Evaluating the Implementation of a Workplace Weight Loss Program Using a Modified Process Evaluation Rating Sheet

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Objective: The aim of this study was to demonstrate the utility of a modified Process Evaluation Rating Sheet (PERS) for analyzing implementation quality and program efficacy in a workplace weight loss program. **Methods:** Health care system workgroups formed teams to implement weight loss activities between 2018 and 2020. We used Spearman correlations and hierarchical regressions to examine associations between implementation quality captured by the modified PERS and program efficacy outcomes such as organizational health climate and supervisor support measured by the Multifaceted Organizational Health Climate Assessment and Job Content Questionnaire. **Results:** Four hundred seven workers from 11 workgroups participated. Workgroups with high PERS scores sustained improvement in Multifaceted Organizational Health Climate Assessment and Job Content Questionnaire scores. No group sustained improvements at 24 months. **Conclusion:** Implementation quality was associated with program efficacy, but the association faded over time. Utilizing the modified PERS may enhance evaluation of workplace health behavior change programs.

LEARNING OUTCOMES

- Readers will identify the utility of a modified Process Evaluation Rating Sheet for assessing implementation quality of participatory workplace weight loss programs.
- Readers will evaluate the relationship between characteristics of implementation quality and program efficacy in a participatory workplace weight loss program.

Keywords: community-based participatory research, health promotion, Total Worker Health®, program evaluation, obesity management

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The dissertation and three conference presentations are also cited within the reference list and called out in the Methods section.

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Nearly 170 million adults in the United States spend much of their day engaged in work,[1] and work-related factors such as stress, scheduling, and organizational climate contribute to the development of unhealthy physical activity and eating behaviors that lead to chronic conditions such as obesity.[2,3] Healthy eating and physical activity programs tailored for low–socioeconomic status (SES) populations (ie, those with lower incomes, occupational status, and educational attainment) are essential to address the increasing prevalence of obesity-related chronic diseases such as diabetes and cardiovascular disease.[4,5] There is a lack of effective and scalable programs tailored for this population,[6–8] and low-SES workforces face barriers to engagement with health behavior change programs,[6,9] such as lack of time, resources, or management support. The workplace can be an ideal place to engage low-SES workers in health behavior change programs to address eating and physical activity behaviors,[7,10,11] although limitations in implementing and evaluating such programs hinder their use in addressing the growing burden of chronic disease among blue-collar working adults in particular.[3]

The National Institute for Occupational Safety and Health's Total Worker Health® (TWH®) program seeks to understand how work environmental factors (eg, perceived support and organizational health climate in the workplace) influence worker health and productivity.[12] To customize interventions for diverse settings, TWH® practitioners and researchers increasingly apply participatory approaches to engage workers in health behavior change.[13,14] Participatory approaches may enhance worker buy-in and perceived autonomy, improving engagement and sustainability of health programs.[13,15,16] Evaluating such participatory approaches in low-SES workers at risk for obesity-related chronic diseases may improve understanding of how to effectively and pragmatically engage workers.[7,11,14] Integrative interventions that engage end users may also be more effective than those that impose top-down changes,[2,17] especially among workers of low-SES.[18] However, integrative participatory interventions thus far have mixed evidence of substantial benefit for workers,[19] likely due to insufficient use of comprehensive implementation models, frameworks, and evaluation tools as well as inadequate engagement of managers and workers.[14,20] Thus, researchers are focusing on improving the quality of tools used in process evaluation.

Quality of implementation and effectiveness of health behavior change programs are associated,[21] and multilevel factors (eg, coworker, supervisory, and organizational) influence these associations. Understanding these associations requires evaluation approaches capable of capturing implementation and clinical measures across individuals, groups, and organizations. Participatory approaches that engage study participants in planning, implementing, and evaluating programs, such as the TWH® Healthy Workplace Participatory Program, have been applied to evaluate complex interventions in frontline retail and corrections workers.[14,15] However, few studies of participatory worker programs offer systematic guidance on concurrently evaluating participatory program implementation and efficacy.[21–23] In addition, better specifying the process of tailoring implementation strategies to different settings is important for informing other such interventions.[24–26]

Using tools such as the Process Evaluation Rating Sheet (PERS) may enhance process evaluation frameworks used to identify which implementation factors are associated with the effectiveness of participatory workplace programs and thus facilitate tailoring of program delivery.[27] The PERS provides a brief assessment of five aspects of program implementation: (1) organizational support and engagement, (2) steering committee engagement, (3) design team engagement, (4) program facilitation effectiveness, and (5) intervention planning and implementation. Evaluators rate four questions within each aspect on a five-point Likert type scale. As described below, we modified the PERS for use in this study. The PERS is increasingly used in participatory worker health promotion studies,[14,28] but few of these studies have both applied and adapted the PERS for the purposes of evaluating program implementation in low-SES workers.

