



“It’s Been a Game Changer”: Examining Treadmill Desk Use When Working from Home

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Abstract

Previous research has established the physical and mental benefits of using active workstations like treadmill desks in the workplace, such as reducing sedentary behavior and improving mood. However, treadmill desk use when working at home has not been examined despite significant increases in working from home during the COVID-19 pandemic. Therefore, the objectives of this study were (1) to be the first to describe how treadmill desks are used when working from home and (2) to describe perceived benefits, motivators, and barriers for treadmill desk use when working from home. Twenty participants who worked from home and used a treadmill desk were interviewed between February 2022 and April 2022. Participants reported using their treadmill desks while completing a variety of work and non-work tasks and experienced physical, mental, social, and work-related perceived benefits. Motivators for use included desires to reduce prolonged sitting and be more active, wanting to be healthier and fitter, tracking and reaching goals like daily step counts, feeling good during use, and to overcome increased sedentary behavior due to working from home during the COVID-19 pandemic. Barriers to use included the type of work being done, physical limitations, accessibility issues, social concerns, and mental barriers. Future research should investigate ways to increase treadmill desk use at home by capitalizing on motivating factors and reducing barriers to use.

Keywords Active Workstation · Treadmill Desk · Physical Activity · Walking · Sedentary Behavior

Past experimental research has demonstrated that employees who use treadmill desks in a laboratory or an office environment experience physical and mental health benefits (e.g., Sliter & Yuan, 2015). Treadmill desk users are more active, walking

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about 2 additional miles per day when compared to not using a treadmill desk (Giumetti et al., 2021). While the benefits of treadmill desk use are clear, research exploring how workers use treadmill desks is needed to encourage their implementation and continued use (Tudor-Locke et al., 2014). To the authors' knowledge, no studies have explored treadmill desk use by employees working from home. However, the home office environment is particularly important to understand due to the recent increase in working from home caused by the COVID-19 pandemic, with 59% of employed adults whose job responsibilities can be done from home choosing to continue working from home all or most of the time (Pew Research Center, 2022). Therefore, the goal of this study was to contribute novel research findings to the literature on active workstations by exploring how treadmill desks are used at home, the perceived benefits of treadmill desk use at home, and what factors serve as motivators or barriers for treadmill desk use at home.

Benefits of Treadmill Desk Use

Sitting for prolonged periods of time at work is associated with negative physical and mental health outcomes including increased neck and back pain, weight gain, negative affect, fatigue, risk of diabetes, cardiovascular disease, and even increased risk of death (Flint et al., 2017; Wilmot et al., 2012). Active workstations such as sit-to-stand desks, cycling desks, and treadmill desks can be used to improve health outcomes for employees who work in seated desk jobs by reducing sedentary behavior and increasing engagement in light physical activity. In a recent randomized-controlled trial examining the long-term effects of active workstations, employees using a treadmill desk engaged in fewer daily sedentary bouts at the workplace when compared to a sit-to-stand desk group and a control group at 12 months (Arguello et al., 2021). Furthermore, reviews of the active workstation literature have revealed that treadmill desks increase energy expenditure more than other types of active workstations (Tudor-Locke et al., 2014) and are associated with greater physiological benefits than a standing desk (MacEwen et al., 2015). In a sample of physicians, treadmill desk walking led to weight loss and reduced body fat when compared to not using a treadmill desk (Thompson et al., 2014). Furthermore, treadmill desk use is associated with better recall and attention (Labonté-LeMoyné et al., 2015), more vigor and positive affect (Giumetti et al., 2021), and greater arousal, less stress, and more task satisfaction than standing (Sliter & Yuan, 2015).

Fortunately, treadmill desks provide these benefits while not sacrificing most task performance (Cao et al., 2016). Treadmill desk users may experience modest, short-term decreases in motor performance (Straker et al., 2009), but cognitive performance and long-term work performance are not affected (Ehmann et al., 2017; Koepp et al., 2013; Sliter & Yuan, 2015). However, it is unknown how the benefits of treadmill desk use in the workplace compare to the benefits of treadmill desk use at home. Furthermore, although there is no research on the organizational benefits of treadmill desks specifically, past research has demonstrated that workplace physical activity interventions more broadly are associated with less absenteeism (Grimani et al., 2019). Additionally, companies that provide strong health promotion

programs for employees have better performance outcomes (Goetzel et al., 2019). Therefore, organizations may choose to invest in employee health and well-being via active workstations like treadmill desks, and an understanding of the motivators and barriers to their use are important for their successful implementation.

