

# A Web-Based Mind-Body Intervention (Mindful Steps) for Promoting Walking in Chronic Cardiopulmonary Disease: Insights From a Qualitative Study

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## Abstract

**Background:** Given the deleterious effects of physical inactivity in persons with chronic obstructive pulmonary disease (COPD) and/or heart failure (HF), interventions that promote long-term daily physical activity are needed. Mindful Steps, designed to promote walking behaviors in COPD and HF, is a multicomponent intervention that integrates mind-body content with other self-regulatory components. The aim of the current qualitative study was to characterize participants' experiences with Mindful Steps and understand the perceived influence of the intervention on walking and health.

**Method:** In the context of a pilot randomized controlled feasibility trial comparing the year-long Mindful Steps program to usual care among individuals with COPD and HF, semi-structured qualitative interviews were administered at 6- and 12-months. Interviews were audio recorded and transcribed. The constant comparative method was used to code transcripts, identify categories, and develop interrelated themes.

**Results:** Nineteen participants (63% female;  $M_{age} = 70.2$  years,  $SD = 6.95$ ) who were randomized to the intervention group completed the 6-month interview and 17 completed the 12-month interview. The pedometer with feedback, live group classes, and mind-body videos were described as the most helpful intervention components. Participants learned several strategies that helped their walking (e.g., breathing regulation and awareness, body awareness, mind-body techniques, pacing), described walking as enjoyable, and identified internal reasons for walking (e.g., to feel good). They also reported several physical and mental health benefits of the intervention. Some participants reported limited influence of the intervention on walking or health. Many participants continued to use the strategies they learned in the first half of the intervention at 12-months.

**Conclusions:** The mind-body content of Mindful Steps appeared to positively influence walking behaviors. Participants' experiences with the intervention helped to identify areas for future intervention refinement. Future quantitative work is needed to corroborate these qualitative findings and assess the efficacy of the intervention on long-term physical activity engagement.

**Trial Registration:** This trial is registered in ClinicalTrials.gov, ID number NCT01551953.

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physical activity, mind-body, chronic obstructive pulmonary disease, heart failure, self-regulation

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## Introduction

Chronic obstructive pulmonary disease (COPD) and heart failure (HF) are associated with significant reductions in physical activity.<sup>1-5</sup> When engaging in physical activities, individuals with COPD and HF experience considerable dyspnea and fatigue, which often lead to a vicious cycle of physical activity avoidance, worsening disease-related symptoms, and poorer overall health.<sup>6-8</sup> Complicating the clinical picture, frequently co-occurring anxiety and depressive symptoms also have a detrimental impact on physical activity.<sup>9-12</sup> Lower physical activity is associated with poor health outcomes in COPD and HF, including hospitalizations and readmissions,<sup>13-16</sup> COPD symptom exacerbations,<sup>15</sup> poor health-related quality of life (HRQL),<sup>17,18</sup> and increased mortality.<sup>13,19-22</sup>

Treatment guidelines for COPD and HF emphasize the importance of increasing physical activity levels.<sup>23,24</sup> Conventional pulmonary and cardiac rehabilitation programs, which are typically center-based, have been shown to improve exercise tolerance and HRQL in both COPD and HF.<sup>25-27</sup> However, only a small proportion of potential candidates are referred to and initiate these programs.<sup>28,29</sup> In addition, supervised aerobic exercise in cardiac and pulmonary rehabilitation may not translate to meaningful improvements in daily physical activity for individuals with COPD and HF after the programs end.<sup>30-33</sup> Therefore, accessible interventions are needed to help individuals with COPD and HF sustain long-term daily physical activity.

Given their convenience and accessibility, technology-based interventions have been developed to help promote PA in COPD and HF. In COPD, technology-based interventions that include pedometers, web platforms, or smartphone applications have been shown to improve PA levels, exercise capacity, and HRQL in the short-term, and COPD exacerbations in the long-term.<sup>34-38</sup> In HF, pedometer- or smartphone application-based interventions have demonstrated improvements in PA, symptom burden, and HRQL in the short-term,<sup>39,40</sup> and PA levels and exercise capacity in the long-term.<sup>41</sup>

The aim of the Mindful Steps study was to pilot test a new mind-body-focused intervention that was developed from a technology-based PA intervention, which has demonstrated promise for promoting walking behaviors in COPD. The original intervention, assessed in studies of Every Step Counts and Taking Healthy Steps,<sup>36,42</sup> was based on self-regulation theories of health behavior change and included individualized feedback from a pedometer, goal-setting, education for disease self-management, motivational

strategies, and social support.<sup>43</sup> The intervention coupled a pedometer with a web-based platform where participants could access their weekly and daily step counts, step-count goals, educational tips and motivational messages, and an online forum to interact with other participants. While this intervention significantly improved daily step counts compared to controls at 4 months, these improvements were not sustained at 12 months.<sup>44</sup>

In an effort to facilitate long-term walking behaviors in COPD and HF, Mindful Steps was created through the addition and integration of mind-body principles and content within this web-based intervention and expanded for use in patients with HF. Mind-body exercise interventions, such as tai chi, have been shown to be safe for individuals with COPD and HF and may help promote daily PA engagement.<sup>45,46</sup> Mind-body exercise interventions integrate low-to-moderate intensity movement with breathing regulation/awareness, body awareness, and mindful attention. Mind-body components may supplement the original web-based intervention by targeting new processes relevant to health behavior change, including intrinsic motivation and self-awareness/mindfulness (see Litrownik et al<sup>47</sup> for a conceptual model). The modified Mindful Steps intervention retained all of the components from the original web-based intervention (iterative feedback, goal-setting, educational tips and motivational messages, social support) and combined them with live, mind-body exercise classes and a video curriculum emphasizing mindful movement and walking. This multi-component intervention was designed to target multiple health behavior change processes (e.g., intrinsic motivation, mindfulness, self-regulation) to facilitate long-term walking behaviors.

