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Effects of physical activity interventions using digital health interventions on cancer-related fatigue in cancer survivors: scoping review

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Abstract

Background: Cancer-related fatigue (CRF) is one of the most common and persistent symptoms experienced by cancer survivors. Exercise has been proven effective in alleviating CRF, yet traditional face-to-face programs may not be accessible due to physical, temporal, or geographical barriers. Digital health interventions (DHIs) offer a scalable and accessible alternative to deliver exercise-based strategies.

Objective: To examine the characteristics and effectiveness of digital health-based physical activity interventions on CRF.

Methods: A systematic literature search was conducted across four databases (PubMed, EMBASE, Cochrane, PsycINFO) up to June 2024. Inclusion criteria comprised experimental studies involving adult cancer survivors, digital exercise interventions, a control group, and fatigue outcomes. The review followed NECA guidelines and PRISMA 2020 standards and was registered on PROSPERO (CRD42022304285).

Results: Twenty studies with a combined total of 2,657 participants were included. The majority (85%) were randomized controlled trials, with interventions delivered via mobile applications, web platforms, wearable devices, Xbox programs, and augmented reality. Breast cancer was the most commonly studied cancer type. Of the 18 analyzed interventions, 11 showed statistically significant reductions in CRF, particularly those using mobile apps or wearable devices. The most common fatigue measurement tool was the FACIT-F scale. Most interventions were classified as grade C based on the Evidence Standards Framework, focusing on treatment rather than self-management or cost-saving outcomes.

Conclusions: Digital health-based physical activity interventions demonstrate significant potential for alleviating CRF in cancer survivors. However, current evidence is concentrated in breast cancer populations and mid-aged adults. Future research should expand to diverse cancer types, include multi-component interventions, and address digital health literacy to improve accessibility and equity in CRF management.

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Keywords

Cancer Survivors; Digital Health; Exercise; Fatigue; Neoplasm

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Introduction

Cancer-related fatigue (CRF) refers to the tiredness and exhaustion related to cancer treatments that interfere with usual functioning. CRF is one of the most common symptoms of cancer and its treatment, and persists for several years after cancer treatment. Although it is known that exercise is effective in reducing CRF, most studies have relied on face-to-face intervention modalities at the individual level and/or in small groups. Thus, this study seeks to identify the effects of physical activity interventions using digital health modalities on CRF.

Exercise is one of the non-pharmacological interventions for the management of cancer-related fatigue, and several studies have demonstrated its effectiveness in reducing CRF [1,2]. However, the majority of extant studies have focused on face-to-face interventions with individual patients or small groups, which can make it difficult for patients to participate in exercise programs due to time and space constraints or physical limitations [3,4].

Digital health interventions (DHIs) are interventions delivered through digital technologies that are scalable tools to improve the health and healthcare delivery of individuals and populations by promoting effectiveness, efficiency, accessibility, safety, and personalization [5]. Digital health approaches have recently garnered attention as a potential solution to temporal and spatial challenges, with the expectation of expanding the scope of physical activity promotion and self-management in cancer patients [6].

However, there is a paucity of studies that have comprehensively analyzed and summarized digital health-based exercise interventions to manage cancer-related fatigue. Consequently, the present study aimed to review digital health-based physical activity interventions conducted in cancer survivors with fatigue and systematically analyzing their impact on improving CRF.

Methods

The study adhered to the guidelines of the National Evidence based Healthcare Collaborating Agency (NECA) [7] and reported in accordance to PRISMA 2020 reporting guidelines [8]. The protocol for this review was registered on PROSPERO (International Prospective Register of Systematic Review; registered number CRD42022304285).

Study Design

This scoping review selected studies on cancer survivors engaging in physical activities using digital health methods for CRF, and analyzed the findings.

Inclusion and Exclusion Criteria

The key questions for the study were selected according to NECA criteria [7] for Participants, Interventions, Comparisons, and Outcomes (PICO; Textbox 1).

Textbox 1. PICO (Population, Patient, or Problem; Intervention; Comparison)

- P: Cancer survivors (adults aged 18 and older since diagnosis with cancer, excluding pediatric patients)
- I: Exercise/physical activity through a digital health intervention (e.g., mobile app, web-based, wearable device, etc.)
- C: In-person physical activity, no physical activity, or ordinary care
- O: Fatigue, cancer-related fatigue

In addition, the specific inclusion criteria were :(1) experimental design studies with a control group, (2) using digital delivery methods, (3) identifying a physical activity intervention for cancer survivors, (4) reporting fatigue as an outcome, (5) aged 18 and older at diagnosed cancer, and (6) studies published in English.

We excluded studies that did not meet one or more of these criteria, (such as studies without a physical activity component, lacking digital delivery, not involving cancer survivors, without a fatigue outcome, or those that were review or protocol papers.)

Search Strategy

A systematic review of the major databases PubMed, EMBASE, PsycINFO, and Cochrane, was conducted until June 2024. The search formulae comprised MeSH terms and text words, with filtering methods employed to increase specificity based on the characteristics of each database. The search period was not limited for the review, which was based on key questions, and inclusion and exclusion criteria were used to select eligible studies. The search and data collection process was initially consulted with a professional librarian, and reviewed and discussed in research team meetings. The research team was comprised of four PhDs, one graduate student and a professor of nursing. The search terms were the combined keywords "cancer", "digital health", and "cancer-related fatigue" in English in each database (see Appendix 1 for a full list of search terms). Two research team members (authors XX and YY) independently conducted at least one search in each database individually to check for literature matches, and the retrieved articles were collected and organized using the EndNote 21 program.

Study selection

The screening of the collected data was conducted using Covidence [9] through more than 10 research team meetings. The titles and abstracts of the initially retrieved articles were reviewed independently and then the full text of articles that appeared relevant was assessed. Inclusion and exclusion criteria were used to select eligible studies, but in cases of disagreement, the full text was reviewed with the entire team until consensus was reached through comprehensive discussion.

Data Extraction

The data analysis was organized and categorized into tables according to the analysis framework that was created around the objectives of the study. Literature was identified, categorized, and analyzed according to general characteristics (author, publication year, country, sample size, cancer type and stage, fatigue scale, intervention effectiveness), intervention characteristics (intervention method, intervention delivery format).