Motivators and Barriers to Treadmill Desk Use

All the research examining treadmill desk use has occurred in either a research laboratory or an office setting, with only one study exploring the motivators and barriers to treadmill desk use in an office setting. Cifuentes et al. (2015) conducted a qualitative study with five female university employees who used a treadmill desk in their offices for 6 months. Usability, safety, comfort, and productivity were identified as factors influencing treadmill desk use. Employees found an electric treadmill desk easy to use, used it more often when they had control over their daily schedule, and reported feelings of enjoyment, increased energy, higher concentration, and positive mood after 4 months of use. However, they also identified several barriers to using the treadmill desk, such as it being difficult to move everything from the sitting area to the standing area, knee and foot pain during the first few weeks of use, the noise negatively impacting communication, interruptions throughout the day, and derogatory comments from coworkers. These findings could be used to improve usability and acceptability of treadmill desks in an office environment with the goal of improving worker health through reduced sedentary time. However, it is unknown if the motivators and barriers to treadmill desk use are different when working from home.

Present Study

To address these gaps in the literature, our study aimed to answer the following research questions (RQs):

RQ1: How are treadmill desks used when working from home and by whom?

RQ2: What are the perceived benefits of treadmill desk use at home?

RQ3: What motivates individuals to use their treadmill desks when working from home?

RQ4: What barriers exist to treadmill desk use when working from home?

Method

Participants

Twenty participants completed the study between February 2022 and April 2022. The study was constrained to 20 participants due to funding limitations. Participants were eligible if they had a treadmill desk at home, worked from home at least one

day per week, lived in the United States, and were at least 18 years old. Participants were recruited via study advertisements emailed to treadmill desk owners via Lifespan Fitness and iMovr and posted in relevant groups on LinkedIn, Twitter, Facebook, and Reddit. Participants were compensated for their time with a \$50 Amazon.com gift card.

Measures

Structured Questionnaire

Participants completed a 23-item structured questionnaire to report their demographics, characteristics of their home environment (e.g., neighborhood type), employment (e.g., type of job; hours per week; work location), and treadmill desk characteristics (e.g., manufacturer and date of purchase). Participants uploaded an optional photo of their home treadmill desk and provided explicit permission for the photo to be used in presentations and publications of this research.

Interview Script

Nineteen interview questions with optional follow-up questions were developed to explore how participants used their treadmill desk while working from home (e.g., hours per day; speed of walking) and the perceived benefits, motivators, and barriers to treadmill desk use. The interview questions included items such as “What motivates you to use the treadmill desk?” and “What makes it difficult for you or prevents you from using the treadmill desk?” The complete set of interview questions is provided in the Appendix.

Procedure

The study was approved by the Eastern Connecticut State University Committee for the Use of Human Subjects in Research (CUHSR). Interested participants who responded to the study advertisement were emailed a survey to complete in Qualtrics. The survey began with participants providing informed consent, followed by pre-screening questions to ensure participants met the study requirements. After passing the prescreening questions, participants completed the structured questionnaire. The researcher confirmed they were in the United States using the Qualtrics provided location. All eligible participants were sent an invitation to schedule a 30-min interview with a member of the research team.

Interviews were conducted virtually using Microsoft Teams. Video and audio were recorded with permission, and the automatic transcription feature was used. The researcher also took notes on the participant’s answers to help with future transcription editing. The researcher followed the interview script, using pre-planned prompts when additional information was needed to further understand a participant’s response.

Quantitative data were analyzed using IBM SPSS v25, and qualitative data were analyzed using Taguette, a free and open-source tool for qualitative research. Qualitative data were analyzed using a type of thematic analysis known as Template Analysis with 6 phases (Brooks et al., 2015). The Template Analysis approach was selected as a good fit for answering the research questions because it allows for *a priori* themes, and it also lends itself well to a team-based analysis (Brooks et al., 2015). This manuscript's first author is a home treadmill desk user. To minimize possible bias, the second through fourth authors, who have never used a treadmill desk, conducted all interviews, transcription editing, and initial coding and theme generation. The first author provided methodological guidance on how to conduct the analysis and collaborated on the development of the coding template.

