Safety and Health Support for Home Care Workers: The COMPASS Randomized Controlled Trial

Ryan Olson, PhD, Sharon V. Thompson, MS, RD, Diane L. Elliot, MD, Jennifer A. Hess, PhD, DC, Kristy Luther Rhoten, BA, Kelsey N. Parker, PhD, Robert R. Wright, PhD, Brad Wipfli, PhD, Katrina M. Bettencourt, MA, Annie Buckmaster, BA, and Miguel Marino, PhD

Objectives. To determine the effectiveness of the COMmunity of Practice And Safety Support (COMPASS) Total Worker Health intervention for home care workers.

Methods. We randomized 16 clusters of workers (n = 149) to intervention or usual-practice control conditions. The 12-month intervention was scripted and peer-led, and involved education on safety, health, and well-being; goal setting and self-monitoring; and structured social support. We collected measures at baseline, 6 months, and 12 months, which included workers' experienced community of practice (i.e., people engaged in a common activity who interact regularly for shared learning and improvement). Implementation occurred during 2013 and 2014 in Oregon.

Results. In an intent-to-treat analysis, relative to control, the intervention produced significant and sustained improvements in workers' experienced community of practice. Additional significant improvements included the use of ergonomic tools or techniques for physical work, safety communication with consumer–employers, hazard correction in homes, fruit and vegetable consumption, lost work days because of injury, high-density lipoprotein cholesterol, and grip strength. Consumer–employers' reports of caregiver safety behaviors also significantly improved.

Conclusions. COMPASS was effective for improving home care workers' social resources and simultaneously impacted both safety and health factors. (*Am J Public Health.* 2016;106: 1823–1832. doi:10.2105/AJPH.2016.303327)

By 2030, more than 20% of the US population will be aged 65 years or older.[1] Home care workers (HCWs) will play a pivotal role in helping the growing elderly population maintain quality lives in their homes and communities. There are currently more than 2.1 million personal care and home health aides working in the United States, and that number is expected to grow to more than 3.1 million in the next decade.[2]

Despite demand, HCWs generally receive low wages and limited occupational resources. They typically work alone in unregulated environments (i.e., private homes) and are often directly employed by clients. Such consumer–employers (CEs) are not required to complete occupational health or safety training and may have disabilities that further limit their ability to protect workers from harm. Musculoskeletal injuries are a commonly cited occupational hazard for HCWs.[3] Physically demanding tasks include assisting CEs with bathing, toileting, mobility, and housecleaning. Home care workers in publicly funded programs, who are the focus of the current project, have a lost time injury rate about 3.5 times higher than the national average for all occupations.[4] Caregiving is also emotionally taxing, and stressful aspects of the job (e.g., interpersonal conflict with CEs) are significantly associated with poorer health among HCWs.[5] In light of the hazards and projected growth of home care, it is critical to develop interventions that protect HCWs' safety, health, and well-being.

Peer-reviewed safety and health intervention studies with employed HCWs are scarce, but include efforts to reduce blood and bodily fluid exposure,[6] improve physical fitness and work ability,[7] and reduce musculoskeletal pain (neck, back, and shoulders).[8] These interventions have used education, stress management, and exercise training programs, and have produced statistically significant improvements in the use of sharps containers, low back pain interference, body weight, physical fitness, and work ability. Additional safety training content and resources for HCWs have been developed through participatory research by the National Institute for Occupational Safety and Health [9–11] and through other research efforts (e.g., Safe Home Care project).[12]

Research on programs for family caregivers, who perform similar work to HCWs, is more prevalent. A meta-analysis of family caregiver interventions noted a range of statistically significant impacts, including reduced caregiver burden and depression, improved well-being, and increased knowledge.[13] Intervention tactics have included education, social support, counseling, cognitive–behavioral therapy, and respite programs. A second meta-analysis focused on support group interventions for family caregivers found them to be effective for

ABOUT THE AUTHORS

At the time of the study, Ryan Olson, Sharon V. Thompson, Kristy Luther Rhoten, Kelsey N. Parker, Brad Wipfli, Katrina M. Bettencourt, Annie Buckmaster, and Robert R. Wright were with the Oregon Institute of Occupational Health Sciences, Oregon Health & Science University (OHSU), Portland. Miguel Marino is with the Department of Family Medicine, OHSU. Diane L. Elliot is with the Division of Health Promotion and Sports Medicine, OHSU. Jennifer A. Hess is with the Labor Education and Research Center, University of Oregon, Eugene.

Correspondence should be sent to Ryan Olson, PhD, Oregon Institute of Occupational Health Sciences, Oregon Health & Science University, 3181 SW Sam Jackson Park Rd, L606, Portland, OR 97239-3098 (e-mail: olsonry@ohsu.edu). Reprints can be ordered at http://www.ajph.org by clicking the "Reprints" link.

This article was accepted June 15, 2016.

doi: 10.2105/AJPH.2016.303327

improving well-being, depression, and a range of social outcomes.[14] For example, Toseland et al.[15] evaluated peer-led and professional-led "facilitated self-help group" interventions for caregivers consisting of weekly 2-hour meetings over 8 weeks. Both formats resulted in long-term improvements in stress, interpersonal competence, and social support network size.[15] Although previous relevant interventions have improved a range of valuable outcomes for caregivers, family caregiver interventions have addressed a relatively narrow spectrum of worker well-being, and few safety-related interventions for employed HCWs have been empirically evaluated. We did not identify any interventions with an integrated focus on worker safety, health, and well-being.

To address research gaps and public health exigencies, we developed the COMmunity of Practice And Safety Support (COMPASS) intervention for HCWs. COMPASS was designed to improve caregivers' Total Worker Health. This perspective focuses on the impact of work on the whole person, and has been defined as "policies, programs, and practices that integrate protection from work-related safety and health hazards with promotion of injury and illness prevention efforts to advance worker well-being."[6(p4)] COMPASS extends previous intervention efforts by simultaneously targeting worker safety, health, and well-being. The intervention also aims to foster professional "communities of practice" among HCWs, who are typically isolated from peers, by bringing them together in groups for education and social support. According to Etienne and Beverly Wenger-Trayner, "Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly."[16(p1)]

COMPASS integrates several evidence-based intervention tactics, including elements of effective social support groups,[15,17] scripted team-based health promotion programs,[18–21] and goal setting with behavioral self-monitoring.[22] Intervention materials were developed collaboratively with engagement and feedback from members of the Service Employees International Union (SEIU) Local 503 and training staff from the Oregon Home Care Commission (OHCC). Previous publications describe the study protocol[23] as well as the pilot study curriculum development process, demonstrated feasibility, and estimated effects.[24] Here we report the results of a randomized controlled trial of the intervention.

