Employee Self-rated Productivity and Objective Organizational Production Levels

Effects of Worksite Health Interventions Involving Reduced Work Hours and Physical Exercise

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Objective: To investigate how worksite health interventions involving a 2.5-hour reduction of weekly working hours with (PE) or without (RWH) mandatory physical exercise affects productivity. **Methods:** Six workplaces in dental health care were matched and randomized to three conditions (PE, RWH and referents). Employees' ($N = 177$) self-rated productivity and the workplaces' production levels (number of patients) were examined longitudinally. **Results:** Number of treated patients increased in all conditions during the intervention year. While RWH showed the largest increase in this measure, PE showed significant increases in self-rated productivity, that is, increased quantity of work and work-ability and decreased sickness absence. **Conclusions:** A reduction in work hours may be used for health promotion activities with sustained or improved production levels, suggesting an increased productivity since the same, or higher, production level can be achieved with lesser resources.

Learning Objectives

- Summarize previous research on the productivity benefits of worker physical activity interventions.
- Outline the design of the new study, including distinctive features related to the workplace physical exercise intervention and assessment of productivity.
- Discuss the study implications for design of health promotion activities, including the potential for programs taking place during regular work hours.

Work hours may be used for health promotion activities with sustained or improved production levels, suggesting an increased productivity since the same, or higher, production level can be achieved with lesser resources. Higher output during work hours and fewer absence days may contribute to this effect.

In this study, the overall aim is to investigate how workplace health promotion interventions taking place during work hours (thereby leading to loss of hours worked), affects the productivity in the workplace. Previously, a large number of studies have shown that ill health among employees is related to decreased productivity.[1–3] Not only does ill health decrease productivity as health problems lead to employee absenteeism but ill health also hinders employees from performing at their best at work, for example, presenteeism. A recent literature review of 80 studies showed that presenteeism was at least as important as absenteeism to the relationship between health and productivity.[3] The organization's costs associated with absenteeism and presenteeism are substantial. Absenteeism has been estimated to account for 29% up to 47% of the health care costs (including medical and pharmacy costs).[4] The costs associated with presenteeism may be even greater, up to 74% of total health care costs, depending on condition.[1,5–7]

Going beyond descriptive and comparative questions, previous studies investigating effects of interventions on productivity have focused mainly on specific conditions, such as obesity and metabolic syndrome[2,4,8,9] and have often involved pharmaceutical treatments.[3,10] However, recently, employers have also been encouraged to provide programs that help healthy employees stay healthy, such by encouraging the use of fitness centers.[3] Implicit here is that aside from focusing on how "ill" health (sickness and disease) relates to productivity "losses," and thereby financial costs, there is a positive side to the equation, such that improvements in health are related to productivity "gains" and financial "profits." Consistent with these conclusions, a recent study reported that improvements in employee health was related to increased self-rated productivity.[11]

Reviews focusing on the effect of multicomponent health promotion programs have shown that workplace health promotion is related to increase in employee health and well-being and reduced health care costs and absenteeism.[12,13] Mills, et al[14] found that participation in multi-worksite health promotion programs were related not only to decreased sickness absence but also to higher self-rated performance, in effect, reduced presenteeism. Similarly, Pelletier, et al[15] showed that employees who improved their self-rated health-risk status had a concurrent increase in self-rated productivity (in terms of a combined measure of both absenteeism and presenteeism).

Studies focusing specifically on workplace physical activity interventions have shown consistent results in that such interventions have been related to reduced absenteeism.[16–19] This is not surprising, given that studies also report positive effects on employee health.[20–22] For presenteeism, on the contrary, previous research has provided contradictive results. The results from a literature review showed that workplace physical activity interventions were related to an improved performance on cognitive complex tasks, as well as improved self-rated productivity.[19] However, a recent study showed no effect on self-rated productivity, despite positive effect on various health variables.[22] Falkenberg [19] describes a conceptual model suggesting that physical exercise (PE) can relate to productivity in two ways. First, PE may, in the short term, improve productivity by reducing stress symptoms and improve mental state, and in the long term, enable arousal levels to be more appropriate adjusted for cognitive work and by increased stress resistance. Second, workplace physical activity interventions may improve productivity by facilitating flexible scheduling of work and home activities, thereby decreasing absence and lateness; as well as by increasing the employee's commitment to the organization as one that cares about its

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employees. Drawing on Falkenberg's model, health promotion may affect productivity in two ways: first, by decreasing ill health, and thereby protecting against productivity loss stemming from presenteeism and absenteeism; and second, by increasing the individuals' capacity to perform at work.

