 3.4 | Effectiveness of web-based psychosocial interventions on depression

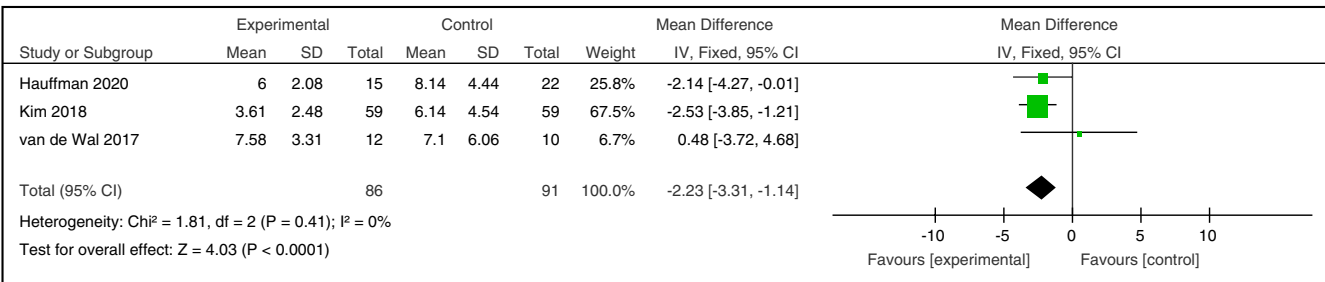
Eleven studies examined the effects of web-based psychosocial interventions on depression. Out of these 11 studies, six used the HADS depression (HADS-D) subscale, two the patient health questionnaire (PHQ-2 and PHQ-9) and one each by the NIH PROMIS, DASS and the Self-rating Depression Scale. Among the six which used the HADS-D, only three studies involving 86 experimental group participants and 91 control group participants were included in the meta-analysis. The other three were excluded due to the following reasons: sample size was negligible (Duffecy et al., 2013; Murphy et al., 2020) or the study only had a single arm (Børøsdund et al., 2019). Our forest plot (Figure 4d) results showed a statistically significant intervention effect on depression, favouring the experimental group (MD  $-2.84$ , 95% CI:  $-4.09$  to  $-1.59$ ,  $p < .01$ ). Heterogeneity was also observed to be low and was statistically insignificant ( $I^2 = 28\%$ ,  $p = .25$ ).

### 3.5 | Effectiveness of web-based psychosocial interventions on QoL

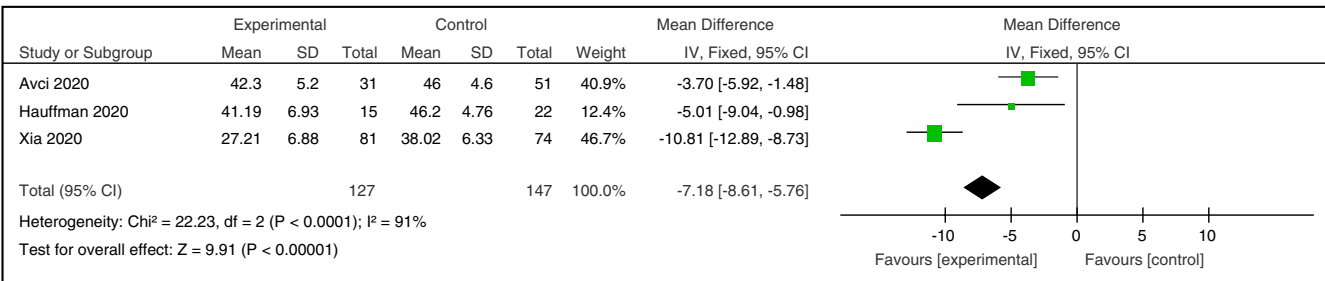
Eleven out of 14 studies included in the review examined QoL as one of their study outcomes. Of these, majority ( $n = 4$ ) used the EORTC QLQ-C30 while the others used various tools (refer to Supporting Information 5) and thus was not meaningful or appropriate to be included in the meta-analysis. Among the 4 studies, data were unavailable for one study. Our results from using a fixed effects model (Figure 5) to pool data from 107 experimental group participants and 104 control group participants showed a non-significant intervention effect supporting the control group (MD  $2.83$ , 95% CI:  $-0.31$  to  $5.98$ ,  $p = .08$ ) although no statistically significant heterogeneity was found ( $I^2 = 0\%$ ,  $p = .43$ ).



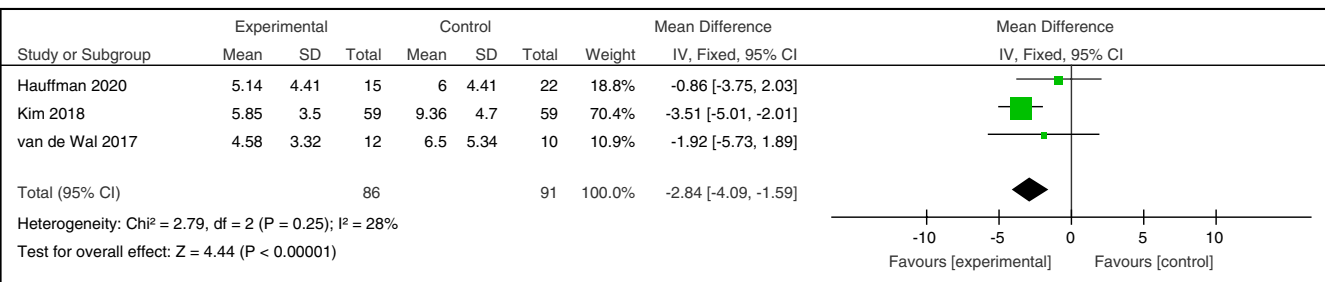
(a) Self-efficacy



(b) Anxiety (HADS-A)