METHODS

We designed our study to test the primary hypotheses that the intervention would be more effective than usual practice for

1. improving HCWs' experienced community of practice,
2. well-being,
3. daily fruit and vegetable consumption,
4. reduced daily consumption of high-fat and high-sugar foods,
5. days per week with 30 minutes of moderate exercise, and
6. safe behaviors and conditions when working in CEs' homes.

Secondary outcomes included CE evaluations of their caregivers' performance and behaviors, and HCWs' perceived stress, musculoskeletal symptoms, injuries and illnesses, and physical health.

Design, Randomization, and Enrollment

We evaluated the intervention with a cluster randomized controlled design with measurements at baseline, 6 months, and 12 months. When HCWs were prescreened for eligibility they were asked for their preference between 2 meeting times (Tuesday evenings, Saturday mornings) and their address. Clusters were filled with workers who could meet at the same time and lived relatively close to each other (target cluster size was 12 members). Once 2 clusters were filled, one was randomized to intervention and the other to usual practice control. Cluster pairs completed enrollment during the same time period and conditions were implemented over 12 months. We selected a target sample of 16 clusters with 160 workers through an a priori power analysis to provide 0.85 power for detecting a medium effect size on the basis of behavior changes observed in a previous group-based intervention.[25] Enrollment began in April 2013 and 12-month measurements were completed in October 2014.

Recruitment methods and inclusion criteria. Participants were recruited from Portland and Eugene metropolitan areas in Oregon through fliers, e-mails, referrals, and direct recruitment at training events. Recruitment focused on HCWs represented by the SEIU Local 503 who cared for CEs enrolled in publicly funded programs managed by the OHCC. The only educational requirement for HCWs in this system is an orientation training. However, the OHCC encourages voluntary participation in further training with pay and other benefits (e.g., hourly pay for each nonduplicated course annually; listing in a registry and referral system for meeting certain training participation criteria). Interested workers were prescreened by phone for eligibility. Inclusion criteria included current employment by at least 1 public- or private-pay CE and willingness to attend monthly meetings.

Informed consent data collection procedures. Participants met with researchers at SEIU facilities to complete informed consent, surveys, and objective physical measurements. The HCWs also delivered brief surveys and return envelopes to their CEs who received a $10 gift card for responding. The HCWs were initially paid $11 an hour for attending data collection periods and intervention meetings. Following a negotiated wage increase in October 2013, participants were compensated $15 an hour for study activities with a $30 retention bonus for each follow-up. Each measurement time point included lottery drawings for supplemental compensation awards totaling $1000. The HCWs also received study-branded materials at baseline (tote bag), 6 months (t-shirt), and 12 months (lunch bag).

Experimental Conditions

After baseline data collection, all participants received immediate feedback on physical measurements relative to normal or healthy standards and were informed of their random assignment. Control participants received pay and materials and concluded enrollment. Intervention participants received a brief intervention orientation and additional materials (workbook, knee pad, step counter) before finishing enrollment.

Usual practice control procedures. In addition to receiving health feedback (in person and by mail), control participants had access to the usual resources provided by the SEIU and the OHCC. These included leadership development and service opportunities with the union and paid 3-hour classes offered by the OHCC (multiple monthly offerings; > 20 total courses). Therefore, it was possible for control participants to attend monthly paid training that matched or exceeded total paid monthly activities for intervention participants.

Intervention procedures. The intervention involved a researcher-led half-day workshop followed by 12 monthly peer-led meetings that were implemented by using scripted workbooks and supporting materials. Team leader manuals included additional instructions for peer leaders, who were predominantly recruited from the COMPASS pilot through peer nomination. For 2 teams that did not have a leader from the pilot, 2 peer coleaders were selected from volunteers. Peer leaders received brief facilitator training at the beginning and midway through the program. The repeating monthly meeting routine involved a WorkLife check-in (i.e., rating or sharing current work and life status), educational lesson, goal setting, healthy meal break, WorkLife support (i.e., structured problem solving), and a reflection. Educational lessons and goals alternated between safety and health or well-being topics (see the box on page e4). COMPASS workbook 1, which was developed and revised on the basis of the pilot study,[24] was used during the first 6 months. Workbook 2, which was developed and tested with a subgroup of original pilot participants (unpublished results), was used during months 7 through 12. Instead of fully scripted lessons, workbook 2 allowed teams to choose a schedule of readings from a menu of options. The HCWs were asked to complete readings before meetings and the team leader manual provided discussion questions. Each "reading discussion" option included scripted group and individual goal setting. Intervention participants were provided individual and team "certification" incentives for meeting certain attendance and goal completion criteria.

Measures

The survey included a range of demographic measures, including work characteristics and health conditions, as well as self-reported primary and secondary outcomes. Survey outcomes emphasized previously published and validated scales. We measured additional secondary outcomes objectively.

Primary outcomes. We measured experienced community of practice with language adapted for HCWs.[26] We measured well-being with the 12-item Short Form Health Survey version 2.0.[27] We assessed safety behaviors with 5 questions about the frequency of specific actions in the past 6 months.[24] Health behavior measures included a healthy physical activity scale,[18] the National Cancer Institute fruit and vegetable screener,[28] and questions about the frequency of consuming sugary drinks, sugary snacks, and fast food, and bringing meals from home.[29]

Secondary outcomes. We assessed CEs' satisfaction and conflict with their HCW with the Home Care Client Satisfaction Inventory[30] and an adapted interpersonal conflict scale.[31] We assessed CEs' reports of HCWs' safety actions by using adaptations of the 5 safety behavior items from the HCW survey.

We measured HCWs' sleep quality with a single item from the Pittsburgh Sleep Quality Index.[29] Psychosocial experiences and stress measures included interpersonal conflict with CEs[31] and the Perceived Stress Scale.[32] An adapted Nordic questionnaire assessed the degree to which musculoskeletal pain and discomfort interfered with normal tasks.[33] We also measured functional impairment with activities of daily living,[33] work related injuries, and lost work time attributable to illness or injury.