In this study, we examined the utility of the modified PERS as part of an evaluation approach for the Working For You (WFY) program. Working For You was a cluster-randomized trial testing a participatory worker program that addressed individual health behaviors and work environment factors contributing to obesity in low-SES workers.[29] Design teams of workers representing their workgroups collaborated with researchers to propose, implement, and evaluate healthy eating and physical activity solutions for their workgroups. We sought to evaluate implementation of the WFY program with short-term efficacy outcomes including perceived organizational health climate in the Multifaceted Organizational Health Climate Assessment (MOHCA) and perceived coworker and supervisor support in the Job Content Questionnaire (JCQ) 6.[30,31]

Our specific objectives were to (1) assess associations between our process measures and the implementation factors in the modified PERS in our logic model and (2) assess associations between the process measures and modified PERS, and short-term efficacy outcomes over time in the program logic model. We hypothesized that (1) higher modified PERS scores would be associated with higher scores on process measures and (2) better quality program implementation as indicated by higher modified PERS scores and process measures would be associated with larger changes in short-term efficacy scores over time.

METHODS

Study data came from a cluster-randomized trial of a participatory weight loss program conducted in 2015 to 2020 among employee workgroups in a large American health care system and affiliated university.[29] The Washington University School of Medicine Institutional Review Board approved this study (ID: 201505131), and all participants gave written informed consent. Text and data from this manuscript are derived from the first author's dissertation, and preliminary results have been presented at prior conferences.[32–35]

The intervention arm of the WFY study was composed of 11 workgroups of between 25 and 137 workers, and trial implementation occurred in 2018 to 2020. Four to six workers made up the design team for each group, and a program facilitator worked closely with each group. The design teams and program facilitators met weekly during the first 3 months of the intervention and then biweekly for 21 months. The meeting goals were to propose and implement healthy eating and physical activity initiatives within their work units.[29]

To propose workplace changes, each workgroup's design team followed a seven-step participatory process described by the Center for the Promotion of Health in the New England Workplace's Healthy Workplace Participatory Program[13,36]: (1) evaluating the workplace, (2) identifying problems, (3) generating solutions, (4) creating solution prototypes, (5) gathering feedback about the prototypes, (6) modifying the prototypes, and (7) implementing the solution prototypes. Program facilitators from the research team worked closely with design teams during the first 12 months of the intervention; design teams ran independently during the second 12 months. Throughout the intervention, the design team and program facilitators vetted proposals with managers when feasible.

Logic Model

This study adapted a logic model from prior participatory worker programs and described in the first author's dissertation.[32–35,37–39] The model comprised three domains: (1) program implementation with three subdomains of inputs, activities, and outputs; (2) program efficacy with short-, intermediate-, and long-term outcomes; and (3) context. In this study, we studied aspects of program implementation and short-term measures of program efficacy within the logic model (Table 1). A specific timeline of data collection activities is included in Supplemental Digital Content 1 (http://links.lww.com/JOM/C265).

TABLE 1. Study Logic Model and Evaluation Framework

	Implementation and Process			Program Efficacy		
	Inputs	*Activities*	*Outputs*	*Short-term efficacy outcomes*	*Intermediate efficacy outcomes*	*Long-term efficacy outcomes*
Indicators	• Facilitator, design team, and management engagement	• Quality of meetings, process, and feedback	• Developing, testing, implementing, and supporting ideas	• Perceived workplace psychosocial changes	• Workplace health behavior changes	• Health outcome changes
Measures	• Process Evaluation Rating Sheet (PERS) • Intervention logs	• PERS • Intervention logs	• Number of interventions implemented	• Multifaceted Organizational Health Climate Assessment • Job Content Questionnaire	• Use of workplace health supports	• Body mass index (kg/m^2)

Adapted from Strickland et al (2019).

