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Effects of an employee exercise programme on mental health

N. D. Emerson[1,2], D. A. Merrill[1], K. Shedd[3], R. M. Bilder[1] and P. Siddarth[1]

[1]Department of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles (UCLA), Los Angeles, CA 90095, USA, [2]United States and Department of Psychology, Loma Linda University, Loma Linda, CA, USA, [3]Department of Recreation, UCLA, Los Angeles, CA, USA.

Correspondence to: N. D. Emerson, Department of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles (UCLA), 760 Westwood Plaza, Suite 38-259, Los Angeles, CA 90095, USA. Tel: 310-206-7392; e-mail: ndemerson@mednet.ucla.edu

Background	Prior research indicates that workplace wellness programmes (WWPs) are generally associated with lowered healthcare costs and improved employee health. Despite the importance of mental well-being in workplace productivity and attendance, few WWP studies have focused on improvements in psychological well-being.
Aims	To examine the effects of the Bruin Health Improvement Program (BHIP), a 3-month exercise and nutrition WWP, on seven domains of health: physical and mental health, stress, energy level, social satisfaction, self-efficacy and quality of life.
Methods	Using data from BHIP completers, we conducted multiple one-way multivariate analyses of variance and follow-up univariate *t*-tests to examine changes in physical and mental health, stress, energy level, social satisfaction, self-efficacy and quality of life. Effect sizes were also calculated *post hoc* to determine the magnitude of each effect.
Results	Results for the 281 participants reveal significant improvements across all seven domains ($P < 0.001$). Effect sizes ranged from 0.19 to 0.67.
Conclusions	This study is unique in revealing the effects of a WWP on multiple domains of psychological well-being. Given rising healthcare costs associated with mental health, targeting mental health through WWP may be an effective strategy for reducing indirect healthcare costs associated with absenteeism and presenteeism.
Key words	Exercise; mental health; workplace wellness programme.

Introduction

In the USA, most employees receive healthcare through private health insurance companies subsidized by employers. Since most Americans spend a considerable amount of time at work, the workplace is an ideal setting to target health and behaviour change and minimize healthcare costs to employers [1]. Workplace wellness programmes (WWPs), which provide employees with complimentary exercise or nutrition programmes, have been explored by many institutions as cost-saving measures to minimize economic losses associated with illness or injury [1].

Literature reviews and meta-analytic studies have generally provided evidence for the cost saving of WWPs, both in terms of lowered healthcare costs and absenteeism [1,2]. However, other meta-analyses suggest that the benefits of WWP may not elicit the sustainable behaviour change necessary to decrease healthcare costs to employers [3]. Moreover, a majority of WWPs predominantly target physical health or physiological marker changes [1,2,4]. Although mental health, self-efficacy, stress and energy levels impact productivity, absenteeism and disability costs [5], most workplace interventions have focused on the physical benefits of programmes, rather than on the socio-emotional impact of improved exercise and nutrition. Despite this emphasis on the physical, mental health costs are rising at a disproportionate rate, projected to cost US$6 trillion globally by 2030 [6]. Among workplace costs of mental health, both work strain and psychological illness have been shown to contribute to absenteeism, unemployment and disability [7–9]. In fact, mental illnesses are the leading cost of disability-adjusted life years [6] accounting for more than half of all healthcare costs [10]. Given this immense cost, it becomes crucial to understand how to optimize

psychological wellness in the workplace in order to reduce both direct and indirect costs.

Despite the importance of psychological well-being, very few studies have focused on the effects of WWP on mental health; those that have done so have yielded inconsistent results [4,11–14]. Therefore, the current study was designed to examine the effects of the Bruin Health Improvement Program (BHIP), a WWP for employees of the University of California, Los Angeles (UCLA), on multiple domains of physical and mental well-being. The study focused on the following seven domains: physical health, mental health, stress, energy level, social satisfaction, self-efficacy and quality of life. We hypothesized that participants who completed BHIP would demonstrate decreased stress and improved mental health, in addition to the expected physical health gains.

