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Key terms: cluster randomized controlled trial; core task; intervention; occupational health; psychosocial; randomized controlled trial; RCT; short-term sickness absence; sickness absence; sickness absence; stress; stress-as-offense-to-self

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Effect of a participatory organizational-level occupational health intervention on short-term sickness absence: a cluster randomized controlled trial

by Elisabeth Framke, MSc,[1, 2] Ole Henning Sørensen, PhD,[2] Jacob Pedersen, PhD,[1] Reiner Rugulies, PhD [1, 3, 4]

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Objectives The aim of this study was to examine whether employees in pre-schools that implemented a participatory organizational-level intervention focusing on the core task at work had a lower incidence of short-term sickness absence compared to employees in the control group.

Methods The cluster randomized controlled trial (RCT) comprised 78 pre-schools that were allocated to the intervention (44 pre-schools with 1760 employees) or control (34 pre-schools with 1279 employees) group. The intervention lasted 25 months and followed a stepwise and structured approach, consisting of seminars, workshops, and workplace-directed intervention activities focusing on the core task at work. Using Poisson regression, we tested differences in incidence rates in short-term sickness absence between the intervention and control groups during a 29-months follow-up.

Results Estimated short-term sickness absence days per person-year during follow-up were 8.68 and 9.17 in the intervention and control groups, respectively. The rate ratio (RR) for comparing incident sickness absence in the intervention to control groups during follow-up was 0.93 [95% confidence interval (95% CI) 0.86–1.00] in the crude analysis and 0.89 (95% CI 0.83–0.96) when adjusting for age, sex, job group, type and size of workplace, and workplace average level of previous short-term sickness absence. A supplementary analysis showed that the intervention also was associated with a reduced risk of long-term sickness absence with a crude RR of 0.83 (95% CI 0.69–0.99) and an adjusted RR of 0.84 (95% CI 0.69–1.01).

Conclusions Pre-school employees participating in an organizational-level occupational health intervention focusing on the core task at work had a lower incidence of short-term sickness absence during a 29-month follow-up compared with control group employees.

Key terms core task; psychosocial; RCT; stress; stress-as-offense-to-self.

The design, implementation and evaluation of organizational-level occupational health interventions are increasingly receiving attention, but results are inconsistent (1). In a systematic review of job stress interventions, LaMontagne et al (2) found that interventions targeting the organizational level appeared to be more effective than those targeting the individual. In another systematic review, Bambra et al (3) concluded that organizational interventions aimed at task restructuring may improve employee health if the restructuring increases employees' job control. In a recent systematic review on the effects of organizational-level interventions on employee health-related outcomes, Montano and colleagues (4) identified 39 intervention studies published between 1993 and 2012. Of those studies, 19 reported significant effects on various, mostly self-reported health endpoints. However, the majority of studies were of medium quality, and only 4 were regarded as high-quality studies. Sickness absence was examined in 6 of the 39 studies, but none of the studies were of high quality. When examining reasons for lack of success, Montano et al identified lack of employee participa-

1 National Research Centre for the Working Environment, Copenhagen, Denmark.
2 Center for Industrial Production, Aalborg University Copenhagen, Denmark.
3 Department of Public Health, University of Copenhagen, Denmark.
4 Department of Psychology, University of Copenhagen, Denmark.

Correspondence to: Elisabeth Framke, National Research Centre for the Working Environment, Lerso Parkallé 105, DK-2100 Copenhagen, Denmark. [E-mail: elf@nrcwe.dk]

tion, difficulties regarding implementing the originally planned intervention design, lack of employee and management support, external events, and short follow-up time as important contributors.

Participatory interventions that involve employees from the start of the intervention and that follow a structured and step-wise approach are well established key components within organizational intervention research (5, 6). However, less attention has been paid to the fact that most occupational intervention activities are sideline activities with limited relevance for the core task of the workplace (7). Kristensen pointed out that developing methods for integrating the working environment and workplaces' core tasks are key for enhancing implementation and securing management support (7). According to Semmer, interventions will be more successful if they become an integrated part of daily operations and attempt to achieve "good work" that gives employees a sense of meaning, participation in social life, and accomplishment (8).