While PE is one of the most common workplace health interventions, either alone or as part of a comprehensive workplace health promotion program, reduced work hours (RWH) is an intervention being used in the public health service and health care sectors in the Nordic countries.[23–28] Reported results are mixed regarding the effects of RWH on employee health. For example, only minor effects on health-related factors, such as, fatigue, disturbed sleep and physiological factors has been reported.[24,26,27] Concurrently, other studies have reported that RWH may be related to positive social effects, such as decreased work-family conflict, particularly in employees with children,[23,26] as well as reduction of neck/shoulder pain[25,27] and decreased stress levels in participants.[27] In sum, the evidence for health-related effects of RWH is limited and we know of no prior studies that have investigated the effect of RWH on productivity.

In previous studies relating ill health or workplace interventions to productivity, productivity have, with a few exceptions, been based on self-reports on presenteeism (eg, productivity in relation to health conditions).[29,30] Although self-ratings of presenteeism are widely used and are often considered the only estimate of productivity available, self-ratings also offer questions of dependability.[30] In the few cases where objective measures have been used, they have often focused on abseentism rather than productivity.[31,32] This means that less is known about the potential changes in individuals' capacity to perform at work following participation in workplace health promotion. To our knowledge, no previous study concerning the effects of health promotion programs has used objective measures of on-the-job productivity, despite that the need for this has been highlighted.[33]

In its simplest form, work productivity can be defined as the output-per-unit-of-input.[34,35] In traditional economical models of productivity, such as the human capital method, decrease in labor input, for example, "Number-of-days-lost-due-to-illness" or the "Percentage-of-time-lost-due-to-presenteeism," is directly translated to productivity losses. This implies that employees are 100% productive when they are at work.[30] This is also the assumption of most cost-effectiveness models. According to these models, scheduling a health intervention during work hours would automatically lead to productivity losses, since the input of work hours is reduced. In this study, the intervention involved a 2.5 work-hour reduction per employee (a decreased input). Following the human capital method, an equally large reduction of output would be expected, thereby reducing the total productivity. In Bernolak's[36] definition of productivity, on the contrary, productivity is defined as how much and how well we produce from the resources we use. This means that if the same production levels can be met with fewer resources (eg, less man hours), productivity is increased.

In this study we aim to compare two workplace interventions, each of which is conducted during work time, and examine these comparatively for influences on productivity. Our hypotheses are:

1. A decreased input of working hours in a PE intervention will be offset by improved employee health, and therefore, will be related to increased self-rated productivity and sustained (or improved) organizational output during the intervention period.
2. A decreased input of working hours in a RWH intervention will not be offset by improved health, and therefore, will be related to decreased self-rated productivity and organizational output during the intervention period.
3. In the control group, there is no change in work hours, and no health intervention and hence, there will be no change in self-rated productivity or organizational output during the intervention period.

METHOD

Design

A longitudinal quasi-experimental study was designed to evaluate the relationships between conditions. Participants were instructed to complete self-ratings at baseline (November 2004), after 6 months and after 12 months as based on experience from previous studies.[23,25] For the purpose of this study, only data from baseline and 12-month follow-up were used (Fig. 1). Data on objective production covered the study period and the corresponding time period the previous year.

Setting

Worksite facilities were selected from a large public dental health care organization in Stockholm, Sweden. Dentistry has been described as the most stressful of the health care professions.[37] It involves a challenging psychosocial work situation with high demands, low rewards, and third-party constraint, as well as physical and visual demands, and requires fixed postures and repetitive movements for extended periods of time, which generates a high muscular load.[38–42]

Of the public dental health care organization's 51 general dental health practices (GDPs) with 1311 employees in total, six workplaces were selected to participate by the parent human resource department. The selection was on the basis of the number of employees (at least 25), currently being profitable and having both management and a majority of employees agreeing to participate. Also, the selected workplaces included workplaces with both high and low short-term sickness absence (>14 days). The six workplaces were matched on the number of employees, resulting in three pairs that where randomly allocated to one of the three conditions (PE, RWH, and referents) For details on selection and randomization procedure and more information concerning the interventions, see von Thiele Schwarz, et al.[21]

