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*Article*

# Understanding in-Person and Online Exercise Oncology Program Delivery: Participant Perspectives

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**Abstract:** Alberta Cancer Exercise (ACE) is an exercise oncology program that transitioned from in-person to online delivery during COVID-19. The purpose of this work was to understand participants' experiences in both delivery modes. Specifically, survivors' exercise facilitators and barriers, delivery mode preference, and experience with program elements targeting behaviour change were gathered. A retrospective cohort design using explanatory sequential mixed methods was used. 57 participants completed a survey, and 19 subsequent, optional interviews were conducted. Most participants indicated preferring in-person programs (58%), followed by online (32%), and no preference (10%). There were significantly fewer barriers (i.e., commute time) ($p<0.01$), but also fewer facilitators (i.e., social support) ($p<0.01$), to exercising online. Four themes were generated from the qualitative data surrounding participant experiences in both delivery modes. Key differences in barriers and facilitators highlighted a more convenient experience online relative to a more socially supportive environment in-person. For future work that includes solely online, focusing on building social support and a sense of community will be critical to optimizing program benefits. Beyond the COVID-19 pandemic, results of this research will remain relevant as we aim to increase the reach of online exercise oncology programming to more underserved populations of individuals living with cancer.

**Keywords:** exercise oncology; telehealth; synchronous delivery; supervised exercise; group-based exercise

## 1. Introduction

From the onset of the COVID-19 pandemic, a broad expansion of telehealth technology has occurred to deliver remote healthcare to cancer populations. Telehealth broadly refers to providing distance-based exercise or other health-based interventions by utilizing communication technologies [1,2]. Rapid improvements over the last ten years in telehealth technology, coupled with the need for online support due to COVID-19-related restrictions, has created an opportunity to optimize remotely delivered supportive cancer care resources [3–5]. Given the barriers that COVID-19 presented to people living with cancer maintaining adequate physical activity levels and quality of life [6,7], there is a need to evaluate supervised telehealth interventions that include videoconferencing to replicate in-person programming within exercise oncology [1].

To our knowledge, there has been very little intervention research investigating synchronously delivered, online, supervised, and group-based exercise oncology programs. In the last six years, reviews have evaluated the feasibility and effectiveness of telehealth exercise oncology interventions, both before and during COVID-19 [8–16]. Results have been predominantly positive in terms of participant acceptability; trial feasibility; and effects on moderate-to-vigorous physical activity (MVPA) levels, quality of life, and self-reported fatigue across a range of cancer diagnoses [5,8,9,14,16–21]. Only two reviews have compared the use of synchronous, asynchronous, or

combined exercise oncology telehealth interventions in a home environment, both concluding that there was insufficient evidence to determine which delivery mode is more effective at promoting beneficial health outcomes [10,22]. Further evaluation into online, synchronously delivered, group-based exercise oncology programs is needed. An opportunity to evaluate such a program arose at the onset of the COVID-19 pandemic when the Alberta Cancer Exercise (ACE) program was forced to transition from in-person to online offerings.

ACE is a hybrid implementation-effectiveness study [23] that offers a free, supervised, group-based exercise oncology program, led by qualified exercise professionals [24], to individuals living with cancer. Exercise classes (Calgary and Southern Alberta programs) are 60 minutes in length and are offered twice weekly for a period of 12 weeks. ACE classes are offered at two levels: baseline and maintenance classes. Baseline classes are free and the first ACE program in which participants enrol. ACE maintenance classes are a pay-for-service program and are accessible for anyone who has completed the initial baseline program.

ACE aims to support sustainable exercise habits for its participants by addressing exercise barriers and facilitators using behaviour change techniques (BCTs), delivered in the Exercise and Educate model. This model is based on the COM-B behaviour change framework, a component of a larger behaviour change model referred to as the behaviour change wheel [25]. This framework identifies three necessary components for a behaviour to occur: capability (C), opportunity (O), and motivation (M), in which all components and the interactions between them contribute to a behaviour (B). Within ACE, the COM-B framework outlines the mechanisms through which exercise behaviour change can occur [25], including through exercise barriers and facilitators.

