Workplace Health Promotion
A Meta-Analysis of Effectiveness

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Context: An unhealthy lifestyle may contribute to ill health, absence due to sickness, productivity loss at work, and reduced ability to work. Workplace health promotion programs (WHPPs) aim to improve lifestyle and consequently improve health, work ability, and work productivity. However, systematic reviews on intervention studies have reported small effects, and the overall evaluation of effectiveness of WHPPs is hampered by a large heterogeneity in interventions and study populations. This systematic review aims to investigate the influence of population, study and intervention characteristics, and study quality on the effectiveness of workplace health promotion programs.

Evidence acquisition: A systematic literature search was conducted identifying RCTs, published before June 2012, evaluating the effect of a WHPP aimed at smoking cessation, physical activity, healthy nutrition, and/or obesity on self-perceived health, work absence due to sickness, work productivity, or work ability. Studies were included in the meta-analyses if quantitative information was present to calculate an effect size (ES). A meta-analysis, stratified meta-analyses, and meta-regression analyses were performed in Spring 2012 using Comprehensive Meta-analysis software 2.0 and PAWS 17.0.2.

Evidence synthesis: In 18 studies describing 21 interventions, the overall effect of a WHPP was small (ES=0.24, 95% CI=0.14, 0.34). The effectiveness of a WHPP was larger in younger populations, in interventions with weekly contacts, and in studies in which the control group received no health promotion. A 2.6-fold lower effectiveness was observed for studies performing an intention-to-treat analysis and a 1.7-fold lower effectiveness for studies controlling for confounders. Studies of poor methodologic quality reported a 2.9-fold higher effect size of the WHPP.

Conclusions: The effectiveness of a WHPP is partly determined by intervention characteristics and statistical analysis. High-quality RCTs reported lower effect sizes. It is important to determine the effectiveness of WHPPs in RCTs of high quality.
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Context

An unhealthy lifestyle is one of the major risk factors for chronic diseases in developed countries.[1] Additionally, for employees, unhealthy lifestyle behaviors and obesity might lead to negative effects related to work.[2] Research has shown that unhealthy employees and those with an unhealthy lifestyle are less productive at work, have decreased work ability, and take more sick days.[3–7]

The workplace is considered to be a fruitful setting for public health promotion because of the presence of natural social networks, the possibility of reaching a large population, and the amount of time people spend at work.[8,9] This had led to the development and evaluation of numerous WHPPs in the past decades. Reviews have concluded that WHPPs can improve overall health,[9] increase physical activity,[10,11] lead to small improvements in weight status,[12] and have potential positive effects on dietary behavior.[13,14] In addition to this, other systematic reviews have indicated that WHPPs may decrease work absences due to sickness[11,15,16] and increase work ability.[16] Moreover, two recent reviews showed promising effects of WHPPs on work productivity.[17,18]

Still, the effects of WHPPs found by systematic reviews tend to be small, and there is large heterogeneity in the effects of the included studies.[19] Reviews on potential effectiveness of workplace health promotion programs often address the question of whether programs lead to improvements in lifestyle behaviors[10–14] and, to a lesser extent, more-distal outcomes such as work productivity and sick days. These systematic reviews seldom provide

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evidence of how characteristics of the study population, features of design and methods of the study, and program content influence the observed changes in lifestyle behavior.

Insight into the role of these determinants of effectiveness is important for generalizability of findings across various settings and populations and for facilitating appropriate implementation of WHPPs in specific situations. This systematic review evaluates (1) the effectiveness of WHPPs aimed at a healthy lifestyle on self-perceived health, work absence due to sickness, productivity at work, and work ability and (2) the influence of population characteristics, study characteristics, intervention content, and methodologic quality on the effectiveness of these WHPPs aimed at a healthy lifestyle.

Evidence Acquisition

Identification of the Studies

Relevant articles were identified by means of a computerized search in the bibliographic databases PubMed, Embase, and Web of Science up until November 2011 with an update for up to June 2012. The search terms were related to (1) workplace; (2) health promotion program; (3) lifestyle: physical activity, nutrition, and smoking; (4) outcome: work ability, productivity, sickness absence, self-perceived health; and (5) RCT. In June 2012, an additional search was performed including the search terms *perceived health* and *self-perceived health*. The detailed search strategy per bibliographic database is presented in Appendix A (available online at ajpmonline.org).