Data Collection and Recruitment

The research staff approached managers and administrators of departments to recruit workgroups to the study, to recruit design team members, and to recruit all workgroup members to participate in surveys every 6 months between baseline and 24 months. Worker inclusion criteria for participating in the study were as follows: (1) membership in a chosen workgroup, (2) English-speaking, and (3) aged ≥18 years. Exclusion criteria were as follows: (1) pregnant or nursing, (2) weight-loss surgery within the past 12 months, and (3) currently receiving chemotherapy or other radiation treatments.[29]

Participant Information

Each participant completed a baseline demographic questionnaire and indicated their gender, age, race, ethnicity, education level, annual household income, and cohabitation status. Members of the research staff generated measures of weight on an electronic scale by averaging two measures to the nearest tenth of a pound. Height was also measured to the nearest quarter of an inch on a portable, calibrated stadiometer. Then, the research team generated measures of approximate body mass index (BMI; kg/m^2) and classified participants with BMI ≥ 30 kg/m^2 as having obesity.[29]

Process Measures

Throughout the program, program facilitators attended team meetings and recorded team process measures in intervention logs, including management support and engagement measures (management is supportive and management communicates effectively), design team engagement measures (meeting attendance, action between meetings, number of team members, number of meetings completed, and proportion of planned meetings that were held), and program implementation measures (team runs independently, program delivered as planned, and number of interventions delivered). At the end of the study, the research team reviewed intervention logs recorded by program facilitators and calculated final scores.

Modified Program Evaluation Rating Sheet

The PERS is an implementation quality assessment tool, created by the Center for the Promotion of Health in the New England Workplace's Healthy Workplace Participatory Program. The PERS rates 20 items grouped in five domains relevant to participatory workforce programs: management support, steering committee engagement, health team engagement, program facilitation effectiveness, and intervention planning and implementation.[40] Because our intervention did not include two program elements rated in the original PERS (a labor-management steering committee and external rating of program facilitation), we modified the original PERS by eliminating the steering committee engagement and program facilitation effectiveness domains and moving relevant items from these domains to the three remaining domains of program implementation evaluation: (1) management support, (2) team engagement, and (3) planning and implementation.[40] Our modified PERS retained 13 of the 20 original PERS questions distributed among these three domains.

We derived each domain score from four to five component items (see Supplemental Digital Content 2 [http://links.lww.com/JOM/C266] for further details about the PERS and Modified PERS as well as questions and scoring). The research team evaluated each item on a scale of 1 (strongly disagree) to 5 (strongly agree), or "NA" for ratings that were not applicable. Research staff who served as program facilitators throughout the 2-year intervention independently rated the modified PERS items at the end of design team meetings and resolved any differences in ratings through consensus with research staff and investigators uninvolved with program facilitation. Design team participants only rated the final item, "Facilitators communicated effectively," at the end of each design team meeting. All program facilitator and research staff raters were fully unaware of workers' self-reported

efficacy outcomes. Total scores on the modified PERS ranged from 0 to 65, with higher scores indicating better implementation quality. We then classified study groups by modified PERS scores into low (0 to 22), medium (23 to 45), and high (46 to 65) groups. We calculated domain scores of the modified PERS as means and total modified PERS scores as sums of the 13 items within the three domains.

Multifaceted Organizational Health Climate Assessment

The MOHCA evaluates organizational health climate or "employee perceptions of active support from coworkers, supervisors, and upper management for the physical and psychological well-being of employees."[31] We used the MOHCA to assess three levels of organizational health climate: (1) workgroup, (2) supervisor, and (3) organizational. Individuals completed surveys at baseline, 6 months, 12 months, 18 months, and 24 months and rated questions on an ordinal scale ranging from 0 (strongly disagree) to 6 (strongly agree). We used the average MOHCA scores of workers in our analyses.

Job Content Questionnaire

The JCQ is a standardized survey that assesses domains of perceived psychological demands, decision latitude, social support, physical demands, and job insecurity in workers. We used the six-item subscales of perceived coworker support and perceived supervisor support.[30] Individuals rated questions on an ordinal scale ranging from 1 (strongly disagree) to 4 (strongly agree). We used JCQ scores of individual workers in our analyses.

