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A Remotely Delivered, Peer-Led Intervention to Improve Physical Activity and Quality of Life in
Younger Breast Cancer Survivors

A dissertation submitted in partial satisfaction of the
requirements for the degree of Doctor of Philosophy

in

Public Health (Health Behavior)

by

Lauren Saltoun Weiner

Committee in charge:

University of California San Diego
Sheri J. Hartman, Chair
Eric B. Hekler
Samantha Hurst
H. Irene Su

San Diego State University
Elva M. Arredondo
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2021

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Chair

University of California San Diego

San Diego State University

2021

DEDICATION

To Julie M., a beautiful METAvivor. Your courage, resilience, and steadfast commitment to physical activity during and after treatment is awe-inspiring.

Twenty-four and there's so much more.

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VITA

2012 Bachelor of Arts, Double Major in Community Health and Psychology, Tufts University

2021 Doctor of Philosophy, Public Health (Health Behavior)

University of California San Diego & San Diego State University

ABSTRACT OF THE DISSERTATION

A Remotely Delivered, Peer-Led Intervention to Improve Physical Activity and Quality of Life in Younger Breast Cancer Survivors

by

Lauren Saltoun Weiner

Doctor of Philosophy in Public Health (Health Behavior)

University of California San Diego, 2021

San Diego State University, 2021

Professor Sheri J. Hartman, Chair

Background: Younger breast cancer survivors (YBCS) consistently report poorer quality of life (QOL) than older survivors. One potential strategy to improve QOL is through increasing physical activity (PA), but this has been understudied in YBCS. YBCS face unique barriers to PA related to treatment side effects and life stage.

Purpose: This dissertation leveraged a community-academic partnership to evaluate the feasibility, acceptability, and implementation of a 3-month, peer-delivered, fully remote intervention to increase PA and improve QOL in YBCS.

Methods: Participants completed six video sessions with a trained YBCS peer mentor; self-monitored PA with a Fitbit activity tracker; and interacted with a private Fitbit Community for social support. At baseline, 3, and 6-months, participants completed validated QOL

questionnaires and PA was measured through accelerometer (objective moderate-to-vigorous PA [MVPA]) and self-report (strength and flexibility). A parallel mixed methods approach (qualitative interviews and quantitative satisfaction survey) explored feasibility and acceptability. One-way repeated-measures ANOVA examined impacts on PA and QOL at 3- and 6-months. A multimethod process evaluation explored peer mentors' barriers and facilitators to intervention delivery and adaptations.

Results: On average, participants (N=34) were 43.1±5.5 years old, 46±34.4 months post-diagnosis, and self-reported a BMI of 30.2±7.4 kg/m². The intervention was feasible as evidenced by efficient recruitment, high retention, and adherence to intervention components. Remote delivery was highly acceptable, as were working with a peer mentor and using the suite of Fitbit tools to support behavior change. From baseline to 3-months, participants increased time spent in objectively-measured MVPA, strength, and flexibility exercises, and experienced meaningful improvements to QOL, including body image, fatigue, anxiety, and emotional support. Adaptations to enhance feasibility of study protocols and engagement in the Fitbit Community occurred throughout intervention delivery. Prominent barriers and facilitators to effective delivery were related to communication, preparation and training, complexity of technology, and life circumstances.

Conclusions: A fully remote, peer-to-peer, technology-based intervention is an acceptable and promising strategy to increase PA and improve QOL in YBCS. Refinements to the intervention and its implementation should be assessed in a fully-powered hybrid effectiveness-implementation trial, toward the goal of disseminating an evidence-based, scalable intervention to the growing number of YBCS.

INTRODUCTION

Women diagnosed with breast cancer under 50 years old comprise less than 20% of all breast cancer survivors,¹ but have lower survival rates than older survivors and experience unique health and psychosocial issues.² The median age at breast cancer diagnosis for women in the United States is 62.³ Younger age at diagnosis is a risk factor for more advanced disease and younger women often undergo more aggressive treatment regimens.⁴ Younger cancer survivors consistently report a higher impact of their cancer experience on quality of life compared to older survivors,⁵ likely due to the fact that younger survivors are diagnosed at a time when they are in the midst of forming relationships, starting and raising families and/or caring for aging parents, and establishing a career and work-life balance.^{6,7-10} Cancer-related physical and psychosocial changes can impact productivity at home and work, even after treatment concludes.¹¹⁻¹³ Key psychosocial concerns in this population include body image disturbances due to physical changes (e.g., hair loss, weight gain, surgical scars), sexual functioning, and fatigue.^{5,6,14-18} To date, few evidence-based interventions have been identified for younger breast cancer survivors to improve these aspects of quality of life.

In older breast cancer survivors, physical activity reduces risk of cancer recurrence and mortality.¹⁹⁻²² Physical activity has also been shown to decrease fatigue and anxiety and may ameliorate some of the problems most troubling to younger survivors such as body image and sexual function.²³⁻²⁵ Younger breast cancer survivors often reduce their activity levels during and after treatment²⁶ and are less likely to be active than similar-aged women without cancer.²⁷ Physical activity interventions have not been extensively tested in younger survivors.²⁸⁻³⁰ Due to a combination of persistent side effects from aggressive treatment regimens and the many competing demands of this life stage, younger survivors may experience unique barriers to physical activity.⁹ Further research is needed to determine

feasible and acceptable strategies for promoting physical activity, and potential benefits for quality of life, in this understudied population.

Project Overview

The present community-academic partnership study was funded by a Community Research Collaboration Pilot Award from the California Breast Cancer Research Program (CBCRP). Our community partner was Haus of Volta, a non-profit organization that aims to promote positive body image and well-being among younger breast cancer survivors. The project was developed using a community based participatory research (CBPR) approach.³¹ Thirty-four younger breast cancer survivors were enrolled into a 12-week remotely-delivered, peer-moderated physical activity program (Pink Body Spirit) and completed standardized measures at baseline, 3, and 6 months to assess physical activity and multiple aspects of quality of life including body image, sexual function, and fatigue. The Pink Body Spirit program was based on an intervention that has been efficacious in promoting physical activity in older survivors.^{32,33} Pink Body Spirit was guided by Control Theory³⁴ and Social Cognitive Theory³⁵ and used peer mentors, motivational interviewing, and technology (Zoom video sessions, Fitbit tracker and app, and Fitbit Community) to support behavior change. Five younger breast cancer survivors were trained as peer mentors to deliver the program to fellow younger survivors. A mixed methods approach was used to explore feasibility and acceptability of the pilot trial methods to participants. A multimethod process evaluation explored barriers and facilitators to intervention delivery and adaptations by peer mentors.

Study Aims and Hypotheses

Aim 1: Explore the feasibility and acceptability of the Pink Body Spirit physical activity intervention. Feasibility included recruiting and retaining younger breast cancer survivors to the study, completing the mentoring sessions, wearing the Fitbit, and posting in the Fitbit community. Acceptability and satisfaction with the program were explored through a parallel mixed methods approach consisting of post-intervention quantitative surveys and semi-structured interviews.

H_{1a}: The study will be considered feasible if we are able to enroll $\geq 50\%$ of women who are screened and determined to be eligible within the 5-month recruitment time frame, and if $\geq 80\%$ of those enrolled are retained through the 24-week measures

H_{1b}: Participants will have high adherence to the intervention. Adherent will be defined as meeting at least 2 out of 3 of the following metrics: complete $\geq 75\%$ of mentoring sessions, wear the Fitbit on $\geq 75\%$ of days in the intervention, and post in the Fitbit community at least once per week on $\geq 75\%$ of weeks in the intervention.

H_{1c}: The quantitative satisfaction surveys and qualitative interviews will be analyzed and results will be reported separately. Triangulation will be used to explore complementarity between the quantitative and qualitative findings.

Aim 2: Assess the preliminary impact of a remotely delivered, peer-moderated physical activity intervention (Pink Body Spirit) on physical activity and quality of life.

H_{2a}: Participants will increase weekly minutes of objectively measured physical activity (ActiGraph GT3X+ accelerometer) from baseline to 12-weeks.

H_{2b}: From baseline to 12 weeks, participants will experience improvements in body image, sexual functioning, and fatigue

H_{2c}: Increases in physical activity will be associated with improvements in body image, sexual functioning, and fatigue

Exploratory aim: Using a multimethod approach, explore the process of intervention delivery and adaptations made by peer mentors. There were three unique data sources:

1. Peer mentor field notes. After each mentoring session, peer mentors reported their confidence and preparedness for delivering the session and completed a field note about their perceptions on the session and any explicit adaptations made.
2. Standardized review of video recorded sessions by the project manager. A random 50% of initial goal setting sessions and a random 20% sample of follow-up sessions were reviewed to explore adaptations from the study protocol.
3. Monthly reflections composed by the project manager to document adaptations and context. These reflections were based off discussions with multiple stakeholders (co-PIs, peer mentors, and research staff). The reflections helped document key activities, events, and changes that occurred over the course of the study.

Literature Review

Young Breast Cancer Survivors- Biology and Treatment

Breast cancer is the most common cancer in women age 20-49 years and the leading cause of death from disease among this age group.³ While the overall mortality rate for breast cancer continues to decline,³⁶ younger breast cancer survivors have higher rates of recurrence, secondary cancers, and cancer-related mortality compared to older breast cancer survivors,^{37,38} although outcomes may vary by tumor subtype.³⁹ Breast cancers in younger women are more likely to be fast-growing and higher grade, necessitating more aggressive treatment.^{40,41} Even after treatment concludes, younger breast cancer survivors experience a multitude of elevated medical and psychosocial risks. Cardiotoxic chemotherapy, chest-focused radiation treatment, and/or treatment-induced menopause can increase the risk of cardiovascular disease.^{42,43} Chemotherapy and radiation can also increase the risk of being diagnosed with a second cancer.⁴² Further, younger women with more aggressive tumors are more likely to be treated with mastectomy, and are more likely to also undergo a contralateral prophylactic mastectomy (CPM)³⁶ The proportion of women undergoing surgery for non-metastatic disease in one breast who receive a mastectomy on the other, non-affected breast to help prevent the spread of future cancer (i.e., CPM) has increased drastically, more than tripling from 10% in 2004 to 33% in 2012 among women aged 20-44 years.³⁶ A recent longitudinal study that measured body image and quality of life before and after breast cancer surgery found that CPM was associated with more body image distress and worse quality of life after surgery.⁴⁴ While not all issues are exclusive to younger women, younger cancer survivors are more likely to experience emotional distress than older survivors,^{26,45,46} particularly around treatment-related physical changes (e.g., hair loss, weight gain, surgical scars).^{5,6,14,15}

Moreover, many younger survivors experience early menopause after treatment with chemotherapy and/or endocrine therapy, which can impact fertility and lead to premature ovarian insufficiency.⁴⁷⁻⁴⁹ Declining estrogen levels due to ovarian insufficiency is associated with menopausal symptoms such as night sweats, hot flashes, and vaginal dryness.²⁶ Younger breast cancer survivors are especially impacted by menopausal symptoms,^{14,50} all of which can impact body image, sexual functioning, and psychological well-being.⁵¹ Overall, there are clear disparities in the burden of treatment side effects between younger and older breast cancer survivors, likely due in part to biological differences in disease and consequent treatment decisions.

Quality of Life in Young Breast Cancer Survivors

Though part of the larger breast cancer community, expectations, experiences, and outcomes are markedly different in younger breast cancer survivors, who consistently report worse psychosocial adjustment compared to older cancer survivors.^{26,45,46} During this time in their lives, younger women are balancing many competing demands and roles such as starting a career and/or a family, taking care of children and/or parents, and developing relationships.⁵² From a life stage perspective, it has been argued that younger women have more of their life ahead of them, and therefore may be particularly impacted by a diagnosis of cancer and the cancer treatment experience.⁵³ Physical and psychosocial changes related to cancer, including anxiety, depression, and fatigue, can present challenges to work and home productivity, which can linger for months to years following completion of treatment.¹¹⁻¹³ Lost productivity, coupled with high medical costs, can lead to dependence on family members and financial concerns that negatively impact younger survivors' social and familial relationships.⁵⁴ For younger women, breast cancer factors may be compounded by age-specific stressors, resulting in poor quality of life across many domains. **(Figure 1)**

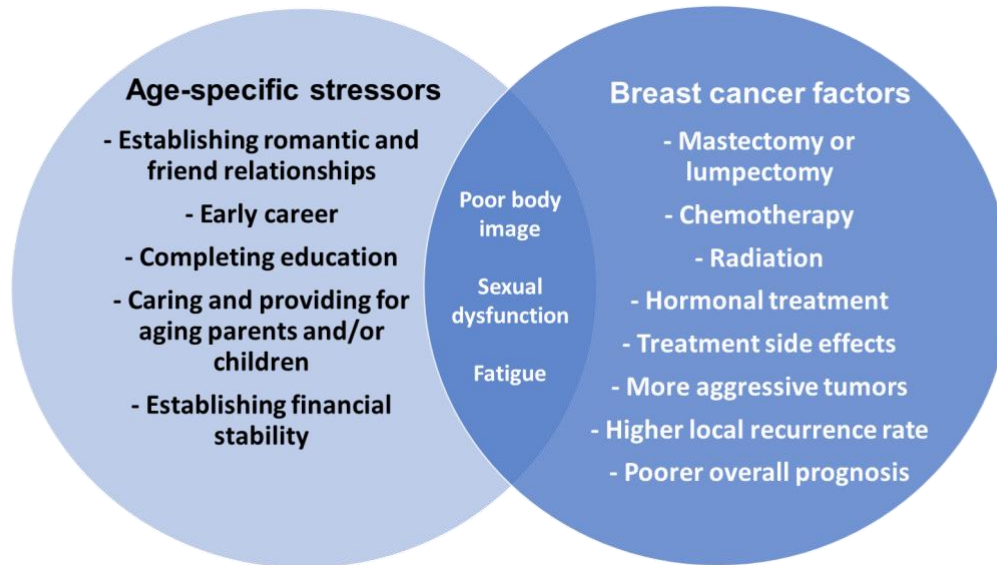


Figure 1. Breast cancer factors may interact with age-specific stressors, promoting poor quality of life in younger breast cancer survivors

Body image, in the context of understanding the experience of female breast cancer survivors, is defined as the way in which one perceives and evaluates the integrity of her physical body.¹⁶ This includes an attitude about the body being functional, whole, and healthy.¹⁶ For younger women undergoing treatment for breast cancer, major physical changes including surgical loss of the breast tissues and scarring, chemotherapy-induced hair loss and weight change, and radiation-induced skin damage and discoloration can lead to concerns not only about body integrity, but also self-consciousness about how to adapt to and accept these often dramatic and distressing changes.^{55,56} This may be particularly relevant for the younger survivor, who is in the midst of a life stage when she is typically working to build self-confidence and develop a strong relationship with herself and intimate others.⁵⁷ During this sensitive developmental period, changes in appearance from breast cancer and/or its treatment may negatively impact a woman's emotional health and overall self-image.⁵⁸ Physical changes can act as a constant reminder of an ill body or of a body that is vulnerable to disease. A recent systematic review of 36 studies found that body image disturbance is

highly prevalent, emotionally distressing, and often associated with other issues such as sexual dysfunction among younger cancer survivors.^{56,59}

Sexual function encompasses both physical and psychosocial aspects including desire, arousal, lubrication, orgasm, satisfaction and pain, body image, psychological health, and sensuality.⁶⁰ Cancer treatments disrupt normal ovarian function resulting in menopausal symptoms such as hot flashes, night sweats, and vaginitis, which can lead to dyspareunia (i.e., painful intercourse).⁶¹ Although sexual difficulties decrease gradually over time for some breast cancer survivors, others continue to experience sexual problems years after completing treatment.⁴⁶ Compared to age-matched controls and older cancer survivors, younger cancer survivors report poorer sexual function.⁶² Negative body image can also impact sexual functioning.⁶³ Nonetheless, sexual function is often not discussed with younger cancer survivors, perhaps because there are few evidence-based treatments to ameliorate these problems.⁶⁴

Fatigue is also an important issue to younger breast cancer survivors. Cancer-related fatigue differs from fatigue experienced by women without a history of cancer in that it is chronic and not relieved by rest.⁶⁵ Younger breast cancer survivors suffer higher rates of cancer-related fatigue than older breast cancer survivors, potentially due to residual effects from aggressive treatments.^{62,66} A larger number of competing demands for younger survivors' time and resources (e.g., family and work, as described above), as well as greater (unrealistic) expectations for energy, may also contribute to the high levels of cancer-related fatigue reported by younger survivors.⁶⁷

In summary, poor body image, sexual dysfunction, and cancer-related fatigue are highly prevalent and disruptive to younger breast cancer survivors. There is a pressing need to identify strategies to improve these aspects of quality of life among younger cancer survivors.

Physical Activity and Breast Cancer Survivorship

Physical activity after breast cancer can reduce both cancer- and non-cancer related morbidity and mortality^{20-22,68,69} and improve various aspects of quality of life.^{70,71} Many studies have shown moderate to vigorous intensity physical activity (MVPA) has substantial health benefits for cancer survivors across a range of physical and psychosocial domains.^{23,72-74} Flexibility exercises such as yoga and Pilates may also improve quality of life in cancer survivors.^{75,76} However, much of the research on breast cancer survivorship has been conducted with older breast cancer survivors or included very few young survivors.⁵⁶

A rich body of evidence indicates that physical activity is an effective strategy for reducing cancer-related fatigue in breast cancer survivors.^{23,77} A large body of literature has shown that physical activity can improve depression⁷⁸ and anxiety in cancer survivors. Much less is known about the impact of physical activity on body image and sexual functioning. Physical activity may improve body image in older survivors,^{25,79} though at least one trial has shown no effect of physical activity on body image in cancer survivors.⁸⁰ Most studies have been non-randomized and conducted in small samples.⁵⁶ There have also been limited studies assessing the impact of physical activity on sexual functioning in breast cancer survivors. Sexual functioning has been examined as a secondary outcome in at least three trials, but the heterogeneity of measures used renders it challenging to compare findings across studies.⁸¹ One exception is a fully-powered trial by Speck et al. that randomized 234 breast cancer survivors to a 12 month, twice-weekly, strength training intervention or control group.²⁵ The intervention group experienced greater improvements than the control group on the Body Image and Relationships Scale, which captures elements of body image, strength, sexuality, and appearance unique to breast cancer survivors.²⁵ While these results are encouraging, participants were on average 57 years old. It is unclear if the quality of life

benefits of physical activity observed in older breast cancer survivors also extend to younger breast cancer survivors. No intervention trials have examined the impact of physical activity on body image and sexual functioning in younger breast cancer survivors and only one pilot trial has assessed benefits for fatigue.^{28,82}

Physical activity promotion in young cancer survivors is especially important due to their elevated risk of chronic conditions, cancer recurrence, secondary cancer, and high rates of cancer-related mortality.^{37,38,42} A longitudinal observational study of young breast cancer survivors found that increased physical activity after diagnosis was associated with improved quality of life up to ten years later.⁸³ Yet many young cancer survivors decrease their activity levels during and after treatment²⁶ and are less likely to be active than similar women without cancer.^{27,84} According to data from the National Health Interview Survey, 24.4% of cancer survivors age 18-44 (95% CI: 20.7% to 28.6%) reported no leisure-time physical activity, which is higher than age-matched adults without cancer (22.7%; 95% CI: 22% to 23.5%).²⁷ Moreover, these data found that only 22.3% of younger cancer survivors (95% CI: 18.7% to 26.4%) meet federal guidelines for aerobic and strength training activities. Younger cancer survivors are less active than the remaining US population without a history of cancer, of whom 27.8% (95% CI: 27.3% to 28.4%) do not meet federal guidelines.²⁷

For young cancer survivors, general barriers to being physically active, such as lack of time and competing demands, may be compounded by age-specific personal and professional stressors.⁹ This can include completing their education, establishing a career, and simultaneously caring for both young children and aging parents.^{6,7-10} Given young survivors' higher rates of depressive symptoms and fatigue, they may be more likely than older survivors to experience psychological barriers to activity (e.g., low motivation, emotional distress).⁹ Taken together, these factors make it difficult for younger cancer survivors to start and maintain an exercise routine.

Physical Activity Interventions in Younger Cancer Survivors

Few home-based physical activity interventions have been tested in younger cancer survivors,²⁸⁻³⁰ even though younger survivors have distinct support needs and preferences from older cancer survivors and would be best served by interventions designed or adapted to target their specific needs.^{8,85,86} Given the limited number of studies in this population, theories of health behavior change can be used to guide the development of effective interventions. Health behavior theories, such as Social Cognitive Theory³⁵ and Control Theory,^{34,87,88} can help inform targets for intervention (i.e., mechanisms of action), which theoretically, if changed, will lead to changes in behavior.⁸⁹ They can also help determine which Behavior Change Techniques⁹⁰ should be used to promote behavior change. Social Cognitive Theory posits that behavior is a function of a dynamic and reciprocal interaction of person factors, behavior, and environmental influences.³⁵ In the context of physical activity, Social Cognitive Theory suggests that a supportive environment may enhance an individual's self-efficacy (i.e., confidence in one's ability to be physically active and overcome barriers to physical activity), and in turn, promote self-regulation (i.e., self-monitoring, goal setting, and action planning) to produce behavior change.³⁵ Self-efficacy, self-monitoring, goal setting, performance feedback, and environmental factors (e.g., social support) are key constructs described by Social Cognitive Theory that are related to increases in physical activity in cancer survivors.⁹¹⁻⁹⁴ Control Theory suggests that feedback loops provide awareness of discrepancies between performance and goals that can promote behavior change.^{34,87} The Behavior Change Techniques (BCT) framework put forth by Michie and colleagues suggests that self-monitoring is the skill most strongly associated with intervention success when combined with at least one other self-regulatory technique from Control Theory (e.g., receiving feedback on performance, goal setting, reviewing progress toward goals).^{34,88} Theories can also aid in understanding why behavioral interventions were successful or unsuccessful.

Three published studies have tested a physical activity intervention in younger cancer survivors.²⁸⁻³⁰ Two studies were conducted Rabin and colleagues.^{28,30} The first study randomized 18 young cancer survivors (any form except non-melanoma skin cancer, age 18-39 years, completed all treatment, inactive) to a 12-week individually tailored, web-based physical activity intervention (n=8) or control comparison group (n=10).²⁸ The intervention was grounded in Social Cognitive Theory and the Transtheoretical Model and participants received tailored feedback based on responses to monthly surveys integrated into the website, which was also used for goal setting and logging activity. Participants could communicate with other young survivors in the study through an online forum but no specific instructions were provided to participants regarding how frequently they should post. The control group received cancer resources but no physical activity information. Physical activity was self-reported through the Seven-Day Physical Activity Recall (PAR). While the study was underpowered to detect significant between-group differences in physical activity at follow-up, there was a moderate effect size (Cohen's $d=0.64$) for between group differences at 12 weeks (Intervention mean change +102.5 min/week (SD=44.54) vs. Control mean change +16.5 min/week (SD=54.77)).²⁸ Strength and flexibility outcomes from the PAR were not reported. There was also a trend toward improvements in fatigue, measured by the Profile of Mood States (POMS), in the intervention group compared to the control group. Interestingly, only one participant posted in the online message board. This result highlights that while younger cancer survivors express interest in interventions that facilitate social support, more intensive contacts and/or a more convenient platform may be needed to promote engagement.

The second trial by Rabin and colleagues tested a combined physical activity and meditation intervention delivered via telephone.³⁰ Thirty-five young cancer survivors (18-39 years old, diagnosed with any cancer, completed all active treatment, sedentary) were randomized to receive the 12-week intervention immediately or after a 12-week delay. The

intervention, based on Social Cognitive Theory and the Transtheoretical Model, included guided goal setting and provided pedometers to self-monitor activity. Participants received behavioral coaching calls from a trained researcher weekly over the 12-week intervention to review progress, problem solve, and revise goals as needed. There was also an online forum (monitored by the researcher) that could be used to communicate with other young survivors in the study. Participants self-reported physical activity through the PAR and wore accelerometers for three days prior to each assessment to provide an objective measure of activity. At 12 weeks, the physical activity group was performing greater self-reported minutes of MVPA per week compared to the waitlist control group (Intervention group mean change = +113.8 min/week, SE = 23.5 vs. Waitlist Control group mean change = - 8.7 min/week, SE = 27.1; $p < 0.002$),³⁰ but there was no change in objectively-measured activity. Strength and flexibility outcomes from the PAR were not reported. There was a trend toward improving mood (POMS). Similar to the initial study by Rabin and colleagues,²⁸ the online message board was rarely utilized.

There are multiple potential reasons why participants in these studies may have not engaged with the online message boards. Of note, data for the first trial were collected from approximately 2009-2010, before mobile phones became essentially ubiquitous among adults in the United States.⁹⁵ Data for the second trial were collected from approximately 2012-2013, but even in the last five years, smartphone ownership has increased substantially.⁹⁵ Prevalence of mobile phone use and text messaging are highest among young adults. Message boards integrated within smartphone apps may offer an opportunity to access social support from anywhere at any time.⁹⁶ Lack of engagement could have also been related to the fact that the forum moderator was a researcher. A recent mixed methods study of breast cancer survivors' preferences for social support features within technology-supported, remotely delivered physical activity interventions revealed that survivors were extremely

interested in using technology-supported message boards to post questions, give and receive feedback, and share ideas with other survivors.⁹⁶ Similarly, survivors believed that sharing their physical activity on a progress board or within a private community would help formalize goals, create a sense of accountability, and facilitate an understanding of their achievements relative to their peers⁹⁶— theory-supported behavior change techniques.⁹⁷ In the time since the previous physical activity interventions in younger cancer survivors were conducted, consumer technologies have emerged that can facilitate many of these behavior change techniques. For example, Fitbits (wearable activity trackers) and the companion Fitbit mobile app, can promote numerous theory-based techniques that have been shown to be associated with physical activity change in cancer survivors including self-monitoring, goal setting, performance feedback, and social support.^{88,90,94,97-102} Private, online message boards accessed within a mobile app, moderated by other young survivors, could enhance intervention effectiveness by increasing the likelihood that participants will engage with theory-based strategies designed to promote behavior change.⁹⁶

The third study in younger cancer survivors was conducted by Valle and colleagues.²⁹ Eighty-six young cancer survivors (21-39 years old, at least 1 year post-treatment, currently inactive) were randomized to a 12-week theory-based behavioral exercise program (intervention group) or a 12-week self-help exercise program (comparison group). Both group conditions utilized Facebook. The behavioral exercise intervention was based on Social Cognitive Theory and included Facebook messages with behavioral strategies, online goal setting and physical activity logging tools, and pedometers. Participants in the intervention group manually logged data from pedometers that were then used to create feedback charts comparing self-reported steps with weekly exercise goals. To foster group interaction and social support, the intervention Facebook group was moderated by a researcher. Physical activity was self-reported through the Godin Leisure Time Exercise Questionnaire. Over 12

weeks, both the intervention and control groups increased MVPA (Intervention group mean increase = + 67 min/week (95% CI 13.6, 143.4) vs. Comparison group mean increase = + 46.3 min/week (95% CI 0.8, 109.0)), but there was no significant between-group difference. There were no differences in quality of life, measured by the Functional Assessment of Cancer Therapy: General (FACT-G). Intervention effects on strength and flexibility exercises were not measured. Although this study included intervention components that are preferred by young cancer survivors⁸ (e.g., remote delivery and peer support), a substantial limitation is that participants did not manually transfer data from their pedometer to an online activity log.²⁹ While activity logs were important data sources for generating personal feedback charts comparing pedometer activity with physical activity goals, the burden of manual tracking resulted in non-compliance, reducing the dose of the theory-based program for some survivors (i.e., they were not self-monitoring their activity).²⁹ The intervention was designed to target theoretical constructs, but because participants did not engage with intervention components as planned, they received a lower dose of the intervention.

In summary, few studies have tested physical activity interventions for young cancer survivors,²⁸⁻³⁰ and none have specifically focused on young breast cancer survivors, whose high levels of psychosocial distress may present unique challenges to physical activity.⁹ Only one used an objective measure of MVPA,³⁰ and none of the studies reported intervention effects on strength training or stretching & flexibility activities that are of high interest to younger cancer survivors.⁸⁵ Additionally, none of these trials assessed intervention effects on body image or sexual functioning, issues of critical importance to younger breast cancer survivors.¹⁶

Technology Based Physical Activity Interventions

Newer technologies could help overcome engagement-related challenges observed in the previous studies. A promising alternative to traditional tracking using a paper and pencil

online log is through wearable activity trackers, such as the Fitbit, and their associated mobile apps. Activity trackers reduce burden through automatic tracking of physical activity and allow for remote support based on objectively collected activity information.¹⁰³ Several studies using wearable trackers have demonstrated their efficacy, particularly when combined with traditional counseling, for increasing physical activity in the general population¹⁰⁴ and in older breast cancer survivors.^{33,103} Ownership of smartphones, which are typically needed to engage with the information collected by these trackers, is nearly universal.⁹⁵ As of June 2019, 96% of 18-29 year olds and 92% of 30-49 year olds, and 82% of White, 80% of Black, and 79% of Hispanic adults across all groups reported owning a smartphone.⁹⁵ Smartphone ownership has also been increasing in lower-income households with ownership at 71% and 78% in household making less than \$30,000 a year and between \$30,000 and \$50,000 a year, respectively.⁹⁵

Moreover, the most common barriers to exercise in young breast cancer survivors are related to scheduling and lack of time. Intervention modalities that do not require in-person attendance and can be accessed anytime and anywhere, such as remotely-delivered, technology-based physical activity interventions using wearable trackers and mobile phones, may be an ideal fit for this population.^{8,105} Technology-based approaches have several advantages over traditional intensive lifestyle interventions, including the potential to be more cost-effective, accessible, and convenient.¹⁰⁶⁻¹⁰⁸ Commercially-available technologies also have high potential for dissemination and continued use after the end of a research study, as these products are widely used and continually updated with new devices and features.¹⁰⁹

Peer-delivered interventions and social support

Social support refers to the direct and indirect resources derived from interactions with members of one's social network.^{110,111} In the context of physical activity, social support concerns tasks or steps that others take to facilitate physical activity behaviors. One way to

integrate social support into physical activity interventions is through peer mentors. Peer mentors are trained individuals who have shared experiences to provide knowledge, emotional, social, and or/practical help to support others. Integrating peer mentors into a physical activity program is supported by Social Cognitive Theory.³⁵ For example, feedback from others increases self-efficacy, and behavior can be learned by observing and imitating others (i.e., modeling).¹¹² Many physical activity intervention trials for cancer survivors have been conducted in research settings and delivered by trained research staff. Using peers to deliver behavioral interventions has been identified as an opportunity to extend the reach of evidence-based interventions into the community.¹¹²⁻¹¹⁴ In chronic disease populations, peer led-programs have been effective for promoting and maintaining physical activity.¹¹⁵⁻¹¹⁷ Few peer-delivered physical activity interventions have been tested in cancer survivors. A randomized controlled trial by Pinto and colleagues tested a 12-week, peer-delivered physical activity intervention using phone counseling compared to contact control to 76 breast cancer survivors (mean age 56 years old).¹¹⁸ Results indicated significant intervention effects on self-reported and objectively-measured minutes of MVPA.¹¹⁸ To our knowledge, no peer-delivered physical activity programs have been trialed in younger cancer survivors, despite their preferences for behavioral interventions that provide support from other younger survivors.^{8,105} Cancer-treatment related and/or schedule barriers may prevent younger survivors from attending face-to-face sessions, and large geographical distances between a younger survivor and the nearest in-person support program could make attendance difficult.⁹ Adding peer support features to technology-based interventions may enhance their effectiveness⁹⁶ and may be appealing to younger cancer survivors.^{8,119} A conceptual framework for the Pink Body Spirit study is displayed in **Figure 2**.

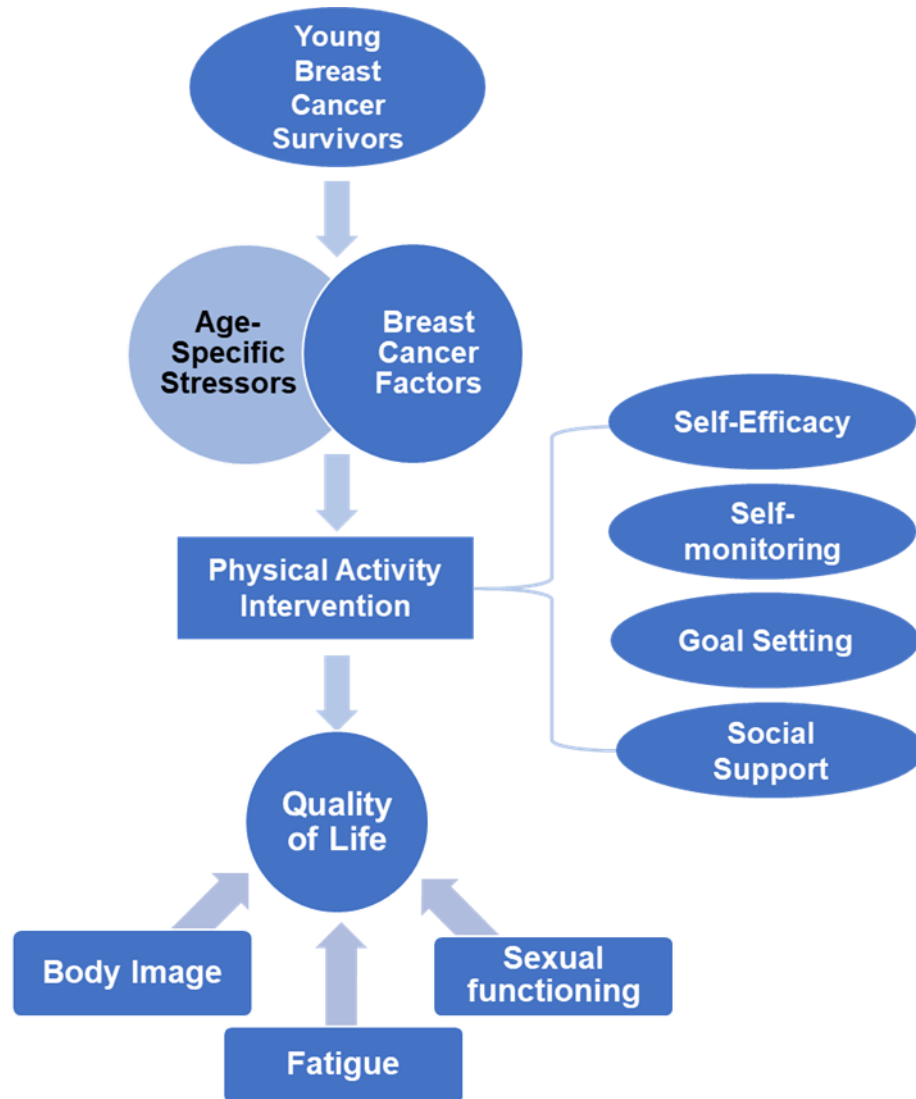


Figure 2. Conceptual framework guiding the Pink Body Spirit physical activity intervention

Collaboration with Community Partner

This project was a community-academic partnership between Stori Nagel, Founder, Haus of Volta, and Dr. Sheri Hartman, Associate Professor, UC San Diego. The study was developed using a CBPR approach, which emphasizes the equal partnership and active involvement of community members and researchers in all aspects of the research process.^{31,120} Ms. Nagel (further referred to as co-PI SN) and Dr. Hartman (further referred to

as co-PI SJH) were the co-Principal Investigators of the study and the dissertation author was the project manager.

Haus of Volta is a non-profit organization based in Murrieta, California that works with younger breast cancer survivors to promote positive body image and positive outlook on life after cancer. Through her own experience undergoing treatment for Stage III breast cancer and mentoring a diverse group of younger breast cancer survivors, co-PI SN found that physical activity helped herself and many other younger survivors readjust to life after cancer treatment. Through this collaborative project, Haus of Volta was deeply interested in learning whether being physically active could help any of these common concerns among younger survivors, and how younger survivors can help each other increase their activity and improve their health. The initial research questions were developed based on co-PI SN's own experience with breast cancer and her outreach in the young survivor community. During the development of the CBCRP grant proposal, these research objectives were reviewed with Haus of Volta's Community Advisory Board (CAB) to ensure the questions captured the concerns and needs of the community.

As described below, the Pink Body Spirit pilot intervention leveraged evidence-based behavioral intervention strategies. These evidence-based intervention strategies have successfully increased MVPA in older breast cancer survivors in the context of a clinical research study at a comprehensive cancer center.³² Co-PI SN and the Haus of Volta CAB served as primary resources in the design of the pilot intervention. As part of the development of the grant proposal, the Haus of Volta CAB field-tested the proposed pilot intervention components and worked with the project manager and co-PI SJH to modify evidence-based intervention strategies to meet the needs of young breast cancer survivors, thereby enhancing the cultural sensitivity and relevance of the intervention to this population. These modifications included 100% remote-delivery (rather than an initial in-person intervention session and in-

person measurements) and the additions of the Pink Body Spirit Fitbit Community and the intervention toolbox (details in Physical Activity Intervention section). Co-PI SN also selected the name for the intervention (i.e., Pink Body Spirit) that she felt would resonate with the younger breast cancer survivor community. Co-PI SN and the Haus of Volta CAB reviewed all validated quality of life questionnaires to confirm that the questions were worded in ways that would elicit trustworthy and credible responses from younger breast cancer survivors. Further, discussions with co-PI SN and the Haus of Volta CAB revealed a desire to study a range of activities of different intensities beyond aerobic MVPA including strength training, yoga, and Pilates. To capture the spectrum of activities that younger survivors may elect, the study used multiple methods to measure both objective and self-reported activity, including self-reported measures of strength training and stretching & flexibility exercises.⁸⁵ The co-PIs and project manager met every other week over the course of the study to review study plans and progress and to ensure the project methods consistently incorporated both perspectives. Any modifications to the methods were documented and collectively decided upon. Haus of Volta also contributed to the interpretation, and together with the CAB, will continue to help guide dissemination of the mixed methods findings.

Project team

In addition to co-PI SN, the team for this pilot study included individuals with different life experiences and content and methodological expertise. Co-PI SJH is a clinical psychologist and physical activity interventionist with extensive experience developing and testing behavioral interventions in cancer survivors. She was responsible for oversight of all study activities. Dr. Irene Su is a reproductive endocrinologist at UC San Diego Moores Cancer Center and the study physician who reviewed any safety concerns and adverse events. Dr. Su's deep experience working with young cancer survivors in clinical and research contexts helped ensure the clinical relevance of this work. Haus of Volta led recruitment of

participants and peer mentors to deliver the intervention and aided with interpretation and dissemination of the mixed methods results. The dissertation author (project manager) worked closely with the co-PIs to develop and write the grant to CBCRP; led the planning and implementation of the pilot trial and quantitative and qualitative data collection and analysis; and was responsible for designing and facilitating peer mentor training and providing ongoing support to the peer mentor and research teams.

