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Men's Physical Activity and Sleep Following a Workplace Health Intervention: Findings from the POWERPLAY STEP Up challenge

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Abstract

The workplace provides an important delivery point for health promotion, yet many programs fail to engage men. A gender-sensitive 8-week team challenge-based intervention targeting increased physical activity was delivered at a petrochemical worksite. The purpose of this study was to examine men's pre–post physical activity and sleep following the intervention, as well as to explore program acceptability and gather men's recommendations for health promotion. Pre–post surveys assessed physical activity, sleep, program exposure, acceptability, and suggestions for continued support. Overall, 328 men completed baseline surveys and 186 (57%) completed follow-up surveys. Walking increased by 156.5 min/week, 95% confidence interval (61.2, 251.8), $p = .001$. Men with higher program exposure increased moderate and vigorous activity 49.4 min more than those with low exposure ($p = .026$). Sleep duration and quality were higher postintervention, though changes were modest. Program acceptability was high as was intention to maintain physical activity. Men's suggestions to enable physical activity involved workplace practices/resources, reducing workload, and leadership support. These findings suggest that a gender-sensitive physical activity workplace intervention showed promise for improving physical activity and sleep among men. The men's suggestions reflected workplace health promotion strategies, reinforcing the need for employers to support ongoing health promotion efforts.

Keywords

physical activity, sleep, men's health, health promotion, occupational health, health behavior, masculinity

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Background

It is well recognized that men access traditional health services at low rates, prompting initiatives to bring services to men (Kerr, 2011). Indeed, the workplace has been recognized as a promising setting for health promotion, targeting lifestyle behaviors such as physical activity (Jirathananuwat & Pongpirul, 2017) and sleep (Soprovich et al., 2020). In 2019, there were over 3 million Canadian-based men working in the goods-producing sector, including 275,000 men working in forestry, construction, mining, and oil and gas (Statistics Canada, 2020). Mining and oil/gas extraction is one of the largest industries, with 9.4% of employed males in Alberta working in this sector (2016 Census of Canada. Labour release, 2018). Employers in the oil/gas business continue to attract a male-dominated workforce with men accounting for more than 75% of employees (PetroLMI, division of Energy Safety Canada, 2018). In these industries, there is considerable variation worldwide in working conditions and work time arrangements, which can

have a major impact on the health and safety of workers (Stergiou-Kita et al., 2015).

Workplace health promotion programs can effectively improve employee health and prevent workplace injuries (Sun Life Financial, 2016). These programs tend to engage more women than men (Robroek et al., 2009), despite the notion that the workplace is an ideal location to reach men (Robertson et al., 2013). Within male-dominated workplaces there are often normative frames related to physical work (e.g., heavy lifting and working with hand-held tools) (Lewis, 2013) and doing overtime (i.e., feelings of pressure or obligation to work long hours) (Bunjo et al., 2020); the net effect of such cultures is that other forms of physical activity and sleep are compromised (Seaton et al., 2018; Soprovich et al., In review). Few workplace programs take into consideration masculine norms or incorporate men's preferences or interests; yet, growing evidence suggests that programs designed using a gender-tailored approach are effective for reaching men (Bottorff et al., 2015; Sayers et al., 2019; Sharp et al., 2020). In particular, it has been argued that leveraging positive and strength-based aspects of masculinity (e.g., male relational styles, use of humor, group orientation of men) may increase men's specific engagement with health promotion (Kiselica & Englar-Carlson, 2010; Seidler et al., 2018).

A workplace health promotion program ("POWERPLAY") was designed to appeal to men. The POWERPLAY program is unique in that it is gender-sensitive, meaning it recognizes and addresses the realities and needs of men based on their normative roles and identities within masculine workplace milieus (World Health Organization, 2007). The POWERPLAY program includes modules on physical activity, healthy eating, mental wellness, and smoking cessation. The modules were designed based on the existing literature and considering men's input (via focus groups [Oliffe et al., 2017]) to incorporate men's interests and preferences. The physical activity module (STEP Up) was the focus of the present research. Informed by formative research (Bottorff et al., 2015; Oliffe et al., 2017), the STEP Up challenge was designed to engage potential male end-users via strategies of friendly competition, humor, self-monitoring, and positive and action-oriented messaging while taking into account the specific workplace characteristics. These attributes have been previously effective in male populations in systematic reviews of physical activity interventions (Bottorff et al., 2015; Sharp et al., 2020). In a pilot study, the STEP module focused on self-monitoring and challenges to increase moderate and vigorous physical activity (MVPA) and the STEP Up challenge improved physical activity among men working at a regional municipality, a shipping terminal, and two trucking companies (Johnson et al., 2016). The present study extends this work with a large sample in a different industry and explores the potential impact of this physical activity intervention on working men's sleep duration and quality.

Objectives/Hypotheses

The primary objective of this study was to examine pre–post changes in physical activity among men following implementation of the POWERPLAY STEP Up (physical activity) challenge, and to examine whether changes in physical activity were associated with level of exposure to the intervention. Based on the success of this program in other industries (Johnson et al., 2016), we hypothesized that at 2 months post baseline, MVPA and minutes walking would increase, and that greater exposure to the program would be associated with increased physical activity. The secondary objective was to evaluate the impact of this physical activity intervention on participant sleep duration and quality. Based on the literature suggesting that physical activity interventions promote sleep (Hori et al., 2016; Kredlow et al., 2015), we hypothesized that sleep duration and quality would be improved

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at 2 months, and that greater program exposure would be associated with increased sleep duration/quality. Finally, we gathered men's input on the acceptability of the POWERPLAY program and their suggestions for ongoing workplace support to help contextualize the pre–post results.

Methods

Study Design and Context

This study included a pre–post survey design. Respondents were recruited from a large petrochemical complex located in western Canada. This region is most well known for its proximity to oil and gas production facilities, with many male-dominated, resource-based occupations. This facility was located outside of a community of 25,000 people (Statistics Canada, 2017), and adjacent to a city with a population of 1.3 million. Thus, unlike companies based in the extractive industry that adopt fly-in-fly-out workforce models in remote settings, the facility in this study employed a primarily resident workforce.

Intervention and Procedure

The POWERPLAY program includes modules to promote physical activity, healthy eating, mental well-being, smoking cessation, as well as suggestions for workplace supports. All the POWERPLAY modules have three components: (1) Educational materials supporting workplaces to share evidence-based health information and motivational messages; (2) opportunities to act in the form of a challenge, or friendly competition, to get everyone in the workplace doing some activity; and (3) support—working with employers to create supportive changes in organizational practice and policy to build up a positive and healthy working environment. Since the original pilot study with physical activity and healthy eating modules (Johnson et al., 2016), the program has been enhanced to include a detailed manual for employers to support program delivery, outline the challenges, and provide a variety of different recommendations for workplace supports. In addition, program materials are now made available to employers through a secure section of the POWERPLAY website (www.powerplayatwork.com) called the coach's corner where worksite leads can access all the program resources.

In this study, the physical activity module was implemented at a petrochemical complex and involved a step-based challenge (STEP Up). Recruitment was coordinated by a corporate head office (off-site) and promoted through an on-site health and wellness committee. Prior to the start of the program, promotional materials and an on-site launch event (held May 27, 2019) introduced and lobbied participation in the program. The employer tailored posters, announcements (e.g., in company newsletter), and promotional videos to meet the inclusivity needs of the organization (e.g., company logo and committee branding were added). All employees (excluding contractors) over 18 years were eligible to participate. The STEP Up challenge formed the basis for an employer-led six-pack initiative to bring employees together in groups of six with the intention of continuing the group comradery after the challenge ended. All employees were invited to find five other employees who they would like to support and form a team, select a team captain, and register their team with the on-site wellness committee. Rolling recruitment occurred in June and July 2019.