Data Analysis

We completed statistical analyses with SAS Software 9.4 (Cary, NC) to analyze all study data.[41] Descriptive analyses included calculating scores for PERS, MOHCA, and JCQ, as well as modified PERS and process measure scores. Then, we evaluated trends in modified PERS and process measure scores. Changes in organizational health climate and perceived coworker and supervisor support means were evaluated from baseline to 12, 18, and 24 months to evaluate the relationship between workgroup activities and short-term outcomes sustained with lower research team involvement. Spearman rank correlation coefficients were analyzed to evaluate associations between modified PERS and process measure scores on the one hand and short-term outcome measures on the other. We accounted for data nesting in our analyses by adding random intercepts to our models and applied a significance level of $P < 0.05$ for all hypothesis testing. In addition, prior to completing analyses, we assessed the amounts and patterns of missing process and outcomes data. Participants who completed the baseline survey as well as at least one of the follow-up surveys (12, 18, or 24 months) were included in analyses. In line with the parent trial's analytic protocol, we assessed outcomes on an intent-to-treat basis and used linear mixed models to analyze available data and handle missing follow-up data.

RESULTS

Participant Information

The parent trial allocated 11 workgroups and 608 participants to treatment at baseline, representing approximately 42% of eligible workers in the treatment workgroups. This analysis of those data included 407 participants who included data at baseline and at least one follow-up survey at 12, 18, and 24 months. Three hundred eight participants contributed data at 12 months, 281 contributed data at 18 months, and 237 contributed data at 24 months. At each time point prior to analyzing differences by implementation quality, grand means and standard deviations of MOHCA, JCQ coworker support, and JCQ supervisor support were similar despite attrition (data not shown). At baseline, study participants were predominantly female, with an average BMI in the obese range (≥30 kg/m^2). The majority were Black and had some education beyond high school. Only 16% of participants reported an annual household income of greater than $70,000 (approximately the median household income in the study area at the time); 44% had a household income less than $30,000 (approximately the poverty level). At baseline, distributions of age, race, education, income level, and cohabitation status differed significantly between workgroups with low, medium, and high PERS scores. Distributions of weight, MOHCA, and JCQ scores were not statistically different across groups at baseline (Table 2).

Associations between Implementation Measures and the Modified PERS

We first evaluated associations between the modified PERS total and subscale scores with our design team process measures derived from the program facilitator intervention logs. Figure 1 depicts a heat map of total and subscale-level modified PERS scores, as well as design team process and implementation measures gathered throughout the 24-month study period. The heat map shows that groups with higher modified PERS scores, indicated by more green and yellow cells, tended to have higher process measure scores, indicating better overall implementation quality. Design teams with more orange and red cells had lower modified PERS scores, indicating poorer implementation quality. We also identified statistically significant correlations between the overall score and domain scores of the modified PERS with the major endpoint of number of interventions delivered by each design team ($r_s = 0.74$ to 0.91, $P < 0.05$; data not shown).

Associations Between Implementation and Short-Term Outcomes

Next, we evaluated associations between changes in overall organizational health climate (assessed by the MOHCA) and perceived coworker and supervisor support (assessed by the JCQ) to changes in overall PERS scores from baseline to 12, 18, and 24 months. We compared workgroups with low (0 to 22), medium (23 to 45), and high (46 to 65) modified PERS scores to understand associations between intervention implementation quality and short-term efficacy. Overall, we observed larger improvements in MOHCA and JCQ scores from baseline among workgroups with higher modified PERS scores, and the groups sustained this trend throughout the first 12 months. Workgroups with the highest PERS scores experienced a positive change in organizational health climate at 12 months (ΔMOHCA mean [95% CI] from baseline = 0.57 [0.33 to 0.80]) and 18 months (ΔMOHCA mean [95% CI] from baseline = 0.31 [0.06 to 0.55]). Workgroups with the highest PERS scores also had a statistically significant change in perceived supervisor support at 12 months (ΔJCQ mean [95% CI] from baseline = 0.63 [0.08 to 1.17]). There were no statistically significant changes over time among workgroups with low and medium PERS scores, nor were there statistically significant changes between baseline scores and 24-month scores in any of the workgroups (Table 3).

