AHEAD OF PRINT

Study protocol

Oncology; rehabilitation; telemedicine

Digitally supported physical cancer rehabilitation during and after systemic treatment in South Baltic countries: Protocol for the AMBeR eRehab feasibility study

Gunn Ammitzbøll[1,2,A–F], Sabine Felser[3,A–F], Kathrin Thiele[3,B–F], Hugo Murua Escobar[4,A,D–F], Aelita Bredelytė[5,A–F], Jan Arnholtz Overgaard[6,7,B–F], Zofia Sotomska[8,9,A–F], Hanna Lotzke[10,A–F], Carl Johan Orre[10,11,A,C,E,F], Bartłomiej Baumert[12,A,C,E,F], Niels Henrik Holländer[1,A,E,F], Christian Junghanß[3,A,E,F], Katarzyna Gierat-Haponiuk[8,9,A–F], Anna Jamrowska[8,9,B,C,E,F], Dariusz Szplit[9,A,C,E,F], Susanne Oksbjerg Dalton[1,2,A–F]

[1] Department of Clinical Oncology and Palliative Care, Zealand University Hospital, Næstved, Denmark
[2] Cancer Survivorship, Danish Cancer Institute, Copenhagen, Denmark
[3] Department of Internal Medicine, Clinic for Hematology, Hemostaseology, Oncology, Stem Cell Therapy and Palliative Care, Rostock University Medical Center, Germany
[4] Institute of Medical Genetics, Rostock University Medical Center, Germany
[5] Faculty of Health Sciences, Klaipeda University, Lithuania
[6] Department of Rehabilitation, Lolland Municipality, Maribo, Denmark
[7] Musculoskeletal Function and Physiotherapy (FOF), University of Southern Denmark (SDU), Odense, Denmark
[8] Independent Team of Physiotherapists, University Clinical Center, Gdańsk, Poland
[9] Department of Clinical Physiotherapy, Medical University of Gdańsk, Poland
[10] Department of Rehabilitation, Ängelholm Hospital, Sweden
[11] Department of Innovation and Development, Ängelholm Hospital, Sweden
[12] Department of Hematology and Transplantology, Pomeranian Medical University, Szczecin, Poland

A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation;
D – writing the article; E – critical revision of the article; F – final approval of the article

Advances in Clinical and Experimental Medicine, ISSN 1899–5276 (print), ISSN 2451–2680 (online) *Adv Clin Exp Med*. 2026

Address for correspondence
Gunn Ammitzbøll
E-mail: gunnam@cancer.dk

Funding sources
EU Interreg South Baltic (grant No. STHB.01.01-IP.01-0005/23).

Conflict of interest
None declared

Received on March 15, 2026
Reviewed on April 11, 2026
Accepted on May 28, 2026
Published online on September 8, 2026

Cite as
Ammitzbøll G, Felser S, Thiele K, et al. Digitally supported physical cancer rehabilitation during and after systemic treatment in South Baltic countries: Protocol for the AMBeR eRehab feasibility study [published online as ahead of print on September 8, 2026]. *Adv Clin Exp Med*. 2026. doi:10.17219/acem/222595

DOI
10.17219/acem/222595

Abstract

Background. Research in exercise oncology has consistently provided evidence supporting the integration of exercise into all phases of cancer care. However, less is known about how this can be implemented across different patient populations and healthcare settings. This study aims to generate knowledge about the equitable implementation of digitally supported physical rehabilitation during and after systemic cancer treatment through feasibility testing in 5 South Baltic countries.

Methodology. This study is part of the "AMBeR" project (Advanced Modeling of Baltic E-cancer caRe) and is an international, multicenter, prospective study with a hybrid implementation-effectiveness design. It includes 2 single-arm feasibility trials, each aiming to enroll 30 patients undergoing systemic treatment and 30 patients who have completed systemic treatment or are receiving long-term or life-prolonging treatment at each participating site, for a total of 300 adult cancer patients. All tumor groups are eligible, and participants must be ≥18 years of age. We will use the Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework to structure data collection and reporting. Additionally, Group Concept Mapping will be used to evaluate determinants of participation among patients and determinants of intervention delivery among healthcare professionals (HCPs). Enrollment began in September 2024 and is expected to be completed by December 2026.

Discussion. While digital solutions have the potential to overcome barriers to integrating exercise into oncology care, inequitable implementation may inadvertently exacerbate disparities in cancer rehabilitation if these innovations remain inaccessible to patients with fewer resources. By evaluating reach, effectiveness, adoption, implementation, and maintenance, as well as the determinants of participation among patients and HCPs, this study will contribute to the evidence base on the implementation of digitally supported physical rehabilitation in cancer care.

Conclusions. Findings from the AMBeR eRehab study will inform future efforts to digitize cancer rehabilitation while ensuring that inequities are not reproduced.

Key words: quality of life, implementation, rehabilitation, neoplasms, telehealth

Highlights

- This study investigates equitable implementation of digitally supported physical cancer rehabilitation.
- The study will include 300 adult patients in 2 feasibility trials across 5 South Baltic countries.
- A hybrid implementation–effectiveness design guided by the RE-AIM framework is applied, while Group Concept Mapping identifies determinants for participation among patients and HCPs.
- Findings will inform digital cancer rehabilitation strategies to reduce inequity in provision and uptake.

Background

The incidence of cancer is increasing worldwide, mainly due to demographic change, improved early detection programs, and advances in diagnostics.[1] At the same time, cancer prognosis is improving, with an overall 5-year survival rate of 67% in Europe during the period 2015–2022.[2] As life expectancy continues to increase and cancer incidence rises with age, more patients will live with or beyond cancer and thus be at risk of cancer- and treatment-related symptoms and late effects. Among the most common symptoms and late effects are fatigue, chemotherapy-induced peripheral neuropathy, pain, and reduced physical and psychological functioning, all of which impair health-related quality of life (HRQoL).[3–10]

These symptoms and late effects increase the demand for healthcare services and highlight the need for structured and sustainable supportive care. Participation in targeted exercise programs, especially when supervised by qualified professionals, can alleviate cancer- and treatment-related symptoms and late effects.[11–13] Furthermore, exercise has the potential to improve survival, as recently demonstrated by Courneya et al.,[14] in which a 3-year exercise program after colon cancer resection significantly improved disease-free survival (hazard ratio (HR) = 0.72, 95% confidence interval (95% CI): 0.55–0.94, p = 0.02). Accordingly, international guidelines recommend integrating physical activity and exercise into rehabilitation and across all phases of oncological care.[15–17] Implementation of exercise recommendations in clinical practice has been insufficient to date and varies greatly both internationally and regionally.[18,19] Current literature suggests that low socioeconomic status is strongly associated with reduced participation in oncological rehabilitation programs, despite a higher prevalence of symptoms and greater rehabilitation needs.[10,20–23] Furthermore, both structural barriers, such as long travel distances and inadequate infrastructure, and patient-related factors, such as age, general health, and social support, hinder access to and uptake of physical cancer rehabilitation and pose major barriers to the equitable provision of adequate care.[24–29] Digital interventions may enhance access to precision cancer rehabilitation while empowering patients to take an active role in their own treatment.[30] Precision rehabilitation relies on individualized exercise prescriptions based on the FITT principles (frequency, intensity, time, and type).[31] The use of digital interventions may allow remote supervision and support adherence to prescribed exercise. Emerging studies show that various forms of cancer telerehabilitation can improve cardiorespiratory fitness and physical functioning, while their effects on HRQoL and muscle strength remain unclear.[32,33] This discrepancy may result from implementation issues, as evidence highlights specific challenges, including IT infrastructure, digital health literacy, data protection, financing, integration into clinical routines, and insufficient resource allocation for implementing new practices.[34–36]