In this article, we examine an occupational health intervention that focuses on the core task at work. This approach was inspired by the work of Semmer et al on illegitimate tasks, an occupational stressor developed from the stress-as-offense-to-self (SOS) theory (9, 10). Semmer et al define illegitimate tasks as those that employees regard as either unreasonable (outside of one's occupation or occupational status and should be done by others) or unnecessary (should not be done at all). Previous research showed associations between illegitimate tasks and counterproductive work behaviour (11), higher level of cortisol (12), higher level of stress (13), decreased level of mental health (14), sleep disturbances (15), lowered self-esteem (10, 16), and feelings of resentment towards one's organization and burnout (10).

The illegitimacy of a work task depends on whether the task is perceived as core or peripheral (10). We assume that an intervention focusing on the core task at work will reduce unreasonable and unnecessary tasks, which subsequently will reduce employees' stress level leading to a lower incidence of short-term sickness absence. It has been suggested that short-term sickness absence may partly be a reaction, either health- or coping-based or both, to a problematic psychosocial work environment (17–19). Long-term sickness absence, on the other hand, may more often be related to severe diseases (20). Although prolonged exposure to adverse psychosocial working conditions, eg, job strain or bullying, may contribute to risk of severe diseases and disorders, such as cardiovascular disease (21) and depression (22), we did not expect that an intervention focusing on the core tasks at work would affect onset and course of severe somatic diseases and mental disorders. Consequently, we chose short-term sickness absence as the primary outcome of this study, while examining long-term sickness absence in a supplementary analysis. To our knowledge, no intervention study has yet examined whether an increased focus on the core task at work has an effect on sickness absence.

In this article, we test the hypothesis that a participatory organizational-level intervention that focuses on the core task at work will lead to a lower risk of short-term sickness absence in the intervention compared to the control group. We defined short-term sickness absence as absence of ≤14 calendar days in accordance with previous Danish studies (23). In addition to the hypothesis testing, we conducted three supplementary analyses to examine whether (i) the intervention effect was similar, when excluding the first 12 months of follow-up; (ii) the effect of the intervention differed by employees' age, sex, and job group; and (iii) the intervention had an effect on long-term sickness absence.

Methods

Setting

The intervention, called the "Pioneer Project" (in Danish: "Pionerprojektet"), included 196 pre-schools in the Children and Youth Administration in the Municipality of Copenhagen. In Denmark, pre-schools are voluntarily attended by children aged 0–6 years. Attendance is 9.7% (0 years), 89.7% (1–2 years), and 97.5% (3–5 years) respectively (24). Municipalities run about 70% of pre-schools, with private organizations running the remaining 30% (25).

The Pioneer Project was funded by the Danish Prevention Fund through a grant awarded to a joint application from a private consultancy company and the Municipality of Copenhagen, which dedicated additional funding to the project. Only municipal (and not private) pre-schools were eligible for the intervention, which was carried out with eight professional working environment consultants from the consultancy company who facilitated and supported implementation. The University of Aalborg and the Danish National Research Centre for the Working Environment (NRCWE) conducted the research evaluation, which was funded by a separate grant from the Danish Working Environment Research Fund.

Sickness absence data was retrieved from a municipal register, using participants' unique civil registration number that is assigned to all Danish residents. The retrieved data was stored at a special secured intranet drive at NRCWE and the civil registration number was replaced by an anonymized serial number. All analyses were conducted with this fully anonymized dataset. According to Danish law, research studies that use solely

questionnaire and register data do not need approval from the National Committee on Health Research Ethics (Den Nationale Videnskabetiske Komité).

