Pilot and Feasibility Studies

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The online delivery of exercise oncology classes supported with health coaching: a parallel pilot randomized controlled trial

Maximilian Eisele[1*], Andrew J. Pohl[1], Meghan H. McDonough[1], Margaret L. McNeely[3], Manuel Ester[1], Julia T. Daun[1], Rosie Twomey[1,2] and S. Nicole Culos-Reed[1,4,5]

Abstract

Purpose The primary objective was to investigate the feasibility of a synchronous, online-delivered, group-based, supervised, exercise oncology maintenance program supported with health coaching.

Methods Participants had previously completed a 12-week group-based exercise program. All participants received synchronous online delivered exercise maintenance classes, and half were block randomized to receive additional weekly health coaching calls. A class attendance rate of ≥ 70%, a health coaching completion rate of ≥ 80%, and an assessment completion rate of ≥ 70% were set as markers of feasibility. Additionally, recruitment rate, safety, and fidelity of the classes and health coaching calls were reported. Post-intervention interviews were performed to further understand the quantitative feasibility data. Two waves were conducted — as a result of initial COVID-19 delays, the first wave was 8 weeks long, and the second wave was 12 weeks long, as intended.

Results Forty participants ($n_{8WK} = 25$; $n_{12WK} = 15$) enrolled in the study with 19 randomized to the health coaching group and 21 to the exercise only group. The recruitment rate (42.6%), attrition (2.5%), safety (no adverse events), and feasibility were confirmed for health coaching attendance (97%), health coaching fidelity (96.7%), class attendance (91.2%), class fidelity (92.6%), and assessment completion (questionnaire = 98.8%; physical functioning = 97.5%; Garmin wear-time = 83.4%). Interviews highlighted that convenience contributed to participant attendance, while the diminished ability to connect with other participants was voiced as a drawback compared to in-person delivery.

Conclusion The synchronous online delivery and assessment of an exercise oncology maintenance class with health coaching support was feasible for individuals living with and beyond cancer. Providing feasible, safe, and effective exercise online to individuals living with cancer may support increased accessibility. For example, online may provide an accessible alternative for those living in rural/remote locations as well as for those who may be immunocompromised and cannot attend in-person classes. Health coaching may additionally support individuals' behavior change to a healthier lifestyle.

Trial registration The trial was retrospectively registered (NCT04751305) due to the rapidly evolving COVID-19 situation that precipitated the rapid switch to online programming.

Keywords Health coaching, Exercise, Physical activity, Maintenance, Cancer survivors, Online delivery, mHealth

*Correspondence:
Maximilian Eisele
Maximilian.eisele@ucalgary.ca
Full list of author information is available at the end of the article

Key messages regarding feasibility

- To the best of our knowledge, this is the first synchronous online supervised maintenance exercise program for individuals living with and beyond cancer, thus understanding measures of feasibility is required prior to larger-scale implementation.
- The synchronous online delivery of a group-based maintenance program, the additional health coaching support, and the measurement tools used are feasible and safe for individuals living with and beyond cancer.
- Offering two supervised classes per week, providing instructions on using the objective activity tracker, and providing meaningful results to the participants about their physical function may enhance participation.

Background

The COVID-19 pandemic and associated physical distancing measures have limited access to fitness facilities and sporting activities, increased sedentary behavior, loneliness, and reduced physical activity (PA) levels [1]. These issues are exacerbated for individuals living with or beyond cancer [2], who may be dealing with negative side effects of cancer and cancer treatment and may be immunocompromised [3]. Indeed, these individuals face more than a twofold risk of contracting COVID-19 and are at increased risk for more severe symptom progression [4]. PA reduces the impact of cancer-related side effects such as fatigue [5], cachexia, and cardiorespiratory deconditioning [6], so necessary physical distancing measures may be more detrimental in this population [3].

PA is beneficial for individuals living with and beyond cancer (i.e., those from the point of diagnosis onward, through survivorship, and including those living with advanced cancer) [7, 8] and evidence has supported the development of cancer exercise guidelines [9]. However, the proportion of individuals meeting these guidelines remains low [10]. Common barriers to being physically active include lack of time, proximity to exercise facilities or accessibility of cancer-specific exercise programs, and treatment-related symptoms [11]. These barriers, and new barriers imposed by physical distancing measures during the pandemic (e.g., facilities being closed), can be addressed by providing home-based exercise oncology programs.