Objectives

The overall aim of this study is to gain insight into the feasibility and implementation of digitally supported physical cancer rehabilitation during and after systemic cancer treatment. The findings will be used to develop country-specific and trans-European guidance for the digitization of physical cancer rehabilitation. Specifically, the objectives are to assess the reach, effectiveness, acceptability, implementation, and maintenance of digitally supported physical cancer rehabilitation (eRehab) in clinical practice and to explore the determinants of participation in eRehab.

Methodology

Design

This study is a multinational, multisite feasibility study of the implementation of eRehab in rural regions of 5 South Baltic countries – Denmark (DK), Poland (PL), Germany (GER), Sweden (SWE), and Lithuania (LTU) – during systemic treatment (Feasibility Study 1) and after systemic treatment or during long-term life-prolonging treatment (Feasibility Study 2). Both feasibility studies are designed as single-arm intervention studies (NCT06768918; protocol version 1, registered before recruitment began, November 27, 2024).

The overarching aim of the AMBeR project is to develop a model for implementing digital cancer care across countries and healthcare settings. Two designated work packages are allocated to implementation support and model

Table 1. Usual cancer rehabilitation care across participating study sites in the AMBeR eRehab study

Study site	University Clinical Center, Gdańsk (PL)	University Medical Center, Rostock (GER)	Ängelholm Hospital, Ängelholm (SWE)	Klaipėda University, Klaipėda (LTU)	Zealand University Hospital, Næstved (DK)
Usual care practice for rehabilitation	• Referrals: During oncological treatment, referrals to physiotherapy are made on a needs basis by a physician (e.g., an oncologist, general practitioner, or another specialist). • Provision: Publicly funded by the National Health Fund (NFZ) contract (a substantial waiting list exists). Priority early access is given to patients with disabilities defined by law. Duration and contents of programs differ by cancer type. • Level of digitalization: No digital solutions used.	• Referrals: Self-referral from patients visiting the hospital, and through public advertisement • Provision: Free exercise consultation including test of physical function and body composition, individual exercise recommendations, plan and instruction/ supervision, assistance in finding a local sports club, information on possible prescriptions (e.g., rehabilitation sports), inclusion in exercise studies, or membership in a non-profit organization („IN|FORM"). Funded through the clinic budget and donations, available to individuals with cancer residing in Mecklenburg-Western Pomerania. • Level of digitalization: No digital solutions used.	• Referrals: Patients undergoing anticancer treatment are routinely referred by doctors or nurses to the cancer rehabilitation unit in Lund (but gaps in the systematic approach exist). After anticancer treatment, only patients with specialized rehabilitation needs are referred. If patients have basic rehabilitation needs, they may be referred to the local primary healthcare center. • Provision: Publicly funded through taxes for all patients. • Level of digitalization: National platform 1177.se and Vidicue are fully operational in clinical practice.	• Referrals: During anticancer treatment, no physiotherapy is provided, but private rehabilitation is available if the patient wishes. • Provision: After anticancer treatment, rehabilitation is publicly funded through taxes for all patients. • Level of digitalization: No digital solutions used.	• Referrals: During anticancer treatment, no hospital-based physiotherapy is offered (except for the Head & Neck cancer team, where all patients are referred and physiotherapy is initiated upon functional decline). Based on needs assessments, patients are referred to primary care rehabilitation (municipality), initiated either during or after anticancer treatment. • Provision: Publicly funded through taxes for all patients. • Level of digitalization: No digital solutions used.

PL – Poland; GER – Germany; SWE – Sweden; LTU – Lithuania; DK – Denmark.

development, while 2 other work packages focus on feasibility testing of digital solutions in cancer care: one evaluating home blood sampling (NCT06809101) and the other evaluating eRehab. The results of the AMBeR eRehab study will therefore provide data for the development of the implementation model, which can serve as guidance and a framework for others embarking on the digitization of physical rehabilitation in their local context.

A hybrid implementation-effectiveness design is employed to evaluate the implementation of eRehab while simultaneously assessing its effectiveness at the individual patient level. This study design was chosen for several reasons. First, there is substantial evidence and several international guidelines supporting participation in physical rehabilitation during and after cancer treatment, although knowledge of the effectiveness of eRehab interventions remains limited. Second, usual care and the organization of healthcare vary considerably across countries (Table 1), which calls for a feasibility-oriented study design with flexible starting points and iterative refinement to adequately capture these differences and enhance the value of the feasibility study. In this study, the definition of rehabilitation is limited to the physical component of rehabilitation, aimed at maintaining (Feasibility Study 1) or improving (Feasibility Study 2) physical performance and HRQoL through targeted exercise prescription.

The study began in September 2023 and will run for 3.5 years, until March 2027. Recruitment was initiated at different times across participating sites due to differences in the timing of approvals from local ethics committees and in the availability of digital solutions (Supplementary Table 1). The first patient was enrolled on September 13, 2024.

Setting

The study is part of the Interreg South Baltic Programme-funded AMBeR project (Advanced Modeling of Baltic e-cancer caRe), a collaboration among 7 partners from 5 countries in the southern Baltic Sea region (Fig. 1). The 5 partners involved in the AMBeR eRehab study are Zealand University Hospital, Næstved, Denmark (lead partner); University Clinical Center Gdańsk, Poland; Rostock University Medical Center, Germany; Ängelholm Hospital, Sweden; and Klaipėda University, Lithuania (Fig. 1).