In the context of a pilot randomized controlled trial examining the feasibility and acceptability of Mindful Steps, we conducted a qualitative study to characterize participant experiences with the intervention and to understand the perceived influence of the intervention specifically on walking behavior, as well as overall health. Findings will inform avenues for intervention optimization/refinement and generate hypotheses for future studies.

## Method

### *Participants and Parent Study Design*

The study (NCT03003780) was a 1-year pilot randomized controlled trial comparing a multicomponent program for promoting walking behaviors (Mindful Steps) to usual care. The study was approved by the Beth Israel Deaconess

Medical Center Institutional Review Board (approval number 2016P000368) and written informed consent was obtained from all participants. Forty one participants were randomized, in a 2:1 ratio, to the 1-year Mindful Steps intervention or usual care.

Participants were recruited from primary care and specialty clinics at Beth Israel Deaconess Medical Center and pulmonary rehabilitation clinics in the community. Individuals were eligible if they met the following criteria: (1) age >40 years; (2) clinical diagnosis of COPD, defined as either a ratio of forced expiratory volume in 1 second (FEV<sub>1</sub>) to forced vital capacity < .70 or chest computed tomography evidence of emphysema, and/or clinical diagnosis of HF syndrome (with left ventricular systolic dysfunction or preserved ejection fraction, and New York Heart Association Class 1-3); (3) medical clearance from a provider to participate in an exercise program; (4) an active email account with the ability to check email at least weekly; (5) and access to a computer with an internet connection and USB port (for uploading data from the pedometer to computer). Individuals were excluded if they met the following: (1) self-reported COPD or HF exacerbation in the previous 2 weeks; (2) inability to ambulate; (3) clinical signs of unstable cardiovascular disease; (4) hypoxemia during 6-minute walk test (oxygen saturation <85% with supplemental oxygen); (5) inability to collect at least 7 valid wear days of 14 days of baseline step counts; (6) current participation in a cardiac or pulmonary rehabilitation program.

### **Mindful Steps Intervention**

A detailed description of the Mindful Steps intervention has been previously published.<sup>47</sup> In brief, the multicomponent intervention was modified from the intervention used in the studies of Every Step Counts and Taking Healthy Steps.<sup>36,42</sup> This original intervention included a pedometer paired with a website with 3 main components: (1) homepage to visually display daily/weekly steps walked and individualized step goals based on the prior week's step count (*Feedback and Goals*); (2) motivational messages and educational disease self-management information (*Motivational Messages and Educational Tips*); and (3) a forum to read and post messages for all participants (*Online Forum*). Mindful Steps retained these intervention components, with some adaptations. For example, the motivational messages and educational tips were modified to include mind-body principles. Moreover, the original intervention was designed for individuals with COPD. Mindful Steps was adapted for individuals with COPD and/or HF. All intervention material was reviewed and made applicable to both COPD and HF. Disease-specific content was provided for both COPD and HF. Weekly step-count goals were calculated via similar algorithms used in previous studies.<sup>36,48-50</sup> The algorithm for

the current study included adding 400 steps to the average daily step counts from the prior week for the entire 12-month intervention. Step-count goals never exceeded 10,000 steps per day.

Four new intervention components were added to the original intervention. First, the *Mindful Walking Video Curriculum* included 26 brief videos focused on the themes from the live classes, including, for example: Introduction to Body, Mind, Breath; Motivation to Move; Putting the Joy Back into Exercise; Self-Kindness; Renewing Your Body with the Breath; Pain Management; Preventing Falls; Stop and Smell the Roses; Belly Breathing; and Walking for Your Mind and Spirit. Each video included didactic teaching of the theme and a guided mind-body exercise related to the theme. A new video was populated each week on the Mindful Steps website homepage. Second, the *Mind-Body Exercise Video Library* included 13 videos of the mind-body exercises taught in the live classes, which were meant to reinforce learning and facilitate home practice. These included, for example: Swinging and Drumming; Dragon Wags its Tail; Song Breathing; The Fountain; and Mindful Breathing. Third, *Live Group Classes* were offered throughout the year-long intervention. Live classes were 75 minutes and included guided walking (in-person classes included guided walks together; virtual class participants were given prompts for outdoor or indoor walks and then asked to reconvene after the walk) and mind-body exercises used in previous tai chi trials.<sup>45,46,51,52</sup> Mind-body exercises included mindful warmups and stretches, simple tai chi movements, and practice of mindful walking as detailed in the *Mindful Walking Video Curriculum* and the *Mind-Body Exercise Video Library*. Each class focused on a theme relevant to supporting walking (see Litrownik et al<sup>47</sup> for a list of themes). Classes were held weekly during the first 6 weeks of the intervention, biweekly for the next 34 weeks, and monthly for the last 12 weeks. Classes were initially conducted in-person and then were transitioned to video-conferencing due to COVID-19. Fourth, *Earn Your Stars* was designed to be a reward system for interacting with the website. Participants earned stars for reaching their step-count goal, watching videos, and viewing the motivational messages and educational tips. In addition, the original 6-month intervention was expanded to 12-months in Mindful Steps. New content was available in weekly motivational messages throughout the 12 months. For educational tips and the Mindful Walking Video Curriculum, content was repeated after the first 6 months. Participants were provided with a demonstration of the Mindful Steps website at the beginning of the intervention.