To date, most home-based exercise oncology interventions have been unsupervised and report lower adherence rates compared to in-person supervised settings [12–14]. The synchronous delivery of online exercise programming by a trained professional may address barriers to PA maintenance (e.g., accessibility to facilities and time constraints). However, to our knowledge, the feasibility of providing synchronous online group-based exercise programming for individuals living with and beyond cancer, with virtual supervision by a qualified exercise professional, has received relatively little attention [15, 16]. In addition to these initial supportive findings, synchronous online supervised exercise interventions in other populations with chronic disease have shown promising results in terms of feasibility and preliminary effectiveness [17, 18]. To support online exercise interventions and the long-term maintenance of increased PA, additional support may be beneficial, and health coaching (HC) provides one option. HC is a behavior change tool that is participant-centered and built on a coach-participant relationship [19]. It includes participant-determined goals, a self-discovery process to find solutions, participant accountability, and health education [19]. Preliminary evidence suggests HC may increase QoL, mental well-being [20], PA levels [21], as well as maintenance of PA levels [22, 23]. Given these potential benefits, the primary objective of this pilot study was to assess the feasibility of a synchronous online group-based supervised exercise oncology maintenance program with additional HC support. We hypothesized that an online supervised group-based exercise oncology maintenance program supported with individual HC sessions would be feasible, as measured by a class attendance rate of $\geq 70\%$, a HC completion rate of $\geq 80\%$, and an assessment completion rate of $\geq 70\%$. Recruitment rate, safety, and fidelity of the exercise maintenance class and HC were also evaluated. The qualitative inquiry aimed to understand the participants' perceptions on the feasibility of completing assessments, participating in synchronous online exercise classes, and weekly HC calls, as well as understand how the intervention may have prepared them to be successful in maintaining being active.

Methods

Study design

The study was a pilot randomized controlled trial (RCT) with two parallel intervention arms. An embedded mixed methods study design was used, guided by a pragmatic philosophy, which aligned with addressing practical concerns of feasibility [24]. The study was approved by the Health Research Ethics Board of Alberta – Cancer Committee (HREBA.CC-19–0206) and retrospectively registered as a clinical trial (NCT04751305). The retrospective registration was due to the rapidly evolving COVID-19 situation that precipitated the rapid switch to online programming. The CONSORT Extension to Pilot

and Feasibility Trials checklist was completed and can be found in supplementary file 4.

Study setting

All components of the study were performed in an online environment through an end-to-end encrypted version of the Zoom videoconferencing application (Zoom video communications; San Jose, CA) or the survey monkey platform (Momentive Inc.; San Mateo, CA) for patient-reported outcomes. Two waves were conducted — as a result of initial COVID-19 delays in securing ethics and approvals, the first wave was 8 weeks long, and the second wave was 12 weeks long, as intended. The intended 12-week timeframe was chosen for a number of reasons. First, this study was embedded into an existing maintenance program that had been designed from the Alberta Cancer Exercise (ACE) study, which had an initial in-person intervention of 12 weeks, and a subsequent in-person maintenance program of 12 weeks [25]. These timelines for both our initial and maintenance interventions are based on behavior change research defining the maintenance phase as 3 to 6 months of continuous exercise [10, 26]. Finally, the habit, or maintenance, of exercise behavior change is known to be volatile, thus increasing time for support is critical [27]. Recruitment, trial commencement, and follow-up for the first 8-week wave occurred from May to the end of July 2020. Recruitment, trial commencement, and follow-up for the second 12-week wave occurred from August until the beginning of December 2020. The only change made to the study methods after the trial commenced was to add an activity tracker usage questionnaire to the post-assessment for the 12-week participants.

Participants

All participants have completed the ACE baseline intervention [25], a 12-week group-based exercise class that was delivered in-person for the first cohort in the current study, and online for the second cohort (due to the pandemic restrictions). Additional inclusion criteria were (1) individuals living with and beyond cancer — all cancer types and stage up to three years after treatment completion; (2) 18 years or older; (3) access and familiarity with a computer, laptop, or tablet with a video camera capable of running Zoom video conferencing software; (4) an internet connection strong enough to support a live video broadcast; and (5) provided written informed consent in English. Participants were also screened for exercise readiness by a clinical exercise physiologist (CEP) with the PAR-Q+Readiness Questionnaire tool. Eligible participants completed the pre-maintenance exercise program baseline assessments and were randomized with a 1:1 allocation ratio to either the HC intervention or the non-HC intervention through an online random sequence generator [28]. The first author enrolled participants, generated the random allocation sequence, and assigned participants to the intervention groups. The exercise class instructors and physical functioning assessors were blinded to intervention allocation (HC or non-HC). All participants were invited to participate in semi-structured interviews after completion of the intervention. The goal was to interview half of each of the intervention (HC and non-HC) groups to gather feedback on the intervention components from a range of participants. Interviews were audio-recorded over the Zoom application and conducted by the first author.

Online exercise oncology maintenance program

All participants received the online group-based exercise oncology maintenance program, which consisted of online exercise classes and additional educational and program resources to support additional home-based exercise engagement. An in-depth description of the intervention, including the behavior change support, can be found in supplementary file 1. The classes were instructed by a CEP through Zoom video conferencing and were multimodal, including strength, cardiovascular fitness, balance, and flexibility exercises. The CEP was assisted by a moderator during class, whose responsibilities were to ensure safety and address technical problems with the Zoom application [29]. After each class, the instructor and moderator facilitated a post-class discussion intended to foster social support, evoke thoughts about an active lifestyle (e.g., by posing discussion questions), and offered the opportunity for questions. The classes were twice a week for the first 2 weeks of the exercise maintenance program and then reduced to once a week for the remainder of the study, to facilitate participants being active independently for the remainder of the week. Once tapering occurred, all participants received a PDF of an at-home exercise program, which included six different circuits with three different intensity options, providing the participants with the opportunity to tailor exercises to meet their needs. The timeline of the intervention is graphically displayed in Fig. 1.