Objective physical measures included blood pressure (3-reading average; Omron HEM-907XL; Omron Healthcare Inc, Lake Forest, IL) and finger-stick whole blood measures of cholesterol, triglycerides, and glucose after a minimum 3-hour fast (Cholestech PA Analyzer, Alere, Waltham, MA). We computed body mass index (defined as weight in kilograms divided by the square of height in meters) from measured height (SECA 213 stadiometer; SECA, Chino, CA) and weight (Tanita TBF-310GS; Tanita Corp, Arlington Heights, IL). Fitness measures included grip strength (JAMAR hydraulic hand dynamometer, 200 lb, Lafayette Instrument Co, Lafayette, IN), hamstring flexibility (Cooper Institute/YMCA scale on the Flex-Tester Sit and Reach box, Novel Products Inc, Rockton, IL), and a 6-minute walk test (15-m course because of space limitations).[34]

Statistical Analyses

We performed analyses on outcome measures using intent-to-treat principles, with study condition as the primary predictor. We first assessed differences between intervention and usual practice groups for HCW and CE samples by using generalized linear mixed models to account for clustering of participants. To examine longitudinal changes in outcomes, we used a multilevel mixed modeling with identity link approach to model the hierarchical structure of the data with measurements at each time point, nested within participants, and further nested within clusters. We accounted for clustering through random intercepts for cluster and additional random effects for study participant to account for temporal correlation of observations within a participant.[35] We treated time as a categorical variable (baseline, 6-month, 12-month) to produce a profile analysis in which we used model parameter estimates to estimate means by study condition for each time point. We estimated intervention effects (i.e., change in mean outcome from baseline) from linear combinations of regression coefficients from multilevel mixed models. We also performed this approach for CE data. We computed standardized effect sizes (denoted as d) as the change in mean outcome from baseline to follow-up divided by baseline standard deviation for the intervention group, which was then subtracted from the change in baseline to follow-up divided by baseline standard deviation for the control group.[36]

We performed statistical analyses with SAS version 9.4 (SAS Institute Inc, Cary, NC), and all inferential tests were 2-sided with significance set at $P < .05$. Because hypotheses were specified a priori and many outcome categories were related (e.g., 5 safety behaviors), we followed recommendations to report P values (or confidence intervals in tables)

COMMUNITY OF PRACTICE AND SAFETY SUPPORT (COMPASS) MEETING TOPICS IN THE RANDOMIZED CONTROLLED TRIAL: OREGON, 2013–2014

Workbook 1: Meeting Topics	Workbook 2: Meeting Topics
Workshop: team-building activities and how COMPASS teams work	7. Sustaining our team
1. Fruits and vegetables	8. Body mechanics *or* Helping consumer–employers obtain tools
2. Back to healthy postures	9. Healthy eating on a budget *or* Rethink your drink[a]
3. Functional fitness	10. Home safety *or* Injury slip ups
4. Take a load off with tools	11. Fitness walking *or* Exercise fun
5. Communicating for hazard correction	12. Healthy sleep *or* Coping with stress *or* Hand hygiene
6. Mental health	

[a]"Rethink Your Drink" is an initiative of the Centers for Disease Control and Prevention.

rather than implement multiple comparisons adjustment.[37]

In longitudinal community-based research, nonadherence and loss to follow-up is expected. As a sensitivity analysis, we conducted a complete-case–only, as-treated estimation of the study outcomes over time by study condition.

RESULTS

A total of 244 HCWs volunteered and were prescreened for eligibility (Figure 1). We excluded 34 individuals before randomization for declining participation or failing inclusion criteria (most common reason was lacking a current CE). We randomized 16 clusters (range: 7–12 members). Ultimately, 148 HCWs (n = 74 intervention; n = 74 usual practice) reported and fully enrolled at baseline. An additional participant randomized to intervention did not complete baseline data collection but did complete 6- and 12-month data collection. Thus, we included 149 total participants in the intent-to-treat analysis. At the 6-month time point, 127 participants completed data collection (n = 64 intervention; n = 63 usual practice); 122 returned at 12 months (n = 63 intervention; n = 59 usual practice). A total of 131 unique CEs completed 226 surveys about their HCWs over the 3 time points.

Baseline contrasts demonstrated no imbalance in HCW demographic characteristics across conditions (Table A, available as a supplement to the online version of this article at http://www.ajph.org). The overall HCW sample was 89% female, averaged 51.6 years of age (SD = 13.2), was obese (mean body mass index = 31.9 kg/m^2; SD = 8.2), and averaged 24.1 weekly work hours (SD = 17.1). Reported lifetime prevalences for diagnoses of depression and anxiety were 39% and 23%, respectively. The CEs were 73% female and averaged 63.0 years of age (SD = 16.5), 181.6 pounds (SD = 58.9), and 2.1 (SD = 2.7) years being served by their HCW (Table B, available as a supplement to the online version of this article at http://www.ajph.org).

Intervention meeting attendance averaged 8.63 (SD = 5.06) of 13 possible events. A minority of HCWs randomized to intervention (n = 16) failed to attend any meetings after the workshop.

