

Rehabilitation interventions for young adult cancer survivors: A scoping review

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Abstract

Objective: To map existing research concerning rehabilitation interventions for young adult cancer survivors (YACS) that address at least one factor from the biopsychosocial health model.

Design: Scoping review.

Data sources: Searches were performed in EMBASE, MEDLINE, PsycINFO, CINAHL and Cochrane in January 2022 and updated in March 2023, and grey literature between February and April 2022.

Methods: The review followed Joanna Briggs Institute's methodology for scoping reviews. Quantitative, qualitative and mixed methods studies evaluating interventions for YACS of any cancer who had completed primary treatment and were between 18 and 39 years old at diagnosis were included. Two authors independently screened studies for eligibility, and standardised forms were used for data extraction. Descriptive statistics, narrative summaries and thematic analysis were used to analyse the data.

Results: The search revealed 5706 records, of which 70 were full-text screened. The 20 included studies represented a heterogeneous group of 444 young adults with different cancer types, mean age above 25, and an overrepresentation of females. Most studies were feasibility and pilot studies. The 20 studies consisted of 14 unique interventions focusing primarily on one dimension of the biopsychosocial health model like biological or psychological factors. In the 14 interventions, the most frequent intervention element was peer-to-peer support ($n = 12$). The interventions were often delivered online ($n = 9$), lasting 3–12 months ($n = 8$). A wide variety of theories, providers and outcome measures were used.

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Conclusion: The results show that current research on multicomponent, biopsychosocial and age-specific rehabilitation for YACS remains at an early stage.

Keywords

Rehabilitation, cancer, young adults

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Introduction

Young adult cancer survivors (YACS) aged 18–39 years old who have completed primary cancer treatment¹ face multiple physical and psychological long-term effects.^{2,3} These effects can persist many years into survival and impact their future career, financial status, intimate relationships and health-related quality of life.^{4–6} YACS often have a higher risk of long-term effects than child, middle-aged and older cancer survivors.^{7–9} In addition, YACS differ markedly from other cancer age groups because cancer strikes during a critical developmental phase of their lives when they are often establishing relationships and a family, finishing education and are in the early stages of gaining employment and developing a career.⁵ Although YACS comprise around only 5% of the total cancer population, adequate age-specific rehabilitation for YACS is needed addressing their unique and complex biopsychosocial challenges.^{10–12}

Rehabilitation is usually defined as a complex problem-solving process focusing on the dynamic interaction between biological, psychological and social factors to improve functioning and participation, and is grounded in the biopsychosocial model of health and the International Classification of Functioning, Disability and Health.^{13–17} Research has shown that physical and psychosocial rehabilitation interventions may improve participation in everyday life and health-related quality of life in older adults with cancer.^{18,19} Despite this knowledge and the growing recognition of the need for age-specific rehabilitation for YACS, no review has so far provided a comprehensive overview of existing interventions addressing all factors of the biopsychosocial model of health, which is necessary to meet the multifactorial challenges that YACS face in everyday life.^{20–23} Such

knowledge could provide valuable evidence to inform future evidence-based rehabilitation for YACS. The objective of this review is thus to map existing research concerning rehabilitation interventions for YACS that address at least one of the dimensions of the biopsychosocial model of health. More specifically, we aim to answer the research question: What are the characteristics of rehabilitation interventions (concept) in institutional or non-institutional settings (context) for YACS (population)?

Methods

A scoping review was chosen as the most appropriate method because it is useful for exploring the breadth of existing evidence and creating an overview of an emerging field, such as rehabilitation for YACS. In addition, it is suitable for identifying and mapping key characteristics of a selected concept and exploring how research is carried out.²⁴

We followed the Joanna Briggs Institute methodology for scoping reviews²⁴ and report the process and findings according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews checklist (Supplemental Material).²⁵ A protocol for the review was developed and registered in December 2021 in Open Science Framework (10.17605/OSF.IO/HN5DF).

Eligibility criteria

The eligibility criteria were based on the research question and the population/concept/context framework.²⁴ Papers were included if they fulfilled the following requirements:

- The intervention involved young adults with any type of cancer at age 18–39 years at the time of diagnosis and the time of the intervention, and had completed primary treatment
- The intervention included elements related to physical, psychological or social dimensions from the biopsychosocial model of health
- The intervention took place in institutional and non-institutional settings including hospitals, public or private community rehabilitation clinics, at home or online with no limitation regarding geographical location
- The study used quantitative, qualitative or mixed methods
- The findings were reported in English, Swedish, Norwegian or Danish.

No restrictions were applied to the rehabilitation intervention regarding delivery methods, intervention frequency and duration, or the providers' background. In addition, no restrictions applied to publication dates. Studies were excluded if analyses were not conducted separately for the age group 18–39 years of age.

Searches and information sources

The primary search strategy aimed to locate published research articles in indexed databases. A search matrix for the following blocks was developed based on the research question: (a) young adults, (b) cancer and (c) rehabilitation. The concept (the characteristics of rehabilitation interventions) and context (institutional or non-institutional settings) from the research question were merged into one block, block 3, in the search matrix, as searching on context alone was too narrow. We retrieved search terms and subject headings for the search matrix from previous reviews of cancer rehabilitation and reviews concerning YACS.^{26–30} To find alternative search terms, we used a thesaurus and Google Scholar. One author performed a pilot search in EMBASE and CINAHL to identify relevant articles which we could use to expand the search matrix. Thus,

search terms and subject headings were retrieved among the titles and abstracts of the articles identified in the pilot search.

The final search matrix was consolidated with a research librarian from the University of Southern Denmark, and we made few adjustments (e.g. adding tumour). The search matrix was adapted for each of the following databases where one author performed searches on January 31, 2022:

- EMBASE 1947 to 2022 January 28 via Ovid
- MEDLINE(R) ALL 1946 to January 28, 2022, via Ovid
- PsychINFO 1086 to January, week 4 2022 via Ovid
- CINAHL via EBSCOhost
- Cochrane Central Register of Controlled Trials (CENTRAL)

An updated search was performed on March 10, 2023. An example of a complete search strategy and detailed search matrix is outlined in online Supplemental File 1.

The supplementary search was twofold. First, the reference lists of all included studies were screened for additional studies and a citation search in Web of Science in June 2022.

Then, the first author searched grey literature following a developed grey literature search plan inspired by a previous review³¹ (see online Supplemental File 2). We used four different search strategies: (a) grey literature database searches (e.g. WHO International Clinical Trials Registry Platform), (b) targeted web-based searches (e.g. <https://www.cancer.gov/>), (c) Google searches (e.g. Google Scholar) and (d) contacting experts. We performed the searches between February 2022 and April 2022 and contacted experts between 3 and 7 March 2022.

Study selection and data extraction

We uploaded all identified articles into the web-based management software Covidence and removed duplicates. Two authors independently screened titles/abstracts to identify records for

full-text review and inclusion in the analysis. If any articles lacked the necessary information to assess eligibility for inclusion in the full-text review stage, we contacted the corresponding author to retrieve further details. Disagreements between the reviewers at each stage were resolved through discussion or, if necessary, with an additional reviewer. The screening process and reasons for exclusion at the full-text stage are shown using a Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews checklist flow diagram.²⁵

Three data extraction tools were developed inspired by a previous review and the template for intervention description and replication checklist.^{18,32} First, one author performed a pilot data extraction of three articles^{33–35} and necessary adjustments were made. Then, one author extracted data and the data were verified by a second author. We resolved disagreements between the authors in the data extraction process through discussion and, if necessary, with an additional author. To describe the interventions, we extracted the following data: key intervention elements, aim, theoretical principles, contents, delivery, outcome measurements, data collection methods and the main results from the studies based on the template for intervention description and replication checklist. Data relating to first author, year, country, sample size, cancer type, years since diagnosis and age of study participants were also extracted.