(c) Anxiety (STAI-S)



(d) Depression (HADS-D)

**FIGURE 4** Forest plot of meta-analysis for self-efficacy, anxiety (HADS-A), and anxiety (STAI-S), depression (HADS-D). (a) Self-efficacy. (b) Anxiety (HADS-A). (c) Anxiety (STAI-S). (d) Depression (HADS-D). HADS, Hospital Anxiety and Depression Scale; STAI, State-Trait Anxiety Inventory



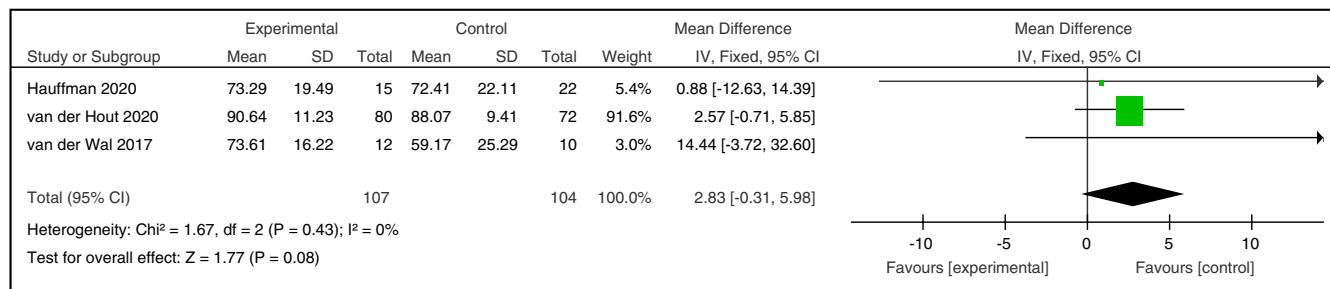


FIGURE 5 Forest plot of meta-analysis for quality of life (EORTC QLQ-C30)

### 3.6 | Other psychosocial outcomes

#### 3.6.1 | Non-specific psychological distress

Apart from the aforementioned outcomes, the effects of web-based psychosocial interventions on non-specific psychological and emotional distress, subjective and mental well-being were considered by five studies (Chambers et al., 2018; Murphy et al., 2020; Northouse et al., 2014; Rahimi et al., 2021; Wright et al., 2021). However, due to the use of various tools and unavailability of colorectal-specific data, a narrative synthesis was undertaken. Psychosocial interventions in four of the studies were delivered through web pages, while one was delivered through a blended (phone and virtual social networks) mode. Two were based on CBT (Chambers et al., 2018; Murphy et al., 2020), one was guided by the stress-coping theory (Northouse et al., 2014) but the other two did not specify (Rahimi et al., 2021; Wright et al., 2021). Findings on the effectiveness of web-based psychosocial interventions on non-specific psychological distress were largely supportive of its benefits in alleviating distress and enhancing well-being. For instance, the CRC-specific double-blinded RCT by Rahimi et al. (2021) reported significant improvements in mean subjective well-being scores for the intervention group after a month of exposure to a peer support programme over the phone and virtual social networks ( $p < .001$ ), as compared with the control group. For Chambers et al. (2018), intervention effects were non-significant from the intention-to-treat analysis ( $p = .22$ ) but statistically significant when a secondary per-protocol analysis restricted to participants with over 50% completion of the 6-core CBT programme over an 8-week intervention period was performed ( $p = .03$ , 95% CI: 0.04 to 0.99,  $d = .52$ ), as compared with the static patient education website control group. The study by Murphy et al. (2020) found a large between-group effect size for distress ( $g = 1.56$ ) but did not report its corresponding  $p$ -value.

#### 3.6.2 | Cancer-specific distress

Four studies in this review examined cancer-specific distress but data was unavailable for a meta-analysis as well (Beatty et al., 2019; Chambers et al., 2018; Dragomanovich et al., 2021; van de Wal et al., 2017). All except one study involved CBT interventions; two were delivered via web pages (Beatty et al., 2019; Chambers

et al., 2018) while one utilized the blended mode (van de Wal et al., 2017). Results also suggested that web-based psychosocial interventions might be beneficial for reducing cancer-specific distress. Only Beatty et al.'s (2019) saw no significant differences between groups across all follow-up time-points at post-intervention ( $p = .74$ ), 3-months ( $p = .93$ ) and 6-months post-intervention ( $p = .94$ ). van de Wal et al. (2017) found significant improvement in cancer-specific distress for the blended-CBT group as compared with the control group ( $p = .008$ , 95% CI:  $-14.008$  to  $-2.205$ ,  $d = .54$ ). For Chambers et al. (2018), a significant decrease in cancer-specific distress ( $p = .02$ , 95% CI: 0.15 to 1.10,  $d = .63$ ) was reported from the per-protocol analysis involving participants with over 50% completion of the intervention, as compared with the control group.