### **Qualitative Methods and Analysis**

This qualitative study was conducted in the 19 participants randomized to the intervention group that completed a qualitative interview as part of a mixed methods research

design, within specified boundaries,<sup>53-55</sup> to focus on the acceptability of the intervention and to discern evidence pertaining to the Mindful Steps conceptual model.<sup>47</sup> Both deductive and inductive methods were used in the development of interview protocols and data analysis. Nevertheless, inductive methods of analysis were used to capture unanticipated themes.<sup>56</sup>

**Data Collection.** Semi-structured interviews were conducted at 6- and 12-months in both the intervention and control groups. Given that the focus of this study was on examining acceptability of Mindful Steps, rather than examining differences in outcomes between groups, only the interviews from the intervention group were included in the current study. All interviews (see [supplemental materials](#) for interview guides) consisted of both directed and open-ended questions. Interviews began with a holistic question regarding participants' overall experience in the study, followed by content questions focused on the components of the intervention and the influence of the intervention on walking. Four interviews were conducted in-person and the remaining interviews were conducted over the phone due to the COVID-19 pandemic. Interviews ranged from about 10-79 minutes in length. Interviews were audio-recorded, transcribed, and labeled with the study ID.<sup>53</sup>

**Data Analysis.** Data analysis was conducted in 2 phases; a full analysis of the 6-month interviews preceded analysis of the 12-month interviews. Members of the qualitative research team (KMK, KK, DL, BJL, GY) conducted the analyses, using the constant comparative method, undertaking the following steps: (1) creating summary sheets, noting key ideas and exemplar quotes; (2) discussion of overall impressions and ideas; (3) coding subsets of transcripts to identify meaningful chunks in the data; (4) comparing and contrasting codes to verify intercoder agreement and reconcile areas of disagreement; (5) generating categories and integrating across categories to establish final themes.<sup>53,55,57</sup> After conclusion of the 6-month interview analysis, similar methods were used to identify emergent themes, and to search for similarities and differences across 6-month and 12-month interviews.<sup>57</sup> When selecting illustrative quotes, we used Study IDs to ensure we captured a broad range of participant input; IDs were then deleted in the manuscript to protect confidentiality.

## Findings

Nineteen participants randomized to the intervention group completed the 6-month interview and 17 participants completed the 12-month interview. Overall, participants (N = 19) were 63% female with a mean age of 70.2 years ( $SD = 6.95$ ). 84.2% self-identified as White, 10.5% as Black or African American, and 5.3% as Other. In regards to ethnicity, 94.7% self-identified as Not Hispanic or Latino and 5.3% as

Hispanic or Latino. 63% of participants had a qualifying diagnosis of COPD, 26% had qualifying diagnosis of HF, and 11% had both COPD and HF. 31.6% of participants previously attended pulmonary or cardiac rehabilitation. For N = 4 participants, all but 2 *Live Group Classes* were in-person prior to the COVID-19 pandemic. For N = 5 participants, 56% of classes were in-person and the remaining were conducted via videoconferencing, and for N = 10 participants, all classes were conducted via videoconferencing.

Our analysis of the 6-month interviews revealed the following themes: (1) our participants used the web-based intervention components in varied ways, believing some to be more beneficial than others for promoting their physical activity level; (2) participants expressed the belief that their varied use of the components positively influenced their walking and reported a sense of improved health. Our analysis of the 12-month interviews revealed that (3) participants continued to use the components in varied ways and continued to express their views of improved walking and improved health.

## Six-Month Interviews

### *Theme 1: Varied Experiences with the Intervention Components*

**Category 1A: Overall feedback on specific intervention components (Textbox 1A).** Participants expressed that the *Live Group Classes* allowed them to develop heightened body awareness, learn skills for walking, acquire social connections, and gain reinforcement from peers and instructors. In regards to the intervention website as a whole, which housed the remaining intervention components, there was tremendous variation in the amount of time and ways participants used it; some participants endorsed using it daily and other used it more sporadically. The *Pedometer with Feedback and Goals* was described as a means for self-monitoring and regulating PA and a source of encouragement or motivation for walking to achieve a pre-set goal. Participants often described a sense of accomplishment when achieving their goal. *The Mindful Walking* and *Mind-Body Exercise Videos* were helpful for reminding participants of a particular mind-body strategy, including the proper technique of the mind-body exercise, and reinforcing what they learned in the classes. Some participants identified the *Motivational Messages and Educational Tips* as helpful, particularly for reinforcing their learning. Very few participants endorsed using the *Earning Your Stars* component; participants that did use this component noted that it motivated them to engage with the intervention. Others suggested that they did not notice the *Earning Your Stars* component or that they could not make sense of how to use it. Most participants did not use the *Forum*, suggesting that they did not understand how to use this component or never saw other participants using it.

Textbox 1A. Illustrative Quotes – Feedback on Specific Intervention Components

Classes

- I think they're [the classes] good because it gives you an opportunity to meet and reinforce some of the things that you're trying to do. It gives you an opportunity to talk with the other study participants that are in the group.
- You don't realize that you're remembering the things, you get a flash and comes, and you use that. So, as I'm...doing 1 of the classes I might not be aware of it, but when I'm outside and walking it'll come to mind, and I'll utilize that tool.