Methods

The study was approved by the UCLA Institutional Review Board. Data were obtained from UCLA employees who participated in BHIP for one academic quarter (12 weeks) between January 2013 and August 2014. BHIP was advertised to all existing UCLA employees through BruinPost, an inter-university email advertising service, giving all employees an equal opportunity to join. About 33 000 employees receive the email each quarter. BHIP participants were randomly selected from the pool of applicants using www.random.org. Those not selected were invited to participate in a subsequent quarter. BHIP participants were asked to complete an online survey on Survey Monkey both before starting the programme (Time 1) and post-completion (Time 2). Since the survey was not a mandatory part of BHIP, some participants did not complete either pre- or post-completion surveys.

BHIP includes both physical exercise and nutritional coaching components. Participants attend three cardiovascular conditioning and strength training workouts per week for 12 weeks, run by fitness trainers in groups of 20–40. The workouts are designed to improve the general fitness of UCLA employees and to address common postural adaptations and movement limitations associated with excessive sitting. Each workout starts with a 5- to 10-min warm-up consisting of light intensity aerobics, body weight movements and dynamic and static stretches. New exercise techniques are then taught for the remainder of the class. These body weight and conditioning exercises are of moderate to vigorous intensity, derived from traditional strength and conditioning protocols [15] and influenced by the popularized Crossfit training module [16]. Participants are also invited to participate in weekly optional nutrition coaching, including three in-person lectures with a registered dietician and nine webinars with a question and answer portion at the end of each lecture. Participants provided demographic data including age, education, gender, ethnicity, height and weight. They then completed the Perceived Stress Scale-4 Item (PSS-4), a short-form scale of the original Perceived Stress Scale, designed to assess the degree to which people appraise their lives as unpredictable, uncontrollable and overwhelming [17]. The measure has demonstrated strong reliability in normative samples ($\alpha = 0.84–0.85$) [17]. The four-item scale includes items such as 'How often have you felt that you were unable to control the important things in your life?' Items are answered on a five-point Likert-type scale ranging from 0 for *never* to 4 for *very often*. In the current survey, questions were rephrased to assess stress over the last 3 months. Additionally, the first item was reworded in a positive way so that it read: 'How often have you felt that you were *able* to control the important things in your life?'

Participants also completed the Thirty-Six Health Survey Questionnaire (SF-36), a self-report measure of physical and emotional health, vitality, social functioning, general health perceptions, bodily pain and role limitations due to physical or emotional problems [18]. The current study used the vitality and mental health subscales, both of which have adequate reliability ($\alpha = 0.87$ and $\alpha = 0.80$, respectively) [18]. The vitality subscale includes four questions on energy and fatigue, such as: 'Did you feel full of pep?' The mental health subscale assesses emotional well-being through five questions, including: 'Have you felt downhearted and blue?' Items are answered on a six-point Likert scale, ranging from 1 for *all of the time* to 6 for *none of the time*. BHIP participants also completed the Patient-Reported Outcomes Measurement (PROMIS) Global Health—Short Form (GHSF) and the PROMIS-29 Satisfaction with Participation in Social Roles Subscale. The GHSF is a 10-item measure designed to assess global physical health (GPH) and global mental health (GMH) [19]. It was derived from the PROMIS item bank, a more extensive measure designed to access patient-reported outcomes relevant to day-to-day functioning [20]. The GPH scale uses four questions to assess physical health, physical function, pain and fatigue; the GMH scale contains five questions on quality of life, mental health, satisfaction with social activities and emotional problems [19]. The sixth GMH question, on satisfaction with social roles, was excluded from the measure by Cella and colleagues [20] because it correlated more highly with the GPH scale. Both scales demonstrate good internal reliability (GPH $\alpha = 0.81$; and GMH $\alpha = 0.86$). Eight of the nine questions are answered on a five-point Likert scale. Examples of questions include, 'How would you rate your mental health?' and 'How would you rate your pain?' The pain question is answered on a 10-point Likert scale from 0 for *no pain* to 10 for *worst imaginable pain*. GPH and GMH scale scores were derived by summing

respective items for a total scale score, and then converting totals into *T*-scores, with higher scores indicating better functioning [19].