ACE has been offered in-person since early 2017, until the COVID-19 pandemic necessitated the rapid transition of the program to an online platform in April 2020. This transition of the ACE program to an online delivery format presented a unique opportunity to provide valuable, practice-based evidence that has the potential to direct future research and inform the safe and effective delivery of online exercise oncology programs. The purpose of this project was to thus gather perspectives of people living with and beyond cancer who have experienced the transition from the in-person to online ACE program. Specifically, understanding participants' preferences, facilitators, barriers, and experiences within the ACE program will further our understanding of how to optimize online exercise oncology program delivery. We hypothesized that (1) exercise barriers and facilitators for in-person and online exercise programs will exist in both modes, but the type of barriers and facilitators will be different depending on the program delivery mode, and (2) less reported experience with or use of BCTs will be associated with more barriers, less facilitators, and lower exercise levels.

## 2. Materials and Methods

### *2.1. Participants*

All participants were part of the larger ACE program in Southern Alberta, who had transitioned from in-person to online (maintenance) programs. Participants were invited via email to complete a single survey and an optional interview, conducted online via Survey Monkey and Zoom, respectively.

### *2.2. Study design*

An explanatory sequential mixed methods design was used, following a pragmatist approach [26]. Pragmatism is a philosophical approach focused on finding solutions to practical problems using a variety of perspectives and methods and is commonly used in mixed methods research. This design was conducted in two phases. Quantitative data collection and analysis were conducted first, followed by qualitative data collection and analysis. This design allowed the exploration of qualitative results to expand upon and further understand the quantitative findings [26].

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*2.3. Measures*

2.3.1. Demographics

Participants self-reported demographic information including name, date of birth, marital status, education level, annual family income, employment status, cancer diagnosis, start date of ACE baseline program participation, self-identified gender, and self-identified race.

2.3.2. Exercise levels: ACE class attendance

Attendance data for participants' most recent in-person (baseline or maintenance) exercise oncology program (dates ranged from Winter 2017 to Winter 2020) and online (maintenance only) exercise program (Summer 2020 to Winter 2021) was collected.

2.3.3. Exercise setting preferences.

Participants were asked to indicate one of the following as their preferred exercise setting: online, in-person, or no preference. Participants were given the option to provide reasons for their exercise setting preference in a comment box.

2.3.4. Exercise barriers and facilitators

To measure participants' barriers and facilitators to exercise, the modified version of the Exercise Barriers/Benefits Scale (EBBS) was used [27]. EBBS scores were used to identify barriers and benefits (facilitators) to exercise in online and in-person settings. EBBS is a 43-item questionnaire that has demonstrated reliability and validity [28–30]. EBBS question prompts were adapted to cancer populations. The option 'not applicable' was added to the items 'I will prevent heart attacks by exercising', 'exercising will keep me from having high blood pressure', and 'my spouse (or significant other) does not encourage exercising'. Additionally, one question that could elicit negative feelings was removed: 'I will live longer if I exercise'. Therefore, the total EBBS score ranged from 39 to 168.

2.3.5. Behaviour change techniques

To measure participants' experiences with behaviour change techniques (BCTs), they were asked to report their BCT use and frequency during their in-person and online ACE programs. In both settings, participants were specifically asked to identify if they used or engaged with a particular BCT (i.e., goal setting, social support). If a BCT was used, participants were further probed on how often they used the BCT during the duration of either program session. Eight BCTs in total were included in the survey, based upon BCTs incorporated into ACE program delivery and instruction. Five were derived from the ACE 'Exercise and Educate' model: 1. Principles of exercise and cancer, 2. Goal setting, 3. Behaviour change, relapse prevention, and motivation, 4. Stress management and fatigue, and 5. Social support and long-term maintenance. Additional BCTs that are commonly used within ACE were also evaluated, including: 1. Verbal persuasion to boost self-efficacy, 2. Providing feedback on performance, and 3. Prompting review of behavioural and outcome goals.