Pedometer With Feedback and Goals

- I found the Fitbit to be very good for setting my goals. My wife says 'you're always looking at that thing' and I say 'I got to see what my steps are.'
- I have to say it's the Fitbit and I can look at how many steps I've done, and it enables me to go more. Sometimes I feel like I won't go anymore, and I'll look at what I've done on the Fitbit and I think to myself that I'm not tired and I can still keep going. It really motivates me.

Mindful walking/mind-body exercise videos

- I think those [the videos] are good. They usually tie in with the class. That's even better. Sometimes if I go through the class and I haven't seen the video I'll go look at it afterwards just to follow up with it.
- I like the videos to just see the exercise and see if I'm doing them right, that's very helpful.

Motivational Messages and Educational Tips

- I found most of the messages to be very interesting because it's not stuff that I've actually talked that much about. So it's given me a lot more reminders about—good motivation—messages to practice and incorporate.
- Most of the tips were really great, especially when they give you links to other sites which expanded my whole knowledge of COPD and the steps you can take to alleviate issues.

**Category 1B: Challenges to participation in the intervention and suggestions for improvement (Textbox 1B).**

For a few participants, social support/connection from peers was a particularly important source of motivation, yet was insufficient in the intervention. Participants who expressed this concern were enrolled when all classes were conducted via videoconferencing due to COVID-19. These participants believed it was difficult to connect with others via Zoom. Several participants noted that they would have benefited from more interaction in the classes, with some suggesting formal check-ins would help facilitate connection and would allow time to ask questions/review progress with walking and mind-body exercises.

The complexity of the website also posed challenges for some. Participants noted that the weekly themes from *Live Classes* did not always match the themes from the *Videos*. Some found the website difficult to navigate due to their technical knowledge. Two participants suggested providing more clarity/instructions around how to best use and engage with the multiple components of the website, including expectations for daily engagement and home practice.

Integrating mind-body components into the intervention surprised a few participants who were unclear about why mind-body components were included. One participant did not believe in the mind-body content of the intervention (i.e., considered it not to be real/believed it doesn't have benefits), which limited their use of some intervention components. A persistent barrier to walking and meeting step-count goals was weather variability. Despite tips/strategies for dealing with this barrier in the intervention, participants preferred walking outdoors and were limited by weather conditions. Some participants also found the class/website content to be repetitive, suggesting that more variety in exercises, classes, and website content would help them engage more with the intervention.

Textbox 1B. Illustrative Quotes – Challenges/Suggestions for Improvement.

- It would be helpful if you devote some time in those classes so that people could talk about their individual experiences...this exchange probably would've taken place if we were meeting in person, because there's always a little time before class or after...to know other people's situation and how they're doing can be helpful...
- I was thinking, would that be better if it was released [the class] and done at the [same] time that the video hit the streets? Because it's a long time late that you're doing it physically. I'm wondering, am I missing something or is there disconnect between the opening of a weekly video and class?



- ...there may be some paper that needs to come ahead...to say how to use the website, 'this is how you can gain more out of the website'. And maybe that can just be done by using the forum. It's probably the simplest way, to blast messages out on the forum...
- ...since I don't know tai chi, the exercises that we do which I really like—for example... why did you choose tai chi warmups as part of the study? Is it because they're connected to walking? I can't really answer some of these questions.
- I never really bought in to all this spiritual, mind stuff—some I do, some I don't. But that's me.
- The weather, yeah [keeps me from going out walking]. Yes I go outside its too cold and my asthma and stuff bothers me. And then I don't want to build up fluid in my lungs because it takes forever to get out. But come springtime I'm sure I'll kick back in again.
- As for the exercises...I found them too repetitive...to repeat a particular exercise for a whole week is boring...

## Theme 2: Influence of the Intervention on Walking and Health

**Category 2A: Learned Strategies that Positively Influenced Walking.** Participants described various strategies they developed throughout the intervention to help with their walking, including breathing regulation and awareness, body awareness and mindful attention, pacing, mind-body exercise techniques, and goal setting and monitoring.

2A.1: Breathing Regulation and Awareness (Textbox 2A.1). Shortness of breath while engaging in physical activity is a concern for persons with COPD and HF. Two strategies frequently endorsed as helpful for walking and shortness of breath were breathing regulation and awareness. Participants were able to regulate their breathing while walking through the use of breathing exercises introduced and reinforced in the classes and videos. Simply paying attention to the breath was also cited as helpful for walking. Overall, breathing regulation and awareness helped participants manage shortness of breath, enjoy walking more, relax while walking, and feel stronger or more confident while walking.

Textbox 2A.1. Illustrative Quotes – Breathing Regulation and Awareness.

- ...I think I'm more conscientious of my footing, and my breathing. I used to walk real fast, and now, I feel as though when I am

walking, I'm enjoying it more, because I'm paying attention to myself and my breathing and all that.

- ...I think the breathing things have been really helpful, and for instance, the thing I was doing yesterday, [similar to the video of] the person breathing in and out. I often do that when I'm going up a hill because that's when my breath gets shorter...
- I want to get out and walk so I'm outside anyways, and doing the breathing as I'm walking, it relaxes you.
- Being more aware of my movements and integration with your breathing and those pieces of it [were especially helpful]. But [the intervention activities] absolutely made me more aware. I feel like I have better tools to really enhance what I'm doing no matter what activity it is.

2A.2: Body Awareness and Mindful Attention (Textbox 2A.2). Heightened body awareness or overall mindful attention was a persistent theme emerging as a result of the program. Enhanced body awareness and mindfulness helped participants enjoy walking more, notice the positive effects of walking, feel more confident or capable of completing walking, be more aware of external surroundings, and potentially prevent falls. Increased body awareness or mindful attention helped participants take appropriate actions during a walk, such as releasing tense muscles or breathing more deeply.