Ethical approval and informed consent

Ethical approvals were obtained from the respective national ethical committees before any study activities took place (PL: Independent Bioethics Committee for Scientific Research, Medical University of Gdańsk, no: KB/545/2024-2025, dated 28.02.2025; GER: Ethics Committee of the University of Rostock A 2024-0150, dated 21.08.2024; SWE: Swedish Ethical Review Authority, Dnr 2024-04222-01, dated 21.08.2024; LTU: Regional Research Ethics Committee, BE-2-64, dated 11.06.2025). In Denmark, no ethical approval was required, but a Data-protection Board registration was approved, p-2024-17503,

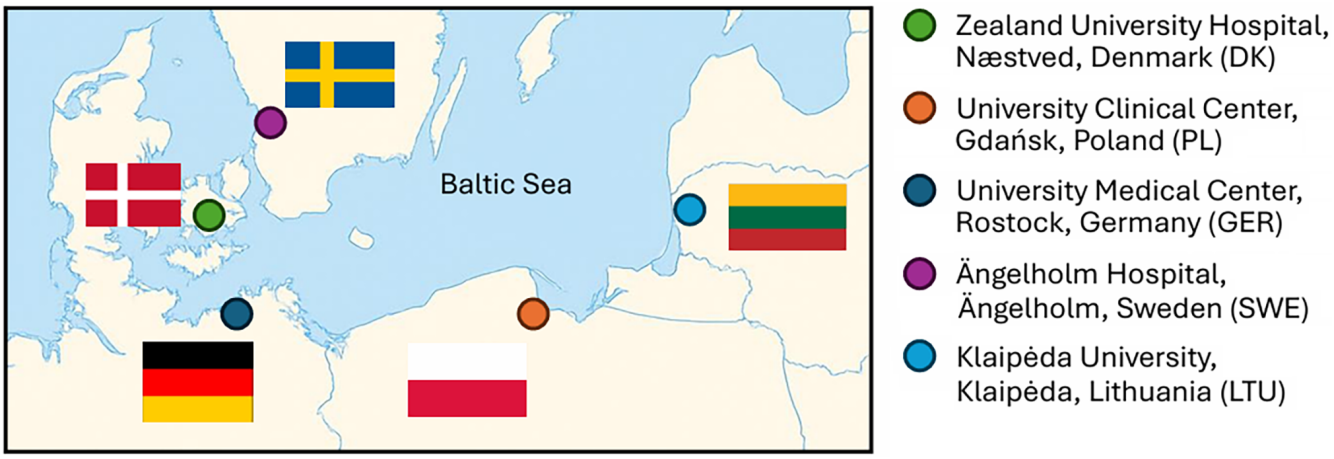

Fig. 1. Study sites in the AMBeR eRehab study

dated 27.11.2024. Written informed consent was obtained by all particpants. Patients who declined participation were asked to fill in a questionnaire on anthropometrics, socio-demographics, and clinical characteristics, consenting by answering the questionnaire. No information was recorded for patients who also declined answering the decliner questionnaire.

Participants

Each study site will conduct 2 single-arm intervention studies with 30 participants in each study, for a total of 300 participants across both feasibility studies. The basic eligibility criteria are age ≥18 years, any cancer diagnosis, including myeloproliferative neoplasms (ICD-10: C00*–C97*, D45, D47*), and the cognitive ability to provide informed consent. Additional study-specific inclusion criteria are: **Feasibility Study 1:** patients undergoing systemic cancer treatment. Participants should preferably, but not necessarily, have a treatment duration of at least 8 weeks at the time of study enrollment. **Feasibility Study 2:** patients who (a) completed systemic treatment within the previous 6 months or (b) had received long-term (>6 months) maintenance and/or life-prolonging systemic treatment. Patient group (b) was added through a protocol amendment during the enrollment period because it was not explicitly included in the original study protocol; however, early experience indicated that it represented a relevant target population for eRehab. The specific patient categories and clinical settings were allowed to vary across study sites and are described in more detail in Table 2.

Introducing new practices in existing care pathways

In both feasibility studies, the intervention is intended to follow usual practice and, whenever possible, use existing referral pathways. However, usual care with respect to needs assessment, referrals, and the content of physical rehabilitation varies substantially across participating sites, with the integration of exercise into oncology care ranging from being considered contraindicated to being fully embedded, as has also been described in the international literature.[18,37–39] At some participating sites, this study introduces physical rehabilitation in oncology as a novel component of care, whereas at others it introduces a new method of delivering physical cancer rehabilitation (digitally supported) within an already established rehabilitation framework. Accordingly, where no existing referral pathways for physical rehabilitation are available, new pathways must be established, whereas other sites already have well-established referral pathways that can readily incorporate the new intervention. Usual care and the intervention settings across participating sites are described in more detail in Table 2.

The intervention contents

The eRehab interventions will be delivered as a hybrid service but should primarily rely on digital solutions during follow-up consultations. To account for heterogeneity across sites while allowing for cross-national assessment of outcomes, a core framework for rehabilitation delivery, with room for site-specific variations, was established. The core framework was defined as follows: The intervention may be delivered remotely through digital solutions or as a hybrid intervention combining in-person and remote digital delivery. To encourage the transition to digital and remote delivery, an average of 2 in-person visits per month after the initial assessment is permitted per patient. The intervention should include an exercise prescription individually tailored to patients' needs, personal preferences, and goals, and should comply with national and/or international clinical guidelines based on the FITT principles.[12] The program should preferably last 8–12 weeks, but it was agreed between the study sites that length of program should be customized to the target population, relevance for the rehabilitation intervention, and the oncological treatment

Table 2. Details about the intervention setting, target patient groups, content, duration, and delivery across study sites in the AMBeR eRehab study