Study design and population

The Pioneer Project included both a regression-discontinuity design (RDD) analysis and a nested cluster randomized controlled trial (RCT) that was parallel and two-armed. The results presented in this article are from the RCT part only. All pre-schools in the Municipality of Copenhagen with ≥10 employees were eligible for the study. District managers excluded 25 pre-schools because they were assessed as not being ready for the intervention. The remaining 196 pre-schools were included in the project. The 98 workplaces with the highest short-term sickness absence were selected for further analyses and, of those, the 20 workplaces with the highest short-term sickness absence were selected for obligatory participation in the intervention. The remaining 78 workplaces formed the nested RCT, ie, the study sample for this article. The Municipality of Copenhagen had resources available to conduct the intervention at 44 pre-schools and decided that the remaining 34 pre-schools should serve as the control group. A statistician randomized the workplaces accordingly using a random number generator. Figure 1 shows that of the 44 intervention group workplaces, 3 did not complete the intervention: one dropped out before the intervention started because employees were occupied with other projects; another was closed during the intervention phase; and the third left the study because the pedagogical leader had a negative appraisal of the intervention. In accordance with the intention-to-treat principle, we kept the drop-out workplaces in the analyses.

The study sample consisted of all pedagogical leaders, nursery nurses, nursery nurse assistants and other employees who were employed at the 78 workplaces at some point between June 2011 and December 2013. Nursery nurses' educational background is upper secondary education and a bachelor's degree in social education. Nursery nurse assistants may have various educational and professional backgrounds, and their task is to assist nursery nurses. Other job groups were primarily kitchen and cleaning staff and school caretakers. We excluded 122 nursery nurse students, because the intervention was not designed for this group. In total, there were 3039 participants in the study sample: 1760 in the intervention group and 1279 in the control group.

The follow-up period was from June 1st, 2011 (when workplaces were informed about allocation to either intervention or control group) to December 31st, 2013 (end of data reading in the sickness absence register). Employees who were hired at one of the workplaces after June 1st, 2011 were followed from the date of hiring, and employees who left one of the workplaces before December 31st, 2013 were followed until date of termination.

The intervention

The intervention was designed as an open framework with no content requirements related to changing specific elements of the performance and organization of work. There were, however, specific requirements to participate in generic intervention activities common for all intervention workplaces and to develop and implement workplace specific intervention activities focusing on the core task.

Employees' participation in the development and implementation of workplace specific intervention activities was pivotal in this intervention. Pedagogical leaders in cooperation with employee representatives, shop stewards and occupational health and safety representatives, formed a steering group that managed the intervention.

A working environment consultant was assigned to each workplace for the full intervention period. The consultants initiated the intervention by informing the steering group in each workplace about the intervention and assisted the steering group in conducting a dialog meeting with all employees at each workplace. The steering groups received implementation support from the consultants throughout the full intervention period. Intervention activities common for all workplaces were seminars and workshops for all steering groups on how to develop workplace-specific intervention activities, change management training, workplace culture, and evaluation.