Textbox 2A.2. Illustrative Quotes – Body Awareness.

- ... but when I'm doing the walking, my mind connects to it and I'm able to think about how I'm putting my foot down. And I think about how my hip doesn't really hurt me, and I think about how my arms are swinging and it feels good and I think about how my body is reacting to what I'm doing. It's so great, it's really great. I think my mind engages more than it did before when I was trying to walk by myself.
- Feeling the different parts of your body and how they feel when you walk—I think that was good because I tended not to do that. It left me 100% feeling great...
- I mentioned to [the instructor] last week that I'm walking more often with [my partner] and I find that I'm not breathing or I'm very tense and my hands are clenched, and I remind myself that I shouldn't be doing this. So, I'm

just more aware of how my body feels when I walk, and I think that's terrific.

- ...I've tried different things and tried to focus on certain things when I walk now as opposed to before just walking and not realizing what was going on, so now I know what actually is happening...

2A.3: Mind-Body Exercises/Techniques (Textbox 2A.3). Mind-body exercises and techniques, learned through the classes and videos, were described as helpful for participants' walking, perhaps influencing their awareness and mindfulness. Some noted that they used the exercises at different times throughout the day, such as when they noticed aches or pains, or when they woke up in the morning, while others used them while walking or to help relieve stress prior to walking.

Textbox 2A.3. Illustrative Quotes – Mind-Body Exercises/Techniques.

- Early on [the instructor] was talking about patting and I was thinking about that because I was having an issue walking initially and it would start to hurt, my hips would start to hurt. Then I said, well [the instructor] said something about patting, and I started just walking and patting my hip on the strides and then the pain went away.
- I still get up and I've got to do the stretches, the mindful part of it; those little exercises and the tai chi stuff, and it really helps it gets the flow. When you have a couple of aches and pains you can just do a little hip thing that gets you moving. With the arms I do the swinging, that really just gets you going, and it helps with balance.

2A.4: Pacing Walking to Meet Individual Needs (Textbox 2A.4). Learning to pace themselves during walking enhanced participants' ability to successfully complete their walking goal. Pacing also enabled them to plan and complete future walks, including modulating the intensity of the walk; knowing when to stop, breathe, and rest; and knowing when they shouldn't push themselves.

Textbox 2A.4. Illustrative Quotes – Pacing.

- I think the 1 thing that's changed is not approaching it [walking] as a challenge or task, not thinking if you don't do a certain time or you don't do a certain distance, you fail, but

yeah, I would always compare myself to that. I was always pushing myself to go faster but now I'm just happy and satisfied to be doing it at whatever pace you can, which is an adjustment, but I can definitely do it now.

- So, it's about, like I said, being aware of what you can handle and what you can't handle. And the program does in some ways give you that tool of being aware of what you can handle and what you can't. First of all, the instructor, they'll tell you in a minute 'stop, stop what you're doing, take a minute. Stop trying to push yourself to satisfy other people or try keeping with the class or whatever, stop.'
- ... and it's also teaching me not to exert myself, whereas before, if it was gorgeous out, I would force myself to go to the next block. And then it's like I'm all out of breath, I can't get my breathing back to normal, and then it's like I'm in the hospital.

2A.5: Goal Setting and Attainment (Textbox 2A.5). Participants found the step-count goals set by the study, and tracked via the pedometer, as helpful for their walking. Participants noted that having the step-count goal provided external motivation for walking and attaining the goal provided reinforcement. While participants were encouraged to use the step-count goal set by the study, some set their own goals or used goals pre-set by the pedometer. The resetting of goals seemed to be evidence of active engagement in goal setting based on individual preferences, perhaps a step toward becoming more aware and confident in walking.

Textbox 2A.5. Illustrative Quotes – Goal Setting and Attainment.

- I enjoyed putting it [pedometer] on because it makes me work to the goal. Or if I could pass the goal even better, I was so excited.
- Well, it allows me to push myself and make sure I reach a goal. And what are you looking for if you can't reach the goal?

**Category 2B: Walking Enjoyment and Motivation (Textboxes 2B.1 and 2B.2).** Another theme indicated that walking became more enjoyable as a result of the intervention.

Textbox 2B.1. Illustrative Quotes – Walking Enjoyment.

- Yes, I'm not rushing through the walk. It's more relaxing now for me. Before, if I went

out for a walk, I felt like I had to just get the walk over with. I felt that so much. Now I try to enjoy the walk.

- It's actually more enjoyable to walk since I've been taking this program, because of the suggestions that have been made by the facilitators.
- But I do think that it's definitely made me think differently about—well I've always enjoyed walking—the whole appreciation of nature has always been important. I had the internal dialogue going on and all of its gone and it's really good from my perspective since I'm much more in the moment and I think of it more as enjoyment time.

Participants also described walking for internal, autonomous reasons, including for their health, because it feels good, and for a sense of meaning and accomplishment.

Textbox 2B.2. Illustrative Quotes – Motivations for Walking.

- Well [in regards to my primary reason for walking] it started because of the program, of course, it was like, I don't want them to take away steps from these goals. It was goal oriented, it felt that way, but yeah [now], it's like, okay, I want to feel better, and a lot of times I do feel better...
- I have to tell you, walking to me means life. And I can't explain it any other way but that's what it means to me. It means life. So, as long as I keep walking, I'm going to have life. And I'm going to have lots of hope and just keep on moving—that's what it means to me.
- No, [the reason I walk is] to feel better. To stay healthy, to stay alive. That's the God's honest truth. Because it's been a rough 3 years for me and it took me 1 year to just get up to do anything so...the motivation is there.