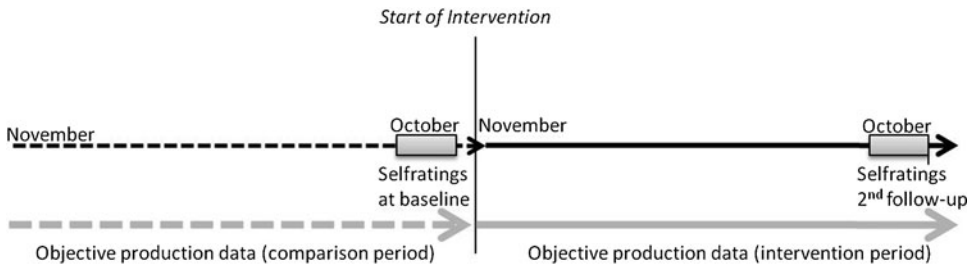

FIGURE 1. A schematic model of the time line for the data collections.

Participants

In all, 201 employees currently on duty at the six workplaces (ie, not on leave of absence due to sickness or personal reasons, or on parental leave) were invited to participate. Of these, 199 volunteered to participate. The dropout was 11.8%. The dropouts were due to change of jobs (7.9%), parental leave (2.3%), long-term sick leave or disability pension (1.1%) while 0.6% declined to participate in follow-ups. The final sample consisted of 177 employees.

Interventions

Each intervention, PE and RWH, effectively removed each employee from their work duties 2.5 hours out of 40 full-time work hours amounting to a 6.25% reduction of weekly work hours. In the PE condition the off-work time was split into two mandatory PE periods, for a total of 2.5 hours. In the RWH condition employees were free to spend the same 2.5 hours however each chose. Thereby, RWH served as a control condition within work hours. Those in the reference group continued working a 40-hour week and did not participate in any programmed reduction of weekly work hours. Employees working less than full time were scheduled for RWH that matched as closely as possible the 6.25% reduction. Thus, those working 30 to 39 hours/week (39% of the employees) were scheduled 2 hours reduction, those working 21 to 29 hours/week (14%) scheduled 1.5 hours, and those working less than 20 hours (2%) scheduled one hour. All employees in the intervention groups retained their salaries. No additional personnel were employed and all worksites were expected to deliver full services throughout the study period.

Data Collection

Prior to collection of the questionnaire data, each participant was given detailed oral and written information about the project, and ethical issues were explained and informed consent obtained. The questionnaires were distributed at the worksite by the researchers at an information meeting and participants were instructed on how to complete the instruments. The self-ratings were completed individually at home, placed in an envelope, which was collected by an occupational nurse during a health check-up. Objective measures of workplace production were obtained at the end of the intervention period from administrative records available to HR and financial departments of the parent GDP organization. Data was retrieved for the six participating worksites. Also, data for all GDPs combined was retrieved and used as a second referent, making comparison to the general development in production in the organization possible. The study was approved by the central ethical review board.

Outcome Measures: Employee Self-ratings of Productivity

On-the-job Productivity

Work ability was measured using a single item.[43,44] Respondents were asked to rate their current work ability as compared with their individual best work ability on a ten-point scale, ranging from "Completely lacking work ability" (1) to "Work ability at its best" (10). Quality and quantity of work were measured using two single item questions adapted from QPS Nordic.[44] The respondents were asked to rate how often they were satisfied with the quantity and the quality of the work they performed. The ratings were made on a five point scale ranging from "Very seldom or never"(1) to "Very often or always" (5).