METHODS

Study Design and Overview

The purpose of this study was to conduct a single-arm feasibility trial of a 12-week remotely delivered, peer-moderated physical activity intervention (Pink Body Spirit) among breast cancer survivors who were diagnosed under age 50, had completed primary breast cancer treatment at least 6 months prior to enrollment, and were not physically active. The Pink Body Spirit program was based on an intervention that was successful at increasing physical activity in older survivors, delivered by a professional interventionist in an academic comprehensive cancer center setting.³³ The Pink Body Spirit program used peer mentors, motivational interviewing, and technology (Fitbit and Fitbit Community) to promote behavior change. Five younger breast cancer survivors (diagnosed < 50 years old and currently < 55 years old) were trained as peer mentors to deliver the program to fellow younger survivors. At baseline (T0), 3 months (postintervention; T1), and 6 months (follow-up; T2), participants completed quality of life questionnaires and physical activity was measured through accelerometer (MVPA) and self-report (strength and flexibility). At T1 and T2, participants also completed quantitative satisfaction questionnaires and qualitative interviews. Using a mixed methods approach, findings from quantitative questionnaires and qualitative interviews were triangulated to explore feasibility, acceptability, and satisfaction with the pilot study methods. Feasibility was assessed through recruitment and retention metrics and adherence to intervention components (completion of intervention sessions, wearing the Fitbit, and posting in the Fitbit Community). A multimethod process evaluation explored how the intervention was delivered and adaptations needed or made by peer mentors. Participants were enrolled on a rolling basis, and intervention process data collected throughout the study were used iteratively to provide feedback to peer mentors and adapt the program to meet the needs of

the target population. The UC San Diego Institutional Review Board approved this study (Protocol # 181367). **Figure 3** shows the study flow.

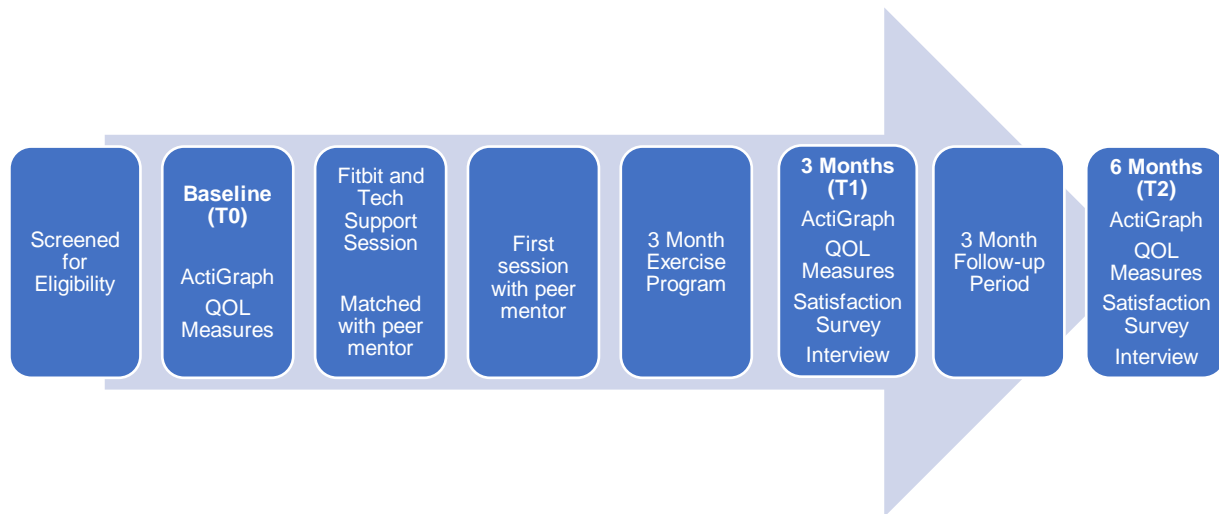


Figure 3. Overview of study flow

Recruitment and Eligibility

Nationwide recruitment was led by co-PI SN and Haus of Volta. The primary recruitment strategy was through social media postings (Facebook and Instagram) in groups tailored toward younger breast cancer survivors across the United States, including the Young Survival Coalition and Living Beyond Breast Cancer. Co-PI SN gave presentations at community events throughout Southern California and used these community connections to support recruitment. Breast cancer oncologists and patient navigators at UC San Diego Moores Cancer Center were also asked to provide information to any patients who appeared to meet the study criteria. Sample recruitment materials are provided in **Appendix 1**.

The inclusion criteria were as follows: (1) breast cancer survivor diagnosed when aged between 18 and 49 years and currently aged between 18 and 54 years; (2) completed active treatment (specifically surgery, chemotherapy, and/or radiotherapy) at least six months before enrollment; (3) sedentary, using a common definition of self-reporting < 60 minutes of MVPA each week;^{32,121} (4) accessible by phone or video chat; and (5) have a Fitbit-compatible

cellphone, tablet, or laptop with internet. Exclusion criteria included the following: (1) self-reported medical condition that could make it potentially unsafe to be in an unsupervised physical activity intervention as determined by the Physical Activity Readiness Questionnaire¹²² or self-reported peripheral neuropathy that interferes with ambulation, (2) currently pregnant, (3) unable to commit to a 3-month intervention schedule, or (4) prisoner.

Phone Screening. Interested women contacted the study office via phone or email and were phone screened for eligibility. Screener questions included date of diagnosis, date treatment was completed, self-reported physical activity, willingness to comply with study procedures, and access to and comfort with technology. The Physical Activity Readiness Questionnaire (PAR-Q) was used to assess the risk of complications resulting from physical activity, including potential heart, joint, or bone problems.¹²² Questions also asked about self-reported neuropathy and lymphedema that could make it difficult for a participant to exercise safely on their own. If eligibility was unclear after phone screening, the study physician reviewed the data to determine if study enrollment was appropriate.

Informed Consent. Interested and eligible women were provided additional information about the study and had any questions answered by research staff. Participants were then emailed a link to a web-based consent form through REDCap, a secure research database hosted on UC San Diego servers. Participants were enrolled in the study on a rolling basis. See **Appendix 2** for IRB-approved consent form.

Pink Body Spirit Peer Mentors

The Pink Body Spirit peer mentors were women who were diagnosed with breast cancer when they were less than 50 years old and had completed all active treatments for breast cancer (i.e., surgery, chemotherapy, and radiation). Peer mentors had previous connections to and were selected by Haus of Volta to serve in this role due to a strong desire to give back to their community. Peer mentors were paid for their time by the California Breast

Cancer Research Program grant that funded this project. Peer mentors were trained to deliver the intervention by the project manager and co-PI SJH in Fall 2018 and Spring 2019. All trainings were conducted via Zoom video conferencing except for one component of the Motivational Interviewing training that had a virtual or in-person option. All trainings were recorded for future use. Trainings included the following: Research Ethics, Privacy, and Data Safety; Exercising Safely and Adverse Events; Motivational Interviewing; and Intervention Protocol and Delivery (details provided below). Haus of Volta and the peer mentors were not involved in collection of participant measures (online questionnaires, accelerometer) at any of the three measurement time points.

Research Ethics, Privacy, and Data Safety. Peer mentors completed the mandatory UC San Diego Collaborative Institutional Training Initiative (CITI) and Health Insurance Portability And Accountability (HIPAA) web-based trainings. The project manager led an additional web-based Zoom training that applied key components covered in the CITI and HIPAA trainings to issues that were specifically relevant to this study. Some of the topics included research ethics, informed consent, bias, self-disclosure, and confidentiality.

Exercising Safely and Adverse Events. This web-based Zoom training, led by the project manager, focused on exercising safely after breast cancer. Mock scenarios specifically relevant to this project were reviewed as a group to ensure that the mentors had gained the necessary knowledge of American College of Sports Medicine recommendations for cancer survivors^{123,124} and how to help participants set safe and appropriate exercise goals. They were also trained on the study protocol to respond to and report adverse events, including encouraging participants to seek medical attention and stop physical activity if necessary. Peer mentors were trained to proactively monitor for adverse events throughout the study including asking participants about adverse events as part of the intervention sessions.

Motivational Interviewing. Peer mentors were trained in motivational interviewing techniques for communicating with others, effective in supporting behavior change.¹²⁵ Motivational interviewing is a collaborative, goal-oriented method of communication with particular attention to the language of change. It is designed to strengthen an individual's motivation for and movement toward a specific goal by eliciting and exploring the person's own arguments for change. Peer mentors completed a standardized 10-hour introductory course on motivational interviewing (<https://academy.psychotherapy.net/store/jhDjd9Xc>). The publicly available, web-based training course, which could be completed anytime and anywhere, introduced peer mentors to the general principles of motivational interviewing (express empathy, develop discrepancy, roll with resistance, and support self-efficacy) and provided an overview of critical skills (open-ended questions, affirmations, reflective listening, and summaries). Following the web-based introductory training, peer mentors completed a 4-hour, study-specific, in-person course on motivational interviewing led by co-PI SJH, who is a clinical psychologist (4 hours). The in-person training focused on applying motivational interviewing skills to the Pink Body Spirit intervention and helping others increase their physical activity. During this training, peer mentors practiced mock intervention sessions with each other and were provided real-time feedback on their use of motivational interviewing skills. Of note, the study team and three peer mentors based in Southern California elected to conduct this training in person, one peer mentor was trained entirely remotely, and one peer mentor completed some parts in person and other parts remotely due to a relocation. The in-person training was recorded, and peer mentors who were trained remotely met with the project manager over Zoom for additional practice sessions.

Intervention Protocol and Delivery. The project manager worked with a peer mentor to create training videos of mock video mentoring sessions. The videos were distributed to all peer mentors along with a detailed script for the first mentoring session and the follow-up

sessions. Peer mentors practiced the mentoring sessions with each other and individuals unfamiliar with the study such as other young cancer survivors and friends. Before gaining approval to mentor study participants, peer mentors completed two mock sessions with the project manager over Zoom to demonstrate proficiency of the protocol content and use of motivational interviewing skills, logistics (e.g., ability to save and upload session records to secure servers, schedule future sessions on study calendar, etc.), and safety information. The approval process also included verification of the peer mentor's ability to accurately complete data entry forms and track sessions in the REDCap database.

3-Month Physical Activity Intervention (Pink Body Spirit)

The Pink Body Spirit physical activity intervention leveraged an existing evidence-based exercise intervention that was successful at increasing physical activity in older breast cancer survivors.³³ To help address common barriers to exercise among young cancer survivors, the Pink Body Spirit program was fully remote.^{9,126} The intervention targeted constructs from Social Cognitive Theory³⁵ and Control Theory^{34,87,88} to support behavior change. The 12-week program included six video or phone sessions with a trained peer mentor (every other week) and weekly interactions with a peer mentor and other participants through a private Fitbit Community. To promote accountability, participants were informed that their peer mentor would be able to see the physical activity data collected by the Fitbit. Between scheduled sessions, peer mentors used real-time Fitbit data to identify participants in need of additional support to increase their exercise (see Fitbit and Associated Apps section below). Specific theoretical constructs and how intervention components target each theoretical construct are described below in **Table 1**.

Technology Support Session and Peer Mentor Matching. After completing the T0 (baseline) measures, participants were mailed a Fitbit Charge 3 and were matched with a peer mentor based on mutual schedule availability. Participants then completed a brief technology

support session via Zoom video conferencing with the project manager. During this 15-20 minute session, the project manager helped participants set up their Fitbit and verified that they could successfully join the Zoom call in preparation for the peer mentoring sessions. Proactive technical support from research staff was implemented to allow peer mentors to focus on intervention delivery, including goal setting and behavior change strategies. See **Appendix 3** for Technology Support Session Script.

Peer Mentoring Sessions. Participants were scheduled to meet with their peer mentor six times over the course of the 3-month intervention. After completing the technology support session, participants completed an initial 45-minute video session with their peer mentor. Initial session topics included: (1) self-monitoring with the Fitbit; (2) directions for using the in-app, private Fitbit Community; (3) goal setting; and (4) scheduling five follow-up sessions (every two weeks). The Pink Body Spirit intervention was guided by Control Theory and Social Cognitive Theory^{34,35,87,88} and incorporated elements of evidence-based physical activity interventions developed and tested at UC San Diego Moores Cancer Center.^{32,109} In line with Control Theory,^{34,87} peer mentoring sessions and Fitbits were used to facilitate feedback loops that provide awareness of discrepancies between performance and goals to promote behavior change. (**Figure 4**)

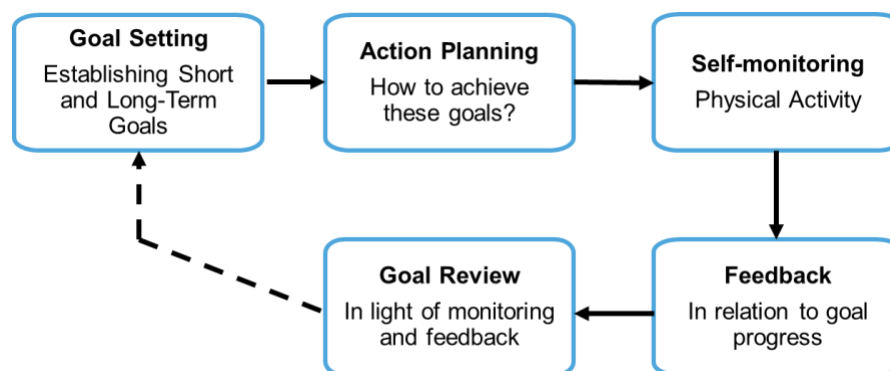


Figure 4. Conceptualization of feedback loops that provide awareness of discrepancies between performance and goals to promote behavior change in the Pink Body Spirit intervention

Participants learned how to self-monitor their physical activity using the Fitbit (see Fitbit details mentioned below and **Figure 5**). To promote self-efficacy, participants were encouraged to set specific, stepwise goals. To increase self-efficacy and promote intention formation, peer mentors used motivational interviewing techniques during the mentoring sessions. Participants set an initial exercise goal and a specific action plan to meet that goal. Goal setting focused on safe and gradual increases in activity over time to meet the American College of Sports Medicine^{123,127} and the American Cancer Society (ACS)¹²⁴ guidelines for cancer survivors of engaging in at least 150 minutes of MVPA per week. The primary focus was on MVPA, but participants were also supported in engaging in other types of activity, such as strength training and stretching and flexibility exercises. No specific recommendations were provided to participants regarding a target amount of strength training. To increase behavioral capability, peer mentors demonstrated how to use the Fitbit to monitor heart rate to determine moderate intensity and how to customize the home screen of the Fitbit app such that active minutes are displayed as the primary activity goal. Participants were also instructed on how to use the Fitbit to track activities that are not automatically captured by the device, such as strength training and flexibility exercises. A total of 5 follow-up video or phone sessions (approximately 20 minutes) were scheduled every other week over the 3-month program to check on progress, revise goals, and provide support. To promote accountability, participants were informed that their peer mentor would be able to see the activity data collected by the Fitbit. Peer mentors used Fitbit data to support performance feedback and goal review during biweekly follow-up sessions. To promote social support, improve rapport, and enhance continuity, participants worked with their same peer mentor for the entire 3-month program. Peer mentoring session scripts and a sample goal setting/action plan worksheet are provided in **Appendix 3**.

Peer mentors met with the project manager and co-PI SJH every other week for approximately 1 hour over Zoom video conferencing to gain support in delivering the intervention through discussion of how intervention sessions were going, problem solving for difficult participants, and practicing of skills. The use of the REDCap database, the Fitbit Community, safety, and adverse events were also discussed. All intervention sessions were video recorded. A random 50% of initial goal-setting sessions and a random 20% sample of follow-up sessions were reviewed by the project manager. Review of the session recordings served a dual purpose: (1) to examine the use of motivational interviewing techniques and the safety of session content, which was used to support peer mentors during supervision meetings; and (2) to examine adaptations from the study protocol (exploratory aim; further described in qualitative evaluation of peer mentor adaptations and intervention delivery). The project manager provided feedback to peer mentors based on the review of session recordings and information from participant qualitative interviews that were analyzed throughout the intervention using a rapid approach.

Fitbit and Associated Apps. Participants received a Fitbit Charge 3 (Fitbit, Inc.), an accelerometer-based activity monitor that provides real-time feedback on several activity-related metrics, including the number of steps taken, active minutes (similar to MVPA) and continuous heart rate tracking. The Fitbit was selected owing to its relatively low cost and ubiquity in the consumer wearables marketplace and in research studies. It is water resistant up to 50 meters, has a battery life of approximately 1 week, and has 15 exercise modes to set goals and track statistics for activities as varied as swimming, yoga, and strength training. The Fitbit wirelessly uploads data from the tracker to the Fitbit website and smartphone app (Android, Apple, or Windows) that provide graphical visualizations of daily activity patterns. In this study, participants were instructed to wear their Fitbit daily and sync the tracker with the mobile app at least once per week so that their peer mentor could view their activity data in

Fitabase (Small Steps Lab). Fitabase is a password-protected, web-based database program that collects physical activity and heart rate data from the Fitbit cloud. Through Fitabase, peer mentors were able to see graphs of daily light, moderate, and vigorous activity; date of last Fitbit sync; and Fitbit battery level for each of their mentees. Peer mentors were trained to use Fitbit data to support their scheduled follow-up sessions by identifying days with low activity where activity could be added and days with high activity to reinforce what is working well. Peer mentors were also asked to check each of their participants' Fitbit data through the Fitabase website at least weekly. Peer mentors were instructed to use Fitabase data to identify general trends in activity and provide feedback to participants through email, text, or private Fitbit messages between biweekly mentoring sessions. Peer mentors were provided with sample messages and encouraged to reach out to participants when (1) they decrease activity or do not meet their weekly goal, (2) they exceed their weekly goal, or (3) they have not worn or synced their Fitbit (see **Appendix 3** for sample messages). This method of proactively reaching out to participants between scheduled sessions was highly successful and extremely liked in our previous study.³³ **Figure 5** illustrates how Fitbit trackers and data were used by participants and peer mentors in the Pink Body Spirit Study.

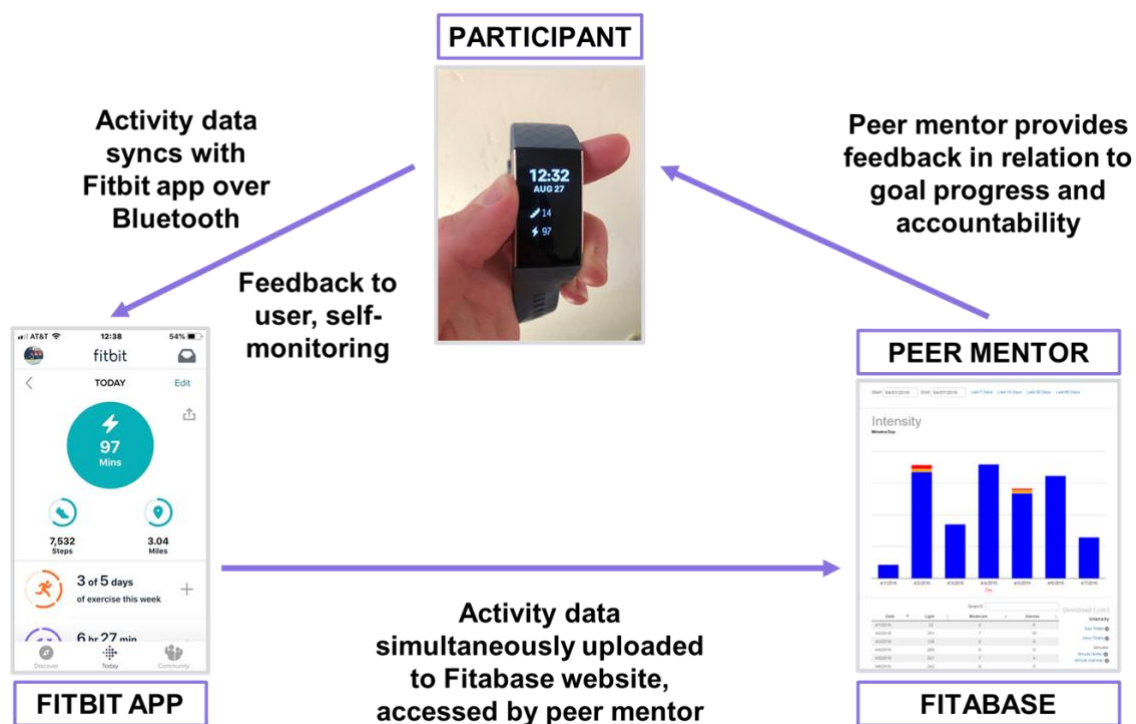


Figure 5. Visual depiction of how Fitbits were used to support increasing physical activity in the Pink Body Spirit intervention

Fitbit Community. Participants were asked to participate in a private Community group within the Fitbit mobile app where they could communicate with other participants and all peer mentors, and view the activity Leaderboard (i.e., rolling 7-day average steps of all participants and mentors). The Fitbit Community targeted several theoretical constructs including social support; rewards and recognition (by other participants and mentors); and opportunities, barriers, and problem solving (through collective sharing of challenges, solutions, and resources). During the initial mentoring session, peer mentors invited their mentee to join the Fitbit Community and demonstrated how to access and post in it. Step-by-step instructions for accessing and posting in the Fitbit Community were also included with the Fitbit when mailed to participants. Participants were asked by their peer mentors to visit and post in Fitbit Community at least once a week. To overcome the limitations of past studies in young cancer

survivors that observed low engagement with online forums, the Fitbit Community was moderated by peer mentors. Peer mentors were instructed to provide support to all participants through the Fitbit Community by checking it at least once a week and responding or posting as appropriate. Peer mentors were also trained to remind and reinforce participation in the Fitbit Community during biweekly mentoring sessions. Participant directions for using the Fitbit Community and screenshots of sample posts and the Fitbit Leaderboard are provided in **Appendix 3**.

Fitbit Challenges, a feature of the Fitbit app and Fitbit Community, enabled participants and mentors to compete for the greatest number of steps or active minutes in a set amount of time. After completing a Challenge, the user is rewarded with badges and trophies. Participants could view their ranking on a Challenge-specific Leaderboard throughout the Challenge. One to 30 people could participate in each Challenge depending on the type of Challenge. Some of the Fitbit Challenges used in this study included the *Workweek Hustle* (competition for the most steps Monday through Friday), *Weekend Warrior* (most steps Saturday and Sunday), and *All for One*, a collaborative Challenge in which Fitbit generates a collective goal for all Challenge participants based on each individual's average activity statistics. The study also used *Custom Challenges*, which could be customized to focus on steps, distance, or time over any time period from 1 hour to 30 days. The Fitbit Challenges focused on steps allowed participants and mentors to send messages of encouragement and "cheer" others within the Challenge interface. Fitbit Challenges facilitated numerous behavior change techniques including rewards and recognition, comparison of performance to goals, and social support (**Table 1**).

Fitbit Challenges were introduced to the intervention by peer mentors starting in December 2019 to increase engagement in the Fitbit Community (rationale and details of this adaptation are described in the Adaptations section of this dissertation). Fitbit Challenges were

an optional intervention component; participants could join as many or as few Challenges as they wished. Participants could quit a challenge at any time and could also take part in multiple challenges simultaneously. Participants were not restricted from joining Fitbit Challenges organized outside the study (i.e., organized by other friends or family who use Fitbit devices).

Toolbox. Peer mentors were encouraged to individualize the intervention using a *toolbox* of exercise-related strategies and materials to help participants overcome barriers and achieve their unique exercise goals. Peer mentors were allotted US \$40 for each participant to provide them with toolbox items such as fitness apps (free or paid), exercise materials for home-based workouts (e.g., resistance bands, stability ball, or jump rope), and information about free workouts or exercise groups. Peer mentors could offer toolbox resources any time after the first session, and they had to be directly linked to the participant's individual exercise goal and action plan. Development of the toolbox was guided by the Haus of Volta Community Advisory Board's field testing. An individualized toolbox approach has been a key component of numerous successful lifestyle interventions.^{128,129}

Postintervention Follow-Up Period (Months 4 to 6)

The postintervention follow-up period in months 4 to 6 focused on exploring the extent to which participants continued to engage with their mentors and different aspects of the Pink Body Spirit program beyond the initial 3-month intervention. There were no scheduled contacts or video chat sessions with peer mentors during the follow-up period, but at the end of the intervention, peer mentors strongly encouraged participants to continue wearing and syncing their Fitbit to track their activity and participate in the Pink Body Spirit Fitbit Community. Peer mentors were advised that they were not expected to check activity data on Fitabase once a mentee entered the follow-up period. Although there were no planned sessions, it was anticipated that some contacts would still occur. Peer mentors were trained to track in the REDCap database any optional communications with mentees during the follow-up period

(date of support, mode (e.g., email, Fitbit message, text, call, or Zoom video chat), and general reason for support).

Table 1. Overview of Social Cognitive Theory and Control Theory constructs targeted by the Pink Body Spirit physical activity intervention

<u>Theoretical Construct</u>	<u>Peer Mentor Session Components</u>	<u>Fitbit Components</u>	<u>Measurement</u>
Self-monitoring	<ul style="list-style-type: none"> • Orientation to self-monitoring & importance • Check-in about self-monitoring strategies and reinforce self-monitoring during each session 	<ul style="list-style-type: none"> • Automatically tracks activity, option for manual input (swimming, etc.) • Graphical visualizations of daily, weekly, and monthly activity 	<ul style="list-style-type: none"> • Self-reported number of times app used per day, week, and month • Fitbit tracker wear time (% of intervention days worn)
Goal setting & review, action planning	<ul style="list-style-type: none"> • Focus on incremental goals • Review progress toward goals • Goals & action plan updated as needed 	<ul style="list-style-type: none"> • In-app goal setting for active minutes and steps, can be updated as goals change • Fitbit Exercise Calendar • Fitbit-recommended workouts 	<ul style="list-style-type: none"> • Self-reported frequency of adjusting pre-set goals on Fitbit app
Comparison of performance to goals	<ul style="list-style-type: none"> • Learn to compare current behavior with baseline behavior to detect small changes in behavior as they occur • Extra support from peer mentor based on Fitbit data compared to goal set 	<ul style="list-style-type: none"> • Prompt review of behavioral goals • Rich visualizations of behavior over time relative to defined goals • Fitbit Challenges 	<ul style="list-style-type: none"> • Self-reported frequency of viewed graphs comparing performance to benchmarks or weekly/monthly annual average performance
Opportunities & Barriers, Problem solving	<ul style="list-style-type: none"> • Identify barriers to physical activity • Generate strategies to overcome barriers and increase facilitators • Intervention toolbox 	<ul style="list-style-type: none"> • Fitbit community board postings from mentors and other participants 	<ul style="list-style-type: none"> • Self-reported extent to which this was learned during program • Self-reported use of Fitbit community to problem-solve for self or others

Table 1. Overview of theoretical constructs targeted by the Pink Body Spirit physical activity intervention (continued from previous)

<u>Theoretical Construct</u>	<u>Peer Mentor Session Components</u>	<u>Fitbit Components</u>	<u>Measurement</u>
Outcome expectations	<ul style="list-style-type: none"> Peer mentor provides info about positive outcomes of increasing activity, including reducing risk of recurrence and improving quality of life 	<ul style="list-style-type: none"> Fitbit app provides info about benefits of exercise 	<ul style="list-style-type: none"> Self-reported exposure to information about health consequences in Fitbit app, Community, and from peer mentor
Self-efficacy	<ul style="list-style-type: none"> Identify previous success sticking to a goal (previous mastery) Encouraged to feel proud of their ability to achieve and maintain intended goals (verbal persuasion) Tips to stay motivated Incremental goals 	<ul style="list-style-type: none"> Reminders of previous successes in app Motivational messages in app and on tracker 	<ul style="list-style-type: none"> Self-reported use of smaller or incremental goals (e.g., 250 steps/hour) Number and type of extra contacts received from peer mentor
Social support	<ul style="list-style-type: none"> Matched with same peer mentor for entire 12-week intervention Identifying helpful and unhelpful sources of social support for behavior change (e.g., family, friends, healthcare team) 	<ul style="list-style-type: none"> Support from other participants and peer mentors in Fitbit Community Group Fitbit Leaderboard & Challenges 	<ul style="list-style-type: none"> Self-reported and objective frequency of posting in Fitbit community Self-reported social comparisons with other participants or mentors in Fitbit community or people outside of study
Rewards/Recognition	<ul style="list-style-type: none"> Verbal and written praise for meeting goal Create a plan to reward self for achieving goal 	<ul style="list-style-type: none"> In-app badges, banners, vibrations (on tracker) and emails from Fitbit for meeting goals Likes, comments, and mentions in Fitbit Community Group Fitbit Leaderboard. & Challenges 	<ul style="list-style-type: none"> Number of badges earned Usefulness of rewards/recognition provided in Community Group Self-reported use of Leaderboard
Feedback on performance	<ul style="list-style-type: none"> Feedback from peer mentor about behavior using activity data from Fitabase 	<ul style="list-style-type: none"> In-app feedback Feedback on Fitbit tracker Weekly progress emails from Fitbit 	<ul style="list-style-type: none"> Self-reported usefulness of Fitbit feedback features and peer mentor feedback

Measurement

Baseline Assessment (T0). Participants were emailed a link to a battery of web-based questionnaires (See Aim 2 Measures) consisting of quality of life measures and items assessing self-reported strength training and stretching & flexibility exercises. Participants self-reported demographics, general medical history, menstrual and reproductive history, and cancer history. Self-reported general medical history included all current conditions and medications prescribed by a health care provider and dietary and nutritional supplements. Self-reported menstrual and reproductive history included any history of hysterectomy and/or oophorectomy, age at first menstrual period, last menstrual period, and/or reason(s) period has stopped. Self-reported cancer history included date of diagnosis, stage at diagnosis, type of surgery, date of surgery, cancer treatments (radiation, chemotherapy, and/or hormonal therapy, history and current), infusions for human epidermal growth factor receptor 2-positive breast cancer (e.g., Herceptin, history and current), and lymphedema (history and current).

Once the web-based questionnaires were completed, participants were mailed an ActiGraph GT3X+ accelerometer, a device that objectively measures activity, and instructed to wear it on the hip for the next 7 days during waking hours (for at least 12 hours per day). Two compliance reminders (email or text, depending on participant preference) were placed over the 7-day wear period. Once the ActiGraph was worn for 7 days for at least 12 hours per day, participants returned it to the study office using a prepaid envelope. Upon receipt, ActiGraph data were screened for sufficient wear time. If participants had not worn the device for at least 10 hours over 5 days or 50 hours over 4 days, they were mailed a replacement device and asked to repeat the measurement. Participants received US \$20 for completing the T0 measures. All T0 measures were completed, and sufficient wear time was verified before being matched with a peer mentor to begin the exercise program.

Postintervention Assessment (T1). Three months after completing the first intervention session with their peer mentor, participants repeated the web-based questionnaires completed at T0 as well as a 3-month quantitative satisfaction questionnaire. Participants were again mailed an ActiGraph and asked to wear it for 7 days. The same wear and mail-back instructions and compliance protocol described above were used. After returning the ActiGraph, participants were asked to complete a 3-month qualitative interview. Participants received US \$20 for completing the ActiGraph and questionnaires and US \$10 for the individual interview.

Follow-Up Assessment (T2). Six months after completing the first intervention session with their peer mentor, participants repeated the web-based questionnaires completed at T0 as well as a 6-month quantitative satisfaction questionnaire. Participants were again mailed an ActiGraph and asked to wear it for 7 days. The same wear and mail-back instructions and compliance protocol described above were used. After returning the ActiGraph, participants were asked to complete a 6-month qualitative interview. Participants received US \$20 for completing the ActiGraph and questionnaires and US \$10 for the individual interview.

Measures, Outcomes, and Analyses

Full text of all self-reported outcome measures, the T1 quantitative satisfaction questionnaire, and the T1 qualitative interview guide used in this dissertation study are provided in **Appendix 4** and described below. Qualitative interviews and satisfaction surveys that were administered at T2 are beyond the scope of this dissertation.

Aim 1: Feasibility and Acceptability

Aim 1 Measures & Outcomes

Recruitment and Retention. Recruitment and retention were reported using a Consolidated Standards of Reporting Trials (CONSORT) diagram. We tracked the number of women who contacted the study office via phone or email, referral source for each (e.g., social

media, community event, UC San Diego patient navigator), number of women phone screened, number of eligible participants, and number of participants enrolled in the study. We compared yield from different recruitment approaches. We also reported information on any adverse events.

Adherence. Adherence to the 12-week intervention utilized several metrics: completion of intervention sessions, wearing the Fitbit, and posting in the Fitbit Community. Adherent was defined as completing 2 out of 3 of the following activities: completing >75% of the six prescribed intervention sessions, wearing the Fitbit on >75% of days over the 12-week intervention, or posting in the Fitbit Community at least once per week for >75% of the intervention weeks. Intervention session attendance and completion was determined through review of the intervention session tracking database. Adherence to posting in the Fitbit Community was measured through objective review of participants' posts in the Fitbit Community. The date of each post was matched to the week in the intervention and the number of weeks a participant posted was summed.

Data from the Fitbit Charge 3 were used to calculate daily adherence to wearing the Fitbit throughout the intervention period and to support peer mentoring. Participants were encouraged to wear the Fitbit for as many hours per day as possible, and especially while exercising so their peer mentor could monitor their activity. Fitbit data were wirelessly uploaded to the user's personal Fitbit account and downloaded by our research team through Fitabase (Small Steps Labs), a web-based database program that collects physical activity and heart rate from the Fitbit cloud. Fitabase allowed each participant's Fitbit data to be batch downloaded at the 1-minute level. Fitbit uses a proprietary algorithm to classify each minute as sedentary, light, moderate, or vigorous activity. Non-wear time was determined based on the lack of heart rate or activity (steps or intensity) at any given minute.¹³⁰ Daily adherence to wearing the Fitbit was defined as ≥ 600 minutes (10 hours) of heart rate data or logging at

least some activity (≥ 1 minute of “Fairly Active Minutes” or “Very Active Minutes” (MVPA)).¹⁰³ This definition for a valid Fitbit wear day was selected because the intervention emphasized using the Fitbit specifically to self-monitor intentional exercise and to allow peer mentor to track participants’ active minutes. Therefore, wearing the Fitbit to log MVPA, even if it was not worn all day, was considered valid wear based on the intervention instructions. Additionally, the Fitbit tracker holds day-level activity data, from which active minutes are derived, longer than minute-level heart rate data. A wear time definition that included either >10 hours of heart rate or at least one minute of MVPA for a valid day was thought to minimize the amount of missing data in instances of poor syncing, when day-level activity data may have been retained even in the absence of minute-level heart rate data. Fitbit data were not used to measure changes in physical activity as participants could not be blinded to the data collected.

Mixed Methods Evaluation. A parallel mixed methods approach (QUAL + QUAN) was used to explore the feasibility, acceptability, and satisfaction of the Pink Body Spirit intervention from the participants’ perspectives. This design is illustrated in **Figure 6**. Qualitative and quantitative data were separately collected, analyzed, and reported. Complementarity of qualitative and quantitative findings were explored in the interpretation.¹³¹ A parallel mixed methods approach was selected because qualitative and quantitative data collection were equally important to the study aims. Quantitative satisfaction questionnaires were used to gain breadth of understanding and qualitative interviews added depth of understanding.¹³² Using two types of data enabled the examination of slightly different, but related aspects of the intervention experience and provided a more complete picture of the intervention from the perspectives of the participants compared to using only qualitative or quantitative methods. A parallel mixed methods approach was selected because each type of data had the potential to yield unique information about the intervention experience. Additionally, using mixed methods facilitated greater assurance about the validity of the

research questions and the amount of data collected to answer these questions. For example, the quantitative satisfaction survey assessed ways in which participants communicated with their peer mentor, and the interviews allowed for a deeper exploration of why participants liked or disliked certain methods of communication and what they liked most about working with a peer mentor. Another instance of how we sought to achieve complementarity was that through the survey, participants reported how often they read or scroll through posts in the Fitbit community; during the qualitative interviews, participants were afforded the opportunity to describe what they liked and disliked about the Fitbit community and provide rich context for quantitative responses. Other domains were explored using only one method; for example, participants described benefits of participation during the interviews, but this was not assessed in the quantitative satisfaction survey.

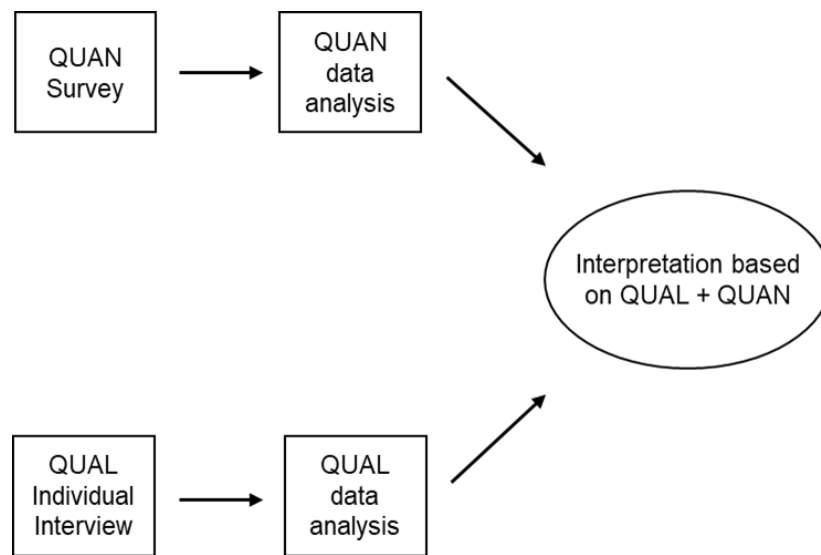


Figure 6. Parallel mixed methods design used to evaluate the Pink Body Spirit exercise intervention.

Post-intervention Qualitative Interviews. At T1 (3 months), individual interviews were conducted via Zoom video conferencing. Interviews were carried out between January and April 2020. A semi-structured approach was employed to keep the interview prioritized and

targeted, but also allow for the flexibility to use additional probes to clarify responses and add depth to participants' answers. Interview questions were posed in a flexible order. The wording of each question was adapted as needed to maximize each participant's understanding. Participants were notified that none of their individual responses would be shared with their peer mentor. The interview guide was piloted internally with the research team and with younger breast cancer survivors not involved in the study before it was used. The full interview guide is provided in **Appendix 4a**. The T1 interviews explored the following topics: overall perceptions of the intervention and specific components (e.g., peer mentors, Fitbit, toolbox), perceived benefits, the remote delivery format, and ways to improve the Pink Body Spirit program for other young breast cancer survivors. At the end of each interview, the interviewer summarized key points and conducted a member checking exercise with the participant to verify whether the key point summaries accurately reflected the participant's perspective. This step also provided participants an opportunity to clarify any points the interviewer may have misunderstood.