**Category 2C: Perceived Overall Health Benefits.** 2C.1: Ease of Breathing (Textbox 2C.1). Shortness of breath and dyspnea are 1 of the main symptoms of COPD and HF. "Better breathing" became a recurrent theme throughout the interviews, as participants noted fewer episodes of shortness of breath and coughing, a welcome relief from these distressing symptoms.

Some participants noted that guidance on body position/posture was helpful for better breathing.

Textbox 2C.1. Illustrative Quotes – "Better Breathing".

- ...so since the study, I've seen my exercise increase.... Every day that I walk, I see my breathing improve, and I can walk around without breathing heavy.
- Well, my lungs feel like they're stronger—I'm still coughing and everything—but not like I did in the beginning, I was coughing all the time. So, I do feel like they've strengthened because I have the asthma and COPD.
- The whole thing about your body position really has an impact on [how you breathe] and I've never thought about that before – I just thought about belly breathing...and deep inhales...the stuff you learn normally. But that breathing piece about giving your lungs the least amount of resistance to be able to fill the best they can was probably the biggest thing I learned and used.

2C.2: Other Health Benefits (Textbox 2C.2). Participants noted other aspects of improved health, including an ability to manage stress, weight loss, as well as better musculoskeletal strength, balance, flexibility, and energy. One participant noticed improvement in the sensation in their feet and another noticed reduced leg swelling.

Textbox 2C.2. Illustrative Quotes – Other Health Benefits.

- As far as managing stress, it has allowed me to do that better because it brings you back to something that I actually knew and put away which is breathing. That when you're anxious or stressed, you can sometimes breathe your way out of it. So, that's a good thing.
- My legs aren't getting swollen anymore, the swelling in my legs has gone down. I was in the hospital 3 times last year; I haven't been near the hospital.
- My legs are definitely stronger. They were strong before, but I feel like they're stronger now. I don't get as crampy as I used to.
- On a regular basis I find that I'm more flexible than I was. Some of the classes were talking about balance and my balance is better than it was, you can even notice that in the shower. So it makes a difference.



**Category 2D: Limited Influence of the Intervention (Textbox 2D).** A few participants reported that they did not experience an increase in walking or confidence for walking as a result of the intervention. Some noted that they needed other forms of accountability or motivation for walking (e.g., walking buddy). Participants wondered if walking and the *Live Group Classes* were insufficient to result in health benefits, with some specifically denying health improvements. One participant noted that their cardiac rehabilitation program had been more intense, though they did see Mindful Steps as a way to develop a more regular habit of exercise.

Textbox 2D. Illustrative Quotes – Limited Influence of the Intervention.

- [The study] wasn't what I expected it to be. I thought it would be more physical than it is...
- I don't know if ultimately if it is beneficial in the sense of relieving symptoms of COPD and in terms of slowing it down...
- Physically it was okay. I got the point now let's go do something that actually makes us break a sweat and is more entertaining.
- There should be exercises that require a little more of them physically. ... although they might be good in terms of stretching... and learning how to breathe properly... some of the exercises should be a little more rigorous.

## Twelve-Month Interviews

### Theme 3: Continued Use of the Intervention Components

**Category 3A: Varied engagement with specific components at 12 months (Textbox 3A).** At 12-months, we noted broad variability in engagement with the intervention components. The content of the *ive Classes* and some website materials (e.g., videos, tips) in the final 6 months of the intervention was repeated from the first 6 months. Some participants found the repeated content helpful for reinforcing their learning or reviewing a skill, while others believed they did not need to re-review the content (e.g., did not need or want to re-watch the same videos). Of the 7 intervention components, participants tended to derive the most benefit from the *Live Classes* and the *Pedometer with Feedback and Goals* in the final 6 months. In regards to the *Live Classes*, participants described them as helpful for practicing the mind-body exercises they learned in the first 6 months. At the time of the 12-month interviews, all participants experienced some classes via videoconferencing, with some having transitioned from in-person classes. While the

videoconferencing classes were described as convenient, many participants missed connection with others in the classes and wanted more discussion with other participants and instructors. Some suggested using a hybrid of in-person and videoconferencing classes in the future. A majority of participants continued to use the pedometer to track their steps and promote their walking. If participants did engage with the website in the final 6 months of the intervention, they tended to re-watch the *Videos*, use the step goal chart, or read the *Motivational Messages and Educational Tips*.

Textbox 3A. Illustrative Quotes – Engagement with the Intervention Components at 12 months.

- ...if [I saw a skill] and I forgot what the person said, I would go onto the website and look at those sessions and study them...Because sometimes you are paying attention to the presenter and you do miss things, so I do that in order to go over what I missed.
- ...would've been nicer to see more from the website, you know, fresher stuff, because it was like, "Okay, yeah," but really am I missing something?
- I found the classes in particular to be really helpful and I use some of those techniques seriously... well not every day but certainly weekly...it's encouraged me to not give up, which I think is probably the biggest thing...you feel like you're actually trying to participate in maintaining as much health as possible.
- ...well I really enjoy that [the videos] cause I'll forget a little bit. I'll remember most of what to do but then want to make sure that I'm doing it right so it's nice to be able to refer to it.