In order to be included, the articles had to meet the following criteria: (1) describe a primary preventive WHPP aimed at physical activity, healthy nutrition, weight loss, or smoking cessation; (2) evaluate the effects of the WHPP on self-perceived health, productivity at work, sickness absence, or work ability; (3) evaluate the intervention in an RCT; (4) present a detailed description of the study, population and intervention characteristics, and outcome measures; and (5) be written in English. Additionally, to be included in the meta-analysis, information was required on either pre- and post-levels, levels of change per intervention and control group, or differences between the intervention and control group with corresponding 95% CIs or SDs.

Selection

The literature search resulted in 3668 unique titles. The titles and abstracts were reviewed and full-text articles were obtained from potentially eligible titles. In case of doubt, a discussion was held among the authors. Figure 1 shows a flowchart for the inclusion trajectory of the articles.

Based on their titles, 3424 of 3668 (93%) articles were excluded. Most titles (n=3055, 89%) were excluded because the study was not on a primary preventive WHPP. During subsequent analysis of the abstract, 197 (81%) of 244 abstracts were discarded mainly because information was not provided on self-perceived health, productivity at work, work absence due to sickness, or work ability (n=92, 47%), or because they did not describe a primary preventive WHPP (n=66, 34%). The remaining 47 (19%) articles were retrieved for full review, of which 29 were excluded. Ten (34%) were excluded because the study design was not an RCT, and four (14%) gave no

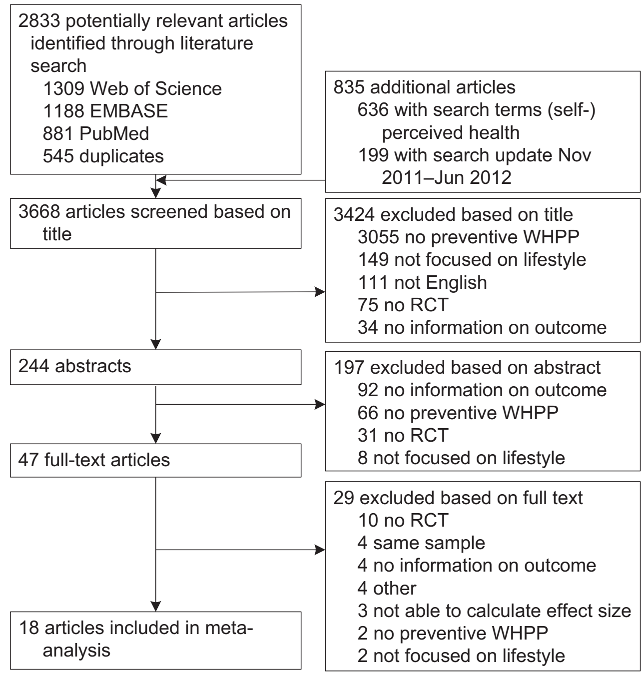

Figure 1. Flowchart for the inclusion trajectory
WHPP, workplace health promotion program

information on the outcome measure of interest. Another four (14%) studies evaluated the same sample and intervention as in other included studies; three (10%) studies lacked information to calculate the effect size; two (7%) studies did not evaluate a primary preventive WHPP; and two (7%) others did not focus on lifestyle. Finally, 18 publications met the inclusion criteria.

Data Extraction

Using a data extraction form, information was collected on the characteristics of the population (e.g., gender, age); study (e.g., randomization procedure, response); intervention content (e.g., frequency, type); and outcome measures (self-perceived health, sickness absence, productivity at work, and/or work ability). For each outcome measure of interest, either pre- and post-levels, levels of change per intervention and control group, or differences between the intervention and control group were retrieved. Together with the corresponding 95% CIs or SDs, effect sizes were estimated. Two authors performed the data extraction. In case of doubt, data were discussed until agreement was reached.