At the onset of the COVID-19 pandemic, we determined the interview would be more inclusive and encompassing to address the potential impact of COVID-19. Therefore, for participants who completed the T1 interview after March 12, 2020, the interview guide was expanded to include questions that allowed for exploring experiences during the COVID-19 pandemic, including barriers and facilitators to study participation and progress toward exercise goals. Each interview lasted approximately 30-45 minutes. Interviews were video recorded through Zoom and uploaded to an encrypted server to ensure privacy and confidentiality. For consistency, the project manager conducted all individual interviews with participants. Immediately following each interview, the project manager recorded a field note in the electronic study database. The field note described major ideas discussed for each section of the interview guide and a summary of key points reviewed with the participant at the end of

the interview. All interviews with transcribed verbatim by research staff using InqScribe transcription software (Inquirium, LLC). The project manager reviewed and finalized all transcripts.

Quantitative Satisfaction Questionnaire (Postintervention and Follow-up). Satisfaction questionnaires were adapted from a survey used to evaluate the previous intervention in older breast cancer survivors upon which the Pink Body Spirit program is based.^{32,103} Topics included overall satisfaction with the program, the extent to which the program provided motivation to start and continue exercising, and the likelihood of recommending the program to other younger survivors. A series of items using Likert-scale response options assessed self-reported frequency of use, satisfaction with, and helpfulness of intervention components. Participants were asked to rate different features of the Fitbit tracker, the Fitbit app, and the Fitbit Community. There was a *did not know how to use* option for each feature assessed. Participants were also asked to rate their satisfaction with the number and content of peer mentoring sessions and contacts from their mentor between scheduled sessions. Open-ended questions asked participants to describe their favorite and least favorite aspects of the program and provide suggestions for improvement. The full T1 satisfaction survey is provided in **Appendix 4b**.

Feasibility of Intervention and Acceptability of Intervention. To assess general attitudes toward Pink Body Spirit, at T2, we used two validated, Likert-type implementation science outcome measures of feasibility and acceptability, the Feasibility of Intervention Measure (FIM) and Acceptability of Intervention Measures (AIM).¹³³ Each measure consists of four items; item values range from 1 (Completely Disagree) to 5 (Completely Agree). The measure score is the average of the four item scores. Higher scores indicate greater feasibility (FIM) and acceptability (AIM). Cut-off scores and norms for interpretation have not yet been established. In the present study, the FIM and AIM measures showed high internal consistency

(Cronbach's $\alpha = 0.91$ and 0.89 , respectively). Questionnaires were piloted internally with the research and peer mentor teams before use. The FIM and AIM measures used in this study are provided in **Appendix 4b**.

Aim 1 Analyses

Adherence. Descriptive statistics and frequency counts (mean [SD] and n [%] where applicable) were used to explore how adherence varied between the three adherence measures (completion of intervention sessions, wearing the Fitbit, and posting in the Fitbit Community). Adherent was defined as completing 2 out of 3 of the following activities: completing >75% of the sessions, wearing the Fitbit on >75% of the days, or posting in the Fitbit Community at least once per week for >75% of the weeks.

Post-intervention qualitative interviews. Twenty-nine of 31 women retained at T1 measures completed the T1 qualitative interview. This represents 93.5% of those who completed the T1 quantitative measures. Two participants who completed the T1 quantitative measures could not be reached to schedule the T1 interview. During the intervention, two participants stopped responding to contacts from their peer mentors (i.e., lost to follow-up) and one participant was withdrawn by the study team. We attempted to reach the two participants who were lost to follow-up during the intervention to complete T1 measures, including the qualitative interview, but were not successful.

Rapid qualitative analysis techniques, including matrix displays,¹³⁴ were used to analyze individual semi-structured interviews conducted at T1. Rapid analysis in qualitative research has been defined as "intensive, team-based, qualitative inquiry using triangulation, iterative data analysis, and additional data collection to quickly develop a *preliminary understanding* of a situation from the insider's perspective."¹³⁵ Although traditional, in-depth qualitative analyses may be more constructivist, exploratory, and inductive, rapid analysis takes a *more* positivist that is more deductive in nature.¹³⁶ The project timeline was relatively

condensed, so a rapid approach, whereby qualitative analyses were conducted over the course of the intervention, was more feasible than conducting all qualitative analyses after data collection had ended. Additionally, using rapid analysis techniques allowed us to feed data from participants back into the ongoing study to improve it (e.g., peer mentor performance, toolbox suggestions, barriers and facilitators that could be feasibly addressed to improve the intervention for other participants).

Interview transcripts were analyzed using a multistep procedure, described below, adapted from Dr. Alison Hamilton's rapid qualitative analysis approach.¹³⁶ A team-based approach was used to maximize dependability and trustworthiness of the analyses and preliminary findings; members of the team were willing and able to challenge each other's beliefs and ideas about the data.¹³⁷ The use of matrix analysis techniques added reliability to assumptions about main themes across the sample. Matrix techniques also enabled assessment of the quality and consistency of data collection.¹³⁴

1. To begin, a neutral domain name was selected that corresponded with each section of the semi-structured interview guide. The domain names were working with a peer mentor; remote, technology-based intervention delivery format; Fitbit tracker and app; Fitbit community; perceived benefits of participation; and perspectives on maintaining exercise behavior change during the 12-week post-intervention follow-up period.
2. An Excel matrix organized as participant (rows) by interview domain (columns) (participant x domain) was created. Key points from the project manager's post-interview field notes were verified against the transcripts, and line numbers of key points in the transcripts were noted. The project manager then transferred verified key points for each domain into the participant x domain matrix, which provided a way to view key similarities and differences for each domain across participants.

3. Key points for each domain were validated with subject matter expert and co-PI SJH. The key point validation process was designed to enhance the consistency and validity of interpretations of data. Interviews were split into three cohorts in chronological order of when they were conducted (the first 5 interviews, the next 10 interviews, and the final 14 interviews) and three separate key point validation sessions, one session for each cohort, were conducted. The first session consisted of the smallest sample of interviews ($n = 5$) to allow the validation team to explore key points in more detail. The cohort sizes were enlarged for the second and third validation sessions to broaden the possible range of responses available during the validation process. Key point validation sessions aimed to build team consensus around key points that had been identified by the project manager and offered the opportunity to enhance or elaborate on interpretations of key points. If any points needed clarification, line numbers of key points in transcripts were referenced and key point statements were revised, as necessary. During each session, the focus was on validating key points from the new interviews that had been added to the matrix since the last key point validation session.
4. After each key point validation session, the project manager created a list of main themes for each domain. Once all three key point validation sessions had occurred and key points across all interviews were validated, lists of themes from each validation session were triangulated and descriptive summaries were developed to describe main themes for each domain.

Post-intervention Quantitative Satisfaction Questionnaires. Descriptive statistics were used to analyze close-ended satisfaction questionnaire responses. Responses were reported as percentages (frequency counts) or as mean (SD) as applicable. All responses to open-ended questions were reviewed by the project manager, who subsequently identified themes reflecting participants' descriptions of their experience with and suggestions for improving the

intervention. Themes were presented to co-PI SJH, who reviewed and revised themes as necessary. Once team consensus was reached and themes were validated, results from open- and close-ended questions were synthesized and summarized narratively by category of feedback (working with a peer mentor, Fitbit, Fitbit Community, overall impressions, other suggestions for improvement).

Mixed Methods Interpretation. The qualitative interviews and quantitative surveys exploring feasibility, acceptability, and satisfaction were analyzed and results were reported separately. The two sets of results (QUAL + QUAN) were triangulated by area of feedback (e.g., feedback on working with peer mentor, Fitbit & Fitbit Community, perceived benefits) to examine ways in which each set of data corroborated and strengthened ideas in the other set and to explore complementarity of the findings. The QUAL + QUAN results are synthesized in the discussion of this dissertation.

Results interpretation with community partner. Co-PI SN and the peer mentors contributed to interpretation of the findings related to feasibility and acceptability of the pilot intervention and changes in physical activity and quality of life. The project manager led a structured results presentation and discussion with the peer mentors to elicit their reactions to and interpretations of the findings. Co-PI SJH supported the project manager in facilitating this meeting and recorded detailed notes. The meeting was held via Zoom and video recorded. Insights gleaned from this meeting were triangulated with findings from the peer mentor adaptations and process evaluation. Interpretations are presented in the Discussion section of this dissertation.

Aim 2: Changes in Physical Activity and Quality of Life

Aim 2 Measures & Outcomes

Aim 2 measures are described below and summarized in **Table 2**. See **Appendix 4c** for full text of all self-reported measures.

Physical activity

Objectively measured MVPA. The ActiGraph GT3X+ (ActiGraph, LLC) was used to measure changes in minutes of MVPA from T0 to T1 and T1 to T2. For seven days around each measurement time point, participants wore the ActiGraph GT3X+, a research grade, hip-worn accelerometer that measures movement and intensity of activity and that has been validated against heart rate telemetry and total energy expenditure.^{138,139} Physical activity data were not shown to the wearer. The GT3X+ provided second-by-second estimates of activity that were categorized into daily minutes spent in sedentary, light, moderate, vigorous, and very vigorous activity using calibration thresholds using Freedson cut-points.¹⁴⁰ Sufficient wear time was defined as five days with ≥ 600 minutes of wear time or 3000 minutes (50 hours) across four days. Minutes of MVPA per day were calculated by summing average moderate, vigorous, and very vigorous minutes for each valid day. Average minutes of MVPA per week was calculated by summing the minutes of MVPA per day for each valid day in the wear period, dividing by the number of valid wear days, and then multiplying by 7 to yield a standard metric of weekly MVPA.³² On average, participants wore the ActiGraph for 6.83 days/week (SD = 0.79) at T0, 7.0 days/week (SD = 0.87) at T1, and 6.77 days/week (SD = 0.94) at T2.

Self-reported activity. While the ActiGraph accelerometer is a rigorous measure of objective physical activity in cancer survivors,¹⁴¹ it is not well suited to measure the range of diverse physical activities that participants may have chosen to engage in, such as strength training and stretching & flexibility exercises.¹⁴² Therefore, strength training and stretching & flexibility exercises were measured using two items adapted from the Exercise Vital Sign.^{143,144} Participants self-reported the number of days per week that they do two types of activities: (1) muscle strengthening exercises (e.g., weight lifting, bodyweight exercises (push-ups, sit-ups), or resistance training; hereafter referred to as “strength training”) and (2) stretching and flexibility exercises (e.g., yoga).

Quality of Life

Body image was measured using the Body Image Scale (BIS), a 10-item scale developed for cancer survivors that measures perceptions of body disturbance related to cancer and its treatment.¹⁴⁵ Each item is rated on a 4-point Likert scale ranging from 0 (not at all) to 3 (very much). Total scores are calculated by summing the 10 items. Total scores range from 0 to 30, with higher scores indicating poorer body image. The BIS has shown high reliability, good clinical validity, and sensitivity to changes in psychosocial and physical activity interventions in older breast cancer survivors.^{146,147} Total scores ≥ 10 have been considered indicative of body image distress,¹⁴⁸ but minimal clinically importance differences over time have not yet been established.¹⁴⁶ The BIS showed high internal consistency in the current study (Cronbach's $\alpha = 0.93$ at T0, 0.93 at T1, and 0.92 at T2).

Sexual function was assessed using the Female Sexual Function Index (FSFI). The FSFI comprises 19 items assessing 6 domains of sexual functioning over the past 4 weeks: desire (2 items), arousal (4 items), lubrication (4 items), orgasm (3 items), satisfaction (3 items), and pain (3 items).¹⁴⁹ Total scores, which reflect overall sexual function, range from 2 to 36. Higher scores indicate fewer problems with sexual functioning. A total score of ≤ 26 has been validated as a cutoff score for clinically relevant sexual dysfunction.¹⁵⁰ The FSFI has been shown to be highly acceptable to breast cancer survivors and has been responsive to change in exercise intervention trials.^{151,152} The measure has shown good internal consistency (Cronbach's $\alpha = 0.83 - 0.96$); test-retest reliability ($r = 0.74 - 0.86$); and convergent, divergent, and discriminant validity among sexually active breast cancer survivor samples.¹⁵³

At baseline (T0), 22 women in the present study reported being sexually active and 12 women (35.3%) reported no recent sexual activity. There are documented problems scoring the FSFI in sexually inactive women.¹⁵⁴ Fifteen of the 19 FSFI items have a 0 value for "no sexual activity" or "did not attempt intercourse." Zero scoring biases sexually inactive women

toward having scores indicating sexual dysfunction and does not account for the many reasons other than sexual dysfunction that might explain why a participant reports no sexual activity or intercourse.^{155,156} To overcome potential biases and limitations of zero scoring in women who are not sexually active, previous studies in sexually inactive and sexual minority women have utilized alternative strategies to reporting and interpreting FSFI scores.¹⁵⁶ One approach is to report scores on the Desire subscale.¹⁵⁴ The Desire subscale consists of two items (Items 1 and 2) measuring sexual desire that do not utilize zero scoring, recognizing that desire can be present even in the absence of any sexual activity.¹⁵⁵ Item 1 on the Desire subscale is as follows: “Over the past 4 weeks, how often did you feel sexual desire or interest?” with response options ranging from 5 (Almost always or always) to 1 (Almost never or never). Item 2 on the Desire subscale is: “Over the past 4 weeks, how would you rate your level (degree) of sexual desire or interest?” with response options ranging from 5 (very high) to 1 (very low or none at all).

The present study examined scores on both total FSFI and the FSFI Desire subscale among all participants. Both the FSFI and the FSFI Desire subscale showed high internal consistency in the study sample (FSFI: Cronbach’s $\alpha = 0.98$ at T0, T1, and T2; FSFI Desire subscale: Cronbach’s $\alpha = 0.96$ at T0, 0.95 at T1, and 0.95 at T2). In an exploratory sub-analysis of total FSFI score that was limited to women who reported sexual activity at baseline ($n=22$), the FSFI showed high internal consistency: Cronbach’s $\alpha = 0.94$ at T0, 0.96 at T1, and 0.97 at T2.

PROMIS Measures. Fatigue, anxiety, and depression were assessed through the Patient-Reported Outcomes Measurement Information System (PROMIS) Cancer v1.0 measures for each construct.^{157,158} Emotional support was measured through the PROMIS v2.0 measure.¹⁵⁹ The Computer adaptive testing forms were used; for each measure, participants only completed 4-10 items out of the entire question bank. Each PROMIS

measure yields a standardized t-score with a mean of 50 and a standard deviation of 10. Higher scores indicate higher levels of the construct being measured. The fatigue, anxiety, and depression instruments have shown responsiveness to change over time in prospective¹⁶⁰ and intervention¹⁶¹ studies in cancer survivors. Sample items are provided below.

Fatigue. Respondents indicated how they felt various symptoms over the past 7 days, with Likert response options ranging from 1 (never) to 5 (always). Sample items with these response options include: “How often did you feel tired even when you hadn’t done anything?” and “How often did you have trouble finishing things because of your fatigue? Other items ask respondents to answer the extent to which they perceived a symptom or over the past 7 days, with Likert scale options ranging from 1 (not at all) to 5 (very much). Sample items with these response options include: “To what extent did your fatigue make you feel slowed down in your thinking?” and “How easily did you find yourself getting tired on average?” Participants are also asked to report their level of fatigue on most days over the past 7 days, with Likert response options ranging from 1 (none) to 5 (very).

Anxiety. Respondents indicated how often they felt various symptoms over the past 7 days, with Likert response options ranging from 1 (never) to 5 (always). Sample items include: “I felt uneasy” and “My worries overwhelmed me.”

Depression. Respondents indicated how often they felt various symptoms over the past 7 days, with Likert response options ranging from 1 (never) to 5 (always). Sample items include: “I felt sad” and “I felt hopeless.”

Emotional support. Respondents indicated often they experienced various feelings or situations over the past 7 days. Likert-scale response options range from 1 (never) to 5 (always). Sample items include: “I have someone who understands my problems” and “I have someone who will listen to me when I need to talk.” Minimally important differences for this measure have not been established.

Table 2. Physical activity and quality of life outcomes and measures

<u>Outcome</u>	<u>Measure</u>
<u>Physical activity</u>	
MVPA	ActiGraph GT3X+ accelerometer (min/week)
Strength training	Self-report (days/week) ^a
Stretching & flexibility	Self-report (days/week) ^a
<u>Quality of life</u>	
Body Image	Body Image Scale (BIS) ^b
Sexual Function	Female Sexual Function Index ^c
Fatigue	PROMIS Cancer Fatigue v1.0 ^d
Anxiety	PROMIS Cancer Anxiety v1.0 ^d
Depression	PROMIS Cancer Depression v1.0 ^d
Emotional Support	PROMIS Emotional Support v2.0 ^d

Note. MVPA = Moderate to Vigorous Physical Activity; ^a Measures of self-reported strength training and stretching & flexibility were adapted from the Exercise Vital Sign; ^b Scores range from 0-30, score ≥ 10 is considered distressed body image; ^c Scores range from 2-36, score ≤ 26 is considered clinically relevant sexual dysfunction; ^d PROMIS measures yield a standardized t-score with mean = 50 and SD = 10.

Aim 2 Analyses

Data were analyzed using RStudio (Version 1.3.71073).¹⁶² Descriptive statistics and frequency counts (mean [SD] and n [%] where applicable) were calculated for each outcome of interest in **Table 2** at T0, T1, and T2. Normality of data distribution for each outcome at each time point was assessed using standardized tests of skewness and kurtosis and through visual inspection (histograms and Q-Q plots). For self-reported outcomes, values that were greater than ± 2.58 SDs from the mean (greater than the 99th percentile or less than the 1st percentile) were considered outliers and were excluded from all analyses.¹⁶³ Internal consistency reliability of self-reported body image and sexual function measures were calculated at each time point using Cronbach's alpha. Reliability was not calculated for CAT-administered PROMIS measures (fatigue, anxiety, depression, and emotional support).

Separate one-way repeated measures ANOVAs assessed change in each outcome of interest over time. If Mauchly's test of sphericity indicated a severe violation, a Greenhouse-Geisser correction was applied, and degrees of freedom were adjusted. An alpha level of 0.05

was used for statistical significance. For significant ANOVAs, Tukey post hoc tests were used to determine differences between time points. Eta-squared effect sizes were also calculated. Correlations between key outcome variables and potential covariates (BMI, age, and time since diagnosis) were explored. All variables were weakly correlated ($r = 0.01$ to $r = 0.36$). Therefore, none of the potential covariates were included in the analyses.

To overcome limitations of scoring the FSFI in sexually inactive women (previously described in the Measures & Outcomes section), two additional analyses explored changes in sexual functioning over time. A sub-analysis explored changes in total FSFI score among women who were sexually active at baseline ($n=22$ or 64.7% of the study sample). Another exploratory analysis assessed changes in the two-item FSFI Desire subscale across the entire sample (including both sexually active and inactive women). The two items comprising the FSFI Desire subscale do not contain zero ratings and this subscale has been used to assess sexual dysfunction in women who are not sexually active.¹⁵⁴

An additional exploratory analysis examined associations between change in physical activity (objectively measured MVPA, self-reported strength training, and self-reported stretching & flexibility exercises) and change in quality of life outcome variables for which the one-way repeated measures ANOVA showed a significant main effect for time (body image, fatigue, anxiety, and emotional support). For each physical activity and quality of life outcome variable, differences in scores between time points (i.e., change scores; T0 to T1, T1 to T2, and T0 to T2) were calculated. Relationships between change scores were analyzed using Pearson correlations. There were moderate correlations between change in self-reported strength training and change in fatigue ($r = -0.44$) and anxiety ($r = -0.59$) from T0 to T1. Therefore, separate linear regression models examined the association between change in strength training and change in anxiety and fatigue from T0 to T1. In the linear regression models, change in self-reported strength training was entered as the independent variable and

change in quality of life (anxiety or fatigue) was entered as the dependent variable. Parameter estimates are interpreted as the amount of change in the quality of life measure (anxiety or fatigue) associated with a 1-unit (1-day per week) change in strength training. For each model, R^2 represents the proportion of the variance in change in quality of life score that can be explained by change in self-reported strength training.

Missing data. An intention to treat analysis approach was used to avoid overestimation of the impact of the intervention on physical activity and quality of life. Intention to treat analysis reduces the likelihood of Type I error by including all enrolled participants in analyses, even if they did not receive the full intervention or complete follow-up assessments at one or more time points.¹⁶⁴ This study used the “last observation carried forward” approach. For missing data at T1 or T2, the value from the last completed assessment was carried forward or imputed. For instances where data were incomplete (i.e., one or more survey items were missing from a scale), the mean of the other items in the scale (or subscale) was imputed.

Exploratory Aim: Multimethod Process Evaluation of Peer Mentor Adaptations and Intervention Delivery

Exploratory Aim Measures & Outcomes

A pragmatic, multimethod approach was used to explore adaptations made to the program and how it was delivered, describe and understand barriers and facilitators to intervention delivery, provide contextual process data about intervention delivery to aid in interpretation of intervention outcomes, and identify how the intervention and its delivery could be refined for future studies. Data sources for this evaluation included field notes peer mentors completed after each mentoring session; structured review of video-recorded peer mentoring sessions; and templated reflections by the project manager. Data collection occurred during and after intervention delivery and data from all sources was used iteratively to improve intervention delivery by peer mentors.

Peer Mentor Session Field Notes. After each mentoring session, peer mentors completed a templated field note documenting their perceived confidence and preparedness in the electronic study database. Field note templates were developed in partnership with a peer mentor and were pilot tested and refined with the other peer mentors during mock training sessions. Questions asked peer mentors to assess the extent to which they used motivational interviewing skills during the mentoring session; the helpfulness of the motivational interviewing training in preparing them for the session; their confidence during the session; and general notes and reflections about the session, including any explicit adaptations made. A slider/visual analog scale was used for several of these questions to capture a broader range of responses than would a Likert scale. The electronic field note template is presented in **Appendix 4d**.

Video Review of Peer Mentor Sessions. Zoom peer mentoring sessions were recorded by peer mentors and uploaded to an encrypted server to ensure privacy and confidentiality. A random 50% of initial goal-setting sessions and a random 20% sample of the follow-up sessions were reviewed by the project manager to support peer mentor supervision and safety and appropriateness of exercise goals set. A checklist was used to guide the exploration of adaptations from the protocol, barriers and facilitators to intervention delivery, and other aspects of the intervention process. The checklist used to systematically review video sessions is provided in **Appendix 4d**.

Templated Reflections by the Project Manager. The project manager composed monthly reflections to document adaptations and process outcomes.¹⁶⁵ Templated reflections were based on discussions and interactions with multiple stakeholders (peer mentors, research team, and any informal feedback from participants). The periodic templated reflections were intended to help document key activities, events, and changes as they

occurred over the course of the study. The periodic reflection template is provided in

Appendix 4d.

Exploratory Aim Analyses: Multimethod Process Evaluation of Peer Mentor Adaptations and Intervention Delivery

The multimethod evaluation focused on exploring and understanding the process of intervention delivery and adaptations. The analysis steps for each method are described below. To support triangulation across methods, within each unique data set, references to adaptations were identified and key adaptations were classified using constructs adapted from the Wilstey Stirman FRAME: Framework for Reporting Adaptations and Modifications-Expanded.^{166,167} See **Table 3** for a template of how key adaptations were described. Barriers and facilitators to intervention delivery were also identified from each method/data source as described below. Results from the three unique sources of process data (peer mentor field notes; systematic reviews of intervention session videos; and periodic templated reflections) were triangulated and adaptations, barriers, and facilitators across data sources were summarized. Of note, the dates of the peer mentor adaptations are estimates based on the available data. While peer mentors were asked to record a field note after each mentoring session, other intervention-related activities they performed were not necessarily documented.

Electronic peer mentor field notes, composed by peer mentors after their mentoring sessions, were downloaded from the REDCap database and reviewed by the project manager to identify adaptations, barriers, and facilitators to intervention delivery. She recorded memos throughout her review and prepared a separate summary of field notes for each of the five peer mentors. The five separate summaries were then synthesized into a collective narrative summary. Adaptations were categorized using the process outlined above. The project manager followed up with peer mentors directly if any of the field notes required further clarification. Specifically, for this evaluation, 160 peer mentor field notes were reviewed. These

data included 34 field notes completed by peer mentors after Week 1 sessions and 126 field notes completed by peer mentors after a follow-up session (Week 3, 5, 7, 9, or 11).

Video recordings of peer mentoring sessions were reviewed by the project manager using a template checklist of predetermined variables. Data from each category of the template (adaptations, barriers to intervention delivery, and facilitators to intervention delivery; see **Appendix 4d**) were transferred to a matrix to visualize and identify key ideas and themes for each category (adaptations, barriers to intervention delivery, and facilitators to intervention delivery) across data episodes.¹³⁴ Adaptations were characterized using the process outlined above. Key findings from video recordings were synthesized in a narrative summary. For this evaluation, 54 video recorded peer mentoring sessions were reviewed, including 19 initial (Week 1) video sessions and 35 follow-up video sessions (Week 3, 5, 7, 9 or 11).

Periodic reflections by the project manager were first coded for broad concepts corresponding to topics on the template (barriers/concerns and solutions, adaptations to the intervention or its delivery, stakeholder engagement, changes in environment/context, planning, and lessons learned; see template in **Appendix 4d**). As coding proceeded, emergent themes were also identified. Adaptations were categorized using the process above and key adaptations were synthesized in a narrative summary. For this evaluation, 13 periodic reflections were reviewed. Twelve of the 13 periodic reflections were completed by the project manager over the 12-month period between September 2019 (when recruitment started) and August 2020 (when the final participant completed all measures). An additional reflection was completed by the project manager in December 2020 after preliminary results from Aims 1 and 2 were shared with the peer mentor team as part of the interpretation process.

Table 3. Adaptation coding template

What was the adaptation?	
Who made the adaptation?	
How was the adaptation made?	
When was the adaptation made?	
Why was the adaptation made?	
Process data source(s) used to capture adaptation	

Note. Coding schema was adapted from the Wilstey Stirman FRAME: Framework for Reporting Adaptations and Modifications-Expanded.¹⁶⁶

RESULTS

Aim 1 Results: Feasibility and Acceptability

Recruitment and Retention

Recruitment occurred over three months from September 2019 to December 2019. A total of 107 women contacted the office and 63 women (59%) scheduled a phone screening and were screened for eligibility. Of the 63 women screened, 43 (68%) were eligible. Reasons for ineligibility included treatment end date within the past 6 months (n=13), too active (n=7), and peripheral neuropathy that impacted ability to exercise safely (n=2). Of the 43 eligible women, nine did not continue for the following reasons: did not sign consent form (n=2), did not begin baseline measures (n=5) or referred to another study (n=2). Of the 43 eligible women, 34 were enrolled in the trial (defined as completing baseline measures, being matched with a peer mentor, and completing at least one intervention session). The number of participants who were enrolled (34) represents 54% of women who were screened for eligibility and 79% of those who were eligible. Participants were enrolled in the active 3-month intervention from October 2019 – April 2020 and in the 3-month follow-up period from Jan 2020 – July 2020. Two participants were lost to follow-up during the intervention (after completing at least one mentoring session) and one participant was withdrawn by the study team after one mentoring session due to unplanned pregnancy (rendering her no longer eligible to continue in the study). Around the time they were due for T1 and T2 participants, we attempted to contact the two participants who were lost to follow-up to request that they complete the measures. However, these participants were not responsive. Thirty-one participants were retained for T1 and T2 measurements, respectively, resulting in a 91% retention rate (CONSORT diagram, **Figure 7**).

Figure 8 shows an overview of the strategies used in to recruit participants in this nationwide study in partnership with Haus of Volta. Of the 63 women who contacted the study

office and were telephone screened for eligibility, the largest proportion were referred from social media (47/63, 75%) (**Figure 8**). Among the 34 women who enrolled in the trial, social media resulted in the enrollment of 26 (76%) study participants, followed by support group referral (4/34, 12%), referral from another participant (3/34, 9%), and UC San Diego Moores Cancer Center Patient Navigator referral (1/34, 3%) (**Figure 9**).

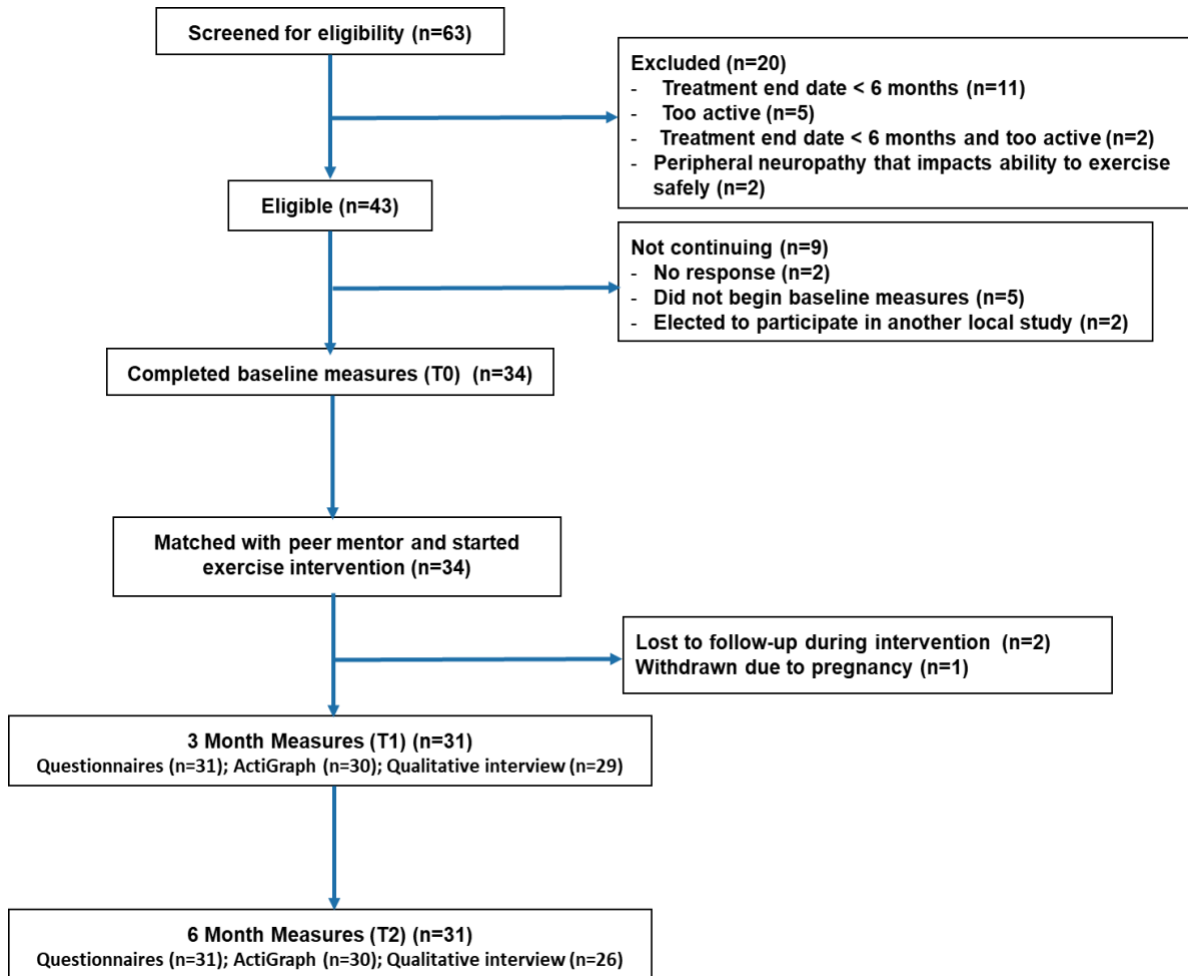


Figure 7. CONSORT diagram showing participant recruitment and retention throughout the trial

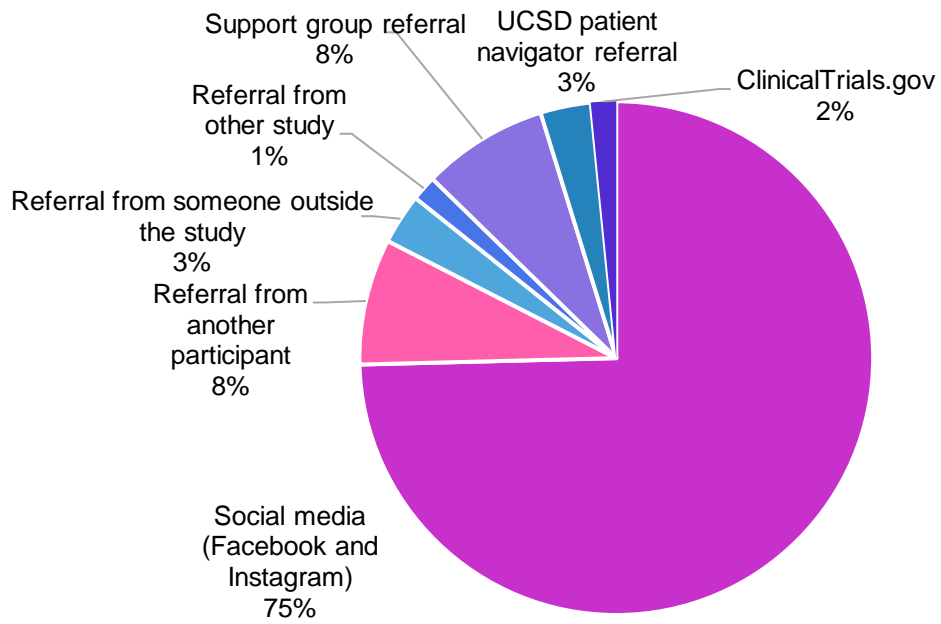


Figure 8. Referral sources for women telephone screened for eligibility (N=63)

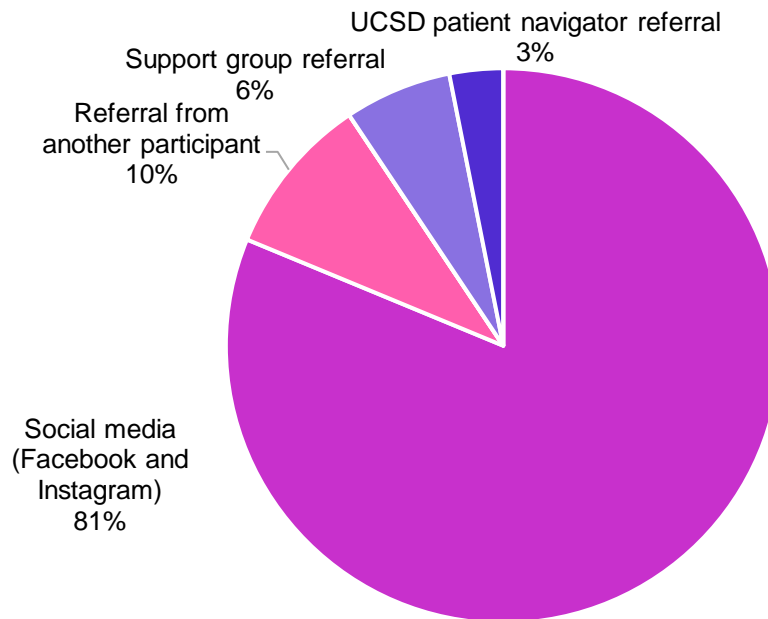


Figure 9. Referral sources for women enrolled in the trial (N=34)

Baseline demographics and self-reported cancer characteristics of the participants are shown in **Tables 4 and 5**. Women in the study were, on average, 43.1 ± 5.5 years old, predominantly white (30/34, 88%), non-Hispanic (29/34, 85%), with an average BMI of 30.2 ± 7.4 kg/m². Participants were an average of 46 ± 34.4 months post-diagnosis. All participants were treated with breast cancer surgery; 9/34 (27%) underwent lumpectomy, 5/34 (15%) underwent one-sided mastectomy, and 20/34 (59%) underwent bilateral mastectomy. Over half (18/34; 52.9%) were treated with radiation and 24/34 (70.6%) were treated with chemotherapy. At baseline, half (50%) of participants reported currently taking hormonal therapy (e.g., Tamoxifen) and 7/34 (21%) were currently experiencing lymphedema. Eight of 34 (24%) reported Stage I disease, 15/34 (44%) reported Stage II disease, 10/34 (29%) reported Stage III disease, and 1/34 (3%) reported Stage IV disease. Participants resided in 15 different states across four time zones (Pacific, Mountain, Central, and Eastern). The greatest number of women were recruited from California (13/34; 38.2%) followed by Texas (5/34; 14.7%). Overall, 15/34 (44.1%) lived in the Pacific time zone, 3/34 (8.8%) lived in the Mountain time zone, 5/34 (14.7%) lived in the Central time zone, and 11/34 (32.4%) lived in Eastern time zone.

At baseline, on average, participants were engaging in 90.2 ± 49.9 minutes of accelerometer-measured MVPA per week, 5/34 participants (14.7%) self-reported strength training exercises on at least one day per week, and 7/34 participants (20.6%) self-reported stretching or flexibility exercises on at least one day per week. At baseline, the mean body image scale (BIS) score was 17.2 ± 8.4 (range = 1-29). Scores on the BIS can range from 0 to 30; total scores ≥ 10 have been considered indicative of body image distress.¹⁴⁸ The mean sexual function (FSFI) score was 14.8 ± 10.7 (range = 2.0-33.2). Scores on the FSFI can range from 2 to 36; a total score of ≤ 26 has been validated as a cutoff score for clinically relevant sexual dysfunction.¹⁵⁰ PROMIS fatigue, anxiety, depression, and emotional support

measures yield a standardized t-score with a population mean of 50 and standard deviation of 10. Mean PROMIS scores at baseline were as follows: anxiety (60.7 ± 7.6 , range = 38.9-70.5), depression (54.0 ± 9.0 , range = 32.6-67.6), and emotional support (46.5 ± 8.2 , range = 28.6-66.2).