Additionally, 8 of the 10 PROMIS domain scores were used to derive a global quality of life index score, the EuroQoL, using a calculation outlined by Revicki *et al.* [21]. The PROMIS-29 Satisfaction with Participation in Social Roles Subscale is a four-item scale that includes items such as: 'How would you rate your satisfaction with your social activities and relationships?' answered on a five-point Likert scale. Scale scores were translated into *T*-scores, with higher scores indicating better functioning [22,23]. Finally, four additional, miscellaneous questions were asked of participants. These included questions relating to overall energy level, to the ability to succeed at new tasks, to concentrate and to cope with daily stress. The ability to succeed at new tasks, hereafter referred to as self-efficacy, was phrased as follows: 'On a scale of 1 to 7, how would you rate your ability to succeed at new tasks?' Concentration, stress coping and energy were assessed using the following question format: 'How would you rate your [energy level; ability to concentrate/deal with stress]?' The three questions were answered on a five-point Likert-type scale ranging from 1 for *very high* to 5 for *very low*.

Prior to statistical analyses, data were inspected for outliers and homogeneity of variance to ensure their appropriateness for parametric statistical tests. Survey questions were then grouped by domain: physical health, mental health, stress, energy level, social satisfaction, self-efficacy and quality of life. To examine improvements in mental health, stress, energy level and social satisfaction, four separate one-way multivariate analyses of variance (MANOVAs) were estimated, using the change scores of the individual items (constructed by subtracting scores at Time 1 from scores at Time 2) as dependent variables. If the MANOVA was significant, *post hoc* univariate paired *t*-tests were conducted to determine which individual items within the domain contributed to the significance. Changes in the remaining three constructs, physical health, self-efficacy and quality of life, were examined using univariate *t*-tests since each domain involved only one item. No item was used more than once in the analyses. Given our large sample size, results could have been statistically significant even when actual effect sizes are small. Hence, we also calculated effect sizes (partial η^2 for the MANOVAs and Cohen's *d* for univariate analyses) to determine the magnitude of each effect and emphasize effect sizes over *P*-values in our results.

Results

Data were obtained from 858 UCLA employees (72% female, 38% Caucasian) between the ages of 21 and 69 (M = 37.15, standard deviation [SD] = 10.99) with an average of 17 years of education (SD = 2.51). In total, 1100 participants started BHIP. Of these, 858 participants filled out the survey at Time 1 and 281 of the 599 completers filled out both Time 1 and Time 2 surveys. Of the 858, 70% of participants (n = 599) completed BHIP. Figure 1 presents the CONSORT flow diagram for the study. Table 1 contains demographic information about the sample by completion status.