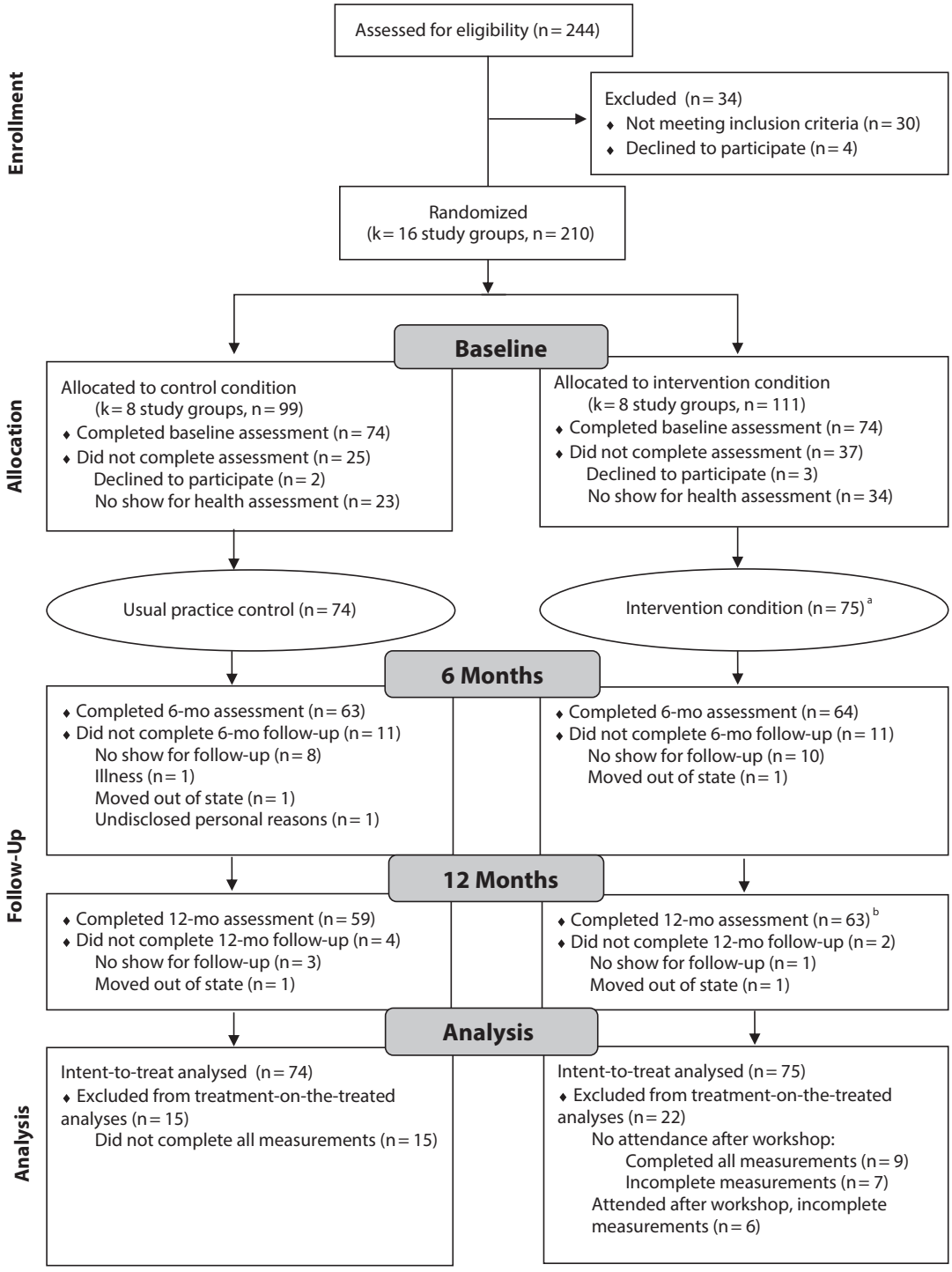
Intent-to-Treat Analyses

Model predicted means, standard errors, confidence intervals, and effects sizes from multilevel models for primary outcomes are shown in Table 1. The intervention produced a statistically significant and sustained improvement in experienced community of practice (6-month $d = 0.36$; $P = .023$; 12-month $d = 0.37$; $P = .024$). Additional significant improvements included talking with CEs about improving unsafe conditions (12-month $d = 0.84$; $P < .001$); correcting slip, trip, or fall hazards (12-month $d = 0.45$; $P = .027$); using new tools or techniques for moving objects or CEs (6-month $d = 0.65$, $P = .009$); using new tools or techniques for house cleaning (6-month $d = 0.51$; $P = .041$; 12-month $d = 0.64$; $P = .006$); and daily fruit and vegetable servings (12-month $d = 0.31$; $P = .038$). In all, the majority of between-group contrasts (18 of 28) for primary outcomes were in predicted directions. However, an unexpected finding was a significant reduction in meals brought from home among intervention participants relative to controls (12-month $d = -0.46$; $P = .014$). We estimated intracluster correlation coefficients for all outcomes (Table C, available as a supplement to the online version of this article at http://www.ajph.org).

Relative to CEs of control participants, CEs of intervention participants reported significant increases in their HCWs' adoption of new tools or techniques for housecleaning (6-month $d = 0.69$; $P = .019$); correcting slip, trip, and fall hazards (12-month $d = 0.51$; $P = .049$); and large sustained increases in correcting "other hazards" at 6 months ($d = 0.82$; $P = .007$) and 12 months ($d = 1.01$ $P = .002$; Table 2). Longitudinal between-group contrasts for other secondary outcomes included significant improvements in high-density lipoprotein (6-month $d = 0.22$; $P = .045$) and grip strength (12-month $d = 0.29$; $P = .011$), as well as a significant reduction in lost work days because of injury (6-month $d = -0.66$; $P = .01$). Remaining secondary outcomes among HCWs were predominantly stable and nonsignificant (Table D, available as a supplement to the online version of this article at http://www.ajph.org).

Completers-Only Analyses

Completers-only analyses included participants with all 3 measurements and



[a]The 75th intervention participant was randomized to intervention but did not complete baseline data collection. This participant did complete the 6-month data collection and is included in the 6-month "completers" count.

[b]One participant who did not complete 6-month data collection returned and completed 12-month data collection, and is included in the 12-month "completers" count.

FIGURE 1—CONSORT Flow Diagram: COMmunity of Practice And Safety Support (COMPASS), Oregon, 2013–2014

TABLE 1—COMmunity of Practice And Safety Support (COMPASS) Intervention Effects on Primary Outcomes Among Home Care Workers: Intent-to-Treat Analyses, Oregon, 2013–2014