Table 4. Baseline demographics of the study sample

<u>Characteristic</u>	<u>Value</u>
Age, years, mean (SD), range	43.1 (5.5), 33.6 - 51.8
Body Mass Index (kg/m ²), mean (SD), range	30.2 (7.4), 21.0 - 45.0
<u>Race^a, n (%)</u>	
White	30 (88.2)
Black or African American	4 (11.8)
American Indian or Alaska Native	1 (2.9)
<u>Ethnicity, n (%)</u>	
Hispanic	5 (14.7)
Non-Hispanic	29 (85.3)
<u>Education, n (%)</u>	
High school or GED	2 (5.9)
Some college or Associate's degree	13 (38.2)
College or Graduate degree	19 (55.9)
<u>Marital status, n (%)</u>	
Never Married	5 (14.7)
Divorced or separated	4 (11.8)
Presently married or living with partner	25 (73.5)
<u>Living situation, n (%)</u>	
Live alone	2 (5.9)
Live with spouse or partner	4 (11.8)
Live with spouse or partner and children	20 (58.8)
Live with children (no spouse or partner)	4 (11.8)
Live with parents or other relatives	4 (11.8)
<u>Employment^b, n (%)</u>	
Employed full-time	21 (61.8)
Employed part-time	5 (14.7)
Homemaker, raising children, caring for others	7 (20.6)
Student	2 (5.9)
Volunteer	2 (5.9)
Not working	3 (8.8)

Note. N=34; SD = Standard Deviation; ^a Total exceeds 100% because participants could self-identify as multiple races; ^b Total exceeds 100% because participants could self-report more than one type of employment

Table 5. Baseline Self-Reported cancer characteristics of the study sample

<u>Characteristic</u>	<u>Value</u>
Time since diagnosis (months), mean (SD), range	46.0 (34.4); 9 - 160
<u>Disease stage, n (%)</u>	
Stage I	8 (23.5)
Stage II	15 (44.1)
Stage III	10 (29.4)
Stage IV	1 (2.9)
<u>Breast cancer surgery, n (%)</u>	
Lumpectomy	9 (26.5)
One-sided mastectomy	5 (14.7)
Bilateral mastectomy	20 (58.8)
Chemotherapy, n (%)	24 (70.6)
Radiation, n (%)	18 (52.9)
<u>Hormonal therapy, n (%)</u>	25 (73.5)
Currently taking hormonal therapy	17 (68.0)
Not currently taking, currently prescribed	4 (16.0)
Not currently taking, completed	4 (16.0)
<u>HER2+ infusions (e.g., Herceptin), n (%)</u>	9 (26.5)
Currently receiving infusions	1 (2.9)
Not currently receiving infusions	8 (23.5)
<u>Lymphedema</u>	
Ever diagnosed with lymphedema	13 (38.2)
Currently experiencing lymphedema	7 (20.6)
Hysterectomy	6 (17.6)
Oophorectomy	11 (32.4)

Note. N = 34; SD = Standard Deviation: HER2+ = human epidermal growth factor receptor 2

Adverse Events

During the study, five participants reported a total of seven adverse events. Of note, one participant reported three separate adverse events during the intervention. Details are provided in **Table A2, Appendix 3**. All adverse events were reviewed and classified by Dr. Su, the study physician. Five adverse events were classified as “mild” and two were classified as “moderate” in severity. Five adverse events were classified as “possibly related” to the study and two events were classified as “definitely related” to the study. The two events classified as “definitely related” were injuries sustained while engaging in intentional exercise prescribed by the intervention (cross country skiing and hiking), and both injuries resolved on their own without medical treatment. No adverse events were classified as serious.

Adherence

Adherence utilized several metrics: wearing the Fitbit, completion of intervention sessions, and posting in the Fitbit Community. Adherent was defined as completing 2 out of 3 of the following activities: wearing the Fitbit on >75% of the days, completing >75% of the sessions, or posting in the Fitbit Community at least once per week for >75% of the weeks.

Fitbit. Adherence to wearing the Fitbit tracker ranged from 46% of intervention days (39/84) to 100% of days (84/84) with a mean of 90% of days (75/84, SD = 39). Across participants, Fitbit wear peaked at week 3 and was generally maintained over the 12 week intervention period. Across the sample, the mean number of valid days the tracker was worn during Week 1 (6.5) was very similar at Week 12 (6.6). Twenty-nine of 34 women (85.3%) wore the Fitbit on at least 75% of intervention days. Over the 12 week follow-up period (weeks 13-24), on average, participants wore the Fitbit on 85% of days (71/84, SD 14.6), with a range of 26 to 84 days. Across all participants, the mean number of valid days the Fitbit was worn at week 23 (5.7) was about one day per week less than the mean number of valid days the tracker was worn during week 12 (6.6 days). (**Figure 10**)

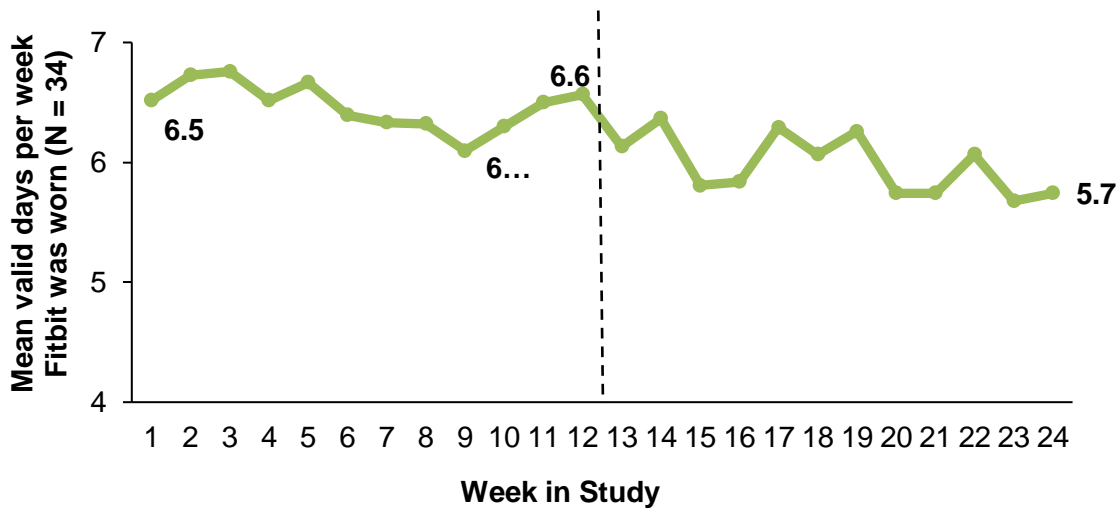


Figure 10. Mean number of valid days the Fitbit was worn during each week of the study across all participants

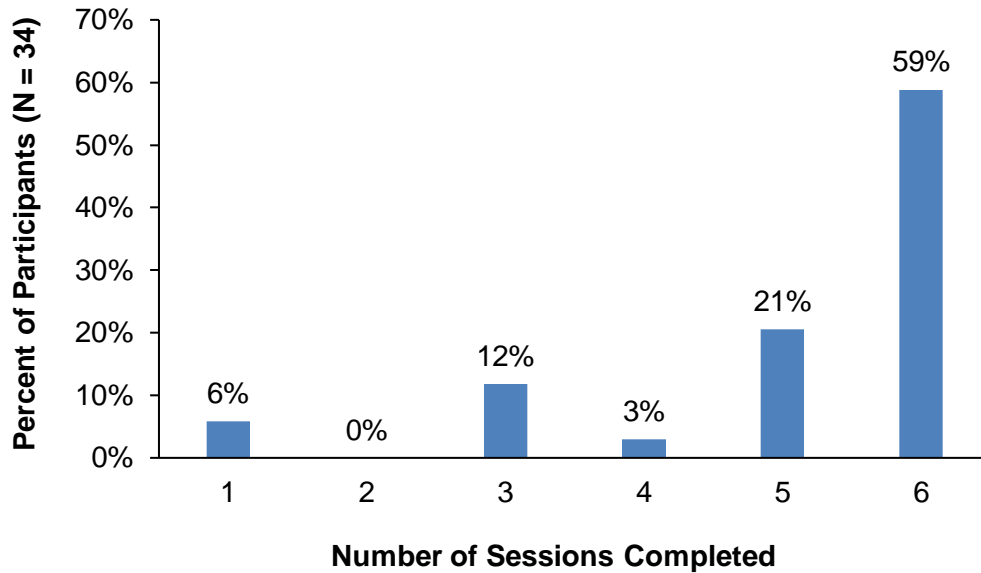


Figure 11. Proportion of participants completing peer mentoring sessions, by number of sessions completed

Peer mentoring sessions. **Figure 11** shows the proportion of participants who completed different proportions of the six scheduled mentoring sessions. Seventy-nine percent of participants (27/34) completed at least 75% of sessions, with 59% of participants (20/34) completing 100% of scheduled sessions (6 out of 6 sessions). Two participants (6%) completed only one intervention session.

Fitbit Community. Frequency of posting in the Fitbit Community, defined as initiating a new post, varied among participants but was low overall. Two of 34 participants (6%) posted in the Community on at least 75% of intervention weeks, 29% (10/34) posted in the Community on at least 50% of intervention weeks, and 85% (29/34) posted in the Community at least one time. See **Figure 12.**

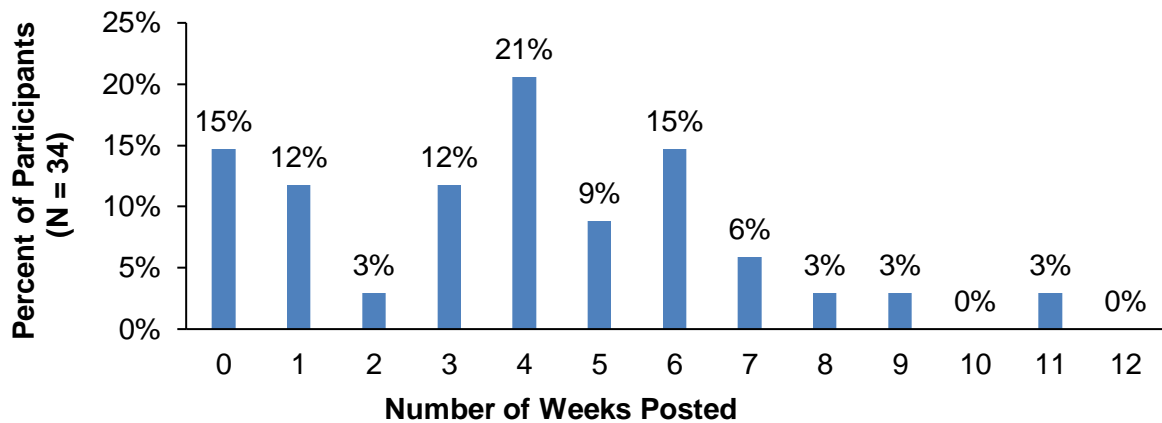


Figure 12. Proportion of participants initiating a Fitbit Community post over the course of the study, by number of weeks posted

Overall adherence. The proportion of participants who met zero, one, two, or all three adherence metrics is displayed in **Figure 13**. Four participants (12%) met 0 of the three adherence criteria, four participants (12%) met one of the adherence criteria, 24 participants (71%) met two of the adherence criteria, and two participants (6%) met 3 of 3 adherence criteria. Overall, 76% of participants (26/34) met at least two of 3 adherence metrics and were considered adherent.

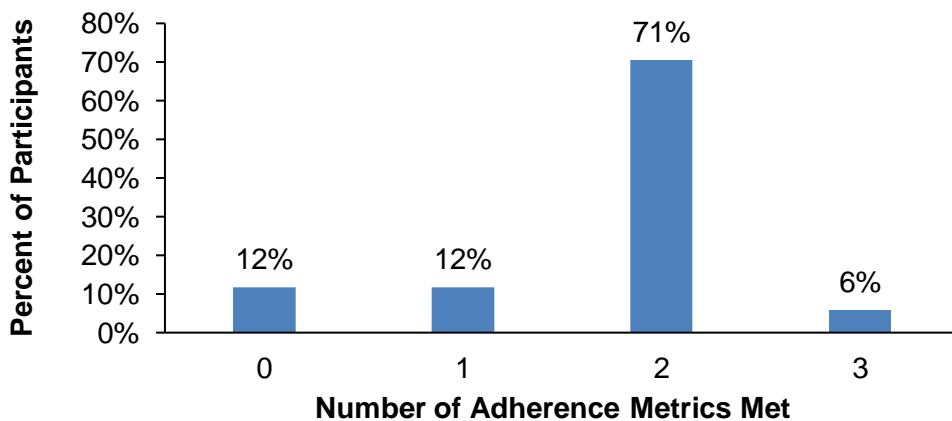


Figure 13. Proportion of participants meeting adherence metrics

Toolbox. Four of the five peer mentors utilized the toolbox to personalize the intervention for their mentees. In total, 19 of 34 participants received access to intervention toolbox resources during the study (note, peer mentors could provide multiple resources up to the \$40 per person budget). Four participants received a one year subscription to the Sworkit app, a virtual personal training app that allows the user to customize and play personalized video workouts on demand. Sworkit includes cardio, strength, cardio, and yoga workouts. Eight participants received exercise equipment (e.g., resistance bands, ankle weights, jump rope, etc.), eight participants were sent links to YouTube channels with exercise videos (either the study's YouTube channel or other channels selected by their peer mentor), and one participant received a personalized guide of walking routes from her peer mentor.

Acceptability

Qualitative Interviews

Twenty-nine of 31 or 93.5% of women who were retained for T1 quantitative measures completed a T1 qualitative interview. Key findings from each domain of the interview guide are summarized below. Supporting quotes are presented to help illustrate more complex concepts; the presence or absence of quotes does not signify the relative importance of the idea presented. Quotes are verbatim unless indicated by an ellipsis (...) to signal that small segments of the text have been removed to enhance clarity or facilitate deidentification.

I. Physical Activity Intervention

Participants provided feedback on many aspects of their experience in the intervention, including working with a peer mentor, the Fitbit and Fitbit Community, the intervention toolbox and other exercise resources. They also shared their thoughts on the remote delivery format and length of the intervention.

A. Peer mentor & mentoring sessions

Overall, most participants reported positive experiences working with their peer mentors. For many participants, working with their peer mentor was their favorite part of the intervention.

A.1. Being mentored by a fellow younger breast cancer survivor

Participants spoke at length about the value of working with another younger breast cancer survivor. Participants felt this experience was uniquely supportive because their peer mentor's lived experience with breast cancer helped them understand and relate to the struggles of their mentees.

I think that it was great to have somebody that has been in the same shoes and can really understand it, the different levels of frustration that might come about when you're coming out of treatment. At least for me, survivorship has been in some ways harder than active treatment. I think a lot of it is just mentally wanting to get back to where you were before, and putting certain standards on ourselves...but having the peer mentor was great because it was relatable, and she had a really good attitude as far as being able to motivate, but also having empathy.

Furthermore, some participants noted that connecting with a breast cancer survivor close in age differentiated Pink Body Spirit from other survivorship programming they had previously engaged with. For instance, one shared: "When I go to the doctor, all the ladies who've had breast cancer are all 60 [years] and up... [my mentor] knew what I was going through at such a young age—just being able to talk to her, she's gone through the surgery, and I went through the surgery...it sucks she had to go through it also but having someone around the same age has been nice."

Many participants described a desire for a deeper, more personal relationship with their peer mentor and sought varying levels and types of information about their mentor. A few participants characterized their peer mentor as "very scripted" and felt that mutual sharing of more personal information at the start of the study would have helped them "establish a little bit more community or connection." Numerous participants were especially interested in knowing more about their peer mentor's cancer history. A few participants did not know their

peer mentor was also a breast cancer survivor. Several felt that explicit acknowledgement of the shared breast cancer connection would have helped them feel more comfortable with their mentor.

When I was talking with my mentor, I feel like it would have been nice to have known her story... just so we can kind of relate a little bit more...we look at each other, and we're all young, and we're like, "Yeah right, there's no way you had [cancer]," and I feel like that about myself, too. It would have been nice to as you start out, set that groundwork for you to come to common ground...There aren't many young people that you come in contact with that have breast cancer, so to actually be chatting with somebody, just to have that connection.

While most participants felt knowing more about their peer mentor's cancer history would be helpful, they noted that *how* their peer mentor disclosed information about herself was also important. For example, one participant described how her peer mentor shared the nuances of her treatment, side effects, and post-treatment exercise limitations during a mentoring session. The participant felt that learning such detailed information about her peer mentor's breast cancer experience made it more difficult to "relate" to her mentor. Aside from information about cancer, some participants stated that more general background information about their mentor, such as their geographic location, hobbies, family, and occupation, would have helped them feel closer to their peer mentor.

A.2. Accountability

Many participants cited their peer mentor as an incredible source of support and accountability. Participants shared that their mentors offered accountability through bi-weekly mentoring sessions and by providing feedback on their mentees' Fitbit activity between scheduled sessions. Participants felt that being accountable to their peer mentor helped them succeed in the intervention and set them up for longer term maintenance of their behavior change.

I liked the accountability, that it wasn't just me or my little personal bubble of people around me, because that hasn't been working for me. I liked that I had a person that I knew, okay, I'm going to need to do this phone chat or this

video chat with somebody by the end of this next week...And I need to be able to answer the questions that she's going to ask me about how it went...So really, the accountability of it was wonderful to help me get my habit formed. And then after I had my habit formed, it was easier for me to do it myself.

Participants that reported receiving feedback from their peer mentor between scheduled sessions felt that the more frequent communication increased their accountability to their mentor. Knowing that their peer mentor could monitor their real-time activity via the Fitbit kept them motivated and on track. One participant explained: "She pushed me to try my hardest to get to my next level with the active minutes. What I liked about it, too, she followed up with me via email or on the Fitbit messenger. We were able to connect [on Fitbit], so it wasn't just waiting for her [mentoring session] every two weeks. Within those missing weeks, I knew I was gonna get a text from her or I was gonna get an email from her."

In some cases, participants did not have clear expectations about how their mentor would be monitoring their Fitbit data and the frequency of communication between sessions. Some participants who were told they would receive extra communication and support between scheduled sessions were frustrated when this did not occur. One participant who felt that more frequent contacts from her peer mentor between sessions would have provided more accountability explained:

I needed to feel like somebody was watching me, so I was feeling accountable. Because I could lie to myself all day long, but it's harder to lie to somebody else when I'm wearing a tracking device and they can see what I'm doing, right? Or not doing. It would have been more helpful [to receive contacts] every couple days at least for the first month, so I could get a routine going or get that habit going...Once a week or once every two weeks was not enough for me...just a text message, an email, a message through the Fitbit app, something. I don't need to have a conversation and probably, I wouldn't want to [have a conversation], I don't have time to just chat about it. But just like a quick little note.

A.3. Remote delivery

Participants overwhelmingly reported very positive feedback about remote delivery aspects of the program. Most participants had at least some familiarity with Zoom video chat

and had previously used the platform to complete work, school, and/or volunteer activities remotely. Those who were not familiar with video chat shared that it was easy to familiarize themselves in the first few weeks of the intervention. Most participants found that Zoom sessions were convenient and easy to schedule, even among many competing demands. Numerous participants felt that engaging in mentoring sessions through video chat was preferable to phone sessions because video enabled them to read body language and make eye contact with their mentor, strengthening their rapport. They also valued the opportunity to connect with other younger breast cancer survivors across geographic areas.

I just have a busy lifestyle, so the face-to-face would have been nice, but I understand that we all lived in different areas of the country. So just being able to get on a video chat, especially after work, is just easier to do than trying to schedule to meet up in-person. It was nice just to be able to see each other's faces...you could see how each person is responding. For example, she could see if I'm having an off day or if I'm really happy, and I [could] see if she heard my type of progress, or what I was doing... you could see actual physical emotions instead of just having to guess the type of emotion or reaction that the person was having.

A.4. Frequency of peer mentoring sessions

There was mixed support for biweekly sessions versus weekly sessions. Several participants expressed that meeting with their mentor every two weeks was too infrequent and that meeting more often would have increased accountability and “kept the momentum going.” One participant shared: “I feel at least a weekly [session] would be more beneficial. I felt sometimes after a week I would kind of fall off the— my motivation would kind of decrease, and I'd have to try to remind myself, "Okay, I have to keep going because I have another week until I meet with her.” I feel like maybe more frequent meetings would boost that motivation and of course, increase that accountability.”

However, some participants stated they simply did not have time for weekly sessions. Some women believed that meeting with their mentor every two weeks was an optimal

schedule for helping them increase their exercise. One participant explained: “[Every 2 weeks] gave me time, like if I set a goal, it gave me time to adjust to whatever that goal was, especially if I was going up and increasing my active minutes. And I did. For me, it would have been more stressful to have to meet like maybe every couple of days or once a week, versus with every two weeks, it gave me enough time to adjust, or if I wasn't doing enough, to get myself up to the point where I needed to be.”

A few participants suggested that their familiarity and history with exercise may shape their preference for the frequency of mentoring sessions. For example, one participant who exercised prior to her cancer diagnosis felt comfortable meeting with her mentor every two weeks because she “knew what she needed to do”, but that the optimal cadence “depends on the person and how comfortable they are with self-starting, and where they’re at in their own journey of exercise.” No participants expressed that they would have preferred the sessions be more infrequent than every two weeks.

A.5. Length of intervention.

Feelings were mixed regarding the ideal length of the active exercise intervention. Some participants felt that 12 weeks was an acceptable duration while others desired a longer program. One participant explained that extending the active intervention period by 2-3 months would provide intervention support “across two seasons, instead of just one season. That way, you could see an improvement in yourself beyond just the “hard” season or the “easy” season.” No participants voiced interest in a shorter program.

A.6. Peer mentor preparation and communication

Participants valued clear and consistent preparation, communication, and follow-through from their peer mentor. Many participants described their mentors as “professional,” “prepared”, or “organized”. Yet not all participants felt this way. A few participants reported logistical issues related to scheduling sessions that were perceived to have been the result of

miscommunication and disorganization on the part of their mentor. Participants were “frustrated” and “irritated” when their peer mentor missed or was tardy to a scheduled session without communicating in advance. Some participants who lived in different time zones than their peer mentor suggested it would be easier to work with a peer mentor who was in the same time zone. Technical problems also presented challenges to effective communication between mentors and mentees. For example, one participant reported that she was unable to contact her peer mentor for several weeks due to a technical issue with her peer mentor’s email account. The participant did not have a back-up contact method for her mentor, and the lapse in communication was “confusing” and “threw [her] off.” Several participants also shared that a clearer orientation to the structure of the study (e.g., information about the total number of peer mentors and current participants, rolling enrollment, etc.) from their peer mentor would have helped them feel more oriented to the study.

B. Fitbit

B.1. Overall impressions

Overall, participants reported positive experiences using the Fitbit Charge 3 tracker and app. Many participants found that the Fitbit was easy to use out of the box and liked the aesthetics. Some participants reported receiving clear instructions from their peer mentor on how to use the Fitbit specifically for this study, including how to monitor their heart rate and track their active minutes; these participants generally described fewer technical challenges related to the Fitbit. However, several participants expressed the need for a more detailed orientation to the Fitbit and how to use it to track active minutes while in the study.

B.2. Active minutes

While a few participants would have preferred for the study to focus on increasing steps instead of active minutes, most participants liked the study’s focus on achieving active minutes and enjoyed using their Fitbit to track their active minutes. Active minutes were a

novel activity target for most participants including those who had previous experience using a Fitbit or other wearable activity tracker. Participants shared how using a Fitbit to monitor their heart rate and active minutes broadened their understanding of how they could be active. Tracking their active minutes also helped them see the ways in which they were already fitting in active minutes throughout the day and how they could accumulate more active minutes—and the resultant health benefits—by increasing the intensity of light activities they were already performing in their daily lives. For example, one participant shared: “The Fitbit made me realize how often I’m doing active stuff and I don’t even realize. Being a mom, when you’re running around, it’s like, ‘Oh, I just got in 20 minutes of cardio!’ I had no idea, just having a dance party with my kids.” Another stated:

I really, really, enjoyed having the Fitbit to use. I’ve used tracking apps before...I’ve tracked my steps before, I’ve tried to do 10,000 steps in a day, and it’s never really created any kind of weight loss or anything like that, and I always wondered why. Well, having the Fitbit tell me my [heart] beats per minute and then show me my active minutes helped me understand that it’s because I wasn’t getting the appropriate heart rate and the appropriate active minutes to create the calorie burning weight loss that I needed. And then I was also able to go back and look at my active minutes and see what times of day I was actually doing them...I was able to look at the other activities in my normal daily life that created active minutes... and realize that there were just those little tweaks in my daily schedule that I can do. And that was handy, being able to see that on the Fitbit app.

Participants described how using the Fitbit to track their active minutes increased their motivation to exercise. Participants liked setting and revising custom exercise goals in the app such as a daily active minutes goal and a weekly exercise goal (number of days of exercise per week). They also found it helpful to see trends in the number of active minutes they attained over time (e.g., over one week, one month, three months, or a year). Several participants noted it was useful that the Fitbit app clearly showed which days they were able to achieve their daily active minutes goal and which weeks they were able to achieve their weekly active minutes goal. Participants were also motivated by weekly emails sent directly by Fitbit that summarized their weekly activity statistics and achievements. Much like the trends

and graphs displayed in the Fitbit app, participants reported that these summary emails helped provide clear feedback on their progress toward their activity goals. Participants also liked that they could simultaneously self-monitor many different exercise-related metrics, including active minutes, heart rate, and steps, and that they could view their active minutes on the Fitbit tracker itself without having to open the Fitbit app.

B.3. Other Fitbit features

Participants liked using the “Exercise” feature on the Fitbit to track activities that are often not automatically captured on the Fitbit such as strength training and biking. Participants also liked being able to track multiple other health behaviors using one device and app, including sleep, food intake, water intake, and body weight. Some participants also reported connecting their Fitbit tracker to another health-focused app, such as WW (formerly Weight Watchers) or MyFitnessPal.

B.4. Problems with the Fitbit

Some of the technical issues participants reported included difficulty syncing the tracker with the Fitbit app, inaccurate tracking of active minutes during intentional exercise, and problems receiving notifications on the Fitbit tracker and in the Fitbit app. Participants also reported challenges manually entering activities into the Fitbit app, such as when an activity was not automatically detected by the Fitbit or when the Fitbit was not worn while exercising. Some participants were “confused” about how to access Fitbit features across the different Fitbit platforms (app, tracker, and website).

One participant shared: “I think we can only see the [Fitbit Community] posts on the app and not on the computer [website]. Those types of thing in general are kind of confusing, because some things you do on the computer, like [manually] adding the extra activity like skiing, but the social media [Community] is only the phone.”

A few participants reported problems with physical aspects of the tracker that prevented them from wearing it all day such as skin reactions on their wrists or the device hitting the keyboard when they were typing. Some participants found the Fitbit Charge 3 model to be bulky.

C. Fitbit Community

Participants provided detailed feedback about their experience with the private, in-app Pink Body Spirit Fitbit Community. Overall, participants felt the Community was positive, supportive, and motivating. Participants reported a wide range of engagement with different aspects of the Community, including creating posts, participating in Fitbit Challenges, and using the Leaderboard. Nearly all participants desired more interaction and connection between participants.

C.1. Posting in the Fitbit Community

Participants noted that while the volume of posts in the Fitbit Community fluctuated throughout the study, most participants did *not* post regularly. Participants reported that a small group of mentees and some of the peer mentors authored most posts. One participant liked posting on the Fitbit Community because it was a safe space to “humble brag” about exercise progress and gain social support among like-minded women working toward a shared goal of increasing their exercise and living a healthy lifestyle in survivorship. Some noted that while they did not post often, they found reading others’ posts to be motivating and inspiring. Several participants reported engaging in the Community by commenting on and “liking” things that other members posted, even if they did not author many of their own posts. The Community afforded an opportunity to exchange ideas and learn about challenges other younger survivors encountered and what solutions helped them overcome these challenges. For example, one woman shared: “It really did help me to meet other people close to my age that [have] been through what I went through, because I don't really have a lot of friends that

have been through it. So that was helpful for me mentally, seeing other people thriving, living their life, having a great time.” Another participant explained:

I probably wasn't as involved as I could've been. It was a little weird at first, just because I'm not a super outgoing person. But I did find that we—this group of women—really are there for each other and it's more like the sisterhood of “we've been there”. I found that there were a couple ladies that—very similar family size and things like that...I think just knowing you're not alone is huge. In my area, I was the youngest person in chemo when I went through my chemo, and the support groups that are here locally, they meet at 10 o'clock on a Tuesday or noon on a Monday, and I work. I can't make all of that. So, it's just nice having women that are similar.

Some participants explained that they did not post or engage in the Community because they were reluctant to share personal experiences with a community comprised of women they did not know. Others described themselves as “not posters in general” who do not post on any social media platforms (e.g., Facebook, Instagram), so it is unlikely they would have posted, even if they were familiar with other community members. Furthermore, the extent to which participants were aware of expectations for participating in the Fitbit Community was inconsistent. Some participants expressed that they did not know how often and what kind of content could or could not be posted. Several participants described needing extra support or encouragement from their mentor to post. A few stated that if posting in the community was presented as a “mandatory” part of their participation in the study, they would have posted regularly.

If I was told I had to [post], then I would have. The one time my mentor told me you really need to [post], I did, but then I didn't do it again after that. I'm not a huge person when it comes to posting in general, but I liked seeing other people's, so I can assume that other people would like to see mine. If I was told this is part of the program, you need to [post] once a week or whatever the number is, then I would have been more apt to do it. I would have just forced myself.

Other suggestions for increasing engagement in the Fitbit Community included initiating “posting challenges” with incentives to encourage posting; involving participants as moderators of the Community; and posting more open-ended prompts to provide structured opportunities

for participants to post. Participants shared that consistent introduction posts by peer mentors to introduce each mentee to the Community would help them feel more comfortable posting. Others noted that a template for their first post would have been useful, as they lacked direction about what to post.

C.2. Fitbit Challenges

Participants provided feedback on Step and Active Minutes Challenges in the Fitbit app. Several participants mentioned liking the interactive features of the Step Challenges such as notifications about their progress and an integrated chat function to directly communicate with and support other participants in the Challenge. Some participants shared that Fitbit Challenges were not introduced to the Community until they were close to completing the intervention, and nearly all participants felt they would have benefited from participating in more Challenges and suggested they be part of the exercise intervention for the entire 12 weeks. Some participants described feeling so motivated by the Fitbit Challenges that were part of the study that they sought out additional Fitbit Challenges with individuals outside the study. On the other hand, some aspects of the Step Challenges were problematic for participants. Some participants described feeling frustrated when they were not able to join a Challenge they were invited to, explaining that the challenges filled up quickly because they were limited to 10 people on a first come, first served basis. Moreover, a few participants expressed that it was harder to participate in Step Challenges if they worked a non-traditional schedule (i.e., anything other than Monday-Friday). For example, one participant explained: “I work 12:30pm to 9pm. A lot of the challenges and things were all based on normal people’s work schedules. Like the Weekend [Warrior], that’s not my weekend. I’m off Sunday-Monday, so that’s not my week. Being able to set the [Challenge] for my schedule and not the norm would be good... I get behind on everybody else, because they’re Monday through Friday.”

Other participants felt that the Step Challenges were not motivating because they were misaligned with the study's focus on active minutes. Some participants described a discrepancy between success in Step Challenges and success in the intervention in that they were meeting their active minutes goals through moderate intensity exercises that didn't generate many steps (e.g., swimming or cycling). Participants liked that Active Minutes Challenges were more customizable than Step Challenges, allowing all participants to compete in a single Challenge over any amount of time from 60 minutes to 30 days. Participants also noted that the Active Minutes Challenges were more connected to the study focus and their individual goals of increasing their active minutes. Participants expressed that one limitation of the custom Active Minutes Challenges was that there was no way to communicate with other participants within the Challenges, a favorite feature of the Step Challenges.

C.3. Fitbit Community Leaderboard

Another feature of the Fitbit Community that participants provided feedback on was the Fitbit Community Leaderboard (example in **Appendix 3**). A built-in feature of all private Communities on the Fitbit app, the Leaderboard ranks and displays a list of Community members in the order of their average 7-day step count. Some participants felt motivated by the social comparisons displayed on the leaderboard. For instance, one shared: "I'm one of those people that a slap on the back is worth nothing, but a trophy is worth everything... I think it's once a week, they put up where you fell compared to the other people. Being a very competitive person myself...I look to see where I've fallen [on the leaderboard], third place. Oh, that's pretty good, but later on, I want to be first place, 'cause that's just my nature."

Others found the social comparisons to be discouraging and were not motivated by the Leaderboard.

I thought that the program was supposed to be for women that were not active at all. Sometimes I would look at who was in the [top of the Leaderboard], and

it just seemed like some of the women already had [activity] that they were doing when they first entered into the program. I thought everybody was basically “couch potato status” like me. And then I see these women that were fairly new to the program that had already been working out, or that's what it seemed like.

One participant suggested the Leaderboard may have been more motivating if instead of displaying everyone's steps, it displayed smaller subgroups of participants with similar exercise levels, providing the opportunity to see more movement up and down the Leaderboard. She explained: “I was always at the bottom of the Leaderboard...that sometimes can be a little bit discouraging...it kind of feels like, "Oh well, I'm at the bottom, I might as well stay at the bottom.” Whereas if it's a smaller group, you can kind of bounce around a little more...you don't feel like a little fish in a big pond. You feel like a little fish in a little pond, and you feel confident.”

C.4. Fitbit Community Platform

Participants provided input regarding the best platform for the Fitbit Community. Several participants acknowledged that a Community of younger breast cancer survivors focused on exercise was unique among existing cancer support group offerings, including both in-person and other virtual offerings. While participants were not specifically probed about the best platform for the Fitbit Community, some participants stated that it was “logical” for the Community to be located within the Fitbit app due to the emphasis on exercise. Participants shared that having the Community built into the Fitbit app enabled them to easily share their Fitbit dashboard to the Community and show their progress to the group.

It definitely was weird at first to post to all these people that I didn't know, but after I did it, even just [after] the first [post], I was like "Oh, this is kinda cool. I like this." 'Cause I'm not—I have some social media friends that post about their exercise on their normal Instagram accounts and it gets old because it's the only thing you see. But when I'm looking at Fitbit, it's what I'm looking for, what I expect to see. So, it made me more comfortable to post my own stuff...it's a place to encourage each other and express something you're excited about.

On the other hand, some participants felt strongly that Facebook would have been a better platform for a community. Many explained that they already use Facebook regularly for work, pleasure, or other breast cancer advocacy or support groups. For some of these participants, having to open the Fitbit app to access the Community was a barrier. Because they were already on Facebook, they also would have been more likely to see notifications for the Community, which would have prompted more engagement. Numerous participants described that while they had intended on participating, they simply “forgot” to check the Fitbit Community. Participants also noted the Community would have felt more personal if user profiles were connected to a Facebook profile.

I would've loved a Facebook group... if you connect with someone, you can go look at their profile and see what the— I just like all of that stuff, it seems a little more personal.... you can share links to a cool article and things like that, whereas the Fitbit Community was more like, “Here's my picture. Yay, I'm walking today!” There just wasn't as much to [the Fitbit Community]. I don't think [Fitbit] is caught up with the Facebook platform. I just feel if we had this Facebook group, I feel like I could've connected with the other women. I have no idea who any of the other women are who are in this [study], because I just didn't go in that group like I probably should have.

One participant suggested that a Facebook group could be used to augment, rather than replace the Fitbit Community to encourage further interaction. A few participants mentioned that a barrier to posting in the Fitbit Community was having to compose a separate duplicate, post of something they were already sharing on Facebook, Instagram, or another social media site. Regardless of the platform, participants sought the ability to easily re-post from other social media sites.

C.5. Connections between participants

Across all aspects of the Fitbit Community, participants consistently expressed that facilitating deeper personal connections with each other and all the peer mentors would foster a greater sense of “community accountability” and provide further motivation to meet and exceed their exercise goals. For example, participants shared ideas to initiate Fitbit

Challenges with each other and play an active role in moderating the Fitbit Community. While acknowledging the benefits of video chat and the convenience and inclusiveness of a remote intervention, another suggestion was to offer regional in-person exercise meetups for participants and peer mentors to build deeper personal relationships and accountability through exercising and socializing together. Several participants felt that meeting other participants and peer mentors through periodic group Zoom video chat sessions would enhance the accountability and support provided by individual peer mentor sessions and the existing Fitbit Community. Numerous participants suggested that working with a small group would make it easier to forge the more personal connections they desired, and in some cases required, to feel comfortable engaging with the Community. One participant explained:

I never really connected with anybody on it at all. I'd see some people post now and then, but to me it just wasn't— maybe it's just underutilized. And I never— maybe it's that comfort of not knowing people, which would maybe be where a small group would be beneficial, because if I knew them, I would be more apt to posting... I'm not comfortable posting when I don't know people. Like social media, I don't really put all of my stuff out there for everybody to see, so to me, that's kind of the same thing.

D. Toolbox and other exercise resources

Through the intervention toolbox, peer mentors could provide additional resources to participants to help them increase their exercise. Among participants who said they received resources, commonly discussed resources included the Pink Body Spirit YouTube exercise video playlists, the Sworkit app, and material exercise equipment. Many participants liked the study-curated YouTube exercise video playlists, particularly the walking playlist. Participants expressed that the YouTube videos were a convenient option when faced with barriers to walking outdoors (such as weather, daylight, and needing to care for children) and the videos were generally easy to follow. Participants who received access to the Sworkit app, a virtual personal training app that allows the user to customize and play personalized video workouts on demand, reported mixed experiences. Some women found that the exercise

demonstrations and directions were hard to follow. Participants felt that while the Sworkit app was very customizable, it was too self-guided. They would have benefited from more guidance on how to use the app to work toward their specific exercise goals. Some liked using Sworkit for guided stretching but did not use it for cardio or other MVPA that would help them achieve active minutes.

Several participants described receiving material exercise equipment from the study (e.g., foam roller, resistance bands, weights). One participant who received resistance bands expressed that she did not know how to use the exercise bands and they were not integrated into her action plan. She felt the bands were not useful to her because she lacked support and accountability from her peer mentor regarding their use.

It was great they were provided by the study. They were more than I probably would have bought for myself. I've only used them a handful of times and I'm sad to say that I think that's because I didn't have to report back how many times am I using it...I've fallen short on using them consistently. I think if the study had sent a handful of exercises to do, whether it was the diagrams, how to do it, or even a link to find them online, just to give me a direction with them. A couple for your arms or shoulders, a couple for your legs and say, "These are some good ones to try out, start with these." That would have given me a focus point to begin at.

Some women reported that they did not receive any extra toolbox resources from their peer mentor but provided feedback about the types of resources that would have enhanced their experience in the intervention. Several participants expressed that a library of exercise resources would be helpful when beginning the program. Even among those with previous exercise experience, participants felt they did not know what kind of exercise to try out and sought more explicit direction from their peer mentor. One stated: "I don't exercise, I don't go to the gym. I used to, but it's just not for me right now and my life. My only source of exercise was walking...When I first started, it was kind of like, "so what do you want to do for exercise?" I wish they would have given me options. Say, "oh we have this, you could do this,

would you like to try it?" Something like that would have been more helpful in the beginning, instead of me trying to figure it out...I didn't even know what I wanted to do!"