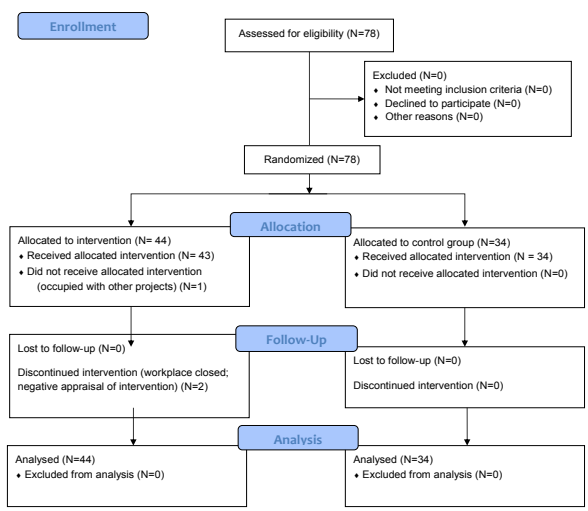

Figure 1. Consort Flow Diagram

Figure 2 shows intervention phases and activities and data collection. A more in-depth analysis of the implementation process from a multiple case study of four selected pre-schools is published elsewhere (26). Briefly, the intervention was structured in four phases. In phase I (September 2010 to September 2011), the intervention was planned and coordinated by the project leader team with members from the municipality, consultants and research. In phase II, the action planning phase (September 2011 to February 2012), the steering group involved all employees in developing workplace-specific intervention activities. The workplaces were asked to focus on the core task at work by improving the performance of central work tasks and procedures and to develop workplace specific intervention activities and intervention activity plans. In phase III, the implementation phase (February 2012 to June 2013), generic intervention activities common for all intervention workplaces were conducted and workplace specific activities were implemented. In phase IV (March 2013 to June 2013), the participants' conducted a self-evaluation of the implementation of their workplace specific intervention activities. Counted from the date when workplaces were informed about group allocation (June 2011) until completion of the implementation phase (June 2013), the intervention lasted 25 months. The research evaluation lasted from June 2011 until December 2013 (31 months), with data on sickness absence available for 29 months. We further collected sickness absence data for the 12-month period preceding June 1st, 2011.

Effect measure

The effect measure was the number of short-term sickness absence days per person-year during a 29-month follow-up. Data was drawn from the municipal sickness absence register. The number of calendar days with short-term sickness absence was registered monthly for each participant counting from the first to the last calendar day of absence. The monthly number of days with short-term sickness absence could be >14 days, but a single, uninterrupted absence period had to be ≤14 days to be considered short-term sickness absence. We excluded long-term sickness absence, part time sickness absence, absence due to pregnancy related sickness and children's sick days. We allowed for the possibility that short-term sickness absence occurred more than once in the same person within the predefined time period. In this dynamic population where new participants were added during the follow-up period, and where some participants terminated their employment before the end of the follow-up period, we used participant's monthly update on employment status to calculate time at risk.

Statistical analysis

Using Poisson regression with time at risk for short-term sickness absence as an offset variable, we tested differences in incidence rates in short-term sickness absence between the intervention and control group. Each day a participant went on sickness absence during follow-up was calculated as an incident event, as long as the spell to which the sickness absence day belonged was not >14 days. Thus, a person who had during a calendar year one spell with 8 sickness absence days, one spell with 18 sickness absence days and one single sickness absence day, would be counted as 9 incident events. We used this procedure to optimize exploitation of the available information given by the data that included monthly updates on number of days with short-term sickness absence (27).

We calculated the incidence rate of short-term sickness absence, ie, the number of events of short-term sickness absence per person-year, for both the intervention and control group and calculated the rate ratios (RR) for comparing the two groups. We calculated both unadjusted RR and RR adjusted for sex and age (continuous) (model 1) and further adjusted for job group, workplace type, workplace size (continuous) and workplace average level of short-term sickness absence

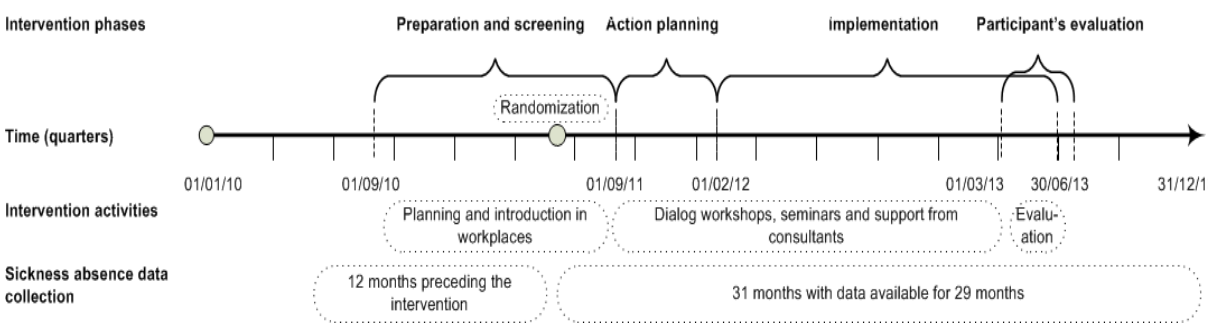

Figure 2. Timeline: intervention phases and activities and data collection

during the 12 months preceding the intervention (continuous) (model 2).