Methodologic Quality Assessment

Assessment was performed using a predefined nine-item checklist based on the guidelines in Cochrane Collaboration's tool for assessing the risk of bias[20] and the checklist used by Verweij et al. (Appendix B, available online at www.ajpmonline.org).[21] Items A and B relate to selection bias; C and D to performance bias; E and F to attrition bias; and G, H, and I to detection bias. Publications were scored as positive when the quality criterion was met (1 point); negative when the quality criterion was not met (0 points); or as unclear when the publication provided insufficient information to judge (0 points). In case of multiple outcomes or multiple interventions, publications could receive 0.5 points on criteria item B (similarity at baseline on outcome variable) and/or item H

Table 1. Population characteristics, study characteristics, and intervention content of the included WHPPs

Study	Industry	Focus program	Program content	Duration and contacts
Atlantis (2004)[26] Australia	Casino	Physical activity	Multifaceted: physical activity group, health education seminars, health counseling sessions	24 weeks; three physiologic data collection + five counseling sessions
Robroek (2012)[27] The Netherlands	Health care, Commercial services, Executive branch government	Nutrition and physical activity	Web-based tailored program aimed at lifestyle: tailored advice, online self-monitoring, contact health professionals	2 years; monthly e-mail during first year, two health checks
Brox (2005)[28] Norway	Nursing home	Physical activity	Group fitness program; classes regarding physical activity, nutrition, and stress management	6 months; 26 contact moments
Tveito (2009)[29] Norway	Nursing home	Physical activity and lifestyle	Physical exercise (1), health information/stress management sessions (2)	9 months; (1) three times per week (2) once per week for 4 months
Eriksen (2002)[34] Norway	Post services	Physical activity	Group aerobic dancing program (1), three-component health program: physical exercise, information lifestyle, examination worksite (2)	12 weeks; (1) 24 contact moments (2) + 12 sessions + two examinations
Gerdle (1995)[35] Sweden	Home care services	Physical activity	Group physical exercise program	1 year; twice per week
Groeneveld (2011)[36] The Netherlands	Construction	Weight	Health goal setting in counseling sessions focused on overweight/obesity	6 months; seven sessions
Jeffrey (1993)[37] U.S.	Mixture	Weight	Incentive-induced, onsite goal-setting classes aimed at weight loss	2 years with four enrol moments; 11 times per 2 weeks
Kerr (1993)[38] The Netherlands	Bank	Physical activity	A tailored onsite fitness program	One to two times per week, duration unknown
Proper (2004)[39] The Netherlands	Municipal services	Physical activity	Counseling sessions focused on physical activity and nutrition	9 months, seven sessions
Zavanela (2012)[42] Brazil	Bus company	Physical activity	Resistance training program	24 weeks; Week 0−8, 3 times per week; Weeks 9−24, four times per week
Terry (2011)[43] U.S.	Airline Health care	Lifestyle	Seminars and campaigns on (1) lifestyle and improving environment and (2) consumerism of health resources; additional risk group coaching sessions (1+2)	18 months, no. of sessions n/a; additional 13 (1), 7 (2) sessions
Puig-Ribera (2008)[30] Spain	University	Physical activity	Two pedometer-based walking exercise programs: outside (1) or at work (2)	9 weeks; 9 e-mails + three measurement moments
Block (2008)[31] U.S.	Health insurance	Nutrition and physical activity	Web-based program: health risk assessment; e-mail with tips, feedback, goal-setting; personal health page	4 months; 25 contact moments by e-mail
Von Thiele Schwarz (2008)[32] Sweden	Dentistry	Physical activity	Employee own choice of medium-to-high physical exercise program	6 months; one introductory sessions + three measurement moments
Reijonsaaire (2012)[41] Finland	Insurance	Physical activity	Web-based program focused on physical activity: monitoring by accelerometer, counseling at distance	12 months; three measurement moments
Morgan (2012)[40] Australia	Aluminium industry	Weight	Crew incentive- based weight loss program with information sessions and website usage	14 weeks; one session and biweekly updates
Nurminen (2002)[33] Finland	Laundry service	Physical activity	Counseling sessions aimed at physical activity	8 months; 26 sessions

(continued on next page)

[a]Participation level: employees starting with the intervention divided by number of employees invited/targeted
[b]Loss to follow-up: employees completing the intervention divided by the number of employees starting with the intervention
n/a, not able to calculate based on data presented; QQ, Quality of Life and Length, or Quantity, of Life Questionnaire; WHPP, workplace health promotion program; WLQ, Work Limitations Questionnaire; SF-36, Short-form 36