Results

A total of 4,856 studies were identified based on the search strategy and 3 studies were identified from citation searching. From this total, 932 studies were removed due to duplications. Titles and abstracts of the remaining 655 studies were screened based on the inclusion criteria. Consequently, 638 articles were excluded in the following order: no physical intervention (n=160), no digital health component in the intervention (n=422), no fatigue results (n=26), no control group (n=16), wrong population (n=2), review paper (n=2), and protocol paper (n=10). Ultimately, 20 studies [10-29] were included in the review. (Figure 1)

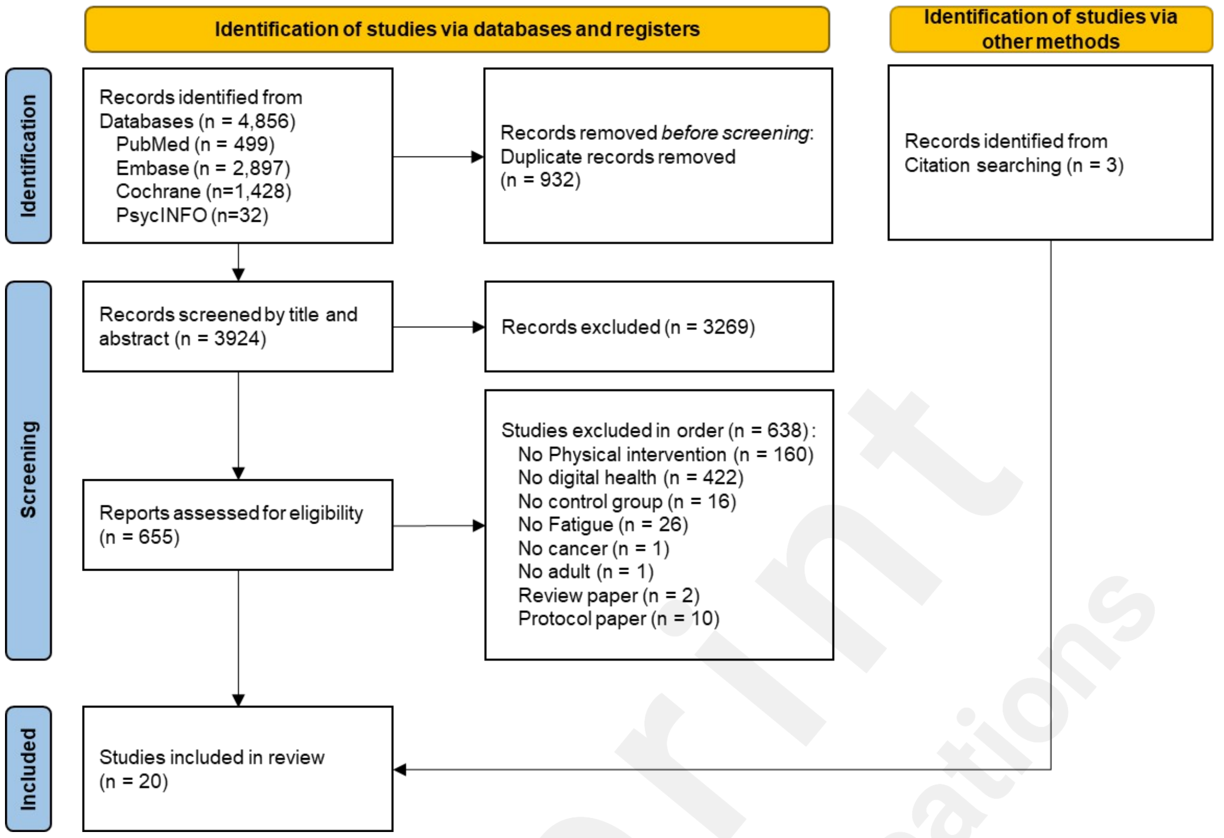

Figure 1. Flow diagram of study selection

Characteristics

The general characteristics of the 20 selected studies are shown in Table 1. The publication dates ranged from 2015 to 2023, with 13 studies (65%) published after 2020. The United States accounted for the largest number of articles, with four studies (20%) [16,17,26,29], followed by three studies (15%) each from Spain [10,13,18] and the Netherlands [14,15,23], and two each (10%) from Brazil [11,27] and China [19,25].

In terms of study design, the majority (17 studies, 85%) were RCTs and three (15%) [27-29] were quasi-experimental design. Nineteen studies were two-arm studies (95%), and only one study (5%) [23] was a three-arm study including an online intervention, blended intervention and control.

Table 1. Overview of included studies (N=20)

First author (Year)	Country	Design	Aim	Sample size	Age (overall)	State of cancer, other special characteristic	Fatigue scale	Within group	Between group	Follow up time	Control Group
Álvarez-Salvago (2023)	Spain	RCT	The therapeutic exercise programs have been sustained for over 5 years and influenced current physical activity levels on fatigue	I=42, C=38	I=48.8, C=49.7	Stage I-IIIA of breast cancer survivors who participated in [Galiano-Castillo, 2016]	PFS	Ti0>Ti1, Tc0>Tc1	Ti0-Ti1 = Tc0-Tc1	1: 5 years after baseline	Usual care
da Silva Alves (2023)	Brazil	RCT	To analyze the influence of exergaming on quality of life, cancer-related fatigue, muscle strength, and endurance in cancer patients undergoing chemotherapy	I=28, C=28	-60.07	Stage 0-III of any cancer including breast, abdominal and pelvic, and gastrointestinal tract cancer patients	FACIT-F	Ti0<Ti1, Tc0>Tc1	Ti1-Ti0 > Tc1-Tc0	1: post intervention	Cross-over
Forbes (2015)	Canada	RCT	To test the feasibility and preliminary efficacy of a web-based physical activity behavior change program among cancer survivors	I=48, C=47	I=64.5, C=65.7 (65.1)	Localized or metastasized breast, prostate, and colorectal cancer survivors	FACT-F	Ti0>Ti1, Tc0>Tc1	Ti0-Ti1 = Tc0-Tc1	1: post intervention	Usual care
Galiano-Castillo (2016)	Spain	RCT	To evaluate the impact of an internet-based exercise intervention on quality of life, pain, muscle strength, and fatigue in breast cancer survivors	I=40, C=41	I=47.4, C=49.2	Stage I, II, IIIA of breast cancer survivors who completed adjuvant therapy	R-PFS	(-)	Ti1<Tc1, Ti2<Tc2	1: post intervention 2: 6-month follow-up	Usual care
Golsteijn (2018)	Netherlands	RCT	To assess the efficacy of a computer-tailored physical activity intervention for prostate and colorectal cancer patients and survivors, evaluating its impact on physical activity, fatigue, and quality of life	I=249, C=229	I=66.6, C=66.4	Prostate and colorectal cancer patients and survivors who were at least 6 weeks post-surgery	CIS	(-)	Ti0-Ti1 > Tc0-Tc1, Ti0-Ti2 > Tc0-Tc2	1: 3 months before the end of the intervention 2: 6 months after intervention	Wait-list

Table 1. Overview of included studies (N=20) (continued)