Synthesis of results

Two authors were involved in synthesising the results, which consisted of three steps. First, a summary of descriptive statistics and a narrative recap of study characteristics were conducted along with items from the data extraction inspired by template for intervention description and replication. Second, the intervention characteristics were deductively analysed thematically to identify common intervention characteristics across the interventions. This involved reading and re-reading the articles and developing categories and themes arising from each intervention and across the interventions. We produced a summary of the major

findings for the identified intervention characteristics organised under the headlines in the template for intervention description and replication checklist. Third, an inductive thematic analysis of included outcome measures was conducted using the International Classification of Functioning, Disability, and Health as a framework.¹⁷ This involved classifying each outcome measure into one of the components of the International Classification of Functioning, Disability and Health: (a) body functions and structures, (b) activity and participation, (c) environmental factors, (d) personal factors or (e) other if the outcome measure did not fit the International Classification of Functioning, Disability and Health's classification.¹⁷ After having conducted the analysis, members of the author group who did not participate in data extraction and analysis were consulted to discuss the analysis and ensure agreement.

Results

Study identification and selection

The searches yielded 5706 records after the removal of 2054 duplicates. Title/abstract screening resulted in 70 full-text articles that were screened, of which 54 studies were excluded. Additionally, we identified two further studies by consulting experts and two studies were identified when updating the search. Thus, a total of 20 studies were included for data extraction.^{34–53} Figure 1 presents the study flow chart and reasons for exclusion at the full-text stage. The reasons for the exclusion of each study are listed in online Supplemental File 3.

Study characteristics (n = 20)

Table 1 shows the study characteristics. All studies had been published within the past 12 years, over half of them ($n = 13$) over the previous five years. The studies were exclusively conducted in North America ($n = 15$) and Europe ($n = 5$). The majority were pilot/feasibility studies ($n = 12$). Eleven studies collected data quantitatively, two studies qualitatively and seven studies used mixed

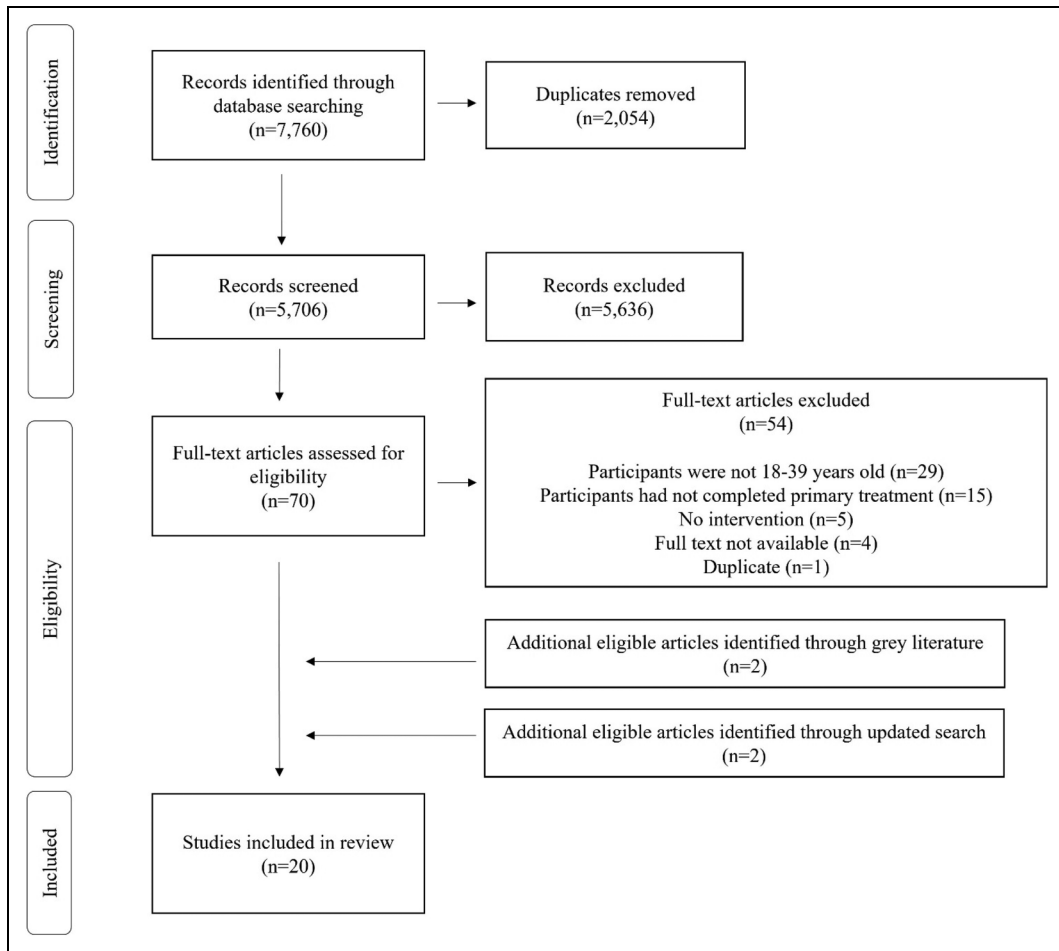


Figure 1. PRISMA flow chart.

methods for data collection. The 20 included studies were based on 14 unique interventions which will be referred to as the interventions. The study population across the 14 interventions consisted of 444 YACS, primarily females, who were on average over 25 years of age. The majority of the interventions included mixed cancer types.

Intervention characteristics (n = 14)

A detailed description of the intervention characteristics of each of the 14 interventions is outlined in Table 2, and Figure 2 provides an overview of

the intervention characteristics across the 14 interventions. Finally, Figure 3 outlines the outcome measures used in the included interventions, and Table 3 describes the measure points and findings of the included interventions. Here, we will summarise the results from the tables.

Aims

As outlined in Table 2, three of the 14 interventions aimed primarily at increasing or promoting physical activity. In addition, four interventions aimed at increasing or promoting physical activity or capacity as one of several aims, such as Hauken

Table 1. Study characteristics of the included studies ($n = 20$).

| First author, year, country (reference #) | Study design | Data collection method | Sample size (Female, %) | Cancer type | Years since diagnosis | Age of study participants |
|--|--|--------------------------------|----------------------------|---|---|--|
| Albers, 2021, The Netherlands and Belgium (36) | Pilot study (A single-arm intervention) | Mixed | 13 (77) | Breast, haematologic, sarcomas, gynaecological and other* | N/A | 28.58 (6.2) ^a |
| Campo, 2017, USA (37) | Feasibility study (a single-arm intervention) | Quantitative | 25 (100) | N/A | 3.2 (2.9) ^a | 26.9 (2.12) ^a |
| Dorfman, 2022, USA (52) | Feasibility study (a single-arm intervention) | Qualitative | 10 (46) | Breast, haematologic, testicular and gastrointestinal | N/A | 32.1 (6.6) ^a and 20–39 ^c |
| Fauske, 2021, Norway (38) | Pilot study (a single-arm intervention) | Mixed | 13 (77) | Haematologic and sarcomas | 7 (2–12) ^b | 30 (21–36) ^b |
| Hauken, 2014, 2015, 2017, Norway (39, 34, 40) | Feasibility study (a single-arm intervention) | Two mixed and one quantitative | 16 (75) and 20 (75) | Breast, haematologic, sarcomas, gynaecological, testicular and gastrointestinal | 2.1 (1.5) ^a and 2 (1.4) ^a | 30.8 (3.6) ^a and 31.1 (3.9) ^a |
| Hoyt et al., 2020, USA (41) | Protocol for an RCT (a two-arm intervention) | Mixed | N/A (N/A) | Testicular | N/A | N/A |
| Johnson, 2021, USA (42) | Pilot RCT (a two-arm intervention) | Quantitative | 49 (Group A/ B: 53.8/56.5) | Breast, haematologic, gynaecological, testicular, gastrointestinal and other* | Group A/B: 3.4 (1.1)/3.7 (1.3) ^a | Group A/B: 34.1 (4.6)/ 32.9 (5.3) ^a 27 ^b |
| Lathren, 2018, USA ¹ (43) | Feasibility study (a single-arm intervention) | Qualitative | 20 (100) | Breast, haematologic, sarcomas, gynaecological and other* | 3.3 (3.2) ^a | 28 (6) ^a |
| Oswald, 2022, USA (53) | Feasibility study (a single-arm intervention) | Quantitative | 11 (64) | Haematologic and other* | N/A | 33.9 (3.1) ^a |
| Price, 2020, 2021, Canada (45, 44) | Protocol for a feasibility study and a feasibility study (a single-arm intervention) | Mixed | 7 (86) | Haematologic, testicular and other* | N/A | 33.9 (3.1) ^a |
| Rabin, 2011, USA (46) | Pilot RCT (a two-arm intervention) | Quantitative | 18 (Group A/ B: 62.5/50) | Breast, haematologic, testicular and other* | Group A/B: 3.26 (2.06)/4.65 (2.78) ^a | Group A/B: 32.88 (4.88)/ 31.60 (6.28) ^a |
| Rabin, 2016, USA (35) | RCT | Quantitative | 35 (83) | N/A | N/A | 33.6 (4.0) ^a |
| Valle, 2013, 2015, 2017, USA (49, 50, 48) | RCT | Quantitative | 86 (Group A/ B: 91.1/90.2) | Breast, haematologic, sarcomas, gynaecological, gastrointestinal and other* | Group A/B: 5.3 (0.6) /4.5 (0.4) ^a | Group A/B: 30.8 (5.7)/ 32.7 (4.2) ^a |