Primary Outcomes (Time Anchor)	Intervention (n = 75), Mean (SE)	Control (n = 74), Mean (SE)	Absolute Intervention Effect From Baseline (95% CI)	Effect Size (*d*) From Baseline
Experienced community of practice[a] (3 mo)				
Baseline	33.56 (0.95)	33.04 (0.96)	. . .	. . .
6 mo	35.83 (0.99)	32.49 (1.01)	+2.82[b] (0.39, 5.26)	+0.36
12 mo	35.32 (1.01)	31.92 (1.03)	+2.88[b] (0.39, 5.38)	+0.37
Safety behaviors[c]				
Talked with CE about improving unsafe conditions (6 mo)				
Baseline	1.56 (0.20)	1.64 (0.20)	. . .	. . .
6 mo	2.33 (0.21)	1.79 (0.22)	+0.62 (–0.04, 1.28)	+0.34
12 mo	2.81 (0.22)	1.41 (0.23)	+1.48[b] (0.80. 2.16)	+0.84
Corrected slip, trip, or fall hazards (6 mo)				
Baseline	1.51 (0.20)	1.58 (0.20)	. . .	. . .
6 mo	1.83 (0.21)	1.70 (0.21)	+0.20 (–0.44, 0.85)	+0.13
12 mo	2.18 (0.21)	1.51 (0.22)	+0.74[b] (0.09, 1.39)	+0.45
Corrected other hazards (6 mo)				
Baseline	0.92 (0.18)	0.93 (0.18)	. . .	. . .
6 mo	1.09 (0.19)	1.19 (0.20)	–0.09 (–0.65, 0.46)	–0.05
12 mo	1.37 (0.19)	1.17 (0.20)	+0.21 (–0.35, 0.78)	+0.16
Used new tool or techniques for moving objects or CEs (6 mo)				
Baseline	0.61 (0.14)	0.60 (0.14)	. . .	. . .
6 mo	1.15 (0.15)	0.54 (0.15)	+0.60[b] (0.15, 1.05)	+0.65
12 mo	1.08 (0.15)	0.66 (0.15)	+0.41 (–0.05, 0.87)	+0.47
Used new tools or techniques for housecleaning (6 mo)				
Baseline	0.81 (0.15)	1.07 (0.15)	. . .	. . .
6 mo	1.34 (0.16)	1.06 (0.17)	+0.54[b] (0.02, 1.05)	+0.51
12 mo	1.31 (0.16)	0.83 (0.17)	+0.74[b] (0.22, 1.26)	+0.64
Daily diet or exercise behaviors				
Fruit and vegetable servings (1 mo)				
Baseline	3.95 (0.45)	4.69 (0.45)	. . .	. . .
6 mo	3.87 (0.46)	3.93 (0.47)	+0.68 (–0.48, 1.84)	+0.12
12 mo	4.69 (0.47)	4.17 (0.48)	+1.26[b] (0.07, 2.24)	+0.31
Sugary snacks[d] (1 mo)				
Baseline	0.63 (0.09)	0.54 (0.09)	. . .	. . .
6 mo	0.41 (0.09)	0.57 (0.09)	–0.25 (–0.50, 0.00)	–0.28
12 mo	0.42 (0.09)	0.39 (0.09)	–0.06 (–0.32, 0.19)	–0.03
Sugary drinks[d] (1 mo)				
Baseline	0.63 (0.13)	0.86 (0.13)	. . .	. . .
6 mo	0.52 (0.13)	0.75 (0.14)	+0.00 (–0.33, 0.33)	+0.00
12 mo	0.50 (0.14)	0.64 (0.14)	+0.09 (–0.23, 0.43)	+0.05
Fast food[d] (1 mo)				
Baseline	0.09 (0.02)	0.12 (0.02)	. . .	. . .
6 mo	0.08 (0.02)	0.10 (0.02)	+0.01 (–0.04, 0.05)	+0.00
12 mo	0.08 (0.02)	0.09 (0.02)	+0.02 (–0.03, 0.06)	+0.06

Continued

TABLE 1—*Continued*

Primary Outcomes (Time Anchor)	Intervention (n = 75), Mean (SE)	Control (n = 74), Mean (SE)	Absolute Intervention Effect From Baseline (95% CI)	Effect Size (*d*) From Baseline
Meals brought from home[d] (1 mo)				
Baseline	1.64 (0.16)	1.24 (0.16)	. . .	. . .
6 mo	1.21 (0.17)	1.01 (0.18)	−0.20 (−0.71, 0.32)	−0.13
12 mo	1.09 (0.17)	1.36 (0.18)	−0.67[b] (−1.19, −0.14)	−0.46
Healthy physical activity[e] (1 mo)				
Baseline	1.82 (0.18)	1.98 (0.18)	. . .	. . .
6 mo	2.08 (0.18)	2.11 (0.19)	+0.13 (−0.37, 0.63)	+0.09
12 mo	2.38 (0.19)	2.29 (0.19)	+0.25 (−0.27, 0.76)	+0.18
Well-being				
SF-12 physical composite score (1 mo)				
Baseline	45.71 (1.17)	45.63 (1.17)	. . .	. . .
6 mo	45.42 (1.21)	45.89 (1.22)	−0.56 (−3.38, 2.25)	−0.06
12 mo	44.06 (1.23)	45.73 (1.26)	−1.75 (−4.66, 1.15)	−0.18
SF-12 mental composite score (1 mo)				
Baseline	48.39 (1.22)	49.29 (1.22)	. . .	. . .
6 mo	47.95 (1.26)	49.19 (1.28)	−0.34 (−3.59, 2.90)	−0.03
12 mo	48.71 (1.29)	49.29 (1.33)	+0.31 (−3.05, 3.68)	+0.03

Note. CE = consumer–employer; CI = confidence interval; SF-12 = 12-item Short Form Health Survey version 2.0. We used model parameter estimates from multilevel mixed models with restricted maximum-likelihood estimation and random effects of cluster and home care worker to estimate means by study condition for baseline, 6-mo, and 12-mo time points. We estimated intervention effects (i.e., change in mean outcome from baseline) from linear combinations of the regression coefficients of the multilevel mixed models and standardized effect sizes in change from baseline are reported.

[a]Sum of 9 items rated on a 5-point scale; responses range from 1 (strongly disagree) to 5 (strongly agree); $\alpha = 0.93$.

[b]Statistically significant between-group differences ($P < .05$; 2-tailed).

[c]Six-point frequency scales; responses ranged from 0 (never) to 5 (≥ 5 times).

[d]Items related to sugary snacks, sugary drinks, fast food, and meals from home were reported on 10 frequency intervals. Each frequency interval was then multiplied by a weight to estimate daily frequency of consumption.

[e]Mean of 4 items asking about days per week with 30 minutes of different moderate-to-vigorous physical activities. Eight-point response scale ranged from 0 (none) to 7 (daily); $\alpha = 0.76$.

excluded intervention participants that stopped attending after the workshop (Figure 1). Results were highly consistent with the intent-to-treat analysis with trends toward slightly larger effect sizes (Tables E and F, available as supplements to the online version of this article at http://www.ajph.org).