Study site	University Clinical Center, Gdańsk (PL)	University Medical Center, Rostock (GER)	Ängelholm Hospital, Ängelholm (SWE)	Klaipėda University, Klaipėda (LTU)	Zealand University Hospital, Næstved (DK)
Intervention setting (name of institution and location)	University Clinical Center, Gdańsk	Rostock University Medical Center	Cancer Rehabilitation Lund	Private rehabilitation setting (studio Be skausmo) in cooperation with Klaipeda University	Study 1: Zealand University Hospital, Department of Clinical Oncology Study 2: Lolland Municipality, Department of Rehabilitation
Patient groups targeted in recruitment	Studies 1 and 2: Patients with head and neck, colon, and breast cancer	Studies 1 and 2: Patients with all cancer types, including myeloproliferative neoplasms	Study 1 and 2: Patients with all cancer types	Studies 1 and 2: Patients with all cancer types	Study 1: Patients with head and neck, breast, and prostate cancer Study 2: Patients with all cancer types
Healthcare professionals delivering the intervention	Physiotherapists	Physiotherapists, qualified and licensed sport scientists	Physiotherapists	Physiotherapists	Physiotherapists
Remote/digital vs in-person consultations	Telephone contact for appointment scheduling. First contact in-person (including functional testing, exercise programming, equipment demonstration, and activation). A concluding in-person session with the physiotherapist is scheduled after approx. 8 weeks. If difficulties arise, patients may contact the physiotherapist through the application to arrange additional in-person visits	The first and last contacts (including assessment and program planning) take place in person. All other contacts preferably remote/digital	After the invitation (by phone), the first contact is in-person (including assessment, functional testing, and paper questionnaires). All other contacts, preferably remote/digital, but a maximum of 2 in-person contacts per month	First contact (incl. assessment and program planning) and last contact take place in-person, and all other contacts are preferably remote/digital, but a maximum of 2 in-person contacts per month	Both study 1 and 2: first and last contact with in-person attendance at the hospital (including baseline and end-of-study tests). Follow-up contacts, preferably remote/digital, with a maximum of bi-monthly in-person contacts. Study 1: Follow-up contacts are either made when the patient is at the hospital receiving anticancer treatment or by telephone. Study 2: Patients may additionally participate in weekly in-person team sessions
Duration of intervention	8–16 weeks	12 weeks	12–14 weeks	Approx. 10 weeks	Study 1: Head and neck cancer: 5–7 weeks Breast and prostate cancer: approx.12 weeks Study 2: Duration corresponds to usual care rehabilitation (12 weeks)
Digital platform/device (name, version, and description)	Doctor.One application, Electrocardiograph Eho-Mini rev. 10a, tele EKG from ProPlus, Pedometer BT-HUB v. 4.1 from ProPlus, Fingertrip Puls Oximeter, MBH Mobile Health. Patients use the app with 2 sets of exercises: 1 for primary and 1 for advanced cancer. Physiotherapists can monitor heart rate, ECG, step count, and ePROMs for wellbeing. Once weekly, the patient performs a morning ECG recording, and after the physiotherapist has reviewed the ECG and provided clearance, the patient performs the planned exercise under real-time ECG monitoring.	Lanista exercise app. Web-based software for therapy facilities and gyms. Includes approx.1,500 exercises explained using videos, images, and text (additional exercises can be added). The number of sets, duration, and repetitions can be customized. Patients receive a free app for their smartphone/tablet, can view plans, check off individual exercises or entire units, and contact the project team via a chat function.	Exorlive: Exercise program including approx. 8500 exercises illustrated with videos and text, shared with the patient through 1177.se. National platform 1177.se. A nationally integrated platform for information, booking, and exercise program delivery. Amni Care 9.0.3.3 A regionally integrated platform for data collection of ePROMs and PREMs. Vidicue Regionally integrated video solution for individual and group sessions. Fitbit Charge 6. Study-specific solution. The patient reports daily step counts through 1177.se.	Icura: Mobile phone application and censor for activity tracking, exercise, programming, automatic logging, and prompts for motivation. Physiotherapist backend for real-time exercise supervision and program modifications.	Icura: Mobile phone application and censor for activity tracking, exercise, programming, automatic logging, and prompts for motivation. Physiotherapist backend for real-time exercise supervision and program modifications.

ePROMs – electronic patient-reported outcomes; PREMs – patient-reported experience measure; PL – Poland; GER – Germany; SWE – Sweden; LTU – Lithuania; DK – Denmark.

regime in general. The exercise prescription should target muscle strength, endurance, coordination, range of motion, and/or sensorimotor function, and may be supplemented with group sessions as needed.

The intervention is delivered by trained or certified healthcare professionals (HCPs) with experience in oncology rehabilitation (e.g., physical therapists and exercise scientists), who are referred to as exercise specialists throughout this paper. We will use the Patient-Specific Functional Scale (PSFS)[40] to identify each patient's individual rehabilitation goals and tailor the intervention accordingly. Further details of the intervention are provided in Table 2.

Choosing a digital solution

Exercise specialists and the local study team at each site were involved in selecting the digital solution for eRehab delivery to ensure that it met the required criteria and the expected needs of the local context. The selection was based on market availability, language availability, suitability for the target population, objectivity of movement feedback, opportunities for interaction, and features supporting progression and regression of the exercise program. In addition, the requirements for integration with existing IT systems, as well as the advantages, disadvantages, and costs of each solution, were considered before the final selection was made.

Implementation components

Preplanned implementation support activities were provided by the designated implementation support team in the AMBeR study.

Preparation activities

First, efforts were made to map existing care processes and contexts and identify key stakeholders. Second, the new care process was described, and pathways within the new model of care were identified. To support this work, the lead partner and the implementation support team conducted site visits to all participating sites. A local workshop was held with participation from the implementation support team, the local study team (including local stakeholders), and, whenever possible, a patient representative who contributed the patient perspective on barriers and facilitators. The workshop resulted in a defined implementation strategy and action plan.

Training and onboarding

Before recruitment began, 2 training sessions were organized for project members. The 1st was an in-person, full-day seminar focusing on the rationale for exercise in oncology, familiarization with international guidelines and position statements, and an in-depth discussion and mapping of practice differences across participating sites. The 2nd was a 3-h online meeting focused on enhancing exercise specialists' ability to deliver remotely supervised rehabilitation supported by digital solutions, integrating digital technologies into their professional practice, and developing new competencies related to digital rehabilitation. The content of both training sessions was either recorded or summarized in educational materials for distribution to those who were unable to attend.

Table 3. Local implementation plan across study sites in the AMBeR eRehab study

Study site	University Clinical Center, Gdańsk (PL)	University Medical Center, Rostock (GER)	Ängelholm Hospital, Ängelholm (SWE)	Klaipėda University, Klaipėda (LTU)	Zealand University Hospital, Næstved (DK)
Implementation requirements/ strategy and onboarding	• Establishment of a small team of project physiotherapists facilitating daily contact and direct collaboration with oncologists • Onboarding meetings to establish an internal patient referral pathway and to deliver training on the equipment utilized • Ad hoc team meetings for problem shooting • Physiotherapists have access to support from the hospital administration.	• The establishment of a hematology and oncology exercise therapy working group (n = 4) with local ad hoc meetings/ consultations (face to face or via telephone/email) • Familiarization with protocol and assessments by all project members • Planning and supervision of intervention only by qualified/licensed physical therapists/ sports scientists	• Establishment of a small team of physiotherapists, administrators, and project coordinators • Weekly meetings, online or in-person, with daily online chat communication • Monthly meetings with the project manager for running updates and problem shooting • Project coordinators and the project manager are available for ad hoc online meetings or email.	• In-person onboarding meeting with adjustment of the data collection • Introduction to the protocol and intervention • Monthly online or in-person meetings for exchange of experiences and adjustments to study procedures.	• In-person onboarding meeting (introduction to the protocol and data collection) • Establishment of a small team of project physiotherapists with daily contact • Information to nurses and oncologists at monthly staff meetings for adjustments or problem shooting • Monthly online or in-person meetings with the project manager for problem shooting, exchange of experiences, and adjustments to study procedures.

PL – Poland; GER – Germany; SWE – Sweden; LTU – Lithuania; DK – Denmark.