2.3.6. Interviews

Individuals who confirmed willingness to participate in an interview and who were subsequently selected through purposive sampling took part. Purposive sampling for interviews considered age, gender, cancer diagnosis, and exercise setting preference. This purposive sampling was used to achieve variety across the sample in an attempt to hear varied perspectives [31]. Interview guides were created to foster open-ended responses about the survey topics to get a more detailed and contextualized understanding of participant experiences with barriers, facilitators, and BCTs in both delivery modes.

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*2.4. Statistical analysis*

All quantitative analyses were conducted using SPSS 26 and Microsoft Excel v16.46. Results from the survey were summarized using descriptive statistics. To test our hypotheses, correlation models were used to evaluate the relationships between 1) Exercise Benefits and Barriers Scale (EBBS) scores and ACE class attendance, 2) EBBS scores and BCT use, and 3) BCT use and ACE class attendance in both delivery modes. Independent t-tests assessed differences in BCT use, EBBS scores, and ACE class attendance between delivery modes. Significance level was set at $p < 0.05$ [32].

*2.5. Qualitative analysis*

Content analysis was used to analyze open-ended questions posed on the survey, using Hsieh and Shannon's conventional content analysis approach [33]. This type of content analysis uses an inductive approach to code ideas relevant to the research questions. Interviews were transcribed verbatim by the first author (DD) and subsequently analyzed using guidelines for thematic analysis [34]. Consistent with thematic analysis guidelines and its underlying constructivist philosophy, the first author, who had previous experience with this methodological approach, conducted the analysis, with feedback and input from the rest of the research team [35]. Each transcript was read multiple times to familiarize the first author with the overall meaning of the data. Initial codes were generated using NVivo 12.0 software (QSR International) by inductively identifying and labeling ideas in the transcript related to the research questions. Codes with similar ideas were grouped and themes were identified and named. NCR, MM, and WB provided feedback on the grouping and naming of themes in an iterative process. Once final themes were identified, DD reread the transcripts and reviewed the themes to ensure that the data was coded. A description of each theme was then written, incorporating illustrative quotations.

## 3. Results

*3.1. Survey Results*

3.1.1. Participant demographics

For the survey, 124 ACE participants who had taken part in both in-person and online ACE classes were identified and contacted via email. Of those contacted, 61 opened the survey and 57 provided complete data sets (46% response rate, 93% completion rate).

Most participants who completed the survey were female (84%) and had breast cancer (60%), reflective of the demographics of the larger ACE program. The age of participants ranged from 44 to 84 years (mean ± SD; 62 ± 9 years) at the time of survey completion. A complete overview of survey participant demographics and clinical characteristics (i.e., cancer type) can be found in Table 1.

**Table 1.** Clinical characteristics and demographics of survey participants.

| Clinical characteristic | No. of participants |
|---|---|
| Age: Mean ± SD, year | 61.7 ± 9.2 (Range 44-84) |
| Time since date of diagnosis: Mean ± SD, year | 5.0 ± 5.01 (Range 1.3-27.4) |
| Time since ACE baseline session start: Mean ± SD, year | 2.4 ± 1.1 (Range 1.1 – 4.1) |
| Gender[a] | |
| Male | 8 (14.0%) |
| Female | 48 (84.2%) |
| Another | 1 (1.8%) |
| Primary cancer type | |
| Breast cancer | 34 (59.6%) |
| Leukemia or lymphoma | 7 (12.3%) |
| Multiple myeloma | 3 (5. 3%) |