(Continued)

Table 1. (Continued)

| First author, year, country (reference #) | Study design | Data collection method | Sample size (Female, %) | Cancer type | Years since diagnosis | Age of study participants |
|---|---|------------------------|----------------------------------|---|------------------------|---------------------------|
| Valle, 2021, USA (47) | Protocol for an RCT | Quantitative | N/A (N/A) | N/A | N/A | 18–39 ^c |
| Victorson, 2021, USA (51) | Feasibility study (a single-arm intervention) | Quantitative | 157 YACS (75) 50 caregivers (36) | Breast, haematologic, melanoma, sarcomas, gynaecological, testicular, gastrointestinal and other [*] | 6.7 (7.1) ^a | 33.6 (5.3) ^a |

Abbreviations: SD = standard deviation, RCT = randomised control trial, YACS = young adult cancer survivors, N/A = not applicable. Other^{*} = e.g. bone, brain, head and neck, lung, kidney and renal and thyroid cancer, ^a = mean (SD), ^b = median (min-max), ^c = min-max, ¹ = mother study is Campo, 2017.

et al.^{34,39,40} who aimed at improving both participation, physical capacity and health-related quality of life. Improving health-related quality of life was also the aim of the intervention by Oswald et al.⁵³ and the intervention by Fauske et al.,³⁸ in addition to reducing fatigue. Other interventions were aimed at promoting YACS' post-cancer identity and role in society, improving symptom management and management of psychosocial challenges, including distress and emotion regulation, and finding direction in life after cancer treatment.

Theories and rationales

As shown in Figure 2, a range of theories and rationales were used as the foundation for the interventions, with the majority ($n=9$) including numerous theories and rationales. Over one-third ($n=5$) used social cognitive theory solely or combined with the transtheoretical model. Two studies were exclusively based on self-determination theory, while two other studies combined positive psychology with other theories and rationales.

Intervention elements

As outlined in Figure 2, the contents of the studies' interventions varied, and it was difficult to find any apparent patterns across the intervention elements. Nevertheless, some intervention elements were more frequent than others: (a) peer-to-peer support ($n=12$) and (b) goal setting and action planning ($n=9$) and guidance in or execution of physical activity ($n=9$). Peer interaction varied across the studies and was facilitated through moderated and unmoderated web-based, peer-to-peer support groups, professional-led group sessions and residential stays where participants spent most of their time together, which enabled peer interaction. Price et al.⁴⁴ was one of two interventions that provided no peer-to-peer support. However, the intervention in Price et al.⁴⁴ included planning of social support. The goal setting process also differed across the interventions. In two of the interventions, an online goal-setting tool administered by the participants themselves facilitated the goal-setting process. Goal setting was facilitated in the remaining interventions, including goal setting

Table 2. Interventions characteristics (n = 14).

| First author and brief name of intervention | Key intervention elements | Aim | Theories, rationales, or approach | Materials and procedures | Duration | Number of sessions | Provider | Modes of delivery | Setting |
|--|---|--|--|--|----------|--------------------|---|--------------------------------------|------------------|
| Albers Positive psychology intervention | Narrative autobiographic, Gestalt theatre approaches, art workshops, value-based living, psychoeducation, provision of psychological tools and support, yoga, reflection exercises | 1. Peer-to-peer support 2. Orientation in post-cancer identity and role in society | Elements of positive psychology, trauma and body-oriented therapies, and acceptance and commitment therapy (ACT) Approach of the sessions was experiential learning and stimulating self and group reflections by the participants | Preparation four weeks before intervention: Participants received a narrative autobiographic exercise. The intervention: Day 1: Creating a safe learning environment Day 2: Gestalt theatre approaches and an art workshop that aimed at recognising and expressing negative and painful emotions related to the cancer Day 3–5: Focus on value-based living and psychoeducation to discuss the potentially traumatising effect of the cancer Day 6: Focus on the future and post-cancer identity by writing up the next future chapter of their autobiography and sharing it with the group. Provision of psychological tools and support after the intervention. Every day: Yoga and scheduled time for self-reflection. | 6 days | 26 | Three facilitators: an ACT-certified psychologist, an art therapist, and a yoga teacher | Group and individual Face-to-face | Residential stay |
| Campo and Lathren The Mindful Self-Compassion program | Mindful self-compassion including session with didactic instruction, experiential activities, introduction of different meditations and daily tools and group discussion, a closed Facebook group and audio-supplemented home-practice on a website | Support and improving management of psychosocial challenges that arise in survivorship | The Mindful Self-Compassion program which focuses on: 1. self-kindness oneself with care and compassion in the face of failure or perceived inadequacy. 2. common humanity, defined as recognising that suffering is not in isolation, but rather part of the shared human experience 3. mindfulness, awareness and acceptance of difficult emotions, thoughts or physical sensations. The Making Friends with Yourself programme | Groups of maximum five people Pre-intervention: Introduction to web platform via instructional video and provided with headphones with built-in microphones. Intervention The day or the week before each video sessions: Emailed an online home practice questionnaire to record their completed practice for the week. Contents of video sessions: 1. Introduction to mindful self-compassion 2. Mindfulness part I: paying attention to purpose 3. Mindfulness part II: reacting vs. responding 4. Self-compassion in depth 5. Self-esteem vs. self-compassion 6. Finding your compassionate voice 7. Core values and compassionate strategies for managing difficult emotions | 8 weeks | 8 | Trained and certified MSC instructor | Group and individual Internet | Online |

(Continued)

Table 2. (Continued)

| First author and brief name of intervention | Key intervention elements | Aim | Theories, rationales, or approach | Materials and procedures | Duration | Number of sessions | Provider | Modes of delivery | Setting |
|---|---|---|--|---|----------|--------------------|----------|--------------------|---------|
| Dorfman Symptom management intervention | Traditional behavioural symptom coping skills including goal setting, home-based physical activity, strategies from Acceptance and Commitment Therapy and Meaning-Centred Psychotherapy, strategies to foster self-compassion, and peer-to-peer | Improve symptom management (physical and psychological) | Social Cognitive Theory Acceptance and Commitment Therapy Self-compassion Meaning-Centred Psychotherapy | <p>8. Embracing your life-gratitude and self-appreciation</p> <p>After each video session: Emailed links to access the audio recordings for that week's home practice. Facebook group: Participants were invited to a closed Facebook group where they could interact with their group between the sessions. Home practice: Available at the study website and could, for example, be meditations.</p> <p>The intervention included printed intervention material, a mobile application, and sessions on Zoom. Printed intervention material: The content is not described. 3-h Zoom sessions: Content: 1. Physical activity and relaxation for symptom management and progressive muscle relaxation 2. Identifying values and setting SMART goals consistent with values and activity—rest cycling 3. Identifying thoughts that “hook” you, increasing self-compassion, and formal loving-kindness meditation 4. Coping with thoughts that “hook” you with distancing strategies and workable self-talk and leaves on a stream exercise 5. Identifying sources of support, assertive communication, and informal loving-kindness meditation 6. Communicating with your medical team, workplace, and school and mini-relaxation practices</p> | 10 weeks | 8 | N/A | Group Internet/App | Online |