DISCUSSION

The number and variety of changes observed support COMPASS as an effective program for improving HCWs' social resources and Total Worker Health. Three of 6 primary hypotheses were supported with significant group differences observed for experienced community of practice, fruit and vegetable consumption, and several safety behaviors. According to Cohen's standards[38] for small ($d = 0.20$), moderate ($d = 0.50$), and large ($d = 0.80$) effect sizes, effects for fruit and vegetable consumption and community of practice and were small to moderate. Effect sizes for safety behaviors ranged from moderate to large. The CEs independently verified robust safety behavior changes, and workers' self-reported lost-work days because of injuries were significantly reduced at 6 months. The sustained and significant improvement in experienced community of practice is particularly salient given HCWs' general isolation and lack of workplace social support. If sustained, such professional networks could produce long-lasting benefits for individual workers and home care systems. For example, in a qualitative study of communities of practice at 7 different companies, common valuable outcomes included shorter learning curves for new employees, more efficient performance, greater reuse of previously developed knowledge and resources, and the generation of new ideas.[39]

Relative to effects produced by previous interventions for in-home caregivers, unique impacts of COMPASS include the sustained improvement in experienced community of practice, the number and types of safety behaviors affected, and a significant improvement in a healthy dietary behavior. In contrast with previous support group programs for family caregivers,[15] we did not observe significant improvements in well-being (see "Future Directions" section). Exercise also did not differ between groups over time; previous more intensive exercise programs for HCWs have effectively improved factors such as body measurements, fitness, and low back pain, and have reduced pain interference with daily activities.[7,8]

TABLE 2—COMmunity of Practice And Safety Support (COMPASS) Intervention Effects on Outcome Measures Among Consumer–Employers of Home Care Worker Participants in the Randomized Controlled Trial: Oregon, 2013–2014

Measure (Anchoring)	Intervention Condition (n = 72), Mean (SE)	Control (n = 59), Mean (SE)	Absolute Intervention Effect From Baseline (95% CI)	Effect Size (*d*) From Baseline
Interpersonal conflict with home care worker[a] (3 mo)				
Baseline	1.16 (0.07)	1.30 (0.07)	. . .	. . .
6 mo	1.13 (0.07)	1.32 (0.08)	−0.05 (−0.32, 0.22)	−0.13
12 mo	1.06 (0.08)	1.23 (0.08)	−0.03 (−0.31, 0.25)	−0.18
Home care client satisfaction[b] (current state)				
Baseline	60.9 (1.3)	57.7 (1.5)	. . .	. . .
6 mo	62.8 (1.5)	59.9 (1.7)	−0.30 (−5.55, 4.92)	+0.08
12 mo	61.3 (1.6)	57.6 (1.5)	+0.50 (−4.98, 5.89)	+0.06
Safety behaviors[c]				
Talked about improving unsafe conditions (6 mo)				
Baseline	1.97 (0.28)	1.95 (0.31)	. . .	. . .
6 mo	1.96 (0.31)	2.06 (0.34)	−0.12 (−1.16, 0.92)	−0.06
12 mo	2.35 (0.31)	1.70 (0.35)	+0.63 (−0.43, 1.69)	+0.34
Corrected slip, trip, or fall hazards (6 mo)				
Baseline	1.46 (0.24)	1.74 (0.27)	. . .	. . .
6 mo	1.32 (0.26)	1.20 (0.29)	+0.40 (−0.48, 1.29)	+0.23
12 mo	1.87 (0.27)	1.22 (0.30)	+0.93[d] (0.01, 1.86)	+0.51
Corrected other hazards (6 mo)				
Baseline	0.38 (0.21)	1.18 (0.23)	. . .	. . .
6 mo	1.00 (0.22)	0.70 (0.25)	+1.10[d] (0.31, 1.88)	+0.82
12 mo	1.31 (0.23)	0.80 (0.25)	+1.31[d] (0.50, 2.12)	+1.01
Used new tool or techniques for moving objects or CEs (6 mo)				
Baseline	0.58 (0.20)	0.60 (0.22)	. . .	. . .
6 mo	1.17 (0.21)	0.65 (0.24)	+0.54 (−0.22, 1.30)	+0.39
12 mo	1.02 (0.22)	0.45 (0.25)	+0.59 (−0.21, 1.38)	+0.44
Used new tools or techniques for housecleaning (6 mo)				
Baseline	1.18 (0.23)	1.45 (0.25)	. . .	. . .
6 mo	1.70 (0.24)	0.91 (0.27)	+1.06[d] (0.17, 1.95)	+0.69
12 mo	1.31 (0.25)	1.07 (0.28)	+0.51 (−0.38, 1.42)	+0.33

Note. CE = consumer–employer; CI = confidence interval. We used model parameter estimates from multilevel mixed models with restricted maximum-likelihood estimation and random effects of cluster and consumer–employer to estimate means by study condition for baseline, 6-mo, and 12-mo time points. We estimated intervention effects (i.e., change in mean outcome from baseline) from linear combinations of the regression coefficients of the multilevel mixed models and standardized effect sizes in change from baseline are reported.

[a]Five-point rating scale of the frequency conflict; responses range from 1 (never) to 5 (very often); $\alpha = 0.86$.

[b]Sum of 10 items on a 5-point satisfaction rating scale; responses range from 1 (very dissatisfied) to 5 (very satisfied). We removed 2 items referring to consistency in staffing and choices about care from the original 12-item scale because of lack of relevance; $\alpha = 0.98$.

[c]Six-point frequency scales; responses ranged from 0 (never) to 5 (≥ 5 times).

[d]Statistically significant between-group differences ($P < .05$; 2-tailed).

Strengths and Limitations

We used a randomized controlled trial design with cluster pairs yoked in time—a rigorous evaluation method that bolsters confidence in results. Primary outcomes emphasized validated survey scales, and significant safety behavior changes were independently verified by CEs. High retention rates are a notable strength when one considers the longitudinal design and HCWs' geographic dispersion and atypical employment structures. The program was developed collaboratively with the SEIU Local 503 and the OHCC, and was enthusiastically received by participants as indicated by strong meeting attendance. Also, peer-led group approaches can be relatively inexpensive compared with professionally led or individually administered programs. The use of scripted materials also makes the approach replicable and relatively easy to implement.

The current analysis is limited to outcomes collected during and immediately after the intervention. Future research is needed to examine long-term maintenance of changes and effects on costly but infrequent events such as workers'

compensation claims. Although we measured some secondary outcomes directly, the study lacked more direct measures of primary outcomes such as observations of safety behaviors or actigraphic measures of physical activity. Also, findings are most generalizable to HCW populations in states with similar publicly funded CE home care systems, such as California and Washington. The sample should be reasonably representative of HCWs in the 2 participating metropolitan areas, but comparison demographic information was not available from the OHCC. The intervention was presented in English only, so workers with limited or no English proficiency may have been underrepresented in the sample. Future research is needed to evaluate the generality of the approach with HCWs from diverse backgrounds in other states and systems (including those employed by private agencies).