Program registration and participant package pick-up were coordinated by the on-site health center and allowed for workers on all shifts to participate. All participants competed in teams of 6 (72 teams) to virtually travel across Canada (a distance of 5,246 km) in the POWERPLAY STEP Up challenge that ran for 8 weeks, from August 1 to September 30, 2019. All participants received a Garmin Vivofit 4, as an approved device to use on-site. In addition to incentivizing participation, the devices synced step data automatically, serving as a self-monitoring tool. Participants' daily steps were compiled by the research team into their weekly steps, summed in the teams of six, and converted into kilometers. In addition, participants were encouraged to submit moderate and vigorous activities other than steps not captured by their tracker (e.g., bicycling) by manually entering them in their Garmin account in exchange for bonus steps. In the program registration package, participants were provided with an instruction booklet detailing how to connect their device, how to form team Garmin groups, and how to manually enter activities completed when they were not wearing their tracker. A research assistant downloaded manually entered activities, removed any duplication where steps were also recorded, and added 1,000 and 2,000 steps for each 10 min of moderate and vigorous activity, respectively. Each week of the challenge, weekly progress of each team was sent to the workplace lead. Team progress was reported each week of the challenge via electronic tracking map (Figure 1). Team standings were disseminated to the participants by email and uploaded onto a secured employee dashboard (by electronic maps and the top 10 teams were acknowledged in writing). Progress of participating worksites was also acknowledged on a public POWERPLAY Facebook page by the research team (www.facebook.com/powerplayprogram). Volunteer POWERPLAY team captains on site (both employees and management) were charged with connecting with their five other team members to ensure they were set up and ready to participate, making a team Garmin group where they could see one another's steps,

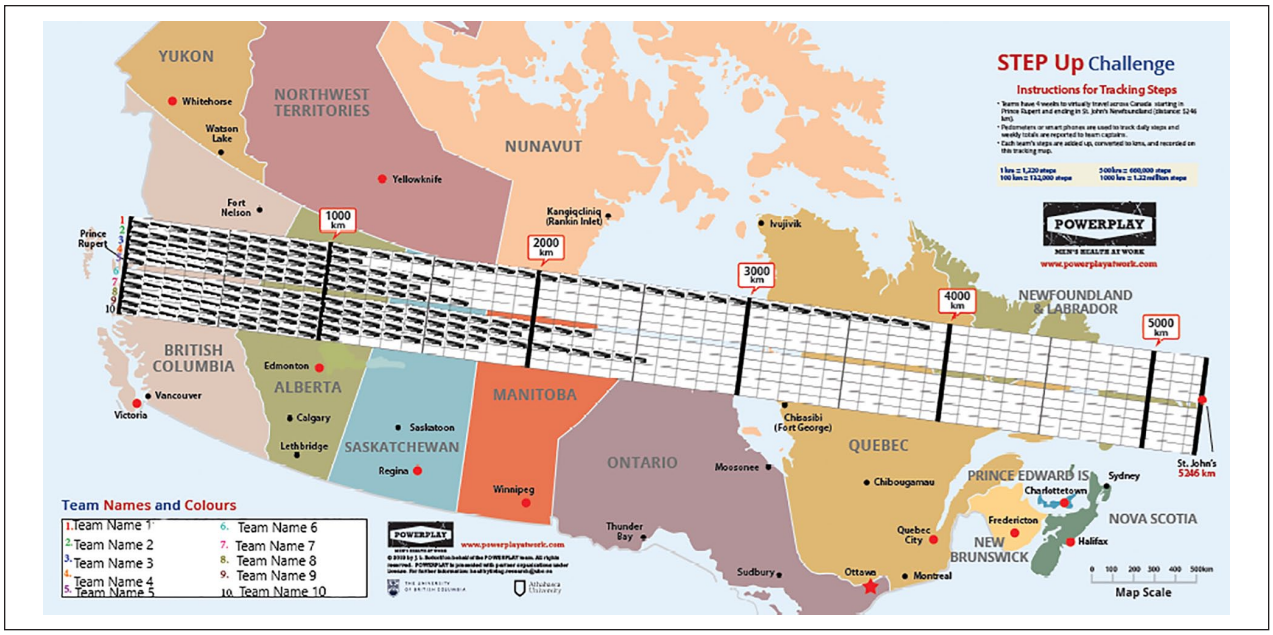

Figure 1. Weekly team-tracking map displaying the first 10 teams at week 6.
Note. Multiple electronic posters were used to display all 72 teams, as each map only allowed up to 10 teams.

encouraging weekly participation, and recognizing team member achievements. The two teams that completed the challenge first in the 8 weeks were offered a recognition lunch by the employer.

Each week a POWERPLAY program play of the week message (i.e., an educational infographic providing motivational messaging around physical activity) designed to appeal to men was disseminated by email to all participants. All play-of-the-week messages are available in flexible delivery options, including posters, email images and text, PowerPoint slides, and videos. Topics included being active at work, moving during commercial breaks, taking the stairs, and trying a new activity (see Figure 2 for examples of program materials).

Both men and women were invited to participate; however, because the program is tailored to appeal to men, men's responses to the program were analyzed. All POWERPLAY STEP Up participants provided written informed consent and were invited to complete self-report surveys at the time of registration and again post program at 2 months. Paper surveys were administered on July 2019, and online surveys were collected on October 2019. Paper surveys were entered into an online survey in duplicate and discrepancies between duplicate entries were investigated and corrected. Participants were provided with $20 gift cards for completing each survey.

Finally, for the support component of POWERPLAY, in addition to providing print copies of the manual, the research team provided consultation support to worksite leads concerning planning the challenge, as well as ideas for modifying the built environment and adapting policies to better support physical activity. The worksite lead completed an employer capacity survey detailing current initiative and future plans, and were provided with reports detailing the participant survey responses and recommendations for ongoing workplace supports for physical activity. For example, it was recommended for the workplace to promote walking meetings and incorporate stretch breaks at meetings.

The study was approved by Athabasca University (Ethics file#:23237), the University of British Columbia Research Ethics Board (#H18-02857), and the University of Alberta's Health Research Ethics Board (Study ID Pro00086564). This study was registered as part of a larger project on ClinicalTrials.gov (Identifier: NCT03781453).

Measures

Sociodemographic questions, work hours/schedule, and stage of change for physical activity were completed at baseline only. Self-report measures of physical activity and sleep were collected at baseline and follow-up. Finally, several questions exploring program exposure, acceptability, and men's suggestions for workplace supports for physical activity were completed at follow-up only. In partnership with the employer, the questionnaires were kept short and some measures were limited. Specifically, traditional demographic questions (income, ethnicity) were not included and only three to four subquestions from some questionnaires were included (as described below).