We first compared BHIP completers (n = 599) and dropouts (n = 259) using chi-squared tests for categorical variables and unpaired *t*-tests for continuous variables. Participants who dropped out of BHIP were not significantly different from programme completers in age, education, ethnicity, baseline quality of life, physical and mental health or physical activity level. Completion status did however significantly relate to body mass index (BMI) and gender. Dropouts (M = 27.04, SD = 6.36) had significantly higher baseline BMIs than completers (M = 25.74, SD = 4.95), $t(853) = 2.94$, $P < 0.01$. Moreover, while only 23% of males dropped out of BHIP, 33% of females did not complete the programme, χ^2 (1, n = 858) = 7.46, $P < 0.01$. More specifically, women in the middle age group (ages 37–52) were significantly more likely to drop out than men [35 versus 22%, χ^2 (1, n = 271) = 4.84 $P < 0.05$]. Completion status did not differ by gender in younger (ages 21–36) or older participants (ages 53–69), $P < 0.05$. Participants did not consistently report reasons for dropping out. Of those who notified trainers (n = 96), 45% provided no reason, 46% cited scheduling conflicts and 9% reported discontinuing due to physical restrictions (exacerbation of prior injuries, difficulty completing exercises or comorbid medical issues). We also compared BHIP participants who filled out only the pre-programme survey (n = 318) to those who filled out both pre- and post-programme surveys (n = 281). These groups did not differ significantly in terms of age, education, ethnicity, BMI, quality of life, physical and mental health or physical activity level. However, women were more likely to complete both surveys than men [50 versus 40%, χ^2 (1, n = 599) = 4.70, $P < 0.05$].

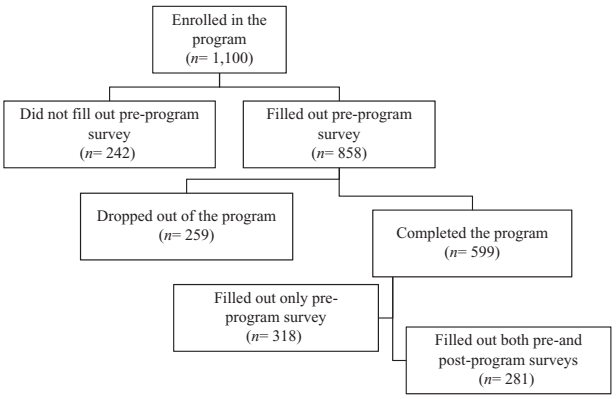

Figure 1. CONSORT flow diagram of BHIP participants.

Table 1. Sample baseline demographics by completion status

	Dropouts (n = 259)	Completers (n = 599)
Age, *M* (SD)	37.15 (10.99)	36.35 (10.66)
Education, *M* (SD)	17.16 (2.51)	17.46 (2.54)
BMI, *M* (SD)[a]	27.04 (6.36)	25.74 (4.95)
PROMIS EuroQoL, *M* (SD)	0.74 (0.07)	0.75 (0.06)
PROMIS Physical Health *T*-score, *M* (SD)	49.02 (6.50)	49.89 (5.95)
PROMIS Mental Health *T*-score, *M* (SD)	49.01 (7.21)	49.41 (7.23)
Ethnicity (%)		
Hispanic	21	20
American Indian	0	0
Asian	24	20
African American	14	8
Native Hawaiian	1	2
Caucasian	32	40
Multiracial	4	6
Prefer not to say	3	3
Missing	1	1
Gender (%)[a]		
Male	22	31
Female	78	69
Physical activity level (%)		
I am not physically active	7	4
I am physically active once in a while, but not regularly	42	44
I am currently physically active, but have only begun doing so within the last 6 months	20	20
I participate in regular physical activity and have done so for >6 months	29	31
Missing	1	1

[a]Refers to significant difference between groups, BMI: $t(853) = 2.94$, $P < 0.01$; gender: χ^2 (1, n = 858) = 7.29, $P < 0.01$.

BHIP completers had significantly better mental health after the programme [$F(7, 252) = 14.60$, Wilks' lambda = 0.71, $P < 0.001$, partial $\eta^2 = 0.29$]. Results of univariate analyses revealed significant improvements in all individual mental health items: the PROMIS Mental Health *T*-score, concentration ability and all five variables of the SF-36 mental health subscale. Likewise, participants who completed BHIP reported significantly less stress [$F(5, 261) = 11.29$, Wilks' lambda = 0.22, $P < 0.001$, partial $\eta^2 = 0.18$], improved satisfaction with social roles [$F(4, 263) = 23.36$, Wilks' lambda = 0.74, $P < 0.001$, partial $\eta^2 = 0.26$], and increased energy level [$F(5, 257) = 38.10$, Wilks' lambda = 0.57, $P < 0.001$, partial $\eta^2 = 0.43$]. For all these domains, changes in each individual item were significant at the univariate level as well. Finally, paired *t*-tests conducted on pre- and post-physical health, self-efficacy and quality of life scores also revealed significant improvements after the intervention. Table 2 shows univariate test results and effect sizes.