(Continued)

Table 2. (Continued)

| First author and brief name of intervention | Key intervention elements | Aim | Theories, rationales, or approach | Materials and procedures | Duration | Number of sessions | Provider | Modes of delivery | Setting |
|--|--|--|---|---|----------|--------------------|---|---|-----------------------------------|
| | | | | <p>7. Meaning making and pleasant imagery practice</p> <p>8. Building a legacy (that you live and give) and reviewing and planning to maintain progress</p> <p>Structure of each session:</p> <ol style="list-style-type: none"> 1. Group socialisation (15 min) 2. Review of home practice and mobile application use (20 min) 3. Provide education, skills training, and opportunities for skills practice (45 min) 4. Assign homework (10 min) 5. Casual interactions between group members (15 min) 6. Didactic, experiential, and group discussion of coping skills presented during the program (75 min) <p>Mobile application Content content to promote skill use (e.g. session-specific exercises)</p> <p>The intervention content (e.g. audio recordings of relaxation exercises)</p> <p>Possibility for pairing with a wireless activity tracker to track daily activity.</p> <p>Ability to chat with group members</p> <p>Spotify playlists to use while exercising</p> | 6 months | 10 | Certified LP instructor from the Phil Parker Training Institute | Group and individual Face to face and telephone | Our-patient at hospital Telephone |
| Fauske Phil Parker's Lightning Process® (LP) | Psychoeducation regarding stress physiology, mind and body interaction, chronic fatigue, and helpful or unhelpful thought processes, and | Reduce fatigue and enhanced health-related quality of life | Neuro-linguistic programming, positive psychology and self-coaching | Pre-seminar: Telephone conversation based on a standard LP checklist. 3-day seminar: Theory session comprising psychoeducation and practical session to put the learned skills | | | | | |

(Continued)

Table 2. (Continued)

| First author and brief name of intervention | Key intervention elements | Aim | Theories, rationales, or approach | Materials and procedures | Duration | Number of sessions | Provider | Modes of delivery | Setting |
|--|--|---|---|---|----------|--------------------|--|--------------------------------------|------------------|
| Hauken Goal-Orientated Rehabilitation Program for Young Adult Cancer Survivors | encouragement to practice the new techniques immediately Goal setting, physical activity, psychoeducation, individual follow-up, peer support and next-of-kin weekend | Improve health-related quality of life and physical capacity and increase participation | Theory about quality of life and cognitive therapy | <p>into practice. After seminar: Monthly follow-up telephone session to support adoption of the new coping skills.</p> <p>Goal setting: Supported by a therapist and the Canadian Occupational Performance Measurement, the participants set a maximum of five goals four times during the intervention</p> <p>Physical activity: Individual program combining strength and fitness.</p> <p>Psychoeducation: Group sessions covering topics particularly relevant to YACS</p> <p>Individual follow-up: Each participant was appointed a professional to address individual challenges</p> <p>Peer support: Participant spent most time together, facilitating a high level of interaction</p> <p>Next-of-kin weekend: Next-of-kin visited the participant to learn about the rehabilitation process and meet others in the same situation</p> | 6 months | 100 h | A specialist in rehabilitation medicine, a nutritionist, a social worker and a physiotherapist | Group and individual Face to face | Residential stay |
| Hoyt Goal-focused Emotion-Regulation Therapy (GET) | Identification of goals and values clarification, psychoeducation and goal navigation | Improving distress symptoms, emotion regulation, goal navigation skills and stress-sensitive biomarkers | Previous cancer control intervention research, models of translational research for behavioural interventions and principles of hope therapy with an emphasis on goal navigation skill building | <p>Intervention Contents of sessions:</p> <ol style="list-style-type: none"> 1. Review of cancer-related experiences and influences on goal pursuits, psychoeducation regarding emotions, skills and values 2. Values clarifications and emotional awareness 3. Achievability of goals, cognitive skills training 4. Goal pathway mapping, navigating blocked goals and re-directing energy 5. Goal motivation and agentic actions, self-care behaviour 6. Goal pursuits moving forward <p>Control Individual Supportive Therapy</p> | 8 weeks | 6 | Male that has at least a Master's-level mental health clinician interventionist education | Individual Face to face | N/A |
| Johnson Fitbit and Facebook-based intervention | Physical activity tracking device, goal setting, a peer-based | Promote physical activity with a focus on increasing steps | Self-determination theory | <p>Intervention Physical activity tracking device (Fitbit): Participants were provided with a Fitbit to</p> <p>Control Individual Supportive Therapy</p> | 12 weeks | 12 | Research staff | Group and individual Internet | Online |

(Continued)

Table 2. (Continued)

| First author and brief name of intervention | Key intervention elements | Aim | Theories, rationales, or approach | Materials and procedures | Duration | Number of sessions | Provider | Modes of delivery | Setting |
|---|--|--|--|--|----------|--------------------|---|-------------------|---------|
| | Facebook group, buddy, text messages | | | provide step count estimates and display progress toward personalised goal. <i>Goal setting:</i> Weekly brief goal setting with research staff by text (primarily) or phone. Participants were encouraged to set weekly goals based on the previous week's steps/day and were recommended to increase goal by 10% each week. <i>A peer-based Facebook group:</i> Participants were encouraged to use closed Facebook group where research staff once a day, four times/week posted, e.g. physical activity discussion prompts. <i>A self-selected PA "buddy":</i> Participants were given the option to choose a "buddy" that were asked to provide encouragement and support. Buddies were provided their own Fitbit and account to share physical activity goals and accomplishments with their partner. <i>Text messages:</i> Participants received text messages every other day at a prescheduled time. Control Participants were provided only with a Fitbit and Fitbit app. | 10 weeks | 10 | A trained member of the study team with graduate-level training in clinical or counselling psychology under supervision | Group Internet | Online |
| Oswald TOGETHER-YA | Relaxation training, cognitive-behavioural therapy, health education, and homework assignments | Improve health-related quality of life | Cognitive Behavioural Stress Management and health education | Each 2-h session contained three intervention components: 1. Relaxation training 2. Cognitively-behavioural therapy relevant health education, including physical activity, healthy eating, school, work, and cancer, fear of recurrence and dating, fertility, and family. Sessions were delivered through a combination of didactics, in-session skills-based exercises, discussion | 10 weeks | 10 | A trained member of the study team with graduate-level training in clinical or counselling psychology under supervision | Group Internet | Online |
| | | | | prompts, and between-session homework assignments | | | | | |

(Continued)

Table 2. (Continued)

| First author and brief name of intervention | Key intervention elements | Aim | Theories, rationales, or approach | Materials and procedures | Duration | Number of sessions | Provider | Modes of delivery | Setting |
|---|--|--|---|--|----------|--------------------|--|-------------------------------|---------|
| Price Theory-based telehealth behaviour change intervention | Education, goal setting and action planning, self-monitoring, social support/ social change planning and environmental restructuring | Promote physical activity Participation, and fruit and vegetable consumption | Self-determination theory and the sessions were built around behaviour change techniques and based on a meta-regression of behaviour change interventions Provision of autonomy and motivational interviewing techniques during each session | Prior to each session: Participants were provided with the material that would be covered. Contents of sessions: 1-2: Providing information to participants about healthy lifestyle behaviours 3-4: Goal setting and action planning 4-5: Action planning and identification of and solving barriers 7-8: Teaching and helping participants to seek out social support from others (e.g. family, friends) 9-10: Helping participants develop self-monitoring techniques and encouraging participants to use them 11-12: Examining current behaviours and environment and discussing ways to modify these to achieve a more positive health-promoting environment | 12 weeks | 12 | Health coaches who had received training on behaviour change, stress management techniques, self-regulation skills, conflict resolution, techniques for increasing and maintaining motivation and group dynamics | Individual Internet | Online |
| Rabin (2011) Internet-based physical activity intervention | Website about physical activity including goal setting, logging exercise, feedback reports of physical activity completed, information about exercise tailored to YACS, stage-based manual for exercise, an online per-to-peer discussion forum, and heart rate monitoring | To increase physical activity and mood and decrease fatigue | Social cognitive theory and transtheoretical model | Introduction to the website and its features, encouraged to contribute to the online forum and introduced to heart rate monitoring Website: Provided: - an individual tailored physical activity manual - theoretically grounded feedback reports based on the participants' responses to questionnaires - features to set weekly physical activity goals, logging physical activity performed and physical activity-related information. Weekly mails: Participants were asked to report medical issues during and after physical activity and, if any were reported, participants were contacted by the researcher Online discussion forum: Participants who had reported a desire to connect with other YACS were given access to the forum. Control Participants were provided with information about three publicly available websites that did not provide | 12 weeks | 2 | Researchers | Group and individual Internet | Online |