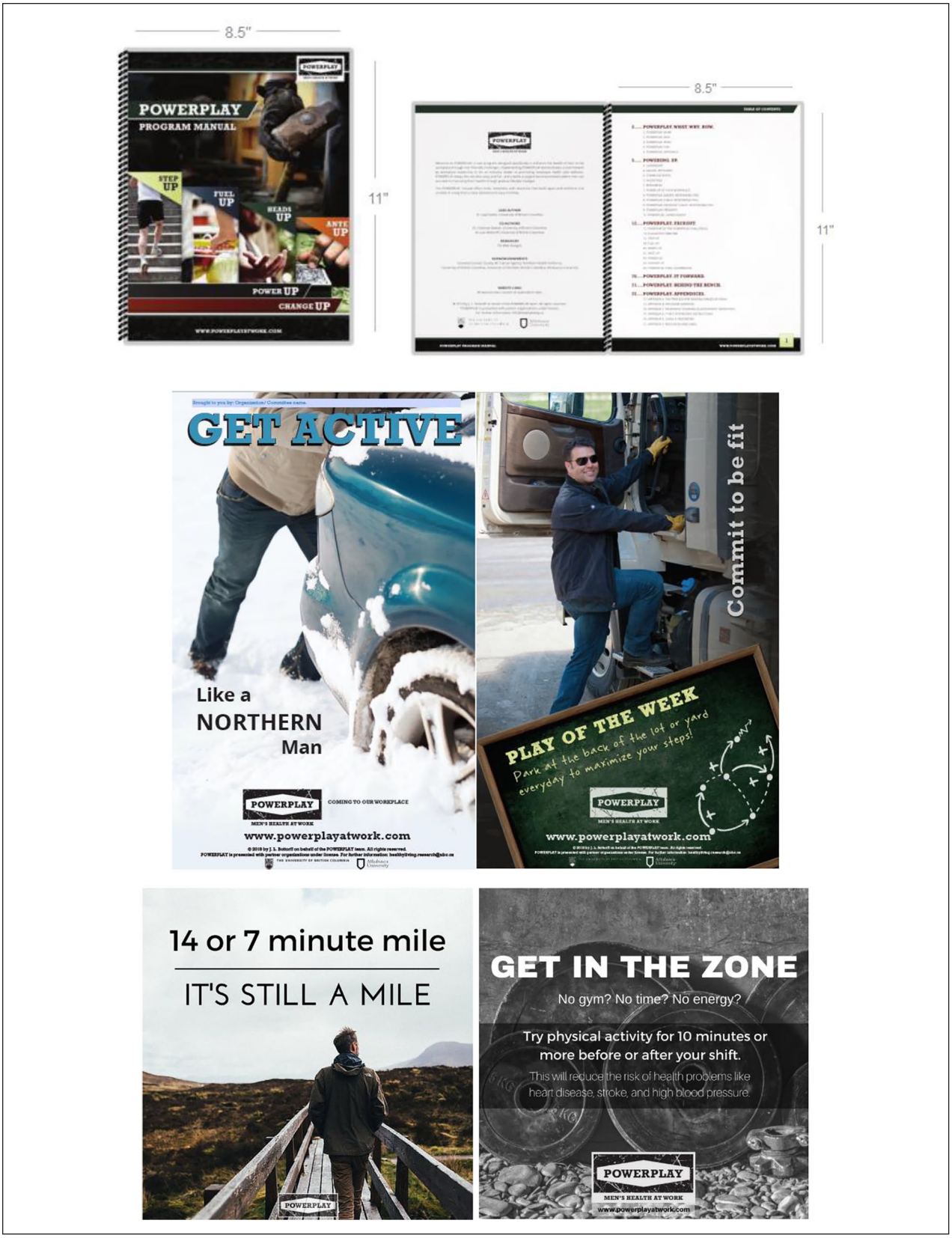

Figure 2. Examples of POWERPLAY program materials: manual for employers, promotional poster, play of the week, email image, and additional weekly message.

Participant Characteristics

Sociodemographic and Anthropomorphic Characteristics. Demographic data collected from all participants included age, gender, and self-reported height (in centimeters) and weight (in kilograms) used to calculate the body mass index in kg/m^2.

Work Hours and Shift/Schedule. Using the Occupational Sitting and Physical Activity Questionnaire (Chau et al., 2012), participants were asked to provide the number of hours they worked in the past 7 days, as well as the number of days they were at work in the last 7 days. Hours worked in the last 7 days were divided by days worked to obtain hours per day. Based on the measures used by Winkler et al. (2018) (Winkler et al., 2018) and Reid et al. (2018), work schedule was assessed with the question: "Which of the following best describes your work pattern in the past 2 months?" Responses included: "Regular day shift; Regular afternoon/evening shift; Regular night shift; Shift rotates (between days, afternoons/evenings, and nights); and Irregular schedule or hours." Participants were also asked whether they worked overtime or weekends "Never," "Sometimes," or "Regularly."

Stage of Change for Physical Activity. Questions were included to categorize participants' stage of change for physical activity (Dumith et al., 2007) at baseline. Participants were asked a series of four questions pertaining to engaging in "regular physical activity" (defined as at least 150 min of moderate activity each week) with different branching options depending on the response options that categorized participants into one of five groups: Pre-contemplation ("No, and I don't intend to within the next six months"); contemplation ("No, but I intend to within the next 6 months"); preparation ("No, but I intend to within the next 30 days"); action ("Yes, and I have for less than 6 months"); and maintenance ("Yes, and I have for more than 6 months").

Physical Activity

Physical activity was measured using validated self-report measures.

Moderate and Vigorous Physical Activity. MVPA in minutes per week was assessed using the Godin Leisure-Time Exercise Questionnaire (GLTEQ; Godin & Shephard, 1985). The GLTEQ contains three self-report questions that assess both the average frequency and duration (in minutes) of mild, moderate, and vigorous activities during free time over a typical week. Moderate and vigorous activities were summed to obtain MVPA (in minutes per week). This measure has demonstrated acceptable test–retest reliability and validity in comparison to other self-report measures of physical activity (Jacobs et al., 1993).

Minutes Walking Per Week. Minutes spent walking at work, from place to place, and for leisure were assessed using questions from the International Physical Activity Questionnaire (IPAQ; Craig et al., 2003). Previous research has supported the criterion validity and test–retest reliability of the full IPAQ (Craig et al., 2003; van der Ploeg et al., 2010). Participants were asked: "During the last 7 days, on how many of those days did you walk for at least 10 minutes at a time: (1) as part of work (2) to go from place to place (3) in your leisure time" and "How much time did you usually spend on one of those days walking (1) as part of work (2) to go from place to place (3) in your leisure time."

Sleep Duration and Quality

The Pittsburgh Sleep Quality Index (PSQI) is a widely used 19-item measure that differentiates "poor" from "good" sleep (Buysse et al., 1989). The PSQI is a well-established, reliable (Cronbach's α ranged from .70 to .83 in a recent systematic review [Mollayeva et al., 2016]) and valid measure of sleep quality (Backhaus et al., 2002). Four questions from the PSQI were included. First, the participants were asked "During the past month, how many hours of actual sleep did you get at night?" Participants could respond in hours and minutes (e.g., 7 hr, 30 min), and this was converted to hours (e.g., 7.5 hr). Second, the participants were asked "During the past month, how would you rate your sleep quality overall?" Response options included very bad (3), fairly bad (2), fairly good (1), and very good (0). Third, the participants were asked "During the past month, how long (in minutes) has it usually taken you to fall asleep each night?" Response options included 0–15 min (1), 16–30 min (2), 31–45 min (3), 46–60 min (4), and more than 60 min (5). Finally, the participants were asked "During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?" Response options included the following: not during the past month (0), less than once per week (1), once or twice per week (2), and three or more times per week (3).

POWERPLAY Program Exposure

Based on the previous work (Caperchione et al., 2016), four questions asked about exposure to the POWERPLAY messages and engagement in tracking activities, and were used to assess the extent to which men were exposed to the POWERPLAY program. The questions included:

"During May or June, did you see POWERPLAY messaging at work [No (0)/ Yes (1)]?"; "During August and September, did you see POWERPLAY messaging at work [No (0)/ Yes (1)]?"; "How often did you wear your activity tracker (Garmin device) while steps were being recorded as part of this challenge [response options included the following: not at all (0), some of the time (1), most of the time (2), and all the time (3)]?"; and "How often did you report activities other than walking in your Garmin account [response options included: not at all (0), 1–3 times a week (1), 4–6 times a week (2), and 7 or more times a week (3)]?" These items were summed to create a POWERPLAY program exposure score (possible range 0–8).

POWERPLAY Program Acceptability

Participants were asked several questions about their perceptions of the POWERPLAY program and challenge acceptability. These included: "Will you keep up your activity beyond the STEP Up challenge (yes/no)?" as well as four questions ("Overall I was satisfied with the POWERPLAY program," "I learned new things about physical activity through the POWERPLAY program," "The POWERPLAY program was appropriate for my workplace," and "I would recommend the POWERPLAY program to other employees") with a Likert response scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Ratings of "agree" and "strongly agree" were combined to denote acceptability.

Participant Suggestions

Open-ended responses were gathered in response to the question "What changes in your workplace could help create a work environment that supports employees in staying physically active and healthy?"

Analysis

Descriptive statistics generated in IBM SPSS Statistics Version 26 were used to describe the sample and summarize survey responses to questions with Likert scales. Baseline characteristics (including physical activity and sleep) of participants who did and did not complete the follow-up were compared using independent *t*-tests for continuous variables and chi-square tests for categorical variables. Using a critical *z* score of 3.29 (Tabachnick & Fidell, 2001), extreme cases (four at baseline and four at follow-up) were removed from MVPA so they would not unduly influence the results. Following IPAQ scoring guidelines, all daily walking time variables exceeding "3 hours" or "180 minutes" were truncated (that is recoded) to be equal to "180 minutes." Separate linear mixed models for repeated designs were used to compare baseline and 2-month MVPA, minutes walking, and sleep variables. Using an AR(1): Heterogeneous covariance structure, the models included a fixed effect for time and a random intercept to account for repeated measures on individuals. The ordinal sleep variables were treated as continuous outcomes in the linear mixed models, with sleep quality categories coded 0–3, latency coded 1–5, and trouble staying awake coded 0–3 (lower number indicated better sleep). Analyses were conducted according to the intent-to-treat principle.

POWERPLAY program exposure scores were used to dichotomize 2-month follow-up participants into those that were exposed to a "low" amount of the POWERPLAY program (0–4) and those that were exposed to a "high" (5–8) amount. Change in MVPA, change in total minutes walking per week, and change in sleep duration were calculated by subtracting baseline from follow-up scores. Change scores were compared for those with high versus low exposure using analyses of variance. For all analyses, a *p*-value of less than .05 was considered statistically significant. Men's responses to the open-ended question were content analyzed and grouped using low inference categories to enable a descriptive summary of responses.