Sickness Presenteeism and Sickness Absenteeism

Three questions were used to assess presenteeism and absenteeism. "Frequency" of presenteeism and absenteeism were assessed using two items from Allvin, et al.[45] As a measure of sickness-presenteeism, respondents were asked "How many times the past 12 months have you been at work even though you, according to your health status, should have stayed at home?" As a measure of frequency of sickness absence they were asked "How many times have you been absent from work due to own sickness during the last 12 months?" The response was given in four categories, including "never," "one time," "2-5 times" or "more than 5 times." This was then recalculated into three categories, by collapsing "never" and "one time" into one category. The "duration" of sickness absence was measured by the respondent's rating of the "total number of days" (duration) absent from work due to own sickness during the last 12 months. The response was given in five categories: "Not absent due to sickness", 1 to 7 days, 8 to 30 days, 31 to 90 days and "more than 90 days." The number of answer categorise was decreased by adding the bottom and top two categories, so that the categories in the analyses was "0-7 days", 8 to 30 days and "more than 31 days."

In addition to productivity related factors, the questionnaire also included measures of PE and demographic factors (gender, age, marital status, children, education, and current occupation).

Outcome Measures: Objective Production Levels

Production at the worksite level was collected from the parent organization administrative records in terms of the number of treated patients (both children and adults) and the number of therapists (dentists and dental hygienist) per month for each participating worksite as well as for all GDPs combined. The mean number of patients per therapist was calculated. This was done to avoid bias in variations in number of treated patients that were due to variations in staffing. All data were assessed during a 2-year period, the interventions year and the corresponding time period the year before (November to October).

Statistical Analyses

To examine time effects on the continuous individual level productivity measures (work ability, quality and quantity of work), repeated measures analyses of variances was performed separately for each condition. To test hypotheses I and II, 1-tailed significance tests were performed while hypothesis III concerning the referent condition, where no change was stipulated, was tested with a 2-tailed test. Interaction and overall time effects between conditions were tested using repeated measures analyses of variance for the continuous variables, using a 2-tailed test. Wilcoxon signed rank test was used to examine differences in sickness presenteeism and absenteeism (frequency and duration) within condition over time. Differences between groups in presenteeism and absenteeism at the two time points were analyzed using chi-square statistics. Because of missing data, sample size and degrees of freedom vary slightly between analyses. Objective production data is presented for each condition, and all the GDPs combined, as the percentage change during the intervention period in comparison to the corresponding time period the previous year. To describe potential early and delayed effects of interventions, the production level for the first and second half of the intervention period is also presented. Since the objective production data are on the worksite level and the number of worksites is limited to two per condition, no statistical analysis is done due to the small sample size.

RESULTS

Self-ratings

Background information on participants can be found in Table 1 and employee self-ratings are displayed in Table 2, along with results from repeated measures analyses of variance for each condition, and comparisons between groups over time (baseline to 12-months follow-up). The analyses of changes over time within groups showed a significant increase in self-rated quantity of work ($P = 0.029$) and

TABLE 1. Demographic Characteristics in the Physical Exercise, Reduced Work Hour and Referent Conditions*

	PE	RWH	Referents	Total
N	61	51	65	177
Proportion women, %	90.2	90.2	93.8	85.9
Age	47.1 (10.2)	45.8 (11.0)	46.5 (11.2)	46.6 (10.8)
Education				
University degree, %	45.9	49.1	46.1	46.9
Upper secondary, %	39.3	35.3	46.2	40.7
Family situation				
Married/cohabitant, %	63.9	76.5	67.7	68.9
Children at home, %	50.9	56.9	55.4	54.2
Occupation				
Dentist/dental hygienist, %	42.6	45.1	41.5	42.9
Work hr/wk	33.5 (7.1)	34.6 (6.1)	34,5 (7.1)	34.1 (6.8)
Tenure, yrs	15.5 (11.4)	14.7 (10.8)	15.3 (11.3)	15.2 (11.1)

*Values are expressed as mean (SD) and %.
PE, physical exercise; RWH, reduced work hour.

TABLE 2. Descriptive Statistics for Self-ratings of Productivity-Related Measures in the Physical Exercise, Reduced Work Hour and Referent Conditions at Baseline and After 12 Months of Intervention and Results From Repeated Measures Analysis of Variance and Separate Repeated Measures Analysis of Variances for Time Effects Within Each Group*

