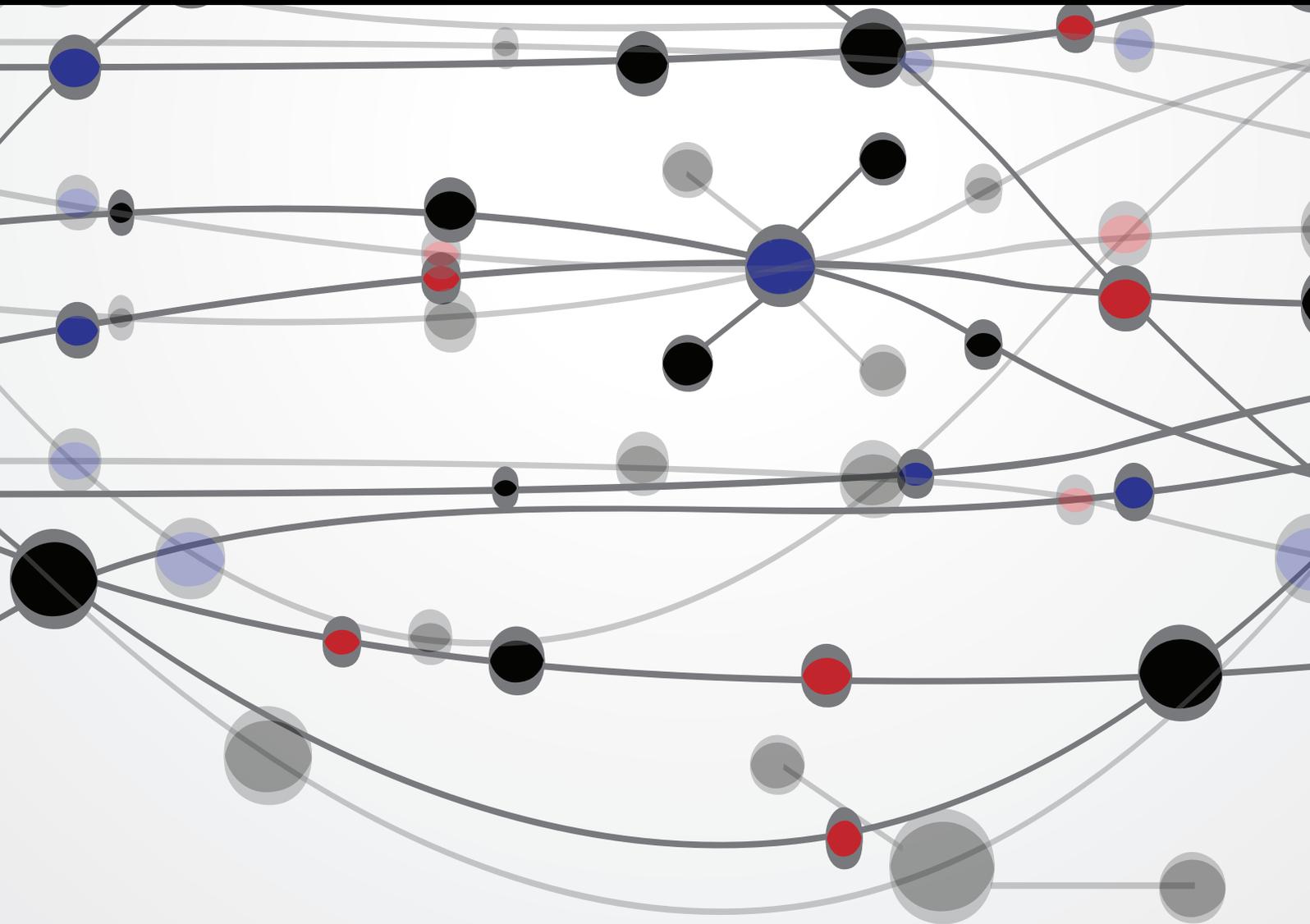


Workplace Health Promotion and Wellbeing

Guest Editors: Lars L. Andersen, Karin I. Proper, Laura Punnett, Richard Wynne, Roger Persson, and Noortje Wiezer





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Editorial

Workplace Health Promotion and Wellbeing

**Lars L. Andersen,^{1,2} Karin I. Proper,^{3,4} Laura Punnett,⁵ Richard Wynne,⁶
Roger Persson,⁷ and Noortje Wiezer⁸**

¹National Research Centre for the Working Environment, 2100 Copenhagen, Denmark

²Physical Activity and Human Performance group, SMI, Department of Health Science and Technology, Aalborg University, 9220 Aalborg, Denmark

³National Institute for Public Health and the Environment, P.O. Box 1, 3720 BA Bilthoven, Netherlands

⁴VU University Medical Center, 1081 BT Amsterdam, Netherlands

⁵University of Massachusetts Lowell, Lowell, MA 01854, USA

⁶Work Research Centre, Dublin, Ireland

⁷Department of Psychology, Lund University, Box 213, 221 00 Lund, Sweden

⁸Netherlands Organisation for Applied Scientific Research (TNO), Delft, Netherlands

Correspondence should be addressed to Lars L. Andersen; lla@nrcwe.dk

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For most humans work is an important fact of life and something that is necessary for survival and individual wellbeing. However, the circumstances under which we work may vary considerably and are, in part, contingent on geographical location, governmental regulations, design of social welfare systems, production systems, and human resource management strategies. In many industrialized countries, demographic developments entailing an ageing workforce increase the importance of developing sustainable employments.

A healthy, safe, and productive working life is the essence of the European Agency for Safety and Health at Work's goal for employees in a modern and sustainable workplace. The goal may be obtained by ensuring the employees' wellbeing at workplaces through improvement of the working environment and through different types of health promotion initiatives at the workplace. The World Health Organization (WHO) emphasizes the workplace as a priority setting for promotion of health and wellbeing, including provision of a safe and healthy physical and psychosocial work environment. In the United States, the Total Worker Health program of NIOSH has a similar mission and emphasizes that health promotion requires compliance with health and safety regulations and protection of workers' rights as a foundation.

Workplace health promotion is the combined efforts of employers, employees, and society to improve the health and wellbeing of workers. This entails programs not only to encourage individual behavior change, but also to reduce stressors in the workplace that have "take-home" negative effects on health behaviors. However, many barriers exist for successfully developing, implementing, and evaluating health promotion and wellbeing initiatives at the workplace. For instance, small enterprises may not have the same infrastructure to support health promotion as larger companies. Some companies may lack time or knowledge to initiate and sustain meaningful health promotion initiatives. Thus, research is needed on how to develop, implement, and evaluate health promotion and wellbeing initiatives in different settings and for different groups of workers.

In this special issue, a wide array of topics on workplace health promotion and employees' wellbeing is described. The topics include (1) alternate ways to consider the value of workplace health promotion, (2) the local context needed for developing healthy workplaces, (3) the impact of participatory interventions on wellbeing at work, (4) the importance of reducing workplace stressors alongside introducing workplace health promotion, (5) strategies that supervisors use to prevent sickness absence among employees with

musculoskeletal disorders, (6) motivation and barriers for workplace health promotion with physical exercise, and (7) the impact of organizational health climate on workers wellbeing.

The contributing authors' efforts have helped to make this special issue appeal to a diverse audience of researchers and illustrate well the diverse and multifaceted challenges that need to be tackled in order to make a difference. We are delighted to see the outcome of the special issue and hope that it will inspire and stimulate further research in this area.

Acknowledgment

The editors of this special issue are indebted to all the authors who provided either original data or a review of the previous and recent literature.

*Lars L. Andersen
Karin I. Proper
Laura Punnett
Richard Wynne
Roger Persson
Noortje Wiezer*

Research Article

When Intervention Meets Organisation, a Qualitative Study of Motivation and Barriers to Physical Exercise at the Workplace

Thomas Viskum Gjelstrup Bredahl,¹ Charlotte Ahlgren Særvoll,²
Lasse Kirkelund,² Gisela Sjøgaard,¹ and Lars Louis Andersen²

¹Institute of Sports Science and Clinical Biomechanics, University of Southern Denmark, Campusvej 55, 5230 Odense M, Denmark

²National Research Centre for the Working Environment, Lersø Parkallé 105, 2100 København Ø, Denmark

Correspondence should be addressed to Thomas Viskum Gjelstrup Bredahl; tbredahl@health.sdu.dk

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Objective. To provide a comprehensive understanding of the motivational factors and barriers that are important for compliance with high-intensity workplace physical exercise that is aimed at reducing musculoskeletal disorders. *Method.* The present study, which used semiductive, thematic, and structured in-depth interviews, was nested in a 20-week cluster randomised controlled trial among office workers. Interviews were conducted with 18 informants with diverse fields of sedentary office work who participated in strength training at the workplace for 20 minutes, three times per week. Organisational, implementational, and individual motives and barriers were explored. *Results & Discussion.* The results show that attention should be given to the interaction between the management, the employees, and the intervention, as the main barrier to compliance was the internal working culture. The results emphasised the need for a clear connection between the management's implementational intentions and the actual implementation. The results emphasise the importance of ensuring the legitimacy of the intervention among managers, participants, and colleagues. Moreover, it is important to centrally organise, structure, and ensure flexibility in the working day to free time for participants to attend the intervention. Recommendations from this study suggest that a thorough intervention mapping process should be performed to analyse organisational and implementational factors before initiating workplace physical exercise training.

1. Introduction

Musculoskeletal disorders constitute a third or more of all registered occupational diseases [1, 2]. Back and neck pain are the most prevalent types of these musculoskeletal disorders and represent a major socioeconomic burden as a result of sickness absence compensation, disability pensions, and health services, among other factors [3]. Repetitive work, for example, computer use, is associated with such musculoskeletal disorders and pain [4, 5], and it can cause poor work ability [6] and sickness absences [3, 7–9].

Physical exercise is a cornerstone of health and wellbeing [10–12], and several studies provide solid evidence that targeted physical exercise is efficient in managing musculoskeletal pain that occurs in a work-related context [13–15]. Because a majority of adults spend many hours each week at

work, the workplace, in contrast to population based physical activity interventions, offers a potential effective arena for targeting the adult population in general but also workers with musculoskeletal disorders, or other life style diseases. However, even if interventions are offered as a part of work, compliance with physical exercise can be challenging for employees. Studies show that, at best, there is moderate compliance with workplace physical exercise [15–17]. To improve workplace health promotion strategies, it is important to consider and act upon the factors that are associated with low compliance. A study of compliance to a workplace intervention showed that individual factors, such as self-efficacy [18], may not fully explain the low to moderate compliance with workplace interventions [19]. This is supported by research showing that individual psychological factors only partially explain adherence to physical activity [20, 21]. These

and other studies emphasise and support social, cultural, and environmental factors as important for adherence to health behaviour [12, 20–22]. Furthermore, studies emphasise the psychosocial work environment, social relations, the workplace organisational structure, and the design of the intervention as important for the initiation of and compliance with interventions [19, 20, 22–25].

A cluster randomised study in Denmark (VIMS) [17, 26], in which this qualitative study was nested, showed the positive effect of high-intensity strength training in reducing musculoskeletal pain in the shoulder and neck region in participants who were regularly compliant. To increase compliance, the researchers in this study attempted to motivate participants as a part of the intervention. The motivational focus of this study was the participants' work environment (see Section 3 for further description of the VIMS intervention) [26].

The study showed that strength training had a clinically significant positive effect on pain reduction in the neck, shoulder, and lower back regions for those who were compliant to the protocol. However, the study also experienced a large dropout rate and many participants had low levels of compliance [17]. Regular compliance, which was defined as at least 20 minutes a week during the 20-week intervention, was only achieved by 56% of the participants [17].

Although the abovementioned study particularly focused on motivation and compliance in the intervention process, the level of compliance revealed that focusing upon these issues was not sufficient. The VIMS study's motivational efforts focused in general upon creating user-friendly training environments. The moderate effect on compliance despite an enhanced focus on these motivational factors in the VIMS study provided the necessity and basis for exploring if other motivational factors for exercise at the workplace were of greater influence than training environments for compliance. These motivational factors from VIMS are the basis for analysis in this study. In future interventions that involve high-intensity physical exercise in the workplace, to ensure compliance and to conduct more impactful physical exercise interventions, and thereby, to obtain the full effects, it is important to analyse the fundamental factors that increase compliance and the reasons for noncompliance and dropping out.

2. Aim

The aim of this study was to provide a comprehensive understanding of the factors that were important for compliance with physical exercise training in the workplace in the VIMS study. The present study, which used qualitative interviews, was nested in the VIMS study [17, 26] for the post hoc exploration of previous reports factors related to motivation and barriers by enrolling participants who had been randomised to an exercise intervention group. The object was to investigate the importance of (1) organisational factors (e.g., workplace culture, managers, and colleagues), (2) the implementational factors of the intervention (e.g., type of exercise and role of the exercise instructors), and (3) individual factors (e.g., motivation) as the VIMS participants' motivation for and barriers to compliance.

3. Materials and Methods

In the VIMS study [17, 26], in a sample of 573 office-working participants, 476 participants were randomised to weekly physical activity in the workplace and 97 participants to a control group. All of the participants gave their written informed consent to participate in this study, which conformed to the Declaration of Helsinki and was approved by the local ethical committee (HC2008103). The 476 participants were cluster randomised into four training-groups that performed the same amount of exercise and repetitions per week, that is, an equal training volume, for a total of one hour per week for 20 weeks during working hours. The first group (1WS) trained for one hour, once a week, the second group (3WS) trained 20 minutes, three times a week, and the third group (9WS) trained seven minutes, nine times a week. Group 4 (3MS) followed the same program as the second group but received supervision only during the initial week. The intervention group performed specific strength training with five different dumbbell exercises for the neck, shoulder, and forearm muscles. The exercises were basic, simple, and designed to be possible to perform for both beginners and more routine exercisers. The exercises were front raise, lateral raise, reverse flies, shrugs, and wrist extension. For more information and illustrations see Andersen et al. [26]. To enhance motivation, the training facilities were placed close to offices to reduce transportation time. Efforts were made to make the facilities appealing through the use of, for example, bright colours, windows, fresh air, and instruction posters. The instructors of the three groups were present at least 50% of the training sessions and focused on positive and qualified training feedback to maintain and enhance motivation and to increase the effect of the intervention. The intervention group filled out a training diary for each session. Furthermore, they answered an e-mail-based questionnaire that included validated scales, for example, the International Physical Activity Questionnaire (IPAQ) [27, 28], Self-efficacy [29, 30], Stages of Change [30, 31], self-reported compliance, pain, and motivational issues. For example, pain was measured by a VAS scale that ranged from 0 to 10. Participants' physical capacity was tested at the baseline, after ten weeks and at a follow-up. The VIMS program was launched 12 months prior to this study. For more information, see [26].

3.1. Sampling. We conducted semiductive, thematic [32], and structured in-depth interviews with 18 informants selected from the study population of the original VIMS study [17, 26]. The informants came from six different workplaces that were situated in six different geographical areas in Denmark [33, 34]. Because former studies had used a 3WS group as the typical method to organise a workplace exercise intervention regarding its intensity, volume, and time schedule, a subsample of participants from this group was selected [17, 35, 36]. Analysis of sociodemographic factors, BMI, and pain measures showed no differences between the 3WS, 1WS, 9WS, 3MS, and reference groups [17, 37]. Within one week after the intervention was completed, the informants were contacted at work by telephone by one of three members of the VIMS research group and were invited to participate in

TABLE 1: Demographics and musculoskeletal pain intensity of the informants in the qualitative study.

	3WS (subsample)		3WS		1WS		9WS		3MS		REF	
Females, %	71%		69%		62%		56%		58%		58%	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age	44.6	(9.2)	46	(10)	47	(10)	45	(10)	45	(11)	46	(10)
BMI	24.2	(4)	24.7	(4.3)	25.2	(4.0)	25.3	(3.7)	25.6	(3.8)	26.0	(4.5)
Neck pain last 3 months	2.5	(2.5)	3.1	(2.4)	3.3	(2.3)	3.1	(2.3)	3.2	(2.4)	3.2	(2.3)
Right shoulder pain last 3 months	2.2	(2.1)	2.3	(2.4)	2.2	(2.3)	1.9	(2.2)	2.0	(2.4)	2.0	(2.4)

TABLE 2: Examples of working questions that were a base for the thematic exploration.

Main categories	Examples of working questions
Organisational perspectives	How did your managers influence your participation? How did your working rhythm influence your participation? How did your colleagues influence your participation?
Implementational perspectives	What influence did the instructor have on your participation? Did you consciously choose to exercise with or without an instructor? How could the instructors improve their performance?
Individual perspectives	Why did you participate in the intervention? Why did you comply with the exercise? What barriers did you experience that affected your participation? Why did you feel like you did not have the time to exercise? How do you think the physical activity in the workplace could have been implemented?

an interview. Information-rich individuals, who were willing and able to express their emotions and attitudes regarding the intervention, were selected (purposeful sampling) [38]. In all, ten regularly compliant and ten noncompliant informants were chosen for the subsample. The number of informants was estimated to be sufficient to reach data saturation. We defined a regularly compliant participant as a participant who participated in both the baseline and the ten-week testing of physical capacity. A noncompliant participant either dropped out of the VIMS project altogether by e-mail or telephone call to the support hotline, or, according to their weekly training diaries, ceased training between weeks four and eight of the intervention. Two noncompliant informants dropped out before being interviewed, which resulted in 18 informants. It was estimated that interviewing the number of included informants could result in data saturation, so there was no further inclusion. The informants were informed about the overall aim, design, and voluntariness of the interview study and that it was possible to withdraw from the study at any time. All interviews took place in the informants' workplace during work hours, not later than three weeks after intervention. Table 1 shows the basic demographics and musculoskeletal pain intensity of the study participants for the subsample, as well as for the whole study population. For further information about the study group (e.g., demographics and compliance to intervention), see [17, 37].

3.2. *Interview Guide.* Questioning was purposefully and thematically designed [32] to elicit responses in organisational,

implementational, and individual categories. These main thematic categories were chosen in advance on the basis of former studies that had elucidated these areas as relevant for further exploration [19, 20, 22–25, 39]. On the basis of the main categories, the interview guide was divided into specific themes concerning organisational factors (e.g., workplace culture, managers, and colleagues), implementational factors (e.g., type of exercise and the instructor's role), and individual factors (e.g., motivation, barriers and expectations). To explore each theme in more depth, we phrased specific questions to work as a base for the thematic exploration (e.g., see Table 2) [34]. See Appendix 1 in Supplementary Material available online at <http://dx.doi.org/10.1155/2015/518561> for the interview guide.

The interview guide was developed by the first, second, and third authors of this paper. Agreement on the main categories and working questions was reached by consulting the literature, discussing the specific organisational structure of the workplace, and the specific implemental elements of the intervention. Three of the authors (BTVG, SCA, and KL) conducted all of the interviews and none of the informants had any preknowledge of these interviewers. The interviews were digitally recorded and the average duration of the interviews was 30 to 45 minutes.

3.3. *Transcribing, Condensation, and Coding.* All of the interviews were transcribed ad verbatim using an adapted transcription guideline [34, 40] and QSR Nvivo version 8.0 was used for the analysis of the 18 transcriptions.

TABLE 3: Node tree of the coding. Not all subcategories were used for this study.

Main categories	Subcategories
Organisational perspectives	Reasons for compliance
	Motivation from colleagues
	Colleagues as barriers
	Work facilitates participation
	Obligation, conscience
	Organisational barriers
Implementational perspectives	Time/priority
	Reasons for compliance
	Organisation of the exercise
	Organisation of the exercise rooms
	Intrinsic value of the exercise form
	The role of the instructor
	The instructor as a motivation
	The instructor as a barrier
The VIMS intervention as inspiration for private exercise	
Individual perspectives	Expectations for participation in VIMS
	Meet expectations
	Personal changes
	Reasons for compliance
	Obligation, conscience
	External motivation
	Time/priority
	The VIMS intervention as inspiration for private exercise
Attitudes towards/recommendations for exercise at the work place	

Coding upon transcription followed a node tree related to the three main categories (organisational factors, implementational factors, and individual factors) and explored both motivational factors and barriers (Table 3). The organisational factor category included colleagues, organisation of work, and priority of time. The implementational category included the specific training, exercise instructor, and inspiration for physical activity within and after working hours. The individual factor category included reasons to participate, expectations, reasons for compliance, commitment, and feelings of guilt (see node tree in Table 3 for examples).

Analyst triangulation was used to increase interrater reliability. Initially, the first and third authors attained consensus on the procedure for the coding of the data and the node tree to limit bias [33, 41, 42]. The first and third authors coded one interview jointly. During this process, agreement on the content of the node tree categories was attained. The coding was performed deductively as a purposeful thematic analysis following the three main categories [32]. The second author did all of the consecutive coding of the interviews with a subsequent validation by the first author. The validation consisted of the first author reading through interviews and

the categorical coding. If the first author disagreed with the coding, the discrepancies were discussed with the third author until a consensus was reached. Finally, essential meaning, supported by anecdotal evidence, was extracted by meaning condensation [43].

4. Results

The results from the qualitative interviews are presented in thematic order in the following sections: (1) organisational perspectives, (2) implementational perspectives, and (3) individual perspectives. See Table 4 for a conceptual map of the main categories, subcategories, and themes.

4.1. Organisational Perspectives. The first object of this study was to analyse how the informants perceived the organisational factors and how this perception influenced their motivation and barriers to compliance.

4.1.1. Motivation

(1) Support from Leading Authorities. Most informants reported that the organisation had a great influence upon their participation in the intervention and their compliance to accomplish the specific exercises. One of the most important motivating factors experienced by a majority of informants was the acceptance of participation from leading authorities in the company, which gave legitimacy to participation in the intervention. By the leading authorities showing interest in the results and process and thus legitimizing the intervention through meetings and information, these informants felt that their participation was accepted. This acceptance improved informants' motivation for participation in the intervention.

Regarding the intervention, we received information from the managers by e-mail. It is good to be encouraged to participate. Then, you know that the managers are interested in the results as well (female, 37 years, compliant).

(2) Flexibility in the Job Planning. In general the employees at the workplace have very different flexibility in job planning making it easy for some and difficult for others to participate in the intervention. Informants indicating more flexibility in job planning state that this flexibility keeps them motivated and makes it possible for them to exercise 20 minutes a day during working hours. Furthermore, the structure of the intervention with three times 20 minutes of exercise makes it possible for those informants to schedule the exercise within an ordinary working day.

Well, it is because it is three times, 20 minutes a week. It is easy to find 20 minutes during a working day (female, 52 years, noncompliant).

(3) Colleagues. In general, a large part of the informants experienced a social change in the workplace after exercising because they met colleagues who were not a part of their daily

TABLE 4: Conceptual map of main categories, subcategories, and themes in the results section.

Main categories	Subcategories	Themes
Organisational perspectives	Motivation	(i) Support from leading authorities (ii) Flexibility in the job planning (iii) Colleagues
	Barriers	(i) Flexibility in the job planning (ii) Guilty conscience (iii) Colleagues
Implementational perspectives	Motivation	(i) Reducing physical deterioration and being part of a research project (ii) Using VIMS exercises as inspiration (iii) Introduction of correct techniques of exercises and enthusiasm of the instructor
	Barriers	(i) Misunderstood exercise schedule and inflexible intervention content (ii) No inspiration, monotony, and attention (iii) Competence and behaviour of the instructor
Individual perspectives	Informants recommendations for future workplace physical activity interventions	(i) Pain, positive changes, and social activities
		(i) Structure, management, and colleagues

working routines. This common frame of reference gave them something other than work to talk about and increased the social interface, which enhanced daily communication within the exercise group. Some informants described exercising with colleagues as a very important factor for their compliance. They reminded each other of the exercise bouts and, for this group, the small talk and laughter during exercise were the most important reason for compliance. The results indicate that social interaction between colleagues is important for compliance to the intervention but also to the social environment at the workplace in general.

Those times during exercise where others attended, I met people and got to know them in a different way. You say hello in a different way when you have been lifting weights together. The social aspect is also what I like about this. I find it great to go to the exercise room and meet people I know, but never have an opportunity to talk to during working hours. It is great to have the exercise in common, I think. Maybe this was one of the main reasons for my participation (female, 47 years, compliant).

4.1.2. Barriers

(1) *Flexibility in the Job Planning.* In the same way as structure and flexibility in the job planning could be a possibility and a motivating factor for some informants, other informants indicated that lack of flexibility in the structure of their work was a major barrier. Moreover, approximately half of the informants had work tasks (e.g., meetings and teaching)

outside of the workplace, and this absence from the workplace reduced flexibility and possibility to exercise and thereby introduced barriers to exercising.

In addition, barriers such as busyness, urgent tasks, deadlines, and unpredictability in the job (tasks that must be solved immediately, from hour-to-hour or day to day) were by some informants mentioned as barriers. These informants had the feeling that they were expected to make up for lost time after exercising and mentioned feeling stressed while exercising because job tasks were accumulating. The informants emphasised that, in many cases, they prioritised work to avoid getting too far behind.

It is a barrier because we always have tasks waiting. There are always people knocking on your door, calling or asking questions. It is very difficult to “get away” from the office to do other things, to say: “Now, it is time to exercise”. There should be some big bells that call out to everybody, saying, “Now, it is time to do your exercises”, and then, it maybe would be easier (male, 53 years, noncompliant).

As a consequence, when they chose to exercise, they hurried through the program in order to return to work. This did, in some cases, result in inadequate warm-ups and the incorrect execution of exercises, which sometimes resulted in inappropriate soreness. This pattern of action led, in some cases, to low compliance or dropping out.

Maybe this has been the largest barrier. I have been a part of the group exercising three times 20 minutes a week, and sometimes, we did not take

time to warm up properly. Then, you can feel a bit sore afterwards if you did not warm up before or stretch afterwards (female, 37 years, compliant).

(2) *Guilty Conscience.* In opposition to the majority of informants experiencing their management as supportive other informants experienced a guilty conscience towards their employer when they exercised. The feeling of a wrong prioritisation was a major barrier for them. This often resulted in choosing work over exercise. They had the perception, as an implicit part of their working culture, that they must choose work before everything else. When these informants did not exercise because they prioritised work, they described having a guilty conscience towards the intervention and feeling guilty for not exercising after they had volunteered.

Well, there is a need for some kind of change, an attitude change for people within these rigid systems, that it is acceptable, completely acceptable, to spend 20 minutes, three times a week, to prevent injuries. Maybe this is the real barrier. Sometimes, I had a really guilty conscience because I really could not find the time (female, 52 years, non-compliant).

(3) *Colleagues.* Even though a large part of the informants found their colleagues motivating for the participation in the intervention, some informants also mentioned their colleagues as barriers. This relates to colleagues within as well as outside of the intervention group. These informants felt that having colleagues who were not part of the intervention put pressure upon them to keep working instead of exercising during working hours. This also relates to existing work culture as described above.

A few informants also stated that performing exercises and being sweaty in a public place at work were a barrier. Exercise facilities situated near areas that were heavily populated by colleagues (e.g., entrance and lunch room) were also expressed as barriers because there were colleagues who were watching.