(Continued)

Table 2. (Continued)

| First author and brief name of intervention | Key intervention elements | Aim | Theories, rationales, or approach | Materials and procedures | Duration | Number of sessions | Provider | Modes of delivery | Setting |
|---|---|---|--|---|----------|--------------------|------------------|-------------------------------|----------------------|
| Rabin (2016) Telephone-delivered physical activity and meditation intervention REbation and Exercise for Wellness (RENEW) | Guidance in physical activity, pedometer, goal setting, meditation, behavioural coaching, online forum and follow-up period | Increase physical activity and improve fitness and mood | Social cognitive theory and transtheoretical model | Physical activity information but other useful resources and online peer support. Intervention Physical activity: Participants were given a pedometer and guided in gradually increasing the frequency and duration of aerobic activity toward a final goal of 30 min, per day at least 5 days a week. Meditation: Introduced to mindfulness meditation and given a mindfulness CD. Participants were encouraged to practise meditation at least 4 days a week. Weekly behavioural coaching through call which was tailored to participants' readiness to make lifestyle changes including: reviewing progress, problem-solving barriers to meeting weekly physical activity and meditation goals and setting a goal for the following week. <i>Online Forum</i> : All participants were given access to the same online forum that was monitored by research staff. <i>Follow-up period</i> with calls to assist maintaining physical activity and meditation. Control identical to the intervention group, except that the control group did not receive three monthly booster calls | 6 months | 16 | Project director | Group and individual Internet | Online and telephone |
| Valle (2013, 2015, 2017) Facebook-based intervention | Pedometer, moderated Facebook group and messages including links to websites with knowledge about PA and/or cancer survivorship and behavioural lessons, website with a goal-setting tool, PA diary and personalised feedback | Increase moderate-to-vigorous intensity physical activity to at least 150 min./week with focus on walking | Social Cognitive Theory | Intervention Pedometer: Participants received the pedometer with user instructions that monitored steps and provided feedback on daily walking. <i>Moderated closed Facebook group</i> : Participants received weekly messages with expanded behavioural lessons on physical activity topics and behavioural strategies. In addition, there were moderated discussion prompts, e.g. to encourage support. <i>Website</i> : With a goal- | 12 weeks | 12 | N/A | Group and individual Internet | Online |

(Continued)

Table 2. (Continued)

| First author and brief name of intervention | Key intervention elements | Aim | Theories, rationales, or approach | Materials and procedures | Duration | Number of sessions | Provider | Modes of delivery | Setting |
|--|--|----------------------------|-----------------------------------|--|-----------|--------------------|---|---|----------------------|
| Valle (2011) Facebook delivered physical activity intervention with adaptive goal-setting and tailored feedback Improving Physical Activity after Cancer Treatment (IMPACT) | Fitbit activity tracker with a companion mobile app and weight scale, a mobile responsive website with behavioural lessons, adaptive goal setting and tailored feedback, tailored text messages and a Facebook group | Increase physical activity | Social cognitive theory | Intervention fitbit and weight scale: Participants received a fitbit activity tracker with a companion mobile app and a weight scale and were instructed in the use of these by email. Afterwards, an individual telephone or video chat session was conducted to discuss current physical activity recommendations for cancer survivors and review study procedures. Prior to the individual session, the participants received feedback on their baseline total PA levels. Website: A mobile responsive website comprising lessons developed specifically for YACS covering behavioural skills, resources, e.g. websites with information on physical activity for cancer survivors, weekly tailored feedback on physical activity and adaptive physical activity goal setting based on objective data and self-report measures. Text messages: Participants received five texts each week providing e.g. motivational messages and behavioural strategies. Closed moderated Facebook group: Prompted encouraging peer support. Maintenance: Over 6 months, participants would | 12 months | N/A | PhD or Master's level background in exercise physiology, nursing, health behaviour, or nutrition and previous experience with behavioural weight control trials or exercise with cancer survivors | Group and individual Internet and telephone | Online and telephone |

(Continued)

Table 2. (Continued)

| First author and brief name of intervention | Key intervention elements | Aim | Theories, rationales, or approach | Materials and procedures | Duration | Number of sessions | Provider | Modes of delivery | Setting |
|---|---|---|--|--|---------------|--------------------|---|--------------------|---|
| Victorson True North Treks | Mindfulness treks in nature, yoga, mindfulness and meditation | To support young adults and caregivers to find direction through connection | Rooted in three connections: 1. Connecting with nature after experiencing something as unnatural as cancer treatment 2. Connecting with peers who "get it" and have walked a similar path and through mindfulness awareness practices 3. Connecting with nature-based treks Research within nature-based treks | Every day: Outdoor opportunities to build greater skills based on nature-based activities such as backpacking, hiking and canoeing Yoga, mindfulness and extended guided meditation Unprogrammed downtime | 3 or 5 nights | N/A | 1-2 wilderness first responder certified trek guides and 1 guide experienced in teaching mindfulness, meditation and yoga | Group Face to face | Different wildernesses with overnight stays |

Abbreviations: PA = physical activity, YACS = young adult cancer survivors, N/A = not applicable.