	Mean (SD) Baseline	Mean (SD) 12 months	*N*	F (*df*)	*P*	η^2
Work ability				6.94 (2,166)	0.001†	0.077
PE	8.08 (1.77)	8.36 (1.40)	59	2.94 (1,58)	0.046	0.048
RWH	8.04 (1.87)	8.15 (1.58)	46	0.20 (1,45)	0.33	0.004
Referents	8.50 (1.36)	7.64 (2.21)	64	8.87 (1,63)	0.004†	0.123
Quality of work output				1.64 (2,167)	0.197†	0.019
PE	4.50 (0.57)	4.43 (0.58)	60	1.00 (1,59)	0.161	0.017
RWH	4.18 (0.60)	4.32 (0.64)	47	2.03 (1,46)	0.081	0.042
Referents	4.25 (0.65)	4.33 (0.55)	63	0.93 (1,62)	0.340†	0.015
Quantity of work output				0.81 (2,167)	0.446†	0.010
PE	4.07 (0.90)	4.27 (0.76)	60	3.77 (1,59)	0.029	0.060
RWH	3.91 (0.58)	3.98 (0.74)	47	0.39 (1,46)	0.269	0.008
Referents	4.00 (0.78)	4.03 (0.74)	63	0.10 (1,62)	0.748†	0.002

**N* differs between items due to questionnaire internal missing values.
†Two-tailed test.
PE, physical exercise; RWH, reduced work hour.

work ability ($P = 0.046$) in the PE group. Concurrently, work ability decreased significantly in the reference group ($P = 0.004$; two-tailed test). There were no significant changes in the other groups. The interaction effect for work ability (time × condition) was also significant ($P = 0.001$). There were no significant differences between groups over time in quality and quantity of work output.

The response rates for self-rated frequency and duration of sickness absence and frequency of sickness presenteeism (going to work despite being ill) can be found in Table 3. Results from related-samples Wilcoxon signed rank test show that, in the PE condition, frequency of sickness absence ($P_{ssfreq} = 0.037$) and sickness duration ($P_{ssdur} = 0.029$) decreased significantly. There was no change in sickness presenteeism ($P_{present} = 0.328$). Changes in the RWH condition were not significant ($P_{ssfreq} = 0.307$; $P_{ssdur} = 0.227$; $P_{present} = 0.355$). No significant change was obtained in the reference group sickness absence frequency ($P_{ssfreq} = 0.074$) but changes in sickness absence duration ($P_{ssdur} = 0.041$) and sickness presenteeism ($P_{present} = 0.028$) were each significant (2-tailed test). Inspection of the response sheet showed that the total number of sickness absent days had increased in the control group, while there was a decrease in sickness presenteeism, for example, fewer reported going to work when ill. Group comparisons using chi-square showed that the groups differed in sickness absence frequency at baseline. More employees in the RWH condition reported being absent more than five times, compared to the other conditions (χ^2 [4] = 16.3, $P = 0.002$, 2-tailed). No other significant differences were found.

In sum, the results from analyses of self-ratings of productivity suggested that the PE condition was associated with an increase in

TABLE 3. Response Rates of Self-rated Sickness Absence (Number of Occasions and Total Number of Days) and Sickness Presenteeism (Number of Occasions) Before Interventions and After 12 Months

	Baseline			12-Month Follow-Up		
	RWH, *n* (%)	PE, *n* (%)	Referents, *n* (%)	RWH, *n* (%)	PE, *n* (%)	Referents, *n* (%)
Sickness absence, total number of occasions (12 mo)	*n* = 50	*n* = 61	*n* = 65	*n* = 47	*n* = 60	*n* = 62
0–1	32 (62.7)	33 (47.5)	43 (66.2)	28 (54.9)	39 (63.9)	42 (64.6)
2–5	9 (17.6)	26 (37.7)	20 (30.8)	15 (29.4)	20 (32.8)	18 (27.7)
>5	9 (17.6)	2 (3.3)	2 (3.1)	4 (7.8)	1 (1.6)	2 (3.1)
Sickness absence, total number of days (12 mo)	*n* = 49	*n* = 60	*n* = 64	*n* = 47	*n* = 60	*n* = 64
0–7	37 (72.5)	43 (70.5)	53 (81.5)	38 (74.5)	52 (85.2)	45 (69.2)
8–14	8 (15.7)	12 (19.7)	8 (12.3)	7 (13.7)	6 (9.8)	12 (18.5)
15–29	4 (7.8)	5 (8.2)	3 (4.6)	2 (3.9)	2 (3.2)	7 (10.8)
Sickness presenteeism (at work despite being ill)	*n* = 50	*n* = 61	*n* = 65	*n* = 47	*n* = 60	*n* = 64
0–1 d	25 (49)	31 (50.8)	26 (40.0)	26 (51)	30 (49.2)	34 (52.3)
2–5 d	19 (37.3)	24 (39.3)	30 (46.2)	16 (31.4)	22 (36.1)	26 (40.0)
>5 d	6 (11.8)	6 (9.8)	9 (13.8)	5 (9.8)	8 (13.1)	4 (6.2)