Health coaching intervention

Participants randomized to the HC intervention received weekly one-on-one HC calls. HC was structured based on Wolever et al. [19], where HC is participant-centered, built on a coach-participant relationship, and includes participant-determined goals, a self-discovery process to find solutions, patient accountability, and education. A day before each HC call, the participants completed a survey on fatigue, QoL, stress, loneliness, and social

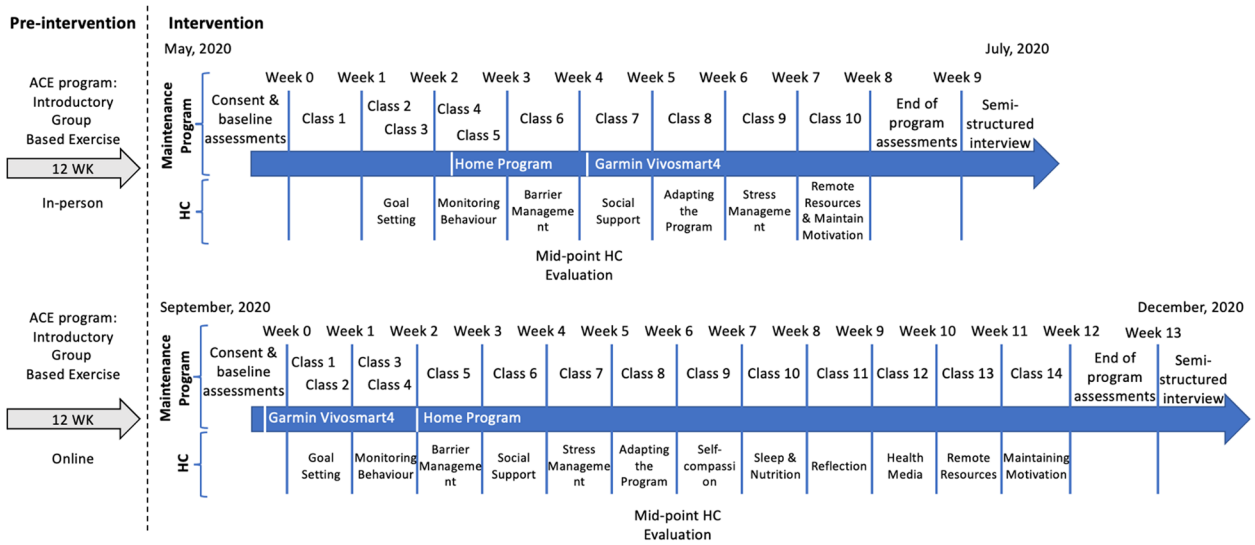

Fig. 1 Timeline of the 8- and 12-week intervention. Notes: Intervention in the current study began with the maintenance exercise program, with or without the randomized inclusion of health coaching. Two cohorts of varying durations (due to pandemic restrictions) occurred, with 8-week and 12-week interventions

support, enabling tailoring of the HC call to address individual needs.

Educational topics within the HC calls included: goal setting, monitoring behavior, barrier management, social support, stress management, adapting the program, remote resources, and maintaining motivation for both study waves. Due to the additional 4 weeks, the 12-week wave included four additional education topics (self-compassion, sleep and nutrition, reflection, and health media). The educational topics were delivered in the above order, however, the health coach had the liberty to adjust the order of delivery to meet participants' needs. Each HC call was structured, starting with a reflection on the previous week, a conversation about the educational topic, and finishing with an action plan for the upcoming week. The duration of the health coaching calls was not pre-determined and was based on participants' needs. Based on participant interest, a summary sheet of the educational topic was sent to the individual. At the halfway point of the intervention, the participant provided feedback to their health coach on the HC calls by setting time aside at the end of the HC call. The health coaches were graduate students trained in behavior change strategies and exercise oncology, had extensive experience with the larger ACE program, and completed at least 30 h of HC training (mock interviews, motivational interviewing techniques, and reviewing the HC literature). The weekly HC calls were held via Zoom at a convenient time for the participant, and the length of each call was dependent on the participant's needs. No restrictions on receiving additional counseling or coaching from outside sources were made. The behavior change tools used can be found in Supplementary file 2.64:108-110

Primary outcome: feasibility

Recruitment was calculated as the percent of those that participated in the study from those eligible (with no pre-determined level). Safety and adverse event reporting followed standardized guidelines [30] and were tracked by the moderator. After completion of the intervention, all participants were invited to participate in semi-structured interviews, which focused on their perceptions and satisfaction with the online classes, the HC intervention, the assessments, and their perceptions of safety. Recruitment, safety, and adverse event reporting and fidelity did not have pre-determined criteria (levels) of feasibility due to limited previous literature of recruiting and administering an online synchronous supervised exercise intervention to individuals living with and beyond cancer. Feasibility measures with pre-determined levels included online exercise and HC attendance, as well as completion of assessments.

Online exercise classes The criteria for establishing the feasibility of the scheduled exercise classes was set at 70% attendance, based on previous findings in an online synchronous setting [18]. Assessment of intervention fidelity (i.e., delivery of content and timing as intended) was performed using a structured fidelity checklist that was completed by the moderator during each class. Fidelity was reported as the overall percentage of items on the checklist adhered to across all classes. Participants were asked

about barriers and facilitators to exercise class attendance during interviews.