Table 4. Outcomes and measurement time-points in the AMBeR eRehab trial

Domain/outcome	Measure	Pre-intervention	Post-intervention (8–12 weeks)	End of study
REACH				
Referrals	Where was patient referred from?	X		
Enrollment	Number enrolled Number declined or preferred usual care at inclusion	X X		
Characteristics enrolled/decliners	Questionnaire for participants: • Anthropometrics (height/weight) • Sociodemographics (age, sex, education, employment, cohabitation status) • Clinical information (cancer stage, time since diagnosis, treatment, comorbidity (a list of relevant co-morbidities and a free-text space)) • Digital literacy: Readiness and Enablement Index for Health Technology (READHY*) or HLQ/eHLQ/heiQ, depending on language availability Questionnaire for decliners: • Anthropometrics (height/weight) • Sociodemographic (age, sex, education, employment, cohabitation status) • Clinical information (cancer stage, time since diagnosis, treatment, comorbidity (a list of relevant co-morbidities and a free text space))	X X		
Reasons for decline	Study specific questionnaire item with options and a free-text space	X		
Structural barriers enrolled/decliners	No internet access Distance to facility Transportation time to the facility	X X X		
IMPLEMENTATION				
Fidelity checks (HCPs)	Frequency of remote/digital vs in-person consultations			X
Safety	Adverse events – ongoing reporting			X
Acceptability	Theoretical Framework of Acceptability (TFA) Questionnaire Operational problems with technology and language (study-specific items)		X X	
Time consumption per patient	Administrative time and contact attempts Consultation time			X X
ADOPTION				
Attendance and adherence	Attendance rates Adherence to exercise prescription			X X
EFFECTIVENESS				
Rehabilitation goal	PSFS	X	X	
PROMs	HRQoL: EORTC QLQ-C30 and EQ-5D-5L Fatigue: EORTC FA12 Optional[∞]: Physical activity level (GSLTPAQ or IPAQ, depending on language availability)	X X (X)	X X (X)	
Physical fitness	Physical measurements (in prioritized order to be selected from the availability of resources, including a minimum of 1 test from each category 1–4) 1) Active/inactive time and/or daily step count (weekly average) ([∞]assessed using PROM if not objectively measured by digital solution) 2) Gait speed test a) 10 m b) 4 m 3) Physical performance a) Chair Stand Test (30 s sit-to-stand) b) Timed Up-and-Go test c) Hand-grip dynamometry (upper body strength) d) Tandem test (balance) 4) Aerobic capacity a) 6-min walk test b) Watt-max test (stationary bike) c) 2-min step test (+ BORG 15 Rate of Perceived Exertion scale for all tests)	X X X X	X X X X	

HCPs – healthcare professionals; PROMs – patient-reported outcome measures; HRQoL – health-related quality of life; EORTC – European Organization for Research and Treatment of Cancer; QLQ – Quality of Life Questionnaire; C30 – Core questionnaire with 30 items; FA12 – Fatigue module with 12 items; GSLTPAQ – Godin-Shephard Leisure-Time Physical Activity Questionnaire; IPAQ – International Physical Activity Questionnaire; PSFS – Patient-Specific Functional Scale. *The READHY instrument consists of items from the 3 original instruments HLQ, eHLQ, and heiQ, and not all have been translated to all languages included in this study. Therefore, READHY is used in Sweden, Denmark, and Germany, while HLQ is used in Poland and heiQ in Lithuania.
[∞] If the digital solution at the respective site does not objectively measure physical activity, a questionnaire-based assessment is used.

Ongoing implementation support

Midway through the study, a 2nd workshop will be held with the theme "Facilitating and Supporting the Ongoing Process," focusing on addressing challenges, refining the implementation strategy, and supporting continued implementation. At the end of the study period, a 3rd workshop will focus on "Harvesting the Fruits of Best Practice," including lessons learned from the feasibility studies and an evaluation of planned, ongoing, and completed implementation activities. To provide a forum for regular project updates, troubleshooting implementation challenges, and harmonizing clinical practice and data collection, monthly online meetings are scheduled with open participation from all project members, with at least one representative from each site required to attend. Details of the local implementation efforts are provided in Table 3.

Data collection and outcomes

We used the RE-AIM framework to structure data collection on effectiveness and implementation outcomes,[41] as detailed in Table 4. For all quantitative data, we maintain a REDCap database to harmonize data collection across sites.

Reach

To assess reach, we examine referral patterns and recruitment rates by comparing participants and decliners with respect to anthropometric, sociodemographic, and clinical characteristics, as well as digital readiness/eHealth literacy assessed using the READHY,[42] HEIQ,[43] and HLQ[44] questionnaires. Furthermore, we explore the reasons for refusal to participate and the structural barriers affecting participation.

Effectiveness

In this study, "effectiveness" should not be interpreted as the effect of an intervention in a randomized controlled trial but rather as effectiveness at the individual level relative to what could reasonably be expected from the intervention.[41] Effectiveness is assessed using pre- and post-intervention measurements with prespecified targets of maintaining or improving physical function. These assessments include patient-reported outcome measures (PROMs), objective functional tests, and the PSFS.[40] PROMs are used to assess HRQoL (EORTC QLQ-C30,[45] EQ-5D-5L[46]), fatigue (EORTC FA12),[47] and, optionally, physical activity level using either the Godin-Shephard Leisure-Time Physical Activity Questionnaire (GSLT-PAQ)[48] or the International Physical Activity Questionnaire (IPAQ).[49] Objective physical tests assess physical function in 4 domains: 1) daily physical activity, 2) gait speed, 3) physical performance, and 4) aerobic capacity. A range of validated assessment methods within each domain was defined to accommodate differences in local resources and available equipment. Table 4 summarizes all assessment methods.

Acceptability, implementation, and maintenance

To assess acceptability, we use the Theoretical Framework of Acceptability (TFA).[50] The project team at each site maintains a logbook documenting the implementation process, actions taken, and the rationale for implementation decisions. In addition, minutes from the monthly online status meetings serve as documentation of the implementation process. Data from both sources will be analyzed using a narrative thematic approach and used to document implementation throughout the planning and intervention phases. The quantitative implementation evaluation, as defined by the RE-AIM framework, assesses intervention fidelity (whether remote delivery was implemented as intended and whether in-person consultations remained at ≤2 per month) and intervention safety (adverse events and time required per patient). We will also evaluate intervention adoption through attendance and adherence rates (Table 4). To assess the long-term maintenance of eRehab in clinical practice, it should be noted that the current study design is constrained by available resources and equipment, limiting the possibility of a full-scale implementation under routine clinical conditions. Therefore, a traditional maintenance evaluation will not be feasible during the project period. However, long-term determinants of sustainability will be explored from the perspectives of patients and exercise specialists using Group Concept Mapping.

Determinants

To explore patient and HCP perspectives on key determinants of engagement in eRehab, we will use Group Concept Mapping[51] during the final phase of the feasibility studies. All activities will be conducted online using Groupwisdom™ and will follow the standard steps: 1) brainstorming, 2) sorting, labeling, and rating, 3) generation of a cluster-rating map, and 4) validation. A representative sample of patients and all HCPs involved in delivering the intervention across participating sites will be invited by email. The brainstorming prompt, developed during a cross-site workshop, is: "What should be considered to ensure that digitally supported physical rehabilitation is meaningful in cancer rehabilitation, both in the short and long term?" Separate platforms will be created for each language, and all statements will undergo iterative translation to enable a shared cross-language analysis.