Table 1. *(continued)*

Participation (%)[a]	Loss to follow-up (%)[b]	Methodologic quality	Outcome measure	Effect size
2 (73/3800)	40 (29/73)	3	Health (SF-36)	0.58 (−0.03, 1.19)
7 (924/12895)	40 (366/924)	5	Health (single item)	0.15 (−0.28, 0.57)
54 (119/220)	18 (22/119)	5	Health (single item) Sickness absence (no. of days)	0.00 (−0.44, 0.44) 0.16 (−0.20, 0.53)
65 (40/62)	28 (11/40)	4.5	Health (SF-36) Sickness absence (no. of days)	0.57 (−0.06, 1.20) 0.03 (−0.59, 0.65)
55 (860/1558)	30 (232/860)	5	Sickness absence (rate)	1: 0.16 (−0.02, 0.34) 2: 0.17 (−0.02, 0.35)
60 (97/160)	21 (20/97)	4	Sickness absence (no. of days)	0.14 (−0.32, 0.59)
14 (573/4058)	27 (154/573)	5	Sickness absence (no. of days)	0.04 (−0.13, 0.20)
21 (32/154 sites)	n/a	2	Sickness absence (no. of days)	0.69 (0.58, 0.81)
n/a	18	3.5	Sickness absence (no. of days)	0.17 (−0.15, 0.49)
30 (299/600)	4 (13/299)	6	Sickness absence (rate)	0.13 (−0.12, 0.38)
n/a Started: 132	27 (36/132)	3	Sickness absence (rate)	0.66 (0.25, 1.07)
39 (631/1628)	49 (311/631)	4	Productivity (single item)	1: 0.05 (−0.21, 0.31) 2: 0.14 (−0.15, 0.43)
12 (79/671)	11 (9/79)	4	Health (single item) Productivity (WLQ-Output demand)	1: 0.53 (−0.08, 1.13) 2: 0.28 (−0.28, 0.83) 1: 0.95 (0.33, 1.57) 2: 1.33 (0.73, 1.94)
8 (787/9733)	30 (238/787)	5.5	Health (SF-8) Productivity (two items)	0.25 (0.11, 0.39) 0.21 (0.03, 0.40)
99 (195/197)	9 (18/195)	3	Health (single item) Work ability (single item)	0.10 (−0.27, 0.47) 0.41 (0.04, 0.78)
49 (544/1116)	36 (193/544)	5.5	Sickness absence (no. of days) Productivity (QQ instrument)	0.00 (−0.17, 0.17) 0.05 (−0.12, 0.22)
9 (110/1200)	18 (20/110)	4.5	Sickness absence (no. of days) Productivity (WLQ-output demand)	0.52 (0.14, 0.91) 0.23 (−0.15, 0.61)
80 (260/325)	9 (28/260)	5.5	Health (single item) Sickness absence (no. of days) Work ability (Work Ability Index)	0.16 (−0.08, 0.41) 0.06 (−0.18, 0.31) 0.10 (−0.14, 0.35)

(data-collection method) when the criterion was met for one intervention group or outcome measure. Finally, all articles received a methodologic-quality score based on the summation of positive scored items: excellent (8–9 points); good (4.5–7.5 points); fair (3–4 points); or poor (0–2.5 points). Appendix C, available online at www.ajpmonline.org, provides detailed information on quality scores.

Definition for Population, Study, and Intervention Characteristics

Definitions of population and intervention characteristics were based on the data reported in the studies included. If the study consisted of 67% or more women, it was stated that this study was performed among "mostly females." Study populations with a mean age of ≥40 years were considered to be an "older" population. The assessment of whether a predominantly (>67%) white- or blue-collar study population was included was based on information provided by the studies on blue/white collar information, types of jobs, and/or the industry. The response was stated to be low when this was less than the median participation of 34% as reported in a recent systematic review.[22]

Whether an intention-to-treat analysis was performed was assessed according to the three criteria described by Hollis et al.[23]: deviations from random allocation, missing outcomes, and false inclusion. Interventions with at least weekly contacts were considered to be "frequent." The content of the intervention was divided into exercise, educational, and/or counseling components. Exercise was defined as interventions that included a physical activity component in which the participants needed to be physically active. Educational interventions were defined as programs that were restricted to providing information on the targeted lifestyle to the individual or group. In counseling interventions, a participant was able to direct personal questions to a health counselor for advice or the program was built on individual counseling sessions.