Health coaching The feasibility criteria for the HC attendance was set at 80%, based on HC completion rates reported in exercise oncology [22]. The fidelity of the HC delivery was assessed by randomly recording two HC calls for each participant. HC recordings were assessed by independent evaluators with HC training, comparing the HC protocol to the recorded HC call. HC call fidelity was reported as the overall percentage of items adhered to on the checklist across the recorded HC sessions. Additionally, participants were asked in the interview about their preference regarding the HC call structure in terms of length, frequency, and general delivery.

Assessments The feasibility cut-off for the completion rate of the physical functioning assessments, the objective PA data, and the questionnaires was set at 70% [31]. Participants' perspectives of these feasibility aspects of the collected data were also explored in the interview.

Exploratory outcomes

Due to the pilot feasibility nature of the current study, and two intervention lengths that were delivered due to the pandemic, exploratory outcomes assessing the potential impact of the exercise maintenance with or without HC intervention are not included in the current manuscript. Individual-level assessments included online physical functioning assessments, PA-level assessments (objective and subjective), and patient-reported outcomes. All measures that occurred pre- and post-intervention, except for objective PA levels, were reported continuously throughout the intervention via a wearable device. Pre- and post-intervention assessments, including self-report questionnaires and physical functioning, were completed in the week before and after the intervention, respectively. For details on measures and the exploratory results, refer to the supplementary files 5 and 6 in the Open Science Framework.

Analysis

Quantitative data analysis All data were analyzed using SPSS statistics (v26, IBM). For continuous data, normality was assessed by inspecting histograms, box plots, QQ-plots, and the Shapiro–Wilk test of normality. Descriptive statistics were reported as means and standard deviations (SD) for normally distributed data and medians and interquartile ranges for non-normally distributed data. Categorical outcomes were reported as frequencies and percentages.

Qualitative data analysis Audio recordings were transcribed verbatim, and data were managed in NVivo12 (QSR International 2019; Burlington, MA). Data analysis used qualitative description [32] and illustrative analysis [24]. Throughout the analysis, the first author stayed close to the participant responses and simply described the content by assigning quotes to shared beliefs. The qualitative results were compared with and interpreted in light of the quantitative results, to illustrate and provide context and elaboration on the feasibility of the intervention. The quality of the qualitative portion of the study was assessed based on its credibility, dependability, transferability, and confirmability [33]. Credibility was enhanced through prolonged engagement (the interviewer moderated each class and health coached some of the participants) and methodological triangulation of the qualitative and quantitative data. To enhance transferability, we strove for thick description (to the extent qualitative description allowed) to allow readers to form their own interpretation of the applicability of the findings to other situations. Dependability and confirmability were enhanced by a dependability and confirmability audit respectively, with the senior author being the auditor.

Results

Participant demographics

The study included 40 participants (25 participants in the 8-week wave and 15 in the 12-week wave). The reasons for exclusion are outlined in Fig. 2. The mean participant age was 56 ± 9 years and most study participants self-identified as being of European ancestry (82.5%) and female (92.5%). The most common cancer diagnosis was breast cancer (70.0%) and more than half of the participants were on active treatment during the exercise maintenance intervention (55.0%). The most common treatment was surgery (87.5%), followed by chemotherapy (75.0%) and radiation (62.5%). Half of the participants had previous experience with an activity tracker (50.0%). A full description of demographics can be found in Table 1. Approximately half (19/39, 48.7%) of the eligible participants participated in the post-intervention interviews. Of these participants, 10 were from the non-HC group (10/20; 50%) and 9 were from the HC group (9/19; 47.4%).

Feasibility

The overall study recruitment rate was 42.6% (Table 2). The attrition rate of the study was 2.5%, with one participant dropping out after 4 weeks due to returning to work. No adverse events were reported. A summary of the quantitative feasibility results can be found in Table 2.