In phase 1 of Template Analysis, familiarization, the researchers independently reviewed the recorded interviews and edited the transcripts for accuracy. In phase 2, preliminary coding, the researchers independently coded the transcripts, using a combination of *a priori* themes based on the interview questions (e.g., motivators, barriers to use, perceived benefits) and subthemes that they generated during this stage (e.g., COVID-19 pandemic). In phase 3, the researchers collaboratively organized the subthemes into meaningful clusters. For example, the team organized the subthemes of mental perceived benefits, physical perceived benefits, and work-related perceived benefits within the broader theme of perceived benefits at this stage. In phase 4, defining the initial coding template, a full template of themes and subthemes was generated. In phase 5, this coding template was applied as data analysis continued, and the template was collaboratively modified as necessary. For example, a theme called interpersonal was later split into a subtheme of perceived benefits called social perceived benefits and a subtheme of barriers to use called social concerns to better represent the relationships within the data. When new subthemes were generated, the researchers returned to the transcripts to add the subthemes where appropriate. In phase 6, the researchers finalized the template of themes and subthemes and applied it to the full data set.

Results

Treadmill Desk Use

Table 1 summarizes participant demographics, Table 2 summarizes features of their employment and treadmill desk usage, and Fig. 1 shows example photos of participants' home treadmill desk set ups. Participants described using their treadmill desk anywhere from once per month to seven days per week, from 45 min to 10 h per day (with breaks), and at a comfortable walking speed of 0.7–3 mph. Sixty-five percent of participants obtained their treadmill desk in 2020 or 2021. There was a non-significant negative correlation between length of time owning a treadmill desk in months and hours used per week, $r(19) = -0.21$, $p = 0.39$. Participants used their treadmill desk during meetings, video conferences, phone calls, webinars, and when reading, writing, studying, entering data, using online chat, using spreadsheets, emailing, teaching, grading, watching videos, and searching the Internet. They also

Table 1 Demographic Characteristics of Study Participants

Characteristic	<i>n</i>	%	Mean	<i>SD</i>
Gender				
Female	13	65		
Male	7	35		
Race				
White	16	80		
Black or African-American	2	10		
Asian	1	5		
Other	2	10		
Age			43	12
Marital Status				
Married	14	70		
Divorced	3	15		
Never Married	3	15		
Children live with you ^a	7	35		
Pets live with you ^a	13	65		
Neighborhood				
Urban	5	25		
Suburban	13	65		
Rural	1	5		
Other	1	5		
Occupation				
Education, Training, and Library	5	25		
Management	3	15		
Healthcare Practitioners and Technicians	3	15		
Life, Physical, and Social Science	2	10		
Computers and Mathematics	2	10		
Legal	1	5		
Business and Financial Operations	1	5		
Community and Social Service	1	5		
Healthcare Support	1	5		
Transportation and Materials Moving	1	5		
Pre-tax household income				
\$55,000–\$64,999	2	10		
\$75,000–84,999	1	5		
\$85,000–94,999	2	10		
\$95,000–104,999	1	5		
\$105,000–\$149,000	5	25		
\$150,000–\$199,999	3	15		
\$200,000 +	5	25		

N = 20. *SD* = Standard deviation

^aReflects the number and percentage of participants answering “yes” to this question

Table 2 Treadmill Desk and Work Characteristics

Characteristic	<i>n</i>	%	Mean/Median	<i>SD</i> /Range
Treadmill desk purchase				
Self	17	85		
Employer	1	5		
Gift	2	10		
Treadmill desk type				
Lifespan	13	65		
Homemade set-up	2	10		
iMovr	1	5		
Other	4	20		
Treadmill desk location at home				
Home office	16	80		
Bedroom	2	10		
Basement	1	5		
Other	1	5		
Days worked per week				
3	1	5		
5	15	75		
6	1	5		
7	3	15		
Hours worked per week				
<20 h	1	5		
25–29 h	1	5		
35–40 h	10	50		
41 + hours	8	40		
Work location				
At home	15	75		
Hybrid of at home and at work	5	25		
Work location change in response to COVID-19				
Working from home more	13	65		
No change	7	35		
Treadmill desk use: Days per week				
1–3	5	25		
4–5	12	60		
6–7	3	15		
Treadmill desk use				
Hours per day			<i>M</i> = 2.71 <i>Md</i> = 2.00	<i>SD</i> = 2.25 Range = 9.25
Speed (mph)			<i>M</i> = 1.87 <i>Md</i> = 2.00	<i>SD</i> = 0.55 Range = 2.30
Miles per day			<i>M</i> = 4.89 <i>Md</i> = 4.00	<i>SD</i> = 3.63 Range = 16.03
Months of ownership			<i>M</i> = 40.20 <i>Md</i> = 14.50	<i>SD</i> = 46.39 Range = 140
Treadmill desk use: Use incline ^a	3	15		

N = 20. *Md* = median, *M* = mean, *SD* = standard deviation. ^aReflects the number and percentage of participants answering “yes” to this question