Discussion

Consistent with our hypotheses, participants who completed BHIP demonstrated improvements across all seven domains of health. Moreover, not only were both intra-subject multivariate and univariate analyses significant, univariate effect sizes indicated a medium effect in 20 of the 24 analyses. The five items that demonstrated a small effect size (Cohen's $d < 0.3$) included the two single items 'ability to concentrate' and 'ability to succeed at new tasks', the SF-36 Mental Health item 'have you felt so down in the dumps that nothing could cheer you up?' and the two PSS items 'ability to control the important things in your life' and 'feeling that difficulties were piling up so high that you could not overcome them'. Single, miscellaneous items may have demonstrated smaller increments in change because they did not originate from previously validated scales. The small effect size of the SF-36 item may reflect a lack of depressive symptoms in the sample, given that participants already demonstrated high scores on this item at baseline. In terms of the PSS, the item 'ability to control the important things in your life' was reworded positively for this study. Such rewording could have contributed to socially desirable responses, unseen in the original, negatively worded item by Cohen *et al.* [17]. The other PSS item, 'feeling that difficulties were piling up so high that you could not overcome them' was the lesser-endorsed item of the scale and thus basal effects may explain the smaller effect size. The addition of miscellaneous questions and

Table 2. *Post hoc* univariate paired *t*-tests by domain: physical health, mental health, stress, energy, social satisfaction, self-efficacy and quality of life (n = 281)