We then calculated Spearman correlation coefficients between MOHCA scores (ie, the short-term organizational health climate outcome) and facets of implementation quality and process measures, including program fidelity (ie, modified PERS scores), dose (ie, meetings attended and engagement), and design-team generated solutions among all employees in the intervention workgroups. Last, we evaluated associations between overall organizational health climate scores in all employees in the intervention workgroups with higher quality of program implementation at the design team level as indicated by modified PERS overall and subscale scores. We found statistically significant associations between MOHCA scores and each of the subscales (management support and engagement, health team engagement, and program facilitation effectiveness) at 12 months ($r_s = 0.14$ to

TABLE 2. Demographics at Baseline Stratified by Modified PERS Levels

	Total, $N = 407$ Workers, 11 Groups	Low Modified PERS (0–22), $n = 112$ Workers, 2 Groups	Medium Modified PERS (23–45), $n = 152$ Workers, 5 Groups)	High Modified PERS (46–65), $n = 143$ Workers, 4 Groups	P*
Baseline weight, mean (SD), kg	90.4 ± 24.3	91.3 ± 24.7	90.6 ± 25.0	89.5 ± 23.5	0.84
Baseline BMI, mean (SD)	33.0 ± 8.7	33.6 ± 8.9	33.2 ± 8.8	32.5 ± 8.4	0.60
Female gender, *n* (%)	302 (74.4)	82 (73.9)	113 (74.3)	107 (74.8)	0.99
Age, mean (SD), yrs	41.8 ± 12.9	43.5 ± 14.3	39.8 ± 12.1	42.5 ± 12.3	0.04
Race, *n* (%)					<0.0001
Black/African American	250 (61.7)	91 (81.3)	91 (60.3)	68 (47.9)	
White/Caucasian	135 (33.3)	15 (13.4)	52 (34.4)	68 (47.9)	
Other	20 (4.9)	6 (5.4)	8 (5.3)	6 (4.2)	
Hispanic	7 (1.8)	3 (2.8)	4 (2.7)	0 (0.0)	0.14
Education, *n* (%)					<0.0001
High school or lower	116 (28.9)	57 (51.8)	34 (23.0)	25 (17.5)	
Technical school/some college	231 (57.6)	43 (39.1)	95 (64.2)	93 (65.0)	
College graduate or postgraduate	54 (13.5)	10 (9.1)	19 (12.8)	25 (17.5)	
Annual household income, *n* (%)					<0.0001
$0–$30,000	173 (43.6)	80 (74.1)	57 (38.8)	36 (25.4)	
$30,001–$70,000	160 (40.3)	23 (21.3)	64 (43.5)	73 (51.4)	
$70,001+	64 (16.1)	5 (4.6)	26 (17.7)	33 (23.2)	
Lives with significant other, *n* (%)	191 (47.0)	46 (41.1)	64 (42.4)	81 (56.6)	0.02
MOHCA at baseline, mean (SD)					
Management support	4.3 ± 1.6	4.3 ± 1.6	4.2 ± 1.6	4.2 ± 1.4	1.00
Workgroup support	4.4 ± 1.5	4.6 ± 1.7	4.4 ± 1.5	4.3 ± 1.5	0.61
Organizational support	4.6 ± 1.5	4.5 ± 1.6	4.5 ± 1.5	4.7 ± 1.4	0.59
Total score	4.4 ± 1.4	4.5 ± 1.5	4.4 ± 1.4	4.4 ± 1.3	0.96
JCQ at baseline, mean (SD)					
Coworker support	12.0 ± 1.9	11.8 ± 2.3	11.5 ± 2.2	11.5 ± 2.1	0.67
Supervisor support	12.3 ± 2.5	11.3 ± 3.2	11.3 ± 2.9	11.7 ± 2.8	0.37

JCQ, Job Content Questionnaire; MOHCA, Multifaceted Organizational Health Climate Assessment.

*P values based on χ^2 tests for categorical variables and one-way analysis of variance for continuous variables; P values for MOHCA and JCQ scores have random intercepts to account for correlations within groups.

