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The Sustainability of a Workplace Wellness Program That Incorporates Gamification Principles: Participant Engagement and Health Benefits After 2 Years

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Abstract

Purpose: To evaluate the results of a workplace wellness program that incorporates gamification principles.

Design: In this prospective cohort study, the participation rate and observed health outcomes were evaluated after approximately 2 years.

Setting and participants: All permanent employees (n = 775) of a national company located in Canada were eligible to participate.

Intervention: The wellness program included web-based challenges (team or individual) incorporating gamification strategies to improve exercise, nutrition, weight reduction, and mental health management behaviors.

Measures and analysis: The primary outcomes were employee participation rates. The secondary pre-specified outcomes were the sustained benefits of the program on physical and mental health measures.

Results: Participation rates in the health screenings were 78% (baseline), 54% (year 1), and 56% (year 2). Participation in the 4 team web-based challenges ranged from 33% to 68% with 76% to 86% of participants tracking their activity on at least half of the days. After 2 years, there were significant clinical improvements in systolic blood pressure (−1.3mm Hg), total cholesterol/high-density lipoprotein (HDL) ratio (−0.14), glycated haemoglobin (HbA_{1c}; −0.1%), weekly physical activity (+264 Metabolic Equivalents [METs]), perceived stress score (−17%), insomnia severity index (−16%), general fatigue (−10%), and reductions in the cardiovascular age gap (−0.3 years). Greater benefits occurred among employees at higher risk.

Conclusions: Workplace wellness programs that evolve over time and focus primarily on fun and competitive challenges may support long-term participation, behavior change, and sustained improvements in clinical outcomes.

Keywords

workplace wellness, gamification, exercise, web-based, challenges, employee health, mental health, stress management, sleep, fatigue, nutrition

Purpose

The potential health benefits of workplace wellness programs have been demonstrated in large cohort and randomized controlled trials.[1-5] Nonetheless, there is continuing debate regarding the long-term benefits in the real world where employee participation rates may be suboptimal and decline over time.[6-9] In addition, there is a lack of information regarding the long-term effectiveness of comprehensive programs including biometric screenings, education, incentives, and/or behavior tracking.

Accordingly, there is increasing interest in techniques to improve continuing employee engagement in these programs, especially employees with increased health risks. This includes

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supportive social and physical environments to support lifestyle changes,[10,11] financial incentives based on behavioral economic theory to encourage participation,[11,12] and the increasing interest in the positive effects of gamification.[13-15]

Gamification has been defined as “the use of game design elements in nongame contexts”.[16] Core elements of gamification with linkages to proven behavior change strategies include: goal setting, the capacity to overcome challenges, providing feedback on performance, reinforcement (eg, gaining rewards such as badges), comparing progress (eg, leaderboards), social connectivity (interacting with other people), as well as, fun and playfulness.[17]

The Canadian workplace wellness program developed and evaluated herein faced limited options to increase employee engagement. Significant financial incentives to employees were not an option due to a publically funded national health-care system. In addition, on-site social networking was also challenging as only half the employees were located at the head office with the remainder scattered across the country. We therefore focused on developing a lifestyle behavior change program that used a web-based platform to support gamification and the social connections among employees.

The first-year results of the program demonstrated high participation rates and improvements in participants’ physical and mental health measures.[18] The second-year results are now reported, evaluating continued participation and the sustainability of improvement in health benefits of a workplace wellness program utilizing gamification techniques in the absence of substantial financial incentives.

Methods

Design

A within-participant pre–post design was used. The study protocol was approved by Institutional Review Board Services (#IRBxxx and #IRByyy).

Study Sample

In 2014, Merck Canada Inc, Kirkland, Quebec, a pharmaceutical company with approximately 775 permanent employees, implemented a comprehensive wellness program. When the program was deployed, there were dedicated internal resources for a clear program strategy to build and sustain employee participation. In addition to the program being branded LIVE IT, it was heavily promoted to the employees using a multimedia approach with a clear message that it was supported by management. Details of the program have been described previously.[18]

The program was open to all employees (a group of approximately 40 field employees did not have access to the biometric screening portion of the program). Participation was voluntary and free of charge. Participants provided online consent, then accessed a web-based platform, available on computers, tablets, and smartphones, that included (1) the results from ongoing health assessments and biometric screenings, (2) educational modules, and (3) behavior change programs using gamification techniques such as goal setting, leaderboards, badges, challenges, and social influence.