First author	Country	Design	Aim	Sample size	Age (overall)	State of cancer, other special characteristic	Fatigue scale	Within group	Between group	Follow up time	Control Group	No.
Golsteijn (2023)	Netherlands	RCT	To exploratively examine whether PA was maintained during the 6-month follow-up period in which the experimental group no longer received the intervention and whether PA levels within groups had changed from baseline to the 12-month follow-up	I=249, C=229	I=66.6, C=66.4	Prostate and colorectal cancer patients and survivors who were at least 6 weeks post-surgery. [Golsteijn, 2018]	CIS	Ti1=Ti2, Tc1=Tc2, Ti0>Ti2, Tc0=Ti2	Ti1<Tc1, Ti2<Tc2	1: 6 months after intervention 2: 12 months after intervention	access to Onco Active	[10]
Johnson (2022)	USA	RCT	To test the feasibility of a Fitbit- and Facebook-based physical activity intervention for young adult cancer survivors, assessing its impact on sedentary time and physical activity	I=26, C=23	I=34.1, C=32.9 (33.6)	Any cancer including lymphoma, brain, and breast cancer survivors who had been from 1-5 years completion of active cancer therapy	Fatigue Symptom Inventory	(-)	Severity: Ti1-Ti0 = Tc1-Tc0 Interference: Ti1-Ti0 > Tc1-Tc0	1: post intervention	Usual care	[11]
Lee (2023)	USA	RCT	To evaluate the feasibility of an 8-week supervised telehealth exercise intervention for frail survivors of hematopoietic cell transplantation	I=10, C=10	I=64.8, C=64.7 (64.7)	HCT survivors 2 years after clinical remission, who self-reported as pre-frail or frail	FACIT-Fatigue scale	Ti0=Ti1, Tc0=Tc1	(-)	1: post intervention	Wait-list	[12]
Lozano-Lozano (2023)	Spain	RCT	To compare the clinical effectiveness of a mobile health application with occupational therapy versus mHealth alone on cognitive function, mood, and physical function in cancer survivors	I=40, C=40	I=53.4, C=49.8	Stage I-IIIA of breast cancer survivors who were overweight or obese and completed adjuvant therapy	R-PFS	Ti0<Ti1, Ti0<Ti2, Tc0=Tc1, Tc0=Tc2	Ti0-Ti1 > Tc0-Tc1, Ti0-Ti2 = Tc0-Tc2	1: post intervention 2: 6 months follow up	Usual care	[13]
Lu (2019)	China	RCT	To examine the effects of Baduanjin Qigong exercise on cancer-related fatigue in colorectal cancer patients undergoing chemotherapy, assessing changes in fatigue, function, and sleep quality	I=45, C=45	I=55.6, C=54.6	Stage I-III of colorectal cancer patients who underwent surgical resection of gastrointestinal tumors and suffered from CRF	BFI	(-)	Ti0=Tc0, Ti1=Tc1, Ti2<Tc2	1: 12 weeks after baseline 2: post intervention	Usual care	[14]

Table 1. Overview of included studies (N=20) (continued)

No.(Year)	Aim	Sample size	Age (overall)	State of cancer, other special characteristic	Fatigue scale	Within group	Between group	Follow up time	Control Group
[15]	To determine whether a smartphone-supported high-intensity interval training program improves cardiorespiratory fitness in breast cancer survivors	I=25, C=25	I=48, C=49	Stage I-IIA of breast cancer survivors	CFS	Ti0>Ti1, Tc0<Tc1	Ti0-Ti1 > Tc0-Tc1	1: post intervention	Wait-list
[16]	To examine the effect of augmented-reality-based rehabilitation exercises on physical and functional fitness, cognitive function, fatigue, mood, and quality of life in patients with high-grade glioma undergoing radiotherapy	I=25, C=22	I=45.6, C=60* (*p*<.002)	Stage III or IV glioma patients who were ECOG 0-2	FACIT-Fatigue scale	=Tc2=Ti2, Tc0=Tc1Ti0=Ti1	Ti0-Ti1 = Tc0-Tc1, Ti1-Ti2 = Tc1-Tc2, Ti0-Ti2 = Tc0-Tc2	1: 30 days (after RT) 2: post intervention	Usual care
[17]	To assess the impact of a wearable-based intervention on health-related quality of life and fatigue in breast cancer survivors, focusing on physical activity and sedentary behavior	I=43, C=40	I=61.3, C=61.9 (61.6)	Stage I-III of breast cancer survivors who were inactive and postmenopausal at the time of diagnosis and had completed treatment	FACIT-Fatigue scale	Ti0>Ti1, Ti1=Ti2, Ti1>Ti2, Tc0=Tc1 =Tc2	Ti0-Ti1 > Tc0-Tc1	1: post intervention 2: 12 weeks after intervention	Wait-list
[18]	To evaluate the effectiveness of an internet-based physical activity support program, with and without physiotherapist telephone counseling, for breast and prostate cancer survivors	online I=45, blend I=46, C=46	online I=59.3, blend I=59.8, C=59.2	Breast and prostate cancer survivors who had completed primary curative treatment 3–36 months earlier	MFI	(-)	Toi0-Toi1 = Tc0-Tc1, Tbi0-Tbi1 = Tc0-Tc1	1: post intervention	Usual care
[19]	To investigate the impact of home-based exergaming on physical function, quality of life, and fatigue in prostate cancer patients on androgen deprivation therapy	I=23, C=23	I=67.6, C=69.8	Stage T1c-T3c of prostate cancer patient receiving continuous ADT for over 3 months	FACT-F subscale fatigue	(-)	Ti0-Ti1 = Tc0-Tc1	1: post intervention	Usual care

Table 1. Overview of included studies (N=20) (continued)

No.	First author (Year)	Country	Design	State of cancer, other special characteristic	Fatigue scale	Within group	Between group	Follow up time	Control Group
[20]	Ochi (2022)	Japan	RCT	Stage IV to II and below of nasopharyngeal carcinoma patients who prescribed radiotherapy and chemotherapy and were KPS 80-100 and ECOG score 0-1	MFI	Ti0>Ti1, Tc0>Tc1	Ti0-Ti1 = Tc0-Tc1	1: post intervention	Wait-list
[21]	Pieczy ´nska (2023)	Poland	RCT	Stage 0-IV and any cancer including breast, head or neck, and sarcoma patients	SCFS-6	(-)	Ti0=Tc0, Ti0-Ti1 > Tc0-Tc1	1: post intervention	Wait-list
[22]	Vallance (2020)	Australia	RCT	Stage 0-III of any cancer including breast, gastrointestinal, ovarian, and prostate cancer patients who were undergoing or having previously undergone radiotherapy or chemotherapy	FACIT-F (total and fatigue subscale)	=Tc2, Ti0<Ti1, Ti0<Ti2, Ti1<Ti2, Tc0=Tc1, Ti0<Ti2, Tc0=Tc1(FIE)	(G*E)< Tc0, Ti <Tc (G*E), Ti0<Tc0, Ti1<Tc1, Ti2<Tc2, Ti < Tc	1: 10 sessions complete 2: post intervention (20 sessions complete)	(-)
[23]	van de Wiel (2021)	Netherlands	RCT	Stage 0-IV of breast cancer survivors who completed primary cancer treatment and ECOG <3	EORTC QLQ C-30 fatigue subscale	Ti0>Ti1, Tc0>Tc1	Ti0-Ti1 = Tc0-Tc1	1: post intervention	Usual care
[24]	Villumsen (2019)	Denmark	RCT	Stage II-IV of squamous cell carcinoma in head and neck region patients who were not chronic medical conditions in immune system and were not regularly using immunosuppressive medications	MFI	Ti0=Ti1, Tc0=Tc1	Ti0=Tc0, Ti1=Tc1, Ti0-Ti1> Tc0-Tc1	1: post intervention	Usual care