Using the offset variable, each participant's short-term sickness absence risk was adjusted according to the participant's own time at risk. We used monthly updates on short-term sickness absence from June 1st, 2011 to December 31st, 2013. Due to technical problems, we were not able to obtain data from the 11th and 12th months of 2012, therefore the analyses are based on 29 instead of 31 months.

All statistical analyses were performed using the Genmod procedure in SAS 9.3 (SAS Institute, Cary, NC, USA). To account for over-dispersion we used the Dscale option. We analyzed employees within workplaces. To take the clustering effect of workplaces and the correlation of repeated measurements of each participant into account, we included workplace and anonymized personal identification number in a repeated statement. For a more detailed description of these procedures see Johnston and Stokes 1996 (27).

We conducted three supplementary analyses. First, we examined whether the intervention effect was similar when we excluded the first 12 months of follow-up (June 2011 to May 2012), a time period that was characterized mainly by action planning and first intervention activities. If an effect of the intervention was found in these first 12 months but not afterwards, this might indicate that the effect was not due to the intervention, but instead was due to other factors, for example an enhanced focus on sickness absence. Second, we explored in post-hoc analyses whether the effect of the intervention differed by participants' age (<36, 36–50, >50 years), sex, and job group (pedagogical leaders, nursery nurses, nursery nurse assistants, other job groups). Third, we analyzed the effect of the intervention on long-term sickness absence (absence of ≥15 consecutive days). We had not hypothesized an effect of the intervention on long-term sickness absence. However, this supplementary analysis on long-term sickness absence is important to rule out that a reduction in short-term sickness absence was achieved by an increased risk of long-term sickness absence. In contrast to the analyses on short-term sickness absence, in which we allowed sickness absence to occur more than once in a person, we analyzed the effect on long-term sickness absence as a time-to-event analysis, ie, participants did not re-enter the analyses after the first day of a long-term sickness absence spell had occurred (28).

Results

Baseline characteristics of participants

Table 1 shows characteristics of the participants and workplaces in the intervention and control groups. The two groups were very similar, indicating that the randomization was successful. Number of days with short-term sickness absence per person-year in the 12 months preceding the intervention was 11.65 days in the future intervention group workplaces (unique participants=1512, number of months=13 221, total number of sickness absence days=12 872) and 11.43 in the future control group workplaces (unique participants=1064, observations=9563, total number of sickness absence days=9069).

Effect of the intervention

Table 2 shows the main results. As described in the method section, we allowed for the possibility that short-term sickness absence occurred more than once in the same person. During the 29 months of follow-up, the number of estimated days with short-term sickness absence was 8.68 per person-year (unique partici-

Table 1. Employee and workplace characteristics in intervention and control group during the 12 months preceding the intervention (June 2010–May 2011). [SD=standard deviation.]

	Intervention group				Control group			
	N	Mean	SD	%	N	Mean	SD	%
Employees	1512				1064			
Age		37.9	12.0			39.0	12.0	
Women	1233			81.6	871			81.9
Pedagogical leaders	87			5.8	66			6.2
Nursery nurses	708			46.8	470			44.2
Nursery nurse assistants	554			36.6	421			39.6
Other job groups	163			10.8	107			10.1
Workplace	44				34			
Size		24.4	9.0			22.0	9.8	
Integrated	1184			78.3	803			75.5
Day care	281			18.6	214			20.1
Kindergarten	47			3.1	47			4.4

Table 2. Rate ratios (RR) for comparing rates of short-term sickness absence (events per person-year, allowing recurrent events) in the intervention group with rates in the control group during 29 months of observations.