Statistical analyses and sample size

Quantitative data will be summarized using frequencies for categorical variables and means (standard deviations (SDs)) or medians (ranges or interquartile ranges (IQRs))

for continuous variables, as appropriate. Effectiveness will be evaluated through pre–post changes in outcome measures, stratified by Feasibility Study 1 and Feasibility Study 2. Paired t-tests will be used for normally distributed continuous outcomes, Wilcoxon signed-rank tests for non-normally distributed or ordinal outcomes, and McNemar's test for paired binary outcomes. Where possible, age, sex, and education will be compared between participants and nonparticipants using χ^2 tests (or Fisher's exact tests, where appropriate) for categorical variables and independent-samples t-tests or Mann–Whitney U tests for continuous or ordinal variables. Standardized mean differences and standardized proportion differences with 95% confidence intervals (95% CIs) will be reported to quantify group imbalances.

Sample size decisions were guided by recommendations for feasibility studies and the need for each site to gain sufficient experience while developing the implementation model. The consortium determined that 30 participants per site per feasibility study (total n = 300) was appropriate. The numbers of decliners and enrolled participants at each site will be recorded.

Discussion

The AMBeR eRehab study addresses a critical and timely gap in contemporary cancer care by investigating the feasibility and implementation of digitally supported physical rehabilitation during and after systemic cancer treatment across multiple South Baltic countries. The increasing demand for healthcare resources in cancer survivorship calls for high-quality, innovative solutions. While exercise-based rehabilitation is strongly recommended in international oncology guidelines,[12,15–17] its implementation in routine clinical practice remains inconsistent and inequitable, particularly in regions with limited access to specialized services.[18–20] It is therefore important that digital telehealth solutions be available and adapted to patients' needs, regardless of socioeconomic status or structural, geographic, and patient-related barriers.

Digital rehabilitation as a strategy to reduce inequities in cancer care

A central contribution of the AMBeR eRehab study is its focus on eRehab as a potential strategy to mitigate patient-related and structural barriers to cancer rehabilitation. Previous research has consistently demonstrated rural–urban disparities in access to supportive cancer care, with rural populations facing longer travel distances, fewer specialized services, and lower participation rates in rehabilitation programs.[24,25,28,29] By enabling remote or hybrid delivery of exercise therapy, eRehab has the potential to improve reach and accessibility while maintaining adherence to evidence-based exercise principles.

Systematic reviews suggest that telehealth-based cancer rehabilitation can improve physical functioning and cardiorespiratory fitness, although its effects on quality of life and disability outcomes remain heterogeneous.[33] The present study is therefore well positioned to extend the existing evidence by examining not only effectiveness-related outcomes but also reach, adoption, acceptability, and implementation across diverse healthcare systems. This comprehensive approach responds directly to calls in the literature to move beyond efficacy and address real-world implementation challenges in exercise oncology.[18,35]

Implementation-focused design and cross-national relevance

A major strength of the AMBeR eRehab study is its hybrid effectiveness–implementation design, which acknowledges the substantial heterogeneity in oncology rehabilitation practices across countries and clinical settings.[35–38] Rather than imposing a rigid intervention model, the study employs a shared core framework for the delivery of physical rehabilitation, with flexibility for site-specific adaptations, thereby enhancing its validity and transferability to routine clinical practice.

The structured implementation support – including co-design workshops, professional training, and continuous cross-site collaboration – reflects best practices in implementation science and addresses known barriers such as limited professional confidence, workflow disruption, and lack of institutional integration.[18,34,36] This study examines healthcare professionals' perspectives alongside patient experiences to generate new knowledge about clinical, organizational, and user-level determinants of eRehab implementation.

Patient-centered rehabilitation and individualized outcomes

Another important contribution of the study is its explicit emphasis on patient-centered rehabilitation. By incorporating individualized goal setting using the PSFS and aligning exercise prescriptions with the FITT principles, the intervention reflects contemporary rehabilitation models that prioritize functional participation over symptom reduction alone. This approach is consistent with international recommendations advocating personalized exercise interventions tailored to patients' preferences, capabilities, and treatment trajectories.[12,17]

Methodological considerations and anticipated limitations

As a feasibility study, the AMBeR eRehab project is not designed to establish causal effectiveness or compare digital rehabilitation with usual care. The single-arm design, modest sample size per site, and variation

in assessment methods across countries limit conclusions regarding intervention effectiveness. These design choices are appropriate, however, given the study's primary focus on feasibility, implementation, and context-specific learning as the foundation for future large-scale implementation.

Heterogeneity in digital solutions, referral pathways, and assessment methods complicates cross-national comparisons but also reflects real-world conditions and provides insight into how digital physical cancer rehabilitation can be adapted across different regulatory, cultural, and organizational contexts. Resource and time constraints prevent a comprehensive evaluation of long-term maintenance and sustainability, although these issues are addressed in part through the determinants analysis.

Implications for future research and practice

The findings of the AMBeR eRehab study are expected to inform the development of country-specific and trans-European guidance for digital physical cancer rehabilitation. By systematically examining feasibility and implementation across multiple settings, the study contributes to the growing body of evidence supporting the integration of exercise delivered in person, digitally, or through hybrid models as a core component of comprehensive cancer care.[17,34] Furthermore, this study is expected to demonstrate the importance of investing in digital health literacy, professional training, and organizational readiness to ensure that digital rehabilitation solutions are both effective and equitable.[31–33] Future research should build on these findings by conducting large-scale implementation studies to evaluate cost-effectiveness and explore the long-term sustainability of digitally supported rehabilitation within routine oncology care.

Conclusions

The AMBeR eRehab study represents an important step toward addressing persistent gaps in access to cancer rehabilitation through digitally supported, patient-centered exercise interventions. By bridging evidence and clinical practice, this study is well positioned to generate actionable knowledge that supports the sustainable integration of digital rehabilitation into oncology care across diverse healthcare systems.

Supplementary data

The supplementary materials are available at https://doi.org/10.5281/zenodo.20442307. The package contains the following files:

Supplementary Table 1. Date of approvals by local ethic committees and initiation of recruitment for all study sites (including amendments).

Consent for publication of personal information

Not applicable.

Use of AI and AI-assisted technology

We used ChatGPT and Microsoft Copilot to improve the language and readability of the paper, with close oversight and control by the authors, and the authors have carefully reviewed and edited the text used.