PE, physical exercise; RWH, reduced work hour.

self-rated productivity in terms of increased quantity of work and work-ability and decreased frequency and number of days of sickness absence. No effect was found in the RWH condition on self-rated productivity. Interestingly, the control group showed a decline in self-rated work ability, as well as an increase in number of sickness absent days but a decrease in sickness presenteeism.

Objective Production Levels: Number of Treated Patients Per Therapist

In comparison to the corresponding time period the previous year, the number of treated patients per therapist during the intervention year increased in all worksites, despite that the work time available for production was decreased with 6.25% in PE and RWH. Reduced work hours demonstrated the greatest increase in number of patients per therapist, 13.4%, followed by referents (5.4%) and PE (1.3%). This can be compared with the organization as a whole, where the increase was 2.9%. For RWH and referents, the greatest increase in production was during the first half of the intervention period (RWH: 5% increase during the first half followed by a 3% decrease during the second half; Referents 13% increase followed by a 7% decrease), while PE showed an opposite pattern (4% decrease followed by a 8% increase). This was similar to the development in the organization as a whole (no change [0%] followed by a 7% increase).

DISCUSSION

This study investigated two workplace interventions, each of which was conducted during work time, and examined these comparatively for influences on productivity. Our results showed that even though a health intervention takes place during work hours, thereby decreasing work-hour input, such an intervention might not be associated with a corresponding decrease in output, that is, production. On the contrary, productivity was improved in the sense that the production levels (number of treated patient) and the self-rated productivity was increased despite fewer work hours.

The traditional economical model view, that work hours lost result in production decrease, assumes a linear model, that is, production increases/decreases linearly with work hours. However, some authors have questioned the proposition that workers are 100% productive throughout the day.[30] The results from this study suggest that such a linear, simple input/output model may lead to an overestimation of the productivity loss association with a health intervention taking place during work hours. Our results showed that when using an objective production measure (number of patients treated), production levels were improved in all conditions during the intervention year in comparison to the corresponding time period the year before, while the self-rated productivity was significantly improved in the PE group, sustained in the RWH and, in some aspects, decreased among the referents. A straightforward comparison of objective production levels showed that PE had the least increase in production while RWH had the greatest increase, and that both the referents and the organization as a whole showed increased production levels as well. However, in contrast to the referents and the organization as a whole, the sustained production level in the PE condition and the improved production level in the RWH condition were achieved despite a decrease in work hours. Following Bernolak's definition of productivity[36] and relating the production level to the resources used, this means that in the PE and RWH groups, even sustained production levels would indicate an improved productivity. Hence, the reduced input in work hours during workplace health interventions may be compensated by improved productivity even though, in the PE group, this was not sufficient to fully compensate the increase in production in the referent group.

Following Falkenberg's[19] model on how PE may affect productivity, one might assume that such improvements could be related either to improved productivity while at work or to decreased sickness absence, thereby increasing the number of days available for production. The results from the self-ratings in the PE condition, showing an increase in quantity of work and work ability, and decrease in sickness absence and frequency, are consistent with both these two pathways. As for the RWH condition, contrary to the hypothesis, the results showed that objective production levels increased while there was no change in self-rated productivity levels. It is unlikely that the improved productivity is due to improved health, since in an earlier study, von Thiele Schwarz et al[21] reported no health effects in this group. Furthermore, since no trends were found in the self-ratings, they provide no insight into possible mechanism. This further highlighted the complexity of employee productivity, suggesting that other factors than health may explain the relationship. On the basis of previous studies, other factors such as job motivation, which was not measured in the present study, may be of importance.[30] Also, the changes in work hours may have influenced the quality of the work process, for example, involving a more efficient use of resources (for example, room utilization), collaboration among staff

members, or both. Previous studies suggest that employee production may be interdependent on how colleagues perform,[46,47] which again, points to the complexity and needs to further investigate these issues.