Data Analysis

For each outcome measure of interest, a generic effect size (ES) was estimated, based on the original data in the article, by the computer program Comprehensive Meta-Analysis software, version 2.0.[24] Thereafter, information on population, study, and intervention characteristics as well as the outcome measure studied was entered. Studies evaluating the effect of the WHPP on multiple outcome measures were entered separately for each outcome measure; the same method was applied when two interventions were studied within the same publication.

First, five meta-analyses were conducted using random-effects models. An overall meta-analysis was performed pooling all publications, independent of the outcome measure. Subsequently, for each independent outcome measure (self-perceived health, absence due to sickness, productivity at work, work ability), a separate meta-analysis was conducted.

Second, stratified meta-analyses were performed on the population, study, and intervention characteristics as well as on methodologic quality. An ES of around 0.2 is considered to represent a small effect, around 0.5 a medium effect, and around 0.8 or higher a large effect.[25] A significant difference was considered to be found when the ES of one condition was not included in the 95% CI of the corresponding opposite condition.

Third, meta-regression analyses were performed. Data on effect sizes and corresponding SEs calculated by CMA and on the independent variables were entered into Statistical Package for Social Sciences PASW, version 17.0.2, for analyses. Meta-regression analyses were carried out studying the difference in effect size by population, study, and intervention characteristics adjusted for the methodologic quality (good/excellent, poor/fair). Studies were weighted by the inverse of the SE of the effect size.

Evidence Synthesis

Eighteen studies evaluated the effect of a workplace health promotion program (WHPP) either on self-perceived health (n=8)[26–33]; sickness absence (n=12)[28,29,33–42]; work productivity (n=4)[30,31,41,43]; or work ability (n=2).[32,33] The study populations ranged in size from 40 to 860, and reflected a wide range of workplace settings (Table 1). The majority of the studies were from northern European countries (n=11/18). The content of the WHPPs was diverse, with 11 studies aimed at improving physical activity, four at weight status, and four at a combination of lifestyle factors. Moreover, three studies evaluated two interventions.[30,34,43]

Meta-Analysis

The pooled effect of WHPPs was, independent of the outcome measure, significant with an effect size of 0.24 (95% CI=0.14, 0.34). In the analyses stratified by outcome, comparable effects of the WHPPs were found for self-perceived health (ES=0.23, 95% CI=0.13, 0.33); sickness absence (ES=0.21, 95% CI=0.03, 0.38); productivity at work (ES=0.29, 95% CI=0.08, 0.51); and work ability (ES=0.23, 95% CI= −0.07, 0.52).

Methodologic Quality

Eight of the 18 studies were quantified as having a poor or fair methodologic quality (Table 1). In 14 studies, the participants were not blinded to the treatment arm (intervention or control group), and in 12 studies, the compliance with the intervention was considered to be low (n=6) or could not be assessed according to the information available (n=6; Appendix C, available online at www.ajpmonline.org).

Studies with a poor or fair methodologic quality found a 2.9-fold higher effect of their WHPP than those studies with good or excellent methodologic quality (ES=0.41, 95% CI=0.20, 0.62 versus ES=0.14, 95% CI=0.08, 0.19). When the analysis was stratified per outcome variable, studies with low methodologic quality found a greater effect on sickness absence, productivity at work, and work ability (Table 2).

Table 3 shows the influence of methodologic-quality criteria on the reported effect size. The studies with a poor methodologic quality found a significantly larger effect size of the WHPP with regard to four quality criteria

Table 2. Stratified meta-analyses for methodologic quality for the pooled outcome measures and after stratification by outcome

	Good/excellent quality		Poor/fair quality	
	n_o (n_s)	Effect size (95% CI)	n_o (n_s)	Effect size (95% CI)
Overall	18 (10)	0.14 (0.08, 0.19)	13 (8)	**0.41 (0.20, 0.62)**
Health	5 (5)	0.22 (0.10, 0.33)	4 (3)	0.29 (0.04, 0.54)
Sickness absence	9 (8)	0.11 (0.03, 0.18)	4 (4)	**0.37 (−0.01, 0.75)**
Work productivity	3 (3)	0.14 (0.02, 0.26)	4 (2)	**0.54 (0.04, 1.05)**
Work ability	1 (1)	0.10 (−0.14, 0.35)	1 (1)	**0.41 (0.04, 0.78)**

Note: Boldface indicates significance.
n_o, number of observations; n_s, number of studies

(unclear randomization, no intention-to-treat analysis, not controlled for confounders, and short follow-up). Studies that blinded their participants to the intervention found a larger effect than when participants knew to which group they belonged.