Measures

The biometric health screenings were offered at baseline and then annually. The following information was collected: gender, date of birth, personal and family history of cardiovascular disease (CVD) and diabetes, smoking status, height, weekly minutes of moderate and vigorous physical activity, and medication use. The following variables were measured including weight, waist circumference, blood pressure, total and high-density lipoprotein (HDL) cholesterol, and glycated haemoglobin (HbA_{1c}). Glycated haemoglobin was only measured at the second and third biometric screenings. The employees immediately entered their data directly into the web-based platform with health-care professionals (nurses and kinesiologists) present to briefly discuss the results with the employee. Validated health assessments included cardiovascular Age (CVage),[19] sleep using the Insomnia Severity Index (ISI).[20-22] stress using the Perceived Stress Scale (PSS),[23,24] fatigue using the general fatigue subscale of the Multidimensional Fatigue Inventory,[25,26] and depression using the Center for Epidemiologic Studies—Depression (CES-D).[27-29] Details of the assessments have been described previously.[18] Employees could update their health assessments at any point of time on the site to determine the impact of adopting healthy behaviors.

Other measures include participation and engagement. Participation is defined as attending a session for program elements such as biometric screenings, lunch and learns, or wellness consultation visits. For on-line challenges, participation is defined as entering at least 1 day of required information. Since behavior tracking was a key element of the lifestyle interventions, we used the days tracked online as a proxy for the level of engagement in the program.

Intervention

The program was under the corporate communication department and directed by a wellness lead who worked closely with the wellness program provider, employee champions, and employees. The wellness program provider was responsible for the data collection, much of the wellness programming, and the data analysis. The employee champions were volunteers who acted as team captains for the online team challenges and were the communication channel between the employees and the wellness lead.

The customized wellness program was delivered using a gradual introduction of the key elements (see Figure 1) including MOVE IT (exercise), FUEL IT (nutrition and weight management), and BALANCE IT (mental health). In July 2014, the program started with MOVE IT given the health benefits associated with regular exercise, the high prevalence of sedentary behavior, and the opportunity to include all employees

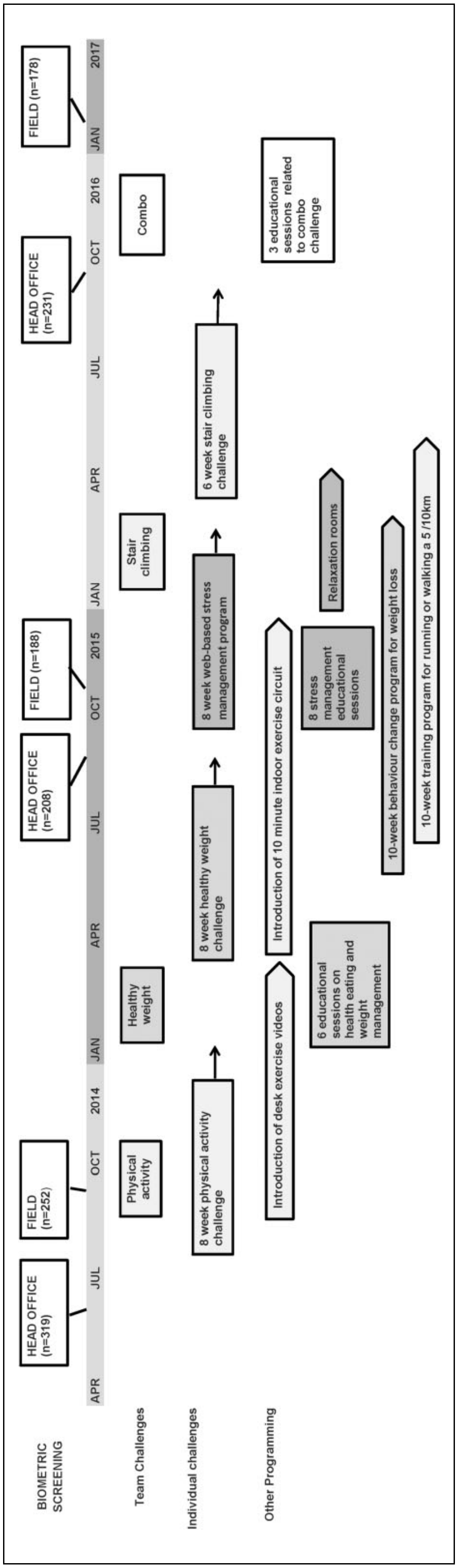

Figure 1. Timeline of biometric screenings and intervention components.

regardless of their baseline habits and health risks. Six months later, the FUEL IT arm was introduced; however, new exercise initiatives were continually available as described later. At the 1-year mark, BALANCE IT initiatives were introduced. Although the focus on key elements of the program was done gradually, employees had access to all of the health assessments and the associated educational modules right from the start of the program (eg, heart, diabetes, sleep, stress, exercise, nutrition, weight loss, smoking cessation, alcohol, and depression). Also, for the duration of the program, a wellness consultant specializing in behavior change was available for 30-minute consultations 1 day/week in person for head office employees and via Face Time for employees off-site.