No.	First author (Year)	Country	Design	Aim	Sample size	Age (overall)
[25]	Wen (2023)	China	RCT	To evaluate the effects of traditional Chinese Baduanjin Qigong exercises on the physical and psychological recovery of patients with nasopharyngeal carcinoma after chemoradiotherapy	I=44, C=44	I=45.6, C=47.0
[26]	Wilkie (2022)	USA	RCT	To evaluate the effects of a tablet-based exercise education program on cancer-related fatigue in patients, comparing it with usual care	I=142, C=137	I=52.3, C=52.3
[27]	Oliveira (2018)	Brazil	Quasi-experimental study	To assess the effects of an exergaming protocol on cancer-related fatigue, function, daily activities, and electromyographic patterns in cancer patients undergoing or having completed treatment	I=19, C=19	I=61.5, C=57.6
[28]	Uhm (2017)	South Korea	Quasi-experimental study	To investigate and compare the effects of mobile health with pedometer and conventional exercise education brochure on physical function and quality of life in breast cancer patients	I=179, C=177	I=49.3, C=51.3 (50.3)
[29]	Xiao (2020)	USA	Quasi experimental study	To explore the effects of a combined aerobic and resistance exercise program on fatigue and inflammatory/epigenetic changes in head and neck cancer patients undergoing radiotherapy	I=12, C=14	I=57, C=56

BFI: Brief Fatigue Inventory; C: control group; CIS: Checklist Individual Strength; CFS: Chalder Fatigue Scale; EORTC QLQ C-30: European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire C-30; FACIT-F: Functional Assessment of Chronic Illness Therapy-Fatigue; FACT-F: Functional Assessment of Cancer Therapy-Fatigue; I: intervention group; MFI: Multidimensional Fatigue Inventory; PFS: Piper Fatigue Scale; R-PFS: Piper Fatigue Scale-revised; SCFS-6: Schwartz Cancer Fatigue Scale-6

All studies reported aiming to determine the feasibility and suitability of the developed interventions or to evaluate their effectiveness. Two studies [10,15] were conducted to ascertain long-term effect of the previous studies [13,14].

The total number of participants was 2,657 with a range of 20-478 participants per article. The most common cancer type was breast cancer [10,12,13,18,20,22,23,28] with eight studies (40%), followed by prostate cancer [12,14,15,23] and colorectal cancer [12,14,15,19]. Ten studies (50%) [10,12,13,16-18,20,22,23,28] focused on cancer survivors finishing intensive initial therapy, eight studies (40%) [11,19,21,24-27,29] focused on patients receiving active cancer treatment or post-treatment phase who were still referred to as patients in the study context, and two (10%) [14,15] included both cancer survivors and patients. The majority of studies reported comparable mean age of participants within the intervention and control groups; however, one study showed significant differences [21]. This study that randomized 72 participants into two groups of 36 participants, over 30% of each group—11 and 14 participants in the intervention and control groups, respectively—dropped out due to withdrawal, recurrence of cancer, and death.

For the control group, most studies used wait-list and usual care [10,12-14,16-26,28,29]of which two studies gave control participants wearable devices without specification [16,20], and two studies allowed access to the mobile application [16,18]. The remaining studies examined long-term effects and permitted controls to access the intervention [15] or employed a cross-over approach [11]. One study did not describe the control group [27].

Various fatigue measurements were used in assessments. The most frequently utilized scale was the Functional Assessment of Chronic Illness Therapy-Fatigue Scale (FACIT-Fatigue scale) [17,21,22,27] (20%), followed by the Piper Fatigue Scale (PFS) [10,13,18] and Multidimensional Fatigue Inventory (MFI) [23,25,29], each reported in three studies (15%). Other measures include the Checklist Individual Strength (CIS) [14,15], and Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-F) [11,27], each used in two studies (10%). Instruments only reported once (5%) include the Brief Fatigue Inventory (BFI) [19], Chalder Fatigue Scale (CFS) [20], European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire C-30 (EORTC QLQ C-30) fatigue subscale [28], Fatigue Symptom Inventory [16], Functional Assessment of Cancer Therapy-Fatigue (FACT-F) [12], FACT-F subscale fatigue [24], and the Schwartz Cancer Fatigue Scale-6 (SCFS-6) [26]. All studies employed fatigue as the primary variable, with the exception of one study [28], where the primary variable was quality of life and fatigue was reported as a subscale of EORTC QLQ C-30 [28].

Efficacy on Fatigue

Excluding two studies that examined the long-term outcome of the intervention [10,15], 18 interventions were analyzed. In all studies, fatigue was measured a total of 28 times after baseline: 17 measurements [11-13,16-29] occurred immediately at the conclusion of the intervention, four measurements [14,19,21,27] occurred during the intervention, six measurements [13-15,18,22] focused on longer-term effects between three- and twelve-months post-intervention, and one study [10] evaluated an ultra-long-term effect five years later.

A total of 12 studies (comprising 11 interventions) reported a statistically significant reduction in CRF in the intervention group compared with the control group. Excluding two studies—one [14] that measured intervention effects one month before and two months after the intervention, and another [15] that assessed long-term effects—the remaining ten studies [11,13,16,18-20,22,26,27,29] measured outcomes after the intervention and the fatigue reduction was significantly effective. Of these ten studies, two [19,27] assessed changes in fatigue during the intervention period, one [27] of which observed a significant reduction in fatigue. Of the three studies [13,18,22] that assessed long-term effects, one [13] found a significant benefit in fatigue reduction at six months. In one study [10] that examined outcomes five years after the intervention, building on its original report [13] showing significant results at the six-month mark, no statistically significant improvement in fatigue was noted at the ultra-long-term assessment.

Among the 11 interventions demonstrating statistically significant fatigue reduction, four [18-20] employed a mobile application, three [16,22,29] used a wearable device, two [13,14] used web pages, two [11,27] used Xbox, and one [26] used software. With respect to the mode of delivery, six interventions [17-20,25,28] were administered via a mobile application; four [12-14,23] through web pages; three [16,22,29] using a wearable device (wristband-type activity monitor); three [11,24,27] via Xbox, all using the "Your Shape Fitness" program; one [21] with an augmented reality (AR) device; and one [26] via software that could not be classified as strictly mobile application- or web-based.