| Studies | Albers | Campo and Lathren | Dorfman | Fauske | Hauken | Hoyt | Johnson | Oswald | Price | Rabin (2011) | Rabin (2016) | Valle (2013, 2015, 2017) | Valle (2021) | Victorson |
|--|--------|-------------------|---------|--------|--------|------|---------|--------|-------|--------------|--------------|--------------------------|--------------|-----------|
| <i>Theories and rationales</i> | | | | | | | | | | | | | | |
| Positive psychology, trauma and body-oriented therapies, and acceptance and commitment therapy (ACT) | X | X | | | | | | | | | | | | |
| Mindfulness and self-compassion | | X | X | | | | | | | | | | | |
| Neuro-linguistic programming, positive psychology and self-coaching | | | | X | | | | | | | | | | |
| Theory about quality of life and cognitive therapy | | | | | X | | | | | | | | | |
| Models of translational research for behavioural interventions and principles of hope therapy | | | | | | X | | | | | | | | |
| Meaning-Centered Psychotherapy | | | X | | | | | | | | | | | |
| Self-determination theory | | | | | | | X | | X | | | | | |
| Social cognitive therapy | | | X | | | | | | | X | X | X | X | |
| Cognitive Behavioral Stress Management | | | | | | | | X | | | | | | |
| Transtheoretical model | | | | | | | | | | X | X | | | |
| Research within nature-based treks | | | | | | | | | | | | | | X |
| <i>Intervention elements</i> | | | | | | | | | | | | | | |
| Goal setting and action planning | | | X | X | X | X | X | X | X | X | X | X | X | X |
| Behavioural change lessons or coaching/health education | | | X | | X | X | X | X | X | X | X | X | X | |
| Yoga/mindfulness/meditation/relaxation | X | X | | | | | | X | | | X | | | X |
| Self-Compassion strategies | X | X | X | | | | | | | | | | | |
| Creative therapy | X | | | | | | | | | | | | | |
| Nature-based activity | | | | | | | | | | | | | | X |
| Psychoeducation | X | X | X | X | X | X | | X | | | | | | |
| Diet | | | | | X | | | X | X | | | | | |
| Guidance in or execution of physical activity | | | X | | X | X | X | X | X | X | X | X | X | |
| Guidance in school/work | | | | | X | | | X | | | | | | |
| Guidance in dating, fertility, and family | | | | | | | | X | | | | | | |
| Activity tracker | | | | | | | X | | | X | X | X | X | |
| Website/app | | X | X | | | | | | | X | X | X | X | |
| Peer-to-peer support | X | X | X | X | X | | X | X | | X | X | X | X | X |
| Follow-up period after main intervention | | | | X | | | | | | | X | | X | |
| <i>Duration</i> | | | | | | | | | | | | | | |
| <7 days | X | | | | | | | | | | | | | X |
| 2 – 2.5 months | | X | X | | | X | | X | | | | | | |
| 3 months | | | | | | | X | | X | X | | X | | |
| 6 – 12 months | | | | X | X | | | | | | X | | X | |
| <i>Provider</i> | | | | | | | | | | | | | | |
| Project or research staff | | | | | | | X | X | | X | X | | | |
| Social and health professionals and instructors | X | | | X | X | | | | X | | | X | X | |
| Person certified in specific method | X | X | X | | | | | | | | | | | X |
| <i>Modes of delivery</i> | | | | | | | | | | | | | | |
| Face-to-face individually | | | | | | X | | | | | | | | |
| Face-to-face in group | | | | | | | | | | | | | | X |
| Face-to-face group and individually | X | | | X | | | | | | | | | | |
| Online*/telephone individually | | | | | | | | | X | | | | | |
| Online*/telephone in group | | | X | | | | X | | | | | | | |
| Online*/telephone in group and individually | | X | | | | | X | | | X | X | X | X | |
| Face-to-face in group and telephone individually | | | | X | | | | | | | | | | |
| <i>Setting</i> | | | | | | | | | | | | | | |
| Outpatient at hospital and telephone | | | | X | | | | | | | | | | |
| Residential stay | X | | | | X | | | | | | | | | |
| Outdoor | | | | | | | | | | | | | | X |
| Online*/telephone | | X | X | | | | X | X | X | X | X | X | X | X |

*Online includes both websites, apps, video conference systems and social media platforms

Figure 2. Intervention elements in rehabilitation interventions for young adult cancer survivors ($n = 14$).

and action planning via one-to-one or group sessions with a provider of the intervention (Table 2).

Duration and sessions

Table 2 shows wide variation in the intervention duration ranging from 3 days to 1 year. However,

12 weeks ($n=4$) and 6 months ($n=4$) were typical durations (Figure 2). The number of sessions varied across studies, while interventions delivered as residential stays had the greatest number of sessions.

| Domain | Data collection method | |
|--|--|--|
| Body functions and structures | | |
| Mental function | PROMIS ¹ Anxiety PROMIS ¹ Depression Profile of Mood States (POMS) Profile of Mood States-Brief Form (POMS-BF) The Center for Epidemiological Studies Depression Scale (CES-D) Hospital Anxiety and Depression Scale (HADS) Patient Health Questionnaire 9 (PHQ-9) Perceived cognitive impairment (PCI) subscale of the FACT ² - Cog, Version 3 survey Pittsburgh Insomnia Symptom Questionnaire POMIS ¹ Sleep Disturbance (4-item version) Body Image Scale (BIS) Emotion Regulation Questionnaire (ERQ) Self-compassion scale (SCS) Life Events Questionnaire (LEQ) Brief Resilience Scale (BRS) The Fatigue Symptom Inventory (FSI) Fatigue Questionnaire (FQ) Psychological Need Satisfaction in Exercise Scale Psychological Need Satisfaction questionnaire – modified to fruit and vegetable Self-Efficacy and Exercise Habits Survey Exercise Treatment Self-Regulation Questionnaire Behavioural Regulation in Exercise Questionnaire-2 (BREQ-2) Dietary Self-Regulation Questionnaire Behavioural Risk Factor Surveillance System–Fruit and Vegetable Questionnaire | The PROMIS ¹ Physical Function |
| Functions of the digestive, metabolic and endocrine systems | Weight Body Mass Index | |
| Neuromusculoskeletal and movement-related functions | Handgrip test | Physical Activity Readiness-Questionnaire (PAR-Q) |
| Functions of the cardiovascular, haematological, immunological and respiratory systems | Treadmill walk-test Astrand 6-minute Cycle Test Forced expiratory volume in 1 second (FEV1) Biomarkers (Interleukin 6 + c-reactive protein) | |
| Sensory functions and pain | | |
| Activity and participation | | |
| Major life areas | The Work and Social Adjustment Scale (WSAS) Career Thoughts Inventory (CTI) | The Canadian Occupational Performance Measure (COPM) |
| Mobility | Accelerometer (steps) 7-day Accelerometer – Assessment (PA min./week) The Sedentary Behavior Questionnaire (SBQ) The Godin Leisure Time Exercise Questionnaire (GLTEQ) (original and modified version) Seven-Day Physical Activity Recall (PAR) International Physical Activity Questionnaire (Short Form) Physical Activity Enjoyment Scale (PACES) | |
| General tasks and demands | Mindful Attention Awareness Scale (MAAS) 10-item Exercise Planning and Scheduling Scale | |
| Environmental factors | | |
| Support and relationships | Health Care Climate Questionnaire (adapted version) (HCCQ) Social Support for Exercise Survey (original and modified version) PROMIS ¹ – Social Isolation | |
| Personal factors | | |
| Other | Height | |
| | The Hope Scale Post-traumatic Growth Inventory (PTGI) Goal navigation scale of the CAYA-T ³ Exercise Goal-Setting Scale | |
| 1 = Patient-Reported Outcomes Measurement Information System, 2 = Functional Assessment of Cancer Therapy-Cognitive Function, 3 = Cancer Assessment for Young Adults for men with testicular cancer. | | |

The European Organisation for Research and Treatment of Cancer Quality of Life C-30 (EORTC QOL C-30)
36-Item Short Form (SF-36)
Functional Assessment of Cancer Therapy-General (FACT-G, version 4, 2007)

Figure 3. Outcome measures used in the included interventions ($n = 14$).

Provider

As shown in Table 2, a wide variety of providers delivered the interventions, including research

staff, project directors, nurses, rehabilitation medicine specialists, nutritionists, social workers, physiotherapists, health coaches, yoga teachers and

Table 3. Measure points and findings of the included interventions ($n = 14$).

| First author | Measure points | Findings |
|-------------------|---|--|
| Albers | Immediately after intervention (6 days) 1 month after the intervention | <p>Quantitative</p> <ul style="list-style-type: none"> • Most appreciated were the presence of nature, the role of peers, the quality of trainers and the contents of the workshops. • Session on the physical aspects of having had a traumatic experience and yoga sessions were most appreciated. <p>Qualitative</p> <ul style="list-style-type: none"> • The intervention offered support to YACS in the promotion of their well-being and post-cancer identity development. <p>Acknowledgement and advice from other YACS were important and very useful.</p> <ul style="list-style-type: none"> • Would have liked to have more individual support during group sessions and as one-to-one sessions. <p>Feasibility</p> <p>The intervention was well received by participants</p> <p>Quantitative</p> <ul style="list-style-type: none"> • ↑ Mindfulness • ↑ Self-compassion (largest effect sizes) • ↑ Post-traumatic growth • ↓ Anxiety (largest effect sizes) • ↓ Depressive symptoms • ↓ Social isolation • ↓ Negative body image (largest effect sizes) <p>Qualitative</p> <p>The intervention addressed three psychosocial needs, which were addressed in this way:</p> <ol style="list-style-type: none"> 1. Peer isolation: through self-reliance, common humanity and mindful awareness of positive support 2. Body concerns: through self-kindness, gratitude, acceptance and awareness 3. Health-related anxiety: through beneficial mindfulness practices and challenging awareness. Body awareness triggered health-related anxiety <p>Feasibility</p> <ul style="list-style-type: none"> • The intervention was feasible (84% participated in at least 6 of 8 sessions) • Acceptability was high with average score of 4.69 (SD 0.43) on a 5-point scale regarding satisfaction with the intervention. |
| Campo and Lathren | Immediately after intervention (8 weeks) | |
| Dorfman | Immediately after intervention (10 weeks) | <p>Feasibility</p> <p>Feasible but suggestions of minor changes for refining the manual and the mobile application materials</p> <p>Participants highlighted the value of:</p> <ul style="list-style-type: none"> • Being able to connect with other • The group format as it allowed learning from each other. • The call-out boxes in the manual helped draw their attention to the important content of the intervention. • The mobile application helped to keep intervention content accessible • The learning actionable symptom coping strategies and skills provided |