Exercise initiatives (light gray in Figure 1) included an 8-week online team exercise and stair climbing challenges, lunchtime educational sessions (recorded for employees in the field), individual exercise or stair climbing challenges (continuously available), desk exercise videos, a 10-minute indoor exercise circuit at head office, and a 10-week training program for a 5- or 10-km run. Head office employees also had free exercise classes 3 days/week and access to an on-site gym. All employees received a free pedometer to help them track their physical activities. Exercise activity was manually entered onto the platform using steps from the pedometer, and for nonwalking activities, the employees entered their activities and the number of minutes, and it was automatically converted to steps using MET intensity from the Compendium of Physical Activities.[30] By the second year of the program, the website allowed for automatic synching of data from the Fitbit which was used by 5% to 10% of employees.

The FUEL IT arm of the wellness program (medium gray in Figure 1) was launched with an 8-week online team healthy weight challenge. Other programming included lunchtime presentations on healthy eating, an 8-week online individual healthy weight challenge, and a 10-week individual or small group behavior change program for weight loss. the BALANCE IT programming (dark gray in Figure 1) consisted of a series of 8 stress management educational sessions (recorded for field employees), an 8-week online stress management program to practice the techniques that were being presented, and relaxation rooms for employees at head office to practice their stress management skills. Finally, in the fall of 2016, a 9-week on-line team challenge was launched with each week focusing on a different behavior goal.

All programming, especially the online challenges, incorporated gamification strategies when possible. These included setting goals, feedback on performance, the ability to compare progress (against others or against an avatar for individual challenges), social support (group exercise, teams, captains, and wellness consultant), and a fun factor (online challenge routes with an interesting narrative, and themed relaxation rooms).

The program provider included academic researchers, clinicians, and web developers, thereby allowing for frequent tailoring of the program based on ongoing analysis of participation rates, website usage, outcomes, and feedback

Table 1. Participation and Engagement in On-Line Challenges.

Challenge	Type	Duration	Participation	Engagement
Physical activity, (September-November 2014)	Team[a]	8 weeks	530 active participants[b], (12 588 average steps)[c]	283 (53%) tracked all days, 170 (32%) tracked 28-55 days, 77 (15%) tracked 1-27 days
Healthy weight, (February-April 2015)	Team	8 weeks	316 active participants, (13 490 average steps)	71 (22%) tracked all days, 188 (59%) tracked 28-55 days, 57 (18%) tracked 1-27 days
Stair climbing, (January-March 2016)	Team	8 weeks	250 active participants, (13 179 average steps; 22 average flights)	104 (42%) tracked all days, 110 (44%) tracked 28-55 days, 36 (14%) tracked 1-27 days
Combo (different goal each week), (October-December 2016)	Team	9 weeks	294 active participants, (14 661 average steps; 20 average flights)	82 (28%) tracked all days, 142 (48%) tracked 32-62 days, 70 (24%) tracked 1-30 days
Physical activity, (June 2014-ongoing)	Individual	8 weeks	358 active participants[d] (13 855 average steps)	142 (40%) tracked all days, 132 (37%) tracked 28-55 days, 84 (23%) tracked 1-27 days
Healthy weight, (April 2015-ongoing)	Individual	8 weeks	61 active participants[d], (10 799 average steps)	20 (33%) tracked all days, 29 (48%) tracked 28-55 days, 12 (20%) tracked 1-27 days
Stair climbing, (March 2016-ongoing)	Individual	6 weeks	43 active participants[d], (13 266 average steps; 35 average flights)	20 (47%) tracked all days, 12 (28%) tracked 22-41 days, 11 (26%) tracked 1-21 days

[a]Team challenges occurred at specific times. Individual challenges (racing against an Avatar) were available at all times after the specified start date.
[b]Active participants include all employees who tracked their activity on at least 1 day during the challenge.
[c]Includes measured steps and step equivalents for non-walking activities.
[d]May include employees who did more than 1 challenge.

from employees. For example, following the team healthy weight challenge, there was a slight increase in average body weight; so, a small group behavior change program for weight loss was introduced. Also, during the stress management educational sessions, employees requested the ability to practice the techniques; so, on-site relaxation rooms were designed. Finally, as it became apparent that more employees were using Bluetooth-enabled digital trackers, this functionality was added to the website.