Results

The petrochemical complex included approximately 1,300 employees, 75% (n = 975) male. In total, 438 (33.7% uptake) employees (328 men, 108 women, 2 gender unspecified) signed up to participate. A total of 328 of the 975 male employees (33.6%) participated in the POWERPLAY program STEP Up challenge and completed data collection measures at baseline. At 2 months, 186 participants completed follow-up surveys (lost to follow-up: 43.3%). Participant characteristics are presented in Table 1. Participants who did and did not complete the follow-up did not differ on any characteristics at baseline except work schedule; men who completed the follow-up measures were more likely to be shift workers compared to those who did not complete the follow-up (Table 1). Of note, most reported working >40 hr per week (n = 174, 55.2%). At baseline, 246 men (75%) reported being in the "action" or "maintenance" stage of change, already engaging in 150 min of activity per week (Table 1).

Physical Activity

Table 2 presents descriptive data for the physical activity measures at baseline and follow-up, including the results of the linear mixed models. Self-reported MVPA based on the Godin questionnaire was high at baseline and MVPA was not significantly higher at follow-up. Minutes

Table 1. Characteristics at Baseline of All Participants, Completers, and Participants Missing from Follow-up.

	All Participants at Baseline (N = 328)	Completers (N = 186)	Participants Missing Follow-up (N = 142)	
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	p[a]
Age (range: 17–72)	41.5 (8.9)	41.5 (9.1)	41.4 (8.7)	.883
Body mass index (kg/m^2) (range: 18.1–45.7)	27.6 (3.9)	27.6 (4.0)	27.6 (3.8)	.991
Hours worked in a typical workday (range: 7–14)	9.15 (1.4)	9.0 (1.3)	9.3 (1.5)	.140
Hours worked per week (range: 33.25–70)	43.82 (5.8)	43.8 (6.0)	43.8 (5.7)	.934
	N (%)	*N* (%)	*N* (%)	p[a]
Work schedule				
Regular day shift	220 (67.1%)	116 (62.4%)	104 (73.2%)	**.038**
Shift worker (regular nights, shift rotates, or irregular schedule/hours)	108 (32.9%)	70 (37.6%)	38 (26.8%)	
Works weekends				
Never	102 (37%)	58 (36.0%)	44 (38.3%)	.889
Sometimes	115 (41.7%)	69 (42.9%)	46 (40.0%)	
Regularly	59 (21.4%)	34 (21.1%)	25 (21.7%)	
Works overtime				
Never	91 (32.7%)	53 (32.3%)	38 (33.3%)	.939
Sometimes	140 (50.4%)	84 (51.2%)	56 (49.1%)	
Regularly	47 (16.9%)	27 (16.5%)	20 (17.5%)	
Physical activity stage of change				
Precontemplation	16 (4.9%)	10 (5.4%)	6 (4.2%)	.085
Contemplation	12 (3.7%)	11 (5.9%)	1 (0.7%)	
Preparation	54 (16.5%)	26 (14.0%)	28 (19.7%)	
Action	20 (6.1%)	10 (5.4%)	10 (19.7%)	
Maintenance	226 (68.9%)	129 (69.4%)	97 (68.3%)	
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	p[a]
MVPA minutes/week	171.1 (150.5)	172.9 (154.2)	167.7 (146.1)	.758
Minutes/week walking at work	211.4 (280.9)	225.9 (302.3)	194.1 (250.7)	.318
Minutes/week walking place to place	149.1 (253.3)	146.8 (261.5)	149.5 (243.1)	.926
Minutes/week walking for leisure	159.6 (234.7)	175.8 (251.0)	138.2 (210.6)	.153
Total minutes/week walking	511.4 (611.0)	539.6 (655.9)	474.9 (547.4)	.345

Note. [a]p Value for comparing completers with participants missing follow-up; for continuous variables this is the p value from an independent t-test, for categorical variables this is the p value from a chi-square test. Significant results are presented in bold.

walking per week at work and from place to place were significantly higher at follow-up. Overall, minutes of walking per week increased by 156.5 min, 95% confidence interval (CI; 61.2, 251.8) (Table 2).

POWERPLAY Program Exposure

The average POWERPLAY program exposure score for 2-month follow-up participants was 4.81 (1.03) out of a possible 8. Means for the four items can be seen in Table 3. A total of 67 (37%) participants were categorized as having a "low exposure" to the POWERPLAY program with remaining 116 (63%) participants categorized as "high exposure." Men categorized as having high exposure reported greater change in MVPA (mean [M] = 21.73 min) compared to men categorized as low exposure (M = −27.65), $F(175) = 5.07$, $p = .026$, though there was no difference in minutes walking per week from baseline to follow-up.

POWERPLAY Program Acceptability

In week 1 of the step challenge, 315 (96.0%) men were syncing steps, and in week 8 there were still 288 (87.8%) men syncing steps. At the follow-up, 167 (91.3%) men responded that they would keep up their activity after the

Table 2. Physical Activity at Baseline and 2-Month Follow-up for the POWERPLAY Program.

	Baseline	2-Month Follow-up			
	Mean (95% CI)	Mean (95% CI)	Change (95% CI)	*t*	*p*
MVPA minutes/week[a]	171.07 (154.64, 187.50)	173.71 (153.27, 194.15)	2.64 (–17.13, 22.41)	0.26	.793
Minutes/week walking at work[b]	211.36 (180.43, 242.29)	284.27 (234.00, 334.53)	72.91 (20.73, 125.08)	2.76	**.006**
Minutes/week walking place to place[c]	149.10 (121.04, 177.15)	202.33 (163.55, 241.10)	53.23 (11.20, 95.26)	2.50	**.013**
Minutes/week walking for leisure[d]	159.68 (134.06, 185.31)	187.95 (151.94, 223.96)	28.26 (–9.85, 66.38)	1.46	.145
Total minutes/week walking[e]	511.37 (444.70, 578.03)	667.87 (571.94, 763.79)	156.50 (61.20, 251.80)	3.24	**.001**

Note. [a]$N = 324$ at baseline and 182 at follow-up; [b]$N = 318$ at baseline and 185 at follow-up; [c]$N = 315$ at baseline and 183 at follow-up; [d]$N = 324$ at baseline and 183 at follow-up; [e]$N = 324$ at baseline and 185 at follow-up. Linear mixed models were conducted using an AR(1): Heterogeneous covariance structure with time as a fixed intercept.
CI, confidence interval; MVPA, moderate and vigorous physical activity.
Significant results are presented in bold.

Table 3. POWERPLAY Program Exposure for Participants Who Completed Follow-up Measures ($N = 183$).

Item	*N* (%)	Range	Mean (*SD*)
Saw POWERPLAY messages in May/June			
Yes	138 (75.8%)	0–1	0.76 (.43)
No	44 (24.2%)		
Saw POWERPLAY messages in Aug/Sept			
Yes	171 (94.0%)	0–1	0.94 (.24)
No	11 (6.0%)		
How often wore tracker			
Not at all	0	0–3	2.64 (.55)
Some of the time	7 (3.8%)		
Most of the time	51 (27.9%)		
All of the time	125 (68.3%)		
How often reported physical activity other than walking in exchange for extra "steps"			
Not at all	114 (62.6%)	0–3	0.48 (.71)
1–3 times a week	51 (28.0%)		
4–6 times a week	14 (7.7%)		
7 or more times a week	3 (1.6%)		
Total exposure (sum score)		2–8	4.81 (1.03)
Exposure category[a]			
Low	67 (36.6%)		
High	116 (63.4%)		

Note. [a]Participants with total scores between 0 and 4 were categorized as "low" exposure, and participants with scores between 5 and 8 were categorized as "high" exposure.

challenge ended, 90 (49.5%) learned new things about physical activity, 164 (90.1%) were satisfied with the program, 170 (93.4%) agreed that POWERPLAY was appropriate for their workplace, and 164 (90.1%) would recommend POWERPLAY.