(Continued)

Table 3. (Continued)

| First author | Measure points | Findings |
|--------------|--|--|
| Fauske | 1 week after intervention 3 months after intervention 6 months after intervention | Quantitative <ul style="list-style-type: none"> • ↓ Fatigue • ↑ HRQOL Qualitative <ul style="list-style-type: none"> • No further benefits were observed from the three- to the six-month follow-up point. • Experience of less fatigue and improved energy level • Particularly helpful aspects of the intervention were theoretical rationale and coping techniques |
| Hauken | During intervention (after 3 weeks) During intervention (3 months) During intervention (6 months) 12 months post intervention | Quantitative <ul style="list-style-type: none"> • ↑ HRQOL, which was stable after 1-year follow-up • ↑ Participation • ↑ Physical fitness • ↑ Lung capacity • ↓ Fatigue Qualitative <ul style="list-style-type: none"> • ↑ HRQOL explained by: increased coping and control, gained through finding balance between different areas of life, insight and knowledge, multidimensional follow-up and decrease in fatigue. • ↑ Participation explained by: insight and facilitation, lower level of and control of fatigue. • ↑ Physical capacity explained by: writing log, a stepwise approach, follow-up with tests, knowledge of exercise and fatigue and energy conservation. • Follow-up and time deemed crucial for successful rehabilitation • Core elements and important factors: setting individual realistic goals, physical testing and exercise (including tailored program), psychoeducation, individual follow-up, peer support and professional assistance |
| Hoyt | Immediately after intervention 12 weeks after intervention | Feasibility <ul style="list-style-type: none"> • Contents and structure were feasible with high compliance N/A |
| Johnson | During intervention week 10–12 | Quantitative <ul style="list-style-type: none"> • ↓ Sedentary time in short term • ↓ Fatigue • No difference in moderate-to-vigorous intensity PA, sedentary time, quality of life Feasibility <ul style="list-style-type: none"> • The intervention was feasible (all feasibility criteria were met) |
| Oswald | During the intervention Immediately after intervention (10 weeks) | Feasibility <ul style="list-style-type: none"> • The intervention was feasible (criteria for recruitment rate, session attendance, and retention were all met) • The intervention was acceptable (all acceptability criteria were met) |
| Price | Immediately after intervention (12-weeks) | Quantitative <ul style="list-style-type: none"> • ↑ Minutes of moderate-to-vigorous intensity PA per week |

(Continued)

Table 3. (Continued)

| First author | Measure points | Findings |
|--------------------------|--|--|
| | | <ul style="list-style-type: none"> • ↑ Consuming fruit and vegetables per day <p>Qualitative</p> <ul style="list-style-type: none"> • The length of the intervention was crucial because it allowed for progression toward long-term goals. • Communicating in real-time with the health coach was important. • Valued the ongoing encouragement and compassion they received from the health coach. • The type of intervention was much needed and offering it via distance was favourable. • Valued completing the sessions when they wanted without having to travel a considerable distance. • Three behaviour change techniques were found to be most beneficial: <ol style="list-style-type: none"> 1. Understanding guidelines for PA participation and fruit and vegetable consumption for cancer survivors. 2. The benefit of learning and utilising self-monitoring techniques. 3. Social support. <p>Feasibility</p> <ul style="list-style-type: none"> • Intervention was feasible • Participants considered the length of the intervention, synchronous communication with the health coach and the distance-based delivery mode to be acceptable. |
| Rabin (2011) | Immediately after intervention (12 weeks) | <p>Quantitative</p> <ul style="list-style-type: none"> • ↑ PA • ↑ Mood • ↓ Fatigue <p>Feasibility</p> <ul style="list-style-type: none"> • Feasible and acceptable |
| Rabin (2016) | Immediately after intervention (12 weeks) 24 weeks after intervention | <p>Quantitative</p> <ul style="list-style-type: none"> • ↑ PA • ↑ Fitness • ↑ Mood <p>Feasibility</p> <ul style="list-style-type: none"> • Feasible to deliver and receive and generally acceptable to YACS |
| Valle (2013, 2015, 2017) | Immediately after intervention (12 weeks) | <p>Quantitative</p> <p>Results, Valle et al., 2013</p> <ul style="list-style-type: none"> • ↑ self-reported weekly minutes of moderate-to-vigorous PA (both groups) • ↓ weight (only intervention group) <p>Results, Valle et al., 2015</p> <ul style="list-style-type: none"> • The proposed mediators (self-efficacy, social support, self-monitoring) did not explain the positive effects of the intervention on mild PA <p>Results, Valle et al., 2017</p> <ul style="list-style-type: none"> • Participant-initiated posts by YACS may prompt more engagement than moderator-initiated posts and could assist with promoting PA in the context of a social media-based intervention for YACS |

(Continued)

Table 3. (Continued)

| First author | Measure points | Findings |
|--------------|--|--|
| Valle (2021) | 3 months after intervention 6 months after intervention 12 months after intervention | <ul style="list-style-type: none"> No association between demographic characteristics and baseline Facebook use and Facebook interaction The active group on Facebook reported significantly greater change in moderate-to-vigorous intensity PA than the other Most engaging moderator-initiated prompts: <ol style="list-style-type: none"> Cancer-related discussion questions About PA Feasibility Most participants reported using the intervention components Participants would recommend the intervention to other YACS |
| Victorson | N/A 3 months after intervention 6 months after intervention 12 months after intervention Immediately after intervention (3 or 5 days) | <p>N/A</p> <p>Quantitative</p> <ul style="list-style-type: none"> ↑ Connection to nature, other survivors/caregivers and oneself ↑ Awareness of health benefits of mindfulness and confidence in incorporating mindfulness in daily life ↑ Comfortable in doing outdoor activities (survivors only) ↓ Anxiety, depression and sleep disturbance symptoms ↓ Interleukin 6 (IL-6) ↑ C-reactive protein (CRP) No difference in outcomes between canoeing and backpacking treks <p>Qualitative</p> <p><i>The participants stated:</i></p> <ul style="list-style-type: none"> They enjoyed the treks They intended to spend time outdoors after returning home They had greater appreciation of the outdoors The experience would continue to affect them positively They learned new skills, e.g. managing stress and uncertainty and accepting themselves They planned to continue practising mindfulness meditation |

Abbreviations: YACS = young adult cancer survivors, SD = standard deviation, HRQOL = health-related quality of life, N/A = not applicable, PA = physical activity.

therapists. Furthermore, Table 2 also shows that four interventions required that the provider had specific certification in the method used, such as Fauske et al.,³⁸ where the provider had to be a certified Phil Parker's Lightning Process instructor from Phil Parker Training. Four interventions required that the provider had a specific level of education, and only one study demanded that the provider had experience with cancer survivors.

Modes of delivery and setting

Figure 2 shows that nine of the 14 interventions were delivered remotely without face-to-face interaction using telephone and internet-based solutions, for example text messages, social media platforms such as Facebook, apps, websites and video conferencing systems. One intervention combined face-to-face with telephone sessions by delivering the first session and the follow-up period by telephone and the main intervention face-to-face. The remaining interventions ($n = 4$) were delivered face-to-face and took place at an outpatient hospital, in different wilderness destinations with an overnight stay, and at two different treatment facilities as residential stays where the participants stayed overnight. Two interventions were provided exclusively to individuals, nine interventions were provided both to individuals and groups and three intervention was solely provided to a group.