Modest incentives branded with the program logo (eg, back packs, water bottles, weight scales, exercise balls, and iPod shuffles) were used to encourage participation in the biometric screenings and the online team challenges, as well as, to reinforce behavior change (eg, regular tracking). They were also used to recognize the team captains.

Data Analysis

Data were analyzed from February 2017 to January 2018. The primary outcome of interest was the continued employee participation and rates for the various wellness programs and the overall engagement in the program (days tracked online).

The secondary pre-specified outcome was the sustained benefits of the program on physical and mental health measures including blood pressure, blood lipids, physical activity, body mass, physical fatigue, sleep quality, mental stress, and depressed mood. We also assessed changes in HbA_{1c} levels, although these were not measured at baseline, therefore decreasing the sample size.

To determine if the program benefited both healthy and nonhealthy employees, we compared the program benefits between healthy employees (no cardiometabolic health conditions or risk factors or elevated mental health metrics) and employees with at least 1 risk factor (diabetes, CVD, current smoker, blood pressure > 140/90 [mm Hg] or on blood pressure medication, total/HDL cholesterol > 4 [♀] or 5 [♂] or on lipid medication, body mass index $\geq$30 kg/m^2, weekly METs <720, stress score $\geq$18 on PSS, poor sleep $\geq$8 on ISI, or depressive symptoms $\geq$16 on CES-D). We also evaluated whether the program impacted head office and field employees differently. Finally, we looked at the sustained benefits of the program on employees at risk for each health measure at baseline. We analyzed within-participant pre–post mean differences with 95% confidence intervals. Analyses were conducted using SAS, 9.4 (Cary, North Carolina).

Results

Participation

Participation in the biometric screening included 571 (78%) of the 735 eligible employees at baseline (319 head office and 252 field), 396 (54%) at year 1 (208 head office and 188 field), and 409 (56%) at year 2 (231 head office and 178 field). There were 314 (43%) employees who attended both the baseline and first-year screening, 310 (42%) who attended both the baseline and second- year screening, and 189 (26%) employees who attended all 3 screenings. Of the 571 employees screened at baseline, 89 were no longer employed by the company at the second-year screening; therefore, the follow-up rate was 64% (310/482).

Participation and engagement in the on-line challenges is shown in Table 1. The highest participation rate (68%) was in the first team physical activity challenge and employees averaged 12 588 steps/d (includes measured steps and step equivalents for nonwalking activities). Subsequent team challenges had participation rates between 33% and 41% and average activity levels between 13 179 and 14 661 steps/d. The optional individual challenges had lower participation rates, but the average steps/d were similar to the team challenges (see Table 1).

Table 2. Changes in Health Measures After 2 Years for All, Healthy, and Higher Risk Employees.[a]