Some informants stated that when a regular training partner ended the intervention, for example, due to busyness, holidays, or new a job, this was a major barrier that, in some cases, resulted in the other training partner dropping out as well.

You do not want to stand near the entrance performing exercises when everybody else leaves. You get a lot of attention and remarks from colleagues who were passing by and were not part of the intervention. Sometimes I think: "Now, it is the time when people leave work", then I do not want to exercise in front of everybody (male, 53 years, noncompliant).

4.2. Implementational Perspectives. The second object of this study was to analyse how the informants perceived the implementation of the intervention and how this perception influenced their motivation, barriers, and compliance.

4.2.1. Motivation

(1) *Reducing Physical Deterioration and Being Part of a Research Project.* As the VIMS intervention was a high-intensity physical exercise intervention that focused on exercises for the neck and shoulders, the informants were fully informed about the specific aim of the exercises. The information from the research group concerning the effect of the exercises motivated some informants to be compliant to the intervention. Other informants felt motivated to perform the efficient exercises because they felt they were able to reduce the physical deterioration inflicted by their job. For other informants, it was motivating to be part of a research project. They felt favourably towards the possibility of helping researchers to prevent future work-related injuries, and due to this, they delivered continuous and stable engagement. The informants emphasised that the weekly e-mail from the research team that was aimed at the awareness of pain and participation in the intervention helped them to keep their focus upon the intervention.

"I would not say that it was fun, because you were not able to do any important stuff meanwhile. But it helps to keep the body in shape. It is necessary and it is what I have been doing too little of for all the years I have had sedentary work" (male, 53 years, noncompliant).

The flexibility of the intervention design was also described by some of the informants as motivating because they were allowed to do the exercises whenever they could find time during their working day.

(2) *Using VIMS Exercises as Inspiration.* Informants, who enjoyed the strength training in the intervention, saw VIMS as a chance to become stronger, while obtaining a visible result at the same time. These informants stated that they were inspired to do additional and various kinds of physical activities as a result of being a part of VIMS. A few informants who already engaged in strength training before the VIMS intervention stated that they implemented the new VIMS exercises in their own strength training programs.

"I like that, and I also like to see, at the end, some muscles that I did not have before. In that sense, it is a nice visible result. I can also feel in my daily life activities that I am stronger. I like that very much" (female, 37 years, compliant).

Some of the informants became motivated to engage in more physical activity. An informant described how he and his colleague hoped to continue the VIMS program once a week in the gym at the workplace. Another informant began to exercise with her whole family in the local fitness centre.

I feel more motivated to participate in activities such as training and running in the fitness centre; activities that I actually dislike (female, 33 years, compliant).

We all started in the local fitness centre. We do strength training and it has helped me a lot. I do

not have back pain anymore (female, 45 years, compliant).

In general, the informants who were compliant were optimistic about continuing VIMS inside or outside the workplace after the intervention period. They hoped to combine VIMS exercises with other exercises. These informants experienced an increased awareness concerning VIMS exercises when they performed activities such as, for example, weight lifting, body pump, or even gardening, because they used the same muscle groups as those used in the VIMS.

It (the VIMS exercises) is included in other activities that you do, like gardening or something in which you use—or feel that you use—the same muscles (male, 53 years, noncompliant).

(3) *Introduction of Correct Techniques of Exercises and Enthusiasm of the Instructor.* The role of the intervention instructors was very important for the informants in VIMS. The majority of the informants agreed upon the importance of the instructors' initial introduction to the different exercises. These informants especially mentioned the importance of the instructors' introduction and coaching of the correct techniques for the exercises for their motivation. Furthermore, they expressed that feeling confident about the instructors' competence level influenced their motivation positively. During the intervention, the majority of the informants also found that the instructors' behaviour was motivating. Moreover, the instructors made them feel more secure due to their energy and enthusiasm when the informants participated, their guidance in the correct lifting techniques, or their adjustments to enhancing training efficiency. These informants also found it helpful to be able to ask the instructors other health-related questions concerning, for example, general physical activity and problems related to tension in their neck muscles.

4.2.2. Barriers

(1) *Misunderstood Exercise Schedule and Inflexible Intervention Content.* A misunderstood perception by some of the informants that they had to follow a specific exercise schedule at specific times during the week was stated to be a barrier to compliance, and as a consequence, their compliance with the intervention, test, and retest was low. Moreover, approximately a quarter of the informants did not experience the VIMS design as being flexible, and they said that they were not aware of being allowed to exercise if the instructor was not present, which effected their compliance negatively.

(2) *No Inspiration, Monotony, and Attention.* In contrast to the issues discussed in the motivation section, other informants also argued that the intervention did not influence their efforts or motivation to become more physically active in general. Moreover, the majority of the informants who were already physically active did not feel inspired to become more active.

Those informants not motivated by doing strength training mentioned other several barriers that arose from the implementation and the type of exercises in the intervention. These informants found strength-training exercises to be boring and they felt that fun aspects were missing during the training. The simple program, which only included five different exercises, was experienced as a very significant barrier because of its monotony. The informants felt that variety and whole body training were missing. They felt that the VIMS exercises should be implemented as a part of a whole training session that should include other exercises as well.

But I think that if it is going to be implemented permanently, it needs more variety. I cannot tell what type of training it should be, but I know it will be boring and too predictable with only these five different exercises, and also it will be more acceptable to come up with excuses to skip the training (female, 47 years, compliant).

Some of the informants were dissatisfied with the progression of the training. They felt demotivated when they could not perceive continuous progression. Other informants also felt obliged to exercise three times a week and felt that if they were not able to do it, the intervention was meaningless, and therefore, they lost the motivation to exercise. A few of the informants also felt obliged to continue their progression in the program despite an injury, which, in some circumstances, led informants to drop out of the program.

Finally, primarily the noncompliant informants described the program as unprofessional and static. They argued that the intensity of the training was too low and that no attention was paid to the individual aspects. Other informants felt that they were left alone. In general, they missed the attention and appreciation for their participation, and, for instance, a reminder or other types of support if their level of participation was too low.

The only thing I wondered was (···) where were we relative to the project? When do we know something? I have no clue about how the participation rate is here. How many informants and so on? It would have been nice on a regular basis to get a feeling of—does the project still exist or not? Or do we just do something here all by ourselves? (male, 53 years, noncompliant).

(3) *Competence and Behaviour of the Instructor.* In contrast to the majority of informants, a small part of the informants perceived the instructor as a barrier to their exercise. Some instructors were perceived as being nonpedagogical, lazy, and uncaring in their approach.

These informants argued their frustration if the instructors did not agree upon the execution of the exercises; for example, one instructor corrected their lifting technique although another instructor had said it already was correct. In the end, pressure from an instructor led to the drop-out of one informant because the instructor did not take the informant's physical capacity into account when increasing load in the exercises.

Different instructors were not necessarily a bad thing. The important thing was for them to say the same things, agree upon the effort level and how to do the exercises (female, 42 years, compliant).

I dropped out simply because I felt I was not able to fulfill the demands of the instructor. He made it clear that if I could not do the exercises, maybe I was not suitable for the intervention. Even though I think I was not really bad, and surely, could have made progress if the weight had been increased slowly. But if I risked meeting an instructor later in the intervention telling me it was all wrong—I gave up, I must admit. I was angry and sad, and then I chose to quit (female, 52 years, noncompliant).

4.3. Individual Perspectives. In this section, which concerns individual factors, the focus is on describing the primary individual experiences with the intervention.

(1) Pain, Positive Changes, and Social Activities. In general, the informants described muscle pain as a primary individual motivation. A majority of the informants mentioned having various pain issues or seeing colleagues with pain as a motivation for participation. Pain in the neck and shoulder region, wrist, lower back, and head was mentioned as important. These informants hoped that the intervention would provide a future strategy to reduce and eliminate their pain issues. The majority of the compliant informants experienced reduced pain in their necks and shoulders and fewer headaches. An informant reported a rehabilitated wrist as a benefit from the intervention, and another reported a reduction in lower back pain.

It is because we are sitting so much, that we are experiencing back pain, all of us. I see a lot of colleagues having pain in their arms and shoulders, and sooner or later, it will be me (female, 45 years, compliant).

For some of the informants, the motivation for participation was free training, the hope to reduce the number of sick days and a reduction in expenses for physiotherapy and chiropractic care. Other informants also found it motivating and inspiring to leave work and engage in social activities with colleagues.

A majority of the compliant informants reported that they had experienced physical, psychological, and social changes during VIMS. The motivating factors that were mentioned included wanting to gain strength, better body posture, curiosity, learning new exercises, doing something good for oneself, feeling a “good conscience,” and having a “lightness” to the body. Furthermore, these informants reported having new experiences as a result of, for example, exercising to fatigue.

After the introduction to VIMS, I have this clear goal to experience measureable physical results with a small effort of time within the workday (female, 45 years, compliant).

4.3.1. Informants Recommendations for Future Workplace Physical Activity Interventions

(1) Structure, Management, and Colleagues. In general, the informants recognized that physical activity at the workplace had positive potential and that it was a very good idea. They acknowledged that it is difficult to be physically active after working hours. In general, they recommended that the physical activity should be implemented as a structured part of the workplace culture. The majority of informants emphasised the social aspect of physical activity as an important factor, and they found it beneficial to exercise with colleagues. Furthermore, the majority of informants stressed the importance of the participation of managers and directors to create the necessary legitimacy.

It would be great to have 30 or 45 minutes of exercise, including a shower. I think the time would be well spent. Especially if the directors and managers would be the first to leave their work to exercise and then announce—“Now it is time to exercise”—then, it surely would be possible to find the time to exercise (female, 37 years, compliant).

Some of the informants found it difficult to notify the managers of very heavy workloads, and at the same time, spend time exercising. Moreover, other informants found it problematic to be interrupted by exercise during their work tasks. In relation to this, the informants in general recommended that exercise should be scheduled in the morning or before the working day ends. They also recommended that the physical activity should be an active break during the day.

I think it is positive to be forced away from your tasks, to get a break and to do something physically active. Then, you get away from your screen and get some fresh air through the system. I really think it is positive (female, 52 years, noncompliant).

In relation to work, I think you are more relaxed and awake when you return to your seat, and possibly, also more effective (female, 42 years, noncompliant).

5. Discussion

This study explored the organisational and implementational issues in the high-intensity physical exercise program VIMS, which is concerned with musculoskeletal disorders [17, 26], because previous research had emphasised that, alone, it is insufficient to address individual factors for employees to adhere to high-intensity physical exercise at the workplace [18–21].

5.1. Organisational Perspectives. The main insight to be gained from this semiductive and thematic qualitative study was that a focus upon organisational factors within the workplace was decisive to attain high compliance, and

thereby, to achieve a more effective intervention. The results show that attention should especially be given to the interaction between the management of the workplace, the employees, and the intervention since the management is both seen as facilitating and a barrier. This is because a main barrier to compliance among some informants was the internal working culture in which managers and colleagues signaled low priority of physical exercise and the intervention, despite having initially approved of participation in the intervention. The results emphasised the need for a clear connection between the implementational intentions of the management and the actual implementation. To avoid noncompliance in relation to this, the results show that it is important to ensure the legitimacy of the intervention among the managers, participants, and colleagues. Moreover, there is a need to centrally organise, structure, and ensure flexibility for all employees during the working day to allow time for the participants to attend the intervention. These results are supported by studies showing that work pressure, task demands, and support are important prognostic factors for compliance with workplace physical exercise interventions [25, 39, 44]. One of these studies stresses the fact that failing to overcome these factors in order to exercise for 20 minutes, three times a week, may not be explained by work demands, but rather, as a negative reaction to perceived and signaled work demands by managers [25]. The same picture is seen in the present study, in which differences in perceptions of manager support and work load affected the informants' compliance.

These results are also supported by the results of another study that analysed a high-intensity physical exercise intervention among laboratory technicians [45]. The results from that study emphasise the type of work and routines in the laboratory as important factors for compliance. In that study, work tasks were scheduled ahead of time, which made it easier for the employees and their managers to plan their high-intensity physical exercise. Moreover, the laboratory technicians were a homogeneous group of workers with strong support from their managers in the organisation, which was shown to be an important factor for compliance [19, 45].

This was not the case for about half of the informants in the present study, who emphasised the following barriers: the lack of managerial support, an inability to plan work tasks, the acute accumulation of work, and a significantly varied work schedule outside of the workplace. The literature supports these findings by emphasising both the structural and functional aspects of social relations as important for behaviour [46]. Because the individual acts to gain acknowledgement and to attempt to comply with social norms and attitudes in order to be included within the social community, the norms and attitudes at the workplace are important factors for compliance [44, 47, 48].

Another main finding from the present study relates to colleagues in the workplace. The results emphasise that colleagues are motivating factors when they offer acceptance and a strong supportive network, but also, that they are barriers when they signal dissatisfaction with extra work pressure and discontentment from not participating in the intervention. Because a workplace intervention involves influence from colleagues, poor social relations among colleagues may

affect compliance negatively, whereas colleagues exercising together could emphasise compliance positively [25, 44, 49].

This is supported by the literature, which indicates that social relations are of the utmost importance in influencing behaviour, and therefore, also compliance to high-intensity workplace physical exercise [50]. This also stresses the fact that, in designing and implementing high-intensity workplace physical exercise interventions, it is important to consider specific workplace circumstances related to work organisation and management support, and the attitudes, norms, and work rhythms of colleagues, to enhance compliance [49, 51]. This could possibly be accomplished through a thorough intervention mapping process [52].

5.2. Implementational Perspectives. The way the intervention was implemented also seemed to play an important role in compliance. The results indicate that emphasis upon effective exercises in a scientific intervention was not enough. Informants highlight in general that varying, motivating, and entertaining exercises were important for compliance, and furthermore, for adherence over the long term. Therefore, a better compliance in this study could possibly have been accomplished if the exercises had been varied, rather than using the same exercises throughout the study. This would also have offered a better opportunity for the participants to implement the VIMS exercises in their own exercise programs. Moreover, a majority of the informants emphasise the importance of flexibility in the program, which, in case of flexibility in their working schedule as well, could make it possible for them to be self-determinant with regard to time and planning; this has been shown in the literature to be influential for motivation [53, 54].

The results also showed the instructors as key elements in the intervention. This is supported by other studies [17, 35, 55, 56]. Although a substudy of the VIMS intervention [26] showed that instructor supervision had no additional effect on pain reduction [37], the results of this qualitative study point out that if instructors are used in interventions, it is important to ensure that they have the same level of competence, give the same instructions and corrections, are able to take individual differences into account, and signal their presence during exercise sessions. Otherwise, the instructors can be barriers as well. This is supported by other studies, which also show that the instructor is important for compliance [20, 57–59]. The results also showed that the instructor provided an impression of safety and security; however, they also had the potential to generate a feeling of dependence in the participants, which could limit long-term adherence after the instructors leave the workplace when the intervention is completed [20]. The gap between an intervention and self-initiated physical activity is a common barrier in health interventions, and it should be taken into account in the design of workplace interventions [20, 60].

5.3. Individual Perspectives. Concerning individual factors, the results emphasised that a lot of informants were motivated by the anticipation of pain reduction and by being a part of a professional research intervention. This is supported

by, for example, the Health Belief Model, which emphasises risk reduction and outcome evaluation as facilitating the initiation of, inter alia, physical activity behaviour [61]. Transparency, through the provision of regular information and feedback from managers in the company and the research team, was also important for motivation for the majority of informants. Ongoing information and feedback were emphasised as important factors for the informants, both as a motivation, but also as a signal of legitimacy for colleagues who chose not to be a part of the intervention.

5.4. Methodological Issues. The results of this study should be considered as providing in-depth knowledge on specific and important motivational factors and barriers for high-intensity workplace physical interventions that are concerned with musculoskeletal disorders and should be seen within the scope of qualitative research and as inspiration for future studies. Despite a small number of informants, who, in some ways, could introduce sample selection bias and contradictory statements, valuable knowledge about compliance and adherence has been gained from these individuals. We acknowledge that another group of informants (e.g., one of the other three training groups in VIMS or from another workplace) may have perceived the VIMS intervention differently and, thus, could add to the understanding of motivation and compliance in a high-intensity workplace physical exercise intervention. However, we believe that this study emphasises fundamental issues that are concerned with participants' compliance with workplace interventions, which makes the results of this study relevant for future studies.

6. Conclusion

Participation in physical exercise at the workplace is very sensitive to how the workplace meets the intervention. The organisation or workplace in which the intervention takes place can be crucial for compliance with and the effects of the intervention. This is not only because of the lack of support of managers or motivation in the employees, but also due to practical barriers that are related to the organisation of the work (e.g., work time, place of work) and the implementation of the intervention (e.g., exercises, instructor) that prevent the employees' compliance, and sustained and steady participation in the intervention. Rather than considering individual factors, such as, for example, personal experience with physical activity, the results of this study show the importance of considering "how the intervention meets the organisation," because the interaction between the individual and the environment seems to be a stronger predictor of compliance than individual factors alone. Thus, several aspects of the psychosocial work environment should be considered when implementing exercise at the workplace. Because the organisational and implemental perspectives are modifiable through appropriate workplace intervention, this introduces the future potential to reduce the prevalence of musculoskeletal disorders through high-intensity physical exercise workplace interventions, using the combined knowledge of exercise physiology, and social and psychological factors.

As our study only included office workers with neck/shoulder pain, more research should be performed to determine the influence of organisational and implementational factors on the barriers and motivations for participation in exercise among different job groups.

7. Perspectives

Major differences exist between workplaces. The recommendations from this study suggest that there should be a thorough intervention mapping process that analyses the relevant organisational and implementational factors that are important for motivation and barriers before initiating any high-intensity workplace physical exercise interventions that are aimed at the prevention and rehabilitation of musculoskeletal disorders [52]. Thus, it is possible to influence and prepare essential partners (e.g., managers and employees) at the workplace and, thereby, to enhance the possibility of high compliance with and the optimal effect of the high-intensity workplace physical exercise intervention.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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Review Article

Tailoring Healthy Workplace Interventions to Local Healthcare Settings: A Complexity Theory-Informed Workplace of Well-Being Framework

Sarah L. Brand,¹ Lora E. Fleming,² and Katrina M. Wyatt³

¹*Plymouth University Peninsula Schools of Medicine and Dentistry, Plymouth PL6 8BX, UK*

²*European Centre for Environment and Human Health, University of Exeter Medical School, Truro TR1 3HD, UK*

³*University of Exeter Medical School, Exeter EX2 4SG, UK*

Correspondence should be addressed to Sarah L. Brand; sarah.brand@plymouth.ac.uk

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Many healthy workplace interventions have been developed for healthcare settings to address the consistently low scores of healthcare professionals on assessments of mental and physical well-being. Complex healthcare settings present challenges for the scale-up and spread of successful interventions from one setting to another. Despite general agreement regarding the importance of the local setting in affecting intervention success across different settings, there is no consensus on what it is about a local setting that needs to be taken into account to design healthy workplace interventions appropriate for different local settings. Complexity theory principles were used to understand a workplace as a complex adaptive system and to create a framework of eight domains (system characteristics) that affect the emergence of system-level behaviour. This Workplace of Well-being (WoW) framework is responsive and adaptive to local settings and allows a shared understanding of the enablers and barriers to behaviour change by capturing local information for each of the eight domains. We use the results of applying the WoW framework to one workplace, a UK National Health Service ward, to describe the utility of this approach in informing design of setting-appropriate healthy workplace interventions that create workplaces conducive to healthy behaviour change.

1. Introduction

Developing a complex intervention to affect healthy behaviour change in healthcare settings is subject to numerous challenges related to setting complexity, in particular difficulties in the “scale-up” and spread of a successful intervention in one setting to a different setting [1]. There is an emerging trend in health services research to acknowledge and consider the importance of local context as a major factor in how a particular intervention will be played out in that setting and whether or not a successful intervention in another setting can be transferred to a new setting. Furthermore, there is a call within social science for complex interventions, which have multiple, synergistic components and interact with context [2] to be properly theorised [3, 4] (e.g., [5–8]).

However, there is no consensus in the literature regarding how to choose which information to gather from a setting

to inform setting-appropriate intervention development or indeed which aspects of a setting may affect the success of a particular intervention. The World Health Organisation (WHO), in its healthy workplace framework, describes an assessment of the present situation of the workplace as one stage of developing a healthy workplace intervention [9], but there is no mention of the dynamics of the workplace system and how these interact with the current situation in each setting to impact the outcome of an intervention.

Complexity theory [10–12] offers a theoretical framework to support intervention design and implementation that acknowledges and works with the complexity of the setting in which the intervention will be put into practice. Complexity science principles are increasingly being used for understanding system-level behaviour and organisational change in complex settings [13–15], including healthcare organisations [16–23].

Healthcare settings are considered to be “complex adaptive systems” because they are made up of groups of individual agents who are free to act in ways that are not entirely predictable and whose actions are interconnected such that one individual’s action will change the context for the other agents in the system [17]. All of the elements of a complex adaptive system that affect the system-level behaviour are interrelated and are coevolving, and thus patterns of behaviour in the system are unpredictable and unlikely to be altered in a stepwise fashion. These types of systems are also open systems, in that they are a component of a wider system, adding to the number of influences on the effect of an intervention in a given setting.

Complexity theory also offers a promising perspective from which to understand the interactions between local context and intervention outcomes. It highlights the dynamic and relational properties of a particular setting and those aspects that enable the people in it to organise themselves into new ways of working, thinking, and relating. For complex healthcare settings, this means both understanding and working with and within the environmental and relational characteristics of the system [24]. Patterns of health-related behaviour are seen as an emergent property of the workplace system: changing the behaviour of people in the healthcare setting (e.g., nurses, doctors, and administrative staff) is unlikely to be achieved through external or top-down input alone or by targeting particular behaviours or at-risk groups in isolation from their context [12, 25]. New behaviours should be facilitated by affecting the dynamic relational properties and physical environment of the workplace system.

Whilst system behaviour at any point in time is hard to predict, patterns of behaviour in complex adaptive systems are able to be seen over time, for example, weather patterns over the seasons [26]. Certain aspects of complex systems are seen to influence patterns of behaviour emerging in that system, and thus patterns of behaviour in a given system will emerge from the unique conditions of that system at that time in relation to these aspects of the system. In workplace settings, these include the rules, beliefs, and values that the people making up the system share, along with the nature of the interactions between the agents in the system over time [12, 14, 23].

In this paper, we use the principles of complexity theory to design a framework to guide the development and the implementation of setting-appropriate intervention activities. We describe applying the Workplace of Well-being (WoW) framework to one NHS hospital ward to illustrate the value of this approach in gaining a rich understanding of a setting in terms of its local system dynamics and relational aspects that affect system-level behaviour in order to support context-appropriate development of healthy workplace activities and processes.

2. Materials and Methods

First, we describe the development of the WoW framework from complexity principles and briefly introduce the method and thematic results of the NHS case study (reported in detail

elsewhere [27]); then using findings from this case study we describe how the application of the WoW framework to a local workplace leads to an understanding of its local characteristics and finally how the WoW framework could guide the design of healthy workplace interventions which are appropriate for the unique system dynamics, culture, context, and relational aspects of a particular workplace.

2.1. Development of the Framework. Reviewing the literature regarding complexity theory in the social sciences and in particular in regard to healthcare settings, we considered how complexity theory could inform the development of an intervention which would be sensitive to and appropriate for the unique nature of the individual hospital ward setting. Table 1 describes the aspects of complexity theory considered and how we have conceptualised them in relation to creating healthy workplaces.

From the complex adaptive system principles described in Table 1, we identified eight interrelated domains that may impact on a workplace’s ability to self-organise into new patterns of behaviour over time. The eight domains are aspects of the workplace that should be considered when seeking to understand the unique nature of a particular workplace to aid setting-appropriate and setting-sensitive intervention development. The WoW framework guides the understanding of aspects of the interrelated context, culture, and dynamic nature of the local setting that enables or blocks the dynamical ability of the system to self-organise into new patterns of behaviour. The eight interrelated domains in the Workplace of Well-being (WoW) framework are illustrated in Figure 1.

Using the WoW framework, a shared understanding of the relationships and behaviours within a workplace is cocreated which allows an understanding of its characteristics as a complex system (e.g., how information flows through the system or how patterns of behaviour form and evolve), as well as specific contextual information (e.g., the local patterns of behaviour in the system at that particular time that will frame which new patterns of behaviour are possible given current conditions).

To apply the WoW framework to a workplace, data collection is carried out to assess the current conditions in that workplace guided by the eight domains in WoW (Figure 1). Figure 1 shows the overarching questions to be asked of the workplace for each domain. Thematic analysis within each domain then results in a detailed description of the workplace in terms of that complex adaptive system characteristic and the enablers and barriers in that domain to self-organisation into new patterns of workplace behaviour. This understanding then supports design and implementation of intervention activities appropriate to that unique workplace system.

2.2. Method and Thematic Results from NHS Ward Case Study [27]. The WoW framework was applied to a single NHS ward within acute healthcare trust to guide the development of appropriate intervention activities to improve staff health and well-being. Potential wards were identified in

TABLE 1: The principles of complex adaptive systems (CAS) and how each principle is relevant to developing setting-appropriate interventions in workplace systems.