Fig. 1 Examples of Participants' Home Treadmill Desks. *Note:* Top left panel: A desk that can allow for sitting on the left and walking on the right. Top right panel: A desk positioned close to laundry machines. Bottom left panel: A treadmill desk positioned near a window letting in natural sunlight. Bottom right panel: A treadmill desk created from a modified traditional sitting desk

used their treadmill desk for non-work activities, like watching TV shows, videos, or sports, online shopping, personal emails, listening to audiobooks or podcasts, and

working on personal finances. They described walking on the treadmill as an effective way to multitask and create time for physical activity, like a “two for one” and “a total win” (Participant 8), especially if they experienced time constraints:

And I also am relatively busy. You know, I have a full-time job. I have 4 kids. It’s, uh, like my opportunities to go for a long walk, like they don’t exist. I don’t have the time for that. Even though I enjoy walking and I know it will keep my body healthier... And so if I don’t use my treadmill desk, there’s no way I am even going to get 10,000 steps in a day. (Participant 20)

One participant described the advantages of using a treadmill desk at home versus the office:

When you work from home, it’s a lot easier to kind of have a treadmill desk. Uh, if you’re in an office, it might be a little bit different, but you know, I can put a pair of shorts on and some workout gear and you know, I’m not feeling... (Researcher: Yeah, they won’t even notice.) Exactly. (Participant 11)

Participants either described treadmill walking as the only planned exercise they got during the day or described a variety of physical activities they engaged in beyond treadmill walking, such as rowing, biking, walking outside, swimming, surfing, skiing, skim-boarding, hiking, running, weightlifting, using an elliptical, yoga, golf, pickleball, snowshoeing, working out at a gym, group exercise classes, spin classes, kickboxing, martial arts, and working out with a trainer.

Perceived Benefits of Treadmill Desk Use

Participants experienced a variety of physical, mental, work-related, and social perceived benefits from using their treadmill desks (see Table 3). Physically, 11 participants described being less sedentary and more active, and nine gained cardiovascular or fitness benefits:

I can’t be away from my computer and so definitely having the treadmill has allowed me to get movement in during a time of day when before I would have just been sitting, which would have been contributing to, you know, less than ideal health outcomes. And so now I kind of feel like, wow, I can do my job and I can get some exercise at the same time, which I never, you know, prior to that really thought was an option because my work is all computer based. (Participant 19)

Mentally, nine participants experienced better focus and felt more alert and less tired, with seven participants also describing improved mood. When asked about how the treadmill desk impacted their work, 11 participants described feeling more engaged or more satisfied with working from home, and 6 participants felt more productive. Socially, all 20 participants recommended a treadmill desk

Table 3 Theme: 1.0 Perceived Benefits

Subthemes	<i>n</i>	%	Representative quote
1.1 Physical Perceived Benefits			
1.1.1 Less sedentary and more active	11	55	"And I just got my treadmill desk at the end of last year. And it's been such a game changer. Just mixing up, you know, my work day, I'm sitting much less." (Participant 17)
1.1.2 Feeling less sore, achy, and stiff	3	15	"I think it does help to kind of keep me [...] from getting sore and stiff and you know breaks up the monotony of sitting." (Participant 1)
1.1.3 Less back, knee, or hip pain	6	30	"It's been kind of a game changer in terms of I was having a lot of hip and back problems, and once I got the treadmill desk, it was like those essentially just went away." (Participant 19)
1.1.4 More energy	4	20	"I just started exploring treadmill desk and got my first one and it was a game changer. I mean, it's here to see. It was so much better. I had so much more energy." (Participant 16)
1.1.5 Weight loss paired with a better diet	6	30	"I also do Weight Watchers and the scale is going the right direction." (Participant 13)
1.1.6 Cardiovascular or fitness benefits	9	45	"Like if we go somewhere and I have to walk around for a long time like they used to get me out of breath. And but now it's like, okay, this is good." (Participant 10)
1.1.7 Sore leg muscles or feet	5	25	"Afterward, by the end of the day, my feet are just a little bit sore." (Participant 12)
1.2 Mental Perceived Benefits			
1.2.1 Better focus	9	45	"It's so much easier to stay focused when I am moving." (Participant 7)
1.2.2 More alert and less tired	9	45	"I do feel significantly less fatigued when I am walking then when I am sitting." (Participant 12)
1.2.3 Improved creativity	3	15	"It sort of spurs more creative thinking sometimes." (Participant 5)
1.2.4 Improved mood	7	35	"My mood elevates. You know, I'm a little more patient, and I can handle the crises that are coming on throughout the day." (Participant 13)
1.2.5 A feeling of accomplishment and pride	6	30	"Mentally I feel like you have a sense of accomplishment." (Participant 8)
1.2.6 Stress relief	3	15	"I guess subconsciously is a stress reliever. Like just being able to move even, you know, in stressful situations or trying to figure out a problem." (Participant 19)
1.2.7 Less guilt about inactivity or food choices	3	15	"When you've already walked for, you know, 20,000 steps for a day and it's noon, you don't feel so bad about having some food that is not necessarily as healthy for you." (Participant 11)
1.3 Work-Related Perceived Benefits			
1.3.1 More engaged and satisfied with work	11	55	"The thing I liked least about working from home was just kind of being less active and now I can be more active while I'm working. So that just leads to increased job satisfaction for me." (Participant 17)