Sleep Duration and Quality

See Table 4 for a summary of men's self-reported sleep at baseline (all participants, as well as completers only) and 2-month follow-up. Sleep duration ranged from 2.0 to 8.5 h per night at baseline and 4.0 to 8.6 h per night at the 2-month follow-up. At baseline, 134 (41.5%) reported 7 or more hours of sleep per night, while at follow-up, 94 (51.9%) reported 7 or more hours sleep/night. Results of separate linear mixed regression models comparing sleep variables from baseline to follow-up are displayed in Table 5. Sleep duration, quality, latency, and trouble staying awake were significantly improved at follow-up compared to baseline. Change in sleep duration was not

Table 4. Summary of Male Participants' Self-reported Sleep Variables at Baseline and 2-Month Follow-up.

	All Participants at Baseline	Baseline-Completers Only	2-Month Follow-up
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
Sleep duration (hours)[a]	6.48 (.92)	6.57 (.86)	6.66 (.84)
	N (%)	*N* (%)	*N* (%)
Overall sleep quality[b]			
Very good (0)	24 (7.4%)	11 (6.0%)	18 (9.8%)
Fairly good (1)	207 (64.1%)	127 (69.4%)	123 (67.2%)
Fairly bad (2)	82 (25.4%)	39 (21.3%)	40 (21.9%)
Very bad (3)	10 (3.1%)	6 (3.3%)	2 (1.1%)
Time to fall asleep[c]			
0–15 min (1)	150 (46.0%)	85 (45.9%)	106 (57.9%)
16–30 min (2)	109 (33.4%)	69 (37.3%)	57 (31.1%)
31–45 min (3)	46 (14.1%)	24 (13.0%)	16 (8.7%)
46–60 min (4)	17 (5.2%)	6 (3.2%)	4 (2.2%)
60+ min (5)	4 (1.2%)	1 (0.5%)	0
Trouble staying awake when driving, eating, and socializing[d]			
Not during the past month (0)	149 (46.4%)	77 (42.3%)	85 (46.4%)
Less than once per week (1)	94 (29.3%)	60 (33.0%)	74 (40.4%)
Once or twice a week (2)	64 (19.9%)	37 (20.3%)	20 (10.9%)
Three or more times a week (3)	14 (4.4%)	8 (4.4%)	4 (2.2%)

Note. [a]$N = 323$ for all participants at baseline, 184 at baseline for completers only, and 181 at follow-up; [b]$N = 323$ for all participants at baseline, 183 at baseline for completers only, and 183 at follow-up; [c]$N = 326$ for all participants at baseline, 185 at baseline for completers only, and 183 at follow-up; [d]$N = 321$ for all participants at baseline, 182 at baseline for completers only, and 183 at follow-up. Independent *t*-tests comparing baseline sleep scores of completers to those missing at follow-up were all nonsignificant at $p > .05$.

Table 5. Results of Linear Mixed Regression Models Comparing Sleep Variables from Baseline to Follow-up.

	Baseline	2-Month Follow-up			
	Mean (95% CI)	Mean (95% CI)	Change (95% CI)	*t*	*p*
Sleep duration (hours)[a]	6.48 (6.38, 6.58)	6.60 (6.49, 6.72)	0.12 (0.02, 0.23)	2.29	**.023**
Sleep quality (0–3)[b]	1.24 (1.18, 1.31)	1.16 (1.07, 1.24)	–0.09 (0.0005, 0.17)	–1.98	**.049**
Time to fall asleep (0–5)[c]	1.82 (1.72, 1.93)	1.60 (1.50, 1.70)	–0.23 (–0.32, –0.14)	–4.97	**<.001**
Trouble staying awake (0–3)[d]	0.82 (0.72, 0.92)	0.68 (0.57, 0.78)	–0.14 (–0.26, –0.03)	–2.50	**.013**

Note. [a]$N = 323$ at baseline and 181 at follow-up; [b]$N = 323$ at baseline and 183 at follow-up; [c]$N = 326$ at baseline and 183 at follow-up; [d]$N = 321$ at baseline and 183 at follow-up. Four separate repeated-measures linear mixed models (one for each sleep variable) were conducted using an AR(1): Heterogeneous covariance structure with time as a fixed intercept to compare pre to post scores.
CI, confidence interval.
For sleep quality, time to fall asleep, and trouble staying awake, lower scores indicate a better outcome. Significant results are presented in bold.

significantly different between men categorized as having high exposure ($M = 0.14$ h) and men categorized as low exposure ($M = -0.004$ h), $F(1, 178) = 1.53$, $p = .218$.

Suggestions to Support Physical Activity and Health

Men were asked what workplace changes could support employees in staying physically active and healthy (open ended), and responses included supportive workplace practices to enable physical activity (e.g., breaks at work), resources and facilities to support physical activity (including incentives), reducing workload, support from leadership, and continuing programming like POWERPLAY (Table 6).

Discussion

The objectives of this study were to estimate the change in physical activity and sleep behaviors following completion of the POWERPLAY STEP Up (physical activity) challenge in the oil/gas industry; examine the impact of

Table 6. Responses to Open-ended Question Gathering Employee Suggestions for Supporting Physical Activity in the Workplace.

What changes in your workplace could help create a work environment that supports employees in staying physically active and healthy? ($n = 130$)
Supportive workplace practices and resources to enable breaks and physical activity
• *Breaking the stigma about going to the gym/exercising at lunch, not booking meetings at lunch*
• *Promoting physical activity as part of our daily routine at work*
• *Encouraging/allowing employees to go for short walks during work hours encourages walking meetings. Providing standing and/or walking desks*
• *Space at the facility (*workplace*) to run and play sports*
• *A dedicated walking path* (that circumvents areas of workplace considered dangerous/off limits)
• *Placing exercise equipment at permit* (worksite) *trailers such as a treadmill and perhaps a Bowflex machine for quick convenient access to gym equipment.*
• *More benefit allowance for personal fitness (equipment, programs, and membership)*
Changes to work schedules and workload
• *Decreasing the work week from 40 to 37.5 hr per week would give employees more energy*
• *Consider how workload affects health and wellbeing; flexible working hours to account for lifestyle choices in promotion of physical activities/work life balance*
Support from leadership and continued programming
• *Active support and encouragement from leadership; ongoing promotion of wellness at work*
• *Company allocating designated physical activity time to employees within a work day*
• *Have team fitness goals to create healthy competition*
• *Do something like this* (POWERPLAY STEP Up challenge) *again*

program exposure on working men's physical activity and sleep; and describe perceived acceptability of the program. We hypothesized that both physical activity and sleep would be improved post-program implementation, with greater program exposure corresponding to greater improvements. These hypotheses were partially supported. Although participants reported high levels of acceptability of the program, several avenues for improvement were noted, many of which aligned with recommended components of workplace health promotion programs including creating supportive physical, social, and policy environments for physical activity.

Physical Activity

Overall, weekly minutes of MVPA did not change following the intervention; however, increases in walking for work and transport were reported by those who completed the follow-up measures. Acknowledging the limitations of the self-report measures, these changes align with the intervention strategy, which was a step-based challenge promoting walking. The changes in these indicators of physical activity are similar to other team-based pedometer studies, which report increases in physical activity (Duncan et al., 2019; Macniven et al., 2015). Although it was not our intent to disentangle which aspect(s) of the intervention influenced the outcomes, we acknowledge that simultaneous behavior change strategies/information could have exerted an influence on the results. For example, increases in physical activity we observed may be linked to use of the Garmin device (i.e., self-monitoring), or the motivational messages, and the support and encouragement within and between participating workplace groups should not be ignored. A recent meta-analysis indicated that interventions with more behavior change techniques and gender-sensitive designs were associated with greater increases in physical activity among men, and among 12 studies that included follow-up assessments 12 or more months post-intervention, there was evidence that physical activity increases were sustained (Sharp et al., 2020). The baseline level of MVPA was also relatively high, which may have limited the ability of participants to further increase activity. Because overall the sample reported high hours per week of work, it is possible that there was not time for the majority to engage in greater *leisure-time* MVPA/leisure-time walking. Based on the available data, our results suggest that employees were more motivated to increase physical activity with teammates at work, such as incorporating walking meetings and walking more between tasks/jobs within the worksite.