Future Directions

Although intervention effects were particularly robust for experienced community of practice and safety behaviors, mixed patterns in outcomes warrant discussion. Some significant effects were observed only at 6 months and others did not appear until 12 months. Effects observed singularly at 12 months may have simply required more time. However, mixed patterns may also have been influenced by the curriculum or schedule of topics. For example, workbook 2 introduced topic and goal variability into the second 6 months of intervention. Curriculum features such as "repeat goals" in workbook 2 encouraged sustaining changes made during the first half of the program; however, it is possible that the growth of topics and targets stretched the boundaries of participants' self-regulatory capacity for making or sustaining multiple behavior changes. Indeed, the Total Worker Health paradigm encourages simultaneous attention to a broader range of outcomes than more traditional interventions.[6] Future research should be informed by the multiple behavior change literature and investigate conditions when multiple targets work synergistically versus when they may produce diminishing returns.

Given anecdotal observations of participant enjoyment and growth in the program, the lack of significant improvements in well-being was surprising. This stands in contrast with significant improvements to life satisfaction and negative affect observed in the pilot.[24] Such mixed findings may indicate the presence of unknown moderators of intervention effects on well-being. The intervention also did not significantly change exercise or high-sugar or high-fat dietary behaviors. It is possible that some momentum with behavioral goals in these domains may have been lost with the month-long gap between meetings. Therefore, adjustments to goals and intermeeting intervals could potentially bolster and broaden intervention effects.

Finally, although the intervention provided a new socially supportive work structure for HCWs and exposed them to a range of protective tools and techniques, it did not alter job design, supervision, or organizational structures. In home care, such structures are typically most aligned to ensure quality care for CEs rather than to protect HCWs. Future cross-level interventions are encouraged that integrate systemic, environmental, and resource changes with supportive peer-led programs like COMPASS. Sustained multicomponent approaches may be needed to have a strong impact on important long-term outcomes such as improved physical health indicators, reduced health care utilization, or reduced workers' compensation claims.

Conclusions

Home care workers are exposed to unique demands and hazards without the benefit of typical safety and health support structures. This older and predominantly female workforce protects and serves society's most vulnerable citizens, yet they are rarely protected themselves. Results of the COMPASS randomized controlled trial support the efficacy of a peer-led group program for creating professional social support resources and improving a variety of important safety and health behaviors among HCWs. The group-based approach may be amenable to replication, adaptation, and dissemination, and thus could become an impactful component of many home care systems. Such interventions are greatly needed to protect this rapidly growing and socially important working population. AJPH

CONTRIBUTORS

All authors contributed to writing and editing the article, and read and approved the final content. R. Olson is the principal investigator and led the team in developing the intervention, carrying out the research, and preparing the article. S. V. Thompson contributed to intervention content development, data collection and validation, preparatory analyses, and the article plan. Co-investigators D. L. Elliot and J. A. Hess contributed to the design and content of the intervention, interpretation of findings, and overall plan and content of the article. K. N. Parker is a research associate on the project who contributed to the article plan, tables and figures, and coordination of article drafting and editing. K. Luther Rhoten, B. Wipfli, R. R. Wright, and A. Buckmaster were research staff members on the project who contributed to intervention content and design, data collection, data validation, and early versions of the article plan. K. M. Bettencourt is a research assistant on the project who contributed to table development and research literature reviews. M. Marino, statistical coinvestigator on the project, conducted the statistical analyses and prepared the Results section and tables.

ACKNOWLEDGMENTS

This research was supported with funding from the National Institute for Occupational Safety and Health (NIOSH) as part of the Oregon Healthy Workforce Center (U19OH010154), a NIOSH Center of Excellence in Total Worker Health.

We thank Nancy Perrin, PhD, and Thuan Nguyen, MD, PhD, for their guidance on the study design and power analyses in the original grant application. The "Fruits & Vegetables" and "Jeopardy" activities in the first session of COMPASS workbook 1 were developed by Diane Elliot, MD, FACSM, Kerry Keuhl, MD, DrPH, and Linn Goldberg, MD, FACSM, Division of Health Promotion and Sports Medicine, OHSU. Autumn Graves, Natasha Gulati, Afsara Haque, Colleen Hunter, Melanie Koren, Veronika Larova, Faith Raspante, and Jacob Wilhite all contributed to data collection or data entry and validation. We thank Helen Moss from the Labor Education and Research Center at the University of Oregon for providing group facilitation training for team leaders. We are particularly grateful to leaders at our partner organizations, the Oregon Home Care Commission (Leslie Houston, Cheryl Miller, Joseph Lowe, Kelly Rosenau, and the full Training Committee) and the Service Employees International Union Local 503 (Jereme Grzybowski), for their longstanding commitment to the success of the research and to advancing the well-being of Oregon's home care workers. And finally, we thank the home care workers who volunteered and invested their very personal time and effort to care for themselves, their consumer–employers, and other caregivers, as well as to advance knowledge about protective and supportive programs for the industry.

The study is registered at clinicaltrials.gov (NCT02113371).

HUMAN PARTICIPANT PROTECTION

The study protocol was reviewed and approved by the human participants institutional review board at OHSU.

REFERENCES

1. Ortman JM, Velkoff VA, Hogan H. An aging nation: the older population in the United States. *Current Population Reports*. 2014;P25-1140:1–28.

2. US Department of Labor, Bureau of Labor Statistics. Occupational outlook handbook, 2014–2015 edition. Available at: http://www.bls.gov/ooh. Accessed April 3, 2014.

3. Markkanen P, Quinn M, Galligan C, Sama S, Brouillete N, Okyere D. Characterizing the nature of home care work and occupational hazards: a developmental intervention study. *Am J Ind Med*. 2014; 57(4):445–457.

4. US Department of Labor, Bureau of Labor Statistics. Number, incidence rate, and median days away from work for nonfatal occupational injuries and illnesses involving days away from work by summary occupational groups and ownership. 2014. Available at: http://www.bls.gov/news.release/osh2.t03.htm. Accessed March 19, 2015.

5. Denton MA, Zeytinoğlu IU, Davies S. Working in clients' homes: the impact on the mental health and well-being of visiting home care workers. *Home Health Care Serv Q*. 2002;21(1):1–27.

6. Schill AL, Chosewood LC. Total Worker Health®: more implications for the occupational health nurse. *Workplace Health Saf*. 2016;64(1):4–5.

7. Pohjonen T, Ranta R. Effects of worksite physical exercise intervention on physical fitness, perceived health status, and work ability among home care workers: five-year follow-up. *Prev Med*. 2001;32(6):465–475.