CAS principle	Relevance for workplace setting-appropriate intervention development
Interrelatedness and distributed control	All elements of a complex adaptive system are interrelated and are coevolving and behaviour change in complex healthcare settings is an emergent property of the interrelated and complex interactions between different workplace elements. Control is not centralised and top-down [12] and nor is it bottom-up, with power being something that can be “given” to the agents of a system [25]. Interventions cannot empower local agents (e.g., staff) by handing them the power to change their work environment; empowerment must take the form of enabling change to emerge within their context.
Order-generating rules	Patterns of behaviour in complex adaptive systems emerge from the operation of a few simple order-generating rules [14, 30]. Order-generating rules in a workplace include staff’s shared instincts, values, priorities, constructs, and mental models, for example, in a healthcare setting, the internalised rule of “first, do no harm” [23].
Edge of chaos	The edge of chaos is a point between chaos and order where a complex adaptive system has the most creativity, growth, and ability to adaptively change; it neither settles into stable equilibrium, nor quite falls apart [11, 32]. If a workplace is too stable, nothing changes; if it is too chaotic, the workplace will be overwhelmed by change. In either case, the workplace will be unable to adaptively change to its changing environment unless new order-generating rules are established [33] that act to hold the system at the edge of chaos [30]. Interventions to change behaviour in these systems need to focus on the enablers and barriers for the system to continuously self-organise into adaptive ways of behaving in response to its changing environment, for example, by enabling the dynamics of the workplace system (e.g., increasing interaction quality and quantity between staff) such that the system can continuously adapt to its environment and establish new order-generating rules and thus be neither too chaotic nor too ordered.
Self-organisation	Self-organisation refers to the internal propensity of complex adaptive systems toward more organised patterned behaviour [10, 11]. System-level patterns of behaviour emerge <i>without external input or central control</i> . This patterned behaviour is <i>emergent</i> , emerging from the interactions and relations of the interdependent agents (i.e., staff) in the system. These interactions are constrained and guided by the implicit or explicit order-generating rules (or shared priorities and values) of the staff. Interventions to change behaviour in a complex social system should enable the self-organising dynamics to support both sustainable adaptive change in the system and the integration of the intervention into the way that the system works.
Attractor patterns	Attractor patterns are patterns of behaviour that a complex adaptive system is attracted toward because of its particular conditions [11]. Staff behaviour patterns are those staff are drawn towards behaving in by the particular conditions of the workplace system at that time (i.e., the interrelations between staff and the order-generating rules or shared values they hold): changing these conditions will attract staff toward different patterns of behaviour [18]. Understanding how people in a setting are drawn towards behaving in certain ways shows how changing the underlying context can draw people to behave in different ways.
Re-enforcing feedback loops	Patterns emerging from the interactions of agents (e.g., staff) feed back into the system and further influence the shared beliefs and interactions of the agents. Feedback loops support the continuation of particular patterns of behaviour through the local experience of agents (e.g., staff) and can support the adaptive dynamic behaviour change in a system in response to its environment [25].
Coevolution of system and its environment	A complex adaptive system has the ability to continually create new order <i>in coevolution with its environment</i> [24]. This involves not only continual adaptation <i>to</i> its environment (i.e., the workplace’s wider social, cultural, and physical environment), but also the <i>influencing of</i> its environment through its changed behaviour. Interventions at a local level can create distributed change throughout the wider system that the local setting is a part of, and the wider system will continuously affect the local setting. Awareness of the wider context, for example, the organisational culture when looking at an individual team or department, is important to support appropriate intervention development and also an understanding of potential barriers or enablers to intervention implementation (e.g., management level support, or not, for a local intervention).
Sensitivity to initial conditions	The characteristics of a social complex adaptive system are highly context specific, not responding in the same way to the same stimulus under different circumstances at different times [12, 15]. System change will always begin from and involve the evolution of the initial conditions present in the system at the time. Behaviour change in a particular workplace can only begin from the particular context of that workplace and thus it is crucial that interventions are tailored to local workplaces’ initial conditions.
Creation of adjacent possibilities and awareness of path dependency	The space of possibilities for a complex adaptive system includes all of the possible (adjacent) new patterns of behaviour available at that time, <i>given the initial conditions</i> of the system. Initial conditions determine the adjacent possible patterns of behaviour, leading to “path dependency”: a system’s current behaviour is dependent upon its history; its previous behaviour made its current behaviour possible, which determines its possible next behaviours (adjacent possibilities). System-level behaviour change emerges from the exploration of new adjacent patterns of behaviour by a system [10, 30]. Depending on its particular dynamics each workplace will have a different space of possibilities and will differ in its ability to test out new ways of behaving. An understanding of the current conditions of a complex setting will help intervention developers to design an intervention that is appropriate for that workplace and that aims to bring about changes that are feasible given the characteristics of that workplace.

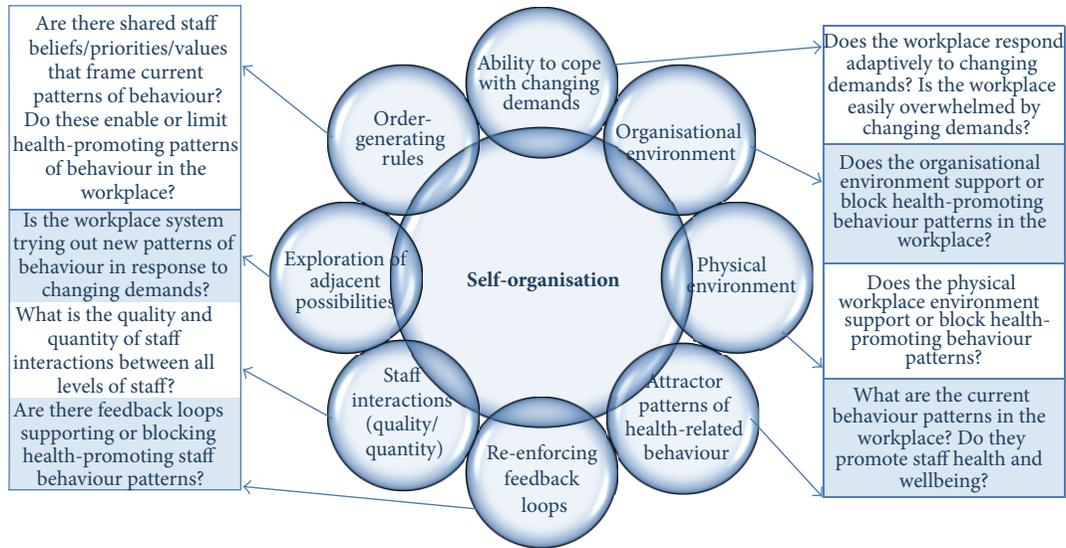


FIGURE 1: The Workplace of Well-being (WoW) framework developed from the principles of complex adaptive system theory guides exploration of eight interrelated workplace characteristics contributing to the ability of a workplace system to self-organise into more health-promoting patterns of behavior.

close collaboration with the senior management team of an NHS acute hospital. A convenience sampling approach identified one ward and all permanent ward staff in that ward were invited to participate in individual open-ended interviews where they were asked to reflect on structural and behavioural barriers and facilitators to their health and well-being at their workplaces and the nature of relations within the ward and with the wider hospital trust. Data was analysed thematically [28]. The interviewer and one of two other members of the research team double-coded the interviews independently and discussed relevant emerging themes. Codes were developed to inductively classify data within each theme. Developing summary themes or categories from raw transcripts in this way enables an understanding of the meaning present in the complex data [29]. All staff were invited to group workshops to feed back the themes and facilitate a shared understanding of the local conditions of their workplace.

Themes developed from the staff interviews were hierarchy of care, unpredictable workload, environmental barriers to health and well-being, break-taking, and relationships [27].

3. Results

We now describe how the application of the WoW framework to a local workplace leads to an understanding of its local characteristics in complexity terms, based on the thematic results from the NHS case study. First we describe the enablers and barriers to system change in relation to each of the eight domains of the WoW framework. We then show how these findings can be translated to design the kind of intervention that would be appropriate to this particular workplace.

3.1. Ability to Cope with Changing Demands. The workload on the ward was described as unpredictable and changeable with a clear sense of lack of control and uncertainty as to what the workload would be on each shift and a feeling of not having the personal resources (time/energy) to meet the demands of the job. Whilst demands were constantly changing, ward staff's experiences suggest that the ward, at the system-level, was unable to appropriately adapt its behaviour in response.

3.2. Organisational Environment. The ward seemed to represent a microcosm of the wider hospital environment. The organisational environment surrounding the ward was experienced as uncaring, unapproachable, and governed by inflexible rules and regulations that did not reflect the hopes and beliefs of staff.

3.3. Physical Environment. The physical ward environment directly limited exploration of more health-promoting behaviours, for example, the lack of a suitable break-taking space for taking proper breaks. Moreover, the physical ward issues of the staff room and windows which had been previously highlighted to off-ward management and the lack of management response to complaints seemed to encapsulate for staff their feeling of being unheard and uncared for in the organisation; this further fed into the shared belief that management were not on their side and the corresponding "us versus them" pattern of behaviour.

3.4. Attractor Patterns of Health-Related Behaviour. Patterns of behaviour on the ward that appeared to limit staff health and well-being included non-engagement in self-care (i.e., hierarchy of care was patients, then other staff, and finally staff

themselves), limited break-taking, and an “us versus them” culture between frontline staff and management level staff.

3.5. Exploration of Adjacent Possibilities. These behaviour patterns had become entrenched, and there was a feeling amongst ward staff that this was just the way things were on this ward. Historically, staff felt there was a lack of response from management when raising work-related concerns, and getting change to happen through contact with off-ward management was described as “like pulling teeth.” For example, staff expressed frustration and stress related to the physical ward environment and their powerlessness to bring about desired changes to it. This related particularly to the loss of their staff room and not being allowed to open the windows on the ward even in summer (due to patient safety and hospital liability concerns).

This perceived lack of response from management led to a lack of belief in the possibility of change and reluctance to try out new behaviours. In complexity terms, this is “path dependency” and describes the “locked-in behaviour” in the ward, with the system unable to create and explore new possible behaviours.

3.6. Re-Enforcing Feedback Loops. These “locked-in” behaviours were supported by several re-enforcing feedback loops. For example, the “us versus them” pattern of behaviour between the wider management and ward staff described a situation in which the beliefs and behaviours of the two groups and the lack of relations between them appeared to have become systemically embedded. This pattern also appeared to feed into the ward staff beliefs that management were not on their side and that change was not possible.

3.7. Ward Staff Interactions (Quality/Quantity). Staff felt a strong sense of team spirit on the ward which was felt to be supportive to their mental well-being. In contrast, a strong “us versus them” culture reflected by a perceived lack of communication, trust, and shared understanding with off-ward management staff underlies many of the descriptions of stress and frustration for ward staff.

3.8. Order-Generating Rules. Three particular order-generating rules or shared staff beliefs/priorities/values were identified that appeared to frame patterns of health-related behaviour on the ward: (1) patient care and team care supersede self-care; (2) change is not possible; and (3) management are not on our side. These rules supported the locked-in behaviour of the ward, attracting staff behaviour towards limited break-taking; low engagement in self-care activities at work; and low quality and quantity interactions with management staff.

3.9. What Kinds of Interventions Are Appropriate for This Ward Environment? In a complex adaptive system, system-level behaviour change is possible when the system is able to explore new ways of behaving. Supporting the ward’s propensity to self-organise into new behaviours would support the ward to adaptively respond to its changing environment

with appropriate new ways of behaving, without becoming overwhelmed by change. This would both directly reduce stressors on ward staff (e.g., feeling unable to cope with an unpredictable overwhelming workload) and allow for the emergence of new and healthier patterns of staff behaviour on the ward (e.g., healthy break-taking and an inclusive, compared to “us versus them,” ward culture).

The understanding of this particular ward’s enablers and barriers to its self-organising into new ways of behaving highlights how to create the conditions in the ward that would enable more health-promoting behaviours to emerge. Healthy workplace interventions in this ward would need to take into account the factors that are limiting or enabling the ward system’s dynamics and consider how an incoming intervention would interact with the current dynamic properties of this ward system.

Introducing a healthy workplace intervention will not produce sustainable behaviour change in the workplace if it does not work to enable the ability of the workplace to self-organise into new patterns of behaviour. In this particular ward, an intervention would need to target the “us versus them” culture and the feedback loops that support it, support better quality and quantity of communication between parts of the ward system, address the physical environment issues that limit break-taking ability and that support feelings of being unheard and uncared for in the organization, and take into consideration the social rules that create the current patterns of ward behaviour. In these ways, an intervention could enable the self-organisation of the system to support staff behaviour to change at the system-level and thus produce a ward environment that is conducive to healthy behaviour change in the intervention.

Activities (such as regular healthy workplace meetings with staff and management) that provide opportunities for new and more diverse relations to be built between different levels of ward staff across the perceived “us versus them” boundaries could increase the quality and quantity of interactions between ward and management staff in turn altering the “us versus them” pattern of behaviour and supporting the self-organisational dynamics of the system towards more healthful behaviours.

Creating “small wins” (i.e., bringing about even small positive desired changes) for this ward could be fundamental in changing their shared belief in the lack of possibility for change and supporting the testing out of new ways of behaving or, in complexity terms, the exploration of the space of possibilities. For this ward, potential small wins are available in the form of changes to the physical ward environment (e.g., windows that open). The complex interrelations in a complex adaptive system mean that small inputs such as these have the potential to bring about nonproportionate (e.g., small input = large output) distributed change throughout the system.

Ward staff learning through small wins requires positive feedback loops that feed the benefits of the small win back into the system to influence staff beliefs and support the emergence of new behaviours. Current feedback loops in the system seemed to act to support the ward not trying out new behaviours, perhaps because these loops were “local” and nondiverse. Interventions that enable or involve the (self-)

identification of workplace champions who facilitate interactions between the ward and management would increase the diversity of information and exposure to new ideas and ways of doing things on the ward, as well as creating new feedback loops which could support new ways of behaving.

Similarly, interventions enabling the recognition and addressing of ward staff voiced needs by management through small wins could allow a new type of relation and interaction between ward staff and management to form. These small wins have the potential to “unlock” staff behaviour patterns through feedback loops that change staff beliefs and create transformative behaviour change in the ward system [25].

In complex adaptive social systems, the patterns of behaviour that can emerge are framed by the order-generating rules that the people in the system share [30]. Shared beliefs and priorities on this ward framed some of its health-limiting patterns of behaviour. Interventions that support staff to consider their beliefs, behaviours, and how they are related in facilitated workshops could begin to change staff beliefs and allow the exploration of possible new healthier behaviours [31]. Similarly workshops with management which allow staff to express their beliefs could increase lines of communication and allow for issues to be resolved mutually.

To ensure that there is a wider receptive context with which the “nested” ward system can coevolve, it is critical that interventions have the active long-term support and understanding of the hospital senior management team and board.

4. Discussion

We describe the development and implementation of the Workplace of Well-being (WoW) framework. The WoW framework was conceptualised from our understanding of the workplace as a complex adaptive system, in order to elucidate what it is about a workplace that is important in determining the success of an intervention to support healthy behaviour change. The WoW framework describes eight domains that are important to consider about a workplace when designing healthy behaviour change interventions. This framework can be applied to individual settings to gather detailed local data about the enablers and barriers regarding the workplace’s ability to self-organise into new and sustainable behaviours. We describe how the framework, when applied to one NHS ward [27], informs what kind of intervention activities are appropriate, feasible, and acceptable for that unique workplace.

4.1. Supporting Setting-Appropriate Intervention Activities. Using the complexity-informed WoW framework an understanding of the characteristics of a particular workplace setting that are enablers or barriers to system-level behaviour change can be gained. This informs which aspects of the workplace need to be targeted by a healthy workplace intervention to support the adoption of more healthful behaviours. In the case of the NHS ward, this means opportunities for increased quality, quantity, and diversity of relations

and interactions between ward and management staff, small quick wins to encourage shared belief in the possibility and the benefits of change, facilitation of re-enforcing feedback loops to support trying new behaviours, and facilitation of action learning to explore health-limiting shared beliefs.

4.2. Creating a Change-Conducive Setting. Using the WoW framework, the setting-specific enablers and barriers to intervention implementation can also be identified and addressed as part of the intervention. In the NHS case study, the WoW framework identified a “locked-in” behaviour pattern on the ward. For this workplace, an intervention implemented without first, or at the same time, enabling the system to self-organise would not be likely to support new ways of behaving/working. According to the principles of complexity theory, if an intervention includes elements that create the conditions for self-organisation, then it will be more likely to lead to sustainable behaviour change [34]. An intervention will be unlikely to affect change if the barriers to behaviour change in a particular system are not addressed.

4.3. Why Local Context Is Important: A Complexity Perspective. Thinking of complex settings in terms of complex adaptive system characteristics highlights why the local context is so important in the success of interventions in complex settings; complex settings have complex dynamic and relational properties that mean the system does not behave in a linear and predictable fashion. Predicting the effect of external inputs to the system, such as an intervention added to a system, is difficult. This is because the intervention itself (as well as any researchers or practitioners who “join” the system as part of its implementation) will interact with the system in a myriad of ways. Targeting interventions such that they take into account and work with or support the dynamic, relational character of the system offers a new way of conceptualising interventions as part of a living, evolving system.

4.4. Redefining “Best Practice” When Transferring Interventions to New Complex Settings. The WoW framework supports the development of interventions that address the problem of scale-up and spread of interventions in healthcare settings [1]. In the “best practice” culture in the UK health service, interventions found to have a positive effect in one setting are implemented in as close to exactly the same way as possible in another setting, with the result that many fail to have a positive impact in the new setting [1].

From a complexity perspective, a behaviour that emerges in one setting is particular to the history, dynamics, and relational properties of that setting and the way those unique properties interact with an intervention. Taking an intervention that “produces” a particular system-level behaviour in one unique setting and scaling it up to fit the wider setting (“scale-up”) or transplanting it to another unique setting (“spread”) is unlikely to produce the same behavioural outcome.

The WoW framework guides an understanding of the history, dynamics, and relational properties of a healthcare

setting. Developing interventions using this framework at a midlevel of abstraction (i.e., a description of the properties shared by social complex adaptive systems) allows scale-up and spread of the intervention framework rather than the intervention activities themselves [1]. Specific intervention activities that are appropriate to each individual setting can then be developed by populating the framework with local information. In this way, the transfer of best practice becomes the transfer of the midlevel framework of how a social complex adaptive system works and what, in a more abstract sense, its properties are. Intervention development then becomes the development of local activities that target the unique enablers and barriers in that particular setting which have been identified by the individuals located in the setting.

4.5. Sustainability of Interventions in Complex Settings. Designing intervention activities that take into account both the dynamic properties of the system and its particular history and space of possibilities (i.e., its possible adjacent patterns of behaviour based on its current properties, dynamics, behaviour patterns, and so on; see Table 1) creates interventions designed to change the way a system behaves. The intervention activities described in relation to the NHS case study, which target the self-organising dynamics of the system itself, can become a sustainable part of the workplace system because they affect the very way the system behaves. For example, by enabling feedback loops that support the evolution of system behaviour in response to its environment, the WoW framework has the potential to create sustainable interventions that evolve with the system they are a part of.

5. Limitations

We sought to apply complexity science as a theoretical framework to consider how to affect the system's properties (in this case, a ward in a hospital) towards health-promoting behaviours. However, whether this approach can deliver such change needs to be properly evaluated in future studies. We also acknowledge that the process of applying the WoW framework to a workplace will require additional time and resources both from the workplace and the researchers, compared to implementing "one-size-fits-all" interventions. This kind of investment in better preparing interventions for their intended particular local contexts should pay off in terms of better outcomes in the short and long term; nevertheless this payoff needs to be explored in future trials of the WoW framework in different workplaces.

6. Conclusions

The WoW framework has the potential to be a useful tool to support the development of setting-appropriate healthy workplace interventions in complex healthcare settings. This framework supports data collection from local settings and guides analysis to understand the local dynamics and relational properties of complex social systems. Thus, the WoW framework can inform the development of intervention

activities likely to support local workplace behaviour change. Intervention activities developed in this way are led by local needs, are setting-appropriate, and are supported by an understanding of how the local setting can be enabled to support the implementation and sustainability of the intervention.

The WoW framework offered a constructive perspective from which to consider the health-related behaviours of the ward staff on one NHS ward as well as the multiple system-level factors that they are emergent products of. The framework helps to identify the kinds of intervention activities that would be appropriate to sustainably support health-promoting staff behaviour change in this workplace.

Interventions developed using the WoW framework have good potential for scale-up and spread across diverse settings, a challenge in current best practice transfer in healthcare [1], because the framework and its implementation are transferrable across different healthcare settings and the resultant intervention activities setting-specific. Nevertheless, further work is needed to explore the feasibility and acceptability of the WoW framework to staff in other healthcare settings and to examine the long-term effectiveness of setting-specific intervention activities developed using this framework.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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Research Article

Health Behaviors and Overweight in Nursing Home Employees: Contribution of Workplace Stressors and Implications for Worksite Health Promotion

Helena Miranda,^{1,2} Rebecca J. Gore,¹ Jon Boyer,^{1,3} Suzanne Nobrega,¹ and Laura Punnett¹

¹Department of Work Environment & Center for the Promotion of Health in the New England Workplace (CPH-NEW), University of Massachusetts Lowell, Lowell, MA 01854, USA

²School of Health Sciences, University of Tampere, 33014 Tampere, Finland

³Boston Children's Hospital, Boston, MA 02115, USA

Correspondence should be addressed to Laura Punnett; laura_punnett@uml.edu

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Background. Many worksite health promotion programs ignore the potential influence of working conditions on unhealthy behaviors. *Methods.* A study of nursing home employees (56% nursing aides) utilized a standardized questionnaire. We analyzed the cross-sectional associations between workplace stressors and obesity, cigarette smoking, and physical inactivity. *Results.* Of 1506 respondents, 20% reported exposure to three or more workplace stressors (physical or organizational), such as lifting heavy loads, low decision latitude, low coworker support, regular night work, and physical assault. For each outcome, the prevalence ratio was between 1.5 and 2 for respondents with four or five job stressors. Individuals under age 40 had stronger associations between workplace stressors and smoking and obesity. *Conclusions.* Workplace stressors were strongly associated with smoking, obesity, and physical inactivity, even among the lowest-status workers. Current working conditions affected younger workers more than older workers. Although this study is cross-sectional, it has other strengths, including the broad range of work stressors studied. Strenuous physical work and psychosocial strain are common among low-wage workers such as nursing home aides. Workplace health promotion programs may be more effective if they include measures to reduce stressful work environment features, so that working conditions support rather than interfere with employee health.

1. Introduction

Obesity, smoking, and physical inactivity represent important and preventable health risks. They are typically framed as the result of individual “lifestyle” choices and often targeted through health promotion programs that seek to motivate individual behavior change. A common venue for these programs is the workplace. However, workplace health promotion (WHP) programs sometimes suffer from low participation and uneven results, especially for low-income workers [1]. There are various possible reasons, including time and financial constraints and failure to incorporate a systems approach into program design [2–6].

In addition, working conditions themselves may contribute to individuals' unhealthy behaviors. For example, obesity has been linked with night work, long work hours,

psychosocial job strain, and job insecurity [7–17]. Physical inactivity during leisure hours has been associated with low decision latitude (both in passive jobs and those with high strain) and frequent involuntary overtime [13, 18–24]. In some populations, smoking habits have been positively correlated with high job demands and job strain and negatively with resources at work (including job control), social support from coworkers and supervisors, and low social capital at work, a construct that overlaps with both social support and participation in decision-making [13, 23, 25–30].

Nonetheless, the literature is inconsistent on all of these associations. Among possible reasons both the lack of formal theoretical hypotheses and, somewhat in contrast, an incomplete set of risk factors are suggested (possibly stemming from excessive reliance on *a priori* models in this relatively early stage of accruing evidence) [9, 16]. Many of these

studies have analyzed data from the general population, where the separate contributions of working conditions and socioeconomic status (SES) may be difficult to disentangle, even with multivariable statistical methods. Further, potential effect modification within these associations has been largely ignored, with the exception of comparing risks between men and women.

Limited decision-making at work is a dominant feature of jobs that are low in the organizational hierarchy, and lower SES workers are typically more exposed to other physical and psychosocial workplace stressors [31, 32], as well as risks from other aspects of their physical and social environment [33]. As a result they may experience additive or even synergistic health effects. However, the cooccurrence of these hazards has rarely been taken into account.

It is well-established that inactivity, obesity, and a variety of chronic diseases become more common with age in the general population. Thus it would be of value to understand better the trajectory of risk and its determinants over the life course. Yet potential effect modification by age on the association between work and health behaviors has been studied with surprising rarity.

This study was a part of a larger project (“ProCare”) examining a variety of factors influencing employee health in a large chain of skilled nursing facilities providing long-term care [34–38]. The purpose of the present analyses was to investigate the exposures of nursing home workers to physical and organizational stressors, whether these work exposures were associated with personal health risks, and (if so) whether the associations differed by age.

2. Methods

2.1. Study Population and Procedures. Questionnaires were distributed to employees in 18 nursing homes, in several states of the U.S., within a single company in 2006–2009. The surveys were timed relative to the implementation of a Safe Resident Handling program. In 12 centers, baseline surveys were administered during the week of initial training for department heads (defined as the implementation date), just prior to installation of the resident handling equipment. In the other 6 centers, the first surveys were conducted at least one year after program implementation, using a very similar instrument. The first (or “entry”) survey in each center was selected for these cross-sectional analyses.

All permanent full- and part-time clinical employees were eligible to participate. Clinical employees included nursing aides (NA), licensed practical nurses (LPN), and registered nurses (RN) as well as other direct care personnel such as physical and occupational therapists. In addition, office, laundry, food service, and janitorial staff were recruited for follow-up surveys in four centers, where a participatory WHP program was under consideration for the entire workforce.

Questionnaires were distributed at the nursing homes by members of the study team and completed by most workers during scheduled break times. For those who could not be met in person, such as third-shift and weekend employees, a prestamped, addressed return envelope was provided. Employees who returned the completed survey

with the informed consent form received compensation of \$20. The study proposal was approved by the Institutional Review Board of the University of Massachusetts Lowell (protocol #06-1403).

The self-administered questionnaire collected detailed information on demographic characteristics (e.g., age, gender, length of education, and ethnic origin), working conditions, health behaviors, and health status. To the extent possible, questions were derived from preexisting, validated items and scales.

2.2. Health Behaviors and Obesity. There were three outcome variables. Physical exercise was assessed by a single question: “how many times a week on average do you work up a sweat (at least 20 min per session, e.g., fast walking, jogging, bicycling, swimming, rowing, etc.)?” Response categories were none; some but less than once a week; 1–3 times per week; more than 3 times per week. Physical inactivity (yes/no) was defined as “none” versus any. Smoking was categorized as current, former, or never. Body mass index (BMI) was computed from self-reported weight and height; “obese” was defined as BMI of 30.0 or above.

2.3. Work Environment Characteristics. The questionnaire addressed psychological demands of work, job control, coworker support, and supervisor support (2 items each, from the Job Content Questionnaire (JCQ)) [39]; adequate staffing (1 item: “my work area is adequately staffed”); schedule control [40] (2 items); and regular night shift work (1 question). Workplace safety and climate issues included perceived safety (4 items, 2 from Griffin and Neal [41] and 2 developed by the investigators); having been assaulted at work by a resident, resident’s visitor or family member in the past 3 months; and tolerance of discrimination (1 item: “this organization practices zero tolerance for discrimination”). Respondents were also asked about work-family interference [42] (3 items), employer support for family or other personal responsibilities (1 item), and other paid jobs outside the survey workplace. Physical requirements at work were characterized in terms of moving or lifting heavy loads (1 item, JCQ); rapid and continuous physical activity (1 item, JCQ); and awkward postures (3 items, JCQ). The sum of these 5 exposures was labeled “physically demanding work.”

All survey items were assessed with a 4-point Likert scale (strongly disagree; disagree; agree; strongly agree) and were dichotomized for these analyses between “disagree” and “agree.” For multi-item scales, the sum of the items (after reversing where appropriate) was dichotomized so as to create categories corresponding as closely as possible to the average of the original item distributions (e.g., if 22% of the workers replied “agree” or “strongly agree” to the first item, and 18% to the second item, their sum was dichotomized so that 20% agreed).

2.4. Statistical Analysis. The three outcome variables were the health behaviors of smoking and physical inactivity, plus obesity. The prevalences of the outcomes and the workplace stressors were compared by job title, geographical region

TABLE 1: Self-reported working conditions and personal factors, by job title: 1,506 U.S. nursing home employees.