### 3.7 | Attrition rates and satisfaction levels

Drop-out attrition (referring to incomplete assessments) and non-usage attrition (referring to incomplete intervention) were assessed across the 19 included studies. Most of the studies (17 of 19 in total) presented the Consolidated Standards of Reporting Trials (CONSORT) flow chart and based on the reported data, the drop-out attrition rate ranged from as low as 0% to 31% for the control group and 0% to 49% for the intervention group. The non-usage attrition rate was only reported in 7 of the 19 studies and ranged between 34% and 90%. One study saw an average of 21 logins per participant, exceeding the expected login count of 16 times over the 8-week intervention period (Duffecy et al., 2013). Another stated the mean website usage time to be approximately 42 min for a 2-week intervention (Giesler et al., 2017). Others sought user feedback through satisfaction levels, ease of use, perceived benefits and frequently accessed sections of the web-based intervention (Børøsund et al., 2019; Chambers et al., 2018; Hauffman et al., 2020; Murphy et al., 2020; Northouse et al., 2014; Song et al., 2021; Xia, 2020). In general, study participants were receptive and had positive responses to the web-based intervention they underwent. Common findings included participants appreciating the accessibility, flexibility, availability of information and help. For example, the entire trial population (100%) in Song et al.'s (2021) study felt more optimistic after the 6-week self-management intervention programme, with 95% of them rating the app information useful and 86% rating the group discussion meaningful. Similarly, Murphy

et al. (2020) saw 83% of their participants indicating that they were 'mostly satisfied' or 'very satisfied' with the internet-delivered CBT. In Duffecy et al.'s (2013) *Project Onward* study, mindfulness and relaxation were identified as the more popular lessons (16%), and almost half (42%) of the participants found peer sharing valuable. In terms of feasibility, Northouse et al. (2014) noted that there was higher retention despite the slower enrolment rate as compared with their preceding face-to-face study. Additionally, usage as intended was also found to be significantly associated with higher education, having a partner and not being employed at the time of the study (van der Hout et al., 2020). The mean age of participants was also relatively young (range: 27–71 years old) which is worthy of consideration in the interpretation of findings.

## 4 | DISCUSSION

This review evaluated the effectiveness of web-based psychosocial interventions on self-efficacy (primary outcome), anxiety, depression, QoL, non-specific psychological and cancer-specific distress, as well as its attrition and satisfaction rates based on 19 studies involving a total of 1386 CRC patients.

Findings from the meta-analyses did not support the effectiveness of web-based psychosocial interventions in enhancing self-efficacy. It is worthwhile to note that despite pooling colorectal-specific data into the meta-analysis, only five of the seven studies were conducted on CRC patients alone (Giesler et al., 2017; Huang et al., 2021; Kim et al., 2018; Song et al., 2021; Xia, 2020). Hence, it may be possible that the interventions were not sufficiently targeted to generate an effect on CRC participants' self-efficacy levels. That being said, a closer examination of the individual findings of the five colorectal-specific studies saw four of them reporting significant improvements in self-efficacy among experimental group participants as compared with the control group (all  $p < .05$ ). All four studies used mobile applications to deliver their psychosocial content lasting 2-weeks to 6-months during the perioperative period. Only Giesler et al.'s (2017) study which used a website found no significant difference between the groups at 2 and 6-weeks post-intervention, which the authors themselves were unable to explain, stressing the need for identification of confounders that may facilitate or hinder self-efficacy. When compared with an earlier review of trials involving psychosocial interventions delivered traditionally on CRC patients (Mosher et al., 2017), only one of the 14 included trials examined self-efficacy as an outcome and reported significant improvements over 6-months (Zhang et al., 2014). None of the trials at present, regardless of their delivery modality, investigated the potential influence of sociodemographic and clinical factors such as profession, personality, education, cancer stage, complication and recurrence on self-efficacy, whose relationships have been established in a cross-sectional study (Qian & Yuan, 2012). On this basis, it is difficult to establish the factors that contribute to the effectiveness of these interventions in raising self-efficacy. Yet, the limited empirical evidence suggests that theory-guided content specific to CRC and the

use of mobile applications as the delivery format may well be useful implications for future trials, given no discrepancy found between groups among baseline socio- and clinical characteristics. More extensive, robust research using consistent and appropriate tools is also required to ascertain existing findings.

Five studies found web-based psychosocial interventions to significantly alleviate anxiety among CRC patients regardless of the measurement tool used, length of intervention duration and delivery mode. This finding concurred with results from past reviews (Lim et al., 2013; Mosher et al., 2017) involving conventionally-delivered progressive muscle relaxation training (Cheung et al., 2003), tailored psychoeducation (O'Connor et al., 2014) and a self-efficacy enhancing intervention (Zhang et al., 2014) evaluated over a time span of 5-weeks to 6-months. A significantly large extent of heterogeneity was, however, noted among the three studies included in the State-Anxiety (STAI-S) meta-analysis (Avci et al., 2020; Hauffman et al., 2020; Xia, 2020). While the risk of bias being comparable across these studies would render a sensitivity analysis unnecessary, our forest plot at face value suggests that Xia's (2020) study was inherently different from the other two. Participants enrolled in Xia's (2020) study were those who had a permanent colostomy after colorectal surgery and yet when compared against the chemotherapy sample in Avci et al.'s (2020) study and the newly diagnosed and/or cancer relapse sample in Hauffman et al.'s (2020) study, this sample had relatively lower anxiety scores. All three studies comprised of outpatients. Although the reasons behind such observations are not clearly known, plausible explanations ascribed to the clinical profiles of participants differing at varying time-points of their treatment continuum, as well as the involvement of a family caregiver during intervention delivery can be deduced. Furthermore, the significant reduction in colostomy-related complications within the experimental group 3-months after discharge may also have contributed to low anxiety levels among Xia's (2020) population. The lack of conclusive evidence reflects a need for longitudinal studies to trend anxiety levels throughout the fluctuating illness trajectory since earlier studies argue that treatment types, setting and screening methods are influencing factors (Graça Pereira et al., 2012; Niedzwiedz et al., 2019) but were not controlled for in the aforementioned trials.