8. Horneij E, Hemborg B, Jenson I, Ekdahl C. No significant differences between intervention programmes on neck, shoulder, and low back pain: a prospective randomized study among home-care personnel. *J Rehabil Med*. 2001;33(4):170–176.

9. Department of Health and Human Services, National Institute for Occupational Safety and Health. Occupational hazards in home healthcare. NIOSH hazard review. 2010. DHHS (NIOSH) Publication No. 2010–125:1–51.

10. National Institute for Occupational Safety and Health. Caring for yourself while caring for others. Cincinnati, OH: Department of Health and Human Services, Centers for Disease Control, and Prevention; 2014. DHHS (NIOSH) Publication No. 2015-103.

11. National Institute for Occupational Safety and Health. Caring for yourself while caring for others: training for homecare workers. 2014. DHHS (NIOSH) Publication Number 2015-102. Available at: http://www.cdc.gov/niosh/docs/2015-102. Accessed March 3, 2016.

12. Lowell Center for Sustainable Production. Resources developed by safe home care project. Available at: http://www.sustainableproduction.org/ResourcesSafeHCProject.php. Accessed May 25, 2016.

13. Pinquart M, Sorensen S. Helping caregivers of persons with dementia: which interventions work and how large are their effects. *Int Psychogeriatr*. 2006;18(4): 577–595.

14. Chien LY, Chu H, Guo JL, et al. Caregiver support groups in patients with dementia: a meta-analysis. *Int J Geriatr Psychiatry*. 2011;26(10):1089–1098.

15. Toseland RW. Long-term effectiveness of peer-led and professionally led support groups for caregivers. *Soc Serv Rev*. 1990;64(2):308–327.

16. Wenger-Trayner E, Wenger-Trayner B. Communities of practice: a brief introduction. 2015. Available at: http://wenger-trayner.com/wp-content/uploads/2015/04/07-Brief-introduction-to-communities-of-practice.pdf. Accessed February 23, 2016.

17. Delbecq J, DeSchryver Mueller C. The Ignatian Faculty Forum: a transformative faculty formation program. *Connections*. 2012;12(7):5–9.

18. Elliot DL, Goldberg L, Kuehl KS, Moe EL, Breger RKR, Pickering MA. The PHLAME (Promoting Healthy Lifestyles: Alternative Models' Effects) firefighter study: outcomes of two models of behavior change. *J Occup Environ Med*. 2007;49(2):204–213.

19. Goldberg L, Elliot DL, Clarke GN, et al. The Adolescents Training and Learning to Avoid Steroids (ATLAS) prevention program: background and results of a model intervention. *Arch Pediatr Adolesc Med*. 1996; 150(7):713–721.

20. Elliot DL, Goldberg L, Moe EL, DeFrancesco CL, Durham MB, Hix-Small H. Preventing substance use and disordered eating: initial outcomes of the ATHENA (Athletes Targeting Healthy Exercise & Nutrition Alternatives) program. *Arch Pediatr Adolesc Med*. 2004; 158(11):1043–1049.

21. Kuehl KS, Elliot DL, Goldberg L, et al. The safety and health improvement: enhancing law enforcement departments study: feasibility and findings. *Front Public Health*. 2014;2:38.

22. Olson R, Winchester J. Behavioral self-monitoring of safety and productivity in the workplace: a methodological primer and quantitative literature review. *J Organ Behav Manag*. 2008;28:9–75.

23. Olson R, Elliot D, Hess J, et al. The COMmunity of Practice And Safety Support (COMPASS) Total Worker Health™ study among home care workers: study protocol for a randomized controlled trial. *Trials*. 2014;15:411.

24. Olson R, Wright RR, Elliot DL, et al. The COMPASS pilot study: a Total Worker Health intervention for home care workers. *J Occup Environ Med*. 2015;57(4):406–416.

25. Olson R, Anger KW, Elliot DL, Wipfli B, Gray M. A new health promotion model for lone workers: results of the SHIFT pilot study (Safety & Health Involvement for Truckers). *J Occup Environ Med*. 2009;51(11): 1233–1246.

26. Cadiz D, Sawyer JE, Griffith TL. Developing and validating field measurement scales for absorptive capacity and experienced community of practice. *Educ Psychol Meas*. 2009;69:1035–1058.

27. Ware J, Kosinski M, Keller SD. A 12-item short-form health survey: construction of scales and preliminary tests of reliability. *Med Care*. 1996;34(3):220–233.

28. Thompson FE, Subar AF, Smith AF, et al. Fruit and vegetable assessment: performance of 2 new short instruments and a food frequency questionnaire. *J Am Diet Assoc*. 2002;102(12):1764–1772.

29. Buxton OM, Quintilliani LM, Yang MH, et al. Association of sleep adequacy with more healthful food choices and positive workplace experiences among motor freight workers. *Am J Public Health*. 2009;99(suppl 3): S636–S643.

30. Westra BL, Cullen L, Brody D, Jump P, Geanon L, Milad E. Development of the home care client satisfaction instrument. *Public Health Nurs*. 1995;12(6): 393–399.

31. Wright RR, Mohr CD, Sinclair RR. Conflict on the treatment floor: an investigation of interpersonal conflict experienced by nurses. *J Res Nurs*. 2014;19(1):26–37.

32. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav*. 1983;24(4): 385–396.

33. Dennerlein JT, Hopcia K, Sembajwe G, et al. Ergonomic practices within patient care units are associated with musculoskeletal pain and limitations. *Am J Ind Med*. 2012;55(2):107–116.

34. American Thoracic Society. ATS statement: guidelines for the six-minute walk test. ATS committee on proficiency standards for clinical pulmonary function laboratories. *Am J Respir Crit Care Med*. 2002;166(1): 111–117.

35. Eldridge S, Kerry SM. *A Practical Guide to Cluster Randomised Trials in Health Services Research*. Chichester, UK: John Wiley and Sons; 2012.

36. Feingold A. Effect sizes for growth modeling analysis for controlled clinical trials in the same metric as for classical analysis. *Psychol Methods*. 2009;14(1):43–53.

37. Rothman KJ. No adjustments are needed for multiple comparisons. *Epidemiology*. 1990;1(1):43–46.

38. Cohen J. *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates; 1988.

39. Lesser EL, Storck J. Communities of practice and organizational performance. *IBM Syst J*. 2001;40(4):831.