### Category 3B: Continued Influence of the Intervention on Walking and Health at 12 months.

3B.1: Continued use of Learned Strategies that Positively Influenced Walking (Textbox 3B.1). In the final 6-months of the intervention, participants continued to use several strategies they learned in the first 6 months for walking. Participants frequently cited using the mind-body exercises, goal-setting, breathing regulation and awareness, and body awareness to help with their walking. The mind-body exercises helped with fatigue, stretching and warming up the body, minimizing ailments during a walk, greater alertness, and more focused attention. One participant who was not "on board" with the mind-body exercises at the 6 month interview reported using them frequently in the final 6 months, recognizing their helpfulness. Several participants continued to use body awareness

and mindful attention while walking, with some noting that it allowed them take helpful action while walking (e.g., regulating the breath). Many participants also continued to use the step-count goals set by the study or their own goals, which helped motivate their walking in the final 6 months.

Textbox 3B.1. Illustrative Quotes – Continued Use of Learned Strategies at 12 months.

- ... or if I was walking and I had pain, I would stop and do the leg circles or hip circles... That helped me continue to go—knowing that stopping isn't that big of a deal... that helped to relax breathing, either 1 or all of it together and then keep going.
- Sometimes I get up in the morning...and my body just doesn't want to move. So I just do a little bit of the swaying and loosening of the hip's thing—it gets the juices flowing, so it really does work.
- ...I pay more attention. Before I would just walk casually hoping not to stumble, but when I walked, I was paying attention to the movement of my foot... So, that's what I found valuable with this study, is paying attention to your movement as you walk...

3B.2: Maintenance of Overall Health Benefits (Textbox 3B.2). Positive health benefits noted at the 12-month interview included better breathing, weight loss, improved balance and posture, improved strength, improved mental function, and feeling in better shape. A few participants denied any notable changes in their health.

Textbox 3B.2. Illustrative Quotes – Maintenance of Health Benefits at 12 months

- Well I feel stronger, partly because I am really trying to do more walking. I feel particularly stronger in my legs. I think my posture is better and I am certainly more attentive to what I am walking on with my balance
- My breathing was not so much anxiety, it was nice and calm and leveled out and it was all good

3B.3: Physical Health and Weather as Barriers to Walking (Textbox 3B.3). At the 12-month interview, some participants described additional physical health ailments that interfered with their ability to engage in physical activity (e.g., knee surgery). Many participants also continued to cite the weather

as a major barrier to walking, explaining that their health conditions make it difficult to walk in overly warm or cold temperatures.

Textbox 3B.3. Illustrative Quotes – Physical Health and Weather as Barriers at 12 months.

- The thing that stood out most to me, was having a lot of health problems during the last 6 months—the blood pressure, the whatever—and so I didn't feel like getting as much out of it as I wanted to. I wasn't able to do as much walking [after health problems], and I kind of felt that I was very limited—I still participated and still helped—but was very limited.
- When you're trying to walk and exercise and get out there all the time, the weather just kills you.

## Discussion

The aim of this qualitative study within a pilot randomized controlled trial was to better understand participants' experiences with the Mindful Steps intervention, as well as its influence on walking and health. Mindful Steps was developed as a multicomponent intervention to provide participants with a broad spectrum of strategies that target processes relevant for health behavior change. At 6-months, consistent with previous research on the efficacy of pedometers,<sup>58</sup> the *Pedometer with Feedback and Goals* was frequently cited as helpful for monitoring and promoting walking. The addition of mind-body content, particularly via the *Live Classes* and mind-body *Videos*, also appeared to be helpful for walking. Participants appreciated that the *Live Group Classes* and *Videos* complemented and reinforced 1 another. For example, participants were able to go back to a video and practice a mind-body technique they learned in the *Live Group Classes*. At 12-months in the current study, the *Live Group Classes* and *Pedometer with Feedback and Goals* were cited as the most used and helpful intervention components. However, across the 12-month intervention, reported engagement with the website and each component varied. In the original intervention assessed in the Taking Healthy Steps study, Moy and colleagues<sup>44</sup> found that pedometer adherence and engagement with the website significantly declined over the course of 12-months. Despite the potential benefits of a long-term intervention for promoting behavior change, to help elucidate the optimal dose of Mindful Steps, future quantitative research is needed to examine engagement with each intervention component over time and the degree to which engagement is associated with physical activity-related outcomes.

Through the Mindful Steps intervention components, participants learned a variety of strategies that were particularly helpful for walking, including breath regulation/awareness, body awareness, pacing, mind-body exercises, and goal setting. For individuals with COPD and HF, fear of breathlessness or fear of PA (likely due to breathlessness experienced during PA) are barriers to engaging in PA.<sup>59-63</sup> In Mindful Steps, participants practiced breathing exercises (e.g., pursed lip breathing) and learned how to non-judgmentally attend to their breath. At 6-months, we identified prominent themes regarding the usefulness of the breathing exercises and improvements in breathing. Breathing regulation and awareness skills allowed many participants to feel more confident in their ability to complete walking and better enjoy walking, potentially because they were able to manage breathlessness. Furthermore, breathing and body awareness may have helped participants take appropriate action while walking based on their individual needs (e.g., take a break, pace the walk, release muscle tension), including for managing shortness of breath. These findings are consistent with results from our previous qualitative research, which suggested that a tai chi mind-body exercise program helped diminish the fear of breathlessness among individuals with COPD.<sup>60</sup> At 12-months in the current study, many participants persisted in using the strategies they learned in the first half of the intervention to help with their walking. The mind-body exercises emerged as particularly helpful in the second half of the intervention for warming up the body, helping to alleviate ailments/distressing symptoms, and promoting continued body awareness.