ORCID iDs

Gunn Ammitzbøll https://orcid.org/0000-0003-3227-9475
Sabine Felser https://orcid.org/0000-0002-4882-0468
Kathrin Thiele https://orcid.org//0009-0001-7085-2714
Hugo Murua Escobar https://orcid.org//0000-0001-7123-7986
Aelita Bredelytė https://orcid.org/0000-0002-5782-0937
Jan Arnholtz Overgaard https://orcid.org/0000-0002-9940-9185
Zofia Sotomska https://orcid.org/0000-0002-4482-1500
Hanna Lotzke https://orcid.org/0000-0002-4616-265X
Carl Johan Orre https://orcid.org/0000-0003-2070-6337
Bartłomiej Baumert https://orcid.org/0000-0001-9933-5844
Niels Henrik Holländer https://orcid.org//0000-0003-2509-2231
Christian Junghanß https://orcid.org/0000-0003-4707-777X
Katarzyna Gierat-Haponiuk https://orcid.org/0000-0002-0638-1997
Dariusz Szplit https://orcid.org/0000-0002-9421-0898
Susanne Oksbjerg Dalton https://orcid.org/0000-0002-5485-2730

References

1. Gatta G, Trama A, Capocaccia R. Variations in cancer survival and patterns of care across Europe: Roles of wealth and healthcare organization. *J Natl Cancer Inst Monogr.* 2013;2013(46):79–87. doi:10.1093/jncimonographs/lgt004
2. Bray F, Laversanne M, Sung H, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2024;74(3):229–263. doi:10.3322/caac.21834
3. Fairman CM, Lønbro S, Cardaci TD, VanderVeen BN, Nilsen TS, Murphy AE. Muscle wasting in cancer: Opportunities and challenges for exercise in clinical cancer trials. *JCSM Rapid Commun.* 2022;5(1):52–67. doi:10.1002/rco2.56
4. Getie A, Ayalneh M, Bimerew M. Global prevalence and determinant factors of pain, depression, and anxiety among cancer patients: An umbrella review of systematic reviews and meta-analyses. *BMC Psychiatry.* 2025;25(1):156. doi:10.1186/s12888-025-06599-5
5. Miaskowski C, Mastick J, Paul SM, et al. Chemotherapy-induced neuropathy in cancer survivors. *J Pain Symptom Manage.* 2017;54(2):204–218.e2. doi:10.1016/j.jpainsymman.2016.12.342
6. Morishita S, Kasahara R, Yamamoto Y, et al. Differences in the relationships between muscle strength, muscle mass, balance function, and quality of life for middle-aged and older breast cancer survivors. *Integr Cancer Ther.* 2022;21:15347354221138574. doi:10.1177/15347354221138574
7. Schmidt ME, Goldschmidt S, Hermann S, Steindorf K. Late effects, long-term problems and unmet needs of cancer survivors. *Int J Cancer.* 2022;151(8):1280–1290. doi:10.1002/ijc.34152
8. Thong MSY, Doege D, Koch-Gallenkamp L, et al. Fatigue in long-term cancer survivors: prevalence, associated factors, and mortality: A prospective population-based study. *Br J Cancer.* 2025;133(6):831–843. doi:10.1038/s41416-025-03116-z
9. Levinsen AKG, Dalton SO, Jakobsen E, et al. Prevalence of and factors associated with clinically important levels of fatigue, pain, and insomnia in survivors of cancer: A population-based cross-sectional study [published online as ahead of print on June 14, 2025]. *J Cancer Surviv.* 2025. doi:10.1007/s11764-025-01851-z
10. Levinsen AKG, Kjaer TK, Maltesen T, et al. Educational differences in healthcare use among survivors after breast, prostate, lung, and colon cancer: A SEQUEL cohort study. *BMC Health Serv Res.* 2023;23(1):674. doi:10.1186/s12913-023-09683-2