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| | |
|---|---|
| Prostate cancer | 2 (3.5%) |
| Lung cancer | 2 (3.5%) |
| Endometrial cancer | 2 (3.5%) |
| Multiple cancers | 2 (3.5%) |
| Colon cancer | 1 (1.8%) |
| Ovarian cancer | 1 (1.8%) |
| Thymus cancer | 1 (1.8%) |
| No cancer (support person) | 2 (3.5%) |
| **Demographic variable** | **No. of participants** |
| Race[a] | |
| Caucasian or white | 43 (75.4%) |
| White Anglo-Saxon Protestants | 3 (5.3%) |
| Chinese | 2 (3.5%) |
| Did not specify | 2 (3.5%) |
| Italian | 1 (1.8%) |
| German | 1 (1.8%) |
| Black | 1 (1.8%) |
| Eurasian | 1 (1.8%) |
| Mixed | 1 (1.8%) |
| Oriental | 1 (1.8%) |
| Arab | 1 (1.8%) |
| Employment Status | |
| Full-time | 10 (17.5%) |
| Retired | 29 (50.9%) |
| Homemaker | 3 (5.3%) |
| Part-time | 6 (10.5%) |
| Temporarily unemployed | 0 (0.0%) |
| Temporarily unemployed due to COVID-19 | 2 (3.5%) |
| Disability/sick leave | 7 (12.3%) |
| Student | 0 (0.0%) |
| Annual family income, CDN$ | |
| <$20,000 | 0 (0.0%) |
| $20,000-$39,999 | 3 (5.3%) |
| $40,000-$59,999 | 3 (5.3%) |
| $60,000-$79,999 | 9 (15.8%) |
| >$80,000 | 20 (35.1%) |
| Prefer not to specify | 22 (38.6%) |
| Education level | |
| Some high school | 0 (0.0%) |
| Completed high school | 2 (3.5%) |
| Some university/college | 4 (7.0%) |
| Completed university/college | 34 (59.6%) |
| Some graduate school | 3 (5.3%) |
| Completed graduate school | 14 (24.6%) |
| Marital Status | |
| Never married | 1 (1.8%) |
| Married | 41 (71.9%) |
| Common law | 4 (7.0%) |
| Separated | 1 (1.8%) |
| Widowed | 7 (12.3%) |
| Divorced | 3 (5.3%) |

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SD, Standard Deviation; ACE, Alberta Cancer Exercise. [a]Race and gender demographic variables were self-identified through an open-ended question.

3.1.2. Exercise levels: self-report

The average MVPA was 186 ± 169 minutes/week. A total of 34 participants (60%) met both the MVPA and resistance training recommendations.

3.1.3. Exercise levels: ACE class attendance

Attendance data was pulled from survey respondents' most recent in-person and online ACE classes. In-person class attendance was either from participants' baseline class (n=27, 52%) or maintenance class (n=25, 48%). In-person class attendance data could not be located for some participants due to limited access to some fitness facilities because of COVID-19 (n=5). All online class attendance was taken from maintenance classes. The average for online attendance, taken from the most recent program offering, was 79.8% of total classes attended. For participants' most recent in-person classes, average attendance was 76.8%. No statistically significant differences were identified between in-person and online attendance data.

3.1.4. Exercise delivery mode preferences

Survey data indicated a preference for the in-person ACE maintenance classes, with 33 participants (57.9%), followed by 18 (31.6%) preferring online, while 6 (10.5%) indicated no preference, or being ambivalent. The most cited reasons for preferring the in-person classes were social interaction, equipment, safety, and the ability to receive more tailored, one-on-one feedback from instructors. For the online classes, the most common reasons for preference included diminished commuting-related factors, convenience, improved confidence when exercising, and decreased fatigue. For those who were ambivalent, reasons for enjoying the in-person program included the social interaction and safety, whereas reasons for appreciating the online classes included the convenience. However, online classes were noted to not provide an equivalent level of social support that was available in-person, including a diminished ability to get to know other participants on a personal level.

3.1.5. Exercise barriers and facilitators

EBBS scores between in-person and online exercise classes indicated significantly fewer barriers ($p<0.01$) but also fewer benefits (facilitators) ($p<0.01$) within the online delivery mode (see Table 2). The most valued facilitators for the in-person exercise delivery mode were 'exercising improves my mental health', 'exercising lets me have contact with friends and people I enjoy', and 'exercising is a good way for me to meet new people'. Barriers that were less prevalent in the online exercise delivery mode were 'exercising takes too much of my time', 'places for me to exercise are too far away', 'there are few too places for me to exercise', and 'I am too embarrassed to exercise'.