Table 3 (continued)

Subthemes	<i>n</i>	%	Representative quote
1.3.2 Better work-life balance	1	5	"And the other thing is actually helped me create a better work life balance because [...] when I step off the treadmill, I'm done for the day." (Participant 9)
1.3.3 More productive	6	30	"So I'd say like productivity for certain tasks, like things that feel more tedious. I'm able to accomplish those and it not feel as tedious." (Participant 4)
1.4 Social Perceived Benefits			
1.4.1 Recommend a treadmill desk to others	20	100	"I encourage everybody to try it. It's again, it's made a huge difference in my life." (Participant 13)
1.4.2 Influence coworker use or purchase	4	20	"One of my colleagues at work saw me walking and eventually got a treadmill desk for herself." (Participant 5)
1.4.3 A topic of conversation with coworkers	9	45	"Some people think that it's cool that I have a treadmill desk. And that has been a topic of conversation And it has helped break the ice 'cause I meet a lot of new people." (Participant 10)

to others, and nine participants found it to be a topic of conversation with their coworkers.

Motivators

Participants found motivation in health and fitness benefits, through tracking and reaching their goals, and from knowing that it would feel good to walk while working (see Table 4). Fourteen participants were motivated to reduce prolonged sitting and be more active, and 13 participants aimed to be healthier and more physically fit while avoiding ill-health:

Wanting to be as active as possible is a motivator. I know that exercise is important. I know it's important to avoid prolonged sitting, you know so that encourages me to kind of get up and get on there. (Participant 1)

Eight participants described aiming to walk 10,000 steps per day and using technology to track outcomes such as step counts, distance walked, or calories burned. Five participants were motivated by pain reduction and the joy of movement. Eleven participants were motivated to obtain and use a treadmill desk due to the COVID-19 pandemic.

Barriers to Use

Barriers to use were more commonly due to the type of work being completed and social concerns (see Table 5). Nine participants described not walking while engaging in tasks requiring greater cognitive effort, such as writing or switching between different work tasks:

And then I've found that there are certain tasks that I was able to do really well and I would, you know, I wouldn't even realize how long that I was walking on there, so it would be like um reading things or doing like data entry. So if I just had to, you know click one or two keys on the keyboard I could do that, but when it came to like really focused writing, so when I you know, having to use a full keyboard or having to really do like effortful thought, that's when I realized like I couldn't, I couldn't do that as well while I was walking, and I would need to be sitting for that. (Participant 4)

Eight participants did not like to walk while engaging in fine motor control tasks involving typing or precise mouse control, and another eight participants did not use their treadmill desk while presenting or in meetings, especially if they were on camera. Physical, mental, and accessibility barriers were less common. For example, fatigue or illness were described as physical limitations by three participants:

Table 4 Theme: 2.0 Motivators

Subthemes	<i>n</i>	%	Representative quote
2.1 Health and Fitness			
2.1.1 Reduce prolonged sitting and be more active	14	70	"I hate sitting for long periods of time and that's something that I didn't do in the office as much. So using the treadmill desk ensures that I'm getting some activity in, getting steps, and while I'm working. So I love that optimization in my day." (Participant 17)
2.1.2 Be healthier, more physically fit, avoid ill-health	13	65	"I wanna be in good shape. My wife and I, we have 4 kids, so I need to be in shape to be able to keep up with them." (Participant 10)
2.1.3 Lose weight	6	30	"I wanted to lose weight, and I thought maybe this could help me." (Participant 9)
2.2 Tracking and Reaching Goals			
2.2.1 Reach goal of walking 10,000 steps per day	8	40	"I tried to get 10,000 steps in as an arbitrary number, you know, but it does it. That does kind of give me some extrinsic motivation." (Participant 1)
2.2.2 Use technology to track outcomes	8	40	"I knew that I would have to gamify this somehow. So keeping that spreadsheet was my way of gamifying it. And that's part of the motivation to, you know, don't break the streak kind of thing." (Participant 14)
2.2.3 Walking competitions	2	10	"She invites me to this challenge called the Workweek Hustle [...] and the goal of it is to do as many steps from Monday through Friday." (Participant 4)
2.3 Feeling Good			
2.3.1 Reduce pain associated with sitting	5	25	"Once I started using it, the pain that I had been experiencing basically went away like within the first week of me using it every day. And so that was just a very clear, undeniable indicator that this is good for me. And so that's what motivates me because I was in, you know, pretty distracting pain." (Participant 19)
2.3.2 Enjoy movement	5	25	"I really enjoy being active. I love going for walks outside, too. So it's exciting to know that like I can get a walk in." (Participant 17)
2.3.3 Overcome afternoon fatigue	2	10	"The trigger to use it is if I'm feeling either tired, like sleepy in the afternoon, or maybe right after lunch where I just feel a little bit bloated and want to go for a walk." (Participant 14)
2.4 COVID-19 Pandemic	11	55	"With the pandemic our whole team went remote and so after about eight months at home, I realized that I needed more activity during the day, so I got a treadmill and a standing desk and kind of put together a treadmill desk at home." (Participant 1)

Table 5 Theme: 3.0 Barriers to Use

Subtheme	<i>n</i>	%	Representative quote(s)
3.1 Type of work			
3.1.1 Fine motor control (e.g. typing, mouse control)	8	40	"I rarely do things like make slides or other things that require fine motor control." (Participant 20)
3.1.2 Higher cognitive difficulty (e.g. writing, task switching)	9	45	"It's hard for me to when I have to do writing or some really deep thinking. It's hard to do while walking." (Participant 2)
3.1.3 Presenting, meetings, or being on camera	8	40	"Like I had to do a presentation for somebody at 7:30 yesterday morning, so I'm not going to be on it for that." (Participant 3)
3.2 Physical limitations			
3.2.1 Back, knee, or leg problems	3	15	"I also have a lingering back issue so if I throw my back out, I'll have to give it a rest for a few days." (Participant 1)
3.2.2 Heart problems	1	5	"I got heart failure like I had some crazy A-fib heart event and so I haven't been at using it as much." (Participant 2)
3.2.3 Menstrual cramps	1	5	"Like if you have menstrual cramps or something." (Participant 7)
3.2.4 Fatigued or sick	3	15	"The only times that I don't use it is if I'm super tired or sick or something like that." (Participant 18)
3.2.5 Room too hot or cold	3	15	"We have air conditioning, but it's window units, and the room that my treadmill is in does not. And so it was really hard to use it during the summer because it was just so hot." (Participant 9)
3.3 Accessibility			
3.3.1 Inconvenient location	1	5	"Right now I have a home office that's downstairs, and my treadmill desk is upstairs, so usually I'm using my home office which is a sit to stand but not a treadmill and the treadmill desk I'll use more infrequently." (Participant 4)
3.3.2 Inconvenient set-up	4	20	"It's a little bit of a hassle to, you know, kind of just get all set up and move everything so that you can do it." (Participant 8)
3.3.3 Treadmill not working correctly	3	15	"I will say currently I cannot use my desk because something is wrong with it." (Participant 12)
3.3.4 Perceived as expensive but worthwhile	5	25	"It was a bit of an investment, but it's been well worth it, that's for sure." (Participant 11)

Table 5 (continued)

Subtheme	<i>n</i>	%	Representative quote(s)
3.4 Social concerns			
3.4.1 Negative coworker perceptions, especially if on camera	8	40	"One of my colleagues said, oh, it's sort of distracting when you're on that. So I try to. I don't want to go too fast, you know." (Participant 3)
3.4.2 Interruptions from family members	1	5	"And the family's at home too, still. So they're coming in and bugging me." (Participant 13)
3.4.3 Loud treadmill bothers others in the home	1	5	"My partner also works in that room, and the sound of my feet is like boom, boom, boom, boom, boom. And so if he is in a meeting, I really can't be walking either." (Participant 20)
3.5 Mental barriers			
3.5.1 Boredom	1	5	"Not so much these days. I don't know why. I'm just kinda bored with it, I guess." (Participant 5)
3.5.2 Feeling lazy or sluggish	4	20	"I mean, you know, sometimes laziness, but again, that's cause I don't feel like doing my work that day." (Participant 9)

I would say the only thing is like I said, I can really only tolerate it for about 45 minutes. It just gets to be too tiring and so I'll stop and rest and you know, sit down. (Participant 16)

Possible differences in perceived benefits, motivators, and barriers to use were explored by gender, age, length of treadmill desk ownership, and treadmill desk use (hours per week). The results of this analysis are presented in the Online Resource, Tables S1-S3.