11. Baumann FT, Jensen W, Berling-Ernst A, Theurich S, Leitzmann M, Götte M. Exercise therapy in oncology. *Dtsch Arztebl Int*. 2024;121(10): 331–337. doi:10.3238/arztebl.m2024.0038
12. Campbell KL, Winters-Stone KM, Wiskemann J, et al. Exercise Guidelines for Cancer Survivors: Consensus Statement from International Multidisciplinary Roundtable. *Med Sci Sports Exerc*. 2019;51(11):2375–2390. doi:10.1249/MSS.0000000000002116
13. Misiąg W, Piszczyk A, Szymańska-Chabowska A, Chabowski M. Physical activity and cancer care: A review. *Cancers (Basel)*. 2022;14(17):4154. doi:10.3390/cancers14174154
14. Courneya KS, Vardy JL, O'Callaghan CJ, et al. Structured exercise after adjuvant chemotherapy for colon cancer. *N Engl J Med*. 2025; 393(1):13–25. doi:10.1056/NEJMoa2502760
15. Cormie P, Atkinson M, Bucci L, et al. Clinical Oncology Society of Australia Position Statement on Exercise in Cancer Care. *Med J Aust*. 2018; 209(4):184–187. doi:10.5694/mja18.00199
16. Ligibel JA, Bohlke K, May AM, et al. Exercise, Diet, and Weight Management During Cancer Treatment: ASCO Guideline. *J Clin Oncol*. 2022;40(22):2491–2507. doi:10.1200/JCO.22.00687
17. Schmitz KH, Campbell AM, Stuiver MM, et al. Exercise is medicine in oncology: Engaging clinicians to help patients move through cancer. *CA Cancer J Clin*. 2019;69(6):468–484. doi:10.3322/caac.21579
18. Kennedy MA, Bayes S, Newton RU, et al. Implementation barriers to integrating exercise as medicine in oncology: An ecological scoping review. *J Cancer Surviv*. 2022;16(4):865–881. doi:10.1007/s11764-021-01080-0
19. Maiwald P, Weis J, Kurlemann U, et al. Barriers to utilisation of cancer rehabilitation from the expert's view: A cross-sectional survey. *Eur J Cancer Care (Engl)*. 2022;31(1):e13522. doi:10.1111/ecc.13522
20. Holm LV, Hansen DG, Larsen PV, et al. Social inequality in cancer rehabilitation: A population-based cohort study. *Acta Oncol*. 2013; 52(2):410–422. doi:10.3109/0284186X.2012.745014
21. Strömberg U, Berglund A, Carlsson S, et al. Socioeconomic inequality in prostate cancer diagnostics, primary treatment, rehabilitation, and mortality in Sweden. *Int J Cancer*. 2024;155(4):637–645. doi:10.1002/ijc.34932
22. Oksbjerg Dalton S, Halgren Olsen M, Moustsen IR, Wedell Andersen C, Vibe-Petersen J, Johansen C. Socioeconomic position, referral and attendance to rehabilitation after a cancer diagnosis: A population-based study in Copenhagen, Denmark 2010–2015. *Acta Oncol*. 2019;58(5):730–736. doi:10.1080/0284186X.2019.1582800
23. Schmitz KH, Demanelis K, Crisafio ME, et al. Proximity to cancer rehabilitation and exercise oncology by geography, race, and socioeconomic status. *Cancer*. 2025;131(1):e35515. doi:10.1002/cncr.35515
24. Butow PN, Phillips F, Schweder J, White K, Underhill C, Goldstein D. Psychosocial well-being and supportive care needs of cancer patients living in urban and rural/regional areas: A systematic review. *Support Care Cancer*. 2012;20(1):1–22. doi:10.1007/s00520-011-1270-1
25. Felser S, Behrens M, Lampe H, et al. Motivation and preferences of cancer patients to perform physical training. *Eur J Cancer Care*. 2020; 29(4):e13246. doi:10.1111/ecc.13246
26. De Jongh ECE, Ammitzbøll G, Van De Poll-Franse LV, et al. Socioeconomic position and access to supportive cancer care in Europe: A scoping review of literature from 2000 to 2024 [published online as ahead of print on October 7, 2025]. *J Cancer Surviv*. 2025. doi:10.1007/s11764-025-01904-3
27. Rajotte EJ, Yi JC, Baker KS, Gregerson L, Leiserowitz A, Syrjala KL. Community-based exercise program effectiveness and safety for cancer survivors. *J Cancer Surviv*. 2012;6(2):219–228. doi:10.1007/s11764-011-0213-7
28. Weaver KE, Geiger AM, Lu L, Case LD. Rural-urban disparities in health status among US cancer survivors. *Cancer*. 2013;119(5):1050–1057. doi:10.1002/cncr.27840
29. Weaver KE, Palmer N, Lu L, Case LD, Geiger AM. Rural–urban differences in health behaviors and implications for health status among US cancer survivors. *Cancer Causes Control*. 2013;24(8):1481–1490. doi:10.1007/s10552-013-0225-x
30. Chang P, Engle J. Telemedicine and virtual interventions in cancer rehabilitation: Practical application, complications and future potentials. *Curr Oncol Rep*. 2024;26(12):1600–1605. doi:10.1007/s11912-024-01612-8
31. Rooney D, Gilmartin E, Heron N. Prescribing exercise and physical activity to treat and manage health conditions. *Ulster Med J*. 2023; 92:9–15. PMID:36762135.
32. Batalik L, Chamradova K, Winnige P, et al. Effect of exercise-based cancer rehabilitation via telehealth: A systematic review and meta-analysis. *BMC Cancer*. 2024;24(1):600. doi:10.1186/s12885-024-12348-w
33. Brick R, Padgett L, Jones J, et al. The influence of telehealth-based cancer rehabilitation interventions on disability: A systematic review. *J Cancer Surviv*. 2023;17(6):1725–1750. doi:10.1007/s11764-022-01181-4
34. Gorzelitz JS, Bouji N, Stout NL. Program barriers and facilitators in virtual cancer exercise implementation: A qualitative analysis. *Transl J Am Coll Sports Med*. 2022;7(3):e000199. doi:10.1249/TJX.0000000000000199
35. Mukhtar T, Babur MN, Abbas R, Irshad A, Kiran Q. Digital health literacy: A systematic review of interventions and their influence on healthcare access and sustainable development Goal-3 (SDG-3). *Pak J Med Sci*. 2025;41(3):910–918. doi:10.12669/pjms.41.3.10639
36. Nopour R. Barriers and facilitators of using tele-oncology in cancer care: A scoping review. *BMC Health Serv Res*. 2025;25(1):541. doi:10.1186/s12913-025-12731-8
37. Ramsey I, Chan A, Charalambous A, et al. Exercise counselling and referral in cancer care: An international scoping survey of health care practitioners' knowledge, practices, barriers, and facilitators. *Support Care Cancer*. 2022;30(11):9379–9391. doi:10.1007/s00520-022-07342-6
38. Ezenwankwo EF, Nnate DA, Usoro GD, et al. A scoping review examining the integration of exercise services in clinical oncology settings. *BMC Health Serv Res*. 2022;22(1):236. doi:10.1186/s12913-022-07598-y
39. Luo H, Bergerot PG, Galvão DA, et al. International perspectives on exercise oncology: Current state, challenges, and opportunities for future development. *J Natl Cancer Inst Monogr*. 2025;2025(71): 325–333. doi:10.1093/jncimonographs/lgaf028
40. Stratford P. Assessing disability and change on individual patients: A report of a patient-specific measure. *Physiother Can*. 1995;47(4): 258–263. doi:10.3138/ptc.47.4.258
41. Holtrop JS, Estabrooks PA, Gaglio B, et al. Understanding and applying the RE-AIM framework: Clarifications and resources. *J Clin Trans Sci*. 2021;5(1):e126. doi:10.1017/cts.2021.789
42. Kayser L, Rossen S, Karnoe A, et al. Development of the multidimensional Readiness and Enablement Index for Health Technology (READHY) tool to measure individuals' health technology readiness: Initial testing in a cancer rehabilitation setting. *J Med Internet Res*. 2019;21(2):e10377. doi:10.2196/10377
43. Osborne RH, Elsworth GR, Whitfield K. The Health Education Impact Questionnaire (heiQ): An outcomes and evaluation measure for patient education and self-management interventions for people with chronic conditions. *Patient Educ Couns*. 2007;66(2):192–201. doi:10.1016/j.pec.2006.12.002
44. Osborne RH, Batterham RW, Elsworth GR, Hawkins M, Buchbinder R. The grounded psychometric development and initial validation of the Health Literacy Questionnaire (HLQ). *BMC Public Health*. 2013; 13(1):658. doi:10.1186/1471-2458-13-658
45. Aaronson NK, Ahmedzai S, Bergman B, Bullinger M, Cull A, Duez NJ, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: A quality-of-life instrument for use in international clinical trials in oncology. *J Natl Cancer Inst*. 1993;85:365–376. PMID:8433390.
46. Herdman M, Gudex C, Lloyd A, et al. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Qual Life Res*. 2011;20(10):1727–1736. doi:10.1007/s11136-011-9903-x
47. Weis J, Tomaszewski KA, Hammerlid E, et al. International Psychometric Validation of an EORTC Quality of Life Module Measuring Cancer Related Fatigue (EORTC QLQ-FA12). *J Natl Cancer Inst*. 2017;109(5): djw273. doi:10.1093/jnci/djw273
48. Godin G. The Godin-Shephard Leisure-Time Physical Activity Questionnaire. *J Health Fitness J Can*. 2011;4(1):18–22. doi:10.14288/HFJC.V4I1.82
49. Craig CL, Marshall AL, Sjöström M, et al. International Physical Activity Questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc*. 2003;35(8):1381–1395. doi:10.1249/01.MSS.0000078924.61453.FB
50. Sekhon M, Cartwright M, Francis JJ. Development of a theory-informed questionnaire to assess the acceptability of healthcare interventions. *BMC Health Serv Res*. 2022;22(1):279. doi:10.1186/s12913-022-07577-3
51. Trochim W, Kane M. Concept mapping: An introduction to structured conceptualization in health care. *Int J Qual Health Care*. 2005; 17(3):187–191. doi:10.1093/intqhc/mzi038