Population Characteristics

Studies including mostly white-collar workers found a larger effect of their WHPP, as did those studies evaluating their WHPP among a population with a mean age of <40 years. When adjusted for the methodologic quality of the study, the differences in effect sizes for age decreased but remained significant. The difference in effect size for occupation attenuated to nonsignificance after controlling for methodologic quality. The distribution of gender in the study population had no influence on the effect of the WHPP (Table 4).

Study Characteristics

The WHPPs showed smaller effects when the participants in the control group received some kind of intervention. The effect size was found to be 3.8 times larger when participation in the study was low. When adjusted for methodologic quality, the differences in effect size were smaller but remained significant (Table 4). Randomizing at either the group level or the individual level did not influence the effect of the WHPP.

Intervention Characteristics

The WHPPs were more effective when there were at least weekly contacts; this effect remained significant when adjusted for methodologic quality. Interventions including a counseling component with participants receiving personal advice were found to be less effective. However, after adjusting for methodologic quality, the effect size attenuated to nonsignificance. The presence of an exercise or educational component did not influence the effect of the WHPP (Table 4).

Discussion

The overall effectiveness of WHPPs was small across all work-related outcome measures: self-perceived health,

Table 3. Stratified meta-analyses for methodologic quality criteria on the nine quality criteria

	n_o (n_s)	Meeting the criteria Effect size (95% CI)	n_o (n_s)	Not meeting the criteria Effect size (95% CI)
Randomization correctly and clearly described	19 (9)	0.17 (0.09, 0.26)	12 (9)	**0.29 (0.06, 0.50)**
Similarity groups at baseline on outcome	21 (13)	0.22 (0.12, 0.31)	10 (8)	0.21 (0.01, 0.42)
Blinding participants to intervention	8 (4)	0.34 (0.09, 0.58)	23 (15)	**0.21 (0.10, 0.32)**
Compliance to the intervention	7 (6)	0.20 (0.06, 0.34)	24 (12)	0.25 (0.13, 0.38)
Low loss to follow-up	24 (13)	0.22 (0.14, 0.30)	7 (5)	0.22 (−0.06, 0.52)
Intention-to-treat analysis	14 (7)	0.14 (0.08, 0.19)	17 (11)	**0.36 (0.18, 0.54)**
Controlled for confounders	18 (11)	0.20 (0.08, 0.32)	13 (7)	**0.33 (0.13, 0.53)**
Objective data collection	9 (9)	0.16 (0.02, 0.30)	22 (14)	0.27 (0.15, 0.39)
Long follow-up	19 (12)	0.15 (0.02, 0.29)	12 (7)	**0.37 (0.23, 0.51)**

Note: Boldface indicates significance.
n_o, number of observations; n_s, number of studies

sickness absence, productivity at work, and work ability. This study is the first to show meta-analytically that effectiveness of a workplace health promotion programs depends on the study population, the intervention content, and the methodologic quality of the study. This study also demonstrates the relative importance of these factors for the effectiveness. Studies performed among younger populations were more effective. The effectiveness was larger in programs with weekly contacts or when the control group received no intervention. Studies found a smaller effect when they analyzed according to intention-to-treat or controlled for confounders. Studies with a low methodologic quality reported a 2.9-fold higher effect of their WHPP.

Overall, a small effect size of 0.24 was found. Across the outcome measures, all related to the concept of sustainable employability; small effects of WHPPs were found for self-perceived health (ES=0.23); sickness absence (ES=0.21); productivity at work (ES=0.29); and work ability (ES=0.23). These findings are in accordance with previous systematic reviews.[9,11,15,16] The method of data collection in most studies was based on self-reports (Appendix C, available online at www.ajpmonline.org) and thus common method bias

Table 4. Stratified meta-analyses and difference in effect size of WHPPs for population, study, and intervention characteristics