Table 1 Participant demographics for the 8- and 12-week interventions

Group	Wave 1 (8WK)		Wave 2 (12WK)		Total
	HC ($n=12$) (Mean ± SD or *n* (%))	Non-HC ($n=13$) (Mean ± SD or *n* (%))	HC ($n=7$) (Mean ± SD or *n* (%))	Non-HC ($n=8$) (Mean ± SD or *n* (%))	($n=40$) (Mean ± SD or *n* (%))
Age (in years)	59 ± 10	54 ± 10	54 ± 6	56 ± 8	56 ± 9
Sex					
Female	11 (91.7)	12 (92.3)	7 (100)	7 (87.5)	37 (92.5)
Male	1 (8.3)	1 (7.7)	0 (0)	1 (12.5)	3 (7.5)
Education status					
High school or less	1 (8.3)	0 (0)	0 (0)	2 (25)	3 (7.5)
Some university or more	11 (91.7)	13 (100.0)	7 (100)	6 (75)	37 (92.5)
Employment status					
Working – part/full time	2 (16.7)	3 (23.1)	3 (42.9)	2 (25)	10 (25)
Not working – retired, disability, unemployed	10 (83.3)	10 (76.9)	4 (57.1)	6 (75)	30 (75)
Marital status					
Married	12 (100)	6 (46.2)	7 (100)	7 (87.5)	32 (80)
Common law	0 (0)	1 (7.7)	0 (0)	0 (0)	1 (2.5)
Widowed	0 (0)	2 (15.4)	0 (0)	0 (0)	2 (5)
Divorced	0 (0)	4 (30.8)	0 (0)	0 (0)	5 (12.5)
Ethnicity					
European	10 (83.3)	12 (92.3)	4 (57.1)	7 (87.5)	33 (82.5)
Indigenous	0 (0)	0 (0)	0 (0)	1 (12.5)	1 (2.5)
East and South Asian	2 (16.7)	1 (7.7)	1 (14.3)	1 (12.5)	5 (12.5)
Latin/Central and South American	0 (0)	0 (0)	1 (14.3)	0 (0)	1 (2.5)
African	0 (0)	0 (0)	1 (14.3)	0 (0)	1 (2.5)
Mixed	1 (8.3)	0 (0)	0 (0)	0 (0)	1 (2.5)
Cancer type					
Breast	6 (50)	10 (76.9)	6 (85.7)	6 (75)	28 (70)
Lung	0 (0)	1 (7.7)	0 (0)	0 (0)	1 (2.5)
Vascular	0 (0)	2 (15.4)	1 (14.3)	0 (0)	3 (7.5)
Gynecological	4 (33.3)	1 (7.7)	0 (0)	1 (12.5)	6 (15)
Genitourinary	1 (8.3)	0 (0)	0 (0)	1 (12.5)	2 (5)
Head and neck	1 (8.3)	0 (0)	0 (0)	1 (12.5)	2 (5)
Skin	1 (8.3)	0 (0)	1 (14.3)	2 (25)	4 (10)
Active cancer treatment	5 (41.7)	7 (53.8)	3 (42.9)	7 (87.5)	22 (55)
Using an activity tracker	4 (33.3)	9 (69.2)	3 (42.9)	4 (50)	20 (50)

HC health coaching intervention group, *non-HC* non-health coaching control group (group-based exercises only)

Online exercise classes

Class attendance was 91.2%, with a 13.5% higher attendance rate for the HC (94.5%) vs the non-HC group (81%). A similar trend was observed in the post-class discussion, with an overall attendance of 88.4%, a HC group attendance of 91.7%, and a non-HC attendance rate of 78.5%. Facilitators of exercise program attendance reported during the interviews included convenience ($n=13/19$), reduced concern about physical appearance ($n=4/19$), and less exposure to pathogens, which was important for this immunocompromised population ($n=3/19$). Participants mentioned reduced travel time to the exercise facility, being in the comfort of home, and not being location-bound contributed to convenience.

> *But you know at 5:00 o'clock in the city, … I wouldn't be driving over to the University and back at 6. Like that would be, you'd be right in traffic at that time. So that's pretty convenient just to turn on your iPad and get going. (female, 59, non-HC)*

Barriers to online programing attendance included the equipment availability, the ability to tailor exercises

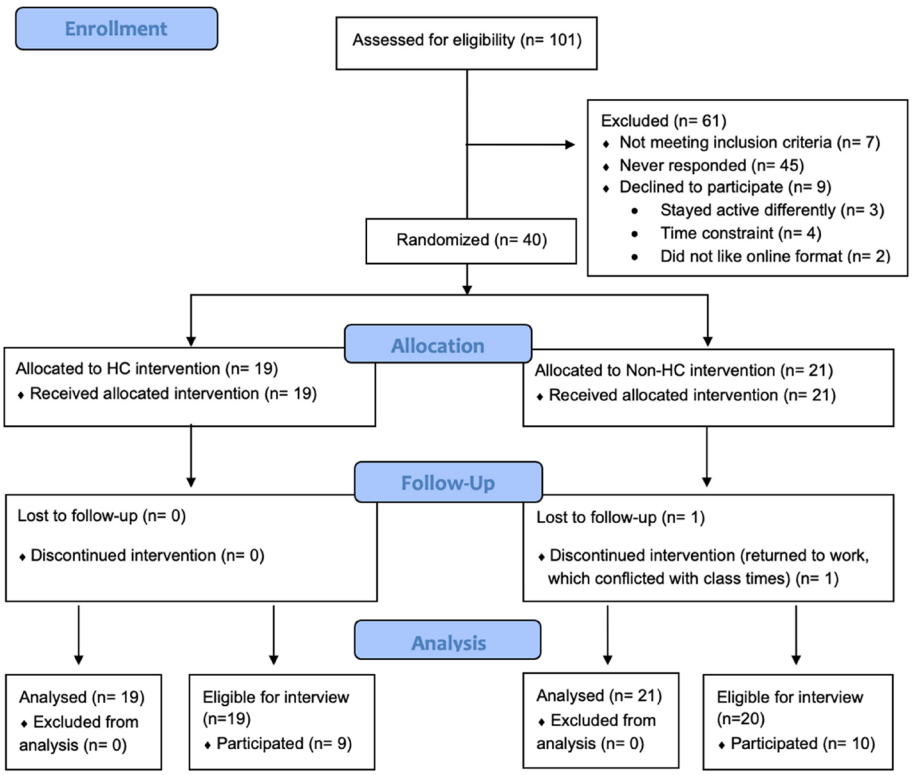

Fig. 2 Flow of participant recruitment, randomization, and attrition

Table 2 Feasibility and safety results of the synchronous online exercise maintenance study for individuals living with and beyond cancer