Positive results supporting the effectiveness of web-based psychosocial interventions in reducing depression were similarly shown in the current meta-analysis (Hauffman et al., 2020; Kim et al., 2018; van de Wal et al., 2017). Our results were in tandem and parallel to reports from reviews of psychosocial interventions for CRC patients (Lim et al., 2013; Mosher et al., 2017). In this meta-analysis, the interventions of two studies were anchored in CBT while one was developed based on Bandura's self-efficacy theory. Participants' depression levels were measured between 1- and 10-months from baseline and this is useful information for future work considering the appropriate duration required to achieve such intervention effects.

QoL was the most common outcome measured by 11 of the 19 studies included in this review, but due to a wide spectrum of measurement tools used and at varying time-points, a meta-analysis could only be performed on three of the studies with

available EORTC QLQ-C30 data (Hauffman et al., 2020; van de Wal et al., 2017; van der Hout et al., 2020). According to our findings, the effects of web-based psychosocial interventions on QoL were non-significant and this agreed with majority of the trials included in both the 2013 and 2017 systematic reviews involving conventionally delivered psychosocial interventions. However, significant positive effects were reported for both overall-QoL (Kim et al., 2018) and selective QoL subscales (Xia, 2020) among colorectal-specific studies which did not use EORTC QLQ-C30. A recent review by Son and colleagues in 2018 (Son et al., 2018) indicated that homogeneous interventions with a small effect had a statistically significant benefit on QoL across eight studies featuring 2117 patients in total. Their subgroup analysis found a small effect size for the face-to-face modality but no significant improvements in QoL for the non-face-to-face modalities (i.e. coaching, telephone interviews and meetings). Moreover, results were statistically insignificant to decipher if longer intervention duration is associated with a larger effect size. Given the complexity of this multifaceted outcome variable, there is a need for tighter definitions and careful design of more effective psychosocial interventions. Future work ought also to assess physical outcomes simultaneously in order to gain a better understanding of the observed intervention effects.

Besides the aforementioned specific outcomes, narrative findings suggest that web-based psychosocial interventions were likely to improve non-specific psychological and cancer-specific distress. Despite this tentative conclusion, these results highlight that high intervention adherence is essential to achieve the desired effects.

Higher drop-out numbers for the intervention group as compared with the control group was congruent with studies involving conventionally-delivered psychosocial interventions (Mosher et al., 2017). In fact, the drop-out rate was approximately 20% or below in all except one study (Avci et al., 2020). This particular study delivered a blended psychosocial programme which was discontinued by a substantial proportion of participants due to the home visit component. Although a minor finding, this preliminary evidence point to a gradual shift in participants' preference from physical, in-person to web-based psychosocial interventions. This is further ascertained by the high satisfaction rates reported by the handful of feasibility studies included in this review. In this regard, greater attention should be paid to recording and reducing non-usage attrition. This may help explain null or insignificant findings, while at the same time promoting the uptake of accountability among participants receiving remotely-delivered interventions. Ensuring standardization and consistency in the measurement of these indicators will be an important goal that warrants consideration in future research.

#### 4.1 | Limitations

To the best of our knowledge, this is the first systematic review to examine the effectiveness of web-based psychosocial interventions on patients with CRC. The stringent eligibility criteria and definitions put in place were advantageous in guiding and ensuring a rigorous

appraisal and selection process. The search including a Chinese database was a key strength given the rapid uptake of eHealth and mHealth applications among the Chinese-speaking population within the past decade (Han et al., 2020). However, this review had several limitations and findings should therefore be interpreted with caution. Firstly, a relatively small number of studies were pooled in the meta-analyses and the small sample sizes may have reduced the statistical power of the actual intervention effects. Next, intervention effects may have been diluted in our analysis due to the scarcity of colorectal-specific trials which led to the need for data extraction of colorectal data from generic cancer studies. Moreover, despite efforts to streamline the retrieved data pool, diverse delivery modalities, intervention mechanisms, measurement tools used and at varying time-points across studies led to a difficult and challenging synthesis of the effectiveness of web-based psychosocial interventions. Subgroup analyses were also not possible with the limited number of CRC-specific studies. Finally, the lack of definition and insufficient description of intervention contents in some studies may have compromised the accuracy and extent of generalizability of our findings.

#### 4.2 | Implications for future research and practice

Web-based modalities offer quick, convenient, flexible and widely accessible care, and are a promising alternative to their traditional face-to-face counterparts during this COVID-19 era. Notwithstanding the supportive evidence, there remains a pressing need for more adequately powered trials conducted on the CRC population, with targeted interventions introduced within a particular treatment period (i.e. surgery, chemotherapy, radiation therapy) and the use of consistent measurement tools to ascertain the validity of existing findings. More information concerning the appropriate dosage and duration of web-based psychosocial interventions are required and most importantly, efforts should be made to examine the impact of potential confounders and control such factors wherever possible.