	Nursing aides (<i>n</i> = 836)**	Other jobs* (<i>n</i> = 661)**
<i>Physical requirements at work</i>		
Heavy lifting (%)	63	47
Rapid and continuous physical activity (%)	85	64
Awkward working postures (%)	75	55
Physically demanding work (%)	60	38
<i>Work organization</i>		
Low decision latitude (%)	27	25
High psychological demands (%)	91	88
Job strain (high demand, low control) (%)	25	21
Low schedule control (%)	21	20
Regular night shift (%)	25	20
<i>Social support at work</i>		
Low coworker support (%)	36	28
Low supervisor support (%)	25	17
<i>Safety and work climate</i>		
One or more assaults at work in the past 3 months (%)	51	32
Poor safety climate (%)	64	53
Employer tolerates discrimination (%)	21	16
<i>Work-family balance and second jobs</i>		
Imbalance between work and family life (%)	46	43
Low employer support for family or other personal responsibilities (%)	51	36
Having another paid job (%)	21	20
<i>Health behaviors and obesity</i>		
Current smoker (%)	27	21
Physically inactive (%)	24	22
Obese (BMI > 30) (%)	36	32
<i>Demographics</i>		
Age (mean ± SD)	38.8 ± 12.8	44.0 ± 11.9
Gender: female (%)	91	87

* Licensed practical nurses (LPNs), registered nurses (RNs), physical and occupational therapists, office, laundry, food service, and janitorial staff.

** Numbers of respondents vary slightly among rows due to missing values.

(southern versus northern East Coast), and age group (under 40 years versus 40 or older).

Associations between outcomes and workplace stressors were assessed by cross-tabulation and log-binomial regression to estimate prevalence ratios (PRs) with 95% confidence intervals (CIs). If the log-binomial model failed to converge, the COPY method was used [43]. To limit the number of independent variables in the models, the five stressors with the highest crude associations with each outcome were chosen to construct an index with 5 levels (exposed to 0, 1, 2, 3, or 4-5 of the factors) for subsequent modeling. All models included gender, geographical region, education, and age (unless age-stratified). Tests of linear trend in effect with the exposure index were obtained by weighted linear regression of the model coefficients on the number of stressors, weighting by the inverse of the standard error of the coefficient.

There was some variation in outcomes by race/ethnicity but no confounding of the associations with exposure indices, so the models did not include ethnicity. The proportion of missing values in each variable in the analyses was at most 4%.

All statistical analyses used the statistical software package SAS (version 9.1, SAS Institute Inc, Cary, NC, USA).

3. Results

3.1. Response, Demographics, and Job Characteristics. Questionnaires were received from 1,506 persons, of whom about 56% were nursing aides (Table 1). Response rate for the clinical staff was about 72% of the complete workforce rosters.

The age, gender, and race distributions were all consistent with the workforce demographics for these workplaces. Survey respondents were 89% female. Almost half (47%) were white, non-Latino, with a large difference by region: more African-American or African (67%) in the states farther south and a majority white in more northern states. The average age was 41 years (standard deviation (SD) 13); nursing aides were about 5 years younger than other employees, on average (Table 1). The mean length of work in the same type of job was 11 years (SD 10), although one in four workers reported over 17 years seniority. Lifetime experience

TABLE 2: Self-reported working conditions and personal factors, by age group: 1,506 U.S. nursing home employees.

	Younger than 40 years (n = 690)*	40 years and older (n = 737)*
<i>Physical requirements at work</i>		
Heavy lifting (%)	61	51
Rapid and continuous physical activity (%)	82	70
Awkward working postures (%)	74	59
Physically demanding work (%)	59	43
<i>Work organization</i>		
Low decision latitude (%)	26	26
High psychological demands (%)	92	87
Job strain (high demand, low control) (%)	23	23
Low schedule control (%)	23	17
Working at night (%)	22	23
<i>Social support at work</i>		
Low coworker support (%)	34	31
Low supervisor support (%)	22	20
<i>Safety and work climate</i>		
One or more assaults at work in the past 3 months (%)	48	38
Poor safety environment (%)	63	54
Employer tolerates discrimination (%)	19	18
<i>Work-family balance and second jobs</i>		
Imbalance between work and family life (%)	49	41
Low employer support for family or other personal responsibilities (%)	45	43
Having another paid job (%)	22	19
<i>Health behaviors and obesity</i>		
Current smoker (%)	24	26
Physically inactive (%)	23	23
Obese (BMI > 30) (%)	30	38

*Number of respondents varied slightly among rows due to missing values.

in similar work (from questionnaires) was 6 to 8 years more than seniority in the current job (from workforce rosters). In the 4 centers where nonclinical workers were recruited they were slightly underrepresented (34% of all employees, 20% of respondents).

Survey respondents were 34% obese, 24% currently smoking, and 23% physically inactive outside of work. One in five held at least one other paid job. Employees reported high psychological demands at work (88% of respondents), awkward postures (65%), poor safety climate (60%), lifting heavy loads (57%), and work-family imbalance (43%). The prevalence of these stressors did not differ importantly by job title, although aides reported more physically heavy and psychologically demanding work, more recent assaults at work, and lower employer support for family responsibilities compared to all other workers combined (Table 1). There were moderate to high correlations among many of these factors [38].

Workers younger than 40 consistently reported more workplace stressors than those aged over 40 (Table 2), especially physical workload and safety problems. No major differences were seen in smoking or inactivity between the age groups, but older individuals were more likely to be obese.

3.2. Work Environment, Health Behaviors, and Obesity. Associations between the study outcomes and the separate work stressors were generally modest when examined separately, although there were many trends in the expected directions, that is, worse health behaviors with more stressful working conditions. In age-stratified cross-tabulations, associations were somewhat stronger among younger participants, the largest differences being for physical demands with smoking and night work with obesity. In contrast, the association between violence and physical inactivity was stronger among older than younger individuals.

The risk of obesity was linearly associated in multivariable modeling with the sum of these occupational features: low decision latitude, low coworker support, lifting heavy loads, night work, and recent physical assault. Twelve percent were not exposed to any of these stressors, whereas 27% were exposed to three or more and 8% to all five. The prevalence ratio was 1.8 for workers exposed to four or five stressors, compared to none; among nursing aides alone the PR was 2.0. Age strongly modified the risks, which were higher for younger workers (Figure 1).

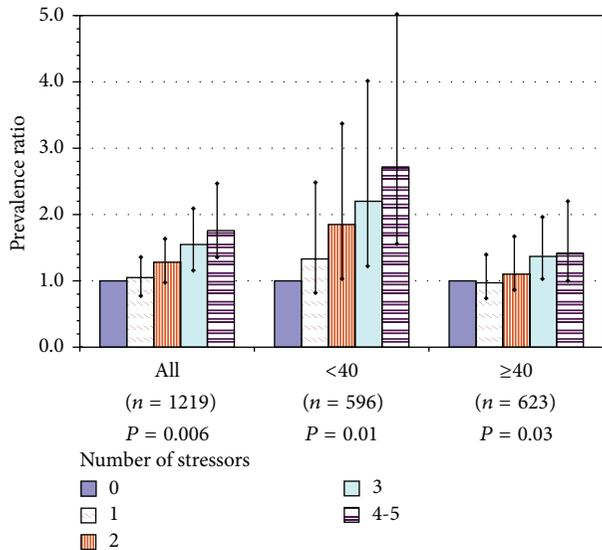


FIGURE 1: Overweight or obesity among U.S. nursing home employees, as a function of number of workplace stressors in the current job, for all participants and by age group: prevalence ratios with 95% confidence intervals for each level above 0 stressors and P value for test of linear trend. Index = sum of workplace stressors: poor coworker support, low decision latitude, recent assault(s) at work, work at night, and lifting heavy loads. Models adjusted for gender, education, and region; adjusted for age only in model of all workers.

Current smoking was almost twice as high among workers exposed to at least 3 of 5 job stressors: low decision latitude, low supervisor support, having another paid job, physically demanding work, and recent physical assault (18% of workers). The effect was about the same when estimated for aides alone and much stronger among younger workers, with PRs of 2 and 2.5 for those with 3 and 4-5 exposures, respectively (Figure 2).

Physical inactivity showed the strongest trend with work stressors, of the three outcomes. The associated exposures were low decision latitude, low coworker support, employer tolerance of discrimination in the workplace, work-family imbalance, and night work. Of all workers, 21% reported 3 or more stressors. The risk of being inactive was approximately 2-fold for workers with 3 or more stressors, compared to none; the linear trend was similar for aides alone and varied little between the two age groups (Figure 3).

4. Discussion

4.1. Study Findings and Interpretations. Our survey results were consistent with a broader literature that the long-term care sector is a physically and psychologically demanding work environment [44–50], with a high frequency of physical assault on clinical staff [51–53]. Certified nursing assistants and other aides, who make up more than one-half of this workforce, experience particularly high physical and psychosocial workload.

Less appreciated to date is the extent to which these working conditions affect workers’ “lifestyle.” In this study, the

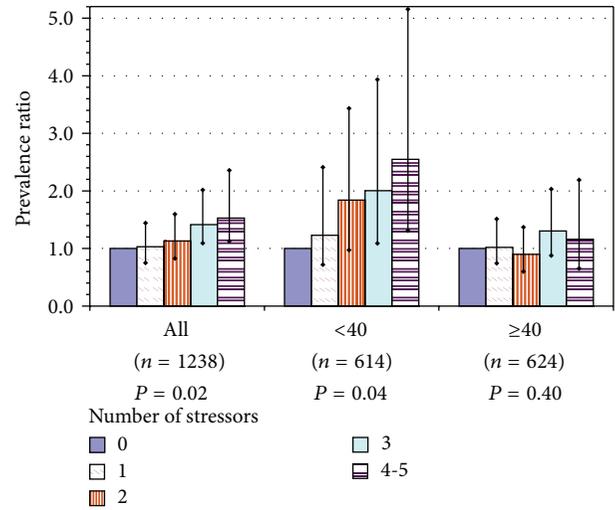


FIGURE 2: Current smoking among U.S. nursing home employees, as a function of number of workplace stressors in the current job, for all participants and by age group: prevalence ratios with 95% confidence intervals for each level above 0 stressors and P value for test of linear trend. Index = sum of workplace stressors: low decision latitude, low supervisor support, recent assault(s) at work, having another paid job, and physically demanding work. Models adjusted for gender, education, and region; adjusted for age only in model of all workers.

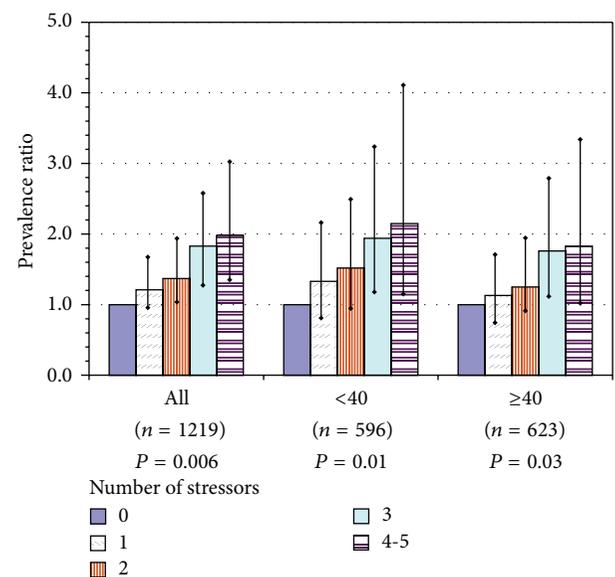


FIGURE 3: Physical inactivity among U.S. nursing home employees, as a function of number of workplace stressors in the current job, for all participants and by age group: prevalence ratios with 95% confidence intervals for each level above 0 stressors and P value for test of linear trend. Index = sum of workplace stressors: poor coworker support, low decision latitude, employer tolerance of discrimination, work-family imbalance, and work at night. Models adjusted for gender, education, and region; adjusted for age only in model of all workers.

cooccurring workplace stressors had a linear association with health behaviors so that the higher the number of challenging working conditions, the more likely the reports of unhealthy behaviors. The risks were about two times higher for those exposed to 3 or more stressors, which applied to one-fifth of all workers. While shiftwork and low decision latitude have previously been linked to health behaviors, some of the contributing exposures in this population, physical workload, assault, work-family imbalance, and perceived toleration of discriminatory behavior, have not previously been reported.

The present findings are consistent with other evidence for the effect on health behaviors of psychosocial strain, night work, and low social support at work, although as noted above the literature is inconsistent to date and in fact discussions of some of these have been quite vigorous (e.g., [54–57]). There are many possible reasons for the inconsistent findings, related both to methodologic approaches and the joint distributions of independent variables within study populations. These issues cannot be resolved within the scope of the present work, only reflected upon in the effort to judge how to interpret these findings.

Among plausible reasons for disagreement, there may be a previous lack of attention to effect modification of some exposures by others, for example, if assault or night work is more potent in low-control jobs. It is common to “adjust for” numerous risk factors in multivariable regression modeling. However, to the extent that these are associated with each other, overadjustment may dilute the risk ratios for causally important variables. The choice of which domain is primary (for example, does SES explain away the effect of job exposures or vice versa?) reflects *a priori* beliefs about mechanism of effect that should be acknowledged explicitly not buried within modeling decisions. Examining associations within SES strata is a simple way to determine both the range of exposures within those strata and whether or not the effect is seen in each subgroup. At the very least these associations deserve continuing investigation to understand better the range of mechanisms that might operate in different settings and subgroups.

Further, the specific operationalization of conceptual domains may have great influence on the findings. For example, in one study, high job control was associated with leisure-time physical activity, whereas job demands alone had no such association [19].

Another issue in this multifactorial web is the possibility that different individuals express the strain through different health behaviors: some may self-medicate with food, while others smoke or drink more as a way to cope with stress and fatigue. Of note, a few investigators have taken the useful approach of examining the effect of job strain on multiple health risks simultaneously, to understand more fully the nature of the effect across parallel outcomes (e.g., [54, 58]).

Our study revealed age differences that have not been reported before: obesity and smoking had considerably stronger associations with workplace hazards among younger workers than among older ones. In fact, in the few prior analyses of effect modification by age in this area, other investigators have reported opposite trends from the present findings. Among Finnish nurses, those who consistently

worked nights or rotating shifts both smoked more and were more often overweight than day workers. However, both of these effects interacted positively with age, so that nurses over 45 years had larger attributable increases [12]. Similarly, among men working on offshore oil/gas installations, higher age predicted higher BMI [59].

We cannot explain the discrepancy, but our findings show an effect in the opposite direction for both obesity and smoking. These results may be affected by “healthy worker” selection: the median turnover rate among all direct care staff in U.S. nursing homes is 50% [60] and the high rate may be related to stressful working conditions [38]. Hence, those older workers who remained in their jobs may be more adapted to their working conditions or may have developed other coping strategies for work-related stress than smoking or comfort eating. Alternatively, increased work experience and age might be protective against these risks among older workers, but it seems more likely that weight, exercise, and smoking behaviors become more difficult to change later in life. If our results are valid, they have implications for the public health importance of improving the work environment in nursing homes, as the impact on the health behaviors of younger workers would have long-term benefits over the full course of their lives, including after retirement.

There are likely multiple mechanisms by which stressful features of the work environment influence health behaviors and weight gain; these deserve more attention. Finding time and energy for exercise may be challenging after a physically or emotionally fatiguing work day; difficulty in balancing work with family demands, especially common for working women, may exacerbate this [61]. Beyond its behavioral effects, chronic stress also leads to deposition of intra-abdominal fat [62]. Comfort eating, as well as other unhealthy behaviors, serves as coping strategies for many workers to better tolerate or relieve work-induced stress [63–65]. Intention to exercise is also often disrupted [66, 67]. Shiftwork and excessively long work hours disrupt sleep and metabolism [68–71], in turn increasing the risk of obesity and metabolic syndrome [72]. Shiftwork interferes with exercise through physiological as well as behavioral mechanisms [73].

4.2. Strengths and Weaknesses of the Study. The present study is cross-sectional, so we cannot determine the temporal direction of these associations: that is, did exposure to stressful working conditions predate the occurrence of smoking, overweight, or inactivity or merely play a role in their continuation. Another methodological weakness is that some individuals may have underestimated their body weight or smoking or overstated their exercise levels. Reassuringly, Huerta et al. reported that self-reported smoking has moderately good reliability [74]. BMI computed from self-reported data is underestimated by about one unit, with slightly larger effects in persons 60 years of age and little variation by ethnicity [75–77]. Such an effect here would likely have resulted in negligible information bias in the overall associations.

This study also has several important strengths. The limited range of job titles surveyed helped to reduce the likelihood of unmeasured confounding by other features of

socioeconomic status. The high proportion of respondents who were nursing aides provided sufficient statistical power to confirm that these associations were observed even in the lowest SES group. Moreover, the high response rate helped to guard against selection bias and produced a sample with demographic characteristics representative of the entire company workforce (i.e., 200,000 people). Generalizability of the results is also strengthened by the fact that this sample of U.S. nursing home employees had health behaviors comparable to the national female workforce [78].

5. Conclusion

The health of healthcare workers, along with turnover and other consequences, is of high international concern. The job features implicated in this study are also known to be widespread in the healthcare sector. Nonetheless, there have been remarkably few studies examining workplace stressors and health behaviors specifically among healthcare workers. Frequent exposure to threats and violence and poor social climate at work predicted smoking relapse in nursing aides [26]. Workplace violence, job strain, and role conflicts also increased risk of poor sleep among nursing aides [47].

These findings suggest that WHP programs might benefit from recognizing and addressing the contribution of the work environment, whether direct or indirect, to the health and health behaviors of individual employees. In the present study, work experiences such as heavy lifting, assault, night work, low social support, and low decision latitude were all linked negatively to personal health behaviors. These aspects of the work environment thus appear to impact employee health indirectly as well as directly. Because these adverse working conditions are especially common for low-wage workers, it is reasonable to hypothesize that preventive efforts might also reduce some socioeconomic disparities in health.

Many workplace stressors are remediable through training, improved job design, and organizational changes [5, 34, 79–82]. However, far too few WHP programs address these important potential determinants of the very behaviors they seek to change. The U.S. Total Worker Health program (<http://www.cdc.gov/NIOSH/twh/>), within which this study was carried out, is one initiative to improve program design by encouraging greater sensitivity to the effects of working conditions [83, 84].

Abbreviations

BMI: Body mass index
 CI: Confidence intervals
 JCQ: Job content questionnaire
 LPN: Licensed practical nurses
 NA: Nursing aides
 PR: Prevalence rates
 RN: Registered nurses
 SAS: Statistical analysis system
 SD: Standard deviation
 SES: Socioeconomic status
 WHP: Workplace health promotion.

Disclosure

Helena Miranda is an occupational Physician and Epidemiologist and Adjunct Professor, School of Health Sciences, University of Tampere, Finland. Laura Punnett is Professor of Occupational Epidemiology and Ergonomics, Department of Work Environment, University of Massachusetts Lowell (UML), and Co-Director of the Center for the Promotion of Health in the New England Workplace (CPH-NEW). Rebecca J. Gore is Senior Biostatistician, Department of Work Environment, UML. Jon Boyer is an occupational Ergonomist employed in the Environmental Health & Safety Department, Boston Children's Hospital. Suzanne Nobrega is Program Manager and Outreach Director at CPH-NEW. Promoting Physical and Mental Health of Caregivers through Trans-disciplinary Intervention ("ProCare") is the name of a research project within CPH-NEW.

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Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

Authors' Contribution

Helena Miranda assisted with questionnaire design, developed the analytic strategy, conducted the statistical analyses, and drafted the paper. Laura Punnett conceived of the ProCare research project (study design, development of the survey instrument, and data collection), advised and reviewed the statistical results, and contributed to writing the paper. Rebecca J. Gore supervised data entry and management and contributed to data analysis and interpretation. Jon Boyer and Suzanne Nobrega had major responsibilities in data collection and reviewed the overall study goals and strategy. All authors read and approved the final paper.

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Research Article

Exploring Environment-Intervention Fit: A Study of a Work Environment Intervention Program for the Care Sector

Louise Hardman Smith, Birgit Aust, and Mari-Ann Flyvholm

The National Research Centre for the Working Environment, Lersø Parkallé 105, 2100 Copenhagen, Denmark

Correspondence should be addressed to Louise Hardman Smith; Louisesmith@city.dk

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Targeting occupational health and safety interventions to different groups of employees and sectors is important. The aim of this study was to explore the environment-intervention fit of a Danish psychosocial work environment intervention program for the residential and home care sector. Focus group interviews with employees and interviews with managers were conducted at 12 selected workplaces and a questionnaire survey was conducted with managers at all 115 workplaces. The interventions enhanced the probability of employees experiencing more “good” work days, where they could make a difference to the lives of clients. The interventions may therefore be characterized as culturally *compelling* and having a good fit with the immediate work environment of employees. The interventions furthermore seemed to fit well with the wider organizational environment and with recent changes in the societal and economic context of workplaces. However, some workplaces had difficulties with involving all employees and adapting the interventions to the organization of work. The findings suggest that flexibility and a variety of strategies to involve all employees are important aspects, if interventions are to fit well with the care sector. The focus on employees’ conceptualization of a “good” work day may be useful for intervention research in other sectors.

1. Introduction

In occupational health and safety research, the importance of developing intervention programs to target different groups of employees and sectors has been emphasized in recent years [1, 2]. The WHO Healthy Workplace Framework and Model suggests that to be successful “the specific needs and requirements of the local culture and conditions should be incorporated into the health and safety activities in the workplace” [3]. Furthermore, a reconciliation of the competing paradigms of maximizing implementation fidelity versus adapting programs to fit local cultures has been proposed, because the tailoring of programs to local cultures has increasingly been recognized as an essential element for implementation. The adaptation of programs should therefore receive the same attention as fidelity to the implementation of intervention activities [4, 5]. As a consequence of the recognition of the need for design of tailored interventions, a search for pathways to target interventions to specific groups

of employees and workplaces such as for instance small enterprises has been intensified [6, 7].

A growing amount of scientific work has furthermore been devoted to strengthening organizational interventions, and deepening the understanding of the processes and contextual issues, that influence the implementation and outcome of interventions, for instance on employee stress and wellbeing [8]. Research on the “healthiness” of organizational change processes within this field of research has emphasized the importance of focusing on how interventions integrate with employees’ experiences of work to shape their reactions to interventions. Among the factors identified as being of special interest for managing healthy organizational change are: role clarification, manager availability, attention to diversity in perceptions and reactions, the use of constructive conflicts and attention to the local norms among employees [9, 10].

Randall and Nielsen, who for years have worked on how to develop, implement, and evaluate organizational interventions for stress and wellbeing, have introduced

the concept of “intervention fit” [11]. In their concept, the degree of “fit” between an occupational health and safety intervention and the specific context is viewed as determining the intervention process, and as a consequence the intervention outcomes. Interventions may in some situations be appropriate and powerful due to a good fit with the organizational context, while the same intervention might lead to weak effects in other organizations due to poor fit [11]. Randall and Nielsen recommend that at least four levels of environment-intervention fit should be addressed in evaluations of organizational interventions. The levels are as follows: the individual employees’ immediate working environment, the environment of the team they work in, the wider organizational environment, and the societal and economic context of the organization.

Based on a social ecological theoretical perspective, Panter-Brick et al. [12] have taken the idea of fit between an intervention and the context, in which the intervention is planned to be implemented, a step further. They advocate that health interventions to be successful should “strive to be culturally *compelling*, not merely culturally appropriate”. They argue that to be culturally compelling, health interventions should build on “existing practices, skills and priorities”. Culturally appropriate interventions are defined by Panter-Brick et al. as interventions that take into account psychosocial variables such as attitudes, norms, and self-efficacy, which may determine intention to change. Culturally *compelling* interventions, however, extend wider due to their focus on how to propel “intention to change” to “actual behavior change.” Panter-Brick et al. propose that key determinants of culturally compelling interventions are related to the choice of trigger, the sense of community ownership, and the fit of interventions with local priorities [12].

The aim of the current mainly qualitative study was to explore the environment-intervention fit of a sector-specific psychosocial intervention program for the home and residential care sector (care sector in the following). Inspired by Randall and Nielsen, we investigated different levels of environment-intervention fit. However, because work in the care sector to a large extent is organized in teams, we did not distinguish between the individual employees’ immediate working environment and the environment of the team they work in. Instead, we investigated the following three levels of fit: (1) the fit of the interventions with employees’ and their teams’ immediate working environment combined, (2) the fit of the interventions with the wider organizational environment, and (3) the fit of the interventions with the societal and economic context of workplaces.

Furthermore, the analytical approach of the study was inspired by the concept of “culturally *compelling*” interventions introduced by Panter-Brick et al. [12]. Based on this approach, we propose that one way for interventions to be culturally compelling is by enhancing the probability of employees experiencing more of what they conceptualize as a “good” work day. This approach focuses on how to enhance the positive aspect of work seen from employees’ perspectives, which is in contrast to much work environment intervention research which primarily focuses on reducing shortcomings and problems in the work environment.

The intervention program for the care sector evaluated in this study was developed in connection with a Danish government-financed occupational health and safety initiative for sectors threatened by attrition. The interventions were called “prevention packages” and The Danish National Research Centre for the Working Environment evaluated the interventions at the workplaces that had applied for an intervention the first year after the launch [6].

2. Material and Methods

The intervention program for the care sector (homecare, nursing homes, and institutions for the physically and mentally disabled) included four different prevention package interventions. The interventions were primarily designed to improve psychosocial wellbeing, but physical work environment issues could also be addressed if the employees chose so.

The specific focus of the interventions differed, but all of the interventions included participatory processes where employees themselves identified and found solutions for the problems they experienced in their everyday work. Such participatory processes have been related to responsibility for and commitment to changes, as well as improvement of health and safety at workplaces [13–15].

The four interventions for the care sector were as follows.

- (1) *Peer Coaching*. In this intervention employees were introduced to a method to give and receive guidance and support to and from colleagues in relation to difficult work situations with clients. As part of the intervention a municipal consultant educated four key employees to become trainers for peer coaching sessions. After the training the key employees conducted sessions of peer coaching for colleagues by themselves.
- (2) *The Three Most Resource-Demanding Clients*. This intervention focused on teaching employees a method to engage in structured collegial dialogue. The method guided the employees to find new ways to solve problems related to the three most resource-demanding clients. The nine key employees who worked the most with these three clients participated in working groups.
- (3) *Future Workshop*. This intervention consisted of a workshop for all participating employees, guided by a municipal consultant. A future workshop is an established method for developing improvement ideas. The workshop included a critical reflection regarding daily routines, development of visions and ideas for improvements and finally the formulation of a realistic action plan [16]. After the future workshop a number of specific improvements were implemented.
- (4) *Occupational Health Circle*. Health circles consisted of managers and a group of employees representing all employees with regard to different tasks, seniority, and so forth. Based on an assessment of the work

environment and during a course of regularly scheduled work meetings led by the municipal consultant, the group developed appropriate suggestions for improvement that were then discussed with the entire group of employees [13, 17]. Eight to ten employees and management representatives participated in the health circle.

Depending on which of the four interventions was chosen, the duration of the intervention was between six and nine months. Financial compensation for salaries was given for between 28 and 40 working hours for key employees, and somewhat less for managers and other participating employees. Compensation for municipal process consultants was given for between 74 and 106 hours of support by consultants.