Table 2. Summary of intervention characteristics

No.	First author (Year)	Intervention Name & Type	Physical Activity Type	Digital Therapeutics & Delivery Method	Intervention Description	Duration	Frequency	Session Duration	ESF
[10]	Álvarez-Salvago (2023)	E-CUIDATE system	Same as Galiano-Castillo (2016)						
[11]	da Silva Alves (2023)	Exergaming	Aerobic exercise	Xbox: Your Shape Fitness Evolved	An Xbox Kinect-based exergaming program for cancer patients undergoing chemotherapy, improving muscle strength and fatigue	20 sessions	2-3 times/week	(-)	C
[12]	Forbes (2015)	UCAN (UWALK website)	Walking, stair climbing	Web-pages	9-module behavior change program with PA tracking, video guidance, and weekly email updates	9 weeks	Self-paced	Self-paced	B
[13]	Galiano-Castillo (2016)	E-CUIDATE system	Aerobics and resistance training	Web-pages	An online system for remote rehabilitation. It is consists of a public interface, which is the homepage with updated information of breast cancer, and a private interface, which could receive personalized exercise programs	8 weeks	3 times/week	90min/time	C
[14]	Golsteijn (2018)	OncoActive	General physical activity encouragem ent	Web-pages	A web-based, computer-tailored PA intervention, providing personalized feedback (BL, 2/3 months) and PA tracking	4 months	PA advice: 3 time points	(-)	C
[15]	Golsteijn (2023)	OncoActive	Same as Golsteijn (2018)						
[16]	Johnson (2022)	Fitbit & Facebook PA Intervention	Walking and general PA	Wearable Device: Fitbit Flex	An intervention using Fitbit and a Facebook support group to encourage physical activity among young adult cancer survivors	12 weeks	Daily tracking	150 min/week	C
[17]	Lee (2023)	Telehealth exercise	Aerobics and strength training	Mobile application	A supervised telehealth exercise program for frail hematopoietic cell transplant	8 weeks	3 times/week	30-60 min	C

					survivors, aiming to improve gait speed and function				
[18]	Lozano-Lozano (2023)	BENECA mHealth app	Multimodal rehabilitation exercises	Mobile application	A mobile health application combined with occupational therapy to improve cognitive function, mood, and physical function	8 weeks	Self-paced and guided	Self-paced	C
[19]	Lu (2019)	Baduanjin exercise	Baduanjin	Mobile application: WeChat	A traditional Chinese medicine-based exercise regimen was given face-to-face during hospitalization, and patients were asked to upload everyday log via the WeChat app, and each video was uploaded by every week	24 weeks	Hospitaliz-ation: 5 times/week Chemothe-rapy period: upload everyday log	Hospitaliz-ation: 20-40 min	C
[20]	Ochi (2022)	Habit-B programme	High-Intensity Interval Training (HIIT)	Mobile application	A smartphone-supported home-based high-intensity interval training program	12 weeks	3 times/week (daily tracking)	Varies	C
[21]	Pieczyńska (2023)	Augmented-reality-based-rehabilitation-exercise	Supervised hospital and home-based exercises	Augmented reality device	A monitor-augmented reality-based rehabilitation exercise program for patients with high-grade glioma undergoing radiotherapy. The study assessed physical fitness, cognitive function, fatigue, and mood	30 days in hospital and 3 months at home	5 times/week	60 min	C
[22]	Vallance (2020)	ACTIVATE	General PA including walking	Wearable Device: Garmin Vivofit 2	A wearable technology-based intervention. Participants received behavioral goal setting and five telephone coaching sessions, and wearable technology activity monitoring	12 weeks	Self-monitored and 5 phone calls	Self-paced	C
[23]	van de Wiel (2021)	Internet-based PA support program (IPAS)	Aerobic and resistance exercise	Web-pages	An internet-based PA support program (IPAS) for breast and prostate cancer survivors, with and without physiotherapist	6 months	Monthly	(-)	C

					telephone counseling				
[24]	Villumsen (2019)	Home-based exergaming	Resistance and aerobic training	Xbox: Your Shape Fitness Evolved	The program was unsupervised exergaming with Xbox Kinect	12 weeks	3 times/week	60 min	B
[25]	Wen (2023)	Baduanjin	Baduanjin	Mobile application	A Baduanjin Qigong exercise program for nasopharyngeal carcinoma patients post-chemoradiotherapy, focusing on improving quality of life, reducing fatigue, and alleviating complications	12 weeks	5 days/week, 40 min/day	40 min	C
[26]	Wilkie (2022)	Fatigue*U*Cope	Walking	Software	A tablet-based multimedia education and exercise prescription program for managing cancer-related fatigue	4 weeks	Self-paced (start with 4 days/week)	Varies	C
[27]	Oliveira (2018)	Exergaming	Aerobic exercise	Xbox: Your Shape Fitness Evolved	An exergaming protocol using Xbox 360 Kinect included 20 sessions of exergaming, focusing on aerobic exercise	8-10 weeks	2-3 times/week (20 session)	50 min	C
[28]	Uhm (2017)	mHealth with pedometer	Walking	Mobile application: Smart After Care	A mobile health intervention using a pedometer and a developed smartphone application to monitor and provide information on prescribed exercises	12 weeks	Aerobic exercise: 90-150 min/week Resistance exercise:2 times/week	(-)	C
[29]	Xiao (2020)	Home-based, combined aerobic resistance exercise	Aerobic and resistance training	Wearable Device: Fitbit Charge 2	The intervention included aerobic exercise and progressive resistance training. The aerobic exercise was tracked with a multi-sensory wristband and based on data research team gave the feedback during weekly clinic visit or by telephone	12 weeks	Aerobic exercise: 5 times/week Progressive resistance training: 2 times/week	Aerobic: 30 min Progressive resistance training: 20-60 min	C

ESF: Evidence Standards Framework

Interventions were graded according to the Evidence Standards Framework (ESF) [30]. Eighteen of the 20 studies [10,11,13-23,25-29] were grade C, i.e., treatment or diagnosis-focused and two studies [12,24] were grade B, i.e, focused on supporting patients' self-management and wellness. There was no grade A which aimed to save cost and time for staff. This is likely due to the selected research being focused on the physical activity of people following cancer diagnosis.

Discussion

Principal Results

This scoping review of studies that implemented digital interventions for cancer survivors with CRF as the main variable, found that the interventions were overall significant in alleviating CRF. Although digital interventions can yield meaningful short-term improvements, long term effectiveness may diminish without additional reinforcement or continued engagement strategies. This emphasizes the importance of designing follow-up systems such as booster sessions, hybrid delivery models, or ongoing motivational supports to maintain benefits over time.