While RWH and the referents both showed greater increase in objective production levels than the PE group, the increased productivity was not supported by self-ratings in either of these groups. On the contrary, self-ratings among referents showed a significant decline in self-rated work-ability concurrently with an increase in sickness absence and decrease in sickness presenteeism. One explanation for the lack of concurrency may be that the increase in production levels in the RWH and referent groups took place during the first half of the intervention, while there was a decline in production during the second half. The self-ratings, which was made at 12-month follow-up, may better reflect this second period. A related interpretation is that while RWH may have some immediate effects on productivity, these may be short-lasting and not sustained over time, while the effects of PE take time to develop. Thus, the mechanisms by which RWH and PE may affect productivity may differ between conditions and over time. In the short run, effects related to for example job motivation may be more important, while over time, other factors may prevail. Hence, the time lag of the study is important. One can argue that a 1-year follow-up time, as in this study, is a sufficient time period to obtain health-related effects while still not suffer too many outside events affecting the results or the size of the study sample. On the other hand, it may lack sensitivity to obtain changes in all aspects of productivity. A previous study reporting on the impact of workplace health promotion programs on health care costs, failed to show any effects on health-costs during less than 3-year follow-ups.[48] Others have shown that although there may be a significant difference in absenteeism between participants and non-participants over a 1-year period, over 2 years these differences are even greater.[49] This delayed effect has been explained in terms of how, with the passage of time, chronic diseases are prevented.[49] Thus, studies with shorter time lag may be better suited for investigating effects on productivity relating to for example job motivation or aspects of health, for example, physical fitness and endurance, other than prevention of chronic health complaints.

Limitations and Strengths

In this study, all employees at the workplace were involved in the intervention. It may be argued that health promotion strategies should focus on the employees with the highest health risk, since they carry a greater proportion of the health care costs. However, the greater proportion of health care costs should be considered relative to the fact that the cases are few. Hence, for example, Burton, et al[50] suggests that targeting all employees to help the majority to "stay" healthy may make sense from en economical perspective. Since most studies on health-related productivity have focused on the extent to which different medical conditions affect employee productivity, there is a need for more studies focusing on employees in general, exploring variations in productivity within this group. There is also a need to explore not only how productivity loss may be prevented, but also how productivity can be optimized.

In countries where the employers are the ultimate purchasers of health care, for example the United States, the burden of medical and pharmacy costs have brought the focus on employee sickness. However, recent studies investigating medical and pharmacy cost along with absenteeism and presenteeism have shown that the true value of health-related productivity losses exceeds the medical and pharmacy costs for most conditions. It is estimated that for every dollar spent on medical or pharmacy costs, at least $2 to $4 are absorbed by productivity losses.[5] This highlights the importance of considering both direct and indirect effects of ill-health and health improvements.

As an organizational level production measure, the number-of-treated-patients was used. An alternative would have been to use revenues-per-therapist. This would have the advantage of resulting in production in monetary terms. However, although the variance of this measure to a great extent comes from the variation in number-of-treated-patients, it also involves variations in fees incurred and treatment types. Since this variation is not relevant to the scope of this study, number-of-treated-patients was used as a measure of organizational level productivity. Also, since the result was presented in relative terms as a percentage, the unit is less relevant, and generalization to other settings is made easier. Nevertheless, productivity is defined differently among organizations,[51] and thus, the generalizability of our findings using the objective measure is limited. The self-ratings, on the other hand, are more general which increases comparability to other occupations and settings. Given that self-ratings have other drawbacks, for example, are subjective and may be under- or overestimated, the combination of self-ratings and objective measures are an important strength in this study. This could be further enhanced by using objective production data on the individual level, or multisite firm- or work-unit level data, to allow significant tests of difference in production levels.

CONCLUSIONS

Health interventions that require a small reduction of working time do not necessarily lead to reduced productivity. On the contrary, production levels may be maintained, and even increased, indicating an increased productivity since the same, or higher, production level can be achieved with less resource. As regards PE as a health promotion intervention, productivity gains may be related to higher output during work hours and a decrease in sickness absence, for example, increase in number of days present.

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