	Working For You Workgroups										
Items	1	2	3	4	5	6	7	8	9	10*	11*
Post-study Researcher-rated Modified PERS Scores											
Modified PERS Total Scale (65 Possible)	**26**	**31**	**23**	**57**	**46**	**26**	**57**	**27**	**58**	**5**	**6**
Modified PERS Management Support Subscale	2.1	2.9	2.4	4.3	4.1	2.8	3.9	3.3	4.9	1.0	1.0
Modified PERS Team Engagement Subscale	2.2	2.4	1.8	4.4	3.4	2.2	4.4	1.4	4.6	1.0	2.0
Modified PERS Implementation Subscale	1.8	2.3	1.3	4.8	3.5	1.5	4.5	1.3	4.5	NA	NA
Process Measures and Ratings from Intervention Logs											
Management support	3.0	4.0	2.3	3.8	4.4	4.0	3.0	2.5	4.5	NA	NA
Management communication	2.5	3.5	2.5	3.0	4.4	4.0	2.8	1.0	4.4	NA	NA
Percentage of team meetings attended	76%	90%	76%	79%	75%	77%	83%	67%	68%	NA	NA
Percentage of meetings after which design team has taken action to implement solutions	36%	74%	42%	95%	93%	65%	87%	65%	93%	NA	NA
Number of interventions delivered	2	3	2	7	3	1	13	1	4	0	0
Program materials delivered as planned	5	5	3	5	4	3	5	2	5	1	1
Can the team run the program without a facilitator?	N	N	N	P	P	N	P	N	N	NA	NA
Percentage of meetings in which team has 4-6 members	67%	27%	27%	74%	79%	100%	100%	50%	95%	NA	NA
Program Dose (# meetings held / # meetings planned)	60%	87%	64%	93%	87%	62%	104%	49%	76%	0%	9%
Facilitators are responsive	4.5	4.8	4.8	4.8	4.7	4.7	4.9	5.0	4.8	1.0	1.0
Facilitators communicate effectively	5.0	4.3	4.8	5.0	4.8	4.7	4.9	5.0	4.8	0.0	0.0

FIGURE 1. Overall modified PERS scores and intervention process measure scores.[a,b] Shading in the heat map is adjusted in each row to compare relative implementation quality on each item across workgroups; green shading indicates high quality, and darker and lighter shades indicate higher and lower quality, respectively; yellow and orange shading indicate medium quality, and darker and lighter shades indicate poorer and lower quality, respectively; red shading indicates low quality, and darker and lighter shades indicate poorer and lower quality, respectively. *Scores rated as not applicable (NA) when items could not be rated in two groups with one or no meetings. [a]Post-study researcher-rated modified PERS scores are averages of subscales rated on a scale of 1 (strongly disagree) to 5 (strongly agree). Higher scores indicate higher quality. [b]Process measures and ratings from intervention logs are derived from the research team's observed measures. Rated measures on a scale of 1 to 5 are averaged from multiple researcher ratings. N, no; P, partial; PERS, Process Evaluation Rating Sheet.

TABLE 3. Hierarchical Regressions Predicting Change in MOHCA and JCQ Scores at 12, 18, and 24 Months Among Modified PERS Groups

	MOHCA	JCQ Coworker Support	JCQ Supervisor Support
	Change From Baseline,[a] Mean (95% CI)[b,c]	Change From Baseline,[a] Mean (95% CI)[b,c]	Change From Baseline,[a] Mean (95% CI)[b,c]
12-mo follow-up			
PERS low (scores 0–22)	−0.13 (−0.44 to 0.18)	−0.23 (−0.75 to 0.28)	0.60 (−0.09 to 1.28)
PERS medium (scores 23–45)	0.08 (−0.14 to 0.29)	−0.04 (−0.43 to 0.35)	−0.06 (−0.58 to 0.45)
PERS high (scores 46–65)	**0.57 (0.33–0.80)***	0.17 (−0.25 to 0.59)	**0.63 (0.08–1.17)****
18-mo follow-up			
PERS low (scores 0–22)	0.16 (−0.18 to 0.51)	−0.34 (−0.91 to 0.23)	−0.56 (−1.30 to 0.18)
PERS medium (scores 23–45)	0.20 (−0.03 to 0.43)	−0.16 (−0.56 to 0.25)	−0.25 (−0.78 to 0.29)
PERS high (scores 46–65)	**0.31 (0.06–0.55)****	0.15 (−0.29 to 0.60)	0.14 (−0.42 to 0.71)
24-mo follow-up			
PERS low (scores 0–22)	0.05 (−0.44 to 0.54)	−0.65 (−1.42 to 0.11)	−0.07 (−1.12 to 0.99)
PERS medium (scores 23–45)	0.15 (−0.08 to 0.39)	−0.08 (−0.50 to 0.34)	−0.30 (−0.85 to 0.24)
PERS high (scores 46–65)	0.23 (−0.03 to 0.48)	−0.01 (−0.46 to 0.44)	−0.39 (−0.99 to 0.20)

CI, confidence interval; JCQ, Job Content Questionnaire; MOHCA, Multifaceted Organizational Health Climate Assessment; PERS, Process Evaluation Rating Sheet.