Most of the interventions focused on breast cancer survivors. The prevalence of CRF and its significant symptoms in breast cancer have been reported as relating to a wide range of potential etiologies, including pathophysiologic issues such as neutropenia, and emotional factors such as family support, spousal care, and depression [31]. However, given that breast cancer patients are often overrepresented in cancer-related programs and studies, future CRF intervention programs should actively plan to recruit other cancer types. This approach is essential for comprehensively assessing the variability in fatigue patterns across different cancer types and in both male and female patients. This would also allow for elucidating potential gender-based differences and the impact of interventions tailored to specific cancer types.

According to previous study [32], common CRF interventions for cancer patients can be divided into activity-based interventions, which include professionally supervised programs and home-based programs designed to promote exercise, and psychological interventions, which include cognitive behavioral therapy, supportive therapy, supportive expressive therapy, and psychoeducation. Although this study did not compare CRF interventions using digital health with those employing non-digital methods, digital health may become a more feasible way to deliver CRF interventions as it becomes more widespread.

Considering that the CRF digital health interventions were most often mobile application-based and that many studies included participants between the ages of 40 and 60, generalizability of the findings may be constrained. Future research encompassing a more diverse sample of age groups and intervention types, extending beyond physical activities to include modalities from psycho-oncology, such as AR, could further examine the potential to enhance engagement and address fatigue through immersive and interactive strategies. Emerging technologies such as AR, virtual reality (VR), and mixed reality (MR) offer promising avenues for immersive and interactive fatigue management, yet challenges related to accessibility, digital literacy, and acceptance across age groups remain. Because patients' ability to engage with digital health interventions varies, leading to unequal outcomes, strategies to improve digital health literacy are essential. Efforts should include education, expanded access to devices and information for under-resourced populations, and quality management of digital health information, enabling more equitable and tailored approaches for diverse survivor groups.

In addition, many interventions were ESF classification tier C, digital health treatments with direct health outcomes. Digital health has enormous potential to improve the ability to accurately diagnose and treat diseases, as well as empower individuals to manage their own health. There is a need to develop CRF interventions not only for direct health outcomes of cancer patients, but also for tier B, i.e., assisting cancer survivors to manage their health and wellness. In the medium to long-term, incorporating self-management components such as symptom monitoring tools, personalized feedback, and behavioral goal setting will be powerful ways for patients to manage their varying capabilities, and reduce disparities in health outcomes.

It is also expected that individuals may or may not be able to undertake these digital health interventions depending on their capabilities, resulting in different health outcomes. A multidimensional strategy to increase the digital health literacy of cancer cancer survivors should be planned, including providing education to increase digital health literacy, providing access to devices and information for under-resourced populations, and further institutionalizing the quality management of digital health information [33].

Comparison with prior work

Previous systematic reviews and meta-analyses on CRF [34,35] have centered on specific interventions, such as physical exercise or progressive muscle relaxation therapy (PMRT), and have not thoroughly investigated a range of exercise interventions with a digital health emphasis. One study exclusively focused on breast cancer patients and aimed to ascertain the efficacy of exercise type and intensity in mitigating cancer fatigue, with the objective of providing optimal exercise prescriptions [35]. However, this study focused on exercise-specific components of a non-digital exercise intervention, and other intervention components were not systematically assessed. Another study explored the impact of PMRT to alleviate cancer fatigue in patients with various types of cancer [34]. However, it also did not address the subject from a digital health perspective and was limited to relaxation-focused interventions rather than exercise.

In contrast, the present study incorporated a comprehensive sample of patients with various cancer types and focused on digital technology-based interventions for CRF. Consequently, this study offers a valuable perspective on the recent trends and technological possibilities for CRF management in cancer patients, especially across various time frames, encompassing short-, medium-, long-term, and ultra-long-term effects. This comprehensive approach has provided substantial and pragmatic evidence concerning the sustainability and long-term implications of digital health exercise interventions for alleviating CRF. A distinguishing feature of this study is its emphasis on the detail of digital health interventions to furnish a reproducible framework that future researchers could use. Study findings confirm the feasibility and clinical value of digital health-based exercise interventions as a strategy to manage CRF.

Limitations

There are some limitations that should be considered. Despite employing a comprehensive search strategy, the selection of articles was constrained to those written in English, which may have resulted in the exclusion of pertinent literature. Moreover, given that the present review exclusively encompassed studies wherein physical activity constituted the primary focal point of the intervention, multi-component interventions were found to be underrepresented. This may have diminished our capacity to discern the particular effects of physical activity within a multi-component framework.

Conclusions

This scoping review summarized the characteristics and effectiveness of digital health interventions for managing CRF. We found that interventions predominantly involved breast cancer patients and frequently employed mobile- or web-based platforms, followed by wearable devices, and an adapted traditional face-to-face approach. Findings can be used by practitioners as they consider the integration of digital health tools to deliver both activity-based and psychological interventions for alleviating CRF. In addition, practitioners can respond to the shortcomings identified in this review by actively exploring strategies to engage and include diverse cancer types and underserved populations. This study confirms the feasibility and clinical value of digital health-based exercise interventions as a strategy to manage cancer fatigue and suggest future research directions. Future research should also include the development of multi-component interventions that encompass psychosocial as well as physical activities; and supporting patients' digital health literacy.

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Authors' Contributions

YK and SK generated the original idea for the study. YK arranged the search results for screening. YK, KRB, JHS, YHK, and SK screened the articles and extracted the original data. YK refined the tables, and all other authors reviewed it. Original draft was written by BKR and YK and edited by SK and YK. All the authors commented on and approved the manuscript before its submission.

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Conflicts of interest

None declared.

Data Availability

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

Abbreviations

CRF: Cancer-related fatigue
DHI: Digital health intervention

Multimedia Appendix 1

Full list of search terms
[EXEL File, Multimedia Appendix 1]

Multimedia Appendix 2

PRISMA ScR Checklist
[WORD File, Multimedia Appendix 2]

References

1. Chen X, Li J, Chen C, et al. Effects of exercise interventions on cancer-related fatigue and quality of life among cancer patients: a meta-analysis. BMC Nursing 2023;22(1):200. [doi:10.1186/s12912-023-01363-0]
2. Herranz-Gómez A, Cuenca-Martínez F, Suso-Martí L, et al. Effectiveness of therapeutic exercise models on cancer-related fatigue in patients with cancer undergoing chemotherapy: a systematic review and network meta-analysis. Arch Phys Med Rehabil 2023;104(8):1331-1342. [doi:10.1016/j.apmr.2023.01.008]
3. Murtezani A, Ibraimi Z, Bakalli A, Krasniqi S, Disha ED, Kurtishi I. The effect of aerobic exercise on quality of life among breast cancer survivors: a randomized controlled trial. J Cancer Res Ther 2014;10(3):658-664. [doi:10.4103/0973-1482.137985] [PMID:25313756]
4. Adams SC, DeLorey DS, Davenport MH, Fairey AS, North S, Courneya KS. Effects of high-intensity interval training on fatigue and quality of life in testicular cancer survivors. Br J Cancer 2018;118(10):1313-1321. [doi:10.1038/s41416-018-0044-7] [PMID:29736007]
5. Murray E, Hekler EB, Andersson G, et al. Evaluating digital health interventions: key questions and approaches. Am J Prev Med 2016;51(5):843-851. [doi:10.1016/j.amepre.2016.06.008] [PMID:27745684]
6. Kasoju N, Remya NS, Sasi R, et al. Digital health: trends, opportunities and challenges in medical devices, pharma and bio-technology. CSIT 2023;11(1):11-30. [doi:10.1007/s40012-023-00380-3]
7. Kim SY, Park JE, Seo HJ, Seo HS, Son HJ, Shin CM. NECA's guidance for undertaking systematic reviews and meta-analyses for intervention. National Evidence-based Healthcare Collaborating Agency; 2011. [ISBN:9788994581590]

8. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. [doi:10.1136/bmj.n71]
9. Veritas Health Innovation. Covidence systematic review software. Veritas Health Innovation. Accessed August 24, 2025. https://www.covidence.org
10. Alvarez-Salvago F, Jimenez-Garcia JD, Martinez-Amat A, et al. Does participation in therapeutic exercise programs after finishing oncology treatment still ensure an adequate health status for long-term breast cancer survivors? A >/= 5 years follow-up study. Support Care Cancer 2023;31(6):343. [doi:10.1007/s00520-023-07801-8] [PMID:37199790]
11. da Silva Alves R, de Carvalho JM, Borges JBC, Nogueira DA, Iunes DH, Carvalho LC. Effect of Exergaming on Quality of Life, Fatigue, and Strength and Endurance Muscle in Cancer Patients: A Randomized Crossover Trial. Games Health J 2023;12(5):358-365. [doi:10.1089/g4h.2022.0161] [PMID:37155685]
12. Forbes CC, Blanchard CM, Mummery WK, Courneya KS. Feasibility and Preliminary Efficacy of an Online Intervention to Increase Physical Activity in Nova Scotian Cancer Survivors: A Randomized Controlled Trial. JMIR Cancer 2015;1(2):e12. [doi:10.2196/cancer.4586] [PMID:28410166]
13. Galiano-Castillo N, Cantarero-Villanueva I, Fernandez-Lao C, et al. Telehealth system: A randomized controlled trial evaluating the impact of an internet-based exercise intervention on quality of life, pain, muscle strength, and fatigue in breast cancer survivors. Cancer 2016;122(20):3166-3174. [doi:10.1002/cncr.30172] [PMID:27332968]
14. Golsteijn RHJ, Bolman C, Volders E, Peels DA, de Vries H, Lechner L. Short-term efficacy of a computer-tailored physical activity intervention for prostate and colorectal cancer patients and survivors: a randomized controlled trial. Int J Behav Nutr Phys Act 2018;15(1):106. [doi:10.1186/s12966-018-0734-9] [PMID:30376857]
15. Golsteijn RHJ, Bolman C, Peels DA, Volders E, de Vries H, Lechner L. Long-term efficacy of a computer-tailored physical activity intervention for prostate and colorectal cancer patients and survivors: A randomized controlled trial. J Sport Health Sci 2023;12(6):690-704. [doi:10.1016/j.jshs.2023.08.002] [PMID:37591482]
16. Johnson AM, Baker KS, Haviland MJ, et al. A Pilot Randomized Controlled Trial of a Fitbit- and Facebook-Based Physical Activity Intervention for Young Adult Cancer Survivors. J Adolesc Young Adult Oncol 2022;11(4):379-388. [doi:10.1089/jayao.2021.0056] [PMID:34677081]
17. Lee K, Shamunee J, Lindenfeld L, et al. Feasibility of implementing a supervised telehealth exercise intervention in frail survivors of hematopoietic cell transplantation: a pilot randomized trial. BMC Cancer 2023;23(1):390. [doi:10.1186/s12885-023-10884-5] [PMID:37127595]
18. Lozano-Lozano M, Galiano-Castillo N, Gonzalez-Santos A, et al. Effect of mHealth plus occupational therapy on cognitive function, mood and physical function in people after cancer: Secondary analysis of a randomized controlled trial. Ann Phys Rehabil Med 2023;66(2):101681. [doi:10.1016/j.rehab.2022.101681] [PMID:35671976]
19. Lu Y, Qu HQ, Chen FY, et al. Effect of Baduanjin Qigong Exercise on Cancer-Related Fatigue in Patients with Colorectal Cancer Undergoing Chemotherapy: A