Program Exposure

Although the lack of a comparison group makes it difficult to ascertain that these positive physical activity changes were a direct result of the POWERPLAY STEP Up challenge, it is notable that greater program exposure resulted in more positive physical activity outcomes. Our intervention was characterized by program components that specifically focused on supporting changes in physical activity and overall well-being for men, and thus we

have relative confidence that this contributed to the improvements in their physical activity. For instance, participants were exposed to promotional messaging in the workplace, describing the STEP Up challenge and highlighting the importance of the physical activity challenge for improving physical and mental health. During recruitment, employees were encouraged to attend events promoting the challenge, where information and education about physical activity and health were disseminated by the organization's wellness committee, on-site health staff, volunteer team captains, and, occasionally, POWERPLAY research team members. During this period, employees signed up for the STEP Up challenge in teams of six, were given an activity tracking device, and each team was included on an electronic map and challenged to virtually walk across Canada. These intervention components align with some of the most effective behavior change techniques identified within the research literature, including information about health and health consequences, prompts/cues, social support, and self-monitoring (Carey et al., 2019; Howlett et al., 2019; Michie et al., 2013). Thus, similar to other research (Caperchione et al., 2016), this suggests that greater exposure to the program was related to greater improvements in physical activity. Sustaining increases in physical activity likely require ongoing promotion and engagement from the workplace. POWERPLAY program recommendations for employers include things like a regular prize draw for those still wearing their devices and bringing back the step challenge on a yearly basis.

Program Acceptability/Importance of Tailoring

It is possible that the high program acceptability was an influential factor in men's physical activity gains. In a previous systematic review of workplace physical activity interventions targeting men, more than half were ineffective for increasing physical activity, highlighting the need to focus on men's preferences and needs (Wong et al., 2012). In terms of the stages of change, the current study findings are also encouraging wherein the majority of men expressed intentions to continue their physical activity beyond the STEP Up challenge. Men have long been touted as most likely to engage with physical activity-based health promotion programs, and this pattern is supported by the current study findings. Though workplace-based, principles outlined in successful community-based men's programs prevailed in POWERPLAY, including working with men in environments that are familiar, active competition-based activities and a manageable program duration (Oliffe et al., 2019). However, the challenge remains to build cultures that are amenable to supporting men to incorporate healthy lifestyle practices in their everyday routines over the long term.

Workplace Support

A challenge of implementing programs within workplaces, particularly those within male-dominated industry, is ensuring that they meet the specific needs of the employees, and are both feasible and acceptable for the employer. The POWERPLAY STEP Up challenge was well received by the employees and successful at increasing walking rates; however, workload may have limited employees' ability to participate in leisure-time activity. Indeed, reducing workload was a common suggestion in response to the open-ended question. Working long hours, shiftwork, and overtime impede the time and energy available for physical activity (Atkinson et al., 2008). Vitale et al. (2015) reported that days during time off are lost due to recovery from night shift in a study of nurses and nightshift, which may also be reflected in the shift workers in this study (Vitale et al., 2015).

Creating a culture of health involves leaders practicing health behaviors, encouraging employees to incorporate healthy activities into their workday, and implementing health-promoting policies and practices into the organization (Avolio et al., 2004). In the present study, men's suggestions around workplace practices/resources and leadership support reflect these standard workplace health promotion strategies. Supporting health in the workplace includes a physical environment that helps employees make healthy choices; however, the suggestion for specific pieces of fitness equipment identified by men in this study was not supported in a previous meta-analysis (Conn et al., 2009). For workplaces with few resources, employees can be provided with inexpensive manual step counters, invited to use their own, and directed to freely available platforms to enter steps and connect with co-workers. Outside of a step challenge, employees could be invited to organically connect and compete with one another in a variety of contexts (e.g., form workplace hockey teams and compete with other workplaces). Allowing dedicated staff time for health promotion (leadership support) and encouraging employees to support one another in healthy behaviors (coworker support) can help create a culture of health (Payne et al., 2018). Integration of health into the way an organization operates should consider leadership styles and commitment levels, job design processes, work scheduling, work processes, production processes, and all aspects that allow the organization to develop a more holistic and sustained approach to the health of its workforce (Heward et al., 2007). The men's suggestions from this study reflect workplace health promotion strategies, which support the workplace as an important setting for interventions to promote health and wellness among employees (Burton, 2010). That employees want these reinforces the need for employers to provide them in health promotion efforts.

Men's Sleep

Increasing physical activity is an effective strategy to improve sleep duration and quality (Kredlow et al., 2015). Despite this evidence, only modest improvements in sleep duration and quality were observed following the STEP Up challenge. Our inability to support larger improvements in sleep may be related to the program's focus on increased walking as well as workplace factors (e.g., shift work, overtime work). Nevertheless, our findings provide support for POWERPLAY's modular approach to support changes in men's healthy behaviors, and the need for a module to directly support working men's sleep. Although physical activity can improve sleep among adults, additional cognitive and behavioral interventions specifically targeting sleep are necessary to maximize improvements in sleep (Murawski et al., 2018; van der Zweerde et al., 2019). It is noteworthy that a recent review reported few interventions specifically targeting sleep among male-dominated industries (Soprovich et al., In review). Given that inadequate sleep is linked to a higher risk of workplace injuries (Uehli et al., 2014) and fatigue has been implicated as a contributing factor to industrial and environmental incidents (Mitler et al., 1988; Sadeghniiat-Haghighi & Yazdi, 2015), the effects of sleep deprivation in safety-sensitive, male-dominated workplaces have significant implications. Research exploring ways to improve working men's sleep health as a part of comprehensive workplace health promotion programs is needed.

Strengths, Limitations, and Suggestions for Future Research

Although the efficacy of behavior change interventions for addressing real-world health outcomes has been debated (Hagger & Weed, 2019), POWERPLAY was a real-world implementation with a high participation rate among men from a large petrochemical complex. More than half of the participants reported already engaging in 150 min of MVPA at baseline, which may have resulted in ceiling effects; however, despite this, we did see improvements in MVPA among those who were most exposed, and improvements in walking overall. More specifically, men increased their walking at work, where they spend the majority of their time and where they were in closer proximity to POWERPLAY. The POWERPLAY program as a group-based intervention was not individually tailored to participants' stage of change for physical activity. However, we note that the majority of men participating in POWERPLAY reported being in the action or maintenance stage of change for physical activity at baseline. The step challenge may have been less appealing to men not ready to change their physical activity. Future research should focus on identifying strategies to encourage participation of all segments of the male workforce in workplace health promotion programs.

The fact that this study was completed by men who signed up for a physical activity challenge may limit generalizability of the results, as this was already a very active group at baseline. Nevertheless, we saw improvements in both physical activity and sleep, which is notable because sleep duration was low overall in this group. There is room for future research to focus on sleep health for men in these settings, incorporating many of the ideals known to influence behavior among men. That a higher proportion of shift workers completed the follow-up measures is noteworthy, and may indicate an interest in improving sleep. Future research could examine work day and nonwork day sleep separately. Another limitation was the use of self-report measures in the present study. Future research could examine sleep with more objective measures (e.g., actigraphy).

Our program acceptability findings strengthen the evidence around gender-based programming. The men were satisfied and agreed that it was appropriate for the workplace and would recommend the program. These elements may influence and contribute to recruitment efforts for men in the participation of workplace health promotion programming. Gender-based programming may be especially relevant for engaging men in male-dominated workplaces, where low levels of health literacy among men have been highlighted (Milner et al., 2020).

Although we cannot determine a true casual effect of the POWERPLAY intervention, the examination of program exposure strengthens our work. We were able to categorize the participants by level of program exposure to focus the effects of the intervention and did find that greater exposure was associated with greater change in physical activity. Despite this strength, this analysis was based on only those who completed the follow-up measures, which could indicate self-selection, limiting the findings.

Conclusions

The STEP Up physical activity–focused workplace intervention was associated with increased walking and improved sleep among men working in a large petrochemical complex, based on available data. Overall, the findings support previous pilot research (Johnson et al., 2016), though the intervention was delivered slightly differently and in a different industry (i.e., oil/gas). Additionally, positive, albeit small, changes in sleep health were observed. Future work to examine the components of a sleep health–targeted intervention would benefit men working in this industry.

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Ethical Considerations and Disclosure(s)

The study was approved by the Athabasca University (Ethics file#: 23237), the University or British Columbia Research Ethics Board (#H13-02408), and the University of Alberta's Health Research Ethics Board (Study ID Pro00086564). All participants provided written informed consent.