*Bold values indicate significance; $P < 0.01$; **$P < 0.05$.

[a]Score at follow-up assessment minus baseline score.

[b]Mean changes and CIs are estimated from the regression model. They take hierarchical structure into account and will vary slightly from raw means.

[c]*P* values derived from linear mixed model with each outcome (MOHCA and JCQ measures) as the dependent variable and PERS category, time point (baseline, and 6, 12, 18, and 24 months), and the interaction of PERS category and time point as the independent variables (fixed effects). Random intercepts for work group and participant were included to account for the hierarchical structure of the data.

0.21, $P < 0.05$) but not at 18 or 24 months (Table 4). We found that the number of interventions generated was associated with each of the modified PERS subscales, including management support, design team engagement, program implementation, and total scores ($r_s = 0.74$ to 0.91, $P < 0.05$; data not shown).

DISCUSSION

We demonstrated the utility of the modified PERS in participatory worker program process evaluation frameworks. The modified PERS scores were associated with multiple program process measures made during the intervention, indicating that the PERS provides a summary measure of implementation quality. The modified PERS was also associated with changes over time in workers' perceptions of organizational health climate, and perceptions of social support from supervisors and coworkers. These findings indicate that the modified PERS may be useful for specifying associations between implementation quality and short-term efficacy outcomes. Our findings partially supported our hypothesis that higher PERS scores would be associated with better process measures, and MOHCA and JCQ scores. Associations between modified PERS and process measures also demonstrated that the PERS measures implementation quality as expected. Workgroups with higher modified PERS scores showed higher scores on process measures taken during the intervention. Moreover, workgroups with higher modified PERS scores experienced greater increases in MOHCA and JCQ scores from baseline during the WFY intervention, although these groups did not sustain these changes after the first 12 months of the intervention, and not all subcategories and items demonstrated expected associations.

Our findings also demonstrated associations between the modified PERS and short-term program efficacy measures including improved

TABLE 4. Associations Among Process Measure, Modified PERS, and MOHCA Scores From Baseline to 12-, 18-, and 24-Month Follow-Up

	Correlation With MOHCA		
	12 mo	18 mo	24 mo
	r_s	r_s	r_s
Post-study, researcher-rated			
PERS total	**0.18**	0.04	0.09
Management support and engagement	**0.19**	0.04	0.08
Design team engagement	**0.19**	0.08	0.02
Program implementation effectiveness	**0.21**	0.07	0.05
Process measures and ratings from intervention logs			
Management support	0.13	0.09	0.06
Management communication	0.15	0.09	0.05
Program dose	0.16	−0.04	−0.05
Number of interventions delivered	0.15	0.01	−0.06
Program materials delivered as planned	0.06	−0.04	−0.03
Research facilitator responsiveness	**0.14**	0.05	0.04
Research facilitator communication	0.07	0.08	0.13

Random intercepts for work group and participant scores were included to account for hierarchical structure of the data. Analyses exclude work units 10 and 11. Bold values indicate $P < 0.05$.

MOHCA, Multifaceted Organizational Health Climate Assessment; PERS, Process Evaluation Rating Sheet; r_s = Spearman rank correlation coefficient.

**P* values from hierarchical linear models where MOHCA is the outcome and process measure and interaction of process measure and time point (12, 18, and 24 months) are the independent variables.

scores on the MOHCA and the JCQ. In addition, the MOHCA and JCQ scores over time demonstrated stronger associations with changes in modified PERS scores than with other process measures. Taken together, these findings suggest the modified PERS may be useful in holistically assessing implementation quality in participatory workforce interventions. Our findings also suggest future directions below to develop better tools for assessing participatory processes in worker health programs.

First, using a breadth of process and efficacy measures within participatory workforce programs may better elucidate connections between implementation quality and short-term efficacy outcomes. Although measures within our framework captured a change in perceived organizational health climate among groups with high levels of implementation quality at 12 months, these associations weakened by 24 months. Facilitator notes indicated that the design teams' engagement with the program tapered off over time. This highlights the importance of maintaining high levels of implementation quality throughout a long-term workforce intervention. Although our findings showed positive associations between the implementation measures and short-term efficacy measures at 12 months, these positive associations diminished by 24 months, even among groups with high overall implementation quality. One potential explanation for this effect is that sustaining design team engagement may be challenging over time, and the research team noted challenges with sustaining engagement in a time-intensive program.