		Effect size	Difference in effect size
	n_o (n_s)	Standard difference in Ms (95% CI)[a]	β (95% CI)[b]
POPULATION CHARACTERISTICS			
Gender (% female)			
≥67	18 (8)	0.21 (0.11, 0.32)	−0.04 (−0.09, 0.01)
<67 (ref)	12 (9)	0.26 (0.08, 0.44)	
Age (years)			
≥40	21 (12)	**0.13 (0.08, 0.18)**[a]	**−0.17 (−0.23, −0.17)**
<40 (ref)	9 (5)	0.48 (0.23, 0.73)	
Occupation (% white collar)			
≥67	13 (7)	**0.33 (0.15, 0.52)**[a]	0.03 (−0.03, 0.08)
<67 (ref)	18 (11)	0.15 (0.08, 0.22)	
STUDY CHARACTERISTICS			
Randomization			
Cluster	13 (8)	0.25 (0.11, 0.39)	**0.08 (0.03, 0.13)**
Individual (ref)	18 (10)	0.21 (0.09, 0.33)	
Control group			
Minimal intervention	10 (6)	**0.07 (0.00, 0.14)**[a]	**−0.13 (−0.18, −0.07)**
No intervention (ref)	21 (12)	0.34 (0.21, 0.47)	
Participation			
High	16 (8)	**0.10 (0.04, 0.17)**[a]	**−0.17 (−0.22, −0.13)**
Low (ref)	14 (9)	0.38 (0.20, 0.55)	
INTERVENTION CHARACTERISTICS			
Frequency			
Often	15 (9)	**0.36 (0.18, 0.53)**[a]	**0.10 (0.05, 0.15)**
Not often (ref)	16 (0)	0.11 (0.05, 0.17)	
Intervention			
Group	8 (5)	0.22 (−0.04, 0.48)	0.01 (−0.05, 0.07)
Individual (ref)	23 (13)	0.21 (0.12, 0.30)	
Exercise component			
Yes	19 (10)	0.25 (0.14, 0.37)	−0.05 (−0.10, 0.07)
No (ref)	12 (8)	0.20 (0.04, 0.37)	
Education component			
Yes	16 (10)	0.27 (0.13, 0.41)	**0.06 (0.01, 0.11)**
No (ref)	15 (9)	0.19 (0.07, 0.30)	
Counseling component			
Yes	13 (9)	**0.13 (0.07, 0.19)**[a]	−0.01 (−0.07, 0.05)
No (ref)	16 (9)	0.35 (0.17, 0.53)	

Note: Boldface indicates significance.
[a]Standard difference in Ms: standardized differences in Ms
[b]Difference in effect size (standard differences in Ms) controlled for the methodologic quality of the study
n_o, number of observations; n_s, number of studies; WHPP, workplace health promotion program

could be present that may result in an overestimation of the effect.[44]

The effectiveness of the WHPPs included differed by study populations, study designs, and interventions. The current meta-analysis showed that WHPPs are more effective in populations containing predominantly white-collar and younger individuals. WHPPs might be better tailored to these specific groups. However, adjustment for the methodologic quality attenuated the estimated difference in effect size for occupation, which might be due to the WHPP implemented. Poor-quality studies with a predominantly white-collar population all incorporated a counseling component, while none of the poor-quality studies with a blue- and white-collar population investigated a WHPP with a counseling component. This meta-analysis has shown that WHPPs with a counseling component are less effective.

Two study characteristics were found to be related to effectiveness. The effects were smaller when the control group received a minimal intervention, possibly resulting in insufficient contrast between the two groups. In addition, the effect of the WHPP was four times higher when initial participation was low. This observation might be due to selection bias, whereby highly motivated participants were self-selected into the program. This observation may guide health professionals toward better WHPPs by stimulating through company-wide informational activities the motivation among employees to improve their health and subsequently by targeting the WHPP resources to those workers with sufficient motivation to change their behavior.

Programs with at least weekly contacts were almost four times more effective. This shows that in general a higher intensity that keeps participants actively involved leads to better results. Six of eight of the WHPPs with such regular contacts were interventions in which participants enrolled in an exercise program with an instructor, and it might be that the regular encouragement from instructors gave rise to these greater effects. However, interventions including an exercise component in comparison to all other studies (exercise component in addition to counseling or education or not including an exercise component) showed no difference.

Future research could be aimed at identifying whether the relationship between intervention effectiveness and the frequency of contact moments is evident regardless of the nature of the intervention components. Further, interventions with a counseling component reported a lower effectiveness, but this effect attenuated to nonsignificance when the methodologic quality of the studies was taken into account. Studies with a counseling component (n=9) were more often of good quality (7 of 9) than studies without such a counseling component (3 of 9).