Feasibility and safety measure	Frequency *n* (%)
Recruitment rate	40/94 (42.6)
Qualitative interview recruitment tate	19/39 (48.7)
Attrition rate	1/40 (2.5)
Adverse events	0 (0)
Completion rate	
Questionnaires	79/80 (98.8)[a]
Objective PA assessment	1489/1785 (83.4)[a]
Physical functioning assessment	78/80 (97.5)[a]
Attendance rate	
Online exercise class	401/441 (91.2)[a]
Post online exercise class	390/441 (88.4)
Health coaching	163/168 (97.0)[b]
Fidelity	
Online exercise class	376/406 (92.6)
Health coaching call	294/304 (96.7)

[a] Feasibility cut-off set a priori: ≥ 70%

[b] Feasibility cut-off set a priori: ≥ 80%

to individuals, and the reduced chances to connect with other individuals living with and beyond cancer as compared to in-person programs:

> *I guess that's probably the disadvantage of the virtual, we didn't really get to meet each other on a kind of … a more social level before and after class that we normally would've … had we been in-person. And I think … as much as the virtual was a good backup, in-person would be great. … Largely because I think it just gives everybody the support because we've all gone through our own little personal hell. (female, 59, non-HC)*

Fidelity of the exercise class delivery was high, with 92.6% of the exercise classes following the protocol as intended, with technical interruptions (4.4%), participants arriving more than 5 min late to class (2.5%), and the class instructor altering the sequence of the exercises (0.5%), reported as protocol deviations. In interviews, participants mentioned their preferred structure would be classes at least twice a week ($n = 18/19$) for an hour duration each session ($n = 19/19$). There were no adverse events during any of the classes, and all interviewed participants felt safe during classes ($n = 19/19$). Program components that enhanced participants' perceptions of safety included receiving the exercise program

beforehand, which allowed them to look up a video of each exercise, and having two exercise oncology fitness professionals present during each class:

> *Yes, but being on camera I think didn't make me worry that I was doing something unsafe because I knew that the instructor and the person that was watching … would correct you if there was something that was unsafe. (female, 60, HC)*

Health coaching

The completion rate for the HC calls was 97.0% (8WK: 6.8/7 sessions completed; 12WK: 11.6/12 sessions completed). Reasons for missing a call included vacation, having a migraine, contracting COVID-19, and being stuck at work. The mean call length was 34.2 ± 13.2 min, with a range from 20.2 ± 4.0 to 52.3 ± 11.2 min. The fidelity of the HC sessions being delivered as intended was 96.7%. Additionally, most participants preferred receiving HC calls once per week, as that schedule gave sufficient time to implement the weekly goals while keeping them accountable.

Aspects of HC as a tool to support exercise engagement included fostering connection with the health coach, providing tailored educational topics that addressed individual needs, and having an active listener to keep one accountable and motivated.

> *Having somebody there who is not your husband, your spouse, your child, your family member who is there and who is committed to your well-being as much as you are. And who will give you some advice, who will provide a listening ear, who will give you some encouragement, and who will put things ... into perspective. … So, it was valuable, like it was really good, I will definitely highly recommend having that. (female, 48, HC)*

Assessments

The questionnaire completion rate was 98.8% and within completed questionnaires, 98.4% of questions were answered. Participants did not find questionnaires to be burdensome, appreciated being able to return to complete them at a later time via the online system, but noted that it would have been helpful to be able to add context or indicate if a question was not applicable:

> *I've been out of treatment for a year and had a really good checkup yesterday by the way and so yeah so some of those questions weren't necessarily as relevant to me. (female, 53, non-HC)*

The completion rate of the physical functioning assessment was 97.5%, with two participants not completing the final assessment. There were no adverse events or safety concerns. Both participants who did not complete the physical functioning assessment were in the non-HC group: one discontinued the study after 4 weeks, and the other was injured (unrelated to the study) in the last week of the study. A facilitator for assessment completion commonly mentioned by participants was their interest in seeing results:

> *I found it quite easy and it was kind of neat I found I … maintained most of almost all of my levels and I increased my cardio so that was good. (female, 53, non-HC)*

Despite the feasibility of the online physical functioning assessments, some participants did not feel particularly confident in the results. This doubt was especially apparent for the hamstring flexibility measure:

> *Yeah, that's a little difficult you know like (laughs) only because I was like I'm using a ruler to try to measure you know like how far I can stretch […] so I'm not sure if it was 100% accurate. (female, 46, HC)*

Of the participants with available data ($n=36$), the trackers were worn ≥ 10 h per day 83.4% of the time, and they were worn on average 5.84 ± 1.87 days per week. Between intervention groups, the non-HC group wore the tracker for 84.7% and the HC group for 82.1% of the possible days in the study. In both waves, the wear time was over the 70.0% feasibility threshold, except for the last week of the 8-week wave (68.9%). No data was obtained from 4 participants: one participant dropped out before receiving the tracker, one participant did not sign the updated consent form regarding Garmin data storage, and two participants synchronized their tracker with a private account instead of the research account. One participant received the tracker a week late due to postal delays and therefore did not have data for the first week. In general, a trend that was visible in both waves was that the wear time was lower in the first and last week of wearing the tracker, as seen in Supplementary File 3. All exploratory results can be found in the open science framework.