Participants were also interested in receiving structured exercise workouts. They desired workouts tailored toward cancer survivors who may be dealing with a range of late effects of treatment, including lymphedema and joint pain. Some also sought specific guidance that could align with physical goals such as losing weight, strengthening bones, and building muscle tone. Participants were pleased when their peer mentor proactively provided resources matched to their exercise goal and action plan. For example, one participant whose exercise goal focused on rowing received links to YouTube guided rowing workouts. After sharing her travel plans with her peer mentor, another participant received suggested walking routes near her vacation destination. Conversely, participants expressed frustration when they did not receive resources their peer mentor had offered or received resources so late in the program that they were not able to incorporate these tools into their action plan.

We talked about, "How can I support you? What can I look up for you? How can I do things for you?" and I would say, "I'm really interested in some Pilates things. I don't have the time to really look for them myself, is there an app?" And then the next time we met, which was two weeks later, I had to bring it up again...It's hard for me to exercise and get the time to exercise, so when there's a set up where someone is supposed to be helping you, and I have to sort of chase after it, it was a little [frustrating].

Other toolbox resource suggestions included a Fitbit premium subscription to upgrade the Fitbit app experience and small cash incentives based on progress toward incremental exercise goals to enhance motivation.

II. Maintenance

At the T1 interview, participants were asked about their expectations for maintaining their exercise behavior during the subsequent 12-week follow-up period. Many participants felt confident they would be able to maintain their exercise during the follow up period because they were able to establish a "habit." Numerous participants believed they would continue to

be motivated by experiencing the physical and mental benefits of exercising, as well as by an expanded understanding and open-mindedness of how physical activity can be achieved in many ways and places. One participant shared: “I think it'll be easier to maintain than it was prior to the study. This has helped me redefine what my exercise is, and what [activity] counts. I don't have to be out there for an hour and a half to count exercise. I've kind of allowed myself— even if I get ten minutes, that's better than nothing. I think having a little bit different mentality about it is really going to help me keep it going, and I've seen the results.”

Participants described a variety of strategies they plan to use to help them maintain their exercise behavior change. Several spoke about their intentions to continue self-monitoring their activity using the Fitbit and to continue participating in the Pink Body Spirit Fitbit Community and Fitbit Challenges. Other behavioral strategies gained from the intervention content that they planned to continue using included setting small incremental goals, creating a specific action plan and scheduling exercise sessions in a calendar, problem-solving barriers and solutions, and rewarding themselves for achieving their goals. Some participants felt they would continue to be motivated by regularly monitoring their standing on the Fitbit Community Leaderboard. One participant who was optimistic about maintaining her exercise gains shared: “[The program has] given me all the tools I need to make it happen and the mental capacity to make it happen. I know that if I needed any specific encouragement, I could reach out to the Fitbit Community and people would be encouraging. So, I feel like I have all the tools needed to do what I need to do.”

Yet several participants acknowledged that the loss of accountability from their peer mentor would challenge their efforts to maintain their exercise. Participants shared that in addition to using the Fitbit Community, they planned to engage family members, friends, and co-workers outside the study for supplemental social support and accountability. Some participants expressed that the structure provided by the intervention was critical to their

success and were concerned their progress would falter without scheduled meetings with their mentor. A few participants shared plans to seek out other structured programs to help them maintain their exercise in the future. Participants also noted that other general barriers to exercise, such as poor weather, limited time, and lack of motivation might also present challenges to maintenance. Lastly, participants shared that lifestyle changes related to the COVID-19 pandemic (e.g., fluctuating work time and/or setting, changes in children's school or activities, gym closures, etc.) could also impact maintenance.

III. Benefits

Participants shared many benefits they gained from participating in the study. These included benefits to physical health, benefits to mental health, and benefits related to exercise and other health behaviors.

A. Physical health

Participants described numerous benefits to their physical health including improved stamina and energy, feeling physically stronger, and less fatigue. Many participants felt that their sleep quality improved over the course of the study. Some women shared that they lost weight and/or gained muscle tone while others expressed frustration that they did not lose weight. Some participants found that increasing their exercise reduced their joint pain. A few described experiencing slightly more joint pain than usual.

B. Mental and psychological health

Benefits to mental health included increased positivity and vitality, improved overall mood, and lower stress. Some women also reported improvements in self-image and self-confidence, self-pride, and a greater desire to care for themselves. Multiple participants described that participating in this study was among their first experiences engaging in self-care since their cancer diagnosis.

It made me want to look better. I kind of threw that out the window for a long time because I've had so much surgery and stuff. It's made me sort of think,

“okay, this year I'm going to start focusing on improving my looks.” Losing the weight is a good start for that. I just got my hair done...I think all these elements together kind of start to rebuild somebody from the inside out...when cancer happened to me, it pretty much destroyed my life. I'm happy that I survived, but a lot of bad stuff came from it, besides just the obvious...it really did a number on me and my ego and my self-worth...I think all of these elements brought by this study have given me a pathway to start to rebuild myself and my life, and that's huge, that's really huge.

Some participants felt that the intervention should more directly address and incorporate quality of life factors that can affect exercise such as mood, stress, and pain. For example, a few participants suggested the intervention could provide participants with journals to document these factors, which could be referenced and incorporated during goal setting and action planning with their peer mentor.

C. Benefits related to exercise and other health behaviors

Participants reported gaining many exercise-related benefits due to their participation in the study. Benefits included a strong sense of accomplishment from increasing their activity, meeting their exercise goals, and in many cases, establishing a habit or exercise routine. They also felt participating in the program increased their self-efficacy for exercising. One participant shared: “I think I have more confidence in my ability to get active minutes and exercise. Before this, I don't think I was very, I know I wasn't confident in my ability to exercise and be able to keep up. I felt very broken, just from everything, from the multiple surgeries and everything. And now, I know I can do it. I don't have an excuse. I can't use "I'm broken" as an excuse anymore.”

Several participants described how behavioral skills learned through peer mentoring sessions contributed to their success. Commonly discussed strategies included planning exercise, learning to set incremental goals, problem solving to overcome barriers to exercise, and using the Fitbit to track their active minutes and monitor progress toward goals over time. Even participants who felt that they did not increase their exercise as much as they had hoped found these behavioral skills valuable. Participants felt confident these strategies could help

them get back on track or increase their exercise in the future. For instance, one woman explained: “I had my most successful weeks when I had [exercise] written down in my calendar and I had a game plan for if that wasn't going to work. When I was actively engaged, I was sticking to it. “Alright, the kids are eating dinner, I'm done, I am going to go do my workout.” Or “I'm up early before everybody else, let me just get it in so I'm done.” I've never put [exercise] on a calendar, I've never done that until this.”

Participants also described gaining a broader understanding of what physical activity is and how to incorporate it into their daily life in many ways and places. Many have found that this expanded comprehension and open-mindedness about how to achieve active minutes and meet their exercise goals has increased their motivation to be active. As one participant expressed: “I realized that exercise doesn't mean I just have to go to the gym and I just have to sweat there. It could be a lot of different things; you can get your exercise many different ways. I definitely learned to think more outside the box, instead of “I just can't do it today.”

Furthermore, many participants stated that taking part in this study increased their interest in improving other health behaviors beyond exercise. Some have already started working toward eating a healthier diet, drinking more water, and improving their sleep hygiene. Participants described how they are leveraging behavioral strategies learned in the Pink Body Spirit program to work toward other health behavior goals. For instance, participants described setting dietary, hydration, and sleep goals in the Fitbit app and using their Fitbit to self-monitor their behavior and track progress toward these goals over time. Numerous women expressed interest in a multiple health behavior change intervention that includes content and guided goal setting to concurrently improve multiple health behaviors, particularly diet and exercise in combination. Women were also interested in setting weight loss goals.

Quantitative Satisfaction Questionnaire

Thirty-one participants completed the T1 (post-intervention) online satisfaction questionnaire. Intervention feedback elicited from the questionnaire, which included both open- and close-ended questions, is summarized below and in **Tables 6 and 7**.

Peer Mentor. Analyses of open-ended responses about favorite and least favorite aspects of the intervention revealed that for many participants, being mentored by a fellow young breast cancer survivor with shared life experience was their favorite part of the program. Participants especially liked being held accountable and receiving feedback on their Fitbit activity from their peer mentor. They also liked learning new behavioral skills to help them increase their exercise, including goal setting and problem solving. When asked to share suggestions to improve the study for the future, a few participants described improvements to how mentors are matched to participants, such as based on a participant's preferences and expectations for communication with their peer mentor. Several participants felt that more frequent, brief contacts with their peer mentor would improve the program. Regarding least favorite aspects of the program, a few participants were dissatisfied when their peer mentor did not follow through with contacting the participant as expected.

Participants also provided feedback on their preferred number of sessions with their peer mentor. Most participants (61.3%) felt that the study's six sessions were "just the right amount" of sessions with their peer mentor. About one third (32.3%) wanted more sessions, and just a few (6.5%) thought there were "a few too many" mentoring sessions. In addition to Zoom, participants communicated with their peer mentor in many ways. Two thirds of participants (67.7%) emailed with their peer mentor, followed by Fitbit private message (48.4%), Fitbit Community post (41.9%), text message (19.4%), and phone call (9.7%).

Fitbit. More than half of participants (54.8%) had previous experience using a wearable activity tracker. There were mixed perceptions about the aesthetics and physical characteristics of the Fitbit Charge 3 used in this study. Some described the Fitbit as

lightweight and not bulky. Others felt that the tracker band was too large, uncomfortable to wear to bed or while typing on a computer and had too small of a screen to view their heart rate while exercising. Participants liked that the device was waterproof.

Participants reported their use of specific Fitbit features related to the study “during a typical week over the past three months”. All participants stated they used the Fitbit app at least once per week, with 84% reporting opening the app at least daily. Overall, participants reported self-monitoring their active minutes on the Fitbit tracker more often than on the Fitbit app. During a “typical week”, most participants (83.9%) viewed their active minutes on their Fitbit tracker at least daily. In contrast, 16.1% viewed a graph of their active minutes in the Fitbit app at least daily, and over a third (35.5%) viewed their active minutes in the Fitbit app once per week or less. (**Table 6**).

Similarly, a greater proportion of participants used the Fitbit tracker than the Fitbit app to self-monitor their heart rate. During a “typical week”, over two-thirds (67.7%) indicated they checked their heart rate on their Fitbit tracker at least half of the times they exercised, while about one third (32.3%) viewed a graph of their heart rate in the Fitbit app a few times per week or more. Only one person (3.2%) stated she did not know how to check her heart rate on the Fitbit tracker, whereas four participants (12.9%) stated they did not know how to view a graph of their heart rate or minutes spent in heart rate zones in the Fitbit app. (**Table 6**)

When asked in an open-ended question what they liked best about the Fitbit app and tracker, participants listed many aspects of the devices that support behavior change techniques, including features that facilitate self-monitoring (tracking active minutes, steps, and heart rate while exercising and trends over time); performance feedback (weekly progress reports via email and viewing progress toward goals); goal setting and goal review (setting active minutes goals and revising based on activity metrics presented on tracker and in app);

rewards and recognition, and outcome expectations (motivational notifications, awards, and trophies in app).

When asked in an open-ended question what they liked least about the Fitbit app and tracker, a theme that emerged among responses was an incomplete understanding of how to use the Fitbit as part of the intervention. For example, some participants noted that they did not know how to use the Fitbit to monitor the intensity of their workouts or did not know which activity metrics the study focused on. Some participants felt this information could have been more clearly explained to them at the start of the study. Other themes in responses included difficulty tracking activities not automatically detected by the Fitbit (e.g., strength training, cycling); issues with how the Fitbit calculates active minutes; and other problems with the Fitbit device or platform (e.g., poor battery life, took too long to sync, too many notifications; discrepancy in which features are available on Fitbit website vs. Fitbit app).

Participants also reported using the Fitbit tracker and app to self-monitor their weight and other health behaviors, including sleep (77.4%), food intake (22.6%), and water intake (19.4%). Several participants (74.2%) used the Fitbit Relax meditation feature on the Fitbit tracker, which guides users through breathing and relaxation exercises for two or five minutes at a time. (**Table A2, Appendix 3**).

Table 6. Use of Fitbit tracker and app features reported by participants at T1 (post-intervention)

Feature	N (%)
Check Active Minutes on Fitbit tracker ^a	
Many times per day	15 (48.4)
Once or twice per day	11 (35.5)
4-6 times per week	1 (3.2)
2-3 times per week	1 (3.2)
Once per week or less	2 (6.5)
Never	1 (3.2)
View graph of Active Minutes in Fitbit app ^a	
Many times per day	2 (6.5)
Once or twice per day	6 (19.4)
A few times per week	12 (38.7)
Once per week or less	4 (12.9)
Rarely or never	6 (19.4)
Don't know how	1 (3.2)
Check Heart Rate on Fitbit tracker while exercising ^b	
Almost every time I exercised	15 (48.4)
More than half of the times I exercised	6 (19.4)
Less than half of the times I exercised	4 (12.9)
Rarely or never	5 (16.1)
Don't know how	1 (3.2)
View graph of Heart Rate or minutes spent in Heart Rate Zones in Fitbit app ^a	
Many times per day	1 (3.2)
Once or twice per day	4 (12.9)
A few times per week	5 (16.1)
Once per week or less	11 (35.5)
Rarely or never	6 (19.4)
Don't know how	4 (12.9)
Set or change daily Active Minutes goal in Fitbit app ^a	
A few times per week	1 (3.2)
Once per week or less	5 (16.1)
Rarely or never	17 (54.8)
Don't know how	8 (25.8)
Use the Exercise feature on Fitbit tracker to "start" exercise session or set a specific distance or time goal ^b	
Almost every time I exercised	6 (19.4)
More than half of the times I exercised	3 (9.7)
Less than half of the times I exercised	6 (19.4)
Rarely or never	13 (41.9)
Don't know how	3 (9.7)

Note. N = 31; ^a Participants were asked to report their use during a typical week in the past 3 months (active intervention period); ^b Participants were asked to report their use over the past 3 months (active intervention period)

Fitbit Community. Participants reported their use of different aspects of the Fitbit Community “during a typical week over the past three months.” (**Table 7**). During a “typical week”, about three-quarters of participants (77.4%) reported reading or scrolling through posts in the Fitbit Community a few times per week or more. The proportion of participants who stated they created posts in the Community was far lower; more than half (64.5%) reported creating a post once per week or less and about a quarter (25.8%) said they rarely or never created a post. All participants stated they knew how to create posts. Regarding the Fitbit Community Leaderboard, about one-third of participants (32.2%) viewed the Leaderboard a few times per week or more. Nearly all participants (85.3%) participated in at least one Fitbit Challenge, with about one-quarter (25.8%) joining a Challenge almost every week. Most Fitbit Challenges were initiated by peer mentors and a few participants also elected to join a Fitbit Challenge organized outside of the study (**Table 7**).

Overall, 90.3% of participants felt the Fitbit Community motivated them to exercise (**Table 7**). When prompted to describe aspects of the Fitbit Community that were motivating, open-ended responses clustered around themes such as the shared experience with other cancer survivors who could understand their struggles, the positive and judgement-free environment, and opportunities for reciprocal social support within the group. The competitive aspects of the Community, including Fitbit Challenges and the Leaderboard, were motivating to many but not all participants. Participants provided several reasons they did not find the Community motivating, including limited interaction between members, only a small number of participants and peer mentors creating posts in the Community, and not feeling connected to others in the group. Furthermore, some participants felt discouraged by social comparisons brought on by participating in Fitbit Challenges and when viewing the Leaderboard.

Table 7. Participant feedback on the Pink Body Spirit Fitbit Community at T1 (post-intervention)

Question	N (%)
Read or scroll through posts in the Pink Body Spirit Fitbit Community ^a	
Many times per day	4 (12.9)
Once or twice per day	11 (35.5)
A few times per week	9 (29.0)
Once per week or less	4 (12.9)
Rarely or never	3 (9.7)
Look at the Leaderboard in the Pink Body Spirit Fitbit Community ^a	
Once or twice per day	5 (16.1)
A few times per week	7 (22.6)
Once per week or less	10 (32.3)
Rarely or never	8 (25.8)
Don't know what the Leaderboard is or where to find it	1 (3.2)
Participate in a Fitbit Challenge or Workweek Hustle? ^b	
Almost every week	8 (25.8)
About half the weeks	3 (9.7)
A few of the weeks	11 (35.5)
Once	4 (12.9)
Never	5 (16.1)
Who initiated the Challenge or Workweek Hustle? (check all that apply)	
You	5 (16.1)
Your peer mentor	14 (45.2)
Another Pink Body Spirit peer mentor	13 (41.9)
Another Pink Body Spirit participant	7 (22.6)
Someone outside the study	3 (9.7)
How much did the Pink Body Spirit Fitbit Community motivate you to exercise?	
It motivated me a lot	16 (51.6)
It motivated me sometimes	12 (38.7)
It did not motivate me	2 (6.5)
I'm not sure if it motivated me	1 (3.2)

Note. N = 31; ^a Participants were asked to report their use during a typical week in the past 3 months (active intervention period); ^b Participants were asked to report their use over the past 3 months (active intervention period)

Numerous themes emerged in response to an open-ended question asking participants to describe their favorite and least favorite aspects of the Fitbit Community. Dimensions participants liked most included gaining exercise inspiration and ideas for how to be active, connecting with other women working to achieve similar goals, and celebrating each other's successes. Parts of the Fitbit Community that participants liked least included low engagement by participants and peer mentors throughout the intervention with "only a few people" regularly participating. Participants described barriers to participation in the Community such as

technical difficulty accessing or posting in the Community, not having enough time to participate, and forgetting to participate. One woman described the Fitbit Community as, “basically another form of social media to keep up with, which I’m not very good at anyway.”

Moreover, participants were asked to describe how the Fitbit Community could be made more helpful. Key themes in open-ended responses encompassed strategies to increase engagement in the Community and ways to enhance connections between all the participants and peer mentors. For example, participants suggested that engagement could be higher if the Community were hosted on Facebook instead of in the Fitbit app, because they perceived most younger breast cancer survivors are already on Facebook and use social media. Within the Fitbit platform, participants felt that posting specific, open-ended prompts and framing Community participation (and more specifically, creating posts) as a required part of the program could enhance engagement. Participants also noted that having peer mentors post formal introductions for each participant in the Community and public check-ins between Community members (such as creating a post and tagging someone for a response) could increase accountability for participating in the Community in a future study.

With respect to strengthening connections between group members, some participants expressed that working in smaller groups of mentees could help them connect with other women and foster a stronger sense of community compared to the larger group with all mentors and mentees. For example, each peer mentor could connect their own mentees so they can encourage each other as a small group within the larger study. Participants suggested an option to exercise together in-person with others in their geographic region could also increase their motivation and provide connections with other participants. Furthermore, participants felt that improving several aspects of the Fitbit Challenges would make the Fitbit Community more helpful. Participants expressed interest in more frequent Fitbit Challenges, longer duration Challenges, and higher capacity for Challenges (i.e., increasing the number of

people able to participate in each Challenge instead of the Challenge being capped at a specific number of people). Participants also desired more dialogue and interaction to support each other during Fitbit Challenges.

Overall impressions. All participants stated they would recommend the Pink Body Spirit program to other breast cancer survivors, with 83.9% very likely and 16.1% likely to recommend the program. A few participants wished the intervention lasted longer than 12 weeks. When participants were asked in an open-ended fashion what they liked best about the intervention, participants shared that the study increased their motivation and confidence to be physically active. Participants felt proud of their successful behavior change. Participants also reported gaining self-confidence, reducing stress, improving sleep habits, and developing “a new perspective on the importance of daily activity in my overall health.” Moreover, participants valued the opportunity to contribute to research on younger breast cancer survivors.

When probed for what they liked least about the intervention, many open-ended responses centered around deficiencies of the Fitbit Community or Fitbit tracker. Some participants stated the intervention felt impersonal and were disappointed that they did not get to know the other women in the Fitbit Community. One participant disliked having to wear the Fitbit at all times as a requirement for the study and a few people expressed they would have preferred the main study activity goal to be steps instead of active minutes. A few participants stated that printed materials provided by the study to support the peer mentoring sessions (e.g., printed goal setting and action planning worksheets) were not useful.

Other suggestions for improvement. Participants offered numerous ideas for how to improve the intervention in addition to the suggestions included above. A key theme among open-ended responses was additional resources that the study could provide. For example, participants mentioned that small, frequent incentives such as cash, gift cards, or workout gear

could increase their motivation to exercise. Some participants also desired access to the Fitbit premium subscription which provides fitness coaching and premium features within the Fitbit app. One participant described how the program could be improved by providing access to pre-set exercise programs targeting specific needs of cancer survivors such as building upper body strength after mastectomy or joint-friendly exercises. Participants also suggested the study more directly incorporate emotional and mental health impacts on exercise by including discussions about mood and other emotional factors during the mentoring sessions. Finally, some participants felt it would have been useful to set goals with their peer mentor around other personal health targets such as lowering their resting heart rate or losing weight.

Feasibility of Intervention Measure (FIM) and Acceptability of Intervention

Measure (AIM) (T2). At T2 (3 months post-intervention), participants rated the feasibility and acceptability of the intervention highly with 90.3 to 100% of participants agreeing or completely agreeing with the FIM and AIM survey items (**Table 8**). All women (100%) felt the intervention was “doable” and “easy to use”. All women (100%) also reported that they “liked” and “welcomed” the intervention and that it was “appealing” [to them]. At T2 (3 months post-intervention), the mean 4-item FIM measure score was 4.62 ± 0.49 , range = 3.75 – 5.00. The mean 4-item AIM measure score was 4.61 ± 0.46 , range = 3.75 – 5.00.

Table 8. Ratings on Implementation Measures of Feasibility and Acceptability at T2 (3 months post-intervention).

<u>Pink Body Spirit Seems:</u>	Completely Agree/Agree <u>N (%)</u>
FIM	
Like something most YBCS can participate in	29 (93.5)
Possible for me to participate in as part of my survivorship	30 (96.8)
Doable	31 (100)
Easy to use	31 (100)
AIM	
Pink Body Spirit meets my approval	28 (90.3)
Pink Body Spirit is appealing to me	31 (100)
I like Pink Body Spirit	31 (100)
I welcome Pink Body Spirit	31 (100)

Note. N = 31; FIM = Feasibility of Intervention Measure; AIM = Acceptability of Intervention Measure

Aim 2 Results: Changes in Physical Activity and Quality of Life

Tables 9 and 10 display means (SDs) for each outcome at each measurement time point as well as mean (SD) of changes in each outcome between time points.

Physical activity

Objectively measured MVPA (ActiGraph accelerometer). Four participants recorded very high levels of MVPA per week at T0: 350, 326.2, 322.7, and 287 minutes per week. The next highest T0 MVPA value was nearly 100 minutes per week lower (189 minutes per week). Upon visual inspection, these four participants were identified as outliers and were removed from the MVPA analyses (**Figure 14**). The repeated measures ANOVA revealed a significant effect for time on MVPA ($F(2, 58) = 5.94, p < 0.005, \eta^2 = 0.06$). Though not statistically significant, Tukey post hoc tests revealed trends toward increases in weekly minutes of MVPA from T0 to T1 ($p < 0.11$) and T0 to T2 ($p < 0.14$). MVPA at T1 was maintained at T2 ($p < 0.99$). Average increases in MVPA were +39.7 min/week (95% CI: -6.8 to +86.2) from T0 to T1 and +37.2 min/week (95% CI: -9.3 to +83.7) from T0 to T2. (**Table 9**).

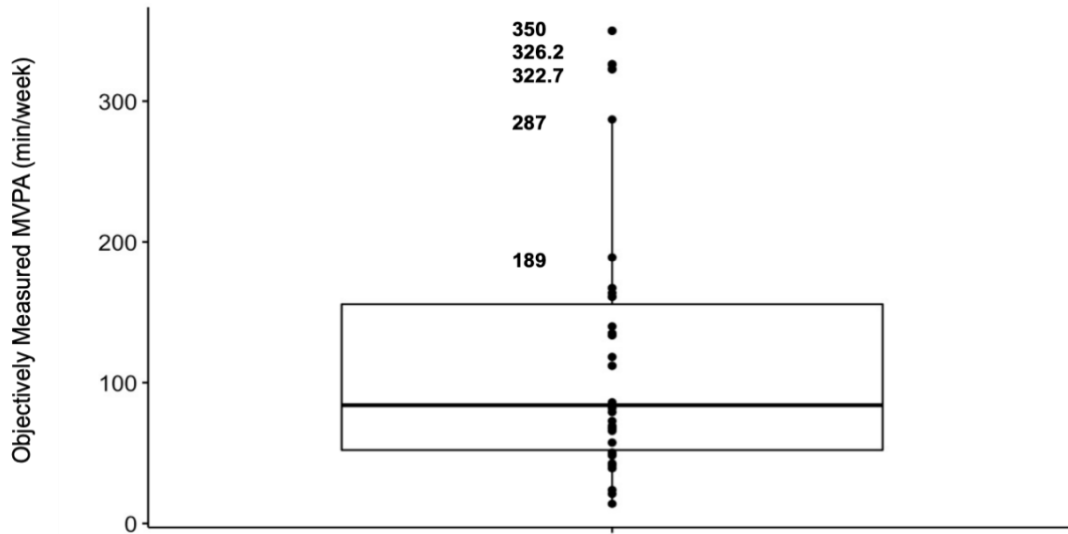


Figure 14. MVPA values at baseline among Pink Body Spirit participants (N = 34)

Self-reported strength training. Two outliers were removed due to very high values at T0. The repeated measures ANOVA showed a significant effect for time on days per week of strength training ($F(2, 62) = 11.20, p < .0001, \eta^2 = 0.14$). Tukey post hoc tests revealed significant increases in days per week of strength training from T0 to T1 ($p < 0.02$) and T0 to T2 ($p < 0.001$). Increases in strength training at T1 were maintained at T2 ($p < 0.71$). (**Table 9**). Average increases in strength training were +0.8 day/week (95% CI: +0.1 to +1.4) from T0 to T1 and +1.0 day/week (95%: +0.3 to +1.7) from T0 to T2.

Self-reported stretching and flexibility exercises. Three outliers were removed due to very high values at T0 or T1. The repeated measures ANOVA showed a significant effect for time on days per week of stretching and flexibility exercises ($F(2, 60) = 8.46, p < .0001, \eta^2 = 0.11$). Tukey post hoc tests revealed significant increases in days per week of stretching and flexibility exercises from T0 to T1 ($p < 0.05$) and T0 to T2 ($p < 0.007$). Increases in stretching and flexibility exercises at T1 were maintained at T2 ($p < 0.75$). (**Table 9**). Average increases in stretching and flexibility exercises were +0.8 day/week (95% CI: 0 to +1.7) from T0 to T1 and by +1.1 day/week (95%: +0.3 to +1.9) from T0 to T2.

Table 9. Physical activity outcomes at T0, T1, and T2 and changes between timepoints among Pink Body Spirit participants

Outcome	N	Timepoint			Change			Repeated Measures ANOVA		
		T0	T1	T2	T0 to T1	T0 to T2	T1 to T2	F value	p-value	η^2
		M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)			
MVPA (min/week) ^a	30	90.2 (49.9)	129.9 (84.2)	127.4 (86.8)	+39.7 (63.4)	+37.2 (76.4)	-2.5 (71.6)	5.94	<0.005	0.06
Strength training (days/week) ^b	32	0.1 (0.3)	0.9* (1.3)	1.1* (1.4)	+0.8 (1.2)	+1.0 (1.4)	+0.2 (1.2)	11.20	<0.001	0.14
Stretching & flexibility (days/week) ^c	31	0.23 (0.5)	1.06* (1.6)	1.32* (1.7)	+0.8 (1.2)	+1.1 (1.5)	+0.3 (1.7)	8.46	<0.001	0.11

Note. M = Mean; SD = Standard Deviation; ^a MVPA = Moderate to Vigorous Physical Activity measured with ActiGraph accelerometer, removed 4 outliers due to high MVPA at T0; ^b Removed 2 outliers with high strength training at T0; ^c Removed 3 outliers with high stretching & flexibility at T0 or T1; *significantly ($p < .05$) different from T0; η^2 = eta-squared effect size

Quality of Life

Body image. The repeated measures ANOVA showed a significant effect for time on body image using Greenhouse-Geisser corrected values due to a severe violation of sphericity ($F(1.69, 55.79) = 21.24, p < 0.001, \eta^2 = 0.09$). Tukey post hoc tests revealed a trend toward reduced body image distress from T0 to T1 ($p < 0.10$) and a significant reduction in body image distress from T0 to T2 ($p < 0.01$). (**Table 10**). Average reductions in body image distress were -4.0 points (95% CI: -8.6 to +0.5) from T0 to T1 and -5.9 points (95% CI: -10.4 to -1.3) from T0 to T2.

Sexual Function. The repeated measures ANOVA revealed no significant effect for time on total FSFI score ($F(2, 66) = 0.117, p > 0.889, \eta^2 = 0.004$). Similarly, the sub-analysis limited to women who were sexually active at baseline ($n=22$) showed no significant effect for time on total FSFI score ($F(2, 42) = 0.192, p > 0.826, \eta^2 = 0.002$). (**Table 10**). A third repeated

measures ANOVA also showed no significant effect for time on the sexual desire subscale ($F(2, 66) = 1.85, p < 0.165, \eta^2 = 0.004$).

Fatigue. One outlier was removed due to very low fatigue at T0. The repeated measures ANOVA showed a significant effect for time on fatigue ($F(2, 64) = 11.94, p < .0001, \eta^2 = 0.10$). Tukey post hoc tests revealed significant reductions in fatigue from T0 to T1 ($p < 0.02$) and T0 to T2 ($p < 0.01$). Reductions in fatigue at T1 were maintained at T2 ($p < 0.99$). (**Table 10**). Average reductions in fatigue were -5.8 points (95% CI: -10.8 to -0.9) from T0 to T1 and -6.1 points (95% CI: -11.1 to -1.2) from T0 to T2.

Anxiety. One outlier was removed due to very low anxiety at T0. The repeated measures ANOVA showed a significant effect for time on anxiety ($F(2, 64) = 3.58, p < 0.034, \eta^2 = 0.04$). Though not statistically significant, Tukey post hoc tests revealed trends toward reductions in anxiety from T0 to T1 ($p < 0.23$) and T0 to T2 ($p < 0.21$). Reductions in anxiety at T1 were maintained at T2 ($p < 1.0$). (**Table 10**). Average reductions in anxiety were -3.5 points (95% CI: -8.8 to +1.6) from T0 to T1 and -3.7 points (95% CI: -8.9 to +1.5) from T0 to T2.

Depression. The repeated measures ANOVA showed no significant effect for time on depression ($F(2, 66) = 2.18, p < 0.121, \eta^2 = 0.01$). (**Table 10**)

Emotional Support. The repeated measures ANOVA showed a significant effect for time on emotional support ($F(2, 66) = 7.91, p < 0.001, \eta^2 = 0.04$). Though not statistically significant, Tukey post hoc tests revealed a trend toward increased emotional support from T0 to T2 ($p < 0.12$). (**Table 10**). The average increase in emotional support was 4.3 points (95% CI: -7.9 to + 9.4) from T0 to T2.

Table 10. Quality of life scores at T0, T1, and T2 and changes over time

Outcome	N	Timepoint			Change			Repeated Measures ANOVA		
		T0	T1	T2	T0 to T1	T0 to T2	T1 to T2	F value	p-value	η^2
		M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)			
Body Image ^a	34	17.2 (8.4)	13.2 (8.2)	11.3* (7.1)	-4.0 (5.7)	-5.9 (6.1)	-1.9 (4.1)	21.24	<0.001	0.09
Sexual Function ^b	34	14.8 (10.7)	15.2 (11.0)	15.2 (11.9)	+0.4 (6.2)	+0.1 (5.9)	-0.1 (7.0)	0.117	<0.889	0.004
Sexual Function ^{b,c}	22	21.2 (7.5)	20.6 (9.7)	21.4 (10.4)	-0.7 (6.9)	-0.6 (8.5)	+0.9 (6.2)	0.192	<0.826	0.002
Fatigue ^{d,e}	33	60.2 (8.2)	54.3* (8.1)	54.0* (9.0)	-5.8 (8.5)	-6.1 (8.4)	-0.3 (7.5)	11.94	<0.001	0.10
Anxiety ^{d,f}	33	60.7 (7.6)	57.1 (9.5)	57.0 (9.3)	-3.6 (9.7)	-3.7 (7.5)	-0.1 (9.8)	3.58	<0.034	0.04
Depression ^d	34	54.0 (9.0)	52.2 (9.2)	51.7 (8.0)	-1.8 (7.1)	-2.0 (6.2)	-0.5 (6.6)	2.18	<0.121	0.01
Emotional Support ^d	34	46.5 (8.2)	49.2 (8.6)	50.8 (9.6)	+2.7 (6.4)	+4.3 (6.3)	+1.6 (6.4)	7.86	<0.001	0.04

Note. M = Mean; SD = Standard Deviation; ^a Score range = 10 - 40; ^b score range = 2 - 36; ^c Removed 12 participants who were not sexually active at T0; ^d PROMIS measures reported as standardized t-score with mean = 50 and SD = 10; ^e Removed 1 outliers with high low fatigue at T0; ^f Removed 1 outlier with low anxiety at T0; *significantly ($p < .05$) different from T0; η^2 = eta-squared effect size

Association between change in physical activity and change in quality of life. There were moderate correlations between change in strength training and change in fatigue ($r = -0.44$) and anxiety ($r = -0.59$) from T0 to T1. **Table 11** presents Pearson correlation coefficients between changes in physical activity outcomes and changes in quality of life outcomes. A linear regression model exploring the association between change in days per week of strength training and change in fatigue from T0 to T1 was significant ($F(1,29) = 6.87$, $SEE = 8.02$, $p < 0.01$) with an R^2 of 0.16. Change in days per week of strength training was negatively associated with change in fatigue from T0 to T1 ($\beta = -3.39$, $SE = 1.29$, $t = -2.62$, $p <$

0.01), with increases in strength training associated with reductions in fatigue over time. For every 1 day per week increase in strength training, there was a 3.39-point decrease in fatigue, and the change in strength training explained 16% of the variance in change in fatigue. A separate linear regression model exploring the association between change in days per week of strength training and change in anxiety was also significant ($F(1, 29) = 15.45$, $SEE = 8.24$, $p < 0.001$) with an R^2 of 0.33. Change in days per week of strength training was negatively associated with change in anxiety from T0 to T1 ($= -4.95$, $SE = 1.26$, $t = -3.93$, $p < 0.001$), with increases in strength training associated with reductions in anxiety over time. For every 1 day per week increase in strength training, there was a 4.95-point decrease in anxiety, and the change in strength training explained 33% of the variance in change in anxiety.

Table 11. Pearson correlation coefficients between change scores for physical activity and change scores for

Outcome	Body Image		Fatigue		Anxiety		Emotional Support					
	Δ T0 to T1	Δ T1 to T2	Δ T0 to T1	Δ T1 to T2	Δ T0 to T1	Δ T1 to T2	Δ T0 to T1	Δ T1 to T2				
MVPA (min/week) ^a	0.11	0.09	-0.08	0.18	-0.05	-0.05	-0.01	0.05	0.20	0.28		
Strength training (days/week) ^b	-0.29	-0.10	0.15	-0.44*	-0.18	-0.02	-0.59*	-0.12	-0.11	-0.02	0.03	
Stretching & flexibility (days/week) ^c	-0.01	0.10	0.40	-0.04	0.02	-0.02	-0.12	0.08	0.07	0.31	0.04	0.33

Note. Note. a MVPA = Moderate to Vigorous Physical Activity measured with ActiGraph accelerometer, removed 4 outliers due to high activity at T0; b Self-reported, removed 2 outliers with high activity at T0; c Self-reported, removed 3 outliers with high activity at T0; * $p < .05$

Exploratory Aim Results: Multimethod Process Evaluation of Peer Mentor Adaptations and Intervention Delivery

Description of the dataset

The process evaluation incorporated data from multiple methods including peer mentor electronic field notes (n = 160), the project manager's structured reviews of video-recorded peer mentoring sessions (n = 54), and the project manager's periodic reflections composed throughout the intervention (n = 13).

Adaptations

Triangulation across process data sources revealed five key adaptations made to the Pink Body Spirit program and its delivery. **Table 12** describes each adaptation using constructs adapted from the Wilstey Stirman FRAME.¹⁶⁶ All adaptations were made during intervention delivery (October 2019 – April 2020).

Key adaptations made by peer mentors to increase engagement in the Fitbit Community included adding more open-ended prompts in the Fitbit Community and adding Fitbit Challenges within the Fitbit app. Key adaptations made by the research team included matching mentors and mentees based on scheduling compatibility, expanding the content of the technology support session, and expanding the intervention toolbox and more deliberately encouraging peer mentors to use it. Due to the small number of peer mentors and condensed timeline of this pilot study, the research team determined it was more feasible to match mentors and mentees based on scheduling compatibility. This adaptation was intended to minimize the delay between baseline measures and starting the intervention and to promote retention. The second adaptation by the research team was to expand the content of the technology support session to add more information and technical support related to the Fitbit and the active minutes metric. This adaptation was made because a few months into the study, it became apparent that some participants did not have a clear understanding of the

study's focus on active minutes or how to self-monitor their active minutes on their Fitbit tracker and app. Understanding how to use these features of the Fitbit that facilitated behavior change strategies was critical for participants to gain full benefit from the intervention, including peer mentoring sessions focused on setting active minute goals and receiving feedback on active minutes from their mentor between sessions. Further, results of the mixed methods acceptability evaluation found that participants desired additional technical support for using the Fitbit beyond the printed instruction manual included with the tracker, links to the Fitbit website, and a study-specific printed manual.

The final adaptation made by the research team was to expand the intervention toolbox and more deliberately encourage peer mentors to use it. The process evaluation revealed that some peer mentors did not know how to use the toolbox or did not use it as intended; for example, some peer mentors offered exercise equipment to mentees that was not related to their individualized exercise action plan or sent equipment as an "apology" upon missing a scheduled session with their mentee. A few participants reported they did not use toolbox resources that were sent by their peer mentors because they did not know how to use the resources, or they were not relevant to their exercise goals and action plan. A few peer mentors expressed disappointment that the Fitbit Premium subscription service, which offers additional health and fitness-related content in the Fitbit app, was not available as part of the toolbox because it was cost prohibitive.