In the care sector 115 workplaces were granted a total of 133 prevention package interventions the first year after the launch (some workplaces had applied for and were granted more than one prevention package). Based on the workplace applications it was calculated that a total of 4,330 employees would participate in the interventions.

2.1. Analytical Approach. We investigated how the prevention package interventions for the care sector fitted with level one, the employees' and their teams' immediate working environment, by relating employees' perceptions of the impact of the interventions to their conceptualizations of a "good" work day. Our proposition was that if employees' perceptions of the impact of the interventions seemed to enhance the probability of them experiencing more "good" work days, the interventions could be characterized as being culturally *compelling*, and the intervention fit with employees' immediate working environment would be interpreted as a good fit. To determine how the interventions fitted with level two, the wider organizational environment, we investigated whether the interventions seemed to support the main tasks of the workplaces and could be adapted to the everyday organization of work. The fit of the interventions with level three, the societal and economic context of workplaces, was determined by investigating whether the interventions seemed to match the changes in the societal and economic context the participating workplaces had experienced the year before the intervention. Because the interventions were mostly aimed at changes in employees' immediate work tasks and environment, most emphasis was put on exploring level one: the intervention fit with employees' and their teams' immediate working environment.

2.2. Data Collection

2.2.1. Interviews and Observations. For each of the four interventions for the care sector, three workplaces were chosen from different geographical areas and from both home and residential care. At these 12 workplaces semistructured focus group interviews with employees, individual interviews with managers [18–20] and observations of staff meetings were performed. The focus group interviews and the interviews with managers were conducted in connection with the termination of the interventions. Four to 10 employees representing

the employees at a particular workplace were interviewed in focus groups at each of the 12 selected workplaces [20]. The employees who participated in the focus groups were selected by their managers. They included both employees who had key roles during the interventions, such as being a member of the steering committee and participant in a "health circle" or in a working group in "the three most resource-demanding clients," and employees who had not performed such roles. The employees were informed by their managers that participation in the focus groups was voluntary. Additionally, the researchers in charge of conducting the interviews informed all interview persons that participation in the interviews was voluntary and that confidentiality was guaranteed. According to Danish National Committee on Biomedical Research Ethics (<http://www.cvk.sum.dk/>), ethical approval in Denmark only applies for studies using biological material.

In the beginning of the focus group interviews, we asked employees to discuss and describe a "good" work day in detail in their own words. Thereafter we asked employees to describe and discuss experiences with the interventions and their perceptions of the impacts of the interventions. Employee perceptions with regard to these two main topics informed the exploration of the intervention fit with employees' and their teams' immediate working environment. The focus group interviews lasted between one hour and one and a half hours. Examples of questions asked in the focus group interviews are presented in Table 1.

Interviews with managers focused on their experiences with the implementation and outcome of the interventions. Most of the interviews lasted about half an hour; however one third of the interviews lasted between half an hour and one hour. Examples of the questions asked in the interviews are presented in Table 1.

Observations were conducted during staff meetings at mid-term and the end of the intervention, where employees were informed about the status of the intervention. The observations of staff meetings included counting how many employees were present and observations of how employees conducted or presented intervention activities. We primarily focused on how many employees seemed to be informed and interested in the activities as well as the character of the verbal and the nonverbal communication between employees and between employees and managers (e.g., the level of detail by which activities were presented and discussed).

Three-quarters of the interviews and observations were conducted by the first author who has considerable experience in qualitative research interviewing [21, 22]. The rest of the interviews and observations were conducted by research assistants under the guidance of the first author. All interviews were audio-taped, transcribed verbatim by research assistants, and coded by the first author in accordance with the topics of the interview guide using the software program Nvivo 9. Based on the coded interview material, thematic analysis within the analytical framework of the study was conducted, and themes that best represented the entire data set were derived from an experience based and creative analytical process [23]. The analytical process included reviewing the themes, defining and naming themes,

TABLE 1: Topics in the interviews with employees and managers.

Topics in the focus group interviews with employees	Examples of questions
Perceptions of a good workday	(1) Describe a good work day: What happens during a good work day from start of shift to end of shift? What does a good workday look like in regard to, for example, main tasks and interaction with colleagues?
	(2) Further questions and probes about a good workday: Could you give some examples? What happens more? Do you others agree? Do you think colleagues, who are not participating in this focus group, have other perceptions? If so, which? Does anyone have other examples?
Perceptions of the impacts of the interventions	(1) Has the intervention had any impacts? If so which impacts? Has the daily work changed? If so how? What has been the most significant change? What has been the best thing about the intervention? What has been annoying, not so good, or deteriorated due to the intervention?
	(2) Further questions and probes about impacts of the intervention: Could you give some examples? What has happened more? Do you others agree? Do you think colleagues, who are not participating in this focus group, have other perceptions? If so, which? Does anyone have other examples?
	(3) Would you recommend the intervention to other workplaces similar to yours? If so, what would you tell them they could achieve from it?
Additional comments	Do you have any other comments about the intervention?
Topics in the interviews with managers	
Perceptions of the implementation of the interventions	(1) Was it possible to adapt the intervention to your workplace? Was the time schedule realistic? Have you been able to implement all the activities? Was the financial support sufficient? Have you changed the intervention so it could be adapted better, and if so how? What did not work well and why?
	(2) How could the intervention be improved?
	(3) What has been the best and the most challenging part of the project?
Perceptions of the impacts of the interventions	(1) Has the intervention had any impacts? If so, which impacts? Has the intervention changed any work routines, if so, which and how? What have been the most significant changes? What impact has the intervention had all in all?
	(2) Has the intervention met your expectations?
	(3) Would you recommend the intervention to other workplaces similar to yours? If so, what would you tell them they could achieve from it?
Additional comments	Do you have any other comments about the intervention?

and selecting extract examples from the data set, besides a final analysis relating back to the research questions and the theoretical and analytical framework.

2.2.2. Questionnaires. Self-administered questionnaires were sent to managers at the beginning and at the end of the interventions at all workplaces conducting one or more of the four interventions the first year after the launch. Of the 133 managers who participated, 121 answered the questionnaire at the beginning (91%) and 105 at the end (79%). Questionnaires to managers at the beginning of the interventions included

questions about a range of selected changes in the societal and economic context of the workplace such as budget and staff cuts the year before the intervention.

The questionnaires to managers at the end of the interventions included items about the adaptability of the interventions. This questionnaire also included optional open-ended questions about experiences with the interventions and the implementation process, which 91 managers chose to answer. The questionnaires at the end furthermore included open-ended questions about suggestions for improvements of the interventions, which 65 managers answered. The items in

the questionnaire were primarily chosen among items which had previously been used in evaluations by The National Research Center for Work Environment, but some were developed specifically for this study. The open-ended questions were similar to the overarching questions asked in the interviews with managers (Table 1).

The questionnaire survey and the interviews were conducted separately. However, the final questionnaire survey to managers and the interviews with managers both took place in connection with the termination of the intervention. Some of the managers had answered the questionnaire at the end of intervention before the individual interview, while others answered it after the interview, depending on when the questionnaire was sent to them and when the interview was conducted.

We compared and analyzed the answers to the open-ended questions in the questionnaire in combination with the material from the interviews with the managers to determine how the interventions seemed to fit with the main tasks and organization of work at the workplaces. The answers to the open questions in the questionnaire were categorized, in a summative analytical process, according to how many managers expressed the same experiences and suggestions i.e. many, several or some managers.

3. Results

3.1. The Fit of the Interventions with Employees' and Their Teams' Immediate Working Environment

3.1.1. *Employees' Descriptions of a Good Work Day.* In the analysis of the focus group interviews we identified five distinct themes regarding the employees' descriptions of a "good" work day. The themes and excerpts from the interviews illustrating the themes are presented as follows.

(1) *"Make a Difference" for the Clients.* Employees described that having good contact with clients and being able to give meaningful care to clients were part of a good work day for them. They described situations where they could "make a difference" to the lives of clients for example, by providing better treatment, and thereby help to improve the clients wellbeing or health status.

"It is a day where you have been in contact with each resident and heard what they are preoccupied with or have given them an offer of activity" (workplace 3).

"It can be when you refer someone to physiotherapy and it goes through, and it makes a difference to the client, or it can be when you identify that a client with mental illness is becoming worse and you can make sure he or she gets the necessary treatment" (workplace 11).

(2) *Sufficient Resources to Do a Good Job.* This theme was related to the availability of sufficient resources, so the employees could do what they were supposed to do in a day's

work and in a quality they were satisfied with. The resources primarily referred to were economic resources and the number of care personnel. High absenteeism and widespread use of temporary workers was especially highlighted as a problem. A good work day was described as a day with low absenteeism and availability of all necessary resources so tasks could be conducted as they were supposed to be.

"There are not too many colleagues sick. We are the number of employees we should be and are able to perform our services" (workplace 3).

"You get done what you need to do and resolve tasks in a way that you are satisfied with" (workplace 6).

(3) *Good Social Relationships with Colleagues.* This theme involved the possibility of interaction with colleagues in a respectful and friendly manner. Respectful interaction referred to the recognition of skills of each other and specific areas of knowledge such as care for clients with dementia or lifting of clients. Friendly interaction referred to reciprocal interest and care for each other also with respect to personal problems

"It is when there is a good tone between us, and we have respect for each other, both professionally and personally" (workplace 1).

"It is if we also have time for some small talk for instance if a colleague is upset" (workplace 3).

(4) *Good Collaboration.* This theme involved having professional collaboration and the possibility of discussing work with colleagues, so the care for clients could be optimized.

"A good work day is when I feel we are a team, where observations of clients and health initiatives merge" (workplace 3).

"We have the possibility of discussing work situations with colleagues and experiencing a positive development with a client due to this" (workplace 9).

(5) *Good Management.* This theme referred to the importance of visible leadership and good planning of work tasks by managers, so the care for clients was not disrupted by disputes or lack of knowledge about how to solve work tasks or who was responsible.

"A good work day requires good planning from management" (workplace 2).

"A good work day requires visible leadership and clear guidelines" (workplace 7).

In summary, all themes identified in employees' conceptualization of a "good" work day contributed to making

a difference to the lives of clients. The other themes could be interpreted as subordinate but important preconditions to fulfill this overarching aim: Good social relationships with colleagues are a precondition for good collaboration; good management and sufficient resources are preconditions for performing a good job, which consisted of making a difference to the lives of clients.

3.1.2. Employees' Perceptions of the Impact of the Interventions. The analysis of the focus group interviews showed that a large majority of the employees perceived, that the interventions had contributed to positive changes in their wellbeing and work environment. However, some employees, primarily among those who had not had key roles during the interventions, perceived that the interventions had only had minor or no impact. As was the case for the description of a "good" work day, we identified five distinct themes in employees' perceptions of the impact of the interventions. The themes and excerpts from the interviews illustrating the themes are presented as follows.

(1) Improved Possibility for Reflection and Discussion of Work with Colleagues. The employees in the focus groups expressed that the interventions had given them time for reflection and improved possibility of discussing difficult and straining work situations. Furthermore, employees reported that the discussions had resulted in a broader variety of viewpoints on how to carry out a work task and how to solve a problem.

"The project has given us the possibility to talk about the things that are straining in our work" (workplace 1).

"We have had time to work thoroughly with some of our challenges in regard to clients. Usually there is not time for this, although there ought to be" (workplace 6).

(2) Improved Communication. Participants pointed out that the interventions had entailed clearer communication internally in the group of colleagues as well as an improved tone. Furthermore, employees emphasized that they listened to one another with more attention.

"People listened to each other in a different way compared to how we usually discuss problems at staff meetings" (workplace 2).

"The tone at the workplace has become more comfortable. We have also become clearer in our communication" (workplace 11).

(3) Improved Interaction and Knowledge of Colleagues' Perspectives. Another aspect described by the participants of the focus group interviews was that the interventions, through the increased number of meetings and activities across employee subgroups, led to more social interaction with colleagues. Furthermore, intervention activities in smaller

groups had given those, who usually did not make themselves heard at large group meetings, the opportunity to express their viewpoints.

"It has been an opportunity to see another side of ones colleagues, which is positive" (workplace 3).

"Those who do not usually say much have expressed their views much more" (workplace 7).

(4) Improved Methods to Work Systematically with Work Tasks and the Working Environment. Participants of the focus group interviews pointed out that the methods introduced to them, during the intervention, had helped them to work more systematically with how to solve their work tasks, and how to improve their working environment. The specific methods described by the employees depended on which of the four interventions had been carried out at their particular workplace.

"The coaching has given us the possibility to talk about the most straining aspects of our work" ("peer coaching", workplace 1).

"I think it is really important that everyone involved in this project has a shared understanding. It has been interesting to examine a client's background. It gives an understanding of why he or she acts the way they do" ("the three most resource-demanding clients", workplace 5).

"We have become more aware of each other's resources. We have experienced more influence on our work through the project. We have also become more creative" ("future workshop", workplace 8).

"We have worked constructively in the group. We have learned to work in a completely different way than before" ("occupational health circle", workplace 12).

(5) Minor or No Impact of the Interventions. Some participants of the focus groups perceived that the interventions had only contributed to minor or no changes. They, for instance, did not find the interventions relevant or sufficient to address the major problems in their work environment, or assessed the fact that the intervention had taken time away from important everyday work tasks.

"I do not think it has made a difference. We have much greater problems in our psychosocial work environment than the small problems that have been dealt with" (workplace 11).

"I thought 'what is it good for'? We are dissatisfied because we do not have sufficient time. I am responsible for the medicine and I have not had time to learn the computer system. Meetings are not always helpful in my opinion" (workplace 12).

To sum up, the themes in employees' perceptions of the impact of the interventions highlight that the interventions had provided time to reflect on work and discuss potential new approaches with colleagues. More social interaction in connection with small team meetings as well as meetings across teams had improved communication and allowed a larger variety of different perspectives, including inputs from those who typically did not express their opinion as much. In addition, the interventions supplied employees with different approaches on how to discuss work in a systematic manner and implement new methods which had improved collaboration. The analyses, however, also showed that some employees perceived that the interventions had not had any impact or had even had a negative impact on everyday work, by taking time away from more important tasks.

When we compared employees' descriptions of a "good" work day with their perceptions of the impact of the interventions, we found that, according to the large majority of employees, the interventions improved the possibilities for reflection and discussion of work situations with colleagues. In addition, the interventions entailed improved methods to work systematically with work tasks. Furthermore, the interventions improved communication and interaction with colleagues which gave the possibility of establishing good social relationships, which are a precondition for good collaboration. Combined, these improvements contributed to the possibility of doing a good job and making a difference to the lives of clients, which was the main intention in the employees' descriptions of a "good" work day. However, according to the employees the interventions had primarily influenced relations between colleagues, whereas nothing was reported about the influence on management, which was also an aspect of a "good" work day. With this exception, the impacts of the interventions seem to enhance the probability of experiencing more of what employees conceptualized as a "good" work day. Based on this, we characterize the interventions as being culturally compelling, and conclude that there was a good fit of the intervention and the immediate working environment of employees and their teams.

3.2. The Fit of the Interventions with the Wider Organizational Environment. The questionnaire survey showed that 85% of the managers reported that the intervention they had chosen could be adapted to their workplace. This result was supported by the open-ended answers in the questionnaire and in the interviews. However, these data sources also gave an insight into the difficulties the workplaces had experienced with the adaption of the interventions.

Most of the managers reported satisfaction with the focus areas of the interventions in answers to the open-ended questions in the questionnaire at the end of the interventions and in the interviews. *Most of the managers'* furthermore expressed that the interventions had contributed to a greater degree of professionalism at their workplace and that communication and cooperation between employees had improved. *Several managers* emphasized that a greater sense of social community among employees had been established and that communication and cooperation with clients and their relatives had improved. According to these managers

the interventions had contributed to improving the main tasks related to the client-related work at their workplace. All of these experiences pointed at a good fit between interventions and the wider organizational environment.

Some managers, however, reported that they had experienced challenges in connection with the adaption of the interventions to the everyday organization of work. These managers recommended a higher degree of flexibility in the interventions. They would have preferred to be able to plan the implementation process so that it would fit better to their particular workplace. Some, for example, would have liked to have had the possibility of determining the length of meetings, number of key employees, or the number of clients who should be involved in the intervention.

According to some of the managers it was furthermore a challenge to inform, involve, and engage the employees who were not the primary participants in the interventions such as key personnel or members of working groups. In all interventions for the home and residential care sector, information about the intervention process was delivered during meetings at start-up, mid-term, and at the end of the interventions, where all employees were supposed to be present. The observations of the meetings, however, revealed that far from all of the participating employees were present at the meetings. Furthermore, some of those who were present knew little about the progress of the intervention, because they had not participated in the previous meeting. When this observation was presented in the interviews with managers, some explained that joint staff meetings were rarely held because employees worked in shifts. Moreover, if joint meetings were held they were usually voluntary for employees who were not working on the day of the meeting. Managers explained also that even when there were written records of the meetings or the progress was depicted in other ways such as on posters or boards, they were not always read by employees. *Some managers* would therefore have liked to have had the possibility of conducting more of the smaller team meetings instead of the scheduled large joint meetings where all employees were supposed to be present.

3.3. The Fit of the Interventions with the Societal and Economic Context of Workplaces. *Most managers* reported satisfaction with the financial compensation for time spent on the interventions and the consultancy support to implement the interventions. This support fitted well with the societal and economic context of workplaces in the care sector, because it counter-balanced a context where the majority of managers reported that they had experienced major changes in the year before the intervention: 53% of the managers reported budget cuts and 60% reported reduction in number of employees (Table 2). *Several managers* reported that the prevention package interventions had been welcomed, because the budget cuts and the many other changes that had occurred in recent years, had not left much time or resources to work specifically with the working environment.

Based on the experiences of the managers, we conclude that the interventions seemed to fit well with the societal and economic context of workplaces.

TABLE 2: Managers' reports of changes at the workplace the year before the intervention.

	Changes the year before the intervention	
	% answering "yes"	Number of respondents
Budget cuts	53	114
Reduction in the number of employees	60	117
Restructuring (e.g., mergers)	49	113
New tasks	64	114
Changes in management	31	114

4. Discussion

A large majority of employees' participating in the focus groups perceived that the interventions had contributed to positive changes in their working environment. According to these employees the interventions had improved the possibilities for reflection and discussion of work situations. Furthermore, better communication and collaboration as well as improved methods to work systematically with work tasks were emphasized. The employees' perceptions of the outcome of the interventions were supported by the managers who reported that the interventions had contributed to improve collaboration and the main tasks related to the client-related work at their workplace.

In their description of a "good" work day, employees emphasized the importance of being able to perform work of a good quality and make a difference to the lives of their clients. In addition, they stressed possibilities to collaborate and interact with colleagues as well as the importance of good management. Thus, when perceptions of the impact of the interventions were related to descriptions of a "good" work day, it appeared that the changes achieved by the interventions seemed to enhance the probability of employees experiencing more "good" work days. The interventions can therefore be characterized as culturally compelling and fitting well with the immediate work environment of employees and their teams. However, the interventions did not seem to have contributed to the management of work, which also was pointed out as one aspect of a "good" work day. This may be explained by the fact that management had not been a specific focus of the interventions.

We are not aware of other studies that have focused specifically on the conceptualizations of a "good" work day among employees in the home and residential care sector. However, several studies confirm selected aspects of our findings. For example, studies have found that the direct care relation with the elderly is associated with the experience of meaning of work [24–27] and that the possibility of adapting care to the individual and the specific work situation are crucial for the perception of conducting satisfactory work in health care [26]. Furthermore, it has been shown that improvements in time available for the contact with the elderly, increased skill discretion, and improved social relations could prompt previous eldercare employees to reconsider quitting or retiring [28].

Our study also showed that some employees did not perceive that the intervention had resulted in any improvements.

Some of these employees reported that the interventions could not improve employee wellbeing or solve the main problems, their workplace experienced in the psychosocial work environment. In a context of major reductions in resources and number of employees, the prevention package interventions offered might not have been sufficient to address all potential psychosocial strains and that is why more extensive measures may be needed in some cases.

A large majority of the managers reported that the interventions could be adapted to their workplace, and they were satisfied with the focus areas of the interventions, which they perceived fitted well to the main tasks related to the client-related work in the sector. This points at a good intervention fit with the wider organizational environment. However, the division of employees with key roles and more peripheral participants in the interventions received some criticism, because it had been difficult to inform, involve, and engage employees without active roles in the intervention activities. Moreover, for some of the workplaces, there was a mismatch between the intervention setup and the meeting practices related to shift work.

The managers revealed that financial compensation for time spent on the intervention, and consultancy support to implement the interventions, fitted well with the recent changes in the societal and economic context of workplaces in the care sector. Savings in public spending partly due to the financial crisis in recent years had been a main problem in the eyes of many managers.

Several managers recommended that the interventions should be more flexible, if they should be able to fit with the daily organization of work. While more flexibility might improve implementation, too much flexibility can jeopardize the implementation fidelity needed to achieve a desired impact, as mentioned in the introduction [4, 5]. In our case the prevention package interventions were funded by public means. This contributed to a more restrictive approach in the guidelines for the first interventions focusing largely on implementation fidelity. Based on the experiences with these interventions, the interventions developed since have become more flexible allowing a greater degree of adaption to local workplace cultures and contexts, including, for example, more flexible meeting structure for workplaces with shift work.

The results of this study may provide inspiration for future targeted occupational health and safety interventions in the care sector or similar sectors. If interventions in the sector

intend to support the positive aspects of work seen from the insider's perspective, they should enhance the possibility for employees to make a difference to the lives of their clients and to perform work of good quality, or at least not be in conflict with these aims. Interventions aiming to support what employees in the care sector define as a good work day should also ensure the possibility to interact and collaborate with colleagues and to focus on a good management of work tasks. Furthermore, our study shows that strategies to involve all employees should be developed further and flexible concepts should be introduced, so interventions can be adjusted to the specific workplace context. Based on our findings, we propose that to design workplace interventions that will fit with the targeted groups of employees and their environment extensive workplace visits and thorough reflections on how to make an intervention fit with conceptualizations of a "good" work day and the everyday organization of work are recommended.

The conceptual focus on the importance of intervention fit with employee conceptualizations of a "good" work day for intervention success may serve as inspiration for intervention research in other sectors. The focus is to some degree aligned with and may therefore be of interest to the field of research that is engaged in "healthy" management of change processes. This research focuses on how interventions integrate with employees' experiences of work to shape their reactions to the interventions [9, 10]. Furthermore, the fit of an intervention with employees' conceptualizations of a "good" work day may provide a supplement to the common variables that have been linked to employees' appraisal of interventions, such as their influence over intervention content, the quality of an intervention, and its sustainability [29].

4.1. Strength and Limitations of the Study. The strength of the study is the detailed investigation of the intervention-environment fit of the implemented interventions with a specific focus on employees' perceptions. By exploring what employees consider as a "good" work day and comparing these aspects with their perception of the impact of the interventions, we were able to investigate to what extent the interventions were culturally compelling, that is, achieving a good fit with the employees and their teams' immediate work environment. The study thereby contributes to a better understanding of the mechanisms that can support or impede the implementation of workplace interventions.

A limitation of the study is that the participants in the focus groups were selected by the managers. Even though we asked the participants to reflect on the viewpoints of their nonparticipating colleagues, the participants may have rated the interventions more positive than their colleagues. Furthermore, a limitation was that focus group interviews with employees and the questionnaire survey and interviews with managers were conducted in connection with the termination of the interventions. A later follow-up could have investigated if the perceived positive impacts of the interventions were sustainable, and if positive impacts were disseminated to employees without key roles in the interventions.

5. Conclusions

Results from the present study may provide inspiration for the design of future targeted interventions which aim to improve work environment and employee wellbeing in the care sector. To achieve a fit between the immediate work environment and employees' conceptualizations of a "good" work day, the interventions should enhance the possibility for employees to make a difference to the lives of their clients, to perform work of good quality and interact and collaborate with colleagues and to contribute to good management. Furthermore, to fit with the wider organizational environment as well as societal and economic context, strategies to involve all employees should be considered and flexible concepts should be introduced, so interventions can be adjusted to the specific context of the workplace. The focus on employee conceptualizations of a "good" work day in this study may be useful for intervention research in other sectors, which aims to design culturally compelling interventions.

Conflict of Interests

There is no conflict of interests regarding the publication of this paper.

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Research Article

Supervisors' Strategies to Facilitate Work Functioning among Employees with Musculoskeletal Complaints: A Focus Group Study

Tove Ask¹ and Liv Heide Magnussen^{1,2}

¹Department of Global Public Health and Primary Care, Physiotherapy Research Group, University of Bergen, P.O. Box 7800, 5020 Bergen, Norway

²Department of Occupational Therapy, Physiotherapy and Radiography, Faculty of Health and Social Sciences, Bergen University College, P.O. Box 7030, 5020 Bergen, Norway

Correspondence should be addressed to Tove Ask; tove.ask@igs.uib.no

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Aim. To explore what strategies the supervisors found beneficial to prevent or reduce sickness absence among employees with musculoskeletal complaints. *Methods.* Five focus groups were conducted and 26 supervisors from health and social sector participated. Commonly used strategies to prevent sickness absence and interdisciplinary cooperation in this work were discussed in the focus groups. Systematic text condensation was used to analyse the data. *Results.* The supervisors described five strategies for sick leave management: (1) promoting well-being and a healthy working environment, (2) providing early support and adjustments, (3) making employees more responsible, (4) using confrontational strategies in relation to employees on long-term sick leave, and (5) cooperation with general practitioners (GPs). *Conclusions.* Strategies of promoting a healthy working environment and facilitating early return to work were utilised in the follow-up of employees with musculoskeletal complaints. Supportive strategies were found most useful especially in the early phases, while finding a balance between being supportive, on one side, and confronting the employee, on the other, was endeavoured in cases of recurrent or long-term sick leave. Further, the supervisors requested a closer cooperation with the GPs, which they believed would facilitate return to work.

1. Introduction

Environmental and organizational factors in the workplace have been highlighted as important in the prevention of long-term sickness absence [1–5], where musculoskeletal complaints are the most frequent reasons for sick leave [6, 7]. Supervisors' responsibility and role have been emphasised in this work [8–13]. They are often the first to notice employees' health problems in the workplace and have an opportunity to make adjustments at an early stage in order to limit work disabilities [3, 13].

Promotion of employees' health and well-being has been linked to increased work ability and work participation [14, 15]. The impact of social support from supervisors has been emphasised in particular [15, 16]. Social support includes

general social support at work, good communication and social contact with supervisors, a good work atmosphere, understanding of pain, help when things are difficult, and social support away from work [15].

Supervisor support may also influence the return to work (RTW) process. Poor supervisor support combined with high psychosocial demands has been found to be strongly associated with increased sickness absence due to overstrain or fatigue [16] and with increased risk of musculoskeletal complaints [15]. Labriola et al. [17] showed that low supervisor support, measured at the workplace level, was associated with increased risk of long-term sickness absence. However, other authors have reached opposite conclusions, demonstrating that low supervisor support was associated with a higher RTW rate [18], or have found no association

between the level of supervisor support and risk of back pain and/or sick leave [19, 20].