Health Measure	Risk Level	Pre	Post	Change
Systolic blood pressure (mm Hg)	All	120.3 (14.3)	119.0 (13.1)	−1.3 (−2.6 to −0.03)[b]
	Healthy	116.0 (11.4)	116.2 (12.2)	0.2 (−1.7 to 2.2)
	Higher risk	122.8 (15.1)	120.6 (13.3)	−2.2 (−3.9 to −0.5)[b]
Diastolic blood pressure (mm Hg)	All	79.1 (9.1)	77.8 (8.7)	−1.3 (−2.1 to −0.4)[b]
	Healthy	75.4 (7.4)	75.5 (8.1)	0.1 (−1.2 to 1.4)
	Higher risk	81.1 (9.3)	79.1 (8.8)	−2.0 (−3.1 to −0.9)[b]
Total/HDL cholesterol ratio	All	3.498 (1.25)	3.34 (1.33)	−0.14 (−0.26 to −0.03)[b]
	Healthy	2.86 (0.70)	2.88 (0.89)	0.02 (−0.09 to 0.14)
	Higher risk	3.80 (1.35)	3.57 (1.45)	−0.23 (−0.39 to −0.06)[b]
HbA_{1c}	All	5.3 (0.5)	5.2 (0.5)	−0.1 (−0.2 to −0.1)[b]
	Healthy	5.2 (0.4)	5.1 (0.4)	−0.1 (−0.2 to −0.0)[b]
	Higher risk	5.4 (0.5)	5.2 (0.6)	−0.1 (−0.2 to −0.1)[b]
Weight (kg)	All	73.6 (16.0)	74.5 (15.7)	0.9 (0.4 to 1.4)[b]
	Healthy	68.2 (11.6)	69.7 (12.4)	1.5 (0.8 to 2.2)[b]
	Higher risk	76.6 (17.4)	77.1 (16.8)	0.6 (−0.1 to 1.3)
Body mass index (kg/m^2)	All	25.3 (4.6)	25.7 (4.4)	0.3 (0.2 to 0.5)[b]
	Healthy	23.6 (2.7)	24.1 (3.1)	0.5 (0.3 to 0.8)[b]
	Higher risk	26.3 (5.1)	26.5 (4.8)	0.2 (−0.0 to 0.4)
Waist circumference (cm)	All	88.6 (12.9)	88.1 (12.4)	−0.5 (−1.2 to 0.3)
	Healthy	82.9 (9.1)	83.1 (9.7)	0.1 (−0.9 to 1.1)
	Higher risk	91.8 (13.7)	91.0 (12.9)	−0.8 (−1.8 to 0.2)
Physical activity (weekly METs)	All	2056 (1508)	2320 (1746)	264 (68 to 460)[b]
	Healthy	2653 (1553)	2629 (1815)	−24 (−384 to 336)
	Higher risk	1723 (1378)	2148 (1686)	425 (195 to 654)[b]
Stress (PSS)	All	13.4 (5.6)	11.1 (5.8)	−2.4 (−3.0 to −1.7)[b]
	Healthy	10.9 (3.9)	9.9 (4.9)	−0.9 (−1.8 to −0.02)[b]
	Higher risk	14.7 (5.8)	11.6 (6.1)	−3.1 (−3.9 to −2.3)[b]
Sleep (ISI)	All	6.1 (4.7)	5.1 (4.5)	−1.0 (−1.4 to −0.5)[b]
	Healthy	3.2 (2.3)	3.5 (3.4)	0.3 (−0.4 to 1.0)
	Higher risk	7.6 (4.9)	6.0 (4.9)	−1.6 (−2.2 to −1.1)[b]
Depression (CES-D)	All	6.1 (6.6)	5.8 (6.5)	−0.3 (−1.0 to 0.5)
	Healthy	3.2 (3.3)	4.0 (4.9)	0.8 (−0.2 to 1.8)
	Higher risk	7.6 (7.3)	6.8 (6.9)	−0.8 (−1.8 to 0.2)
Fatigue (MFI)	All	10.6 (3.7)	9.6 (3.9)	−1.1 (−1.5 to −0.6)[b]
	Healthy	8.8 (3.4)	8.2 (3.5)	−0.6 (−1.4 to 0.2)
	Higher risk	11.7 (3.4)	10.3 (3.9)	−1.3 (−1.9 to −0.8)[b]
CVage gap (years)	All	−1.9 (2.2)	−2.2 (2.0)	−0.3 (−0.5 to −0.1)[b]
	Healthy	−3.1 (1.9)	−3.0 (1.2)	0.1 (−0.3 to 0.5)
	Higher risk	−1.3 (2.2)	−1.8 (2.1)	−0.5 (−0.8 to −0.2)[b]

Abbreviations: CES-D, center for epidemiologic studies—depression; CVage gap, CVage − age; ISI, Insomnia Severity Index; MFI, General Fatigue subscale of the Multidimensional Fatigue Inventory; PSS, perceived stress scale.

[a] Mean (SD). All, all employees, employees with baseline and 2-year biometric screening data (n = 310); healthy, employees with no risk factors (n = 111); higher risk, employees with at least 1 risk factor (n = 199). Risk factors include diabetes (n = 5), cardiovascular disease (n = 1), current smoker (n = 13), blood pressure > 140/90 (mm Hg; n = 44), on blood pressure medication (n = 25), total/HDL cholesterol > 4 (♀) or 5 (♂) (n = 50), on lipid medication (n = 25), body mass index $\geq$30 kg/m^2 (n = 41), weekly METs < 720 (n = 56), stress score $\geq$18 on PSS (n = 62), poor sleep $\geq$8 on ISI (n = 105), or depressive symptoms $\geq$16 on CES-D (n = 26).

[b] Indicates that the lower and upper 95% confidence intervals did not include 0.

Participation in the other programming included approximately 70 to 100 employees attending each lunch and learn, 233 employees meeting with the wellness consultant on at least 1 occasion with a total of 550 visits, 49 employees enrolling in the 10-week behavior change weight loss program, 520 employees entering a 5- or 10-km community-based walk/run, and 15 employees participating in the 8-week online stress management program. Employees opened 1997 online educational documents (656 in 2014, 569 in 2015, and 772 in 2016). The most popular topics included nutrition (464), weight loss (416), fitness (382), stress management (351), and meal plans (223).