Table 12. Key adaptations made to the Pink Body Spirit intervention and its delivery

What was the adaptation?	Matching mentors and mentees based on schedules	Posting more open-ended prompts in the Fitbit Community	Expanded content of technology support session	Added Fitbit Challenges	Expanded Toolbox and deliberately encouraged peer mentors to use it
<p>Who made the adaptation?</p> <p>How was the adaptation made?</p>	<p>Research team</p> <p>Schedule preferences were used as the primary criteria for matching mentors and mentees instead of age. Given the small size of the peer mentor team for this pilot study, the ages of available peer mentors were not always aligned.</p>	<p>Peer mentors</p> <p>Peer mentors posted open-ended prompts to the Fitbit Community on a regular schedule so that participants would have ideas of what to post, e.g., "Post a picture of somewhere you've been active this week." The peer mentor team brainstormed a list of prompts and one of the peer mentors created a schedule for who should post when.</p>	<p>Research team</p> <p>An extra 5-10 min. of content was added to the tech. support session completed with research staff before first mentoring session. The extra content oriented participants to the study focus on Fitbit's "active minutes" metric and help them set up their Fitbit tracker & app to prominently display active minutes. They were also told they would be setting goals with their peer mentor to increase active minutes and were asked to consider what types of activities they would like to try.</p>	<p>Peer Mentors</p> <p>A few peer mentors initiated Fitbit Challenges in the Fitbit app with their own mentees around the holidays, e.g., "Holiday Hustle". Many participants liked the Challenges and peer mentors wanted to expand to all interested participants. A peer created a plan and schedule for how challenges would be organized each week, including which mentors would invite which mentees, and directions to the other peer mentors for how to organize a Fitbit Challenge.</p>	<p>Research team</p> <p>Research team created YouTube playlists. Project manager provided booster training at peer mentor team meeting on how and when to provide toolbox resources to participants. Project manager implemented regular reminders and standardized process for peer mentors to request toolbox resources.</p>
<p>When was the adaptation made? *</p>	<p>During intervention (Dec 2019)</p>	<p>During intervention (Jan 2020)</p>	<p>During intervention (Dec 2019)</p>	<p>During intervention (Dec 2019)</p>	<p>During intervention (Dec 2019)</p>

* Note. Active intervention period: October 2019 – April 2020; follow-up period: January 2020 – July 2020

Table 12. Key adaptations made to the Pink Body Spirit intervention and its delivery (continued from previous)

What was the adaptation?	Matching mentors and mentees based on schedules	Posting more open-ended prompts in the Fitbit Community	Expanded content of technology support session	Added Fitbit Challenges	Expanded Toolbox and deliberately encouraged peer mentors to use it
Why was the adaptation made?	To enable participants to be matched with any available mentor as soon as possible, to minimize the delay between baseline measures and starting the intervention, and to promote retention. This was primarily a feasibility issue.	There was low engagement in the Fitbit Community, with most posts created by peer mentors and a very small group of participants. Some participants and mentors stated that they did not know what type of posts to create in the Community and wanted to get to know others in the Community. Goal of adaptation was to increase engagement in the Community by providing more structure.	Participants did not consistently understand study focus on active minutes, so goal setting & feedback from mentors about active minutes were unclear or confusing for some women. Participants needed to understand active minutes and have Fitbit set up at start of study so they could focus on goal setting & action planning with their mentor. Some wanted more Fitbit tech support at start of study.	To increase engagement with Fitbit app and Fitbit Community by offering an optional opportunity for friendly competition and interaction with other participants and mentors.	Use of intervention toolbox was low and inconsistent. During mentoring sessions, participants reported numerous barriers to exercise such as adverse weather and lack of access to equipment. To better integrate toolbox into the flow of the intervention, peer mentors needed more direction and reminders to use the toolbox to help participants overcome barriers.
Process data source(s) used to capture adaptation	Project manager's templated reflections	Project manager's templated reflections, qualitative interviews with participants	Project manager's templated reflections, review of video recorded sessions, qualitative interviews with participants	Project manager's templated reflections, peer mentor field survey, qualitative interviews with participants	Project manager's templated reflections, peer mentor field notes, qualitative interviews with participants

Note. Active intervention period: October 2019 – April 2020; follow-up period: January 2020 – July 2020

Barriers & Facilitators to Intervention Delivery

Barriers and facilitators to intervention delivery by peer mentors gleaned from process data are summarized below. Supporting quotes from peer mentor electronic field notes are presented when available; the presence or absence of quotes does not signify the relative importance of the idea presented. No quotes were available for some categories. Quotes are presented verbatim from the peer mentor's field note unless indicated by an ellipsis (...) to signal that small segments of the text have been removed to enhance clarity or facilitate deidentification.

Communication, organization, and preparation. Consistency of communication and communication preferences acted as both barriers and facilitators to intervention delivery. In this study, peer mentors were required to regularly communicate with their mentees, the peer mentor team, and the research team. There were set expectations for communication (e.g., checking institutional email at least weekly, confirming sessions with mentees, contacting mentees with additional support between sessions, providing updates to study team when requested, reaching out for technical support, etc.). Peer mentors who did not consistently communicate with the different stakeholders in the study (i.e., the project manager/research team or other peer mentors) or in the expected frequency were challenged in intervention delivery. In contrast, those who proactively communicated with and were regularly responsive to their mentees, colleagues, and the research team were more successful in intervention delivery.

Regarding communication between mentors and mentees, peer mentors' communication preferences acted as both a barrier and facilitator to intervention delivery. There were multiple potential communication channels that peer mentors and mentees could use (e.g., phone, text, Fitbit app, email). When mentors and mentees did not discuss their preferred and back-up communication channels, both mentors and mentees reported

frustration. When preferred communication channels were discussed but there was a mismatch between a mentor and a mentee's preferred communication methods, this also impeded effective intervention delivery. For example, in a case where a mentee preferred email, but her peer mentor preferred Fitbit private message, Fitbit messages sent by the mentor were not received by the participant because the participant was not checking her Fitbit private messages. In this case, both the mentor and the mentee reported difficulty communicating and both were dissatisfied. When there was a mismatch between preferred communication channels, there were fewer interactions between scheduled sessions. Participants who did not receive additional contacts throughout the study reported feeling less support and accountability from their mentor.

Organizational skills were also key determinants of successful intervention delivery. Highly organized peer mentors were adequately prepared for sessions, showed up on time, completed proper documentation and related tasks after the session, and communicated with participants and documented contacts between sessions. Peer mentors who were adequately prepared for sessions had reviewed their mentee's Fitbit activity on Fitabase and notes from the previous session, reviewed motivational interviewing skills, and logged into all required technology systems prior to the start of the session. The ability to stay organized was a prominent facilitator to effective intervention delivery. Peer mentors who had difficulty staying organized found that it was a barrier to intervention delivery because it led to being unprepared, forgetting about sessions, or showing up for sessions on the wrong day or time (sometimes due to forgetting that a participant was in a different time zone or not documenting it correctly in their personal calendar). In sum, successfully delivering this intervention required a high level of organization to carry out several sequential steps.

Life circumstances. Differences in peer mentors' life circumstances were another barrier to intervention delivery and impacted their ability to successfully carry out their

mentoring duties. As younger breast cancer survivors themselves, peer mentors faced many of the same challenges as their mentees including competing demands of this busy life stage and late effects of cancer treatments. Sometimes peer mentors did not have time to prepare for sessions, forgot about a session, or had to cancel a session due to unexpected events in their own life. All mentors experienced personal scheduling challenges at some point in the study and had to contend with stressful employment, caregiving, and/or health-related issues. The COVID-19 pandemic added an additional layer of complexity to peer mentors' life circumstances as many experienced changes to their jobs, family lives, and health that presented both barriers and facilitators to intervention delivery (see Discussion for further discussion of the impact of the COVID-19 pandemic on the study). Furthermore, sessions were sometimes interrupted by a peer mentor's family members, or peer mentors reported feeling tired, anxious, or sad due to personal life challenges that were not related to the study.

For instance, one peer mentor noted: "As soon as I got on the Zoom call, all heck broke loose with the kids and I could hear them screaming and fighting. I tried my best to keep it together, but I was clearly frazzled." Another shared: "She and I were both sleepyheads for this one. I had also just rushed home and didn't feel like my 100% was as good as usual."

Moreover, ebbs and flows in each peer mentor's life circumstances and subsequent fluctuations in their availability for peer mentoring impacted the rest of the peer mentor team. The distribution of participants across the five peer mentors over the course of the study was unbalanced because some mentors had more availability than others. Consequently, some mentors were asked to take on a large number of mentees. In total, two mentors had 12 mentees each, one mentor had five mentees, one mentor had four mentees, and one mentor had one mentee.

Additionally, characteristics and life circumstances of *participants* impacted rapport with their peer mentors, and in turn, presented barriers and facilitators to intervention delivery. Peer

mentors exhibited stronger rapport with mentees who were reliable, punctual, and organized. Conversely, peer mentors felt that some participants were not committed to the study; peer mentors had weaker rapport with participants who they perceived were not engaged. Two participants were re-assigned to a new peer mentor because peer mentors were frustrated by the participant's repeated no-shows. One mentor stated:

[Participant] was rather consistent with her workouts but completely inconsistent with her ability to keep a scheduled appointment, get onto a call on time, or frequently check her email for updates or reminders. She would often email back late in the day asking to do her call that day after I had already finished working for the day...Late calls were totally workable if they were scheduled. There were a few times I would give her a range of availability all week, she would ask for something during a time that I had another meeting or personal thing scheduled and I rearranged the event to accommodate her, only to be stood up.

Remote intervention delivery via video. Peer mentors felt deeper connections to participants when both mentors and mentees had their cameras turned on, suggesting that use of video calls during mentoring sessions was a facilitator in this fully remote study. However, there were some barriers to effective intervention delivery via video. As the study progressed, peer mentors became more comfortable with video sessions and some mentors started to feel less confident about a session when a participant's video was turned off. One peer mentor shared: "Much of my mentoring is facial expressions- I really practice active listening, nodding, smiling, etc. so she was not able to see that without the video. However, we still communicated well without visual feedback."

While peer mentors appreciated the flexibility to conduct video sessions from any location, the convenience presented challenges when sessions were conducted outside of the mentor's typical workplace. Poor internet, lighting, or use of a new device exacerbated technical issues and induced extra stress for peer mentors.

Complexity of technology. Peer mentors were required to use many different software and systems to deliver and document intervention sessions and other interactions with

mentees. The sheer number and complexity of these systems, some of which were required for intervention delivery and others which were related to institutional information security guidelines, presented barriers to intervention delivery. The software and systems needed for intervention delivery included a personal computer, Fitbit app on a personal cell phone or tablet, access to participant's Fitbit data through the password-protected Fitabase website, and Zoom. The software and systems needed to comply with institutional requirements for information security and human subjects research included VPN, institutional email account, HIPAA-compliant REDCap database for tracking session notes and participant information (which could only be accessed while on VPN), and secure OneDrive cloud storage to upload video session recordings. All of the institutional systems required use of Duo two-factor authentication. The success of these systems was contingent upon each other and when there was a technical problem with one system, it often caused a problem with other systems. All peer mentors had issues with Zoom recordings at some point in the study. Peer mentors and participants needed to be in a location with a strong internet or data connection for video sessions but could do the session without video if needed or preferred. A peer mentor's level of competency with technology was either a barrier or facilitator to intervention delivery. Both peer mentors and mentees had issues with technology and Fitbit app notifications that impacted intervention delivery. For example, some participants and peer mentors did not see private Fitbit message push notifications. Peer mentors used their non-institutional/personal email account and personal cell phone to overcome intervention and institutional-related technology barriers as needed. The project manager was heavily involved in remedying all types of technical problems.

Team meetings and intervention support. During the intervention period, the project manager led structured, regular team meetings to brainstorm strategies for difficult participants and solutions to common challenges. These meetings were a facilitator to effective

intervention delivery. Peer mentors also felt that receiving constructive individual feedback from the project manager, who reviewed video recorded sessions and audited the intervention tracking database, supported their success. During the follow-up period, once all participants had completed the intervention, leadership of team meetings transitioned from the project manager to the peer mentors. Lack of structure and irregular scheduling of team meetings during the follow-up period resulted in low attendance by mentors. Some peer mentors expressed frustration and lack of motivation to attend team meetings when the purpose and direction of such meetings was not consistently clear.

Motivational Interviewing (MI) skills. Comfort with and use of MI skills during mentoring sessions varied between peer mentors. Peer mentors expressed disappointment when they perceived they were not using MI skills effectively or did not know how to respond or redirect conversations when participants got off topic. Some stated that their MI skills did not feel "natural" and they needed reminders prior to sessions to use these skills because they were only conducting occasional intervention sessions with participants in the part time peer mentor role. Perceived inability to effectively use MI skills during sessions was a barrier to intervention delivery. On the other hand, mentors who felt confident about their MI skills expressed that MI techniques were helpful in the sessions; in these cases, strong MI skills and confidence in their use were facilitators to intervention delivery. For instance, one peer mentor shared: "I was so very happy with this first meeting. It felt natural overall, even when delicate topics were brought up by participant. The motivational interviewing skills definitely helped me with this one. When I didn't know what to say, rephrasing her words helped her to feel understood. It also gave me the opportunity to gently guide the conversation to something more positive."

Self-disclosure. Another barrier peer mentors encountered was uncertainty in determining how and when to disclose their own experiences with their mentees. Some mentors were able to navigate this ambiguity more comfortably than others. A few mentors did

not feel comfortable bringing their own experience into the peer mentoring relationship at all, while others tried not to share about themselves but did so inadvertently. One peer mentor expressed: "I thought the session felt very genuine. I do have some hesitation about sharing about me as I don't want it to turn to me. I think I did fairly well at keeping it centered on [my mentee], but we had so much in common I wanted to talk to her forever and ask her so much about her interesting life. I had to be mindful of the direction and the goals of the project."

Role in the Fitbit Community. Peer mentors' interest and enjoyment in providing social support to mentees in the Fitbit Community was a facilitator to intervention delivery. However, peer mentors did not consistently understand expectations for their involvement in the Community, such as what and when to post and how to engage participants, which hindered effective intervention delivery. Early in the study, confusion about the scope of the Community led to posts that were unrelated to exercise or endorsements for specific products or businesses; this resulted in the creation of more explicit Community guidelines and guidance about what to post. In these ways, peer mentors' uncertainty about their role in the Fitbit Community was a barrier to intervention delivery. Further, some peer mentors were disappointed by low engagement in the Fitbit Community. The low engagement and resulting disappointment reduced their motivation to post and engage in the Fitbit Community as a peer mentor. The adaptation to the Fitbit Community that resulted in a specific list of topics and schedule for posting helped peer mentors better conceptualize their role in the Community and was a facilitator to improved delivery of this intervention component.

Passion and desire to help others. Peer mentors were women who were connected to and selected by Haus of Volta to serve as peer mentors due to a strong desire to give back to their community. While peer mentors received modest compensation for their time, all peer mentors expressed enthusiasm for contributing to research about how young breast cancer survivors can support each other to become more active. The peer mentors' passion for their

involvement in the project was a facilitator of intervention delivery and helped them stay positive and engaged in their role despite the many barriers they encountered.

DISCUSSION

Overview

To our knowledge, this is the first study to assess the feasibility and acceptability of a fully remote physical activity intervention using trained peer mentors and technology among younger breast cancer survivors. This study showed that it was feasible to recruit and retain younger breast cancer survivors into the 3-month intervention. The theory and technology-based, peer-led intervention approach was acceptable, as demonstrated by high adherence to intervention components and positive feedback from qualitative interviews and satisfaction surveys. Women in this study increased objectively measured and self-reported physical activity and showed meaningful improvements to body image, fatigue, anxiety, and emotional support. Five key adaptations were made to the intervention over the course of delivery. This study identified several barriers and facilitators to effective intervention delivery by peer mentors related to communication, preparation and training, complexity of technology, and life circumstances. The discussion section of this dissertation triangulates and synthesizes results from the three aims and describes strengths and limitations of the methodologies used, implications of the findings, and suggestions for future research.

Recruitment and Retention

Consistent with our hypothesis, this study was feasible to conduct and acceptable to participants. The highest number and proportion of women screened and enrolled were recruited through social media. Recruitment was led by co-PI SN, a young breast cancer survivor and leader of Haus of Volta who was embedded within numerous young breast cancer survivor advocacy communities. A few participants learned of the study through Haus of Volta's own Facebook and Instagram feeds, but most women recruited through social media heard about the study from SN's posts in other private young breast cancer survivor Facebook groups. SN's first-hand knowledge of which virtual communities would produce the best yield,

as well as her access to these closed communities, were important factors that contributed to efficient recruitment observed in the present study. UC San Diego research staff likely would not have had the same level of access to virtual young survivor communities and did not make any of the social media posts. Many women who saw the study promoted in one of the survivor advocacy Facebook groups in which SN posted re-shared the information on their own profiles and with other groups, far extending the reach of the original posts.

Our success with social media recruitment is consistent with previous studies showing that social media is a fruitful strategy for recruiting young adult female cancer survivors into remote, nationwide research studies, particularly when conducted in partnership with young cancer survivor advocacy organizations.^{168,169} The yield in this study (54% of women screened were enrolled) was much higher than two other face-to-face studies in breast cancer survivors (of all ages) conducted at UC San Diego that enrolled 9.5%³³ and 16%¹⁷⁰ of those screened, respectively. A previous home-based exercise intervention conducted by Pinto and colleagues¹⁷¹ concluded that social media was not an effective strategy for recruiting breast cancer survivors. However, their study was not specifically targeting younger cancer survivors, whose technology use is nearly ubiquitous,⁹⁵ nor did they partner with cancer survivors to tap into virtual support groups on social media. The success and efficiency of social media recruitment in our study highlights the importance of having community members play a key role in defining *and* implementing recruitment strategies.

Our community-academic partnership was committed to inclusivity and aimed to design and test an intervention that can be scaled up to reach survivors across the United States. In support of these goals and to increase the ecological validity of the findings, the study had few eligibility criteria. The high proportion of women eligible in a short time frame suggests that the recruitment methods yielded suitable women for the study very rapidly and efficiently. Additionally, we found that having women contact research staff via email or phone and using

an online scheduling platform (Calendly) to have participants schedule a time for phone screening increased efficiency for study staff and participants. This strategy is highly recommended for future studies. Finally, retention in our trial (91% at 6 months) was comparable to that achieved by Rabin et al.²⁸ in their 12-week physical activity intervention with younger cancer survivors and higher than other physical activity intervention studies in younger cancer survivors which had retention rates of 77%.^{29,30} The excellent retention demonstrates that remote measures were feasible and participants were highly committed to the study, even throughout the COVID-19 pandemic.

Adherence, Engagement, and Acceptability

Peer mentoring

Participants had high adherence to completing peer mentoring sessions and reported positive experiences working with their peer mentors. Both peer mentors and mentees sought deeper personal relationships with each other. However, some peer mentors expressed uncertainties about how and what to self-disclose, and a few participants were unaware their peer mentor was also a younger breast cancer survivor. Role models who are perceived as similar, such as peer mentors, may have unique advantages in promoting behavior change³⁵ and multiple studies have successfully recruited and trained highly motivated, older breast cancer peer mentors to deliver physical activity interventions.^{19,118} Future studies should consider supporting peer mentors in forging closer relationships with mentees by building in a structure for peer mentors to introduce themselves, share their own experiential knowledge about exercising after breast cancer treatment, and leverage the mutual identification that only a peer mentor can provide.^{114,172} Participants felt that working with a peer who was diagnosed with breast cancer at a similar age and life stage was a unique aspect of the program compared to other survivorship programming. Thus, experiential support provided by peer mentors has potential to fill a key gap in current survivorship offerings.

Consistent with research showing that younger cancer survivors have varied needs in the context of behavioral lifestyle interventions,^{8,173} women in this study had different preferences for the frequency and intensity of peer mentoring sessions and other intervention contacts they felt they needed to succeed. Participants found that through the program, they learned behavioral strategies that will help them maintain their activity after the study; some felt they needed a slightly longer intervention period to solidify these strategies. Convenience was another key theme throughout participant feedback. Many participants liked meeting with their mentor every other week, but some wanted to meet with their mentor more often for greater accountability. Others felt they did not have time to meet every week, even though it may have been beneficial. Additionally, women had different preferences for the communication channels they felt were most convenient and easiest to use with their peer mentor (e.g., email, Fitbit message, text, etc.). Zoom video sessions were a universally accepted intervention delivery channel. Participants and peer mentors appreciated the convenience of scheduling virtual mentoring sessions through Zoom and felt that video helped them feel more connected than talking on the phone because they could make eye contact and see each other's facial expressions. Yet there were also some barriers to effective use of video sessions in this study. While remote intervention delivery was intended to help participants overcome established barriers to participating in health behavior interventions (e.g., time pressures, competing demands, and transportation),^{9,126,174} some participants still had difficulty committing to the intervention amidst many other time and energy constraints. Overall, despite high motivation and interest in engaging in physical activity, like many younger breast cancer survivors,¹⁷³ participants in our study faced numerous conflicting priorities that made it difficult to fit the program into their lives at times. These findings illustrate that simply delivering the intervention through more flexible, technology-based channels such as video conferencing and the Fitbit app did not fully eliminate common barriers to engaging in

behavioral interventions among our sample of younger breast cancer survivors. Our results underscore the need for supportive programming that is targeted to younger breast cancer survivors but also contains options for tailoring to individual preferences.

To increase accountability, peer mentors were trained to provide feedback to participants based on their Fitbit data between scheduled mentoring sessions, generally through email or private Fitbit message.^{32,175} In line with Control Theory, the brief contacts between sessions were designed to facilitate feedback loops to alert participants to discrepancies between their actual performance and their activity goals to support behavior change.^{34,87} However, these contacts were not consistently delivered by peer mentors, which resulted in participants receiving varying intensities (i.e., doses) of some of the prescribed, theory-based intervention components and different amounts of accountability.

Communication-related challenges such as insufficient communication between peer mentors and mentees regarding preferred communication methods (e.g., email vs. Fitbit private message), mismatch in preferred communication methods, and technical challenges (e.g., issues with notifications) presented barriers for peer mentors to providing consistent and effective feedback to participants. The study was designed to offer as much flexibility as possible for peer mentors and mentees to communicate in ways that were convenient to them in the context of their busy lives. However, the multitude of options instead created opportunities for communication mismatches and unclear expectations on the part of participants and peer mentors.

Moreover, as young breast cancer survivors themselves, peer mentors experienced some of the same life circumstances as participants, most notably lack of time and competing demands, that occasionally impacted their ability to consistently deliver the intervention in an effective manner. While we intended to pair mentors and mentees based on similar age, this matching strategy was not feasible. We therefore adapted the study protocol to match peer

mentors and mentees based on scheduling compatibility, but peer mentors continued to experience scheduling challenges and confusion about participants' time zones throughout the study. To meet participants' preferences and reduce burden on peer mentors, future studies could consider using technology to deliver tailored, data-driven feedback using a participant's preferred communication platform (e.g., email, text, Fitbit private message, etc.). The frequency and intensity of intervention contacts to promote accountability could be adaptive and tailored to participants' preferences assessed at the beginning or over time. For example, a Just-In-Time Adaptive Intervention could provide support to individuals when they need *and* can act on the support provided.^{176,177} Alternatively, the timing, content, and delivery channel of intervention feedback could be adjusted dynamically throughout the study based on a participant's progress toward their individual activity goals, such as through "continuous tuning interventions" that use a participant's data and real-time optimization algorithms to "tune" the intervention to meet the needs of the participant.^{178,179} Using algorithms and technology to facilitate feedback loops could also increase the likelihood that intervention components are delivered consistently and with higher fidelity.¹⁸⁰ Related concepts are currently being tested in an ongoing study in young cancer survivors using activity tracker data to determine the frequency and content of text messages and to tailor feedback to participants.¹⁸¹

In sum, while remote delivery through video and technology was acceptable and more convenient than a traditional face-to-face intervention, some barriers to participation and intervention delivery persisted. Peer-to-peer support was highly accepted. Our findings highlight the importance of training peer mentors on how, when, and what to share about themselves to activate the unique peer mentor connection. Future research should ensure peer mentors prioritize effective communication with mentees and facilitate proactive discussions about expectations for communication, including preferred and back-up channels and response times. Further leveraging technology for intervention delivery, beyond Zoom

video sessions and the suite of Fitbit tools, could help overcome some of the observed logistical challenges with provision of Fitbit feedback and provide greater opportunities for individual tailoring.

Fitbit

Across the study sample, objectively measured adherence to wearing the Fitbit was generally high and stable over the 12-week intervention period. While previous interventions in young cancer survivors²⁹ and general cancer populations¹⁸² have targeted increasing steps, our study found that increasing active minutes was a well-liked and feasible intervention target in our sample of younger breast cancer survivors. Consistent with other studies showing high acceptability of wearable trackers among cancer survivors in the context of a physical activity intervention,^{183,184} participants in our study reported that the Fitbit tracker and app features used to monitor their active minutes and that support behavior change techniques^{100,185} were highly motivating. An important finding was that some women did not clearly understand the study's focus on active minutes. From participant feedback on the qualitative interviews and satisfaction surveys and through review of video recorded sessions, there was clear variation in how peer mentors oriented participants to the Fitbit during the initial mentoring session. A clear understanding of the study's focus on active minutes and that they would be setting goals with their peer mentor specifically to increase active minutes was central to the participant's understanding of expectations for the program. Additionally, having basic knowledge of the device and how it would be used in the study was required to be able to use the device features that support behavior change strategies. Therefore, the study was adapted to add more instruction regarding active minutes into the technology session at beginning of study. After this adaptation, goal setting and action planning were observed to be more effective, as evident through the project manager's review of video recorded sessions. Peer mentors also felt more confident about delivering the intervention when participants were

prepared for the session. In summary, in the context of a digital health behavior change intervention, it is crucial that sufficient technological support is provided so that participants are comfortable using the technology in the ways intended by the intervention to facilitate behavior change techniques.

The finding that some participants found the Fitbit easy to use and others needed more support setting it up further highlights the diversity of needs and experiences among younger breast cancer survivors. Therefore, it is important to proactively assess a participant's familiarity with wearable trackers and general comfort with technology prior to beginning a tracker-based intervention. To support the development of a less resource intensive, more scalable intervention, future studies could consider creating an intervention-specific Fitbit set-up tutorial video, with brief live tutorials available to participants who self-identify as needing additional assistance with set-up. A tutorial video instead of the technology support session was suggested by participants through the mixed methods evaluation. Of note, only a few participants approached the research team for Fitbit technology support once they started the intervention, and most questions concerned using the Fitbit to track strength training, cycling, or swimming. Findings from the present study indicate a tutorial video should include a thorough introduction to how to use the Fitbit and app to track active minutes, including how to record activities that the Fitbit does not automatically detect. This feature is especially important for younger cancer survivors who are interested in a broad range of activities that are not as easily detected by the Fitbit.⁸⁵ Moreover, another purpose of the technology support call was to ensure participants could connect to a Zoom session in preparation for their first meeting with their peer mentor. Since nearly all participants were familiar with video conferencing software prior to the study or easily familiarized themselves, future studies in this population may not need to conduct a live technology support session with all participants to

test this feature. In the wake of the COVID-19 pandemic, most participants in future studies will have at least a basic understanding of how to use video conferencing software.

Participants in our study showed interest in improving a variety of health-promoting behaviors, such as diet, hydration, and sleep, and reported using their Fitbit tracker and app to monitor these behaviors. Consistent with participant feedback, review of video recordings and peer mentors' field notes as part of the process evaluation showed that participants wanted to set goals focused on nutrition and asked their peer mentors for resources for diet tracking. Some participants were also eager to learn about physical activity guidelines to promote weight loss. Notably, the average BMI of women in our study was 30.2 kg/m², indicating that our sample was obese, on average. Our sample's interest in weight loss echoes a key post-treatment concern among younger breast cancer survivors.^{15,26,51} A systematic review of behavioral weight management interventions in breast cancer survivors found that even with intervention, weight gain is more likely in premenopausal compared to postmenopausal breast cancer survivors.¹⁸⁶ This may be due to treatment differences between younger and older breast cancer survivors. Women who are premenopausal at diagnosis are at risk of early menopause and premature ovarian insufficiency from gonadotoxic treatments such as chemotherapy and/or endocrine therapy.^{47-49,187} Premature ovarian insufficiency has been associated with adverse changes to body composition and energy balance, which could promote weight gain.^{188,189} Since both diet and exercise are important for weight management,¹⁹⁰ future interventions in this population should consider targeting these behaviors in combination and supporting women in setting goals consistent with their own health priorities in survivorship.

Fitbit Community

The Fitbit Community was designed to facilitate social support between participants and all the peer mentors.^{96,191} We expected that having peer mentors lead the Fitbit

Community would result in higher use and overcome limitations of previous physical activity trials in young cancer survivors which included discussion forums^{28,30} or a Facebook group¹⁹² that were either unmoderated²⁸ or moderated by a researcher.^{30,192} Minimal change in physical activity in the three prior interventions in younger cancer survivors may have been related to low or variable use of social support features and therefore, participants receiving an insufficient “dose” of the theory-based intervention needed to promote behavior change. In comparison, participants in the present study did not post often but engaged in the Fitbit Community in other ways that facilitated social support and other behavior change techniques. Additional forms of Fitbit Community engagement in our study included viewing posts to gain ideas for exercise and how to overcome barriers; and viewing the Leaderboard and participating in Fitbit Challenges to receive rewards and recognition. Though these alternative modes of engagement are not reflected in our pre-defined adherence metric (i.e., number of weeks a mentee created a post in the Community), our participants likely received strong “doses” of behavior change techniques that are associated with success in a physical activity intervention.^{193,194}

It has been suggested that intervention usage alone is not a valid metric of engagement in digital behavior change interventions, and that *effective* engagement may be more important for behavior change than simply *more* engagement.¹⁹⁵ Results from our qualitative interviews complemented the quantitative engagement data indicating that participants obtained many benefits from the Fitbit Community such as motivation, inspiration, accountability, and encouragement. Participants wanted to forge deeper connections with other participants and the peer mentors. Further, the qualitative results illuminated several of participants’ barriers to posting in the Fitbit Community including discomfort with posting information about themselves to an unknown audience, not having enough time, forgetting to post, or difficulty accessing the Community within the Fitbit app. Peer mentors similarly felt that

the Fitbit Community was a positive aspect of the program and enjoyed supporting all the mentees and other peer mentors. However, peer mentors did not fully understand their role as Community moderators, including the type and frequency of posting that was expected of them. In response to low engagement and to provide more structure, the peer mentor team made two adaptations to the Community: posting more open-ended prompts and initiating Fitbit Challenges. Research has shown that posts soliciting participant feedback, such as polling features and questions to answer, elicit the most engagement in virtual forums within digital health behavioral interventions.^{196,197} After the adaptations were implemented, there was only a slight increase in the number and frequency of posts in the Fitbit Community. Persistent low volume of posts may have been related to the timing of the adaptations. By the time the adaptations were made, some participants were nearing the end of their 12-week intervention period. Having not felt a connection with the Community earlier in the program, some participants may have already made the decision not to engage in this intervention component. Participants also had to be regularly accessing the Fitbit Community to see the change in post types, otherwise they may not have been exposed to the adapted posts. Finally, it is also possible that our sample was too small to reach the “critical mass” of participants needed to generate and sustain an active and vibrant virtual community.¹⁹⁸

Overall, these results highlight the need to better facilitate connections between participants to help them feel comfortable engaging in a virtual community with other young survivors. To overcome participants’ hesitation about interacting with unfamiliar women, future studies could consider enrolling participants in small cohorts. Women who are discouraged by social comparisons may have more positive experiences if competitive elements that show comparisons (e.g., viewing one’s ranking on the Leaderboard or Fitbit Challenges) are used in the setting of a smaller, more familiar group.¹⁸¹ In future studies, when a new participant joins the Community, their peer mentor should also be required to create an introductory post

welcoming and establishing the participant in the Community. Another strategy to help participants feel more comfortable and that may also address some of the other stated barriers to posting such as lack of time or difficulty accessing the Community, would be to host the Community within a closed Facebook group. Several women felt that Facebook would allow for easier sharing of personal information and would be more convenient to access than the Fitbit Community. Most participants in this study were recruited through Facebook groups hosted by cancer non-profit organizations and other advocacy groups, indicating that many participants already use Facebook to connect with other survivors. Our participants' enthusiasm for reciprocated social support for physical activity through a closed Facebook group is consistent with the high acceptability of a Facebook-based exercise intervention in younger cancer survivors conducted by Valle and colleagues,¹⁹² as well as formative research among general breast cancer survivor populations.⁹⁶ Moreover, unmet needs for additional structure and guidance around posting emphasize the importance of providing clear instructions for how to access and engage in a virtual Community. It is also crucial that peer mentors model the posting behavior and engagement that is expected of study participants.

Toolbox

The intervention toolbox was intended to be used by peer mentors to tailor the intervention to each participant's individual needs and action plan and help them overcome their specific barriers to activity. However, toolbox resources were not consistently offered to participants in this study and some participants who received resources did not know how to use them. Much like the confusion that resulted from the multitude of possible communication channels between mentors and mentees, the flexibility of the toolbox had the unintended consequence of making it more difficult for peer mentors and mentees to use. Early in the study, peer mentors did not grasp what constituted an appropriate toolbox resource and how the toolbox should be used in the intervention. Once the booster training on the toolbox was

completed and toolbox protocols were clarified, there was an increase in the number of women receiving toolbox items that they found useful. Our approach of offering peer mentors the opportunity to personalize the intervention for each of their participants through the use of no- or low-cost resources (up to US \$40) is similar to the flexible toolbox approach employed in the highly effective Diabetes Prevention Program (DPP) behavioral weight loss program.¹²⁹ The DPP study encouraged interventionists to tailor the program for each participant throughout the intervention via no- or low-cost resources (Level 1) or approaches that had an extra time or added cost involved (Level 2). As in our study, DPP interventionists were provided a fixed budget for toolbox resources (US \$100 per year).¹²⁹ Interestingly, most toolbox resources accessed were Level 1 approaches; fewer than 10% of all DPP participants received added-cost resources during the first four months of the trial, though this increased over time as participants encountered more barriers to behavior change.¹⁹⁹ The results from the DPP trial highlight the value of a toolbox consisting of lower-cost resources to support behavior change. In our study, about one-third of participants received added-cost exercise resources (exercise materials or paid exercise app). Qualitative feedback revealed that some participants did not know how to use the resources provided; thus, the proportion of participants that used (vs. received) an added-cost resource as part of the present intervention was certainly less than one-third. To support the development of a scalable intervention that is more structured but still provides opportunities for personalization, future studies should consider building out a “menu” of theory-based, low-cost options that peer mentors can offer for additional support. A menu of options could increase utilization of the toolbox by providing more structure for peer mentors regarding which resources are available and appropriate to offer, and address participants’ concerns about not knowing what activities to try. Overall, participants in our study were able to achieve substantial increases in physical activity without

high use of added-cost resources, suggesting that added-cost resources may not be required to help participants overcome barriers to behavior change.

Physical Activity

To our knowledge, this is the first exercise intervention to demonstrate increases in objectively measured MVPA in younger breast cancer survivors. Prior to our study, only three published trials tested a physical activity intervention in younger cancer survivors²⁸⁻³⁰ and just one used an objective measure of physical activity but did not report complete outcome data, precluding comparisons to other studies.³⁰ Only one trial found significant between-group differences in change in self-reported physical activity between the intervention and control groups.³⁰ Among the previous trials, mean increases in self-reported physical activity in the intervention group ranged from +67.0 min/week to +113.8 min/week, which were much greater changes than the +39.7 min/week increase in objectively-measured MVPA observed in the present study. However, self-reported measures of MVPA and accelerometers may estimate different minutes per day of MVPA, so caution must be taken when comparing the magnitude of MVPA intervention results from different measurement methods.^{200,201}

Participants in Pink Body Spirit were encouraged to increase their activity over time to achieve at least 150 minutes of MVPA per week at 12 weeks, consistent with aerobic exercise guidelines for cancer survivors to improve a range of health outcomes.¹²⁴ While the intervention emphasized MVPA and did not provide specific guidance around strength training, participants reported increases in strength training and stretching & flexibility exercises. However, the prevalence of these exercises in our study population was quite low. At baseline (T0), about 85% of participants reported no recent strength training and about 80% of participants reported no recent stretching & flexibility exercises. Furthermore, nearly a quarter of women in the current study reported no strength or flexibility exercises at all time points, meaning they started at 0 days per week and never improved in either category of activity.

None of the prior trials in young cancer survivors assessed these outcomes and among the large body of epidemiological and intervention research on physical activity and breast cancer survivorship, most studies have focused on aerobic exercise and MVPA.⁷⁴ Given the potential for strength training to improve a multitude of cancer-related health outcomes¹²⁴ and young cancer survivors' high interest in interventions that involve strength & flexibility exercises,⁸⁵ future interventions in young cancer survivors should include explicit guidance, support, and accountability for pursuing these types of exercise activities.

While participants significantly increased their MVPA, strength training, and stretching & flexibility exercises from baseline (T0) to 3 months (T1), overall, most participants' activity levels remained below physical activity guidelines¹²⁴ and only five participants met the guidelines at 3 months (T1). The low levels of physical activity observed in this study are consistent with data showing only 22.3% of cancer survivors meet federal guidelines for aerobic and strength training exercises, which is lower than similarly-aged adults without cancer (27.8%).²⁷ Effect sizes in this study for physical activity outcomes were quite small ($\eta^2 = 0.06$, $\eta^2 = 0.14$, and $\eta^2 = 0.11$, respectively). The small effect sizes are not unexpected given the small sample size of our study and that it was not powered to detect statistically significant changes in physical activity over time. As the first physical activity intervention trial among younger breast cancer survivors to report intervention effects on objectively-measured MVPA, these results represent a novel contribution to the field. Our findings provide further evidence that objectively-measured and self-reported physical activity outcomes are sensitive to change in younger breast cancer survivors and are feasible intervention targets for future research.

Quality of Life

Although the present one-arm feasibility trial was not powered to detect statistically significant improvements in quality of life over time, it is promising that participants reported statistically and clinically meaningful improvements in several domains. To our knowledge, this

is the first study to assess changes in body image in a physical activity intervention in younger cancer survivors. Participants reported improvements to self-image and body confidence during qualitative interviews that were also reflected on the BIS. A total BIS score of ≥ 10 has been classified as body image distress.¹⁴⁸ Among our sample, the average BIS score at baseline was 17 and was reduced to 13 at 3 months and 11 at 6 months. Thus, participants in our study were highly distressed at baseline and despite reductions in body image concerns over the course of the study, continued to experience high levels of distress at 6 month measurement. Given the high burden of body image concerns evidenced in this study and in the broader literature,⁵⁶ as well as the lack of evidence-based interventions to ameliorate this prominent issue, future fully-powered trials should continue to measure impacts on body image among younger breast cancer survivors. The BIS, which showed high internal consistency and sensitivity to change over time in our sample, is a suitable measure for future trials.