### 5 | CONCLUSION

Web-based psychosocial interventions effectively ameliorate anxiety and depression among patients with CRC but do not substantially improve self-efficacy or QoL. Based on our narrative synthesis, findings were suggestive of potential benefits in the reduction of distress among participants with higher intervention completion rates. It may be fitting in this day and age for more extensive testing of alike interventions so as to maximize the efficacy of remotely delivered psychosocial care for those with CRC.

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**CONFLICT OF INTEREST**

None declared.

**AUTHOR CONTRIBUTIONS**

Su Wei Wan conceived the design, performed the search, screened, appraised, analysed and interpreted the data, and drafted the manuscript. Yun Jia Devon Chng screened, appraised, analysed and interpreted the data, and reviewed the final version of the manuscript. Siew Hoon Lim contributed clinical expertise for the selection of articles and review of the manuscript. Choon Seng Chong, Minna Pikkarainen and Hong-Gu He provided supervision and critical review of the final manuscript.

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**DATA AVAILABILITY STATEMENT**

The data that supports the findings of this study are available in Supporting Information of this article.

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**REFERENCES**

- Avci, I. A., Altay, B., Cavusoglu, F., Cal, A., Mumcu, N., Eren, D. C., Oz, O., Altin, A., Karaoglanoglu, O., & Buberçi, A. (2020). Evaluation of the efficacy of the three-component health care management program HEWCOT in colorectal cancer patients receiving chemotherapy. *Journal of Cancer Education*, 35(2), 274–283. <https://doi.org/10.1007/s13187-018-1461-2>
- Beatty, L., Kemp, E., Coll, J. R., Turner, J., Butow, P., Milne, D., Yates, P., Lambert, S., Wootten, A., Yip, D., & Koczwara, B. (2019). Finding my way: Results of a multicentre RCT evaluating a web-based self-guided psychosocial intervention for newly diagnosed cancer survivors. *Supportive Care in Cancer*, 27(7), 2533–2544. <https://doi.org/10.1007/s00520-018-4526-1>
- Børøsdund, E., Varsi, C., Clark, M. M., Ehlers, S. L., Andrykowski, M. A., Sleveland, H. R. S., Bergland, A., & Nes, L. S. (2019). Pilot testing an app-based stress management intervention for cancer survivors. *Translational Behavioral Medicine*, 10(3), 770–780. <https://doi.org/10.1093/tbm/ibz062>
- Braamse, A. M. J., van Turenhout, S. T., Terhaar sive Droste, J. S., de Groot, G. H., van der Hulst, R. W. M., Klemm-Kropp, M., Kuiken, S. D., Loffeld, R. J. L. F., Uiterwaal, M. T., Mulder, C. J. J., & Dekker, J. (2016). Factors associated with anxiety and depressive symptoms in colorectal cancer survivors. *European Journal of Gastroenterology & Hepatology*, 28(7), 831–835. <https://doi.org/10.1097/MEG.0000000000000615>
- Campbell, M., McKenzie, J. E., Sowden, A., Katikireddi, S. V., Brennan, S. E., Ellis, S., Hartmann-Boyce, J., Ryan, R., Shepperd, S., Thomas, J., Welch, V., & Thomson, H. (2020). Synthesis without meta-analysis (SWiM) in systematic reviews: Reporting guideline. *British Medical Journal*, 368, l6890. <https://doi.org/10.1136/bmj.l6890>
- Chambers, S., Ritterband, L., Thorndike, F., Nielsen, L., Aitken, J., Clutton, S., Scuffham, P. A., Youl, P., Morris, B., Baade, P. D., & Dunn, J. (2018). Web-delivered cognitive behavioral therapy for distressed cancer patients: Randomized controlled trial. *Journal of Medical Internet Research*, 20(1), e42. <https://doi.org/10.2196/jmir.8850>
- Cheung, Y. L., Molassiotis, A., & Chang, A. M. (2003). The effect of progressive muscle relaxation training on anxiety and quality of life after stoma surgery in colorectal cancer patients. *Psychooncology*, 12(3), 254–266. <https://doi.org/10.1002/pon.638>
- Cotrim, H., & Pereira, G. (2008). Impact of colorectal cancer on patient and family: Implications for care. *European Journal of Oncology Nursing*, 12(3), 217–226. <https://doi.org/10.1016/j.ejon.2007.11.005>
- Deeks, J., Higgins, J., & Altman, D. (2021). Chapter 10: Analysing data and undertaking meta-analyses. In J. Higgins, J. Thomas, J. Chandler, M. Cumpston, T. Li, M. Page, & V. Welch (Eds.), *Cochrane handbook for systematic reviews of interventions version 6.2*. <https://training.cochrane.org/handbook>
- Douaiher, J., Ravipati, A., Grams, B., Chowdhury, S., Alatis, O., & Are, C. (2017). Colorectal cancer—Global burden, trends, and geographical variations. *Journal of Surgical Oncology*, 115(5), 619–630. <https://doi.org/10.1002/jso.24578>
- Dragomanovich, H. M., Dhruva, A., Ekman, E., Schoenbeck, K. L., Kubo, A., Van Blarigan, E. L., Borno, H. T., Esquivel, M., Chee, B., Campanella, M., Philip, E. J., Rettger, J. P., Rosenthal, B., Van Loon, K., Venook, A. P., Boscardin, C., Moran, P., Hecht, F. M., & Atreya, C. E. (2021). Being present 2.0: Online mindfulness-based program for metastatic gastrointestinal cancer patients and caregivers. *Global Advances in Health and Medicine*, 10, 21649561211044693. <https://doi.org/10.1177/21649561211044693>
- Duffecy, J., Sanford, S., Wagner, L., Begale, M., Nawacki, E., & Mohr, D. C. (2013). Project onward: An innovative e-health intervention for cancer survivors. *Psycho-Oncology*, 22(4), 947–951. <https://doi.org/10.1002/pon.3075>
- Foster, C., Haviland, J., Winter, J., Grimmett, C., Chivers Seymour, K., Batehup, L., Calman, L., Corner, J., Din, A., Fenlon, D., May, C. M., Richardson, A., Smith, P. W., & Members of the Study Advisory Committee. (2016). Pre-surgery depression and confidence to manage problems predict recovery trajectories of health and wellbeing in the first two years following colorectal cancer: Results from the CREW cohort study. *PLoS One*, 11(5), e0155434. <https://doi.org/10.1371/journal.pone.0155434>
- Giesler, J. M., Keller, B., Repke, T., Leonhart, R., Weis, J., Muckelbauer, R., Rieckmann, N., Müller-Nordhorn, J., Lucius-Hoene, G., & Holmberg, C. (2017). Effect of a website that presents Patients' experiences on self-efficacy and patient competence of colorectal cancer patients: Web-based randomized controlled trial. *Journal of Medical Internet Research*, 19(10). <https://doi.org/10.2196/jmir.7639>
- Graça Pereira, M., Figueiredo, A. P., & Fincham, F. D. (2012). Anxiety, depression, traumatic stress and quality of life in colorectal cancer after different treatments: A study with Portuguese patients and their partners. *European Journal of Oncology Nursing*, 16(3), 227–232. <https://doi.org/10.1016/j.ejon.2011.06.006>
- Han, Y., Lie, R., & Guo, R. (2020). The internet hospital as a telehealth model in China: Systematic search and content analysis. *Journal of Medical Internet Research*, 22(7), e17995. <https://doi.org/10.2196/17995>
- Hanly, P., Walsh, P. M., O Céilleachair, A., Skally, M., Staines, A., Kapur, K., Fitzpatrick, P., & Sharp, L. (2013). Work-related productivity losses in an era of ageing populations: The case of colorectal cancer. *Journal of Occupational and Environmental Medicine*, 55(2), 128–134. <https://doi.org/10.1097/JOM.0b013e3182820553>
- Hauffman, A., Alfnsson, S., Bill-Axelsson, A., Bergkvist, L., Forslund, M., Mattsson, S., von Essen, L., Nygren, P., Igelström, H., & Johansson, B. (2020). Cocreated internet-based stepped care for individuals with cancer and concurrent symptoms of anxiety and depression:



- Results from the U-CARE adult can randomized controlled trial. *Psycho-Oncology*, 29(12), 2012–2018. <https://doi.org/10.1002/pon.5489>
- Heynsbergh, N., Heckel, L., Botti, M., & Livingston, P. M. (2018). Feasibility, useability and acceptability of technology-based interventions for informal cancer carers: A systematic review. *BMC Cancer*, 18(1), 244. <https://doi.org/10.1186/s12885-018-4160-9>
- Higgins, J., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M., & Welch, V. (2021). *Cochrane handbook for systematic reviews of interventions version 6.2*. Cochrane.
- Hildebrandt, C., Mayer, H., & Koller, A. (2019). Experiences of patients with colorectal cancer from diagnosis until completion of treatment: A meta-ethnography approach. *Psycho-Oncology*, 28(2), 219–227. <https://doi.org/10.1002/pon.4946>
- Holtedahl, K., Borgquist, L., Donker, G. A., Buntinx, F., Weller, D., Campbell, C., Månsson, J., Hammersley, V., Braaten, T., & Parajuli, R. (2021). Symptoms and signs of colorectal cancer, with differences between proximal and distal colon cancer: A prospective cohort study of diagnostic accuracy in primary care. *BMC Family Practice*, 22(1), 148. <https://doi.org/10.1186/s12875-021-01452-6>
- Huang, Q., Zhuang, Y., Ye, X., Li, M., Liu, Z., Li, J., & Pan, Z. (2021). The effect of online training-based continuous nursing care for rectal cancer-patients undergoing permanent colostomy. *American Journal of Translational Research*, 13(4), 3084–3092.
- Johansson, A.-C., Brink, E., Cliffordson, C., & Axelsson, M. (2018). The function of fatigue and illness perceptions as mediators between self-efficacy and health-related quality of life during the first year after surgery in persons treated for colorectal cancer. *Journal of Clinical Nursing*, 27(7–8), e1537–e1548. <https://doi.org/10.1111/jocn.14300>
- Kershaw, T., Ellis, K. R., Yoon, H., Schafenacker, A., Katapodi, M., & Northouse, L. (2015). The interdependence of advanced cancer Patients' and their family Caregivers' mental health, physical health, and self-efficacy over time. *Annals of Behavioral Medicine*, 49(6), 901–911. <https://doi.org/10.1007/s12160-015-9743-y>
- Kim, B.-Y., Park, K.-J., & Ryoo, S.-B. (2018). Effects of a Mobile educational program for colorectal cancer patients undergoing the enhanced recovery after surgery. *The Open Nursing Journal*, 12, 142–154. <https://doi.org/10.2174/1874434601812010142>
- Lim, S. H., Chan, W. C. S., & He, H.-G. (2013). Effect of psychosocial interventions on outcomes of patients with colorectal cancer: A review of the literature. *European Journal of Oncology Nursing*, 17(6), 883–891.
- McKenzie, J., Brennan, S., Ryan, R., Thomson, H., & Johnston, R. (2021). Chapter 9: Summarizing study characteristics and preparing for synthesis. In J. Higgins, J. Thomas, J. Chandler, M. Cumpston, T. Li, M. Page, & V. Welch (Eds.), *Cochrane handbook for systematic reviews of interventions version 6.2*. [www.training.cochrane.org/handbook](http://www.training.cochrane.org/handbook)
- Medeiros, M., Oshima, C. T., & Forones, N. M. (2010). Depression and anxiety in colorectal cancer patients. *Journal of Gastrointestinal Cancer*, 41(3), 179–184. <https://doi.org/10.1007/s12029-010-9132-5>
- Mosher, C. E., Winger, J. G., Given, B. A., Shahda, S., & Helft, P. R. (2017). A systematic review of psychosocial interventions for colorectal cancer patients. *Supportive Care in Cancer*, 25(7), 2349–2362. <https://doi.org/10.1007/s00520-017-3693-9>
- Murphy, M. J., Newby, J. M., Butow, P., Loughnan, S. A., Joubert, A. E., Kirsten, L., Allison, K., Shaw, J., Shepherd, H. L., Smith, J., & Andrews, G. (2020). Randomised controlled trial of internet-delivered cognitive behaviour therapy for clinical depression and/or anxiety in cancer survivors (iCanADAPT early). *Psycho-Oncology*, 29(1), 76–85. <https://doi.org/10.1002/pon.5267>
- Niedzwiedz, C. L., Knifton, L., Robb, K. A., Katikireddi, S. V., & Smith, D. J. (2019). Depression and anxiety among people living with and beyond cancer: A growing clinical and research priority. *BMC Cancer*, 19(1), 943. <https://doi.org/10.1186/s12885-019-6181-4>