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References

2016 Census of Canada. Labour release. (2018). https://open.alberta.ca/publications/2016-census-of-canada-labour-release#summary

Atkinson, G., Fullick, S., Grindey, C., & Maclaren, D. (2008). Exercise, energy balance and the shift worker. *Sports Medicine (Auckland, N.Z.)*, *38*(8), 671–685. doi:3885 [pii]

Avolio, B. J., Gardner, W. L., Walumbwa, F. O., Luthans, F., & May, D. R. (2004). *Unlocking the mask: A look at the process by which authentic leaders impact follower attitudes and behaviors*. https://doi.org/10.1016/j.leaqua.2004.09.003

Backhaus, J., Junghanns, K., Broocks, A., Riemann, D., & Hohagen, F. (2002). Test-retest reliability and validity of the Pittsburgh Sleep Quality Index in primary insomnia. *Journal of Psychosomatic Research*, *53*(3), 737–740. doi:S0022399902003306 [pii]

Bottorff, J. L., Seaton, C. L., Johnson, S. T., Caperchione, C. M., Oliffe, J. L., More, K., Jaffer-Hirji, H., & Tillotson, S. M. (2015). An updated review of interventions that include promotion of physical activity for adult men. *Sports Medicine*, *45*(6), 775–800. doi:10.1007/s40279-014-0286-3

Bunjo, L. J., Reynolds, A. C., Appleton, S. L., Dorrian, J., Vetter, C., Gill, T. K., & Adams, R. J. (2020). Sleep duration moderates the relationship between perceived work-life interference and depressive symptoms in Australian men and women from the north west Adelaide health study. *International Journal of Behavioral Medicine*, doi:10.1007/s12529-020-09866-9

Burton, J. (2010). *WHO healthy workplace framework and model: Background and supporting literature and practice*. World Health Organization.

Buysse, D. J., Reynolds, C. F., 3rd, Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research*, *28*(2), 193–213. doi:0165-1781(89)90047-4 [pii]

Caperchione, C. M., Stolp, S., Bottorff, J. L., Oliffe, J. L., Johnson, S. T., Seaton, C., Sharp, P., Jones-Bricker, M., Lamont, S., Errey, S., Healy, T., Medhurst, K., Christian, H., & Klitch, M. (2016). Changes in men's physical activity and healthy eating knowledge and behavior as a result of program exposure: Findings from the workplace POWERPLAY program. *Journal of Physical Activity & Health*, *13*(12), 1364–1371. doi:10.1123/jpah.2016-0111 [doi]

Carey, R. N., Connell, L. E., Johnston, M., Rothman, A. J., de Bruin, M., Kelly, M. P., & Michie, S. (2019). Behavior change techniques and their mechanisms of action: A synthesis of links described in published intervention literature. *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine*, *53*(8), 693–707. doi:10.1093/abm/kay078 [doi]

Chau, J. Y., Van Der Ploeg, H. P., Dunn, S., Kurko, J., & Bauman, A. E. (2012). Validity of the occupational sitting and physical activity questionnaire. *Medicine and Science in Sports and Exercise*, *44*(1), 118–125. doi:10.1249/MSS.0b013e3182251060 [doi]

Conn, V. S., Hafdahl, A. R., Cooper, P. S., Brown, L. M., & Lusk, S. L. (2009). Meta-analysis of workplace physical activity interventions. *American Journal of Preventive Medicine*, *37*(4), 330–339. doi:10.1016/j.amepre.2009.06.008 [doi]

Craig, C. L., Marshall, A. L., Sjostrom, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., Pratt, M., Ekelund, U. L., Yngve, A., Sallis, J. F., & Oja, P. (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine and Science in Sports and Exercise*, *35*(8), 1381–1395. doi:10.1249/01.MSS.0000078924.61453.FB [doi]

Dumith, S. C., Gigante, D. P., & Domingues, M. R. (2007). Stages of change for physical activity in adults from southern brazil: A population-based survey. *The International Journal of Behavioral Nutrition and Physical Activity*, *4*(25), 1–10. doi:1479-5868-4-25 [pii]

Duncan, M. J., Caperchione, C. M., Corry, K., Van Itallie, A., & Vandelanotte, C. (2019). A RE-AIM evaluation of

a workplace physical activity microgrant initiative: The 10,000 steps workplace challenge. *Journal of Occupational and Environmental Medicine*, *61*(9), 718–723. doi:10.1097/JOM.0000000000001653 [doi]

Godin, G., & Shephard, R. J. (1985). A simple method to assess exercise behavior in the community. *Canadian Journal of Applied Sport Sciences*, *10*(3), 141–146.

Hagger, M. S., & Weed, M. (2019). DEBATE: Do interventions based on behavioral theory work in the real world? *International Journal of Behavioral Nutrition and Physical Activity*, *16*(1), 36. doi:10.1186/s12966-019-0795-4

Heward, S., Hutchins, C., & Keleher, H. (2007). Organizational change–key to capacity building and effective health promotion. *Health Promotion International*, *22*(2), 170–178. doi:am011 [pii]

Hori, H., Ikenouchi-Sugita, A., Yoshimura, R., & Nakamura, J. (2016). Does subjective sleep quality improve by a walking intervention? A real-world study in a Japanese workplace. *BMJ Open*, *6*(10), e011055. doi:10.1136/bmjopen-2016-011055

Howlett, N., Trivedi, D., Troop, N. A., & Chater, A. M. (2019). Are physical activity interventions for healthy inactive adults effective in promoting behavior change and maintenance, and which behavior change techniques are effective? A systematic review and meta-analysis. *Translational Behavioral Medicine*, *9*(1), 147–157. doi:10.1093/tbm/iby010 [doi]

Jacobs, D. R., Jr, Ainsworth, B. E., Hartman, T. J., & Leon, A. S. (1993). A simultaneous evaluation of 10 commonly used physical activity questionnaires. *Medicine and Science in Sports and Exercise*, *25*(1), 81–91.

Jirathananuwat, A., & Pongpirul, K. (2017). Promoting physical activity in the workplace: A systematic meta-review. *Journal of Occupational Health*, *59*(5), 385–393. doi:10.1539/joh.16-0245-RA

Johnson, S. T., Stolp, S., Seaton, C., Sharp, P., Caperchione, C. M., Bottorff, J. L., Oliffe, J. L., Jones-Bricker, M., Lamont, S., Medhurst, K., Errey, S., & Healy, T. (2016). A men's workplace health intervention: Results of the POWERPLAY program pilot study. *Journal of Occupational and Environmental Medicine*, *58*(8), 765–769. doi:10.1097/JOM.0000000000000793

Kerr, J. (2011). *Where are the men? Chief medical health officer's report on the health and well-being of men and boys in northern BC*. Northern Health.

Kiselica, M. S., & Englar-Carlson, M. (2010). Identifying, affirming, and building upon male strengths: The positive psychology/positive masculinity model of psychotherapy with boys and men. *Psychotherapy (Chicago, Ill.)*, *47*(3), 276–287. doi:10.1037/a0021159 [doi]

Kredlow, M. A., Capozzoli, M. C., Hearon, B. A., Calkins, A. W., & Otto, M. W. (2015). The effects of physical activity on sleep: A meta-analytic review. *Journal of Behavioral Medicine*, *38*(3), 427–449. doi:10.1007/s10865-015-9617-6

Lewis, C. (2013). *Physical work, gender, and health in working life: State of knowledge report*. Swedish Work Environment Authority. https://www.av.se/globalassets/filer/publikationer/kunskapssammanstallningar/physical-work-gender-and-health-in-working-life-kunskapssammanstallning-2013-9-eng.pdf

Macniven, R., Engelen, L., Kacen, M. J., & Bauman, A. (2015). Does a corporate worksite physical activity program reach those who are inactive? Findings from an evaluation of the global corporate challenge. *Health Promotion Journal of Australia: Official Journal of Australian Association of Health Promotion Professionals*, *26*(2), 142–145. doi:10.1071/HE14033 [doi]

Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., Eccles, M. P., Cane, J., & Wood, C. E. (2013). The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: Building an international consensus for the reporting of behavior change interventions. *Annals of Behavioral Medicine*, *46*(1), 81–95. doi:10.1007/s12160-013-9486-6

Milner, A., Shields, M., Scovelle, A. J., Sutherland, G., & King, T. L. (2020). Health literacy in male-dominated occupations. *American Journal of Men's Health*, *14*(5), 1557988320954022. doi:10.1177/1557988320954022

Mitler, M. M., Carskadon, M. A., Czeisler, C. A., Dement, W. C., Dinges, D. F., & Graeber, R. C. (1988). Catastrophes, sleep, and public policy: Consensus report. *Sleep*, *11*(1), 100–109. doi:10.1093/sleep/11.1.100 [doi]