Our study used the FSFI to assess sexual function and found there were no changes to sexual function over time. However, the FSFI was not an appropriate measure in our sample given that about over one-third of women in the study were not sexually active at baseline. There are many documented problems with using the FSFI in a sexually inactive sample.¹⁵⁴ Ramifications of using the FSFI in our study are further described in the Limitations section. A sub-group analysis that was limited to women who were sexually active at baseline similarly indicated there were no changes over time. Prior to this trial, no physical activity interventions in younger cancer survivors have assessed impacts on sexual function. Additional studies using larger samples and more rigorous measures are needed to assess if physical activity can improve this highly prevalent and impaired aspect of quality of life in younger breast cancer survivors.⁶

Participants in this study also showed clinically meaningful improvements²⁰² in fatigue and anxiety, assessed with the PROMIS-Cancer CAT measures, and improvements in both domains were maintained from 3 months and 6 months. Participants also reported increased vitality and energy, improved mood, and lower stress in qualitative interviews. These promising findings extend the limited knowledge to date about quality of life improvements among younger cancer survivors participating in a physical activity intervention. Results from the few published interventions in young survivors have been mixed, with two interventions finding trends toward improvements in mood (POMS-total^{28,30} and POMS-fatigue subscale²⁸) and one (Functional Assessment of Cancer Therapy-General)²⁹ finding null results. Only one of these trials found evidence of between-group differences in change in physical activity and there was variable engagement with intervention components. Thus, it is not surprising that there were limited improvements to quality of life in those trials. Further, the high burden of anxiety and depression reported in our sample at baseline is consistent with other studies in younger breast cancer survivors,²⁶ underscoring the pressing need for interventions that can address these quality of life concerns. In an exploratory analysis, our study found that from baseline to 3 months, increases in strength training were associated with reductions in anxiety and fatigue. However, these findings should be interpreted with caution, as the proportion of the total sample performing strength training exercises in the present study was quite small. Additional, fully-powered trials assessing the impact of physical activity on depression and anxiety and potential mediators and moderators of intervention effects among younger breast cancer survivors are warranted.

Furthermore, women in our trial reported increases in perceived emotional support, assessed with the PROMIS-Emotional Support CAT measure. This result complements other findings of the present study that showed high engagement with intervention components designed to provide social support, such as completing mentoring sessions and regularly

reading or scrolling through posts in the Fitbit Community. In the mixed methods acceptability evaluation, many participants reported that components that targeted social support (e.g., peer mentoring, connecting with other younger survivors, Fitbit Challenges) were among their favorite aspects of the program. Taken together, these results suggest that intervention components intended to facilitate social support in this study were acceptable to participants and that participants reported increases in emotional support over time. Social support is especially important for younger cancer survivors, who often report social isolation during and after treatment, and have reported social support as a facilitator of health behavior change.²⁰³ Multiple types of social support (e.g., emotional, tangible, and informational) can provide benefits to young women diagnosed with breast cancer.²⁰⁴ The Pink Body Spirit multicomponent intervention likely facilitated several types of social support. To enhance our understanding of how physical activity interventions can improve various dimensions of social support, researchers should consider using measures that assess more than one type of social support.

Moreover, congruence between quality of life improvements reported in qualitative feedback and improvements on validated survey measures corroborates the meaningfulness of these benefits in the context of our participants' lives. The consistency between qualitative and quantitative findings also suggests there was limited social desirability bias in the qualitative interviews. While interviews were semi-structured and participants were not probed for specific benefits other than the general categories of physical and mental health benefits, they spontaneously identified benefits that aligned with improvements observed through quantitative quality of life measures. The concordance between the benefits participants considered to be meaningful and the quality of life domains we identified a priori, based on the literature and Haus of Volta's personal experiences and interests, increases the validity of our research questions and results in the target population of younger breast cancer survivors.

CBPR Approach

A major strength of this study and contributing factor in its success was the use of CPBR. We worked closely with our community partner to develop the research questions, identify meaningful study outcomes, and determine how the evidence-based exercise program should be adapted to meet the needs of younger breast cancer survivors. The community-academic partnership between Haus of Volta and UC San Diego enhanced the relevance and accessibility of the intervention to the target population. Additionally, using a peer mentor approach increased the impact of the project in the young breast cancer survivor community by providing benefits to both mentors and mentees.¹¹³ Peer mentors gained useful skills to better support each other in making healthy lifestyle choices and improving well-being, in line with Haus of Volta's mission to build capacity among young survivors to promote positive self-image and health after breast cancer treatment. While this dissertation did not formally assess the effects of participation on peer mentors' physical activity and quality of life, other studies have found positive impacts on peer mentors.²⁰⁵ Future studies utilizing peer support should continue to assess physical activity and quality of life outcomes among mentors. A firm understanding of the benefits of becoming a mentor may support peer mentor recruitment and retention in future trials.¹¹³

Mixed Methods Approach

Another key strength was the use of multiple methods and types of data to address our study aims. Our study uniquely captured both participant and peer mentor perspectives on the feasibility and acceptability of the intervention and its delivery. Acceptability was assessed through qualitative interviews and a quantitative satisfaction survey, and benefits to quality of life were explored through qualitative interviews and validated survey measures. As previously noted, using multiple assessment methods (i.e., qualitative interviews and validated outcome measures) to explore benefits to participants enhanced the validity of our findings. Additionally,

the use of standardized, validated measures of implementation outcomes (i.e., FIM and AIM to assess feasibility and acceptability, respectively)¹³³ enhances the potential for these findings to be compared to future studies.

There are also many strengths of the multi-method process evaluation, which incorporated both observational and self-reported data. Self-reported data captured from peer mentor field notes were a relatively time and cost efficient way of gaining the perspective the implementers, although these data are subject to self-desirability bias.²⁰⁶ Observational data gleaned from the project manager's review of video recorded sessions enabled objective assessment of adaptations and program delivery. The videos could be reviewed multiple times, which allowed the project manager to conduct reliability and accuracy checks of the data collected. However, this data collection method is resource intensive as review of each video, even with a templated checklist, was a lengthy process.²⁰⁶ Including periodic reflections as part of the multi-method process evaluation enabled explorations of how the intervention was delivered and adapted in real time. Continuous collection of data across the course of implementation helped minimize recall bias and produced data that were nuanced, detailed, and illustrative of change as events progressed.²⁰⁷ Periodic reflections required minimal resource utilization and could be modified to meet changing study needs, supporting observation and documentation of adaptations over time.¹⁶⁵ Potential bias in periodic reflections from the project manager's interpretations were minimized by having multiple members of the research team contribute to analysis who were able and willing to challenge each other's beliefs and ideas about the data.¹³⁷ Overall, incorporating multiple methods and types of data in the process evaluation helped overcome limitations of using any one method and yielded a rich dataset for exploring the process of intervention delivery.

Limitations

Several limitations need to be considered alongside these encouraging results. Parts of this study occurred during the COVID-19 pandemic. In this dissertation, we refer to the start of the pandemic as March 12, 2020. All participants completed baseline (T0) measures prior to the start of the pandemic. Nineteen participants completed 3 month (T1) measures prior to the start of the pandemic and 12 participants completed T1 measures during the pandemic. All participants completed 6 month (T2) measures during the pandemic. Since all measures were administered remotely and USPS and UPS mailing services were operating as usual, there was no impact on measurement operations, and we were able to collect all outcome data as planned. However, the pandemic undoubtedly impacted our results and the generalizability of the findings outside of the context of the COVID-19 pandemic. Our participants faced various circumstances during the pandemic, and it is not possible to generalize their experiences collectively. Our nationwide sample drew from 15 geographically diverse states with different COVID-19- related restrictions and stay-at-home orders. Some of the many personal impacts participants described included changes to their working hours, work location, amount of work, or employment status; changes to the time and/or location of their schooling or that of their family members; changes to their family life and responsibilities; and changes to their relationships. Some participants reported having more time to exercise and others had less time; access to exercise facilities and options for exercise was also variable. A few participants reported that either themselves or a member of their household contracted COVID-19 and they were required to isolate or quarantine accordingly. In brief, external factors related to the pandemic may have differentially impacted adherence and engagement with the intervention, as well as the results of outcome measures. The COVID-19 pandemic also had differential impacts on peer mentors and their barriers and facilitators to intervention delivery. Some peer mentors experienced changes to their jobs that resulted in more flexibility or availability for

peer mentoring, while some were balancing increased familial responsibilities or other life circumstances that limited their capacity for peer mentoring. This study collected data on participants' experiences during the COVID-19 pandemic through an optional survey and in the qualitative interviews. While analyses of the COVID-19 data were beyond the scope of this dissertation, future analyses can use the COVID-19 data to help conceptualize the present results.

Characteristics of our study participants and how they were recruited may also impact generalizability of our findings. Participants were mostly white (88%) and non-Hispanic (85%), and all five peer mentors were white. There are substantial racial and ethnic disparities in cancer incidence rates, tumor types, and outcomes among young breast cancer survivors; black women have the highest breast cancer incidence rate before age 45 years, are more likely to be diagnosed with aggressive forms of breast cancer (i.e., triple negative disease), and are more likely to die from breast cancer at every age compared to other racial and ethnic groups.^{1,208,209} Recruiting participants and peer mentors from diverse racial and ethnic backgrounds will enhance the generalizability of the findings and relevance to the broader young breast cancer survivor community. Since the impact of physical activity interventions on quality of life may vary by ethnicity,²¹⁰ recruitment of diverse study participants is critical to ensure interventions are relevant to the target populations. Additionally, our study used a relatively wide age range (18-54) for a young breast cancer survivor sample. As younger cancer survivors have different needs and preferences for exercise interventions compared to older survivors,^{85,211} younger and older women within our sample may have perceived study components differently or experienced differential impacts on physical activity or quality of life outcomes. Future studies with larger samples should perform subgroup analyses among different age groups (i.e., 18-25, 26-39, and 40-54 years old) to tease out differences, since younger breast cancer survivors are not a homogenous group.

Moreover, participants in our trial were not screened for eligibility using objective physical activity data; thus, our sample included some very active women (i.e., those with > 150 minutes of MVPA per week at baseline) who were not part of the population of sedentary younger breast cancer survivors we intended to reach. Additionally, participants were enrolled from different geographic regions during the Fall and Winter months. The study also enrolled survivors who were diagnosed as stage I to IV and there was no upper limit on time since diagnosis (which ranged from 9 months to > 13 years). Finally, although social media recruitment was a time and cost-efficient strategy for this study, this approach has potential to introduce biases that limit generalizability. One analysis that compared offline (hospital-based) and online (social media) recruitment strategies in young cancer survivors found that social media yielded a less demographically diverse and generally more distressed sample than hospital-based recruitment.²¹² Thus, participants in this study were likely more technologically savvy and more motivated to change their exercise behavior than the general young breast cancer survivor population. Overall, while the relatively broad inclusion criteria introduced heterogeneity into our sample, these criteria also increase the generalizability of the findings to the diverse young breast cancer survivor community at large.

A few measurement issues are also worthy of consideration. There are known threats to validity when using the FSFI to measure sexual function in women without recent sexual activity.^{154,155,213} Over one-third of women in our sample reported no sexual activity at baseline. The FSFI showed high internal consistency reliability in the present study, but this measure was unlikely to be a valid measure of sexual function among those women in our study who were experiencing the greatest burden of sexual dysfunction and abstaining from sex, whether related to cancer treatment, previous trauma, or another unknown factor.²¹⁴ This study also did not collect information about treatments for sexual dysfunction or use of medications known to impact sexual function (e.g., SSRIs), so we could not control for their potential effects.²¹⁴

Future studies could consider using the PROMIS Sexual Function and Satisfaction (SexFS) scale. The SexFS has specific scoring instructions for respondents without recent sexual activity and includes several domains that have been validated for use in sexually active and inactive adults (e.g., interest in sexual activity, bother regarding sexual function, and factors interfering with sexual satisfaction).²¹⁵

Furthermore, this study used multiple measures of physical activity in an effort to capture the many different types of activities that young breast cancer survivors may be interested in, based on input from Haus of Volta during study conceptualization. However, the self-report questions used to assess strength training and stretching & flexibility exercises were not validated, which limits our ability to compare our findings to other trials. The questions used were adapted from the Exercise Vital Sign^{143,144} but were re-worded to enhance participant understanding; additionally, we elected to omit questions about self-reported aerobic exercise since we also collected objective physical activity data through the accelerometer. Future research should use validated, reliable measures whenever possible.

Lastly, the one-arm, pre-post design was selected to align with our community partner's priorities and for practical reasons. This design ensured that all eligible and enrolled women in the study received the physical activity program without a waiting period, a consideration that was particularly important to Haus of Volta and was expected to promote retention. The one-arm, pre-post design was appropriate given the focus on exploring feasibility, acceptability, and satisfaction of the intervention to participants, and the process of intervention delivery and adaptations by peer mentors. The use of a multicomponent intervention limits our ability to quantitatively determine which aspects of the intervention were most effective and for whom, and to isolate, describe, and evaluate the impact of any specific features on intervention outcomes. Nonetheless, the mixed methods evaluation yielded rich,

novel insights about feasibility, acceptability, and participant preferences that will inform the development of future studies.

Considerations for Future Research

This comprehensive evaluation of the Pink Body Spirit intervention lays a solid foundation for future research to continue to improve the health and quality of life of younger breast cancer survivors through increasing physical activity. This study showed that most intervention components were feasible and acceptable, and participants experienced meaningful increases in physical activity and improvements to quality of life. A future Type II hybrid-effectiveness implementation randomized controlled trial could leverage these findings to test refinements to the intervention and its delivery and evaluate the effectiveness of Pink Body Spirit to improve physical activity and quality of life. A hybrid trial would also facilitate a formal evaluation of the implementation process and should use an established implementation framework to guide measurement and reporting of implementation outcomes.²¹⁶⁻²¹⁸ To increase the potential for broad dissemination and implementation, it will be crucial to continue to partner with younger breast cancer survivors throughout the entire research process, particularly during study conceptualization. When considering how a behavioral intervention can be feasibly scaled up and more broadly disseminated beyond a research context, it is also critical to consider the cost and payor (e.g., patient/survivor/end user, a community organization (via philanthropy), health insurer, or the healthcare system). Thus, a future hybrid trial also needs to include a cost-effectiveness analysis.

One strategy to potentially reduce the cost of this intervention would be to offer participants the option to bring their own wearable tracker to the program. As use of wearable activity trackers among the general population varies substantially by socioeconomic factors,⁹⁵ future studies should support as wide a range of devices at different price points as possible and continue to provide a free device to those who cannot bring their own. However, the need

to support many different devices could limit the type and amount of technical support provided. It could also impact the ability to provide feedback to participants based on real time activity data, a highly liked feature in this intervention and others,^{33,219} as not all devices are supported by the platform our peer mentors used to access Fitbit data (i.e., Fitabase). The method used in this study to provide feedback to participants based on their Fitbit data was resource-intensive and could be challenging to scale. Technological and organizational challenges, in addition to life circumstances and competing demands, made it burdensome for peer mentors to deliver tailored feedback consistently and effectively to each of their mentees. A future study might consider using computer-tailored algorithms to provide adaptive, individualized feedback to each participant based on their activity,^{177,181} reducing the need for peer mentors to lead this specific aspect of intervention delivery. An ongoing randomized controlled trial in young adult cancer survivors is testing an automated, tailored mHealth physical activity program that uses computer-tailored algorithms to deliver feedback based on objective Fitbit data, tailored text messages, and Facebook prompts encouraging peer support.¹⁸¹ Results of the ongoing trial could help inform a refined version of the Pink Body Spirit intervention by providing additional evidence about wearable trackers, automated feedback, and use of Facebook in a large sample of younger cancer survivors. Participants in our study had different needs and preferences for support, suggesting that a more data-driven approach to tailoring the intervention, including which components participants receive and when they are delivered, is a worthwhile consideration for future research.

Moreover, large peer support networks embedded within cancer survivor community organizations such as the Young Survival Coalition's Talk-One-on-One program, the Sharsheret Peer Support Network, or the ACS's Reach to Recovery (RTR) program could be leveraged to promote physical activity among younger breast cancer survivors. The success of the ACS RTR program and similar initiatives that utilize survivors' willingness to share their

wisdom and time suggest there is broad interest in volunteering among cancer survivors.^{113,220}

Multiple studies have successfully recruited and trained highly motivated *older* breast cancer peer mentors as interventionists to deliver physical activity interventions.^{19,118} For example, Pinto and colleagues partnered with the ACS's RTR program to train 18 existing RTR volunteers (mean age = 54.9 years, mean tenure as a RTR volunteer = 4.5 years) to deliver an evidence-based exercise program.²⁰⁵ All RTR volunteers received extensive training and skill building in the areas of active listening, communication, providing empathy, and emotional support before interacting with participants and had annual continuing education requirements. Coaches felt the intervention was easy to deliver and reported high confidence throughout intervention delivery.²⁰⁵

In contrast, the peer mentors in our study were part of a small, existing network of women that were connected to Haus of Volta prior to the study. They were selected as peer mentors by Haus of Volta due to their high interest in working directly with younger survivors and contributing to related research. Our pragmatic process evaluation revealed numerous barriers and facilitators to effective intervention delivery that should be taken into consideration when planning future studies. For instance, a few areas of training needed to be expanded, peer mentors and participants had different communication preferences, and peer mentors faced numerous life circumstances that impacted their availability and capacity to deliver the intervention effectively. Our finding that peer mentors were challenged in balancing peer mentoring among many other competing demands suggests it may be advantageous to offer younger breast cancer survivor peer mentors options to contribute to intervention delivery through different roles with varying levels of commitment. For example, some highly motivated survivors with abundant availability may be able to commit to extensive training and delivery of a standardized intervention as the primary interventionist, while other peer mentors' life circumstances, interests, and skill sets may position them to make effective contributions as a

virtual community moderator providing asynchronous support to participants. Partnering with a larger community-based organization with an established network of peer mentors could help address some of the observed barriers to intervention delivery and provide a larger pool of experienced peer mentors who have already undergone general peer mentor training and communication skill building. Given that only 10% of the RTR volunteers approached by Pinto and colleagues agreed to participate in their exercise study²⁰⁵ and younger cancer survivors face substantial constraints on their time,^{7,9,173} researchers will likely need to partner with one or more larger community-based organizations to yield enough young cancer survivor peer mentors for a future, larger trial.

Prior to broad scale implementation, further research is needed to understand whether changes in activity and/or quality of life are sustained beyond six months, and effectiveness should be evaluated in a larger, more diverse sample. Our findings that participants were able to maintain increases in exercise and improvements to body image, fatigue, and anxiety from 3- to 6-months are promising, but more definitive evidence of these effects is needed. Younger breast cancer survivors are a vulnerable subgroup of survivors who are at elevated risk over time for obesity⁸⁴ and other chronic diseases such as cardiovascular disease and diabetes that can be prevented with physical activity.²²¹ Thus, it is important that interventions targeting this population are designed to facilitate long term behavior change. We believe a hybrid effectiveness-implementation trial is the next logical step to continue this line of research.

Conclusion

The current community-academic partnership study showed that a fully remote, peer-to-peer physical activity intervention is feasible to conduct and acceptable to younger breast cancer survivors. Participants and mentors had positive experiences and there were meaningful improvements to physical activity and quality of life domains that are highly impacted in younger cancer survivors, but for which there are few evidence-based

interventions.^{5,6,14-18} This study also yielded useful information about barriers and facilitators to intervention delivery. Refinements to the intervention and its delivery should be further assessed in a hybrid effectiveness-implementation trial, toward the ultimate goal of scaling up the intervention for broader dissemination to younger cancer survivors across the United States. In closing, peer support and technology can be coupled to provide a supportive, accessible intervention to improve the health and quality of life of the rising number of younger women diagnosed with breast cancer.¹

APPENDICES

Appendix 1: Recruitment material

 <i>Pink Body Spirit</i>
Interested in working with other young breast cancer survivors to increase your physical activity?
The Pink Body Spirit study is looking for women who: <ul style="list-style-type: none">• Were diagnosed with breast cancer when they were between 18-49 years old and are currently under 55 years old• Completed chemotherapy and/or radiation at least 6 months ago• Do NOT exercise regularly and are interested in increasing their exercise• Have a smartphone, tablet, or computer with internet
Participation in this study involves:
<ul style="list-style-type: none">• A 3 month exercise program• Support from a peer mentor• Fitbit for tracking and supporting your exercise• Completing study assessments 3 times: start of study, 3 months and 6 months• Completing individual interviews at 3 and 6 months• Receiving up to \$80 and a free Fitbit activity tracker
FOR MORE INFORMATION, PLEASE CONTACT:
<p>Lauren Weiner [Redacted] pinkbodyspirit@ucsd.edu</p>


Full Online Ad

Recruiting young breast cancer survivors for physical activity study

Haus of Volta, a non-profit collective that helps young breast cancer survivors, has teamed up with researchers at UC San Diego to learn how young breast cancer survivors can support each other to be more physically active and improve their health.

The Pink Body Spirit study is looking for young breast cancer survivors who:

- Were diagnosed with breast cancer when they were between 18-49 years old and are currently under 55 years old
- Completed chemotherapy and/or radiation at least 6 months ago
- Do NOT exercise regularly and are interested in increasing their exercise
- Have a smartphone, tablet, or computer with internet

Participation in the study includes:

- A 3 month exercise program
- Support from a peer mentor
- Fitbit for tracking and supporting your exercise
- Completing study assessments 3 times: start of study, 3 months and 6 months
- Completing individual interviews at 3 and 6 months
- Receiving up to \$80 and a free Fitbit activity tracker

Overall time commitment: about 4.5 hours over 6 months, not including time spent being physically active.

Please call the UC San Diego study office at [REDACTED] or email us at pinkbodyspirit@ucsd.edu to be screened for study eligibility.

Approved by the UCSD Human Research Protection Program

Appendix 2: IRB-Approved Consent Form



181367

University of California, San Diego
Consent to Act as a Research Subject

Physical activity intervention for young cancer survivors

Who is conducting the study, why you have been asked to participate, how you were selected, and what is the approximate number of participants in the study?

Dr. Sheri Hartman, PhD, Assistant Professor at UC San Diego and Stori Nagel, founder of Haus of Volta, a non-profit supporting young breast cancer survivors, are conducting a research study to find out if increasing physical activity is helpful for young breast cancer survivors' quality of life, and how young breast cancer survivors can support each other to be more physically active. You have been asked to participate in this study because you are a young breast cancer survivor. There will be 20 participants in this study.

Why is this study being done?

The purpose of this study is to explore the benefits of physical activity for young breast cancer survivors. Young breast cancer survivors often have many negative effects from their cancer treatments at key transitional points in their lives. This study will help determine whether being physically active could help any of the common challenges young survivors face, and how young breast cancer survivors can help each other be more active.

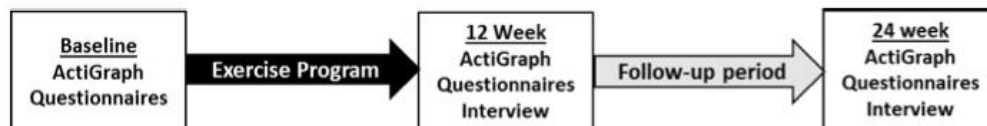
What will happen to you in this study, and which procedures are experimental?

If you agree to be in this study, the following will happen to you:

Baseline Measurement: Once you have consented to participate in the study, you will be asked to do two things:

- 1) Complete a set of questionnaires online that ask about a variety of things including about your mood, your feelings, and questions related to being physically active.
- 2) Wear a device around your hips for 7 days that measures movement, during waking hours. See picture to the right.

The device can be worn over your clothes (as shown) or hidden under your clothes. This device will be mailed to you and you will be given a pre-paid envelope to mail the device back to the study office once you have worn it for 7 days.



Physical Activity Intervention: After you complete the baseline measures, you will begin the physical activity intervention. The intervention will last 12 weeks (3 months). It includes the following parts:



- **Study orientation:** To begin the intervention, you will be mailed a Fitbit Charge HR, a small, wrist-worn physical activity tracker, and will be scheduled for a technology support phone/video call with UCSD staff. During this call, which will last about 30 minutes, you will set up your Fitbit and other technology components of the study. Once your Fitbit has been set up, you will be scheduled for a phone/video call with your peer mentor to begin the physical activity intervention. Your peer mentor will support you in increasing your physical activity throughout the 12-week intervention. During this orientation, you will learn how to: 1) wear and sync the Fitbit; and 2) use the Fitbit message board. You will also set physical activity goals and create an action plan with your peer mentor.
- **Wearing and syncing the Fitbit activity tracker:** You will be asked to wear your Fitbit daily, to keep it charged, and to sync it at least once a week.
 - *Wearing the Fitbit:* You will be asked to wear the Fitbit as many hours (day and night) as possible.
 - *Syncing the Fitbit:* You will be provided instructions on syncing your Fitbit wirelessly via your computer and/or wirelessly via your Bluetooth enabled device. You will be asked to sync your Fitbit at least once a week.
 - *Charging the Fitbit:* You will be asked to keep your Fitbit charged. The Fitbit battery lasts for about 5 days and takes about 1 to 2 hours to charge.
 - *Reminders from study staff:* If you are not wearing, syncing, or charging your Fitbit, your peer mentor or study staff may contact you to remind you to do so.
- **Supportive phone calls with peer mentor:** You will be scheduled to have a phone call or video chats (depending on your preference) with your peer mentor every other week. Each call/chat will last about 20 minutes. When you sync your Fitbit, the data is wirelessly uploaded to the Fitbit.com website and smartphone app. Your peer mentor will have access to your Fitbit data through a password-protected database. Your peer mentor will use this data to give you feedback during the calls and update your action plan. They may also reach out to you outside of the scheduled calls to reinforce your progress or help you get back on track.
- **Exercise resources from your peer mentor:** Your peer mentor will link you with exercise-related resources to help you meet your personalized physical activity goal. This may include a subscription to an exercise app (e.g., Fitbit coach, a workout guidance and coaching service that creates custom workouts and includes explanations of each exercise), exercise videos, or exercise materials (e.g., stretch band).
- **Fitbit community message board:** Through the Fitbit website, we will have a community group (open only to study participants) where you can communicate with other participants, see the activity leader board and activity levels of other participants, and gain support from all peer mentors. You will be asked to read and post on the message board at least once per week.

The physical activity intervention being tested is *experimental*. This is the first time we are testing it in young breast cancer survivors who are supported by peer mentors. However, it is based off an intervention that has been shown to help older breast cancer survivors increase their activity.

12-week and 24 week measures: 12 weeks (3 months) and 24 weeks (6 months) after starting the study, you will be asked to complete the same two measurement tasks completed at baseline:

- 1) Complete a set of questionnaires online that ask about a variety of things including about your mood, your feelings, and questions related to being physically active.
- 2) Wear a device around your hips for 7 days that measures movement, during waking hours. This device will be mailed to you and you will be provided with a pre-paid envelope to mail the device back to the study office once you have worn it for 7 days.

Individual Interviews: After completing each of the 12-week and 24-week measures, you will be asked to complete an individual interview by phone or video chat (per your preference/capability). You will be asked about your thoughts on the intervention and ways to improve it for other young breast cancer survivors. At 24 weeks, you will be asked about your experiences during the time since the program ended.

How much time will each study procedure take, what is your total time commitment, and how long will the study last?

The technology support call will last approximately 30 minutes. The first orientation call/video chat with your peer mentor will last approximately 45 minutes. Each of the five follow-up intervention calls/video chats will last approximately 20 minutes. Each of the three online questionnaires will take approximately 25 minutes to complete. Each of the individual interviews at 12 and 24 weeks will take approximately 45 minutes. Syncing your Fitbit will take approximately one minute each time (about every five days throughout the 12 week intervention).

The total time commitment for this study is about 5 hours, not including time spent being physically active. Participation in the study will last about 24 weeks (6 months).

What risks are associated with this study?

Participation in this study may involve some added risks or discomforts. These include the following:

1. You may become upset while completing the questionnaires. If you are bothered by any of the questions, you can skip questions or discontinue the questionnaires at any time. Please let study staff know, so that we can provide appropriate referrals.
2. You may experience discomfort or soreness because you may increase your physical activity level. As always, there is a small chance that you could become injured while exercising. If you have any injury, you should contact your peer mentor or research staff immediately.
3. There is also a potential, but unlikely risk of loss of confidentiality associated with this study. To minimize this risk, all online questionnaires and this online consent form use a secure database housed at UC San Diego. In addition, identifiable information will be



stored in a secure database at UC San Diego or kept in locked cabinets in secure study offices at UC San Diego Moores Cancer Center. All data downloaded from online questionnaires will be stored in a secure study database. All computerized study data is password protected and only accessible to study staff.

4. There is also a potential risk of loss of confidentiality of the Fitbit data. The activity data collected by the Fitbit is stored on Fitbit's server and owned by Fitbit. We are using activity data from the Fitbit including steps, active minute, and heart rate; the Fitbit being used for this study does not have a GPS in the device and does not track your location. If you would prefer to not have your personal email associated with your Fitbit account, we can provide a study email for you to use. Once we download your Fitbit data we will associate it with your unique study ID to minimize potential for loss of confidentiality.

Because this is a research study, there may be some unknown risks that are currently unforeseeable. You will be informed of any significant new findings.

What are the alternatives to participating in this study?

Study participation is voluntary. The alternative to participating in this study is not participating in this study.

What benefits can be reasonably expected?

There may or may not be any direct benefit to you for participation in the study. Due to the intervention, you may increase your physical activity. Potential benefits of the study to society are a better understanding how young breast cancer survivors can support each other in increasing their physical activity, and how physical activity can improve quality of life.

Can you choose to not participate or withdraw from the study without penalty or loss of benefits?

Participation in research is entirely voluntary. You may refuse to participate or withdraw at any time without penalty or loss of benefits to which you are entitled. If you decide that you no longer wish to continue in this study, you will be requested to inform the investigators of your wishes verbally or in writing and to return the Fitbit. We will send you a postage-paid envelope to mail it back to us. You will be told if any important new information is found over the course of this study that may affect your wanting to continue.

Can you be withdrawn from the study without your consent?

You may be withdrawn from the study if you do not follow the instructions given you by the study personnel or if study personnel deem it is in your best interest not to continue.

Will you be compensated for participating in this study?

You will receive \$20 for completing the baseline measures, \$20 for completing the 12 week measures, and \$20 for completing the 24 week measures. Additionally, you will receive \$10 for completing the interview at 12 weeks and \$10 for completing the interview at 24 weeks. Each payment will be mailed to you within approximately 1 week of completing the measures (mailed at baseline, 12 weeks, 24 weeks, and post interview). Payment at each time point is not dependent on completing the previous time point or completing the entire study. If you complete all study-related measures, you will receive a total of \$80. You will also get to keep



the Fitbit you receive as part of the intervention (\$150 value) and any exercise-related resources you are provided by your peer mentor (up to \$40 value).

Are there any costs associated with participating in this study?

There will be no cost to you for participating in this study.

What if you are injured as a direct result of being in this study?

If you are injured as a direct result of participation in this research, the University of California will provide any medical care you need to treat those injuries. The University will not provide any other form of compensation to you if you are injured. You may call the Human Research Protections Program Office at 858-246-HRPP (858-246-4777) for more information about this, to inquire about your rights as a research subject or to report research-related problems.

What about your confidentiality?

Research records will be kept confidential to the extent allowed by law. All identifiable information will be kept in locked cabinets in secure study offices at UC San Diego Moores Cancer Center or in a HIPAA-compliant database. No identifiable information will be collected online and data downloaded from online questionnaires will be stored in a secure, password-protected study database. All participants will be assigned a random ID, and all data will be coded only with this subject ID. Only the study personnel and peer mentors who are directly involved in the recruitment and actual counseling or intervention effort will see any subject identifiers. All computerized study data is password protected and only accessible to study staff. Research records may be reviewed by the UCSD Institutional Review Board and the National Cancer Institute.

A description of this clinical trial will be available on <http://www.ClinicalTrials.gov>, as required by U.S. Law. This Web site will not include information that can identify you. At most, the website will include a summary of the results. You can search this website at any time.

Who can you call if you have questions?

Dr. Sheri Hartman and/or _____ has explained this study to you and answered your questions. If you have other questions or research-related problems, you may reach Dr. Sheri Hartman at 858-534-9235 or sjhartman@ucsd.edu.

You may call the Human Research Protections Program Office at 858-246-HRPP (858-246-4777) to inquire about your rights as a research subject or to report research-related problems.

Your Signature and Consent

1. Your consent to participate in the study: By selecting the below, "I agree to participate" button, you agree to participate in the study and allow the data collected to be used for research purposes. If you do not wish to participate in this study, please select the "I do not agree to participate" button.

- I agree to participate
 I do not agree to participate



2. Your consent for recording of your contacts with your peer mentor: By selecting the below, “I agree to recording” button, you agree to have your phone/video calls with your peer mentors recorded for research purposes only. You may request to stop the recording at any time or to erase all or any portion of your recording without effecting your participation in the study. If you do not wish to have your peer-mentor sessions recorded, please select the “I do not agree to recording” button. This is completely voluntary and up to you. In any use of the audio or video recording, your name will not be identified.

- I agree to recording of peer-mentor contacts to be used by the research team for use in the research project
- I do not agree to recording of peer-mentor contacts

3. Your consent for recording of the individual interviews at 12 and 24 weeks: By selecting the below, “I agree to recording” button, you agree to have your individual interviews recorded for research purposes only. You may request to stop the recording at any time or to erase all or any portion of your recording without effecting your participation in the study. If you do not wish to have your individual interviews recorded, please select the “I do not agree to recording” button. This is completely voluntary and up to you. In any use of the audio or video recording, your name will not be identified.

- I agree to recording the individual interviews to be used by the research team for use in the research project
- I do not agree to recording of the individual interviews

4. Please select one option below if you are willing to be contacted for future cancer-related studies:

- I agree to be contacted for future studies.
- I do not agree to be contacted for future studies.

Appendix 3: Physical Activity Intervention

Technology Support Session Script/Checklist

Tech Call Content

Review Zoom

- Easiest way to join is by clicking link in email (can also input meeting ID)
 - Write down meeting ID so you can join a Zoom meeting if you don't have email access
 - Join with video when possible!
-

Email associated with Fitbit account

Review Fitbit basics & wear instructions

- Syncing- swipe down on the app
 - Charging- attach charger to tracker, connect to USB wall adapter
 - Wear it on your wrist, not too tight.
 - Wear it as often as possible
-

Review Fitbit features

(directions also in Fitbit booklet - update list below to match main topics in booklet)

- Clock face: we recommend retro double stat
 - Setting Active Minutes as your main goal
 - Tracking activity
-

Explain Fitbit community (refer to page # in Fitbit booklet)

- Check notifications tab
 - Accept peer mentor friend request
 - Accept invite to Pink Body Spirit community board
 - Explain purpose and posting weekly
-

Explain Fitabase

- Accept email invitation
- VERY IMPORTANT: use same email and password as used for Fitbit account

Peer Mentor Session 1 Script

1. STUDY OVERVIEW AND AGENDA

- Welcome to Pink Body Spirit!
 - Review study purpose
 - Review your role as a peer mentor: motivation, support, accountability

2. GETTING TO KNOW YOU

- What made you want to join the study? What do you hope to get out of it?
- What activity, if any, are you currently doing? It's ok if you aren't doing any, I just want to get a sense of where you are starting from

3. ACTIVE MINUTES

- We want you to focus on increasing activities that are in the moderate-to-vigorous intensity zone. These are called “active minutes” on your Fitbit and your Fitbit should be set up to focus on active minutes
- You can track your heart rate to help you know if you are reaching the intensity needed for active minutes
 - Provide target heart rate and demonstrate how to use Fitbit to monitor HR
 - Can also take HR manually
 - If you forget to wear your Fitbit, think about how much physical effort you feel during activity

4. SET A PERSONALIZED GOAL AND ACTION PLAN

- During our sessions, we will work together to set a specific Active Minutes goal and detailed action plan. Study goal is to work up to at least 150 min/week of MVPA, gradually
- Guide participant through goal setting sheet and action plan
 - What type of activity, where, days, time of day, minutes each time
 - Review and summarize complete plan
 - Challenges and Solutions
 - Start date
- Importance & Confidence Ruler questions
 - Importance: “On a scale from 1 to 10, how important is it for you to achieve this goal?”
 - Confidence: “On a scale from 1 to 10, how confident are you that you can achieve this goal?”
 - Use reflections to emphasize reasons that she is confident

5. FITBIT & FEATURES

- Review using Fitbit for self-monitoring and importance
- Emphasize use of Fitbit to track active minutes and heart rate
- Review tracking active minutes on Fitbit or in app, explain how to track strength training, yoga, Pilates, etc. that are not automatically detected

- Accountability:** Inform them you will be checking on their activity between sessions and may contact them. Important to wear Fitbit as often as possible so you can see their activity

6. FITBIT COMMUNITY

- Confirm access
- Explain purpose
- Explain how to use: post at least weekly, more is better
- Give example topics and explain how to cheer or comment on posts

7. INJURY PREVENTION AND EXERCISING SAFELY

- Inform what to do when not feeling well and importance of listening to your body
- Ask if have current or previous lymphedema, neuropathy, or arthralgia (joint pain)?
 - Review tip sheet
 - Ask them to contact you if any of these symptoms get worse as they increase their activity
- Inform ways to avoid injury: gradually increase activity, listen to body, stop if in pain
- **IMPORTANT:** Notify mentor ASAP if they experience any injuries that could impact their ability to exercise safely, whether you think they might be related to the study or not

8. NEXT STEPS/WRAP UP:

- Please let me know if there are changes to contact info or health
- Reminder to wear your Fitbit all the time, charge, and sync it
- Remember, I will check in on your Fitbit data and reach out between sessions.
 - Ask: What is the best way to contact you between sessions?
- Schedule **at least** one future session

Peer Mentor Follow-Up Session Script

Before session:

- Log on to Fitabase
 - Check moderate and intense minutes
- Review last session's notes in REDCap

During Session:

Step 1: Assess for adverse events

- Have you had any medical changes since our last session that would impact your ability to exercise safely on your own?
 - If yes: collect information, document in REDCap, notify Lauren ASAP

Step 2: Review last 2 weeks

- How did you do meeting your exercise goal the past 2 weeks?

If meeting goals and doing great:

- Pick one day of Fitbit data with high minutes –
 - Looks like Monday you were able to get your active minutes in, great job!
 - What helped you to do X that day?