Several aspects may influence the supervisors' choice of strategies in the follow-up of employees with health complaints. Tjulin and coauthors [21] found that workplace strategies shifted during three RTW phases: the prereturn, the initial return, and the postreturn phases. Supervisors seemed to follow the advice from the organisational policy in the RTW process, but when the employee was back in work they took less responsibility. Although assisting people with health complaints to stay at work has been recommended in the literature [2, 22], few have described this phase.

The choice of strategies may also be dependent on national legislation and policy. In Norway, both employer and employees have since 2011 been given increased responsibility in the RTW process. For instance, an early and close follow-up of employees on sick leave is considered important. After four weeks of sickness absence, the employer is responsible for facilitating work modifications and provides a detailed RTW plan in cooperation with the employee on sick leave. At seven weeks of sick leave, all stakeholders are required to participate in a dialog meeting in order to solve the problem [23].

Despite increased focus on the workplace and the supervisor's role in the prevention of sickness absence, knowledge is still lacking about key strategies utilised in the different phases of sick leave management, including the phase where the employee remains in work despite complaints. Insight into these strategies may increase our understanding of aspects that facilitate work participation. The aim was therefore to explore what strategies the supervisors used in the follow-up of employees with musculoskeletal complaints and what strategies they found most beneficial in the different phases of sick leave management.

2. Methods

The present study was part of the project "Function, Activity, and Work," a joint project between the University of Bergen and the municipality of Bergen's Department of Health and Social Services. Focus group interviews were used since we wished to gain insight into the supervisors' experiences of following up employees with musculoskeletal complaints. Group discussions can stimulate the interaction among participants in the target group and yield a wide range of views across several groups [24].

The study was approved by the Regional Committee for Medical Ethics.

2.1. Participants. The participants were recruited from the Department of Health and Social Services in the municipality of Bergen, Norway. The department has around 7,000 employees, with a mean sickness absence rate of approximately 10% in recent years [25], which is considerably higher than the mean rate in Norway, which is 5.2% [7]. A total of 26 supervisors (23 women, three men), aged 31 to 62, who had worked as supervisors for from nine months to 18 years, agreed to participate. They were the immediate supervisors

and, in addition to overall professional responsibility in their department, had responsibility for following up employees on sick leave. Most of them were nurses and a few were social educators. They worked in the home nursing service, nursing homes, or group homes for intellectually disabled people. Each supervisor had responsibility for about 40 employees.

2.2. Procedure. Eligible supervisors were given verbal and written information about the project and were invited to participate through their manager and the project managers. The supervisors contacted the project managers if they agreed to participate. Written informed consent was obtained from all participants before the start of the study.

Five focus groups were conducted between January 2012 and February 2013, with six to seven participants in each group. Three focus groups were carried out at the beginning of 2012, with two additional groups a year later. To get an impression of the strategies used over time, the supervisors in the first focus groups were invited to participate one year later, and six of them agreed. An additional seven supervisors were therefore recruited and mixed with the previous participants in two groups.

The focus groups took place in a conference room at the university and lasted for 90 to 110 minutes. All focus group discussions were led by a moderator (TA), and a comoderator (LHM) took field notes, describing the atmosphere and the interaction in the group discussions.

A semistructured interview guide with open-ended questions was used. The interview guide covered questions about strategies used in the follow-up of employees with musculoskeletal complaints and experiences of interdisciplinary cooperation in this work. The moderator guided the focus group discussions and encouraged all group members to participate. The comoderator summarised the main topics that emerged, and the participants were asked to elaborate on and/or confirm them.

2.3. Data Analysis. The data was analysed using systematic text condensation as described by Malterud [26] in four steps: (i) listening to the interviews and reading all the materials to get an overall impression and describe themes; (ii) identifying units of meaning relating to experiences and strategies when following up employees with musculoskeletal pain and coding them; (iii) systematic abstraction of meaning units by condensing the contents of each code group; and (iv) synthesising from condensation to generalised descriptions and concepts describing supervisors' experiences.

Both authors discussed the themes and their interpretations of the interview data. They met several times to discuss the transcripts and the open codes that were identified by the individual researchers until consensus was reached about the different codes. To validate data and to ensure that important aspects were not lost, all the transcripts were reread.

3. Results

The supervisors described different strategies related to three phases in the sick leave management and five corresponding

themes: phase (1), preventive strategies for all employees: promoting well-being and a healthy environment; phase (2), supporting employees with musculoskeletal complaints to remain in work: providing early support and adjustments; and phase (3), RTW phase: making employees more responsible, using confrontational versus supportive strategies in relation to employees on long-term sick leave, and cooperation with the general practitioners (GPs).

Phase 1

Promoting Well-Being and a Healthy Working Environment. The most basic strategy to prevent sick leave was to ensure a well-functioning social climate in the workplace, which was considered to promote health and well-being. One strategy mentioned was to pay attention to each individual in their day-to-day work, while another was to strive for a good relationship with the employees. A safe and open atmosphere based on mutual trust and respect made it easier for employees to support each other, for example, if a colleague experienced musculoskeletal pain. One of the supervisors said:

We have a positive working climate and know each other well. The working relationship is good and we try to help each other in our day-to-day work.

Having a positive attitude to the workplace was also considered important in a well-functioning working climate. Among other things, this entailed being a role model, for instance, by taking part in the day-to-day work tasks together with employees, if necessary. Sometimes the supervisors organised workshops on the organisation's visions and goals in order to increase the feeling of belonging in the workplace. Educational courses were also regarded as a valuable way of inspiring and motivating employees to identify more with their work. A 35-year-old supervisor explained:

You have to be aware, place people where they have their competence and interests... so that they get their inspiration back, - then a positive spiral will start. If they are motivated, it will be easier to continue working even if they have some pain.

Phase 2

Providing Early Support and Adjustments. The supervisors agreed that sickness absence could be avoided if they recognised early signals of health complaints and offered support and modified work. The supervisors observed the employees in the performance of work tasks and gave advice on better working techniques. The sooner the supervisors became aware of employees' complaints the better, they explained. One of the supervisors put it as follows:

I pay a lot of attention to their (employees') body language... and I try to follow them closely and, for instance, ask about complaints if somebody holds their hands to their back. I consider myself observant and pick up on many things. For me, this is one important way of prevention.

Much time was spent on finding solutions and adjusting tasks to individual needs in order to prevent sickness absence. Easier work tasks, extra aids, working in pairs with the heaviest patients, changing shifts for a period, or, as a last resort, finding an alternative workplace in the municipality was among the solutions offered. Cooperation with the occupational health service was seen as helpful in many of these cases.

She (the employee) told me that she had to be on 50% sick leave because she needed to be treated by a physiotherapist. I asked her if there was anything we (the workplace) could do to prevent the absence. Looking at the job plan together, we changed her shifts for a period. She was also helped by the occupational health service and avoided sickness absence.

Although the supervisors showed great commitment, they expressed frustration about spending so much time and effort dealing with sick leave matters. The supervisors questioned the extent of their responsibility to adjust working conditions, especially in cases where the employees' main problem did not appear to be work-related.

Phase 3

Making Employees More Responsible. Several supervisors argued that employees need to take more responsibility for themselves, both in the workplace and in life situations in general. A healthy lifestyle was encouraged. Being aware of the balance between work and private life and keeping in good physical shape were seen as a prerequisite for this challenging work. A 50-year-old supervisor had told one of her subordinates:

If we intend to work as nurses until retirement, we'll have to do a lot of things like exercising and organising our private lives in a better way.

Employees on sick leave were encouraged to be more responsible in their own RTW process, for instance, by phoning when they received a sick note, participating in meetings, and cooperating with the supervisor to find solutions that could facilitate an early RTW. Statutory requirements, such as preparing a detailed RTW plan and holding a dialogue meeting after a certain time, were seen as useful in this process. When clarifying the responsibility each part had and the consequences of not following the procedures, the supervisors found support in the written rules at meetings with their subordinates. One of the younger supervisors stated:

I think it is okay to make demands of employees even if they are on sick leave. We can be better at that... It can easily happen that we do not dare to ask critical questions. We have to emphasize not only the rights, but also the duties of employees on sick leave in connection with sickness absence.

Confrontational versus Supportive Strategies in relation to Employees on Long-Term Sick Leave. The supervisors agreed that a supportive attitude would facilitate a healthy working environment and thereby prevent sickness absence. However, they disagreed on the most appropriate strategy for following up employees on recurrent or long-term sick leave, and these differences were eagerly discussed in the groups. While some were convinced that being understanding and supportive was the best approach to helping the employees to return to work, others believed that they as supervisors could be too supportive and claimed that, in some cases, a confrontational style was more useful.

Confrontational discussions were especially useful in communication with some of the younger employees and employees with recurrent periods of sick leave who they believed exploited the sickness certification system. In such cases, they were more direct towards the employees and asked critical questions about their sickness absence. They sometimes increased the pressure on the employees by informing them about and discussing financial consequences of being on long-term sick leave and difficulties finding jobs in future. They expressed a lack of trust in those who returned to work after one year's absence when further sick leave would have resulted in reduced disability payments. The supervisors suspected that these employees could manage to work well and wondered why they had not returned to work earlier. One supervisor claimed that, for temporary employees with a sick leave history, sickness absence decreased after these meetings:

I had to explain to each of them that their high level of sickness absence was not in line with national guidelines for that illness and that frequent sickness absence would have consequences for future work.

Some of the supervisors felt guilty, however, about questioning the employees' work ethic. The usefulness of confronting the employees nevertheless appeared to overshadow this feeling. Although the strategy of making demands and applying pressure was emphasised in some situations, supportive strategies were also valued, but the supervisors found it challenging to strike the optimal balance between the two.

Cooperation with GPs. Cooperation with GPs in dealing with challenging cases of sickness absence was seen as very important. The GPs' assessment of what the employees could safely do helped to reassure all parties in the dialogue. This led to a better evaluation of the employee's work ability and provided support when planning modified work tasks. Some supervisors said that these meetings had often resulted in an earlier return to work or at least from full-time to part-time sick leave. The supervisors found, however, that GPs knew little about current opportunities for adjusting work tasks and wanted closer dialogue with GPs in difficult cases. One of the younger supervisors said:

In our jobs, we are working with multi-handicapped people and we have a lot of heavy lifting, but it is not black or white. It is often possible to

find easier tasks for a while, but the doctors know too little about our workplace, and people listen to what the doctors recommend.

As a consequence, employees risked being put on sick leave without having tried other alternatives first.

4. Discussion

In the present study, we explored what strategies the supervisors found beneficial to prevent sick leave among employees with musculoskeletal complaints. All supervisors found supportive strategies useful to promote health and well-being and early RTW. For employees on recurrent or long-term sick leave, some supervisors found these strategies useful as well, while others emphasised a more confrontational style. Striking a balance between being supportive, on the one hand, and making demands and confronting the employees, on the other hand, seemed to be challenging.

The supervisors expressed great enthusiasm and involvement in the follow-up of employees with musculoskeletal complaints. Although most attention was directed towards employees who had already developed musculoskeletal complaints, strategies for creating a good working environment for all employees were also eagerly discussed.

The strategies the supervisors claimed to apply seemed to follow a specific pattern that was related to the different phases in the sick leave management. Mainly supportive strategies were used to promote a healthy working environment and to help employees remain in work despite musculoskeletal complaints. These strategies included facilitating a good social climate at work, taking notice of each individual, assisting in work situations, making modifications, and offering educational courses. They also motivated the employees to engage with the organisation's visions and strategy plans, which was considered to increase well-being and positive attitudes towards the workplace. Our findings are in line with other studies that point to the importance of social support from supervisors to enable employees to remain in work. An in-depth review of 52 studies showed that social support from coworkers and/or supervisors could help employees to cope with their musculoskeletal complaints and thus have impact on the prevention of musculoskeletal complaints and sickness absence [15]. According to a Dutch study [9], workers and occupational physicians as well as supervisors considered the supervisor's role to be important in relation to optimising functioning at work and helping workers with health problems to stay at work. In two systematic reviews, it was found that supervisor support did not seem to prevent the development of back pain [19, 20]. In our study, however, the focus was on management of musculoskeletal complaints and prevention of sick leave due to complaints, not on primary prevention.

There is conflicting evidence as regards which strategies are most appropriate in the RTW phase. Supportive strategies have been considered to be beneficial in the RTW process [2, 3, 10, 13, 27]. Employees on sick leave who reported that leadership qualities were good returned to work sooner than those not reporting such qualities among their leaders [27].

The feeling of being protected by their supervisor was the strongest predictor of early RTW. However, other studies have shown no association between supervisor support at work and sickness absence due to back pain [19, 20]. Post et al. [18] also found that low supervisor support was associated with a higher RTW rate. One explanation may be that having a supportive and empathetic supervisor could make it easier for employees to extend their sick leave and also lead to a feeling of dependency on the supervisor [18].

In the present study, utilising supportive strategies alone was not regarded to be sufficient to reduce sick leave. Confronting employees and demanding more responsibility of them in the RTW process were considered to be essential by some supervisors. Making demands on employees on sick leave was also emphasised by the supervisors in a Swedish study [10]. However, encouragement and pressure to remain in or return to work may have negative consequences for health and well-being if the employees are too ill to work [28]. The supervisors in our study seemed to be aware of this, and close cooperation with the GPs was seen as desirable in order to get a better judgment of the employees' work ability.

In line with our findings, previous research has concluded that close collaboration between health professionals, employees, and supervisors is essential in the RTW process [1-3, 22]. From supervisors' point of view, cooperation with health professionals was considered to be helpful in selecting modified work tasks, establishing a mutual understanding, and clarifying the supervisor's role in the RTW process [1, 10, 11]. However, the supervisors in the present study claimed that GPs knew too little about the workplace and they wanted a closer dialogue with the GPs in order to increase the effectiveness of the RTW efforts. According to a systematic review, employers described that the physicians were difficult to reach when they needed to discuss the employee's capability in relation to work tasks [3]. It is argued that GPs could make better judgments about work ability if they collaborated with the employer to obtain information about the individual's work situation [29].

Supervisors may find it challenging to strike a balance between production demands and employees' health concerns [1, 10, 12], and this could possibly influence their strategies in the RTW process. Swedish workers and supervisors were interviewed about the employers' role in relation to RTW, and both groups reported that the economic consideration for their company often dominated at the expense of the legal and ethical aspects [12]. This may also be the reason why some supervisors in the present study preferred to use confronting strategies in difficult RTW cases.

The supervisors in our study expressed great enthusiasm about following up employees with musculoskeletal complaints. Their preoccupation with sick leave and disability prevention is in accordance with the Norwegian government's policy and with legislation on the follow-up of employees on sick leave [23]. The high level of sickness absence in this department might therefore seem surprising. However, Health and Social Services is the sector with the highest sickness absence rate in Norway [7]. Nursing homes and home nursing services are characterised by female employees, physically demanding work, low control, and night shifts, all

described as risk factors for prolonged sickness absence [30-32]. It is therefore likely that the high sick leave level, in this particular department, reflects the level in such workplaces in Norway in general.

4.1. Methodological Considerations. Five group interviews were conducted with six to seven participants in each group in accordance with common recommendation for optimal group interaction [33]. The data yielded rich and broad descriptions that shed light on the topic, and we considered the material to have reached saturation since no new insights emerged from the last interviews.

We chose a systematic text condensation of the qualitative interview material and carried out an analysis of meaning across the interviews [26]. Two focus groups interviews were conducted one year after the first ones. This gave us more nuanced and broad descriptions, but no new strategies appeared. Because we noticed no time effect in this context, we considered transversal analysis to be the best method.

Half of the participants were invited to participate by their managers and half were self-selected. This may have resulted in selection sample of participants who were more enthusiastic and motivated than others in relation to finding solutions for the employees with musculoskeletal complaints.

The study was limited to the Bergen area and the supervisors were healthcare workers, mainly female nurses. Including male employees and employees from other professions might have provided additional perspectives. Substantial differences in culture, social insurance system, and sickness certification legislations between different countries may also influence the choice of strategies. However, how supervisors follow up employees with health complaints is a general topic, and knowledge from this study may be useful to others involved in prevention of sickness absence.

5. Conclusion

The present study provides insight into strategies used by supervisors to facilitate work functioning among employees with musculoskeletal complaints. Different strategies were applied depending on the phase of sick leave management. Supportive strategies were found most useful especially in the early phases, while finding a balance between being supportive, on one side, and making demands and confronting the employees, on the other side, was endeavoured in cases of recurrent or long-term sick leave. Furthermore, the supervisors requested a closer cooperation with the GPs, which they believed would facilitate RTW.

Conflict of Interests

The authors report no conflict of interests.

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Research Article

The Productivity Dilemma in Workplace Health Promotion

Martin Cherniack

Department of Medicine, University of Connecticut Health Center, 263 Farmington Avenue, Farmington, CT 06030-2017, USA

Correspondence should be addressed to Martin Cherniack; cherniack@uchc.edu

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Background. Worksite-based programs to improve workforce health and well-being (Workplace Health Promotion (WHP)) have been advanced as conduits for improved worker productivity and decreased health care costs. There has been a countervailing health economics contention that return on investment (ROI) does not merit preventive health investment. *Methods/Procedures.* Pertinent studies were reviewed and results reconsidered. A simple economic model is presented based on conventional and alternate assumptions used in cost benefit analysis (CBA), such as discounting and negative value. The issues are presented in the format of 3 conceptual dilemmas. *Principal Findings.* In some occupations such as nursing, the utility of patient survival and staff health is undervalued. WHP may miss important components of work related health risk. Altering assumptions on discounting and eliminating the drag of negative value radically change the CBA value. *Significance.* Simple monetization of a work life and calculation of return on workforce health investment as a simple alternate opportunity involve highly selective interpretations of productivity and utility.

1. Introduction

The emphasis on workforce health and well-being as a component of a corporation's value has inspired a series of novel terms, such as presenteeism and salutogenesis, that are descriptive of Workplace Health Promotion (WHP) [1, 2]. Because of the central role of companies in financing health care in the United States, WHP has assumed the particular formulation of a conduit to reduce health care costs. In both Europe and North America, a common denominator for workplace health programs has been the potential increase of workplace productivity, hence the attention to *return on investment (ROI)* in WHP [3]. For purposes of clarification, the following represent two conventional ways of accounting for ROI, as either a *benefit cost ratio (BCR)* or as *net present value (NPV)*:

ROI: benefit/cost ratio, where discounted inflation-adjusted benefits are divided by costs.

ROI: net present value/present value (NPV/PV of costs), where NPV is defined as the difference between the total discounted inflation-adjusted benefits and the costs of the program over its useful life.

In the United States, there has been a growing countervailing argument that capital investments in the health of the workforce do not afford appreciable monetized benefit in the short or intermediate term [4]. Hence, WHP is an imprudent commitment of resources, even when there are measurable health benefits [5]. More than a decade ago, Riedel et al. [6] observed the limited impact of improved health parameters on health care costs and predicted a greater emphasis on the productivity consequences of improved workforce health.

The effort to monetize health related performance effects has utilized a variety of approaches: (1) direct conversion, based on salary optimization, (2) introspective or self-descriptive surveys, and (3) firm-level or managerial evaluation. Collectively, these methods presuppose that impairment can be expensed as a proportion of annualized salary and that necessary refinements would include more accurate assessment of fringe benefits or localizing of labor replacement costs [5]. However, the problem is more involved than correcting for double counting or valuing service, education, or health care activities in a market economy. Large nonindustrial employers often have the capacity to negotiate group health directly by using self-insurance and scale with effects on health care costs that supersede individualized

activity. They also can rapidly introduce or retract programmatic changes without jeopardizing operating budgets and can absorb effects on morale from reorganization of the workforce. Moreover, the optimistic assumption that WHP advantages will accrue to all parties (the company at the organizational level, the production unit, and the productive workforce) poses a series of potential dilemmas.

2. Methods/Procedures

The following analysis is posed in the form of three problems or dilemmas:

Dilemma #1: the Productivity Paradox.

Dilemma #2: the Problems of Accounting for Discounting and Negative Value.

Dilemma #3: Monetizing the Multiple Dimensions of WHP, Value of a Working Life and a Saved Life.

The *Productivity Paradox* is treated as a nonstructured review and reconsideration of several seminal studies. *Dilemma #2* is an exercise in benefit cost analysis that substitutes alternate value for the discount rate and the determination of negative value. *Dilemma #3* is treated by introducing the economic concept of the *Value of a Statistical Life (VSL)* and comparing relative determinations.

3. Principal Findings

3.1. Dilemma #1: The Productivity Paradox. The *Productivity Paradox* is reflected in the well-recognized observation that increased productivity may generate *decreased* utility, and vice versa. The potential discordance between productivity and utility is appreciated in the traditional example of motor vehicle safety technology and traffic rules. Motor vehicle accidents are a productivity stimulator, generating economic activities in medical care, insurance, and vehicle repair and replacement. Safety technology adds costs and may diminish economic activity, but the argument for the utility of saved lives and reduced mortality has prevailed. The *Productivity Paradox* is influenced by cost benefit uncertainty, when the future value of expected benefits \neq the present value of expected costs, and by the concept of Sunk Benefits, an intervention being discouraged by the negative opportunity cost of an unrecoverable fronted investment. In preventive health, at least in the United States, the determination is often weighted towards reducing sunk costs rather than towards nonvaluated health benefits [7].

Contradictory and even “nonrational” choices over valuing benefits and losses can be appreciated in an example from nursing in the United States. There is substantial evidence for compromised health in nurses, attributable to understaffing, shiftwork, work-family conflict, obesity, and depression [8–10]. Figure 1 presents recent North American Industrial Classification System (NAICS) data on injury and lost time rates for several occupational groups. The data confirms that nursing carries the greatest likelihood of injury related absenteeism of any industrial sector. Table 1 summarizes results from two frequently cited studies on nurse understaffing and

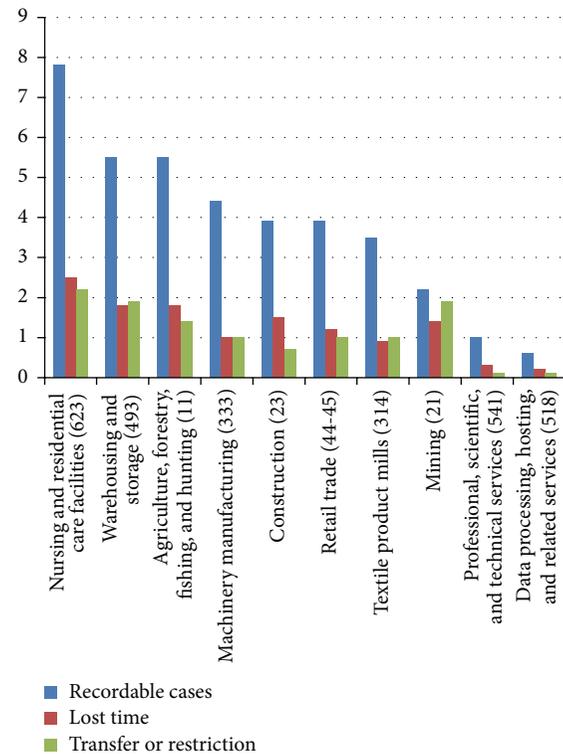


FIGURE 1: Work related injury by NAICS Sector, 2012, incidences per 1000.

impacts on both patient mortality and nursing morale [11, 12]. The effect of understaffing on patient survival is apparently dire, with understaffing contributing as much as a 15% increase in patient mortality within 5 days of an understaffed shift. There have been significant and growing investments in capital intensive hospital based resources [13]. However, the 2011 IOM report entitled *The Future of Nursing: Leading Change, Advancing Health* indicates that the underinvestment in nursing has resulted in deficient education and training and insufficient numbers of personnel [14].

Figure 2 provides a different example of contradiction between productivity and health in terms of the differing implications of productivity improvements for the firm and the workforce. The Johnson and Johnson Company (J&J) *Live for Life Program* was inaugurated in 1979 and has been recognized and commercially disseminated as an effective Workplace Health Promotion (WHP) approach with its combination of health coaching, incentives, and onsite facilities [15]. The CEO of J&J promoted the interval from 2004 to 2008 as a period of high productivity due to genomics, information technology, and greater output ratios from the workforce. A goal of 9% productivity improvement per year was targeted. Over the same time period, J&J was recording an 11–15% annual increase in its yearly dividend (<http://seekingalpha.com/article/1404151-a-new-normal-for-johnson-johnsons-dividend>) without numerical expansion in its workforce (<http://money.cnn.com/magazines/fortune/global500/2010/index.html>). Henke et al. [15] praised the effectiveness of the WHP activities of the company, in

TABLE 1: Consequences of nursing understaffing.

References		Outcome
Needleman et al., 2011 [11] (n = 197,961 admissions)	Shift with RN staffing level 8 hr or more below target during the first 5 days after admission (no patient time in ICU)	12% increase in patient mortality
	Shift with high patient turnover during the first 5 days after admission (no patient time in ICU)	12% increase in patient mortality
	Shift with high patient turnover during the first 5 days after admission (all admissions)	7% increase in patient mortality
	Shift with high patient turnover during the first 30 days after admission (all admissions)	4% increase in patient mortality
Aiken et al., 2002 [12] (n = 232,342 admissions)	Increase in 1 patient/RN/shift	(i) 7% increase in patient deaths within 30 days of admission (ii) 7% increase in failure to rescue (iii) 23% increase in RN burnout (iv) 15% increase in RN job satisfaction

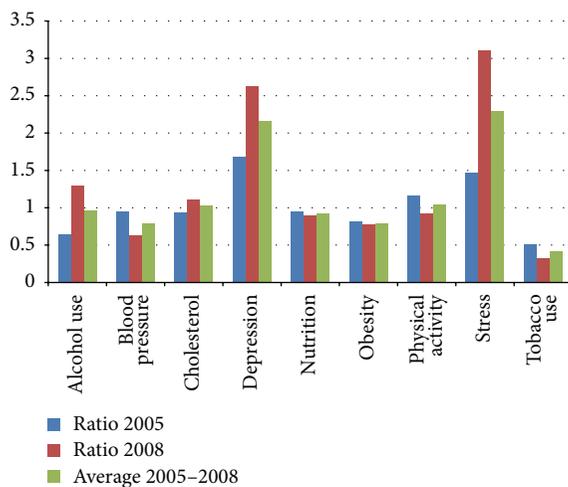


FIGURE 2: Johnson and Johnson Live for Life comparative risks per 100.

a comparison to other New Jersey companies. Figure 2 presents a reconsideration of their data showing the relative level of change in risk profiles. A comparison with other companies shows effective smoking cessation, mild improvement in blood pressure control and exercise, and no change in nutrition or obesity. There were also modest reductions in health costs over the 2004–2008 interval. There was, however, a dramatic increase in reported alcohol use, stress, and depression. Figure 2 is an interval comparison and reflects relative change detached from prevalence. While there is the likelihood of reduced attribution to overall population health from less commonly reported conditions (depression versus nutrition), the trend is, nevertheless, clear and ominous. Whether or not J&J’s improved productivity has the consequence of deteriorating quality of life in its workforce cannot be inferred from the available data. It does suggest, however, that a much praised WHP program may have failed to address an ominous underside.