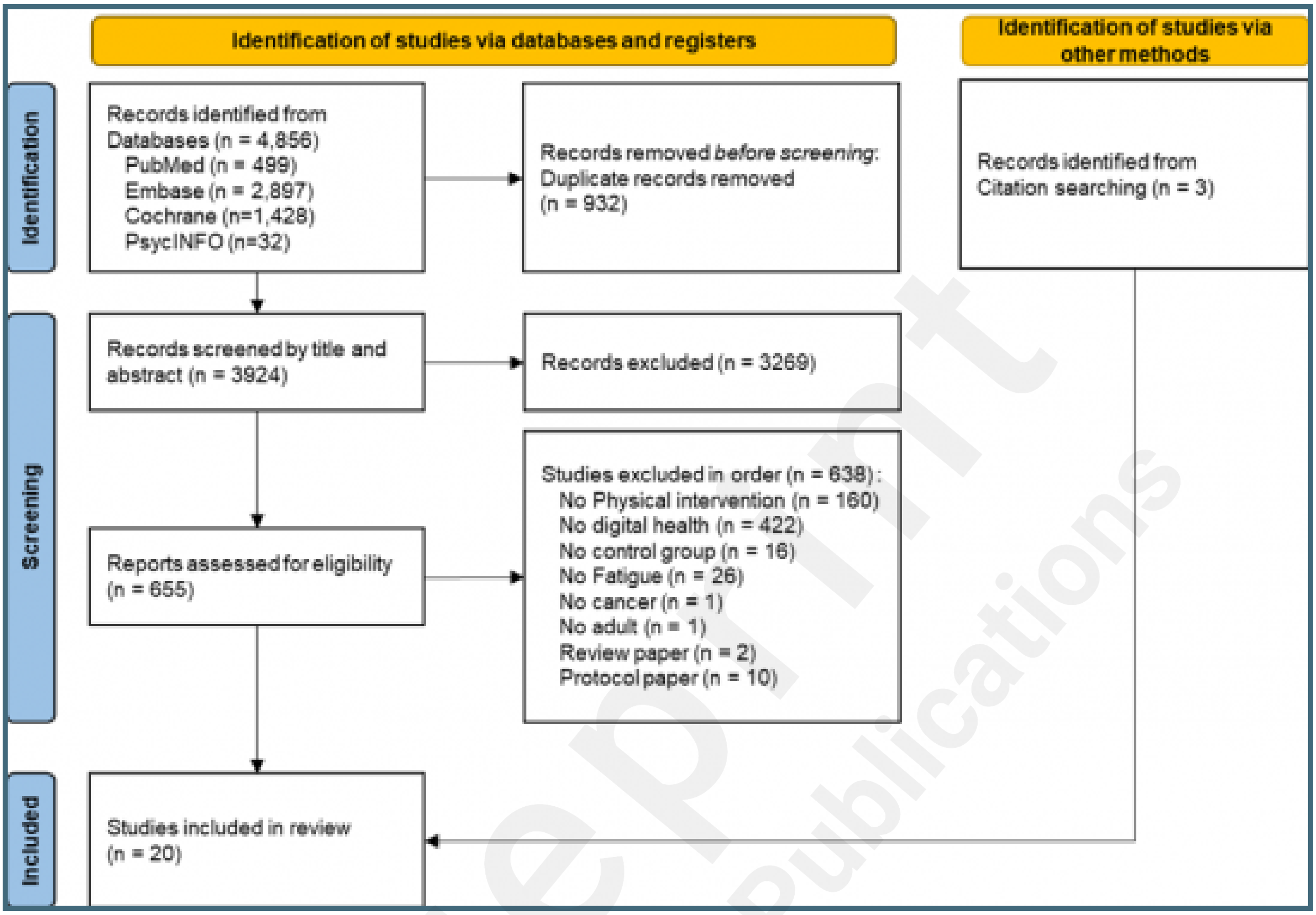
Randomized Controlled Trial. Oncol Res Treat 2019;42(9):431-439. [doi:10.1159/000501127] [PMID:31266043]
20. Ochi E, Tsuji K, Narisawa T, et al. Cardiorespiratory fitness in breast cancer survivors: a randomised controlled trial of home-based smartphone supported high intensity interval training. BMJ Support Palliat Care 2022;12(1):33-37. [doi:10.1136/bmjspcare-2021-003141] [PMID:34389552]
21. Pieczyńska A, Zasadzka E, Pilarska A, Procyk D, Adamska K, Hojan K. Rehabilitation Exercises Supported by Monitor-Augmented Reality for Patients with High-Grade Glioma Undergoing Radiotherapy: Results of a Randomized Clinical Trial. J Clin Med 2023;12(21). [doi:10.3390/jcm12216838]
22. Vallance JK, Nguyen NH, Moore MM, et al. Effects of the ACTIVity And TEchnology (ACTIVATE) intervention on health-related quality of life and fatigue outcomes in breast cancer survivors. Psychooncology 2020;29(1):204-211. [doi:10.1002/pon.5298] [PMID:31763746]
23. van de Wiel HJ, Stuiver MM, May AM, et al. Effects of and Lessons Learned from an Internet-Based Physical Activity Support Program (with and without Physiotherapist Telephone Counselling) on Physical Activity Levels of Breast and Prostate Cancer Survivors: The PABLO Randomized Controlled Trial. Cancers (Basel) 2021;13(15). [doi:10.3390/cancers13153665] [PMID:34359567]
24. Villumsen BR, Jorgensen MG, Frystyk J, Hordam B, Borre M. Home-based 'exergaming' was safe and significantly improved 6-min walking distance in patients with prostate cancer: a single-blinded randomised controlled trial. BJU Int 2019;124(4):600-608. [doi:10.1111/bju.14782] [PMID:31012238]
25. Wen L, Chen X, Cui Y, Zhang M, Bai X. Effects of Baduanjin exercise in nasopharyngeal carcinoma patients after chemoradiotherapy: a randomized controlled trial. Support Care Cancer 2023;31(1):79. [doi:10.1007/s00520-022-07548-8] [PMID:36562869]
26. Wilkie DJ, Schwartz AL, Liao WC, et al. Reduced Cancer-Related Fatigue after Tablet-Based Exercise Education for Patients. Cancer Control 2022;29:10732748221087054. [doi:10.1177/10732748221087054] [PMID:35414203]
27. Oliveira PF, Iunes DH, Alves RS, Carvalho JM, Menezes FS, Carvalho LC. Effects of Exergaming in Cancer Related Fatigue in the Quality of Life and Electromyography of the Middle Deltoid of People with Cancer in Treatment: A Controlled Trial. Asian Pac J Cancer Prev 2018;19(9):2591-2597. [doi:10.22034/APJCP.2018.19.9.2591] [PMID:30256065]
28. Uhm KE, Yoo JS, Chung SH, et al. Effects of exercise intervention in breast cancer patients: is mobile health (mHealth) with pedometer more effective than conventional program using brochure? Breast Cancer Res Treat 2017;161(3):443-452. [doi:10.1007/s10549-016-4065-8] [PMID:27933450]
29. Xiao C, Beitler JJ, Higgins KA, et al. Pilot study of combined aerobic and resistance exercise on fatigue for patients with head and neck cancer: Inflammatory and epigenetic changes. Brain Behav Immun 2020;88:184-192. [doi:10.1016/j.bbi.2020.04.044] [PMID:32330594]
30. NICE. Evidence standards framework for digital health technologies. Accessed April 1, 2025. https://www.nice.org.uk/corporate/ecd7

31. Bower JE, Wiley J, Petersen L, Irwin MR, Cole SW, Ganz PA. Fatigue after breast cancer treatment: Biobehavioral predictors of fatigue trajectories. Health Psychol 2018;37(11):1025-1034. [doi:10.1037/hea0000652] [PMID:30321021]
32. Jacobsen PB, Donovan KA, Vadaparampil ST, Small BJ. Systematic review and meta-analysis of psychological and activity-based interventions for cancer-related fatigue. Health Psychol 2007;26(6):660-667. [doi:10.1037/0278-6133.26.6.660] [PMID:18020836]
33. Choi E, Ryu S, Chun H, Kwak W, Choi SK. Personal Competence Factors Associated with Better Access to Digital Health. Korea Institute for Health and Social Affairs; 2022.
34. Wang Y, Yang L, Lin G, et al. The efficacy of progressive muscle relaxation training on cancer-related fatigue and quality of life in patients with cancer: A systematic review and meta-analysis of randomized controlled studies. Int J Nurs Stud 2024;152:104694. [doi:10.1016/j.ijnurstu.2024.104694] [PMID:38281450]
35. Zhou R, Chen Z, Zhang S, et al. Effects of Exercise on Cancer-Related Fatigue in Breast Cancer Patients: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. Life (Basel) 2024;14(8). [doi:10.3390/life14081011] [PMID:39202753]

Supplementary Files

Figures

Flow diagram of study selection.



Multimedia Appendixes

Full list of search terms.
URL: http://asset.jmir.pub/assets/ea509e4e83ed9263d53feda87a993dab.xlsx

PRISMA ScR Checklist.
URL: http://asset.jmir.pub/assets/8eee07640250fb7998ff0463a2f65ea5.docx