If not meeting goals and/or struggling:

- Pick one day of Fitbit data with high minutes –
 - Looks like Monday you were able to get some active minutes in, great job!
 - What helped you to do X that day?
- If one week was better than the other:
 - Explore: What was different? What worked well?
- What got in the way of you doing your plan this week?
 - Problem solve around challenge:
 - What is your plan to deal with it this next week?
 - Increase motivation (review reasons for entering study)

Step 3: Set new goal

- Set goal for next 2 weeks → your last goal was XX min/week, what do you want your goal to be for the next 2 weeks?
 - Would you like to set a detailed plan of how to do meet that goal?
 - If Yes: Go through action plan → what activity, where, days, time of day, minutes each time
 - If No: still encourage to schedule and make a plan.
- Assess confidence: "On a scale from 1 to 10, how confident are you that you can achieve this goal?"
 - Use reflections to emphasize reasons that she is confident

Step 4: Wrap-Up

- Reminder to wear your Fitbit as often as possible, sync, and charge Fitbit
- IMPORTANT: Let me know ASAP if you experience any injuries that could impact your ability to exercise safely, whether you think they might be related to the study or not
- Confirm next session

After session:

- Fill out REDCap field note
- Confirm next session is on PBS Google Calendar
- Upload recording to OneDrive



Exercise Goal Setting Worksheet Used in Mentoring Sessions

Exercise Goal Setting Sheet

Activity Goal: ___ days per week, ___ minutes per day

Activity	Where	Days	Time of Day	Minutes

<p>Challenges:</p>	<p>Solutions:</p>
---------------------------	--------------------------

 <p>Importance</p> <p>1 2 3 4 5 6 7 8 9 10</p> <p>Not at all Important Very Important</p>	 <p>Confidence</p> <p>1 2 3 4 5 6 7 8 9 10</p> <p>Not at all Confident Very Confident</p>
--	--

Start date ___/___/___

Sample Fitbit Feedback Messages

Not meeting goal or decrease in activity:

Just wanted to check in to see how things were going. You had a huge increase in activity, but it seems to have gone back down again. What helped you be so active that first week of Dec.? Try to get back to your goal of 5-7 days a week, 20 minutes each day if you can. Remember to wear and sync your Fitbit so I can see your progress.

Just wanted to check in to see how things were going. This was the first week you've dipped below 200 active minutes. You are still doing great! I just wanted to make sure everything is okay, especially as we go into the holidays. Remember to wear and sync your Fitbit so I can see your progress.

Meeting goal/doing well:

I was so happy to see that last week you got 75 minutes in. I'm so glad that you've been able to be active this week! Keep up the good work and let me know if I can help with anything. Remember to wear and sync your Fitbit so I can track your progress!

Looks like you are doing a great job getting your walk in every morning! I love seeing how great you are doing through your Fitbit. Keep up the good work! Remember to wear and sync your Fitbit so I can track your progress!

Missed session:

Sorry our session was missed today. I really wanted to touch base to see how things are going with being active. I know you had set your goal to be 60min 3 times a week, but it looks like you might be having trouble meeting that goal. Let me know some good days and times for us to reschedule. Remember to wear and sync your Fitbit so I can see your progress!

Not wearing Fitbit or activity isn't showing up:

How are things going with being active? I don't see any Fitbit data, are you still wearing it? If you need any help, contact our UCSD team at pinkbodyspirit@ucsd.edu
Is your plan of 20 min walks in the morning still working out? Let me know if you want to talk and try to brainstorm a new plan or try to problem solve around challenges.

I wanted to check in to see how things are going for you. I know you had said that the Fitbit wasn't always picking up all of your active minutes, so I want to find out how you're doing with increasing your goal, and if you've been able to walk every day as we talked about. Let me know how things are going. If you need any support, just let me know!

Directions for accessing and posting in the Fitbit Community

Pink Body Spirit Fitbit Community

The Fitbit Community offers a way to connect with other young breast cancer survivors and all of the peer mentors involved in the study. It is a private community that is only available to peer mentors and participants in the study.

Please share a post at least once a week. Here's how to get started:

A dot will appear when you have a notification-check if you have been invited to join the Pink Body Spirit Community

Click "What are you up to?" to share a workout or ask a question

Cheer or comment on other posts to support fellow participants!

Sample Fitbit Community Posts (De-identified)

< Back Comments ...

I've been out of commission the past few weeks. Btwn having the flu, birthday celebrations and family in town, and the Corona here in [REDACTED] I haven't had a chance to just breathe. But I'm back at it today starting with this bike after work because it's been a long day. Add me to any challenges especially active minutes challenges to get my mojo going!!




Add a comment... Send

Community Location Friends Challenges +

< Back Comments ...

Sharing a photo of your feet pictured where you've been getting in your minutes is a way of sharing what you are doing and where you've been. Mine is not so glam but you see it didn't matter because I got my minutes in. Show us where you've been!

Feb 19, 2020 fitbit



10,062 20 4.51 2,563 44

Add a comment... Send

Community Location Friends Challenges +

Fitbit Community Leaderboard (De-identified)

The image shows a mobile app interface for a "Group Leaderboard". At the top, the status bar shows "AT&T", signal strength, Wi-Fi, time "21:17", location, and 76% battery. The app header includes a back arrow, the title "Group Leaderboard", and a help icon. The main content is a list of 9 entries, each with a rank number, a redacted name, and a score with a right-pointing arrow.

Rank	Name	Score
1	[Redacted]	76,554
2	[Redacted]	61,109
3	[Redacted]	58,106
4	[Redacted]	57,327
5	[Redacted]	47,797
6	[Redacted]	44,901
7	[Redacted]	43,739
8	[Redacted]	40,320
9	[Redacted]	37,369

Table A1. Adverse events reported by participants in the Pink Body Spirit Study

ID#	Time in study (weeks)	Event date	Event description	Severity	Relation to Study	Serious (Y/N)	Outcome
0917	2	11/4/2019	Increased pain in ribs and back (pre-existing condition). Treated by chiropractor and craniosacral therapy. Resolved after 3 weeks of treatment.	Mild	Possibly Related	N	Recovered /No symptoms
0918	3	11/17/2019	Increased stiffness and numbness in fingers and hand joints after long bike ride (pre-existing neuropathy). Resolved on its own in 1 week.	Mild	Possibly Related	N	Recovered /No symptoms
1002	3	11/27/2019	Increased pain in neck and left shoulder (pre-existing condition). Incorporated daily stretches and set activity goal for lower body activities to avoid areas of pain.	Moderate	Possibly Related	N	Symptoms still present
0910	10	12/30/2019	Recurrence of pre-existing, occasional lymphedema in left breast. Saw personal physician, who said she did not need to restrict activity. Resolved within 2 weeks.	Mild	Possibly Related	N	Recovered /No symptoms
0918	10	1/2/2020	Twisted ankle while hiking. Pain resolved on its own in one day.	Mild	Definitely Related	N	Recovered /No symptoms

Table A1. Adverse events reported by participants in the Pink Body Spirit Study (continued from previous)

ID#	Time in study (weeks)	Event date	Event description	Severity	Relation to Study	Serious (Y/N)	Outcome
1126	3	1/14/2020	Increased rotator cuff and triceps pain (pre-existing condition). Treated by massage therapist and lymphedema specialist.	Moderate	Possibly Related	N	Symptoms still present
0918	11	1/14/2020	Fell on arm while cross country skiing. Did not seek medical attention for injury, fully resolved within 2 weeks.	Mild	Definitely Related	N	Recovered /No symptoms

Table A2. *Self-reported use of health behavior-related Fitbit features at T1 (post-intervention), N = 31*

Feature	Value (N/%)
Relax feature (Fitbit tracker)	
Once per day or more	1 (3.2)
4-6 times per week	5 (16.1)
2-3 times per week	1 (3.2)
Once per week or less	16 (51.6)
Never	8 (25.8)
View sleep patterns (Fitbit app)	
Once per day or more	10 (32.3)
A few times per week	11 (35.5)
Once per week or less	3 (9.7)
Rarely or never	1 (3.2)
Did not wear Fitbit tracker to sleep	6 (19.4)
Log food intake (Fitbit app)	
Once per day or more	2 (6.5)
A few times per week	1 (3.2)
Once per week or less	4 (12.9)
Rarely or never	23 (74.2)
Don't know how	1 (3.2)
Log water intake (Fitbit app)	
Once per day or more	3 (9.7)
Once per week or less	3 (9.7)
Rarely or never	23 (74.2)
Don't know how	2 (6.5)
View progress toward hourly activity goal (250+ steps)	
Once per day or more	17 (54.8)
A few times per week	2 (6.5)
Once per week or less	5 (16.1)
Rarely or never	6 (19.4)
Don't know how	1 (3.2)

Note. For all questions, participants were asked to report their use during a typical week in the past 3 months (active intervention period)

Appendix 4. Measures

Appendix 4a: Qualitative Interview Guide

I. Peer Mentor

1. Tell me what it was like working with your peer mentor, a fellow young breast cancer survivor.
 - *What did you like most about working with your mentor?*
 - *What would have made working with your peer mentor more helpful?*
 - *What did you think about without seeing each other in person (over video chat)?*
 - How did this method of communication impact how you could work together?
 - *Frequency/every 2 weeks*

II. Fitbit

2. Next, I am going to ask you some questions about your experience using a Fitbit in this program. This includes the Fitbit tracker, the Fitbit app, and the Fitbit community.
 - Tell me about your experience using the Fitbit tracker
 - Tell me about your experience using the Fitbit app
 - Tell me about your experience with the Fitbit Community
 - What would have made the Fitbit community more helpful?
3. What kinds of options or tools did your peer mentor suggest to help you increase your exercise?
 - *How was it using XXX?*
 - *What could the study have done to make XXX more useful?*
 - *What did you like or not like about XXX?*

III. Health benefits

4. What benefits have you experienced from participating in this program?
 - *Health benefits*
 - *Physical benefits*
 - *Other benefits?*

IV. Program overall

5. How do you feel about the program overall?
6. What suggestions do you have for improving the program?
7. Were there things you were hoping to have or do as part of this program that you didn't get?
8. What will it be like for you to maintain your exercise now that the sessions with your peer mentor are over?

Appendix 4b: Quantitative Satisfaction Survey (T1)

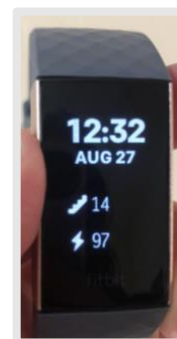
Directions: This survey is your chance to provide useful feedback about your experience in Pink Body Spirit. Please be as honest and open as possible. Your individual responses will not be shared with your peer mentor. Thank you!

I. We would like to learn about your experience using the Fitbit Charge 3 that the study provided.

- 1. What did you like BEST about using the Fitbit tracker and app?**
- 2. What did you like LEAST about using the Fitbit tracker and app?**
- 3. During a typical week in the past 3 months, how often did you wear your Fitbit?**
 - Every day
 - 4-6 days per week
 - 2-3 days per week
 - 1 day per week or less

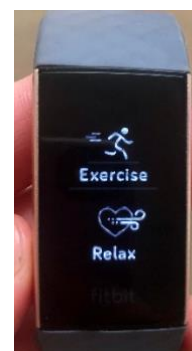
- 4. During a typical week in the past 3 months, how often did you check your Active Minutes on your Fitbit tracker?**

- Many times per day
- Once or twice per day
- 4-6 times per week
- 2-3 times per week
- Once per week or less
- Rarely or never



- 5. Over the past 3 months, how often did you use the Exercise feature on your Fitbit tracker to “start” your exercise session or set a specific goal (distance or time)?**

- Almost every time I exercised
- More than half of the times I exercised
- Less than half of the times I exercised
- I rarely or never used the Exercise feature
- I don't know how to use the Exercise feature on the Fitbit tracker



- 6. During a typical week in the past 3 months, how often did you check your heart rate on your Fitbit tracker while exercising?**

- Almost every time I exercised
- More than half of the times I exercised
- Less than half of the times I exercised
- Rarely or never
- I don't know how to check my heart rate on the Fitbit tracker

7. During a typical week in the past 3 months, how often did you use the Relax feature?

- Many times per day
- Once or twice per day
- A few times per week
- Once per week
- Rarely or never
- I don't know what the Relax feature is



8. During the past 3 months, were there other features on your Fitbit tracker that you like using?

- Yes
- No

If Yes: What was the feature and how often did you use it?

II. The next set of questions refer to the Fitbit app.

9. During a typical week in the past 3 months, how often did you use the Fitbit app?

- Many times per day
- Once or twice per day
- A few times per week
- Once per week or less
- Rarely or never
- I don't know

10. During the last 3 months, which devices did you use to access the Fitbit app? (select all that apply)

- Smartphone
- Tablet
- Other: _____
- I don't know

11. During a typical week in the past 3 months, how often did you manually add an exercise session by entering it into the Fitbit app?

- Many times per day
- Once or twice per day
- A few times per week
- Once per week or less
- Rarely or never
- I don't know how to manually add an exercise session into the Fitbit app

12. During a typical week in the past 3 months, how often did you view a graph of your active minutes in the Fitbit app?

- Many times per day
- Once or twice per day
- A few times per week

- Once per week or less
- Rarely or never
- I don't know how to view a graph of my active minutes in the Fitbit app

13. Over the past 3 months, how often did you set or change your daily active minutes goal?

- Once a week or more
- 2-3 times a month
- About once a month
- Once or twice
- Rarely or never
- I don't know how to change my daily active minutes goal

14. During a typical week in the past 3 months, how often did you view a graph of your heart rate or minutes spent in different heart rate zones in the Fitbit app?

- Many times per day
- Once or twice per day
- A few times per week
- Once per week or less
- Rarely or never
- I don't know how to view a graph of my heart rate in the Fitbit app

15. During a typical week in the past 3 months, how often did you view your sleep patterns in the Fitbit app?

- Many times per day
- Once or twice per day
- A few times per week
- Once per week or less
- Rarely or never
- I don't know how to view my sleep patterns in the Fitbit app

16. During a typical week in the past 3 months, how often did you log your food intake in the Fitbit app?

- Many times per day
- Once or twice per day
- A few times per week
- Once per week or less
- Rarely or never
- I don't know how to log my food intake in the Fitbit app

17. During a typical week in the past 3 months, how often did you log your water intake in the Fitbit app?

- Many times per day
- Once or twice per day
- A few times per week
- Once per week or less
- Rarely or never
- I don't know how to log my water intake in the Fitbit app

- 18. During a typical week in the past 3 months, how often did you view your progress toward your hourly activity goal (hours with 250+ steps)?**
- Many times per day
 - Once or twice per day
 - A few times per week
 - Once per week or less
 - Rarely or never
 - I don't know how to view my progress toward my hourly goal in the Fitbit app

- 19. Are there other features on the Fitbit app that you like using?**

- Yes
- No

If Yes: What was the feature and how often did you use it?

III. The next set of questions asks about your experience with the Pink Body Spirit Fitbit Community.

- 20. During a typical week in the past 3 months, how often did you read or scroll through posts in the Pink Body Spirit Fitbit Community?**
- Many times per day
 - Once or twice per day
 - A few times per week
 - Once per week or less
 - Rarely or never
 - I don't know how to scroll through posts in the Fitbit Community

- 21. During a typical week in the past 3 months, how often did you create new posts in the Pink Body Spirit Fitbit Community?**
- Many times per day
 - Once or twice per day
 - A few times per week
 - Once per week or less
 - Rarely or never
 - I don't know how to make a post

- 22. During a typical week in the past 3 months, how often did you compare your activity with others in the Pink Body Spirit Fitbit Community using the Leaderboard?**
- Once per day or more
 - A few times per week
 - Once per week or less
 - Rarely or never
 - I don't know what the Leaderboard is or where to find it

- 23. Over the past 3 months, how often did you participate in a Challenge or Workweek Hustle?**
- Almost every week
 - About half the weeks
 - A few of the weeks
 - Never

- I don't know what a challenge or Workweek Hustle
If Yes: Who initiated the challenge or workweek hustle? (check all that apply)
- You
 - Your peer mentor
 - Another Pink Body Spirit participant
 - Someone outside of the study

24. How much did the Pink Body Spirit Fitbit Community motivate you to exercise?

- It motivated me a lot
- It motivated me sometimes
- It did not motivate me
- I'm not sure if it motivated me

24a. What about the community was motivating? _____

24b. What about the community was not motivating? _____

25. What did you like best about the Pink Body Spirit Fitbit Community?

26. What did you like least about the Pink Body Spirit Fitbit Community?

27. If you could improve the Pink Body Spirit Fitbit Community for other younger breast cancer survivors, what would you change?

28. During a typical week in the past 3 months, how often did access your Fitbit dashboard on the Fitbit website (www.fitbit.com) through a web browser on a laptop or desktop computer?

- Many times per day
- Once or twice per day
- A few times per week
- Once per week or less
- Rarely or never

29. Before joining Pink Body Spirit, did you ever use a wearable device (e.g., another Fitbit, Garmin, Polar, Jawbone, Apple Watch, etc.) to track your activity for at least one month or longer?

- Yes
- No

If yes: What was the name of the device?

Approximately how long did you wear it for?

Why did you stop wearing it?

What else would you like to share about your previous experiences with wearable activity trackers?

30. Are there devices other than the Fitbit that you would have liked to use to track your exercise?

- Yes
- No

If yes: What device? Why would you have liked this device more? _____

IV. The next few questions ask about your experience with your peer mentor.

31. What did you think about the number of sessions with your peer mentor?

- Way too many sessions
- A few too many
- Just the right amount
- Would have liked a few more sessions
- Would have liked many more sessions

32. Which forms of communication did you use to interact with your peer mentor over the past 3 months? Check ALL that apply

- Video chat (Zoom)
- Phone call
- Email
- Text
- Fitbit message
- Fitbit Community post
- Other: _____

33. Which communication mode did you like best for interacting with your peer mentor?

- Video chat (Zoom)
- Phone call
- Email
- Text
- Fitbit message
- Fitbit Community post
- Other: _____

34. How often did your peer mentor provide you feedback on your Fitbit activity during your scheduled sessions?

- During every session
- During most sessions
- During about half of the sessions
- During less than half of the sessions
- Rarely or never
- I don't know

35. How helpful was it to receive feedback on your Fitbit activity from your peer mentor during your scheduled sessions?

- Very helpful
- Helpful
- Somewhat helpful
- Not at all helpful
- Did not receive

36. How often did your peer mentor give you feedback on your Fitbit activity between scheduled sessions?

- Multiple times per week
- About once a week or between almost every call
- About once a month

- Rarely
- Never
- I don't know

37. How helpful was it to receive feedback on your Fitbit activity from your peer mentor between scheduled sessions?

- Very helpful
- Helpful
- Somewhat helpful
- Not at all helpful
- Did not receive

38. How much did knowing your peer mentor could check your Fitbit data motivate you to exercise?

- It motivated me a lot
- It motivated me sometimes
- It did not motivate me
- I was not aware that my peer mentor had access to my Fitbit data

V. Please think about your entire experience in Pink Body Spirit.

39. What about the program did you like best?

40. What about the program did you like least?

41. If you could improve the program for other younger breast cancer survivors, what would you change?

42. Overall, how enjoyable has your experience been in the Pink Body Spirit over the past 3 months?

- Not enjoyable
- Somewhat enjoyable
- Enjoyable
- Very Enjoyable

If not enjoyable: What was *not* enjoyable about being in Pink Body Spirit?

43. How likely are you to recommend the Pink Body Spirit program to other breast cancer survivors?

- Not likely
- Somewhat likely
- Likely
- Very likely

If Not likely: What are some reasons why you would not recommend the Pink Body Spirit program?

44. What other feedback or suggestions would you like to share?

Feasibility of Intervention Measure (T2)

Directions: As you are answering these questions, think about your entire experience in Pink Body Spirit.

	Completely disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Completely agree (5)
Pink Body Spirit seems like something most younger breast cancer survivors can participate in.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pink Body Spirit seems possible for me to participate in as part of my survivorship	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The Pink Body Spirit program seems doable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The Pink Body Spirit program is easy to use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Acceptability of Intervention Measure (T2)

Directions: As you are answering these questions, think about your entire experience in Pink Body Spirit.

	Completely disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Completely agree (5)
Pink Body Spirit meets my approval.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pink Body Spirit is appealing to me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like Pink Body Spirit.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I welcome Pink Body Spirit.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix 4c: Self-Reported Outcome Measures

Self-Reported Activity

1. On average, how many days per week do you perform muscle strengthening exercises (like weight lifting, bodyweight exercises (push-ups, sit-ups), or resistance training)?
2. On average, how many minutes per day do you engage in muscle strengthening exercises?
3. On average, how many days per week do you perform stretching and flexibility exercises (like yoga)?
4. On average, how many minutes per day do you engage in stretching and flexibility exercises?

Body Image Scale

In this questionnaire, you will be asked how you feel about your appearance, and about any changes that may have resulted from your disease or treatment. Please read each item carefully, and place a firm tick on the line alongside the reply which comes closest to the way you have been feeling about yourself, during the past week.

	Not at all	A little	Quite a bit	Very much
Have you been feeling self-conscious about your appearance?
Have you felt less physically attractive as a result of your disease or treatment?
Have you been dissatisfied with your appearance when dressed?
Have you been feeling less feminine/masculine as a result of your disease or treatment?
Did you find it difficult to look at yourself naked?
Have you been feeling less sexually attractive as a result of your disease or treatment?
Did you avoid people because of the way you felt about your appearance?
Have you been feeling the treatment has left your body less whole?
Have you felt dissatisfied with your body?
Have you been dissatisfied with the appearance of your scar?

Female Sexual Function Index

INSTRUCTIONS: These questions ask about your sexual feelings and responses during the past 4 weeks. Please answer the following questions as honestly and clearly as possible. Your responses will be kept completely confidential. In answering these questions the following definitions apply:

Sexual activity can include caressing, foreplay, masturbation and vaginal intercourse.

Sexual intercourse is defined as penile penetration (entry) of the vagina.

Sexual stimulation includes situations like foreplay with a partner, self-stimulation (masturbation), or sexual fantasy.

CHECK ONLY ONE BOX PER QUESTION.

Sexual desire or interest is a feeling that includes wanting to have a sexual experience, feeling receptive to a partner's sexual initiation, and thinking or fantasizing about having sex.

1. Over the past 4 weeks, how **often** did you feel sexual desire or interest?

- Almost always or always
- Most times (more than half the time)
- Sometimes (about half the time)
- A few times (less than half the time)
- Almost never or never

2. Over the past 4 weeks, how would you rate your **level** (degree) of sexual desire or interest?

- Very high
- High
- Moderate
- Low
- Very low or none at all

Sexual arousal is a feeling that includes both physical and mental aspects of sexual excitement. It may include feelings of warmth or tingling in the genitals, lubrication (wetness), or muscle contractions.

3. Over the past 4 weeks, how **often** did you feel sexually aroused ("turned on") during sexual activity or intercourse?

- No sexual activity
- Almost always or always
- Most times (more than half the time)
- Sometimes (about half the time)
- A few times (less than half the time)
- Almost never or never

4. Over the past 4 weeks, how would you rate your **level** of sexual arousal ("turn on") during sexual activity or intercourse?

- No sexual activity
- Very high
- High
- Moderate
- Low
- Very low or none at all

5. Over the past 4 weeks, how **confident** were you about becoming sexually aroused during sexual activity or intercourse?

- No sexual activity
- Very high confidence
- High confidence
- Moderate confidence
- Low confidence
- Very low or no confidence

6. Over the past 4 weeks, how **often** have you been satisfied with your arousal (excitement) during sexual activity or intercourse?

- No sexual activity
- Almost always or always
- Most times (more than half the time)
- Sometimes (about half the time)
- A few times (less than half the time)
- Almost never or never

7. Over the past 4 weeks, how **often** did you become lubricated ("wet") during sexual activity or intercourse?

- No sexual activity
- Almost always or always
- Most times (more than half the time)
- Sometimes (about half the time)
- A few times (less than half the time)
- Almost never or never

8. Over the past 4 weeks, how **difficult** was it to become lubricated ("wet") during sexual activity or intercourse?

- No sexual activity
- Extremely difficult or impossible
- Very difficult
- Difficult
- Slightly difficult
- Not difficult

9. Over the past 4 weeks, how often did you **maintain** your lubrication ("wetness") until completion of sexual activity or intercourse?

- No sexual activity
- Almost always or always
- Most times (more than half the time)
- Sometimes (about half the time)
- A few times (less than half the time)
- Almost never or never

10. Over the past 4 weeks, how **difficult** was it to maintain your lubrication ("wetness") until completion of sexual activity or intercourse?

- No sexual activity
- Extremely difficult or impossible
- Very difficult
- Difficult
- Slightly difficult
- Not difficult

11. Over the past 4 weeks, when you had sexual stimulation or intercourse, how **often** did you reach orgasm (climax)?

- No sexual activity
- Almost always or always
- Most times (more than half the time)
- Sometimes (about half the time)
- A few times (less than half the time)
- Almost never or never

12. Over the past 4 weeks, when you had sexual stimulation or intercourse, how **difficult** was it for you to reach orgasm (climax)?

- No sexual activity
- Extremely difficult or impossible
- Very difficult
- Difficult
- Slightly difficult
- Not difficult

13. Over the past 4 weeks, how **satisfied** were you with your ability to reach orgasm (climax) during sexual activity or intercourse?

- No sexual activity
- Very satisfied
- Moderately satisfied
- About equally satisfied and dissatisfied
- Moderately dissatisfied
- Very dissatisfied

14. Over the past 4 weeks, how **satisfied** have you been with the amount of emotional closeness during sexual activity between you and your partner?

- No sexual activity
- Very satisfied
- Moderately satisfied
- About equally satisfied and dissatisfied
- Moderately dissatisfied
- Very dissatisfied

15. Over the past 4 weeks, how **satisfied** have you been with your sexual relationship with your partner?

- Very satisfied
- Moderately satisfied
- About equally satisfied and dissatisfied
- Moderately dissatisfied
- Very dissatisfied

16. Over the past 4 weeks, how **satisfied** have you been with your overall sexual life?

- Very satisfied
- Moderately satisfied
- About equally satisfied and dissatisfied
- Moderately dissatisfied
- Very dissatisfied

17. Over the past 4 weeks, how **often** did you experience discomfort or pain during vaginal penetration?

- Did not attempt intercourse
- Almost always or always
- Most times (more than half the time)
- Sometimes (about half the time)
- A few times (less than half the time)
- Almost never or never

18. Over the past 4 weeks, how **often** did you experience discomfort or pain following vaginal penetration?

- Did not attempt intercourse
- Almost always or always
- Most times (more than half the time)
- Sometimes (about half the time)
- A few times (less than half the time)
- Almost never or never

19. Over the past 4 weeks, how would you rate your **level** (degree) of discomfort or pain during or following vaginal penetration?

- Did not attempt intercourse
- Very high
- High
- Moderate
- Low
- Very low or none at all

PROMIS Cancer Item Bank v1.0 – Fatigue

Please respond to each item by marking one box per row.

In the past 7 days...

		Never	Rarely	Sometimes	Often	Always
FATEXP16	How often were you sluggish?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP18	How often did you run out of energy?.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP19	How often were you physically drained? ..	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP2	How often did you feel run-down?.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP20	How often did you feel tired?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP22	How often were you bothered by your fatigue?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP24	How often did you have enough energy to enjoy the things you do for fun?.....	<input type="checkbox"/> 5	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1
FATEXP26	How often were you too tired to enjoy life?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP28	How often were you too tired to feel happy?.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP31	How often were you energetic?.....	<input type="checkbox"/> 5	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1
FATEXP48	How often did you find yourself getting tired easily?.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP5	How often did you experience extreme exhaustion?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP6	How often did you feel tired even when you hadn't done anything?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

PROMIS - Ca Item Bank v1.0 – Fatigue

In the past 7 days...

		Never	Rarely	Sometimes	Often	Always
FATIMP11	How often did your fatigue make you more forgetful?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP13	How often were you too tired to do errands?.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP14	How often did your fatigue make it difficult to organize your thoughts when doing things at work (include work at home)?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP15	How often did your fatigue interfere with your ability to engage in recreational activities?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP16	How often did you have trouble finishing things because of your fatigue?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP17	How often did your fatigue make it difficult to make decisions?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP18	How often did you have to limit your social activities because of your fatigue? ..	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP19	How often were you too tired to do your household chores?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP20	How often did your fatigue make you feel less alert?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP21	How often were you too tired to take a bath or shower?.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP22	How often did your fatigue make it difficult to organize your thoughts when doing things at home?.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP24	How often did you have trouble starting things because of your fatigue?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

In the past 7 days...

		Never	Rarely	Sometimes	Often	Always
FATIMP25	How often was it an effort to carry on a conversation because of your fatigue?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP26	How often were you too tired to socialize with your family?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP29	How often were you too tired to leave the house?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP3	How often did you have to push yourself to get things done because of your fatigue?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP30	How often were you too tired to think clearly?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP33	How often did your fatigue limit you at work (include work at home)?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP40	How often did you have enough energy to exercise strenuously?	<input type="checkbox"/> 5	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1
FATIMP53	How often were you too tired to take a short walk?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP56	How often were you too tired to socialize with your friends?	<input type="checkbox"/> 5	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1
FATIMP6	How often did your fatigue make you feel slowed down in your thinking?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP8	How often were you too tired to watch television?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP9	How often did your fatigue make it difficult to plan activities ahead of time?...	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
		Not at all	A little bit	Somewhat	Quite a bit	Very much
FATEXP12	To what degree did you feel tired even when you hadn't done anything?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

In the past 7 days...

		Not at all	A little bit	Somewhat	Quite a bit	Very much
FATEXP21	How fatigued were you when your fatigue was at its worst?.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP34	How tired did you feel on average?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP36	How exhausted were you on average?.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP40	How fatigued were you on average?.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP41	How run-down did you feel on average?...	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP42	How much mental energy did you have on average?	<input type="checkbox"/> 5	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1
FATEXP43	How physically drained were you on average?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP45	How sluggish were you on average?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP50	How fatigued were you on the day you felt least fatigued?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATEXP51	How easily did you find yourself getting tired on average?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP2	To what degree did your fatigue make you feel slowed down in your thinking?....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP28	How hard was it for you to carry on a conversation because of your fatigue?	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP34	To what degree did you have to limit your social activities because of your fatigue?.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

In the past 7 days...

		Not at all	A little bit	Somewhat	Quite a bit	Very much
FATIMP47	To what degree did you have to force yourself to get up and do things because of your fatigue?.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FATIMP52	To what degree did your fatigue make you feel less alert?.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
		None	Mild	Moderate	Severe	Very
FATEXP55	What was the level of your fatigue on most days?.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

PROMIS Cancer Item Bank v1.0 – Anxiety

PROMIS - Ca Item Bank v1.0 - Emotional Distress - Anxiety

Emotional Distress-Anxiety

Please respond to each item by marking one box per row.

In the past 7 days...

		Never	Rarely	Sometimes	Often	Always
EDANX07	I felt something awful would happen	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDANX05	I felt uneasy	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDANX09	I felt anxious	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDANX12	I felt upset	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDANX08	I had difficulty calming down	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDANX01	I felt fearful	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDANX02	I felt frightened	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDANX03	I felt terrified	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDANX06	I was concerned about my mental health	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDANX04	I felt indecisive	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDANX10	I had sudden feelings of panic	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDANX08	I felt fidgety	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDANX07	I felt like I needed help for my anxiety	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

PROMIS - Ca Item Bank v1.0 - Emotional Distress - Anxiety

In the past 7 days...

	Never	Rarely	Sometimes	Often	Always
<input type="checkbox"/> DANX30 I felt worried.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<input type="checkbox"/> DANX46 I felt nervous.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<input type="checkbox"/> DANX51 I had trouble relaxing.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<input type="checkbox"/> DANX54 I felt tense	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<input type="checkbox"/> DANX41 My worries overwhelmed me.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<input type="checkbox"/> DANX02 It scared me when I felt nervous.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<input type="checkbox"/> DANX48 Many situations made me worry	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<input type="checkbox"/> DANX09 I had unpleasant thoughts that wouldn't leave my mind	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<input type="checkbox"/> DANX39 I worried about dying	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

PROMIS Cancer Item Bank v1.0 – Depression

PROMIS - Ca Item Bank v1.0 - Emotional Distress - Depression

Emotional Distress-Depression

Please respond to each item by marking one box per row.

In the past 7 days...

		Never	Rarely	Sometimes	Often	Always
EDDEP06	I felt helpless	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP10	I felt that I wanted to give up on everything	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP25	I found that things in my life were overwhelming	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP05	I felt that I had nothing to look forward to	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP41	I felt hopeless	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP28	I felt lonely	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP09	I felt that nothing could cheer me up	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP21	I felt discouraged about the future	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP46	I felt pessimistic	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP17	I felt sad	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP29	I felt depressed	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP36	I felt unhappy	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP34	I felt emotionally exhausted	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

PROMIS - Ca Item Bank v1.0 - Emotional Distress - Depression

In the past 7 days...

	Never	Rarely	Sometimes	Often	Always
EDDEP21 I felt that I was to blame for things	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP26 I felt disappointed in myself	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP29 I felt I had no reason for living	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP46 I felt that my life was empty	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP04 I felt worthless	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP14 I felt that I was not as good as other people.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP22 I felt like a failure.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP27 I felt that I was not needed.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP23 I had trouble feeling close to people	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP07 I withdrew from other people	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP02 I felt lonely even when I was with other people.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP12 I had mood swings	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP16 I felt like crying.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDANG09 I felt angry.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDANG29 I felt irritable	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

PROMIS - Ca Item Bank v1.0 - Emotional Distress - Depression

In the past 7 days...

	Never	Rarely	Sometimes	Often	Always
EDDEP21 I felt that I was to blame for things	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP26 I felt disappointed in myself	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP29 I felt I had no reason for living	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP46 I felt that my life was empty	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP04 I felt worthless	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP14 I felt that I was not as good as other people.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP22 I felt like a failure.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP27 I felt that I was not needed.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP23 I had trouble feeling close to people	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP07 I withdrew from other people	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP02 I felt lonely even when I was with other people.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP12 I had mood swings	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDDEP16 I felt like crying.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDANG09 I felt angry.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
EDANG29 I felt irritable	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

PROMIS Item Bank v2.0 – Emotional Support

PROMIS Item Bank v2.0 - Emotional Support

Emotional Support – Calibrated Items

Please respond to each item by marking one box per row.

		Never	Rarely	Sometimes	Usually	Always
SSB-CaP27	I have people who I can talk to about my health.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FSE2102b2	I have someone who will listen to me when I need to talk.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FSE2102b2	I have someone to confide in or talk to about myself or my problems	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FSE2102b2	I have someone with whom to share my most private worries and fears	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
FSE2102b2	I have someone who understands my problems.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
GS1x	I feel close to my friends.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
GS2x	I get emotional support from my family ...	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
SS11x	I have someone who makes me feel needed.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
SS12x	I have someone who makes me feel appreciated.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
SSB-CaP28	I have someone I trust to talk with about my feelings.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
SSD1x	I have people who care about what happens to me	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
SSD2x	I get love and affection	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

PROMIS Item Bank v2.0 - Emotional Support

		Never	Rarely	Sometimes	Usually	Always
SS0262	I have someone to talk with when I have a bad day	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
SS0462	I have someone I trust to talk with about my problems	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
UCLA1862	I feel there are people who really understand me	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
UCLA1962	There are people I can talk to.....	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

Appendix 4d: Multimethod Process Evaluation

Peer Mentor Field Note Template

Peer Mentor Session Feedback

To what extent did you use your motivational interviewing skills during the session?

Did not use Used sometimes Used a lot



(Place a mark on the scale above)

How helpful was the motivational interviewing training in preparing you for this session?

Not at all helpful Somewhat helpful Very helpful



(Place a mark on the scale above)

Please rate your confidence during the session

Not at all confident Somewhat confident Very confident



(Place a mark on the scale above)

Did you check this mentee's Fitbit data on Fitabase since the last session?

- No
- Yes, once
- Yes, a few times
- Unsure/don't remember

If no, why not?

Did you contact mentee since last session to give feedback?

(Remember to track in Extra Support Tracking)

(Fitbit message, Email, Text, Call)

- No
- Yes, once
- Yes, a few times
- Unsure/don't remember

Other notes or reflections about how session went

For example: things that went really well, things that didn't go well, things you did not feel prepared to handle, questions for Lauren, things to share with team, adaptations made

Peer Mentoring Session Video Review Checklist

I. Study Overview/Agenda (Week 1 only)

1. Reviewed study purpose/role of peer mentor YES NO

Adaptations:

II. Getting to Know You (Week 1 only)

1. Discussed motivation for joining the study YES NO
2. Discussed current activity level YES NO

Adaptations:

III. Active Minutes (Week 1 only)

1. Defined active minutes and importance YES NO
2. Discussed heart rate YES NO
 a. Provided target heart rate YES NO
3. Reviewed how to monitor heart rate YES NO

Adaptations:

IV. Set Personalized Goal and Action Plan

1. Discussed last 2 weeks and progress toward goal (Follow-Up Sessions) YES NO
2. Set goal with participant YES NO
3. Discussed challenges & solutions to meeting goal YES NO
4. Asked importance of meeting goal YES NO
5. Asked confidence for meeting goal YES NO

Adaptations:

V. Fitbit

1. Reviewed self-monitoring with the Fitbit YES NO
2. Confirmed participant can charge and sync Fitbit YES NO
3. Explained accountability and checking of Fitbit between calls YES NO

Adaptations:

VI. Fitbit Community

1. Explained purpose of group and how to use it YES NO

Adaptations:

VII. Injury Prevention and Exercising Safely

1. Reviewed injury prevention materials (Week 1 only) YES NO

2. Asked adverse event question YES NO
3. Reminded participant to contact peer mentor ASAP if any injury occurs that could impact safe participation YES NO

Adaptations:

VIII. Next Steps/Wrap Up

1. Reminded participant to wear Fitbit all the time, except when bathing, and charge and sync at least 1x/week YES NO
2. Scheduled at least one follow-up session YES NO

Adaptations:

IX. Overall Impressions

1. Rate the rapport between the participant and peer mentor
 - Poor
 - Fair
 - Moderate
 - Good
 - Excellent

2. Rate peer mentor's ability to help participant set goals and create action plan
 - Poor
 - Fair
 - Moderate
 - Good
 - Excellent

3. Rate peer mentor's use of OARS (motivational interviewing skills)
 - Poor
 - Fair
 - Moderate
 - Good
 - Excellent

4. Rate the appropriateness and safety of goals set and topics discussed
 - Very inappropriate/unsafe
 - Somewhat inappropriate/unsafe
 - Mostly appropriate/safe
 - Very appropriate/safe

5. Rate the appropriateness with which safety alerts were handled during the session
 - Very inappropriate
 - Somewhat inappropriate

- Mostly appropriate
 - Very appropriate
 - N/A – no safety alert
6. Rate your overall impression of the session
- Poor
 - Fair
 - Moderate
 - Good
 - Excellent
7. Adaptations:
8. Other notes and items to discuss at team meetings:

Periodic Reflection Template

1. Date of Reflection
2. Status Update
 - What are the current main activities for the project and how are they going?
 - What barriers/concerns have arisen lately? What solutions have been tried?
 - Have there been any surprises or unexpected events?
3. Adaptations to the Intervention & Delivery
 - Have there been any modifications to how the intervention is delivered in the last month or so?
4. Environment/Context
 - Have there been any recent changes in the local or national environment that might impact the intervention and/or its delivery?
5. Planning
 - What new knowledge has been learned that could inform planning of the next study?
6. Other lessons learned
 - What other lessons have been learned?

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