Discussion

This study has contributed novel findings to the literature on active workstations by being the first to describe treadmill desk use at home. In response to RQ1, we found that our sample of treadmill desk users was comprised of predominantly white, middle-aged, married women who lived in suburban neighborhoods and held high-income, full-time, office-based jobs. The majority had purchased a Lifespan treadmill desk themselves which they kept in their home office. Most participants worked fully from home and reported a shift to working from home due to the COVID-19 pandemic. Participants used their treadmill desks for about two hours per day, picking a speed at which they could walk comfortably and complete their work or non-work tasks.

In response to RQ2, the physical, mental, work-related, and social perceived benefits experienced by the treadmill desk users align with and expand upon previous experimental and qualitative literature on the benefits of treadmill desk use. For example, past findings indicating that participants are more active, lose weight, have more energy, better focus, more positive affect, more task satisfaction, and feel less stressed when using a treadmill desk as compared to sitting or standing were supported (Cifuentes et al., 2015; Giumetti et al., 2021; Sliter & Yuan, 2015; Thompson et al., 2014). However, past research has not demonstrated any changes in physical symptoms, like back pain, when using a treadmill desk (Giumetti et al., 2021), whereas six participants in our study described the relief of joint pain as an important physical outcome and a “game changer”. Another novel finding from our study was that nine participants described cardiovascular or fitness improvements that translated well into their other physical activities. Furthermore, three participants described improved creativity while walking, which has been demonstrated in past research on walking (Oppezzo & Schwartz, 2014) but not in the context of using treadmill desks in the workplace.

Past within-subjects experimental research did not find support for increased job satisfaction at the end of the workday when using a treadmill desk across three 1-h walking sessions compared to three 1-h sitting sessions (Giumetti et al., 2021), but 11 of our participants described treadmill walking as improving their satisfaction with working from home. Additionally, while walking on a treadmill did not improve brief task performance compared to sitting and standing in a 30-min within-subjects experimental session (Zhang et al., 2018), six of our participants described feeling more productive when using their treadmill desk. Importantly, the current study did

not use an experimental design and therefore cannot establish a causal relationship between home treadmill desk use and job satisfaction or productivity. Our findings may be different from the findings of Giumetti et al. (2021) and Zhang et al. (2018) due to many factors, including the qualitative nature of our data, our participants' long-term experiences using a treadmill desk at home, or even our participants' desires to report positive outcomes of their treadmill desk use.

A unique and surprising finding was that one participant felt that their treadmill desk helped them have better work-life balance. Interestingly, this is supported by the finding that taking more steps before the end of the workday is associated with greater satisfaction with work-life balance (Calderwood et al., 2021). Our interviews also revealed that seeing a coworker use a treadmill desk can serve as a social contagion for obtaining and using a treadmill desk of one's own, which is aligned with past research demonstrating that coworker social support is positively related to physical activity in the workplace (Sarkar et al., 2016).

In response to RQ3, our interviews revealed that participants were motivated to use their treadmill desks to reduce sedentary behavior. For many participants, this was in response to increased sedentary behavior brought on by working from home during the COVID-19 pandemic, and this increase in sedentary behavior is supported by past research (Howe et al., 2021). Participants also wanted to be healthier, avoid health problems, and lose weight. These health-related motives are common amongst middle-aged and older adult cohorts (Box et al., 2021). Eight participants also described being motivated to reach step goals, and two participants competed against others to take the most steps. Past research has shown that a workplace-based challenge to walk 10,000 steps per day was very successful at increasing daily walking behavior in working adults (Vandelanotte et al., 2020). Another motivator for treadmill desk use was the anticipation of the perceived benefits like feeling good due to alleviation of pain, enjoying movement, or overcoming afternoon fatigue, which is supported by previous research indicating that feeling good and exercising comprise a positive feedback loop (Emerson et al., 2018).

In response to RQ4, our interviews revealed that many of the barriers to using a treadmill desk at home were similar to barriers experienced by treadmill desk users in the workplace, such as the type of work being done, difficult set-up, back, knee, or leg problems, the treadmill being noisy, interruptions from others, and concerns about coworkers' perceptions (Cifuentes et al., 2015). Some of these barriers to use were unique to working remotely in our sample, such as concerns about how one appears while walking during a video call. Interestingly, previous research indicates that common barriers to physical activity in the workplace are workload and time constraints (Mazzola et al., 2017). However, in our study, having access to a treadmill desk at home enabled participants to overcome these barriers by offering light physical activity while working.