While an explanation of adverse health effects must be speculative, it is notable that the J&J program was a classic lifestyle-directed health promotion that included fitness centers and pedometry programs, healthier foods in cafeterias, Weight Watchers and other weight loss programs, and health coaching for blood pressure management, blood lipid control, smoking cessation, and chronic disease management. What was absent was inclusion of work conditions as predictive of health. The concept of integrating working conditions and work related well-being with more individualized WHP is the core concept in the NIOSH Total Worker Health Program (<http://www.cdc.gov/niosh/twh/>) [16, 17]. Our own health intervention work with corrections officers may also explain the J&J paradox. Targeted weight loss programs were highly effective [18], but in the setting of dramatically increased overtime demands, due to staffing levels, there was decreased sleep and increased depression, and stress, hypertension, and binge drinking all increased [19].

3.2. Dilemma #2: The Problems of Accounting for Discounting and Negative Value. Traditional health economics places an emphasis on discounting, the devaluing of future health benefits against the quantity of present investment. There are also assumptions of time preference that the future will be richer and more technologically proficient than the present, posing an argument for the lower relative cost of deferred investment. A third assumption involves risk avoidance, the bias against current investment by assuming deferred risk. Changing standard assumptions provides a different picture of the cost of nonintervention and delaying prevention.

One feature of the ROI formulae as presented in Section 1 is their presumption that the health and functional status of the workforce should be discounted to adjust for the decreased value of expected future benefits, given the benefit of an anticipated rate of return on an alternative investment. To clarify, discounting is a controversial but generally used mathematical calculation, which reduces future costs to a present value based on the assumption that an alternative rate of return on the intervention cost, such as the bond

rate, was eschewed. The following conventional formula was obtained: $1/(1 + r)^n$, where r = discount rate and n = years into the future. An illustrative example was provided by Torgerson and Raftery on the cost and benefits of preventing hip fractures in older women [20]. The 10-year cost of daily supplemental calcium and vitamin D for 100 women is approximately \$120,000. Without treatment, 16 hip fractures are predicted, but the regimen is expected to lower the incidence rate by 30%. The cost of preventing those 4.8 cases over 10 years would be \$25,000 per prevented fracture, if no discounting was used. However, if a discount rate of 6% is adopted, the decision not to defer the cost of the intervention lowers its value by 56%. This is equivalent to a larger presumptive upfront cost of about \$45,000 per prevented case. The presumption is that the cost of the intervention program is underestimated without discounting because an alternate return on investment was not accrued. Wherever a practical and ethical balance exists regarding the discounting, a large discount rate discourages a substantive investment in interventions by an employer, due to a large concealed cost. A second problem involves the accounting for negative value. Examples of negative value particularly pertinent to workforce health would include “intangibles” such as participatory time on a health and safety committee or cost and time invested in compliance with personal health surveillance protocols. For example, in the evaluation by Gowrisankaran et al. [4] of a WHP program for a hospital workforce, 82% participated; admissions for targeted conditions fell by 41%; and hospital admissions decreased overall by 12%. There was, however, a modest increase in health maintenance and primary care visits, which were assigned a negative value: a desired health outcome but a cost to the employer, and, in the authors’ view, failure to overcome the hospital’s hurdle rate.

Table 2 is a simplified presentation meant to demonstrate the limitations of and possible alternatives to conventional ROI calculation. In this model, the term *thin tailed health uncertainty* means that morbidity and mortality will be predictable and there is no need to provide for a catastrophic event effecting workforce health, such as an industrial explosion in a fertilizer plant, a consuming fire in a textile plant, or the likelihood that phthalates will induce male sterility. *No time preference* reflects the short duration of the interventions and precludes the expectation that American industrial society will necessarily be wealthier and more equitable in the near future and that future utility should be discounted in the present. *Hospitalization/WC* is an omnibus term representing health care costs that may be avoidable. These include reducing hospitalization or lost time from suboptimally managed chronic disease and reducing worker’s compensation indemnity and medical costs due to a vigilant safety culture and more effective treatment and disability reduction. Three negative values are conceptualized: *quality of work life (QWL) activity*, *outpatient coaching (OPC)*, and *workforce participation (WP)*. QWL refers to workplace adaptation to workforce needs and includes mediations such as structured breaks, flexibility in work hours, and labor management relations that feature cooperation and participation. OPC is a preventive health concept that includes outpatient consultation or health coaching which

TABLE 2: The effects of changing basic assumptions.

(a)		
Assumptions		
Duration		5 years
Inflation rate		0%
Discount rate per annum		4%
Thin tailed health uncertainty		
Time preference		None
Risk aversion		N/A
Benefits		Cost
Decreased absenteeism		75 EDU
Decreased hospitalization/workers compensation		75 EDU
Costs		
Programmatics		50 EDU
Staffing		50 EDU
Negative value		
QWL activity		25 EDU
Increased OPC		25 EDU
Workforce participation		25 EDU
EDU: equivalent dollar units.		
(b)		
Outcomes		
BCR*		0.70
BCR (no discount)		0.83
No negative value (adjusted)		1.50
OPC as a positive value		1.75

*BCR: benefit cost ratio.

are expected to improve general health or prevent the progression of morbidity where disease is established. WP is a compound outcomes variable that covers global engagement in health and participatory activities that can be separated from specific measured outcomes. These types of measures are used in the contemporary workplace. Quality of work life (QWL) can be assessed by survey and direct measure [21, 22]. Outpatient coaching has taken the form of direct contact and video and electronic formats. These include case review of chronic disease management compliance and motivational interviewing [23, 24]. Workforce participation can be assessed by engagement in and completion of specific program [25, 26] and also by direct participation in health related policy and program development at the level of the firm [27].

Negative value applies to related interventions that may be either a programmatic endpoint or a mediator of improved health and human performance. From the perspective of WHP, assigning negative value is an acknowledgement that engagement in some level of quality of life activity, such as greater physical activity, preservation of functional health, and involvement in a variety of work activities that add to the capacity of the workforce all have value. While negative value

is customarily added to cost or subtracted from benefit, the converse does not seem to apply. The absence of these interventions does not alter the benefit cost ratio. The abbreviation EDU (equivalent dollar unit), the economic unit utilized in Table 2, is meant to underline that the examples are not meant to replicate real costs. Moreover, if the monetization of quality of work life is translational and a negative value is customarily associated with its implementation, an abstract unit of cost indicator seems the appropriate tender for quantifying work life into a rational economic choice.

While improved health and improved safety do not necessarily translate into reduced premium costs in the health care market, in this abstracted marketplace, the assumption is that improved health and performance does produce cost reduction and/or gain in income. Programmatic costs are self-explanatory and presume that program introduction occurs at the level of the company or employer. In fact, the evolution of the Accountable Care Organization (ACO) and medical home environments in the United States may lead to the transfer of some preventive functions to the healthcare service entity without cost implications for the employee. ACOs and medical homes are terms used to describe new integrated care models in the American health care system. Negative values have been explained, but their direct and indirect utility are central to Table 2.

The results show radically different outcomes for ROI based on the assumed value of the inputs. The principal benefits are health and performance related: reduced absenteeism and reduced group health and worker's compensation costs. If a conventional benefit cost ratio were calculated, and participation, health coaching, and QWL measures were treated as a cost, then the ROI of 0.70 would obviate workplace health related investment. Eliminating the discount rate, as has been suggested for climate change prevention [28], would appear to endorse a parallel presumption that health improvement at critical stages of life is less predictably linear than an alternative investment in, for example, a treasury bond. However, it would not alter the evident lack of positive return on investment.

The issues that are raised by neutralizing negative values or even accepting a positive value in the case of OPC require some elaboration. Participation rates, for example, do not necessarily require a time offset, any more than an 8-hour day represents (or once represented) a cost due to a circumscribed work week. Similarly, team meetings for managers are not customarily valued as a deferment from work responsibilities requiring a ROI calculation. In a related vein, acclimatizing an injured or impaired member of the workforce to a revised work pattern becomes an extravagant cost, but not when disability management is either a culturally accepted or regulated activity, as is the case for safety. A similar set of assumptions applies to QWL activity. If QWL activities are accepted as essential to workplace integrity in the same way that an HR department, a marketing group, or an IT department is considered implicitly necessary, then investment decisions are no longer absolute. Instead, funding questions are operational: internal provision versus outside vendor, scheduling and facilitation, or assignment of personnel. This evolution has already occurred in several hazardous

duty workforces, such as police, fire, and corrections, where quality of life activities are essential components of the budget and organization. In Table 2, when negative value is simply removed from the BCR calculation, the ROI becomes favorable.

A final consideration involves reevaluating the OPC and treating it as a reduced cost, rather than as an expense (negative value) that may lead to reduced health care costs or higher output (productivity). The revision does not require an integration of a measure of productivity. Instead the presumption is that an effective OPC program would be encouraged by revisions in health care financing policy. For example, if the proposed premium reductions of the American health reform initiative, the Affordable Care Act (ACA), were directed to the firm that institutes an aggressive OPC program, rather than to the compliant individual, the result would be the equivalent of a credit. Similarly, if the services were offered by the ACO or medical home, provided there was active compliance on workplace access and with health and rehabilitation recommendations, then OPC would be either revenue neutral or could be structured as a discount. An additional idea that has been floated in economic circles is tax reduction based on domestic workforce investment, such as job creation, domestic purchasing, and healthy workplace programs [29]. While such measures do require considerable imagination and social optimism, they offer a pathway through incentivization to translate negative costs into a positive balance.

The recent experience in the United States with the Affordable Care Act (ACA) demonstrates complexities of incentivization, particularly when economic advantage or penalty is translated to the level of the individual [30, 31]. The ACA maintains essential American anomalies around health insurance—the provision of insurance plans through the employer and the predominant role of the private insurance industry in financing health plans. Workplace Health Promotion is an essential part of the legislation; however, its execution is fashioned around premium reductions for wellness compliant employees and, conversely, penalties for noncompliant plan participants. The ensuing controversies of rights of the disabled and economic penalties, as well as the failure to fund the accompanying policy research activities, have forestalled full implementation.

3.3. Dilemma #3: Monetizing the Multiple Dimensions of WHP, Value of a Working Life and a Saved Life. Cost-effectiveness ratios may be relevant for evaluating interventions in terms of health benefits, but ROI or monetary based valuations are putatively important for financial decision makers in the private sector, responsible for implementing WHP intervention and allocating necessary resources. To be computed accurately, such ROI calculation would require prospective studies that would measure cost and particularly benefits of WHP accurately from each relevant stakeholder's perspective. Bringing about an alignment of incentives to overcome barriers to implementation of WHP interventions also needs to account for differences in perspectives on value, and these are often masked by monetization. As an example, the replacement cost of loss of occupation due

TABLE 3: The value of a life.

Period	Description	US \$ value	Source
Annual or per event	Average investment in WHP	\$144	Baker et al. 2008 [5]
	Occupational value of a statistical life year	\$1,700,000	Moore and Viscusi 1990 [39]
	Implicit value of a statistical injury	\$155,453 (nonsmoker-seat belt users) \$83,186 (smoker-non-seat belt users)	Hersch and Pickton 1995 [40]
	Quality of life, one year (medical expenditure)	\$129,000–\$488,000	Lee et al. 2009 [41]
Lifetime value of a statistical life	EPA valuation	\$7,400,000	NCEE, 2006*
	Prime working age	\$7,000,000	Viscusi and Aldy 2003 [42]

* National Center for Environmental Economics (NCEE), <http://yosemite.epa.gov/ee/epa/eed.nsf/pages/MortalityRiskValuation.html#howvalueVMR>.

to morbidity will usually be a low multiple of wage or salary for an employer, but a disability adjusted life year (DALY) involves a considerably higher calculation for worker economic loss, leaving aside the more difficult issue of valuing an encumbered existence [32, 33].

In Table 3, the differing valuations of lost life and the economic consequences of disease are presented in the context of the value of a statistical life (VSL). The table is deliberately misleading because WHP is a preventive policy with broad implementation and a critical effect on a population fraction; lost life or lost quality of life is a specific consequence. Nevertheless, the point of the table is to demonstrate scale. Health and safety interventions directed to the workforce are valued as a discriminant choice among other investment opportunities and with a narrow perspective on benefit. Moreover, the United States Environmental Protection Agency (EPA) valuation of a lost life or the estimation of a lost working life is not attached to a field of varying benefits; their magnitude is ultimately qualitative, an acknowledgement that human lives have a high value that can only be indirectly monetized.

4. Discussion

The discount rate depends on the assumption that the marginal efficiency of capital is greater than zero and the value of workforce health must exceed the anticipated rate of return on accumulated wealth. However, critical health events and biological aging are nonlinear; include concentrated, even catastrophic, changes in status and function; and instantaneously change from a high marginal cost rate to the extinction of all benefit. From a health perspective, preventing or limiting mortality or significant morbidity, if sufficiently valued, would merit an increase in the utility of interventions. If large enough, expected marginal utility to protect a working life becomes infinite. But this is, of course, an absurd supposition that either direct or socially transferred investment could ever approach 100%, if an absolute premium was placed on quality of life or survival. However, casual acceptance that workforce health promoting

activities always represent a negative value is also an absurd supposition. To illustrate the point that the critical investment in diabetes prevention before clinical disease is present and adaptive physiological systems are exhausted does not represent an actual temporal choice, given that disease evolution involves critical and irreversible stages [34, 35]. Similarly, the investment in child care resources of nurses working 12-hour shifts has qualitative and quantitative consequences that can be monetized but has more complicated effects of discouraging nursing employment due to work family conflict [36].

It should be noted that in these examples the trade-off between risk aversion and so-called moral hazard is dismissed. The presumption is that a stable well-paid workforce will place implicit value on prevention of injury at work and on mitigating serious illness. More to the point, it is unclear that a meaningful trade-off is even appreciable since institutionalized decisions over health and preventive workplace interventions do not presume an individual assumption of risk. Programs that are introduced at the company or plan level are not necessarily subject to differential trade-offs, particularly when preventive interventions are not costly and not particularly differentiable. For example, the compliance functions of a health and safety committee or the public health interventions required of an effective vaccination program are not contingent on the graded assessment of risk. An individual decision not to vaccinate may be foolish or libertarian but it becomes relevant to public health investment if there is a socialization of risk of disease. The combination of regulation, usual safety practice, and public health professionalism is not commonly reduced to a menu of prices.

The appreciation of hazard on the part of employers and workers is often quite different. Several observers have noted an interesting anomaly in the economic literature; it is that while safety and cost are considered from a managerial perspective, the worker's own perceptions of risk are rarely included [37, 38]. Employers tend to put the weight of productivity loss on worker's lifestyle and health status, with particular weight on chronic diseases, lifestyle choices,

and absenteeism [<http://www.towerswatson.com/en-US/Insights/IC-Types/Survey-Research-Results/2013/09/2013-2014-stayingatwork-us-executive-summary-report>]. Workers tend to attribute health and work problems to workload, problems of work-family balance, understaffing, poor supervisory relationships, and replacement by technology and job insecurity. Because both perspectives have legitimacy, the importance of workforce participation in decision making is functionally important. As Table 2 demonstrates, the application of discounting, the socialization of health care costs, and the translation of health effects as replacement costs all tend to deemphasize quality of work life, which is primarily the perspective of the employee.

In summary, the adjustments that are made to value the efficacy of health interventions at the workplace follow an idiosyncratic set of assumptions that limit consideration of quality of life and work. Facile assumptions around discounting and negative value place a grand hurdle before preventive interventions.

Disclaimer

The contents are solely the responsibility of the author and do not necessarily represent the official views of NIOSH.

Conflict of Interests

The author declares that there is no conflict of interests regarding the publication of this paper.

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Research Article

Considering the Differential Impact of Three Facets of Organizational Health Climate on Employees' Well-Being

Zandra M. Zweber, Robert A. Henning, Vicki J. Magley, and Poursan Faghri

University of Connecticut, Storrs, CT 06269, USA

Correspondence should be addressed to Zandra M. Zweber; zandra.zweber@gmail.com

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One potential way that healthy organizations can impact employee health is by promoting a climate for health within the organization. Using a definition of health climate that includes support for health from multiple levels within the organization, this study examines whether all three facets of health climate—the workgroup, supervisor, and organization—work together to contribute to employee well-being. Two samples are used in this study to examine health climate at the individual level and group level in order to provide a clearer picture of the impact of the three health climate facets. *k*-means cluster analysis was used on each sample to determine groups of individuals based on their levels of the three health climate facets. A discriminant function analysis was then run on each sample to determine if clusters differed on a function of employee well-being variables. Results provide evidence that having strength in all three of the facets is the most beneficial in terms of employee well-being at work. Findings from this study suggest that organizations must consider how health is treated within workgroups, how supervisors support employee health, and what the organization does to support employee health when promoting employee health.

1. Introduction

The impact that work has on employee health has been a topic of growing interest for more than 30 years [1]. Though many studies examine the role of individual factors as they relate to the relationship between work and health [2], we argue that organizational factors, such as organizational health climate, play a major role as well. This is in line with the Total Worker Health perspective, which is an integrated approach to workplace health promotion and health protection to advance worker health and well-being [3]. The purpose of the current study is to examine three facets of organizational health climate—the workgroup, supervisor and the organization—and whether these facets somehow act together as a component of employee health and well-being. Although another major component of employee health and well-being is the employee's life outside work, this is beyond the scope of the current paper where we seek to examine the role that the workplace has in employee health and well-being.

We define organizational health climate as “employee perceptions of active support from upper management, as

well as supervisors and coworkers, for the physical and psychological well-being of employees” [4]. This conceptualization of organizational health climate suggests that there is a context for health that exists in organizations that is reflected by perceptions that employees have of the active support of health from coworkers, supervisors, and the organization itself. Individual perceptions of overall organizational health climate have already been found to relate to job stress, burnout, fatigue, and job satisfaction [4], and group-level perceptions of health climate have previously been found to relate to individual general health, body mass index, hypertension, burnout, and job satisfaction [5]. However, the specific components of health climate—the workgroup, supervisor, and organization—have not yet been examined, nor has the possibility that they could act together in influencing individual employee health and well-being outcomes.

The purpose of this study is to examine these three facets of organizational health climate as they appear in the workplace in various combinations in order to determine if strength in all three contributes to optimal employee well-being or if strength in one or two facets can compensate for

what is lacking in the others. We begin by first considering each of the three facets and contributing theories that explain why each should be related to employee health and well-being. We then consider the importance of the three facets of health climate in combination as a means to assess a complex work system. This line of inquiry is then extended by considering the three facets of health climate at the aggregate group level to further examine the role of organizational health climate in employee health and well-being.

Workgroup Facet of Organizational Health Climate. The workgroup facet of organizational health climate assesses support for health from immediate coworkers. Coworkers, for many individuals, can be a major source of social support because of the relatively frequent interactions between an individual and his/her coworkers [6]. If this support regards health specifically rather than general social support, a necessary distinction when assessing organizational health climate, it can be expected that a continuous level of support from coworkers for an individual's health and well-being will have a direct beneficial impact on this employee's health and well-being.

A number of scientific studies have examined the impact of general coworker support on coping as well as on many negative workplace experiences. It is often looked at as a moderator in the relationship between negative experiences/workplace stress and negative workplace outcomes, suggesting that coworker support can act as a buffer in a number of situations [7]. Although some research has found that general coworker support does buffer the negative effects of a stressor, other research finds only that this form of social support directly affects health and well-being [8, 9]. Therefore, coworker support for health specifically might also have this direct relationship with employee health and well-being. Importantly, research studies on the effects of social support usually come from a "stressful life events" paradigm. Organizational stress is unique in that it is more chronic than event driven and therefore is considered to have a larger impact on employee health [6]. Persistence of workplace stressors suggests that social support and specifically support from coworkers might need to be consistently present to be influential rather than occurring only on an event-by-event basis.

Organizational health climate can be seen as a set of resources that are currently available to the employee and specific to employee health and well-being. This allows for Conservation of Resources (COR) theory to serve as a foundation for the reasoning behind why the workgroup facet of health climate would be related to employee health and well-being. COR posits that stress is the result of actual or threatened loss of resources or the lack of gained resources after an individual has invested their own resources [10]. Thus, an employee could greatly benefit from coworkers who regularly support his/her health by providing resources, both tangible and intangible, for improving and maintaining health and well-being. The presence of a constant stream of resources and support that benefits employee health and well-being would contribute to the development of a strong climate of support, as assessed by the workgroup facet of organizational health climate.

Supervisor Facet of Organizational Health Climate. The supervisor facet of organizational health climate can also be understood to play a unique role. For example, it has been reported that supervisors can reduce the success of worksite stress and health intervention simply by expressing negative opinions about the usefulness of the program [11]. In their qualitative study, Saksvik and colleagues [11] highlighted the important barrier of management in the implementation of occupational stress and health interventions, noting that although the target consumers of these programs are the employees, middle management plays a large role in determining intervention success. The importance of middle management support comes out of its ability to control things such as the availability of employee time to participate in health programs as well as other health-promoting resources. Employees perceive and react to these actions, beliefs, and support from supervisors. Therefore, middle management is expected to play a major role in establishing an organization's health climate.

Similar to the previous research on coworker support and its relevance to the workgroup facet of health climate, general supervisor support has been widely studied but supervisor support specific to promotion of health has not. Although general supervisor support for employees may act differently compared to supervisor support for health specifically, general findings and frameworks from previous research on supervisor support can help inform the theoretical reasoning behind how the supervisor facet of organizational health climate will function and why it should be related to employee health and well-being. Because of the emotional, instrumental, informational, and social support that supervisors provide, as well as their ability to prevent certain job stressors, supervisors might have a significant impact on employee health [12, 13]. These latter types of supervisor support might also be applicable in the context of organizational health climate because supervisors can offer a similar type of support and encouragement for employee health and well-being, creating a positive climate for health in their workgroup(s).

Previous research on general supervisor support has found evidence for both the main effect and buffering effect of supervisor support on employee health [14]. For instance, Jones-Johnson and Johnson [15] found that supervisor support had a direct relationship with the psychosocial stress of employees although they had hypothesized supervisor support to act as a buffer. This was similar to findings in previous studies including one that found that supervisor support has a direct effect on reported psychological symptoms [16]. Based on this previous research, as well as the COR theory as explained in the previous section, it is expected that the presence of positive resources and support for health from one's supervisor will be directly related to employee health and well-being.

Organization Facet of Organizational Health Climate. As much as the supervisor and the workgroup members influence employees' perceptions of support for health in the workplace, the organization itself can also be expected to play a major role. In contrast to the more interpersonal nature of the support provided by either the supervisor or

the workgroup members, how the organization supports employee health is more instrumental in nature. Instrumental support has been defined as involving behaviors that directly help the person in need [17]. This would include things such as the organization providing resources for health such as good health insurance coverage as well as setting programs and policies in place in the workplace for promoting and maintaining the health of employees. As found previously for the other two facets of organizational health climate, little to no research has been done to determine the specific type of support for employee health and well-being that would be exemplified in the construct of organizational health climate. However, numerous studies have examined the concept of perceived organizational support and its antecedents and consequences, as well as its role in the stressor-strain relationship. The theoretical frameworks used in these studies can be essential in understanding and predicting the role that the organizational facet of health climate could play.

Organizational Support Theory suggests that individuals have the tendency to assign humanlike characteristics to the organization itself, which in turn results in creating perceived organizational support [18]. This is exemplified by individuals feeling a sense of caring from their organization. In the context of organizational health climate, the perceptions of the employees that would matter are about how much the organization cares for, supports, and encourages employee health and well-being. These more specific forms of support from the organization, as long as they are in line with actual employee needs, can be perceived as a set of resources that are regularly available to the individual. Therefore, COR theory would suggest that a positive organizational facet of health climate will be directly related to employee health and well-being.

Importance of All Three Facets. Although, as outlined above, we have carefully considered each of the facets individually and how they might impact employee health and well-being, the primary research question in present study is whether strength in all three facets of health climate is necessary to facilitate optimal employee well-being. Given that the three facets of health climate—workgroup, supervisor, and organization—are part of a single work system that is dynamic and constantly changing, their combined effects on health may be equally important to consider. It is therefore predicted that an organization that is lacking in one or more of the health climate facets will not provide the full benefits to employee health and well-being that organizations with strength in all three facets of health climate can offer. Employee well-being can be broadly defined to include aspects of mental health, burnout, and stress as well as other work-related well-being constructs such as work ability and workplace civility norms. Health climate is likely to impact these aspects of well-being, and therefore it is predicted that individuals who differ in terms of the three facets of health climate will differ in terms of their work-related well-being. Therefore, we hypothesize the following:

(H1) Employees who perceive a positive climate in all three facets of health climate will experience more positive

health and workplace outcomes than employees who perceive one or more of these facets to be not as strong.

Health Climate Facets at the Group Level. When studying organizations and the people who work within them, it is necessary to examine the multiple levels that exist in an organization in order to fully understand the relationships that are occurring within it. Although the number of levels that exist may differ from organization to organization, generally speaking, organizations are not flat, meaning that some sense of organizational hierarchy does exist. Multilevel theories in organizational behavior can consist of any combination of individuals, dyads, teams, business units, corporations, and industries [19]. The importance of examining organizations from a multilevel perspective is that individual perceptions, actions, attitudes, and behaviors at the workplace do not exist in a vacuum, and to ignore the social context in which they occur can result in missing potentially important influences that exist within the work system.

To further examine whether strength in all three facets of health climate is necessary for optimal employee well-being, we also sought to examine group perceptions of health climate. Organizational climate has been defined as the shared perception that people have of their work settings that can be based on actual or inferred events as well as practices and procedures that occur in the workplace [20, 21]. When talking about shared perceptions, this suggests that analysis should be at the group level or above rather than at the individual level. This is not to say that the individual level of analysis is inappropriate; climate is often examined at the individual level as a summary perception by individuals of the work environment that is descriptive in nature, as done here and elsewhere [22, 23]. However, we believe that, to fully understand the impact of organizational health climate, we would be remiss to only examine health climate in terms of individual perceptions (aka psychological climate [24]) and argue that health climate should also be considered as *shared* perceptions among group members (organizational climate [24]).

Hence, the current study also aims to test whether work and well-being outcomes differ as a result of group-level perceptions of the health climate facets and whether strength in all three of the facets of health climate—as operationalized at the group-level—is necessary for employee optimal well-being. Specifically, the research approach is to compare groups that are similar in certain facets of health climate but differ in one or more of the remaining facets. Examining differences among these types of groups on a set of work and health-related outcomes will allow us to examine whether all three facets of health climate at the group-level are necessary for experiencing the positive effects of a healthy workplace climate and also to determine what the effect on outcomes is when one or more of the facets are lacking. Therefore, we next hypothesize the following:

(H2) Workgroups with a positive climate in all three facets of health climate will experience more positive health and workplace outcomes than workgroups that are not as strong in one or more of these facets.