- Northouse, L., Schafenacker, A., Barr, K. L. C., Katapodi, M., Yoon, H., Brittain, K., Song, L., Ronis, D. L., & An, L. (2014). A tailored web-based psychoeducational intervention for cancer patients and their family caregivers. *Cancer Nursing*, 37(5), 321–330. <https://doi.org/10.1097/NCC.0000000000000159>
- O'Connor, G., Coates, V., & O'Neill, S. (2014). Randomised controlled trial of a tailored information pack for patients undergoing surgery and treatment for rectal cancer. *European Journal of Oncology Nursing*, 18(2), 183–191. <https://doi.org/10.1016/j.ejon.2013.10.011>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *British Medical Journal*, 372, n71. <https://doi.org/10.1136/bmj.n71>
- Peng, Y. N., Huang, M. L., & Kao, C. H. (2019). Prevalence of depression and anxiety in colorectal cancer patients: A literature review. *International Journal of Environmental Research and Public Health*, 16(3). <https://doi.org/10.3390/ijerph16030411>
- Qian, H., & Yuan, C. (2012). Factors associated with self-care self-efficacy among gastric and colorectal cancer patients. *Cancer Nursing*, 35(3), E22–E31. <https://doi.org/10.1097/NCC.0b013e31822d7537>
- Rahimi, M., Mahdizadeh, M., Chamanzari, H., & Mahdizadeh, S.-M. (2021). The effect of peer support with telecommunication on subjective well-being in colorectal patients: A randomized controlled clinical trial. *International Journal of Community Based Nursing and Midwifery*, 9(2), 127–138. <https://doi.org/10.30476/ijcbnm.2021.88061.1484>
- Sheetz, K. H., Waits, S. A., Krell, R. W., Morris, A. M., Englesbe, M. J., Mullard, A., Campbell, D. A., & Hendren, S. (2014). Complication rates of ostomy surgery are high and vary significantly between hospitals. *Diseases of the Colon and Rectum*, 57(5), 632–637. <https://doi.org/10.1097/DCR.000000000000038>
- Simon, A. E., Thompson, M. R., Flashman, K., & Wardle, J. (2009). Disease stage and psychosocial outcomes in colorectal cancer. *Colorectal Disease*, 11(1), 19–25. <https://doi.org/10.1111/j.1463-1318.2008.01501.x>
- Slankamenac, K., Slankamenac, M., Schlegel, A., Nocito, A., Rickenbacher, A., Clavien, P.-A., & Turina, M. (2017). Impact of postoperative complications on readmission and long-term survival in patients following surgery for colorectal cancer. *International Journal of Colorectal Disease*, 32(6), 805–811. <https://doi.org/10.1007/s00384-017-2811-y>
- Smith, F., Öhlén, J., Persson, L. O., & Carlsson, E. (2018). Daily assessment of stressful events and coping in early post-operative recovery after colorectal cancer surgery. *European Journal of Cancer Care*, 27(2), e12829. <https://doi.org/10.1111/ecc.12829>
- Son, H., Son, Y. J., Kim, H., & Lee, Y. (2018). Effect of psychosocial interventions on the quality of life of patients with colorectal cancer: A systematic review and meta-analysis. *Health and Quality of Life Outcomes*, 16(1), 119. <https://doi.org/10.1186/s12955-018-0943-6>
- Song, Q. F., Yin, G., Guo, X., Lv, X., Yu, K., & Liu, C. (2021). Effects of a self-management program for patients with colorectal cancer and a colostomy: A nonrandomized clinical trial. *Journal of Wound, Ostomy, and Continence Nursing*, 48(4), 311–317. <https://doi.org/10.1097/won.0000000000000779>
- Stanton, A. L., Luecken, L. J., MacKinnon, D. P., & Thompson, E. H. (2013). Mechanisms in psychosocial interventions for adults living with cancer: Opportunity for integration of theory, research, and practice. *Journal of Consulting and Clinical Psychology*, 81(2), 318–335. <https://doi.org/10.1037/a0028833>
- Sterne, J., Hernán, M., McAleenan, A., Reeves, B., & Higgins, J. (2021). Chapter 25: Assessing risk of bias in a non-randomized study. In J. Higgins, J. Thomas, J. Chandler, M. Cumpston, T. Li, M. Page, & V. Welch (Eds.), *Cochrane handbook for systematic reviews of interventions version 6.2*. [www.training.cochrane.org/handbook](http://www.training.cochrane.org/handbook)
- Sun, V., Grant, M., McMullen, C. K., Altschuler, A., Mohler, M. J., Hornbrook, M. C., Herrinton, L. J., Baldwin, C. M., & Krouse, R. S.