Domain	Variable[a]	Time 1	Time 2	Change score (Δ = T2 − T1)	*t*	*df*	95% CIs Δ		Cohen's *d*[b]
							Lower	Upper	
		M (SD)	*M* (SD)	*M* (SD)					
Physical health	PROMIS: Physical Health *T*-score[c]	49.90 (6.09)	53.00 (5.56)	3.10 (5.34)	9.57	270	2.47	3.74	0.58
Mental health	Single Item: Ability to Concentrate[d]	2.37 (0.84)	2.16 (0.73)	−0.20 (0.76)	−4.44	275	−0.29	−0.11	0.28
	PROMIS Mental Health *T*-score[c]	49.02 (7.28)	51.84 (6.57)	2.82 (5.64)	8.21	269	2.14	3.49	0.50
	SF-36 Mental Health: Have you been a very nervous person?[c]	4.54 (1.22)	4.86 (1.14)	0.32 (1.02)	5.23	277	0.20	0.44	0.31
	SF-36 Mental Health: Have you felt so down in the dumps that nothing could cheer you up?[c]	5.35 (0.87)	5.56 (0.74)	0.21 (0.75)	4.67	275	0.12	0.30	0.29
	SF-36 Mental Health: Have you felt calm and peaceful?[c]	3.80 (1.12)	4.23 (1.01)	0.43 (0.93)	7.77	275	0.32	0.54	0.47
	SF-36 Mental Health: Have you felt downhearted and blue?[c]	4.94 (1.01)	5.24 (0.82)	0.31 (0.88)	5.75	274	0.20	0.41	0.35
	SF-36 Mental Health: Have you been a happy person?[c]	4.43 (0.97)	4.70 (0.90)	0.27 (0.83)	5.38	276	0.17	0.36	0.33
Stress	Single Item: Ability to cope with daily stress[d]	2.38 (0.76)	2.15 (0.70)	−0.23 (0.72)	−5.45	276	−0.32	−0.15	0.32
	PSS: Ability to control the important things in your life[c]	3.88 (0.83)	4.04 (0.81)	0.16 (0.84)	3.23	276	0.06	0.26	0.19
	PSS: Ability to handle your personal problems[c]	4.02 (0.74)	4.25 (0.72)	0.24 (0.72)	5.45	274	0.15	0.32	0.32
	PSS: Feeling that things were going your way[c]	3.65 (0.79)	3.88 (0.77)	0.23 (0.77)	4.83	274	0.13	0.32	0.30
	PSS: Feeling that difficulties were piling up so high that you could not overcome them[d]	2.33 (0.88)	2.14 (0.83)	−0.19 (0.84)	−3.66	274	−0.29	−0.09	0.23
Energy	SF-36 Vitality: Did you feel full of pep?[c]	3.36 (1.12)	4.00 (1.05)	0.64 (0.07)	9.66	267	0.51	0.78	0.59
	SF-36 Vitality: Did you have a lot of energy?[c]	3.47 (1.13)	4.14 (1.01)	0.67 (1.01)	10.95	275	0.55	0.79	0.67
	SF-36 Vitality: Did you feel worn out?[c]	3.95 (1.16)	4.48 (0.98)	0.53 (1.05)	8.38	273	0.40	0.65	0.51
	SF-36 Vitality: Did you feel tired?[c]	3.53 (1.14)	4.07 (1.03)	0.54 (1.12)	8.14	277	0.41	0.67	0.49
	Single Item: Energy Level[d]	2.86 (0.68)	2.42 (0.63)	−0.44 (0.66)	−10.92	277	−0.51	−0.36	0.66
Social satisfaction	PROMIS: I am satisfied with how much work I can do[c]	3.52 (0.88)	3.91 (0.82)	0.39 (0.90)	7.15	274	0.28	0.50	0.43
	PROMIS: I am satisfied with my ability to work[c]	3.71 (0.94)	4.06 (0.82)	0.35 (0.83)	7.04	276	0.25	0.45	0.43
	PROMIS: I am satisfied with my ability to do regular personal and household responsibilities[c]	3.58 (1.06)	3.98 (0.89)	0.40 (0.93)	7.18	273	0.29	0.51	0.44
	PROMIS: I am satisfied with my ability to perform my daily routines[c]	3.75 (0.93)	4.15 (0.79)	0.40 (0.88)	7.50	276	0.29	0.50	0.46
Self-efficacy	Single Item: Ability to succeed at new tasks[c]	5.78 (1.09)	6.02 (0.86)	0.24 (1.07)	3.72	276	0.11	0.36	0.23
Quality of life	PROMIS: EuroQoL[c]	0.75 (0.06)	0.77 (0.05)	0.03 (0.06)	7.81	262	0.02	0.03	0.39

CI, confidence interval.
[a]All measures improved and all *P*-values < 0.001.
[b]Cohen's *d* presented as absolute value.
[c]Positive change scores indicate improvement.
[d]Negative change scores indicate improvement.

the rewording of previously validated scale item limit the reliability of the measures.

Despite significant findings, the study must be considered in the context of certain limitations. The primary limitation is that this study was not a formal, randomized intervention trial and lacked a control group. It is possible that the findings result from a measurement or Hawthorne effect and thus our results should be generalized with caution. Moreover, since degree of participation in the nutrition component was not available in the data set, we cannot exclude the possibility that changes in nutrition may have contributed to improvements in some participants more than in others. Future research may focus on asking people wait-listed for participation to complete surveys at the beginning and end of each quarter to serve as control participants. A nutrition-based wait-list group may also prove worthwhile as a comparison sample. Furthermore, ensuring that BHIP participants are comparable to the rest of the UCLA workforce would provide additional evidence for BHIP's effects.