Daily PA and exercise capacity are considered distinct constructs, with daily PA modified through behavior change interventions and exercise capacity through intensive exercise programs (e.g., pulmonary rehab).<sup>64</sup> Mindful Steps was designed to build mind and body awareness to help individuals self-regulate (e.g., pacing oneself, taking breaks when needed) and build self-efficacy for maintaining long-term daily PA. While participants in the current qualitative study endorsed pacing as an important walking strategy, it is unclear how Mindful Steps impacts PA intensity and exercise capacity. It is possible that individuals rely on pacing and taking breaks early on, which leads to increased exercise self-efficacy and comfort for increasing their PA intensity. Given the importance of higher exercise intensity for improving functional capacity, future quantitative work should examine whether Mindful Steps modulates PA intensity over time.

Mindful Steps may have also shifted affective responses to walking and motivations for walking, consistent with our conceptual model,<sup>47</sup> although future quantitative research is needed to corroborate these findings. Participants frequently endorsed walking as enjoyable. While it is unclear whether walking enjoyment was associated with greater physical activity engagement in the current study, extant research has identified enjoyment as an important predictor of physical activity participation.<sup>65-67</sup> Many participants also shared their

reasons for walking, including walking for their health, because it feels good, and for a sense of meaning or accomplishment. We interpreted these comments as a potential shift towards more internal and autonomous forms of motivation for PA (e.g., intrinsic motivation, identified regulation), which are associated with greater PA engagement.<sup>68</sup> Given that Mindful Steps was adapted to promote long-term walking behaviors, additional research is needed to evaluate whether changes in enjoyment and motivation lead to downstream improvements in PA.

Overall, these findings suggest that the addition of the mind-body content in Mindful Steps (added on to the original Every Step Counts and Taking Healthy Steps interventions)<sup>36,42</sup> may have benefits for walking. Indeed, we identified themes related to self-regulation (e.g., internal motivation, mindful attention, self-monitoring, pacing), which has been proposed as a key process implicated in mindfulness interventions for behavior change.<sup>69,70</sup> Further, breathing and other mind-body exercises appeared to positively influence distressing symptoms associated with COPD and HF (e.g., breathlessness), as well as more general symptoms that may interfere with walking (e.g., pain), perhaps helping to build self-efficacy for walking. Future quantitative work is needed to examine whether the addition of mind-body content in Mindful Steps facilitates long-term physical activity engagement.

It is important to note that some participants reported limited influence of the Mindful Steps program on walking and health. These participants may have learned a new skill (e.g., body awareness), but generally did not believe the mind-body content was helpful for their walking or health, had health problems that interfered with walking, wanted a more intense physical exercise program, or wanted more accountability for walking. Future research should examine moderators of the intervention response to better understand which patients may benefit the most from Mindful Steps.

Participant challenges and suggestions for improvement have helped to identify potential avenues for intervention optimization. While many participants appreciated the convenience of the *Live Classes* via videoconferencing, they believed they would have benefitted from more peer social support and discussion. Therefore, videoconferencing classes could incorporate group sharing or connection before or after the classes and future iterations may consider a hybrid approach (e.g., mixture of in-person and virtual classes). Participants would have also benefited from clearer guidance or suggestions for how to engage with, or get the most out of, the website. A future iteration of the intervention might consider better concordance between the rollout of the *Videos* and the *Live Classes*, so that they reflect the same themes on the same weeks, which would help reinforce learning. Moreover, participants would benefit from a more concrete rationale regarding why mind-body components and skills might be helpful for improving walking, which may facilitate an autonomy supportive context, consistent with self-determination theory.<sup>71</sup> Consistent with existing research

on COPD and HF,<sup>72,73</sup> many participants identified the weather as a major barrier for engaging in physical activity. Therefore, the intervention might better incorporate strategies for maintaining physical activity during periods of difficult weather. Finally, while participants endorsed physical health benefits of Mindful Steps, some participants noted physical health ailments that interfered with walking, particularly at 12 months. Given the progressive nature of COPD and HF, and the comorbidities associated with these conditions, it may be helpful for the intervention to incorporate strategies for staying physically active during periods of worse health, as appropriate (e.g., chair exercises).

There are several limitations that warrant consideration. First, the qualitative interviewer was an active member of the research team who interacted frequently with participants throughout the study. Therefore, there is the potential for bias with participants trying to please the investigator or not feeling comfortable sharing negative feedback. Second, interviews were designed not to be time-intensive yet cover a broad range of topics. The study was not designed to provide generalizable findings, but may provide insights into how individuals with COPD and HF respond to a novel intervention designed to promote walking. While we were able to identify themes related to acceptability of, and experiences with, Mindful Steps, future in-depth interviews in a mixed-methods study are needed to further explore these themes (i.e., in the context of a larger RCT) and examine how, and for whom, Mindful Steps exerts its effects (e.g., differences between individuals with COPD and HF). Fourth, we did not examine whether qualitative themes differed based on previous enrollment in cardiac or pulmonary rehabilitation. It is possible that individuals who previously completed an intensive exercise program in cardiac or pulmonary rehab had a different experience in the intervention compared to individuals who have never completed a rehab program; future work should examine whether responses to Mindful Steps varies based on rehabilitation status. Fifth, the sample predominantly self-identified as White. It is important to better understand the acceptability of Mindful Steps in a more diverse population.

Despite these limitations, the current qualitative findings suggest that Mindful Steps is acceptable to individuals with COPD and HF and may have benefits for walking. Overall, these findings help to formulate hypotheses regarding the potential pathways through which the intervention may impact walking behaviors.

### Declaration of Conflicting Interests

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### Supplemental Material

Supplemental material for this article is available online.

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