Outcomes Data

There were clinical improvements in blood pressure, the total cholesterol/HDL ratio, weekly physical activity, perceived stress, sleep, fatigue, HbA_{1c}, and the cardiovascular age gap, defined as the difference between individuals' cardiovascular age and their chronologic age (see Table 2). These changes

Table 3. Changes in Health Measures After 2 Years for Head Office (n = 145) and Field (n = 165) Employees.[a]

Health Measure	Pre	Post	Within Group Change	Between Group Change
Systolic blood pressure (mm Hg)				
HO	120.3 (13.8)	118.1 (13.7)	−2.2 (−4.0 to −0.4)[b]	
FB	120.4 (14.7)	119.8 (12.5)	−0.6 (−2.4 to 1.3)	1.6 (−1.0 to 4.2)
Diastolic blood pressure (mm Hg)				
HO	78.8 (9.0)	77.6 (9.5)	−1.2 (−2.5 to 0.1)	
FB	79.3 (9.1)	78.0 (7.9)	−1.3 (−2.5 to −0.1)[b]	−0.2 (−1.9 to 1.6)
Total/HDL cholesterol ratio				
HO	3.45 (1.29)	3.33 (1.23)	−0.12 (−0.28 to 0.05)	
FB	3.51 (1.22)	3.35 (1.42)	−0.17 (−0.33 to 0.0)	−0.05 (−0.28 to 0.19)
HbA_{1c}				
HO	5.9 (0.1)	5.4 (0.4)	−0.5 (−0.8 to −0.2)	
FB	6.5 (1.0)	6.2 (1.1)	−0.3 (−0.7 to 0.1)	0.2 (−0.3 to 0.7)
Weight (kg)				
HO	72.7 (15.2)	73.8 (14.9)	1.1 (0.5 to 1.7)	
FB	74.3 (16.7)	75.0 (16.5)	0.7 (−0.1 to 1.5)	−0.4 (−1.4 to 0.6)
Waist circumference (cm)				
HO	88.9 (13.1)	88.5 (11.5)	−0.4 (−1.7 to 0.9)	
FB	88.4 (12.8)	87.9 (13.2)	−0.5 (−1.2 to 0.2)	−0.1 (−1.5 to 1.4)
Physical activity (weekly METs)				
HO	1572 (1177)	2218 (1672)	646 (422 to 870)[b]	
FB	1824 (1229)	2779 (1905)	956 (704 to 1208)[b]	310 (−27 to 647)
Stress (PSS)				
HO	13.8 (5.5)	11.2 (6.1)	−2.6 (−3.5 to −1.8)[b]	
FB	12.9 (5.6)	10.9 (5.3)	−2.0 (−2.9 to −1.1)[b]	0.6 (−0.6 to 1.9)
Sleep (ISI)				
HO	6.0 (4.5)	5.1 (4.3)	−1.0 (−1.6 to −0.4)[b]	
FB	6.1 (4.8)	5.1 (4.8)	−1.0 (−1.6 to −0.3)[b]	0.0 (−0.9 to 0.9)
Depression (CES-D)				
HO	5.8 (6.5)	5.6 (6.3)	−0.3 (−1.3 to 0.8)	
FB	6.3 (6.6)	6.1 (6.6)	−0.2 (−1.3 to 0.8)	0.0 (−1.4 to 1.5)
Fatigue (MFI)				
HO	10.8 (3.8)	9.9 (4.2)	−0.9 (−1.6 to −0.2)[b]	
FB	10.5 (3.5)	9.2 (3.5)	−1.3 (−1.8 to −0.7)[b]	−0.4 (−1.2 to 0.5)
CVage gap (years)				
HO	−1.8 (2.3)	−2.2 (2.1)	−0.4 (−0.7 to −0.2)[b]	
FB	−2.0 (2.2)	−2.1 (1.8)	−0.1 (−0.5 to 0.2)	0.3 (−0.1 to 0.8)

Abbreviations: HO, head office; FB, field-based; CES-D, Center for Epidemiologic Studies—Depression; CVage gap, CVage − age; ISI, Insomnia Severity Index; MFI, General Fatigue subscale of the Multidimensional Fatigue Inventory; PSS, Perceived Stress Scale.
[a]Mean (SD).
[b]Indicates that the lower and upper 95% confidence intervals did not include 0.

were also observed at 1 year[18] and were maintained or further improved at 2 years for those remaining in the program. There were no substantial differences in any of the changes in the outcome measures between head office and field employees (see Table 3).