TABLE 1: Sample 1 correlation table.

	M	SD	1	2	3	4	5	6	7	8	9
(1) Workgroup HC	4.59	1.46	(0.57)								
(2) Supervisor HC	3.61	1.63	0.42**	(0.93)							
(3) Organization HC	3.59	1.41	0.44**	0.71**	(0.88)						
(4) Civility norms	4.05	1.3	0.33**	0.34**	0.43**	(0.86)					
(5) Work ability	8.79	1.3	0.20**	0.03	0.16**	0.20**	(0.90)				
(6) Job stress	1.2	0.81	-0.13*	-0.09	-0.13*	-0.09	-0.31**	(0.84)			
(7) Depression	1.52	0.47	-0.19**	-0.19**	-0.25**	-0.23**	-0.51**	0.29**	(0.77)		
(8) SF-12 Mental	48.77	10.89	0.16**	0.07	0.16**	0.23**	0.50**	-0.34**	-0.68**	NA	
(9) Burnout	3.98	1.25	-0.15*	-0.20**	-0.25**	-0.34**	-0.37**	0.39**	0.51**	-0.54**	-0.8

Note: * indicates $p < 0.05$ and ** indicates $p < 0.01$.

2. Method

2.1. Participants. Two separate samples and datasets were used to test Hypothesis 1 and Hypothesis 2, an individual-level dataset and a group-level dataset, respectively.

Sample 1, the individual-level dataset, was collected as part of a long-term study by the Center for the Promotion of Health in the New England Workplace [25] with the Department of Corrections (DOC) in a northeast state. The overall study, entitled Health Improvement Through Employee Control (HITEC), seeks to integrate workplace health protection (occupational health and safety) with health promotion in order to improve the health and well-being of the correctional officer population. An All-Employee Survey was administered as a paper based-survey which assessed a number of constructs in addition to the ones used in this study, including ergonomics, workplace behaviors, workplace attitudes, and individual characteristics. The final sample consisted of 263 correctional officers with a mean age of 43 years and 46% worked first shift. Males made up the majority of the sample (69%), which is indicative of true gender ratios in most corrections settings. Average job tenure of the sample was 11 years and 38% of the sample had a college degree or higher. 69% of the sample self-identified as white.

Sample 2, the group-level dataset, was collected as part of an on-going multiyear study, referred to as the Civility Among Healthcare Professionals (CAHP) project. The sample consists of correctional healthcare workers primarily in medical, dental, and mental health. The central purpose of the CAHP project is to improve the social work environment by implementing a workplace incivility training program for all employees. The CAHP project involved several waves of data collection. A baseline survey combined with social network data and qualitative feedback justified the creation of workgroups based largely on facility, shift, and discipline. The current study uses data from the third wave of data collection, which consisted of an online survey that assessed many workplace attitudes, beliefs, and behaviors in addition to the variables used in this study. The final sample used in this study consisted of 171 correctional healthcare workers nested within 42 workgroups. The sample was 72% female, which is consistent with the large proportion of female

healthcare workers generally. The predominant age group of the sample was age 52–60 (30% of sample), 82% of the survey respondents were Caucasian, and 76% had a college degree or higher. Average job tenure was 9 years.

2.2. Measures. Item response scales are a 1 (strongly disagree) to 7 (strongly agree) Likert scale unless otherwise noted. Correlation matrices, scale descriptive statistics, and alpha reliabilities can be seen in Tables 1 and 2 for Sample 1 and Sample 2, respectively.

2.2.1. Health Climate. The workgroup, supervisor, and organization facets of organizational health climate were measured using the Multifaceted Organizational Health Climate Assessment (MOHCA [4]). A sample item from this scale is “my supervisor encourages participation in organizational programs that promote employee health and well-being.” The original MOHCA scale has two workgroup items, three supervisor items, and four organization items. However, one of the supervisor items was excluded due to its effect on the alpha of the scale and results of exploratory and confirmatory factor analyses which have shown that this negatively worded item did not fit well with the other two supervisor facet items. This resulted in the overall scale in each sample consisting of two items for the workgroup facet, two items for the supervisor facet, and four items for the organizational facet.

2.2.2. Work-Related Well-Being. The work-related well-being variables used in the discriminant function analyses differed by sample because, as previously stated, data for both samples were collected as part of larger projects with other goals in mind, and therefore not all well-being variables were available in each sample. Additionally, in Sample 2 some work-related variables were added in addition to well-being variables so as to extend the findings from Sample 1 to apply to other work-related variables. The variables that were used on the work-related well-being discriminant functions were the following.

2.3. Sample 1 Only

2.3.1. Civility Norms. Civility norms were measured using the 4-item Civility Norms Questionnaire Brief [26] An example item is “rude behavior is not accepted by your coworkers.”

TABLE 2: Sample 2 correlation table.

	M	SD	1	2	3	4	5	6	7	8
<i>Grouplevel</i>										
(1) Workgroup facet	4.73	0.81								
(2) Supervisor facet	3.74	0.84	0.60							
(3) Organization facet	3.63	0.83	0.58	0.85						
<i>Individual-level outcomes</i>										
(4) Burnout	4.59	1.33	-0.19	-0.17	-0.21	(0.71)				
(5) Job stress	1.83	0.90	-0.17	-0.26	-0.33	0.40	(0.81)			
(6) Performance	3.93	0.68	0.27	0.19	0.26	-0.15	-0.22	(0.88)		
(7) Engagement	5.10	1.28	0.20	0.21	0.22	-0.67	-0.36	0.23	(0.93)	
(8) OCB-E	6.10	0.96	0.19	0.13	0.17	-0.33	-0.13	0.30	0.46	(0.85)

Note: *p* values are not reported because of the aggregate variables. Coefficient alpha presented on the diagonal for the individual-level variables.

2.3.2. *Work Ability.* Work ability was measured using a four-item scale [27]. The response scale ranged from 0 = cannot work to 10 = work at best. An example item is “thinking about the physical demands of your job, how do you rate your current ability to meet those demands?”

2.3.3. *SF-12.* The short form health assessment survey (SF-12 [28]) was used to assess mental health. This survey uses 12 questions and an equation to compare the health of employees to the general population of the United States. A score of 50 on the scale is comparable to the average health of the United States and a lower score indicates poorer health.

2.3.4. *Depression.* Depression was measured using a ten-item scale [29]. The response option for this scale ranges from 1 = rarely or none of the time to 4 = all of the time (5–7 days per week). An example item from this scale is “I felt that everything I did was an effort.” Higher scores on this scale indicate higher levels of depression.

2.4. *Both Sample 1 and Sample 2*

2.4.1. *Burnout.* Burnout was measured using 4 items from the Oldenburg Burnout Inventory [30]. An example item from this scale is “more and more often I talk about my work in a negative way.”

2.4.2. *Stress.* Stress in general/job stress was measured using the 6-item Stress in General/Job Stress measure [31]. The response options for this scale were 0 = no, 1.5 = ?, and 3 = yes, meaning that higher scores on this scale indicate higher levels of stress. An example item from this scale is “in general, I think my job is pressured.”

2.5. *Sample 2 Only*

2.5.1. *Performance.* Individual self-reported job performance was measured using four items adapted from a scale by Farh and colleagues [32]. Employees were asked the stem “How do you feel your performance is viewed by the SUPERVISOR. . .What does your supervisor (i.e., not you) think of. . .” followed by an item such as “. . .the quality of your work?”

2.5.2. *Organizational Citizenship Behaviors.* OCBs were measured using two items from an interpersonal OCBs scale [33]. An example item from this scale is “I pass along work-related information to others.”

2.5.3. *Engagement.* Engagement was measured using 10 items from the Individual Work Engagement Scale [34]. An example item from this scale is “I am immersed in my work.”

2.6. *Analytic Strategy.* To test the hypotheses, a *k*-means cluster analysis was first run on each dataset to identify groups of individuals based on the strength of the three facets of health climate. This analysis empirically identifies groups of individuals (or groups of groups in the case of Sample 2) that are maximally similar within group while simultaneously being maximally dissimilar between groups. Using the clusters identified in the *k*-means analysis, a Discriminant function analysis (DFA) was then run to determine the linear combination of well-being outcomes that best discriminated among the groups. A comparison of how each of the clusters performs on the discriminant function was then used as evidence for testing Hypotheses 1 and 2.

3. **Results**

3.1. *Individual Level.* In the *k*-means analysis, a 6-cluster solution was retained after examining 2- through 7-cluster solutions. A 6-cluster solution was determined based on adequate cluster size and maximizing meaningful differences between clusters; see Table 3 for cluster sizes. As shown in Figure 1, there were three pairs of clusters that emerged, two clusters that were marked as mostly positive, two that were marked as mostly on average, and two that were marked as mostly negative. In the pair of mostly positive, one cluster of employees (entitled “Consistently Positive”) reported high levels of all three of the health climate facets, whereas another cluster of employees (“Interpersonally Positive”) reported high levels of both the workgroup and supervisor facets yet a lower organization facet. In the pair of average clusters, the “Consistently Average” cluster has average levels of all three of the facets while the “Workgroup-Plus Average” cluster is on average in the supervisor and organization facets yet higher

TABLE 3: Number of individuals (Sample 1) or groups (Sample 2) per cluster.

Cluster	Sample 1	Sample 2
Consistently Positive	36	12
Interpersonally Positive	11	
Consistently Average	62	7
Workgroup-Plus Average	64	15
Consistently Negative	41	8
Workgroup-Plus Negative	49	

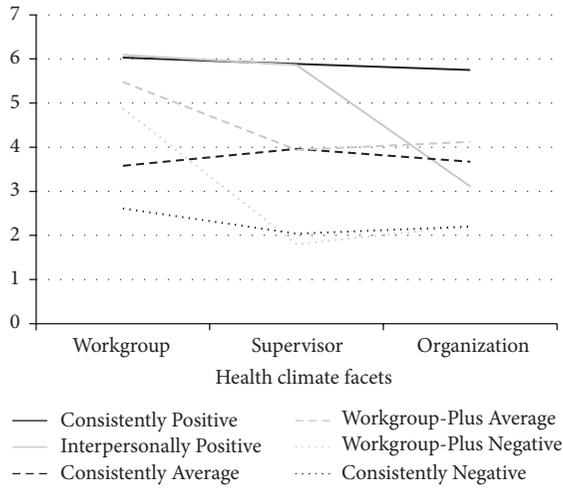


FIGURE 1: Sample 1 k-means cluster solution.

in the workgroup facet. Lastly, in the negative pair of clusters, the “Consistently Negative” cluster reported low levels of all three of the health climate facets and the “Workgroup-Plus Negative” cluster is relatively high in the workgroup facet but low in the supervisor and organization facets.

Cluster membership was saved as a variable and then used as a grouping variable in a discriminant function analysis (DFA). The purpose of using DFA in the current study was to test how well linear combinations of well-being variables also differentiate between the clusters. Seven variables related to employee well-being were entered into the discriminant function analysis: SF-12 mental, job stress, depression, disengagement (burnout), exhaustion (burnout), civility norms, and work ability.

One discriminant function was significant (Wilks’ lambda = 0.685, $p < 0.001$) and accounted for 64% of the variance among the groups. This function was defined with a positive correlation with civility norms ($r = 0.89$), a positive correlation with work ability ($r = 0.39$), a positive correlation with SF-12 mental ($r = 0.34$) and negative correlations with job stress ($r = -0.34$), exhaustion (-0.46), disengagement ($r = -0.57$), and depression ($r = -0.43$). This pattern of correlations indicates that more positive scores on the function are associated with more positive work-related well-being. Group centroids are plotted in Figure 2. Comparisons of how clusters perform on the function within pairs as well as comparisons between pairs in terms of outcomes can

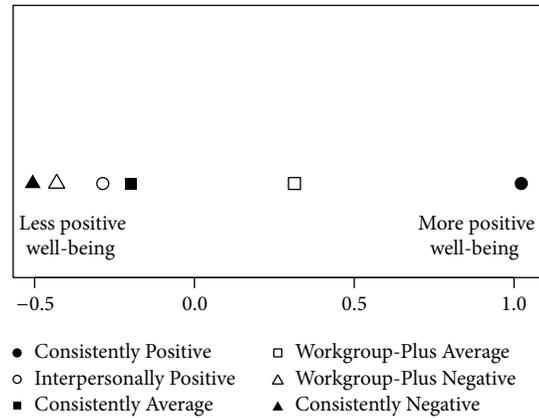


FIGURE 2: Sample 1 DFA group centroids.

serve to address the research question of whether all three facets of health climate are necessary for optimal well-being.

Results from this analysis indicate that Hypothesis 1 was supported. Figure 2 shows that “Consistently Positive” (the cluster that was positive in all three of the facets) is the most positive of all the clusters on the function. A comparison of “Consistently Positive” to “Interpersonally Positive” shows that “Consistently Positive” performs better on the function despite the two clusters being similarly high in the workgroup and supervisor facets. Similarly, “Consistently Negative” (the cluster that was negative in all three of the facets) is the most negative of all of the clusters on the function. A comparison between “Consistently Negative” and “Workgroup-Plus Negative” shows that these two clusters were quite similar on the discriminant function. A comparison of “Workgroup-Plus Average” and “Consistently Average” indicates that “Workgroup-Plus Average” is more positive on the function than “Consistently Average.” In addition to the comparisons within the three pairs, a comparison of “Workgroup-Plus Negative” and “Interpersonally Positive” indicates that “Interpersonally Positive” is more positive on the function than “Workgroup-Plus Negative,” which highlights the importance of supervisory support of employee health with respect to overall employee well-being. Most puzzling is that Figure 2 also shows that “Consistently Average” and “Interpersonally Positive” are similar on the function despite their differences on the workgroup and supervisor facets. This last result is looked at closely in Section 5.

3.2. Group Level. Hypothesis 2 posits that workgroups with a positive climate in all three facets of health climate will experience more positive health and workplace outcomes than workgroups who are not as strong in one or more of these facets. A 6-cluster solution was initially examined, as this was the number of clusters determined when examining Hypothesis 1. However, due to a much lower sample size in Sample 2 (as sample size was determined by the number of groups, $n = 42$), the 6-cluster solution did not yield meaningful results. A 4-cluster solution was retained after examining 2- through 5-cluster solutions yielding similar clusters—a positive cluster, a negative cluster, and two relatively average clusters.

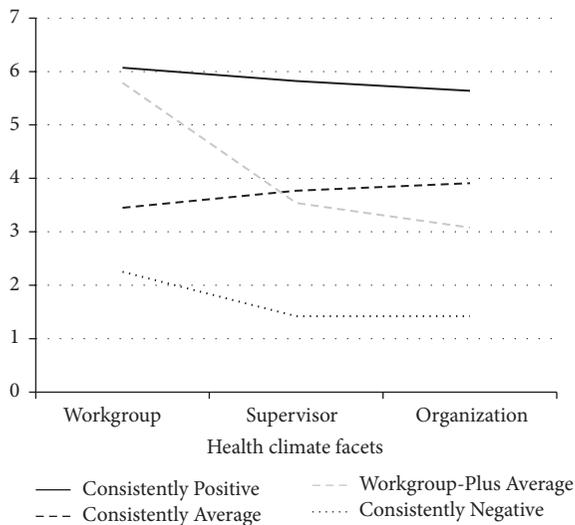


FIGURE 3: Sample 2 final clusters.

The 4-cluster solution is shown in Figure 3. Again, one cluster of employees (“Consistently Positive”) reported high levels of all three of the health climate facets and one cluster of employees (“Consistently Negative”) reported low levels of all three of the health climate facets. Employees clustering in “Consistently Average” and “Workgroup-Plus Average” groups reported similar levels of the supervisor and organization facet of health climate but “Workgroup-Plus Average” reported higher levels of workgroup health climate than “Consistently Average.” Cluster sizes are shown in Table 3.

Cluster membership was saved as a variable and then used in the full dataset, which included individual and group data, as a grouping variable in a discriminant function analysis. Individual-level outcomes were entered into this discriminant function analysis to test whether health climate facet clusters affected employee well-being and work-related outcomes. The five outcome variables that were entered into the discriminant function analysis were burnout, stress, performance, engagement, and organizational citizenship behaviors.

One discriminant function was significant (Wilks’ lambda = 0.80, $p < 0.01$) and accounted for 67.4% of the variance among the clusters. This function was defined with a positive correlation with employee performance ($r = 0.70$), a positive correlation with citizenship behaviors ($r = 0.38$), and a positive correlation with individual engagement ($r = 0.51$). This function was also defined with negative correlations with job stress ($r = -0.80$) and burnout ($r = -0.49$). This pattern of correlations indicates that more positive scores on the function are associated with more positive well-being and work-related outcomes.

Group centroids on this significant function are plotted in Figure 4. Results from this analysis indicate that Hypothesis 2 was supported. Figure 4 shows that “Consistently Positive” fell at the most positive end of this function. Similarly, “Consistently Negative” fell at the most negative end of this

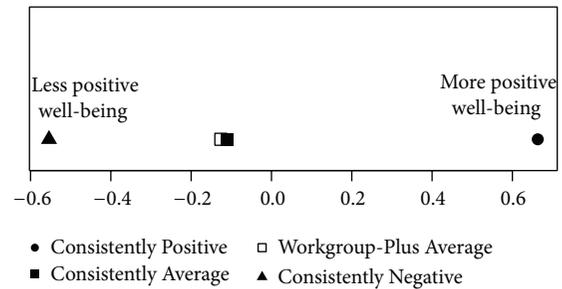


FIGURE 4: Sample 2 discriminant function analysis group centroids.

function. Interestingly, “Consistently Average” and “Average-Higher Workgroup” do not significantly differ on this function, even though “Average-Higher Workgroup” has higher levels of the workgroup facet. However, “Consistently Positive” has a significantly more positive score on the function than “Average-Higher Workgroup” even though these two clusters have similar scores on the workgroup facet but differ in that “Average-Higher Workgroup” has lower scores on the supervisor and organization facets. These results suggest that having high scores in each of the three facets is most beneficial for the outcomes of performance, engagement, organizational citizenship behaviors, burnout, and job stress.

4. Discussion

The purpose of this study was to determine whether all three facets of health climate—the workgroup, supervisor, and organization—work together to contribute to employee well-being. Although this study does not focus on the many influences on individual health and well-being outside of a work organization, some interesting findings emerged that can guide organizations which are interested in promoting the health and well-being of its workers.

Findings from the k -means cluster analysis at the individual worker level suggest that health climate indeed differs for groups of employees and that these groups also vary substantively on organizationally relevant outcomes. Specifically, emergent employee groups noticeably fell into three pairs: (1) those Consistently Positive or at least Interpersonally Positive, (2) those Consistently Average or on average those with greater support from workgroup members, or (3) those Consistently Negative, or negative with greater support from workgroup members. For both Sample 1 and Sample 2, results of the DFA indicate that the cluster that was high in all three of the MOHCA facets had a much higher score on the overall health and well-being function than the other clusters and the cluster that was low in all of the three MOHCA facets had the lowest score on the overall health and well-being function. These duplicate findings at both the individual and group levels highlight the importance of having strength in all three of the MOHCA facets for employee health and well-being.

In comparing the remaining clusters in the individual-level sample, some interesting findings emerged from the breakdown of the pairs of employee groups. First in terms of the positive pair, the results provide clear evidence that

strength in all three of the facets is most beneficial to both organizations and employees. A comparison between the two clusters in this pair, “Consistently Positive” and “Interpersonally Positive,” shows that great strength in two facets alone cannot fully compensate for weakness in the remaining facet. The “Interpersonally Positive” cluster differed from “Consistently Positive” only in that it had a lower score on the organization facet; yet the “Interpersonally Positive” cluster was much more negative on the DFA function than was the “Consistently Positive” cluster. This result suggests that employees’ well-being suffers considerably when organizational support of their health is lacking, even in the presence of both strong supervisory support and strong coworker support of health.

A comparison of the average pair of clusters, “Consistently Average” and “Workgroup-Plus Average” to each other as well as to the “Consistently Positive” cluster, bolsters the importance of organizations needing to strive to have more than a mediocre health climate. The “Consistently Average” and “Workgroup-Plus Average” clusters fell towards the center of the DFA function, much lower than the “Consistently Positive” cluster. Also the “Workgroup-Plus Average” cluster was more positive on the DFA function than the “Consistently Average” cluster. These findings suggest that strength in one of the facets alone cannot fully compensate for mediocrity in the other two facets; however, strength in one facet can result in slightly better health and well-being outcomes. Findings from all of these comparisons of the average clusters support the notion that having strength in all three of the health climate facets is most beneficial and that organizations could greatly benefit from taking steps to improve facets of health climate that only receive average scores on the MOHCA.

Not surprisingly, a comparison of the negative pair, “Consistently Negative” and “Workgroup-Plus Negative,” corroborates the above findings. These two clusters performed the worst on the DFA function in comparison to the pair of average clusters and the pair of positive clusters. Interestingly, “Consistently Negative” and “Workgroup-Plus Negative” lie close to each other on the function, suggesting that when an organization has low scores on one or more of these MOHCA facets, this may overshadow any benefits from average or higher scores on one or more of the remaining facets. This is a key finding, not only because it supports our earlier finding that strength in one cluster cannot compensate for weakness in another cluster, but also because it indicates that a low score on one or more of the MOHCA facets is detrimental and therefore should be prioritized when planning interventions to improve organizational health climate.

Findings from the group-level *k*-means cluster analysis in Sample 2 are very similar to the findings from Sample 1, demonstrating that workgroups can also differ among the facets of health climate, for example, being high in the workgroup facet yet lower in the supervisor and organization facets. A four-cluster solution was extracted in the analyses used to test Hypothesis 2. Although the number of workgroups in each cluster was lower than conventional standards for *k*-means cluster analysis, because this analysis accounted for the number of people nested within these groups, this is not thought to be a limiting factor in this study.

Similar to the detailed individual-level results, at the group-level the “Consistently Positive” cluster that was high in all three of the MOHCA facets was positioned most positively on the health and well-being function, and the “Consistently Negative” cluster which was low in all three facets was positioned most negatively on the function. Interestingly, “Consistently Average” and “Workgroup-Plus Average” did not differ on the function. This was initially an unexpected result because “Workgroup-Plus Average” had significantly higher scores on the workgroup facet than “Consistently Average.” However, this finding is still consistent with the findings from Sample 1 in that strength in one MOHCA facet was unable to compensate for weakness in one or more of the other MOHCA facets. Similarly, “Workgroup-Plus Average” can be compared to the “Consistently Positive” cluster which was high in all three facets, because these two clusters have similarly high levels of the workgroup facet but they differ in that “Workgroup-Plus Average” is significantly lower on the supervisor and organization facets. Results from the discriminant function analysis show that “Consistently Positive” has a more positive score on the health and well-being function than “Workgroup-Plus Average.” The interpretation of this comparison result in combination with the interpretation of the comparison between “Consistently Average” and “Workgroup-Plus Average” suggests that strength in all three MOHCA facets is an important determinant of outcomes regarding job stress, burnout, engagement, performance, and organizational citizenship behaviors.

Together, findings from the Sample 1 and Sample 2 *k*-means analysis and DFA point to the importance of strength in all three facets of health climate at the same time. Findings from these two different samples suggest that strength in all three of the facets leads to more favorable outcomes than when one or more of the MOHCA facets are not strong. This is an important finding for organizations and researchers because, for example, just because an organization has the resources for an employee health program and sponsors many health-related events, this is not likely to be very effective if its supervisors do not support employee health. Therefore, organizations cannot solely rely on top-down efforts to cultivate a healthy workplace climate. Instead, support for health will also need to come from all levels of the organization.

One alternative approach to adopting top-down interventions to benefit employee health is to support a grassroots intervention planning approach that involves employees self-identifying shared health concerns as well developing intervention ideas that could improve coworker support for health consistent with Total Worker Health [35]. Interventions coming out of this participatory design process are intended to be integrated by involving changes in the workplace and work organization as well as changes in employee behavior. This same approach for designing integrated interventions could be used to address a lack of supervisor support of workplace health.

Additionally, the finding that strength in one MOHCA facet cannot compensate for lacking strength in one or more of the other MOHCA facets suggests a unique contribution of each of these three facets and that all three facets are integral

to health climate. A workgroup that is supportive for health cannot alone compensate for an organization that does not provide the resources for its employees to be healthy and supervisors who do not support their employees' health. This finding is important because it suggests the importance of first considering each of the three MOHCA facets separately and then determining how to gain strength in each. Similarly, the finding that a low score in any of the three facets leads to the cluster being much lower on the DFA health and well-being function suggests the need for organizations to identify where their primary weaknesses might be in health climate and to then prioritize interventions to address these weaknesses accordingly.

From a Conservation of Resources theory perspective, an organization must have some level of each of the three facets to support employee needs. Weakness in one or more of the three MOHCA facets suggests an inadequate amount of resources in that facet to support employee health subsequently leading to the possibility of less optimal employee well-being. On the other hand, strength in all three MOHCA facets can provide continuous resources for employee health from multiple levels within the organization in order to proactively support employee health and well-being. This level of support for health from workgroup members, supervisors, and the organization is something able to be perceived by employees and therefore can have an impact not only on health and well-being but also on work-related attitudes.

Overall, the results of the present study suggest that assessment of organizational health climate is important and that additional consideration of each of the three MOHCA facets is useful for achieving a healthy organization. After assessing health climate and determining whether the three facets are positive, on average, or low should determine the action steps for organizational improvement. For example, if an organization finds that their workgroup facet of MOHCA is weak but the supervisor and organization facets are both on average, this organization would benefit most from supporting an intervention designed specifically to target coworker support for health. However if an organization assesses their health climate and finds that all of the MOHCA facets are on average, this organization might benefit from a more generalized intervention that targets coworkers, supervisors, and the organization.

5. Limitations and Future Research

Although the strength of the current study rests in its exploration of two samples, one at the individual level and one at the group level, both consisted of cross-sectional data, and participants in both samples worked in a similar environment. Future research examining the three facets of health climate over time could help determine how strength in these three facets unfolds and whether the MOHCA facets can influence each other over time and how they are related to other well-being related variables such as work sense of coherence [36]. Replicating and extending the findings from the current study to other work samples would also strengthen the case that organizations need to focus on more than one facet of health climate. Additionally, now

that there is evidence that all three facets are important in combination, future research studies could examine how best to develop interventions to target specific areas of health climate that are lacking. New intervention approaches could also be developed that benefit all three facets of health climate in a more comprehensive manner.

6. Conclusion

The overall combined results from analyses performed on Sample 1 and Sample 2 in the present study have highlighted the importance of considering all levels of the work system when thinking about the context for health that occurs in an organization. Understanding how the three facets of health climate can work together provides an important piece to the puzzle of what organizational health climate consists of and also why organizations should care about it. With increasing attention on health in today's workplace, further research using MOHCA to assess organizational health climate could help contribute to a better understanding of this phenomenon as well as further translate these research findings into practice through targeted interventions that create healthier organizations and employees.

Disclosure

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Disclaimer

The content of this paper is solely the responsibility of the authors and do not necessarily represent the official views of NIOSH.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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