Mollayeva, T., Thurairajah, P., Burton, K., Mollayeva, S., Shapiro, C. M., & Colantonio, A. (2016). The Pittsburgh Sleep Quality Index as a screening tool for sleep dysfunction in clinical and non-clinical samples: A systematic review and meta-analysis. *Sleep Medicine Reviews*, *25*, 52–73. doi:10.1016/j.smrv.2015.01.009 [doi]

Murawski, B., Wade, L., Plotnikoff, R. C., Lubans, D. R., & Duncan, M. J. (2018). A systematic review and meta-analysis of cognitive and behavioral interventions to improve sleep health in adults without sleep disorders. *Sleep Medicine Reviews*, *40*, 160–169. doi:S1087-0792(17)30166-1 [pii]

Oliffe, J. L., Bottorff, J. L., Sharp, P., Caperchione, C. M., Johnson, S. T., Healy, T., Lamont, S., Jones-Bricker, M., Medhurst, K., & Errey, S. (2017). Healthy eating and active living: Rural-based working men's perspectives. *American Journal of Men's Health*, *11*(6), 1664–1672. doi:1557988315619372

Oliffe, J. L., Rossnagel, E., Bottorff, J. L., Chambers, S. K., Caperchione, C., & Rice, S. M. (2019). Community-based men's health promotion programs: Eight lessons learnt and their caveats. *Health Promotion International*, doi:az101 [pii]

Payne, J., Cluff, L., Lang, J., Matson-Koffman, D., & Morgan-Lopez, A. (2018). Elements of a workplace culture of health, perceived organizational support for health, and lifestyle risk. *American Journal of Health Promotion: AJHP*, *32*(7), 1555–1567. doi:10.1177/0890117118758235 [doi]

PetroLMI, division of Energy Safety Canada. (2018). *Diversifying Canada's oil and gas workforce: A decade in review*. https://petrolmi-media-library.s3.ca-central-1.amazonaws.com/petro-lmi/corporate-website/current/wp-content/uploads/2019/07/30155625/FINAL_Diversifying_Report1.pdf

Reid, K. J., Weng, J., Ramos, A. R., Zee, P. C., Daviglus, M., Mossavar-Rahmani, Y., Sotres-Alvarez, D., Gallo, L. C., Chirinos, D. A., & Patel, S. R. (2018). Impact of shift work schedules on actigraphy-based measures of sleep in Hispanic workers: Results from the Hispanic community health study/study of Latinos ancillary sueño study. *Sleep*, *41*(10) doi:10.1093/sleep/zsy131

Robertson, S., Witty, K., Zwolinsky, S., & Day, R. (2013). Men's health promotion interventions: What have we learned from previous programmes. *Community Practitioner*, *86*(11), 38–41.

Robroek, S. J., van Lenthe, F. J., van Empelen, P., & Burdorf, A. (2009). Determinants of participation in worksite health promotion programmes: A systematic review. *The International Journal of Behavioral Nutrition and Physical Activity*, *6*, 26–26. doi:10.1186/1479-5868-6-26 [doi]

Sadeghniiat-Haghighi, K., & Yazdi, Z. (2015). Fatigue management in the workplace. *Industrial Psychiatry Journal*, *24*(1), 12–17. doi:10.4103/0972-6748.160915 [doi]

Sayers, E., Rich, J., Rahman, M. M., Kelly, B., & James, C. (2019). Does help seeking behavior change over time following a workplace mental health intervention in the coal mining industry? *Journal of Occupational and Environmental Medicine*, *61*(6), e282–e290. doi:10.1097/JOM.0000000000001605

Seaton, C. L., Bottorff, J. L., Oliffe, J. L., Medhurst, K., & DeLeenheer, D. (2018). Mental health promotion in male-dominated workplaces: Perspectives of male employees and workplace representatives. *Psychology of Men & Masculinity*, *20*(4), 541–552. doi:10.1037/men0000182

Seidler, Z. E., Rice, S. M., River, J., Oliffe, J. L., & Dhillon, H. M. (2018). Men's mental health services: The case for a masculinities model. *The Journal of Men's Studies*, *26*(1), 92–104. doi:10.1177/1060826517729406

Sharp, P., Spence, J. C., Bottorff, J. L., Oliffe, J. L., Hunt, K., Vis-Dunbar, M., & Caperchione, C. M. (2020). One small step for man, one giant leap for men's health: A meta-analysis of behaviour change interventions to increase men's physical activity. *British Journal of Sports Medicine*, *54*(20), 1208–1216. doi:10.1136/bjsports-2019-100912 [doi]

Soprovich, A., Bottorff, J. L., Wozniak, L., Oliffe, J. L., Seaton, C., Duncan, M., & Johnson, S. (In review). Sleep health in male-dominated workplaces: A qualitative study examining the perspectives of male employees.

Soprovich, A. L., Seaton, C. L., Bottorff, J. L., Duncan, M. J., Caperchione, C. M., Oliffe, J. L., James, C., Rice, S., Tjosvold, L., Eurich, D. T., & Johnson, S. T. (2020). A systematic review of workplace behavioral interventions to promote sleep health in men. *Sleep Health*, doi:10.1016/j.sleh.2020.04.008

Statistics Canada. (2017). Fort Saskatchewan, CY [census subdivision], Alberta and Edmonton, CY [census subdivision], Alberta (table). Census profile. 2016 census. Statistics Canada catalogue no. 98-316-X2016001. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E

Statistics Canada. (2020). Table 14-10-0023-01 labour force characteristics by industry, annual (x 1,000). https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410002301

Stergiou-Kita, M., Mansfield, E., Bezo, R., Colantonio, A., Garritano, E., Lafrance, M., Lewko, J., Mantis, S., Moody, J., Power, N., Theberge, N., Westwood, E., & Travers, K. (2015). Danger zone: Men, masculinity and occupational health and safety in high risk occupations. *Safety Science*, *80*, 213–220. doi:10.1016/j.ssci.2015.07.029 [doi]

Sun Life Financial. (2016). *Sun life-Ivey Canadian wellness ROI study update*. http://www.sunlife.ca/static/canada/Sponsor/About%20Group%20Benefits/Group%20benefits%20products%20and%20services/Health%20and%20wellness/Wellness%20ROI%20Study/Files/ROI_dashboard_PDF6807_E.pdf

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (3rd ed.). Lawrence Erlbaum.

Uehli, K., Mehta, A. J., Miedinger, D., Hug, K., Schindler, C., Holsboer-Trachsler, E., Leuppi, J. D., & Kunzli, N. (2014). Sleep problems and work injuries: A systematic review and meta-analysis. *Sleep Medicine Reviews*, *18*(1), 61–73. doi:10.1016/j.smrv.2013.01.004 [doi]

van der Ploeg, H. P., Tudor-Locke, C., Marshall, A. L., Craig, C., Hagstromer, M., Sjostrom, M., & Bauman, A. (2010). Reliability and validity of the international physical activity questionnaire for assessing walking. *Research Quarterly for Exercise and Sport*, *81*(1), 97–101. doi:10.1080/02701367.2010.10599632 [doi]

van der Zweerde, T., Bisdounis, L., Kyle, S. D., Lancee, J., & van Straten, A. (2019). Cognitive behavioral therapy for insomnia: A meta-analysis of long-term effects in controlled studies. *Sleep Medicine Reviews*, *48*, 101208. doi:S1087-0792(18)30196-5 [pii]

Vitale, S. A., Varrone-Ganesh, J., & Vu, M. (2015). Nurses working the night shift: Impact on home, family, and social life. *Journal of Nursing Education and Practice*, *5*(10), 70–78.

Winkler, M. R., Mason, S., Laska, M. N., Christoph, M. J., & Neumark-Sztainer, D. (2018). Does non-standard work mean non-standard health? Exploring links between non-standard work schedules, health behavior, and well-being. *SSM - Population Health*, *4*, 135–143. doi:10.1016/j.ssmph.2017.12.003

Wong, J. Y., Gilson, N. D., van Uffelen, J. G., & Brown, W. J. (2012). The effects of workplace physical activity interventions in men: A systematic review. *American Journal of Men's Health*, *6*(4), 303–313. doi:10.1177/1557988312436575 [doi]

World Health Organization. (2007). *Engaging men and boys in changing gender-based inequity in health: Evidence from programme interventions*. WHO Press.

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