Outcome measures and main findings

Figure 3 shows that, across the 14 interventions, 56 standardised outcome measures were used. In addition, some studies also used non-standardised outcome measures. Most outcome measures were patient-reported outcomes ($n = 46$). The studies either based their measurements solely on patient-reported outcomes or combined patient-reported outcomes with objective outcome measures like a physical activity tracker. The outcome measures were mainly generic, and none were age specific. Unidimensional outcome measures were mostly used, with most of them measuring aspects of body functions and structures ($n = 35$).

Table 3 gives an overview of times of measurements and the main findings of the included interventions. All interventions were measured with

pre- and post-measurements, while six of the 14 interventions included follow-up measures up to 12 months after the intervention. Ten interventions were found to be feasible and acceptable. Although most studies were not powered to examine efficacy, they demonstrated improvements in several outcomes. Improved physical activity and capacity were mostly found. Qualitative data described that the reason for these improvements may have been attributed to the following elements: (a) knowledge of physical activity and understanding guidelines for physical activity for cancer survivors, (b) learning and applying self-monitoring techniques (e.g. logs) and tailored training programme, (c) social support and (d) strategies for energy conservation.^{40,44,45} Four studies also showed improvement in fatigue, and two studies demonstrated improvement in health-related quality of life. Improved health-related quality of life was described in one study as being related to new insights and knowledge, increased control of life, decreased fatigue and a high degree of goal achievement.⁴⁰ Almost all findings reported were positive, although Lathern et al.⁴³ found that, for some, the intervention element of body awareness triggered health-related anxiety.

Discussion

This study mapped existing research concerning the characteristics of rehabilitation interventions for YACS. While this review identified only 20 studies representing heterogenic groups, whereby most included female YACS over 25 and 14 unique interventions mainly focused on either the physical or psychological factors this review clearly demonstrates that research on rehabilitation for YACS remains at an early stage.

The most frequent aim of the identified interventions was to increase or promote physical activity either as the primary or supplementary aim of the intervention. Increasing or promoting physical activity often includes behaviour change, so it was not surprising that the most used theory across the interventions was social cognitive theory, a theory directed at behaviour change.⁵⁴

Furthermore, it was not surprising that physical activity and exercise were the most frequently used study elements as they have been widely researched within cancer rehabilitation, and several scoping reviews on physical activity among YACS already exist.^{20,55–57} The focus on physical activity and exercise can be considered rather one-dimensional although physical activity has shown to influence all biopsychosocial dimensions.²⁰ However, rehabilitation is rooted in a biopsychosocial model of health,^{14,15} which requires multicomponent interventions addressing physical, psychological and social dimensions, including participation in everyday life.^{14,15} The biopsychosocial paradigm has been shown to increase participation in everyday life in adult cancer survivors and aligns with YACS' multifactorial, yet different, needs.^{11,19,58} Hence, there is a need to increase the holistic and biopsychosocial approach within rehabilitation given to YACS.

Across the interventions, the most frequent intervention element was peer-to-peer support. Thus, most of the interventions were delivered mainly in groups. Research shows that YACS prefer and request peer-to-peer support after cancer treatment.^{11,59–62} One of the second most frequent intervention elements was goal setting and developing related action plans. Goal setting as an element aligns with the common understanding and definitions of rehabilitation where goal setting is one of the key components.^{14,63,64} In goal setting, a direction is set for the rehabilitation process; moreover, goal setting increases motivation and supports behaviour change.^{65,66} A systematic review of adults with acquired disabilities found that positive effects were associated with goal planning.⁶⁷ The interventions using goal setting in our review seemed to show the same positive direction in outcomes.

Nine of the 14 interventions were solely delivered online, and all were found feasible and acceptable to YACS. The fact that YACS find online intervention acceptable is not unexpected. Previous research has identified that they prefer internet-based interventions because it is more flexible than in-person interventions.⁶² This is

preferable as they must often find time for rehabilitation concurrent with work, education and family life.⁶² In addition, online delivery is advantageous for YACS as they prefer peer-to-peer support and at the same time the group is small and often spread geographically across a country.⁵ Although, the included online interventions and a review of 40 studies found that digital health interventions show promising results in improving health outcomes among YACS, there is also challenges and disadvantages of online interventions, such as software requirements and technical challenges.^{37,68} Whether the online interventions were more effective than interventions delivered in other ways cannot be concluded in the present review. A previous systematic review of 12 RCTs, including 1669 adult cancer survivors, showed that combining face-to-face intervention with follow-up via telephone was the most effective mode of delivery,¹⁹ but the systematic review did not focus on YACS solely as it included all cancer survivors aged 18 and above.¹⁹

We identified a wide variety of outcome measures, which may be due to the heterogeneity of the aims in the included interventions. Similar variation in the use of outcome measures was also found in a recent scoping review of patient-reported outcomes used in studies with this population.⁶⁹ This variety prevents the possibility of comparing studies in future systematic reviews and meta-analyses.⁶⁹ Hence, it is crucial to agree on a core set of outcomes when evaluating rehabilitation interventions in YACS. For example, such work could be inspired by the established core set of patient-reported outcomes for cancer survivors.⁷⁰ Furthermore, we found that no age-specific outcome measures were used. Research indicates that using generic or disease-specific instruments not developed for YACS may be unsuitable because they do not capture issues that are relevant to YACS, such as fertility, interrupted education, boredom and change in living situation.^{7,71,72}

The main strength of the present study is that we used a well-defined protocol and recommended methodology guidelines to conduct the review.

Another strength lies in the comprehensive literature search that we conducted with assistance from a librarian expert, including searching for grey literature, which was also verified by experts within the field. Finally, we used the template for intervention description and replication checklist to extract information about the included interventions to ensure they were comprehensively described. Nevertheless, risks of selection bias do exist. It was challenging to provide search terms that adequately covered the complexity of the concept of rehabilitation without producing an unmanageable number of hits. Furthermore, we only included studies reported in English, Danish, Norwegian and Swedish, which may have resulted in missed studies. Limitations also apply to generalisability as most studies were undertaken in North America and the majority of included YACS were women.

Providers, healthcare managers and researchers can use findings from the present study to qualify existing or plan future age-specific rehabilitation for YACS. Our findings indicate that clinicians should focus on goal setting, peer-to-peer support and regular follow-ups in their rehabilitation interventions for YACS. Furthermore, the social cognitive theory seems to be an appropriate theoretical approach for behaviour change in YACS, particularly regarding physical activity. In addition, future intervention studies need to focus on recruiting men as this will improve the utility and generalisability of the results of future rehabilitation interventions.

This scoping review mapped the characteristics of rehabilitation interventions for YACS. Only 14 interventions were found, and many focused mainly on the physical or psychological. The most frequent intervention elements were peer-to-peer support and goal setting, the interventions were often delivered online and heterogeneous outcome measures were used. The rehabilitation interventions were found to be feasible and acceptable. Overall, current research illustrates that multicomponent, biopsychosocial and age-specific rehabilitation for YACS remains at an early stage. Such interventions may assist in alleviating YACS' multiple challenges in everyday life.

Clinical messages

- Clinicians can use the findings to develop their rehabilitation practice for young adult cancer survivors
- Clinicians must focus on young adult cancer survivors' complex biopsychosocial challenges, and it is advisable to provide multicomponent interventions for this group of people
- Peer-to-peer support and goal-setting seem to be valuable intervention elements for young adult cancer survivors

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Author contributions

MA designed and planned the study in close collaboration with MSP, CMS, MAH and KIC. MA performed the literature searches, and MA and JJKM screened and selected studies. Any disagreements were resolved in consultation with MSP. MA extracted the data, which MSP verified. Any disagreement regarding data extraction was discussed in consultation with KIC. MA and MSP synthesised the results, which were discussed with CMS, MAH and KIC. MA drafted the manuscript with MSP's contribution and input from CMS, MAH and KIC. Finally, all authors reviewed the article and provided input that was incorporated into the final draft, and all authors approved the final version of the article.

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Supplemental material

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