- (2013). Surviving colorectal cancer: Long-term, persistent ostomy-specific concerns and adaptations. *Journal of Wound, Ostomy, and Continence Nursing*, 40(1), 61–72. <https://doi.org/10.1097/WON.0b013e3182750143>
- Treanor, C. J., Santin, O., Prue, G., Coleman, H., Cardwell, C. R., O'Halloran, P., & Donnelly, M. (2019). Psychosocial interventions for informal caregivers of people living with cancer. *Cochrane Database of Systematic Reviews*, 2020, CD009912. <https://doi.org/10.1002/14651858.CD009912.pub2>
- Trudel-Fitzgerald, C., Tworoger, S. S., Zhang, X., Giovannucci, E. L., Meyerhardt, J. A., & Kubzansky, L. D. (2020). Anxiety, depression, and colorectal cancer survival: Results from two prospective cohorts. *Journal of Clinical Medicine*, 9(10), 3174. <https://www.mdpi.com/2077-0383/9/10/3174>
- van de Wal, M., Thewes, B., Gielissen, M., Speckens, A., & Prins, J. (2017). Efficacy of blended cognitive behavior therapy for high fear of recurrence in breast, prostate, and colorectal cancer survivors: The SWORD study, a randomized controlled trial. *Journal of Clinical Oncology*, 35(19), 2173–2183. <https://doi.org/10.1200/jco.2016.70.5301>
- van der Hout, A., van Uden-Kraan, C. F., Holtmaat, K., Jansen, F., Lissenberg-Witte, B. I., Nieuwenhuijzen, G. A. P., Hardillo, J. A., Baatenburg de Jong, R. J., Tiren-Verbeet, N. L., Sommeijer, D. W., de Heer, K., Schaar, C. G., Sedee, R., Bosscha, K., van den Brekel, M., Petersen, J. F., Westerman, M., Honings, J., Takes, R. P., ... Verdonck-de Leeuw, I. M. (2020). Role of eHealth application Oncokompas in supporting self-management of symptoms and health-related quality of life in cancer survivors: A randomised, controlled trial. *The Lancet Oncology*, 21(1), 80–94. [https://doi.org/10.1016/S1470-2045\(19\)30675-8](https://doi.org/10.1016/S1470-2045(19)30675-8)
- World Health Organization. (2021a). *Cancer treatment*. <https://www.who.int/news-room/fact-sheets/detail/cancer>
- World Health Organization. (2021b). *mHealth: New horizons for health through mobile technologies*. World Health Organization.
- Worster, B., & Holmes, S. (2009). A phenomenological study of the postoperative experiences of patients undergoing surgery for colorectal cancer. *European Journal of Oncology Nursing*, 13(5), 315–322. <https://doi.org/10.1016/j.ejon.2009.04.008>
- Wright, H., Martin, F., Clyne, W., Clark, C. C. T., Matouskova, G., McGillion, M., & Turner, A. (2021). A digital self-management program (help to overcome problems effectively) for people living with cancer: Feasibility randomized controlled trial. *Journal of Medical Internet Research*, 23(11), e28322. <https://doi.org/10.2196/28322>
- Xi, Y., & Xu, P. (2021). Global colorectal cancer burden in 2020 and projections to 2040. *Translational Oncology*, 14(10), 101174. <https://doi.org/10.1016/j.tranon.2021.101174>
- Xia, L. (2020). The effects of continuous care model of information-based hospital-family integration on colostomy patients: A randomized controlled trial. *Journal of Cancer Education*, 35(2), 301–311. <https://doi.org/10.1007/s13187-018-1465-y>
- Zhang, M., Chan, S. W., You, L., Wen, Y., Peng, L., Liu, W., & Zheng, M. (2014). The effectiveness of a self-efficacy-enhancing intervention for Chinese patients with colorectal cancer: A randomized controlled trial with 6-month follow up. *International Journal of Nursing Studies*, 51(8), 1083–1092. <https://doi.org/10.1016/j.ijnurstu.2013.12.005>

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