**Table 2.** Average Exercise Benefits and Barrier Scale (EBBS) scores: total, benefit, and barrier scores and differences between in-person to online.

| | **In-person score: Mean ± SD** | **Online score: Mean ± SD** | **P Value** |
|---|---|---|---|
| EBBS total | 138.02 ± 14.29 | 137.05 ± 13.99 | $p = 0.35$ |
| Benefits | 94.23 ± 10.69 | 91.16 ± 10.96 | $p = 0.00$ |
| Barriers | 25.16 ± 5.13 | 23.05 ± 4.31 | $p = 0.00$ |

*Note*. Two-tailed, paired t-tests were conducted. SD, standard deviation.

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3.1.6. Behaviour change technique support

The average number of BCTs each participant indicated using or receiving from their instructors was significantly lower ($p$<0.01) in the online environment, with an average of 5.5 (out of 8) BCTs reported in-person and 4.6 reported online. There was a trend toward greater use of BCTs in in-person classes as compared to online classes ($p$=0.065). The BCTs with the largest differences between delivery modes included social support, education on exercising with a cancer diagnosis, creating consistent exercise habits, and stress management and fatigue. In all cases, the in-person setting showed to be more conducive to BCT use. BCTs including providing feedback on performance, verbal persuasion to boost self-efficacy, and goal setting were similar across settings.

Correlation analyses indicated no significant relationships between EBBS scores, BCTs, and attendance data in either in-person or online classes (see Table 3).

**Table 3.** Correlation analyses for EBBS Scores, BCTs, and attendance data.

| **Online delivery mode** | | | |
|---|---|---|---|
| | **EBBS score** | **Number of BCTs used** | % of classes attended |
| EBBS score | - | | |
| Number of BCTs used | 0.12 | - | |
| % of classes attended | 0.02 | 0.15 | - |
| **In-person delivery mode** | | | |
| | EBBS score | Number of BCTs used | % of classes attended |
| EBBS Score | - | | |
| Number of BCTs used | 0.09 | - | |
| % of classes attended | -0.20 | 0.23 | - |

*3.2. Interviews*

Nearly all survey participants (53/57, 93%) agreed to be contacted for an interview. A total of 21 participants were purposively sampled and contacted via email to participate in an interview, with 19 responding and completing interviews (91% RR, 100% CR). The majority of participants who completed an interview were female (68%), had breast cancer (37%), identified as white (84%), were retired (68%), married (74%), and were older adults (average age 63 years). While acknowledging the importance of all the themes generated from the participants' knowledge, given the focus of this research, the results and discussion center on participant experiences with the transition from in-person to online delivery, and similar or differing experiences in both settings. Additional themes that were more relevant to the overall ACE program, satisfaction with the program, and future program offerings or improvements are not included. These themes may be explored in future research and incorporated into quality improvement cycles for ACE and other exercise oncology programs.

Thematic analysis

The four themes generated through the thematic analysis are described below.

- Theme 1: It's been the best route that we could take, given the circumstances

Participants described feeling isolated during COVID-19 and how ACE transitioning to an online format allowed them to continue to exercise and reap the physical and social benefits of ACE that they had experienced in in-person classes. These physical and social benefits were a key component to participants' mental and physical health throughout the pandemic.

> "Initially, when the lockdown came along, I thought [I was] going to lose all these things that are keeping me from losing my mind. So, when the ACE program [went] online, […] I was just so happy and relieved […]. It's been such an important way for me to feel like I'm connecting with other human beings during the day, in a time when I can't do normal things

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> […]. That's been kind of the guiding light for my mental health is just knowing that there's consistency that I'm seeing the same group of people every week, and that there's interaction […]. I think that's made a huge difference to me." (P42)

Despite participants expressing gratitude for the opportunity to continue with ACE during the pandemic, individual differences were still reflected in exercise barriers and/or facilitators. One key factor to a successful transition frequently noted by participants was having prior experience with the in-person classes.

> "Had it been proposed me as online straight off, I probably would have passed […]. I tend to think if it's physical, then I need someone else there with me […]. But I think the fact that I was already in the [ACE] system meant that […] I'll try it. If it doesn't work, I'll just move on." (P77)

Despite the online classes not being seen as equivalent to the in-person classes by some participants in terms of the social support and personalized feedback provided by instructors, the ability to continue to see others and to reap the benefits of continued instruction from exercise experts were described as important.