While we demonstrated that participants who dropped out did not differ significantly from completers at baseline, the 30% dropout rate may be considered a limitation of the study. However, this discontinuation rate is rather moderate in comparison to the 50–75% termination rate established by prior reviews [24]. In fact, rather than electing to stop, most dropouts were excluded from BHIP for exceeding three absences. This strict attendance policy, while instituted with good cause to ensure regular participation, prevented many participants from completing BHIP due to work or personal schedule conflicts, a barrier common to other WWP studies [25]. Additionally, while 599 participants finished the intervention, only 47% of these participants (n = 281) completed the post-intervention survey. Providing a small incentive to have both dropouts and completers fill out the post-survey may improve response rates.

The study also has significant strengths. Initially, BHIP was open to any and all UCLA staff and faculty, providing evidence of the generalizability of results as compared with other incentivized or targeted WWP programmes. Improvements in overall well-being, following the completion of a structured exercise and nutrition-based WWP, emphasize the need for employers to prioritize mental health in the delivery of workplace wellness. WWP can promote mental health either indirectly, through exercise and nutrition programmes like BHIP, or directly through evidence-based practices such as mindfulness and stress-management. Given that mental health both predicts absenteeism and also mediates the relationship between work strain and physical illness [7], targeting mental health may lower healthcare costs and increase workplace productivity at a much more significant rate than focusing on physical health alone.

While this study replicates others in underscoring the success of WWP in improving physical health, it is novel in its exposition of the beneficial effects of WWP on mental health, energy, social satisfaction, self-efficacy, quality of life and stress. In contrast to the mixed evidence of mental health improvements reviewed by Osilla *et al.* [4], our results suggest significant improvements across multiple areas of psychological and emotional well-being. Given the importance of mental health in work attendance, productivity and healthcare costs, our results indicate that mental health should be given as much emphasis, if not more, as physical health in employers' attempts to curb absenteeism, presenteeism and illness. Moreover, in comparison to the effect sizes found in WWP meta-analyses [26], our effect sizes reflect a much larger impact of WWP on psychological well-being. While Conn and colleagues [26] found mean effect sizes of 0.23 for quality of life and 0.13 for mood, our analyses reveal a much stronger effect on mental health domains. Given that mental health conditions contribute to more than half of all disability days [27], the significant improvement of mental well-being following successful completion of the WWP is noteworthy.

Key points

- Despite rising mental healthcare costs, few studies have examined the impact of workplace wellness programmes on employee mental health.
- While this study replicates others in demonstrating how workplace wellness programmes improve physical health, it is unique in demonstrating the beneficial effects of workplace wellness programmes on mental health, energy, social satisfaction, self-efficacy, quality of life and stress.
- Targeting workplace mental health through exercise and wellness programmes may be an effective strategy for reducing indirect healthcare costs associated with absenteeism and presenteeism.

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Conflicts of interest

None declared.