There were 111 healthy employees who had no risk factors and 199 employees who had at least 1 risk factor (see Table 2). Healthy employees were very physically active at baseline, with an average self-reported weekly METs of 2653 (equivalent to 11 hours of moderate or 5.5 hours of vigorous exercise per week). The baseline health measures for this group left little room for improvement. The healthy employee group showed no substantial improvements on average in any health measures except for the stress score and HbA_{1c} levels. On the other hand, there were no deteriorations for any variables in this group except a small increase in mean body mass (the majority of these individuals remained well within the healthy body weight range).

The real benefits of the program occurred in the group with at least 1 risk factor (see Table 2). There was an increase in weekly physical activity of 425 METs (95% CI: 195-654) which is equivalent to an additional 100 minutes of moderate or 50 minutes of vigorous exercise per week. There were also improvements in blood pressure, the total cholesterol/HDL ratio, HbA_{1c}, the CVage gap, as well as, sleep, stress, and fatigue scores. Body weight did not change in this group.

Among employees who were not at the recommended target for specific risk factors, the positive changes were more marked (see Table 4). This included clinically important improvements in both physical and mental health measures. For instance, blood pressure dropped from 144/94 to 133/87 mm Hg among those who were hypertensive at baseline and the

Table 4. Changes in Health Measures After 2 Years for Employees With Specific Risk Factors.[a]

Health Measure	Baseline[b]	Year 2	Change 0-2
Blood pressure >140/90 (mm Hg), (n = 38)			
Systolic blood pressure (mm Hg)	144.2 (11.3)	133.1 (12.2)	−11.0 (−16.0 to −6.0)[c]
Diastolic blood pressure (mm Hg)	93.8 (9.0)	87.2 (9.0)	−6.6 (−9.7 to −3.5)[c]
Total/HDL cholesterol >4 (♀) or 5 (♂), (n = 44)	5.43 (1.22)	4.74 (1.82)	−0.69 (−1.14 to −0.24)[c]
HbA_{1c} > 5.7, (n = 16)	6.3 (0.8)	5.9 (1.0)	−0.4 (−0.6 to −0.2)[c]
Body mass index ≥30 kg/m^2 (n = 37)	34.1 (4.8)	33.8 (3.8)	−0.3 (−1.1 to 0.5)
Waist circ. ≥88 cm (♀) or 102 cm (♂), (n = 86)	102.6 (11.9)	99.8 (11.7)	−2.8 (−4.7 to −0.8)[c]
Physically inactive (weekly METs <720), (n = 50)	254 (208)	1310 (1334)	1056 (667 to 1445)[c]
High stress (≥ 18 on PSS), (n = 57)	21.1 (2.9)	16.4 (6.0)	−4.7 (−6.3 to −3.0)[c]
Poor sleep (≥ 8 on ISI), (n = 93)	11.6 (3.4)	8.7 (4.8)	−2.9 (−3.7 to −2.0)[c]
Depressive symptoms (≥16 on CES-D), (n = 25)	22.0 (4.3)	14.5 (9.0)	−7.6 (−11.2 to −3.9)[c]
High fatigue (≥ 16 on MFI), (n = 28)	17.0 (0.9)	13.5 (3.8)	−3.5 (−4.9 to −2.1)[c]
CVage gap (years), (CVage gap >1), (n = 32)	2.0 (2.2)	0.5 (2.6)	−1.5 (−2.3 to −0.7)[c]

Abbreviations: CES-D, Center for Epidemiologic Studies—Depression; CVage gap, CVage – age; HDL, high-density lipoprotein; HbA_{1c}, glycated haemoglobin; ISI, Insomnia Severity Index; MFI, General Fatigue subscale of the Multidimensional Fatigue Inventory; PSS, Perceived Stress Scale.
[a]Mean (SD).
[b]Baseline is at 1 year for HbA_{1c}.
[c]Indicates that the lower and upper 95% confidence intervals did not include 0.

total cholesterol/HDL ratio improved by 0.69 (95% CI: 0.24-1.14) representing an improvement of 13% in employees with elevated lipids. The 50 employees who were sedentary (weekly METs <720) at baseline increased their physical activity 5-fold, from about 1 hour of moderate activity per week to over 5 hours of moderate activity per week. The biggest improvements were in the mental health scores with stress and sleep improving 22% and 25%, respectively. Among the 25 employees with depressive symptoms at baseline, their depression score improved 35%.