Study Limitations

A limitation of the current study was that we did not use a random sampling method, but rather enrolled participants that responded to our study advertisement.

It is possible that individuals who responded to the advertisement felt more positive about their experiences with their treadmill desk than those who did not respond, which may have contributed to our findings on the perceived benefits of treadmill desk use. New treadmill desks also can be expensive, with prices currently ranging from about \$250 to \$3,000. Due to this expense, participants may have been biased to perceive benefits from treadmill desk use.

Another limitation is that participants were not randomly assigned to treadmill desk use, but rather had purchased their treadmill desks for themselves, suggesting that they may have sought their treadmill desk specifically to reduce sedentary behavior or alleviate pain. Additionally, because our study examined treadmill desk use at home rather than at the workplace (Cifuentes et al., 2015), we were able to identify novel perceived benefits, motivators, and barriers. However, our sample was rather homogenous demographically, being composed of mostly White women with high incomes. As a result, our findings may not generalize well to other gender identities, people of color, or individuals with lower incomes. Our small sample size also limits our ability to make conclusions about differences in perceived benefits, motivators, and barriers to use across demographic groups and features of treadmill desk use.

Future Research and Practical Implications

This is a preliminary study on treadmill desk use at home, and future quantitative and experimental research is needed to confirm the findings of this study. Additionally, future research on effective interventions for increasing treadmill desk use at home are needed. The information about motivators and barriers to use from this study should be helpful for intervention design, although a future study on individuals who own treadmill desks but do not use them could provide further ideas for intervention strategies. For example, a future intervention may focus on the health benefits of treadmill desk use and provide participants with opportunities to track their step counts. Interventions tailored to an individual's primary exercise motivations may also be effective, such as a step count competition for those who enjoy the competitive aspects of exercise. Future research could also explore if providing walking prompts and performance feedback would help to increase treadmill desk use (Batchelder & Washington, 2021).

Practically, this study provides further evidence to employers that treadmill desks have a host of positive physical, mental, social, and work-related perceived benefits. Employers can support employees' use of treadmill desks when working remotely by providing financial support for their purchase and positive reinforcement for their use during the workday.

Appendix: Interview Questions

1. Can you tell me about your experience using a treadmill desk?
2. On average, how often do you use the treadmill desk?

- a. Possible follow-up questions:
 - i. Approximately how many days per week do you use the treadmill desk?
 - ii. Approximately how many hours per day do you use the treadmill desk?
3. On average, how fast and how far do you walk on the treadmill?
 - i. How many steps or how far per day?
 - ii. How fast do you walk? (m/km per hour)
 - iii. Do you have and use the incline? What level or difficulty of incline?
4. What types of activities do you do when using the treadmill desk?
 - a. Probes if needed:
 - i. What type of work do you do at the treadmill desk?
 - ii. What type of non-work activities do you do at the treadmill desk?
5. Do you use the treadmill desk for reasons other than work? Can you please describe what those are?
6. Can you describe how you feel physically before, during, and after using the treadmill desk?
7. Can you describe how you feel mentally before, during, and after using the treadmill desk?
8. Do you look forward to using the treadmill desk? Why or why not?
9. What outcomes have you experienced after using the treadmill desk?
 - a. Probes if needed:
 - i. Any positive outcomes or no changes?
 - ii. Any health changes?
 - iii. Any side effects?
10. What motivates you to use the treadmill desk?
11. What makes it difficult for you or prevents you from using the treadmill desk?
12. How has using the treadmill desk impacted your work, positively or negatively?
13. How has the treadmill desk impacted your job satisfaction if at all?
14. What was setting up the treadmill desk like initially? What was it like the first few times you used it?
15. Thanks for sending us the picture of your treadmill workstation. Can you tell us more about it and how you get your workstation ready to use?
16. Do you know other people who use treadmill desks?
 - a. If yes, do you talk to them about using it?
 - b. If yes, what do you talk about?

17. Have you recommended the treadmill desk to others?
 - a. If yes, why have you recommended it?
18. Do you engage in any physical activity or exercise outside of using the treadmill desk?
 - a. If No. STOP.
 - b. If yes, can you briefly describe what you do?
 - c. Do you think using the treadmill desk impacts your other physical activity and how?
19. Is there anything else you'd like us to know about using a treadmill desk?

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Declarations

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