References

1. Baicker K, Cutler D, Song Z. Workplace wellness programs can generate savings. *Health Aff (Millwood)* 2010;**29:**304–311.
2. Cancelliere C, Cassidy JD, Ammendolia C *et al.* Are workplace health promotion programs effective at improving presenteeism in workers? A systematic review and best evidence synthesis of the literature. *BMC Public Health* 2009;**111:**395.
3. Horwitz JR, Kelly BD, DiNardo JE. Wellness incentives in the workplace: cost savings through cost shifting to unhealthy workers. *Health Aff (Millwood)* 2013;**32:**468–476.
4. Osilla KC, Van Busum K, Schnyer C, Larkin JW, Eibner C, Mattke S. Systematic review of the impact of worksite wellness programs. *Am J Manag Care* 2012;**18:**e68–e81.
5. Chapman LS. Presenteeism and its role in worksite health promotion. *Am J Health Promot* 2005;**194:**1–8.
6. Alwan A. *Global Status Report on Noncommunicable Diseases 2010*. World Health Organization, 2011. http://www.who.int/nmh/publications/ncd_report_full_en.pdf (June 2015, date last accessed).
7. Darr W, Johns G. Work strain, health, and absenteeism: a meta-analysis. *J Occup Health Psychol* 2008;**13:**293–318.
8. Lerner D, Henke RM. What does research tell us about depression, job performance, and work productivity? *J Occup Environ Med* 2008;**50:**401–410.
9. Bush PW, Drake RE, Xie H, McHugo GJ, Haslett WR. The long-term impact of employment on mental health service use and costs for persons with severe mental illness. *Psychiatr Serv* 2009;**60:**1024–1031.
10. Bloom DE, Cafiero E, Jané-Llopis E *et al. The Global Economic Burden of Noncommunicable Diseases*. Boston, MA: Program on the Global Demography of Aging, 2012.
11. Butterworth S, Linden A, McClay W, Leo MC. Effect of motivational interviewing-based health coaching on employees' physical and mental health status. *J Occup Health Psychol* 2006;**11:**358–365.
12. Cook RF, Billings DW, Hersch RK, Back AS, Hendrickson A. A field test of a web-based workplace health promotion program to improve dietary practices, reduce stress, and increase physical activity: randomized controlled trial. *J Med Internet Res* 2007;**9:**e17.
13. Gold DB, Anderson DR, Serxner SA. Impact of a telephone-based intervention on the reduction of health risks. *Am J Health Promot* 2000;**15:**97–106.
14. Ozminkowski RJ, Goetzel RZ, Smith MW, Cantor RI, Shaughnessy A, Harrison M. The impact of the Citibank, NA, health management program on changes in employee health risks over time. *J Occup Environ Med* 2000;**42:**502–511.
15. Baechle TR, Earle RW. *Essentials of Strength Training and Conditioning*. Champaign, IL: Human Kinetics, 2008; 379–504.
16. Glassman G. Understanding CrossFit. *CrossFit J Articles* 2007;**56:**1–2.
17. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav* 1983;**24:**385–396.
18. Ware JE, Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care* 1992;**30:**473–483.
19. Hays RD, Bjorner JB, Revicki DA, Spritzer KL, Cella D. Development of physical and mental health summary scores from the patient-reported outcomes measurement information system (PROMIS) global items. *Qual Life Res* 2009;**18:**873–880.
20. Cella D, Riley W, Stone A *et al.* The patient-reported outcomes measurement information system (PROMIS) developed and tested its first wave of adult self-reported health outcome item banks: 2005–2008. *J Clin Epidemiol* 2010;**6311:**1179–1194.
21. Revicki DA, Kawata AK, Harnam N, Chen WH, Hays RD, Cella D. Predicting EuroQol (EQ-5D) scores from the patient-reported outcomes measurement information system (PROMIS) global items and domain item banks in a United States sample. *Qual Life Res* 2009;**18:**783–791.
22. Beaumont JL, Cella D, Phan AT, Choi S, Liu Z, Yao JC. Comparison of health-related quality of life in patients with neuroendocrine tumors with quality of life in the general US population. *Pancreas* 2012;**41:**461–466.
23. Patient-Reported Outcomes Measurement. *PROMIS Scoring Manuals*. http://www.assessmentcenter.net/Manuals.aspx (June 2015, date last accessed).
24. Lovato CY, Green LW. Maintaining employee participation in workplace health promotion programs. *Health Educ Q* 1990;**17:**73–88.
25. Person AL, Colby SE, Bulova JA, Eubanks JW. Barriers to participation in a worksite wellness program. *Nutr Res Pract* 2010;**4:**149–154.
26. Conn VS, Hafdahl AR, Cooper PS, Brown LM, Lusk SL. Meta-analysis of workplace physical activity interventions. *Am J Prev Med* 2009;**37:**330–339.
27. Merikangas KR, Ames M, Cui L *et al.* The impact of comorbidity of mental and physical conditions on role disability in the US adult household population. *Arch Gen Psychiatry* 2007;**64:**1180–1188.