> "It's not quite the same interaction, because Zoom's one person at a time. So, you don't get the same type of conversation. But there's that opportunity to ask questions and have discussion […]. So, for a lot of classes, people are logging in early and then there's some socialization […]. I've done some of those online [classes] where there's no interaction […], it's not quite the same. So, to have live instructors, real time, and adapting as you go, that's probably been the best route that we could take, given the circumstances." (P56)

- Theme 2: A lot of good came out of this opportunity to continue with ACE online, but there were still barriers to exercising from home

This theme captures the varied experiences of participants while exercising with ACE in the online environment. Despite the attempts made by the ACE team to create a beneficial environment online, participants noted that generally they received fewer physical and social benefits in the online environment. The decrease in benefits was often attributed to inherent limitations associated with exercising online.

> "What I miss about the in-person is [the instructors] don't really have the ability online to walk around and check on us […]. […] it was easier to get that kind of that kind of help one-on-one. When […] I'm in a square [on] Zoom, it's difficult to give that kind of help […]. So that kind of chance to have that private conversation is something that I miss. And it's a bit more difficult to get a really good handle on what people's limitations are when it's online." (P77)

However, some participants noted an increase in encouragement from instructors and physical benefits online.

> "The positive reinforcement that's given by the moderators and the instructors has taken on a whole new dimension […]. So, [the instructors are] actually speaking up more often in terms of […] encouragement, than actually happened in the live session […]. The constant, 'great form', 'you guys are doing good', 'you're killing it' […], that's really great […]. Because the instructors are more focused on your form and structure […]. I would say the encouragement [online] is more affordable now than it was before [in-person]." (P18)

> "I honestly think that the physical aspects have been enhanced. I don't feel strongly that that the instructors have been missing me doing something imperfectly or the wrong way or anything like that […]." (P39)

Despite instructors' best efforts to encourage social connections between participants, limitations still existed for fostering personal relationships between participants.

> "You get a chance to know the other people a little bit more [in-person] […]. As opposed to online, other than the people I was in the classroom [in-person] with, I don't know anything

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about these other 10 people. I'm further ahead with the group I came with than the ones I've been with […] since March [online]." (P6)

Despite potential limitations in social benefits, participants noted other benefits to exercising online. New benefits or facilitators included more time throughout the day, less exacerbation of fatigue symptoms, and an increased level of confidence while exercising due to the comfort afforded by attending in the home environment.

"One benefit of [online] is that it's way less easy for me to talk myself out of a class […]. When you have to physically leave your house and drive somewhere, on the days when I'm feeling a little bit low, it's much easier for me to [attend online] […]. I just have to get myself down to the gym in my basement. There's no reason I can't do that." (P42)

"[…] what I'm learning now is [exercising online is] giving me the confidence […] to listen to my body to do what I need to do […]. [Because] You're watching me, but I'm more alone. I do sometimes try new things. I think I'm less intimidated." (P75)

In addition, participants described less barriers to attending the online classes, including no commute time and no need to walk or drive in poor weather. Motivation to attend classes was potentially both increased and decreased across participants by these factors.

"The accessibility, especially when it's 20, 30 below, so much easier to be motivated to go online and do a program than it is to get bundled up and walk […] to the [exercise venue]." (P2)

"And […] you just didn't feel like you had the same incentive to attend when it just meant going upstairs as opposed to preparing to go somewhere." (P6)

Lastly, this theme describes participant experiences with BCTs in the online classes, which some participants described as being similar or slightly less prevalent online.

"The education piece [helps my exercise habits]. And having [the instructors] individually educate me on proper technique to get the benefit. So even though it's difficult via Zoom, it still happens […]. It still modifies the behavior, it still creates that desire […]. I'm still learning new exercises." (P56)

- Theme 3: My in-person ACE experience was great, but I still faced barriers to attending

This theme captures the varied experiences of participants while exercising with ACE in the in-person environment. One of the most important aspects described about exercising in-person were the social benefits received while exercising. Some participants described the social benefits derived from class as a 'bonus' as opposed to an essential component of ACE, while others felt that the social interaction in-person was the best part of ACE and struggled to attend online.