Second, other studies corroborate that sustaining a participatory workforce intervention requires sustained high-level engagement from a variety of stakeholders to obtain changes in desired outcomes.[14,15,20,28] Better understanding sustainability challenges that continually impact participatory workforce programs requires the development of measures, tools, and evaluation frameworks.[28,39] For example, the Program Sustainability Assessment Tool is a tool that specifically measures the sustainability of a complex community-based program.[42,43] To our knowledge, this tool has not been used in workplaces for the purpose of assessing participatory worker health promotion programs, so occupational safety and health practitioners may seek to use the Program Sustainability Assessment Tool in future participatory worker health promotion programs.

In our evaluation of the modified PERS' association with perceived supervisor support, all participants, including the highest scoring modified PERS groups, experienced a larger drop in perceived supervisor support than in perceived coworker support or organizational health climate throughout WFY implementation. This indicated that future studies of participatory workforce intervention may consider more closely assessing quality of worker-supervisor relationships, sustainment of supervisor support, and organization-level leadership changes that influence programs over time.[14,16] Furthermore, better distinguishing between the quantity and quality of administrative support for programs and workers' perceptions of administrators and leaders may inform our understanding of the relative influence of observed and perceived support of participatory worker programs.

Finally, although the efficacy of the program diminished over time, our study offered evidence of the modified PERS' usefulness to capture associations between implementation factors and program efficacy. Because implementation quality and desired outcomes are often associated,[21] observing implementation via process measures and rating implementation via tools like the modified PERS offers further options to evaluate the quality of program implementation. Individual observations of a process such as counts of meetings attended may ignore perceived features influencing an intervention's success, such as perceptions of stakeholder engagement and intervention implementation, which may influence implementation outcomes such as acceptability or feasibility.[16,25,44] Furthermore, the modified PERS enables researchers and participants to measure holistic information quickly and efficiently about the quality of design teams that implement programs in an intervention such as WFY. The modified PERS enables research teams to quickly assess over- or under-performing groups in a participatory intervention at any time point of implementation.

Our study has several limitations. First, most participants were female and non-Hispanic Black, so future studies should seek to replicate findings in other demographic groups to generalize findings. Other factors such as institution-level policy changes and changes in management and work unit staff over the course of the WFY program may have influenced assessments within or among the groups. For example, some of the workgroups were completing participation in the parent trial during the early months of the COVID-19 pandemic in 2020. We were unable to evaluate the extent to which changes to workplace policies and worker health and well-being confounded overall results. Our study protocol also only measured staff turnover during recruitment, so the attrition of individual workers due to turnover within participating work units may also have influenced findings.

Second, our team only rated modified PERS scores at one time point, after the conclusion of the study. Thus, we may have overlooked details from earlier in the study implementation during our rating process. The associations between process measures collected during the study and the modified PERS scores are not surprising, as the modified PERS raters were sometimes the program facilitators who had recorded some of these process measures from team meetings. Future studies may seek to expand assessment time points or incorporate rigorous interrater reliability processes, and collect additional data on contextual factors and implementation factors affecting participatory worker approaches.[44,45]

Third, although low-, medium-, and high-PERS groups had similar MOHCA and JCQ scores at baseline, sociodemographic characteristics varied among the three groups. Thus, additional unmeasured sociodemographic factors outside of our process evaluation framework may have influenced our limited study outcomes,[46] such as perceived organizational health climate and work support over time. Moreover, work units consenting to participate in a worker weight loss program likely had stronger health cultures and climates compared with nonparticipating units. Future study protocols should measure more factors related to these outcomes and include more than 11 workgroups to adequately sample a range of worker, work unit, and organizational features that exist in complex workplaces. Assessing changes to weight and differential treatment effects in participants with and without obesity was beyond the scope of this exploratory study. However, adjusting classifications of obesity to include ethnicity-specific cutoffs, rather than a generic BMI ≥ 30 kg/m^2 cutoff, may facilitate more precise evaluations of BMI changes.

In summary, our findings indicated the utility of the modified PERS in our process evaluation framework as well as the modified PERS' associations with short-term efficacy measures of organizational health climate and perceived supervisor support. As clinicians and researchers develop participatory workplace health programs, embedding rigorously developed tools and evaluation frameworks within programs may facilitate higher quality targeted action toward improving worker health. In addition, our findings underscore the importance of including a breadth of measures to fully capture the implementation quality and efficacy in participatory worker programs.

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