Discussion

A synchronous online group-based supervised exercise maintenance program is safe and feasible for individuals living with and beyond cancer. Adding HC to this program is also feasible, based on quantitative data (attendance and fidelity above pre-specified thresholds) and

participant feedback. Finally, these feasibility markers support conducing a fully powered RCT. Improved practices for the objective measurement of physical activity (PA) levels were learned during this study, and these can be adopted in future trials.

In the move from in-person to synchronous, group-based supervised online exercise programming, safety was a key consideration. To ensure safety, our protocols included extensive staff training on verbal and visual cueing, and a moderator (in addition to the instructor) was present throughout classes, whose primary responsibility was to ensure participant safety and well-being. Participants were required to always remain on camera on Zoom [29], and an emergency response plan was also in place. No adverse events occurred during this study. The online exercise classes were delivered as intended with a high fidelity rate, and attendance was higher compared to previous synchronous online classes [17, 18]. Our high attendance may be because classes took place during the COVID-19 pandemic, where fewer in-person options were open, and people may have been more motivated to attend online classes. One consideration with online exercise classes is the risk of technical interruptions, but these only occurred in 4.4% of the classes, much lower compared to the 25.0% of sessions interrupted reported in a study by Tomlinson et al. [18]. This may be due to the increased emphasis participants placed on having a good internet connection during the pandemic, and thus the growing potential for synchronous delivery of online exercise programs [29]. However, as most of our participants were based in urban areas, it is possible that internet bandwidth may be a larger barrier to participating for individuals in rural or remote locations [16]. The delivery of synchronous group-based supervised exercise classes to individuals living with and beyond cancer addresses important access issues both during and post-pandemic, particularly for immunocompromised participants or those who are unable to travel while still allowing them access to resources to support their health and wellness [34]. Similar to earlier work [18], the removal of travel time was the most frequently mentioned factor that contributed to the convenience of the home-based program. Our online program also eliminated another common barrier to PA, the distance to exercise facilities [11].

A high proportion of HC calls were completed (97%), and overall, participants were positive about taking part in this aspect of the study. Our finding on the feasibility of HC supports the small number of previous studies in exercise oncology [22, 23, 35]. The mean HC call length (34.2 min) aligns with a recent study in individuals living with and beyond cancer that recorded a median call length of 31.5 min [22]. Although education is defined as one of the key pillars of HC[19], other studies in exercise oncology did not include this component within their HC, and this generally resulted in shorter call durations (18–24 min) [36, 37]. The duration of the HC calls has both pragmatic and economic implications for sustainable implementation [38] and aiming for a 30-min call length that includes the key HC components may be recommended for a future fully powered trial. The coach-participant relationship, accountability, and the tailored educational components were highlighted by participants as important components of the HC sessions, fostering PA attendance and a sense of well-being. It is important to note that these components are part of the definition of HC [19], indicating the HC intervention was both delivered (fidelity of 96.7%) and received by participants as intended. It is critical that future studies structure HC based on a strong theoretical framework such as Wolever et al.'s (2013) definition, and report on both effectiveness and costs because one-on-one HC is resource intensive. Future work could tailor HC to those 'most in need' of additional behavior support for maintenance of PA levels (i.e., those with low attendance, those without other sources of social support), or consider the delivery of group HC as a more economically feasible option.

Several other components of this study suggested that the intervention could be tested in larger trials. First, the recruitment rate of 42.6% for the online exercise maintenance study was comparable to the recruitment for our previous in-person exercise maintenance program (41.3%). Other studies with remote delivery of exercise supported with HC had recruitment rates ranging from 35.9% [22] to 70.2% [23]. However, recruitment may have been lower than we might expect in a future trial because the community was dealing with additional personal stressors during the COVID-19 pandemic, potentially heightened for those navigating cancer treatment [39]. Second, future research could explore preferences for online versus in-person delivery. Online programs are beneficial for people who live in remote rural areas, and some individuals may prefer to continue in virtual programs. Finally, assessments of relevant outcomes including patient-reported outcomes, physical functioning, and objective PA were all possible during this study, with completion rates above the pre-specified 70%. Participants indicated that their interest in seeing results was a key motivator for completing the assessments. Guidelines for tests of physical function performed via videoconferencing have yet to be published, although work is ongoing utilizing online assessments [15].Some participants in the current study mentioned concerns about the validity of some of the measures used, and whether it was reflective of their physical function abilities. Given the restrictions enforced by COVID-19, in-person assessments were not possible in the current study.