"When I first got involved, […] I was absolutely overwhelmed by the interaction with [others] […]. […] by quite a wide margin, my preference would be in-person. Because of the value to me of some sort of social contact. And as a result, the sense of community connection, […] the sense of safety that comes from the instructor telling you how to do it right, [and] the presence of a large number of people in the room." (P18)

"I think the social support thing is more important to some people than others. I'm lucky, I've got a really strong support system. And if we weren't able to do any more in-person classes forever, I'd still be okay […]. For me, it wasn't necessary. It was just a really nice bonus […]. That one-to-one and the help when I needed it. And a couple of good friends that I've made. Those were all bonuses." (P16)

Despite the beneficial social support that occurred in-person, attending classes in this delivery mode regularly was still difficult for some participants. Barriers to in-person classes included poor weather, commute time (walking or driving), exacerbated fatigue, and parking costs in-person.

"When it was a cold and wintery and slippery day […] And if I was having a day where I wasn't feeling that strong, […] by the time I got ready, drove through the weather, and

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parked and walked to the university. I'm like, whew, okay, I think I'll just go back. That part of it is easier being at home […]. It was a bit challenging to do that walk." (P16)

Some people felt as if the social support aspect and the benefit of interacting with the instructors in-person was worth combatting these barriers to come in-person, whereas others felt that the convenience of the online was superior to the social support received in-person.

"But […] it didn't matter what the weather was like, [I] still showed up [to see others in the class]." (P6)

"While I enjoy the social support and the interaction, […] I have a pretty busy life, […] the social aspect for me isn't a massive thing […]. But in terms of reduction of barriers [online], that I did find was really high, because we don't have the commute time, it was much easier to interweave it and fit it into the day […]. I found a lot of the barriers to regular exercise actually did drop for me." (P109)

This theme also describes participant experiences with BCTs in the in-person classes, which largely surrounded the social support benefits derived from in-person, the education received on exercising, and the feedback and encouragement from instructors, which were generally described as being more prevalent in the in-person environment.

"Obviously, [behaviour change techniques are] better in-person than they are online. Especially when [the instructors] have 20 people [in class], […] that's a lot. I've actually noticed the difference. Because even with the 12 people, […] somebody would be saying oh, that's good, [NAME], keep that up. But now, [online], it's not very often that you hear that." (P25)

- Theme 4: My goal is to have a good quality of life and maintain my level of functionality through moving more

This theme captured when participants spoke about their overarching goals of maintaining a good quality of life and how they did not feel they needed 'other skills' to engage in exercise. For example, participants described that they do not focus on setting specific physical goals that they need to achieve. Instead, for them, being generally active was their goal in order to maintain healthy physical functioning.

"My goal, if you want to call it that, is to do the exercises, as best as I can, and hopefully better than I did them the last time. Maybe that's pushing myself a little bit harder, doing more cardio, whatever. Those are my sorts of goals […]. It's just keeping my body moving and functioning properly that's important to me […]. I don't set an exercise goal, per se, […] some days even showing up is a challenge in itself." (P39)

Ultimately, participants described a wide variety of experiences with the in-person and online classes. These delivery modes had a variable impact on participant barriers and facilitators and experience with BCTs, ultimately leading to variable exercise delivery mode preferences across participants. The impact of their cancer diagnoses, other factors in their lives (including the impact of COVID-19), where they were along the treatment trajectory – these all influenced perspectives, participation, and experiences of ACE participants.

## 4. Discussion

The current work examined differences between in-person and online exercise oncology maintenance program delivery on participant perceived barriers, facilitators, transitions, and experiences with BCTs. Given the potential role for online delivery of exercise oncology as a supportive cancer care resource, this work is critical for optimizing intervention impact and effectiveness.

In our study, similar attendance was found between in-person and online delivery modes. This relatively high engagement in the online delivery mode may be due to the elements of ACE maintenance delivery, including the synchronous, supervised, and group-based nature of the online program, that facilitated greater engagement and supported building social connections. This is

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consistent with past interventions that demonstrate higher engagement and attendance through videoconferencing [8,10,12,13,36,37]. Calls for telehealth interventions that deliver synchronous, supervised, and group-based exercise sessions, similar to what has been done for in-person exercise programs for individuals living with cancer, have been made and will be important to further examine [1,22].