Discussion

Summary of Key Findings

The 2-year data provide encouraging results on the potential impact of using gamification principles to support long-term participation and behavior change in a workplace wellness program. At baseline, 74% of employees participated in the biometric screening and over 55% had their health metrics measured at the third biometric screening. Similarly, participation in the team challenges, although not as high as the first challenge, remained steady between 33% and 41% of employees. It is also important to note that three-quarters of participants in all team challenges tracked at least half of the available days, and the amount of physical activity (step equivalents) increased over time (see Table 1).

The program engaged not only employees who were healthy but also those at risk due to one or more lifestyle factors or medical conditions. For those with abnormal values, the measured improvements in cardio-metabolic risk factors and mental health metrics were substantial and clinically important, underscoring that measurable improvements in health occurred for many employees. The program was equally effective among head office as well as field-based employees across Canada.

Comparison With Previous Studies

Few programs have published results with follow-up of 2 years or longer, especially in the absence of major financial incentives. Goetzel et al evaluated the impact of an organizational/supportive environmental initiative and showed similar follow-up rates for biometric screening participation of approximately 50% after 2 years. They also demonstrated improvements in lifestyle and clinical outcomes for the intervention group with no change or a decline in the control group.[4]

Long-term results in programs with incentives include Fu et al, who demonstrated high annual participation in biometric screenings (65–80%) and sustained clinical benefits after 3 to 5 years using a program that was incentivized with health insurance premium discounts. The results they observed among participants with high-risk baseline measurements included a decrease of 0.9% for BMI, a decrease of 12% and 10% for systolic and diastolic blood pressure, respectively, and a 12% reduction in cholesterol, which is similar to the results we observed without the use of financial incentives.[3] Byrne et al showed high annual participation rates between 68% and 80% for completing a 39-question health-risk assessment during an incentive-based wellness program that continued for up to 7 years. Physical inactivity, smoking, and high stress all decreased across the 7 years (10.7, 3.3, and 3.5%, respectively).[31]

There are few studies that have used gamification techniques in workplace wellness program. Smith-McLallen et al found higher participation rates at 9 months when a pedometer-based walking program with gamification techniques such as group challenges and badges was compared with only using pedometers (40% vs 24%).[5] We were unable to identify any studies using gamification techniques with follow-up of 1 year or more.

Limitations

As in any real world study, our data are imperfect. We have not addressed the employees who chose not to participate in the first baseline screening nor those who missed the third screening. In the absence of a control group, we cannot conclude that the program alone was responsible for the observed benefits. However, we previously reported a dose response over 1 year where those who accessed the site the most also demonstrated the greatest improvements in health measures. This supports the likelihood that the program was indeed at least partially responsible.[18]

We cannot quantify the magnitude of the effect of specific gamification techniques since the program included a large number of components. However, these results should encourage a more systematic evaluation of gamification techniques. The fact that there were no differences in the participation rates or the health outcomes between the head office and the field employees also suggests that the web-based components of the wellness program (namely the on-line challenges using the gamification techniques) were likely responsible for the impact of the program since it was primarily head office employees who had access to the non-web-based aspects of the program. Finally, the influence of the communication strategy and the changes to the worksite culture is unknown but likely had some impact on the participation rates.

So What?

What Is Already Known on This Topic?

In many studies, the behavior changes and health benefits of a wellness program typically diminish over time once the intervention is completed.[8-9]

What Does This Article Add?

The wellness program evaluated in this study included a comprehensive e-health platform with continuously available wellness assessments, educational modules, and individual challenges (against an Avatar). Rather than focusing on a static intervention or a specific wellness challenge, participants were provided with various changing programs including unique team-based challenges using gamification techniques. Despite the absence of financial incentives, this allowed the program to sustain engagement levels and provide measurable health benefits.

What Are the Implications for Health Promotion Practice or Research?

The results of this study demonstrate that a constantly evolving e-health promotion program that uses gamification techniques may be an effective approach to support long-term participation and health benefits among employees.

Conclusions

Workplace wellness programs focusing primarily on evolving team challenges may support long-term employee participation, engagement with healthy lifestyle habits, and sustained clinical improvements. Gamification techniques including team competition, reinforcement, tracking progress, leaderboards, social connectivity, and an enjoyable narrative during the challenge should be considered potential alternatives to financial incentives. Additional systematic research is required to determine the incremental impact of these techniques on the sustained success of workplace wellness programs.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article. Drs Lowensteyn and Grover are part-time employees of Clinemetrica Inc, which owns the rights to the web-based platform used in this study. Dr Grover is also a shareholder in Clinemetrica Inc. Ms Berberian is an employee of Merck Canada. Ms Berger, Dr Da Costa, and Dr Joseph have no conflicts of interest.

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