The objective measurement of PA was of particular interest during this pilot RCT. Commercially available wrist-worn activity trackers are becoming increasingly popular among the public [40], and we found that data collection using these devices over a timeframe of 8 and 12 weeks respectively was feasible. During this study, we developed protocols to enhance data collection. First, additional time and information for participants were needed before study commencement to set up the activity tracker to increase wear time in the first week. Second, the trend of recording lower wear time in the final week, which has been reported previously in exercise oncology [23], could be improved by sending reminders to synchronize the device before returning it to the study team. An additional consideration for using commercially available wearable devices in research is the valid interpretation of the data. Commercial companies usually have proprietary algorithms for their activity trackers (e,g, for MVPA minutes), and it can be difficult for researchers to access the raw dataset [41]. Researchers that are making interpretations based on data from commercially available trackers are therefore urged to make their analyses or algorithms publicly available to be refined and used in future trials. Bearing in mind the potential for commercially available trackers in healthcare, refining and sharing analyses to interpret the data from these devices will lead to wider use and therefore stronger objective evidence in exercise oncology.

Given the pilot feasibility nature of this work, limitations include recruiting predominately urban living, breast cancer, female, higher education, and SES participants. Thus, the sample is limited in generalizability to all individuals living with and beyond cancer. In addition, the intervention was administered early in the COVID-19 pandemic, and recruitment and adherence to online programs may differ with in-person options resuming. Even though the recruitment rate of 42.6% was comparable to other physical activity trials [22, 23, 42], it is a major limitation in terms of generalizability of our findings. It is possible that our sample consisted of individuals that are already inclined to be active and therefore one has to be careful in interpreting the attendance of both the HC and exercise intervention. Finally, the small sample size did not allow us to draw conclusions on our exploratory outcomes (Open Science Framework). Addressing these in a future trial would increase the generalizability of a fully powered RCT's findings to the larger population of people living with and beyond cancer. Given the potential of HC to support exercise maintenance to enhance well-being in individuals living with and beyond cancer, further research on testing the effectiveness of HC is needed [25, 43]. While a need for online programming was heightened during the COVID-19 pandemic [4], the issue of access to exercise oncology resources that support wellness remains for many individuals living with and beyond cancer, including for rural and remote populations [15, 16].

Conclusion

Synchronous online delivery of a supervised group-based exercise oncology maintenance program with additional HC support is feasible. The effectiveness of this intervention to aid individuals living with and beyond cancer in maintaining an active lifestyle and thereby improving physical functioning and QoL requires further investigation. Based on our findings, a fully powered trial is feasible and should offer at least two structured classes per week, give clear instructions on the use of an objective activity tracker, adapt questionnaires to the participants' situation where possible, and provide meaningful results to the participants about their physical functioning.

Abbreviations

HC	Health coaching
PA	Physical activity
QoL	Quality of life
ACE	Alberta Cancer Exercise
RCT	Randomized controlled trial
CEP	Clinical Exercise Physiologist
EXCEL	EXercise for Cancer to Enhance Living well

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40814-023-01316-z.

Additional file 1. The ACE Online Maintenance Program.

Additional file 2. Health Coaching Protocol.

Additional file 3. Garmin Wear Time Graph.

Additional file 4. CONSORT Extension to Pilot and Feasibility Trials.

Additional file 5. OSF1: Exploratory Outcome Measures and Analysis.

Additional file 6. OSF2: Exploratory Results.

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Authors' contributions

ME: conceptualization, methodology, software, formal analysis, investigation, data curation, writing—original draft, visualization, project administration. RT: methodology, writing—review and editing, supervision. AP: software, resources, data curation, writing—review and editing. MM: methodology, supervision, writing—review and editing. MM: data curation, writing—review and editing. ME: investigation, validation, writing—review and editing. JD: investigation, writing—review and editing. NCR: conceptualization, methodology, validation, resources, data curation, writing—review and editing, supervision. The authors read and approved the final manuscript.

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Availability of data and materials
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request. The feasibility results are included in this published article and its supplementary files. The exploratory analysis and results are available on the Open Science Framework. S1: The ACE Online Maintenance Program, S2: Health Coaching Protocol**,** S3: Garmin Wear Time Graph**,** S4: CONSORT Extension to Pilot and Feasibility Trials, OSF1: Exploratory Outcome Measures and Analysis, OSF2: Exploratory Results.

Declarations

Ethics approval and consent to participate
The study was approved by the Health Research Ethics Board of Alberta – Cancer Committee (HREBA.CC-19–0206) and retrospectively registered as a clinical trial (NCT04751305). All participants gave written informed consent that they agree to participate in the study.

Consent to publication
All participants gave written informed consent that the obtained data may be published.

Competing interests
The authors declare that they have no competing interests**.**

Author details
[1]Faculty of Kinesiology, University of Calgary, Calgary, AB, Canada. [2]Cumming School of Medicine, University of Calgary, Calgary, AB, Canada. [3]Department of Physical Therapy & Oncology, University of Alberta, Edmonton, AB, Canada. [4]Department of Oncology, Cummings School of Medicine, University of Calgary, Calgary, AB, Canada. [5]Department of Psychosocial Resources, Tom Baker Cancer Centre, Cancer Care, Alberta Health Services, Calgary, AB, Canada.

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