Findings from this research can be applied to optimize online delivery for exercise oncology programs. First, current results reinforce that social support and a sense of community need to be continually fostered in the online exercise oncology environment. Ultimately, the group-based aspect of the ACE program was seen as a facilitator for attending on a regular basis in both delivery modes. However, participants also described that receiving the 'usual' level of support (social, BCTs such as goal setting and instructor feedback) as in-person was difficult in the online environment. This was largely attributed to an inability to have informal, one-on-one conversations via an online platform, limiting opportunities for social interactions, similar to other studies [20]. This potential lack of support from simply chatting with other participants was an important facilitator of exercise attendance for in-person classes that was not as available in the online ACE setting. In our exercise oncology programs, we are bolstering social support in the online environment by facilitating pre- and post-exercise Zoom chats (15 minutes each) on topics brought up by participants. Further understanding how these additional times to connect may bolster positive outcomes and support exercise adherence will be essential for optimizing the design, delivery, and impact of future exercise oncology programs.

Second, more steps need to be taken to provide participants with feedback on exercise technique to ensure safety and optimize potential physical program benefits. One advantage to synchronous delivery is increasing the potential to deliver interventions via telecommunication technologies with higher levels of participant engagement and safety, compared to asynchronous delivery [10,22,38]. This is consistent with our results describing the benefits of constant supervision and the ability to receive immediate exercise modifications online, both made possible by synchronously delivered exercise instruction. The safety benefits derived from constant supervision from exercise oncology experts can be applied to other online exercise programs.

Last, the wide variety of findings highlights the uniqueness of every individual living with cancer. In the field of exercise oncology, a variety of factors need to be considered to deliver the most effective exercise experience possible to everyone. This was also seen in the individuality in experiences with BCTs, exercise barriers and facilitators, and exercise delivery mode preferences. This variety in the multiple aspects that contribute towards the success and uptake of an exercise program highlight the need for tailoring and individualization within an exercise program. This tailored approach is essential for successful implementation and requires moving beyond a generic 'one-size-fits-all' exercise prescription.

## 5. Strengths and limitations

Limitations to this work included only collecting data at one point in time. This may have introduced a recall bias when prompting participants to recall their barriers, facilitators, and BCT use in the-person exercise delivery mode. Second, the sample of ACE maintenance participants are more active than the general cancer population. Therefore, the insights and experiences of this population may not be reflective of a less active population of people living with cancer. Third, the sample for this study and the ACE population tend to be middle to upper class, white, highly educated, and retired. This population may have potentially been subject to less negative effects from the pandemic on their overall well-being as well as had greater access to the technology necessary to join online programming. Therefore, the results from this study may not be generalizable to all individuals living with cancer who are engaging in exercise during or beyond the pandemic.

## 6. Conclusion and directions for future research

The present study indicates that ACE participants experience a range of barriers and facilitators to both in-person and online exercise oncology delivery modes. Despite a decrease in both barriers

and facilitators in the online class environment, attendance of ACE maintenance classes online remained the same as when in-person. BCT use was perceived as higher in the in-person class environment, but many participants appreciated the effort put forward by ACE and their instructors to make participants feel supported online. Ultimately, participants felt fortunate to have continued access to ACE during the pandemic to keep them active and connected to others. Future directions for this research are necessary to ensure individuals living with cancer remain supported as complementary therapy services, such as exercise, remain out of reach for many due to the COVID-19 pandemic, and potentially beyond.

Addressing the need for promoting and maintaining exercise in people living with cancer using an online platform is becoming increasingly pertinent given the unknown length of COVID-19 related restrictions for vulnerable populations. The potential benefit of such an accessible exercise program and the continued benefits of exercise through COVID-19 warrant future research into improving such programs. Beyond the COVID-19 pandemic, results of this research will remain relevant as we aim to increase the reach of exercise oncology programming to underserved populations of individuals living with cancer (i.e., rural/remote, immunocompromised, young adult populations) by utilizing synchronous, supervised, and group-based telehealth exercise oncology programs.

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