This meta-analysis has clearly shown that many components other than the intervention itself may account for the effectiveness of WHPPs. This finding calls into question the generalizability and the comparability of WHPPs. To extend knowledge of the potential effect of the heterogeneity in systematic reviews, there is a need to focus on both the effectiveness as well as on the underlying factors, which could be achieved by applying stratified analysis in future meta-analyses.

For policymakers, the results of this meta-analysis are relevant because it shows that WHPPs might influence sustainable employability because of their positive effects on health, productivity at work, work absence due to sickness, and work ability. However, the results also show that attention should be paid to the specific target populations (e.g., age groups) and the content of the offered interventions (e.g., high frequency of contact moments). This information may also guide intervention developers on how one can ensure that the intervention will meet the demands and interests of the study population. Additionally, it would be interesting to test whether WHPPs with frequent contact moments (once a week) have a higher return on investment than WHPPs with less-frequent contact moments (once a month).

In the current meta-analysis, studies that used intention-to-treat analyses and that adjusted the analyses for potential confounders found a lower effect. This is to be expected: intention-to-treat is a more conservative analysis that will reduce the observed effect size. Further, when controlled for potential confounders, part of the effectiveness will be explained by these factors. The well-known CONSORT statement on reporting RCTs advises that intention-to-treat analysis is the preferred analysis strategy and recommends adjustment for important prognostic variables.[45]

During the current meta-analysis, judging whether an intention-to-treat analysis was performed was sometimes difficult because authors do not always present sufficient details on how missing data were handled (e.g., by multiple imputations or a change score of zero). Another item on the above-mentioned CONSORT statements checklist is a description of how randomization was performed.[45] This criterion was not always met by the studies included (n=8), making the distinction not solely on whether the criterion was met but also on whether it was well described.

A surprising observation in this meta-analysis is that studies with poor methodologic quality reported an average effect size 2.9-fold larger than good-quality studies. The larger effect size in low-quality studies is in line with other studies in various research fields.[46,47] Analyses stratified by outcome showed the same result for sickness absence, work productivity, and work ability. This might indicate publication bias; poor-quality studies get more frequently published while they show a great effect. This strengthens the need for methodologically strong studies which are considered to provide a less-biased estimate and will therefore be closer to the observed effectiveness once implemented in the "real world."

Limitations

There are some limitations to this study. First, studies that evaluated the effect of the WHPP on various outcome variables or that had evaluated more than one intervention were entered multiple times into the model. Performing a multilevel meta-analysis was regarded as undesirable because of the low number of studies included. Further, the correlation between the effect sizes of the studies evaluating the intervention on multiple outcomes was low (Spearman's rho: 0.35), thereby limiting the need to perform a multilevel meta-analysis.

Second, publication bias could have been an issue with this systematic review. The inverse relationship between study quality and effect size may point at such bias, as explained above. However, most RCTs included in this meta-analysis did not find a significant effect on the outcome of interest, which makes publication bias less likely. Moreover, the funnel plot (Appendix D, available online at www.ajpmonline.org) showed that only three of the 28 effect sizes fall outside the funnel plot boundaries. Further, most studies with high precision found smaller effects or even a null association, making publication bias in the pooled estimates less likely.

Third, it might be that articles were missed. However, a sensitive search strategy was used (Appendix A, available online at www.ajpmonline.org), leading to a high number of potentially relevant titles. Because of this extensive search, many titles were excluded, mostly because studies were not evaluating a WHPP.

Fourth, the effect sizes observed in the WHPPs were small, which may partly be due to the more-distal outcome variables used in this systematic review. However, other systematic reviews investigating the effectiveness of WHPPs on proximal outcomes, such as health behaviors, have also reported small effects.[9,11]

Conclusion

The effectiveness of workplace health promotion programs in intervention studies depends not only on type and content of the intervention implemented but also on study population, study characteristics, and methodologic quality. WHPPs were shown to be more effective among a younger population, which hampers generalizability. Further, interventions with weekly contacts were more effective, emphasizing the need for intensive WHPPs. Researchers performing meta-analysis are advised to get insight into both the effectiveness and factors underlying the effectiveness of WHPPs. A striking observation was that RCTs of poor quality reported a statistically higher effectiveness than RCTs of good quality. Therefore, in order to correctly judge the effectiveness of WHPPs, it is important that effectiveness be evaluated only in good-quality RCTs.

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Appendix

Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.amepre.2010.12.015.