Groups	N	Sum months	Sum sick days	Estimated short-term sickness absence days per person-year	Crude		Model 1 [a]		Model 2 [b]	
					RR	95% CI	RR	95% CI	RR	95% CI
Control	1279	19 554	14 903	9.17	1.00	reference	1.00	reference	1.00	reference
Intervention	1760	28 353	20 583	8.68	0.93	0.86–1.00	0.90	0.84–0.97	0.89	0.83–0.96

[a] Poisson regression: adjusted for sex and age (continuous).

[b] Poisson regression: Model 1 + further adjusted for job group (pedagogical leader, nursery nurse, nursery nurse assistant, other job group) type of workplace (integrated, day care, kindergarten), workplace size (continuous) and workplace average level of short-term sickness absence during the 12 months preceding the intervention (continuous). Workplace and anonymized personal identification number are included in a repeated statement.

Table 3. Rate ratios (RR) comparing time to onset of first episode of long-term sickness absence in the intervention and the control group during 29 months of observations.

Groups	N	Sum months	Long-term sickness absence events	Estimated long-term sickness absence events per 1000 person-years	Crude		Model 1 [a]		Model 2 [b]	
					RR	95% CI	RR	95% CI	RR	95% CI
Control	1277	17 337	205	141.89	1.00	reference	1.00	reference	1.00	reference
Intervention	1754	25 606	250	117.16	0.83	0.69–0.99	0.85	0.70–1.02	0.84	0.69–1.01

[a] Poisson regression: adjusted for sex and age (continuous);

[b] Poisson regression: Model 1+ further adjusted for job group (pedagogical leader, nursery nurse, nursery nurse assistant, other job group) type of workplace (integrated, day care, kindergarten), workplace size (continuous) and workplace average level of short-term sickness absence during the 12 months preceding the intervention (continuous). Workplace and anonymized personal identification number are included in a repeated statement.

pants=1760, number of months=28 353, total number of sickness absence days=20 583) in the intervention group and 9.17 per person-year (unique participants=1279, number of months=19 554, total number of sickness absence days=14 903) in the control group. The RR for short-term sickness absence in the intervention group compared to the control group in the crude analysis was 0.93 (95% CI 0.86–1.00). The RR was 0.90 (95% CI 0.84–0.97) when adjusting for age and sex and 0.89 (95% CI 0.83–0.96) when further adjusting for job group, type and size of workplace, and workplace average level of short-term sickness absence during the 12 months preceding the intervention.

Supplementary analyses

When we repeated the analyses from table 2 while excluding the first 12 months of follow-up, results were similar (data not shown). During the 17 months of follow-up, the number of estimated days with short-term sickness absence was 8.00 per person-year (unique participants=1446, number of months=16 474, total number of sickness absence days=11 020) in the intervention group and 8.76 per person-year (unique participants=1002, number of months=11 285, total number of sickness absence days=8235) in the control group. The RR was 0.91 (95% CI 0.84–0.98) in the crude analysis and 0.88 (95% CI 0.81–0.95) in the fully adjusted analysis.

Figure 3 shows results from post-hoc analyses that were stratified for participants' characteristics. Some of the subgroups were relatively small (eg, men and pedagogical leaders), resulting into estimates with wide confidence intervals. None of the differences between the sub-groups were statistically significant. When only looking at the effect estimates and at subgroups of similar size, the results may suggest that there was a trend towards a stronger intervention effect with increasing age of the participants.

Table 3 shows the effect of the intervention on long-term sickness absence. Similar to the results on short-term sickness absence, participants in the intervention group had a decreased risk of long-term sickness absence. This was statistically significant in the crude analysis and approached statistical significance in the fully adjusted analysis.

Discussion

We hypothesized that the implementation of the Pioneer invention, which was a participatory organizational-level intervention with a focus on the core task at work, would lead to lower incidence of employees' short-term sickness absence. This hypothesis was confirmed. Incidence of short-term sickness absence was statistically significantly lower in the intervention group compared to the control group during a 29-months follow-up.

This study is unique because, to our knowledge, this is the first RCT showing that an intervention addressing

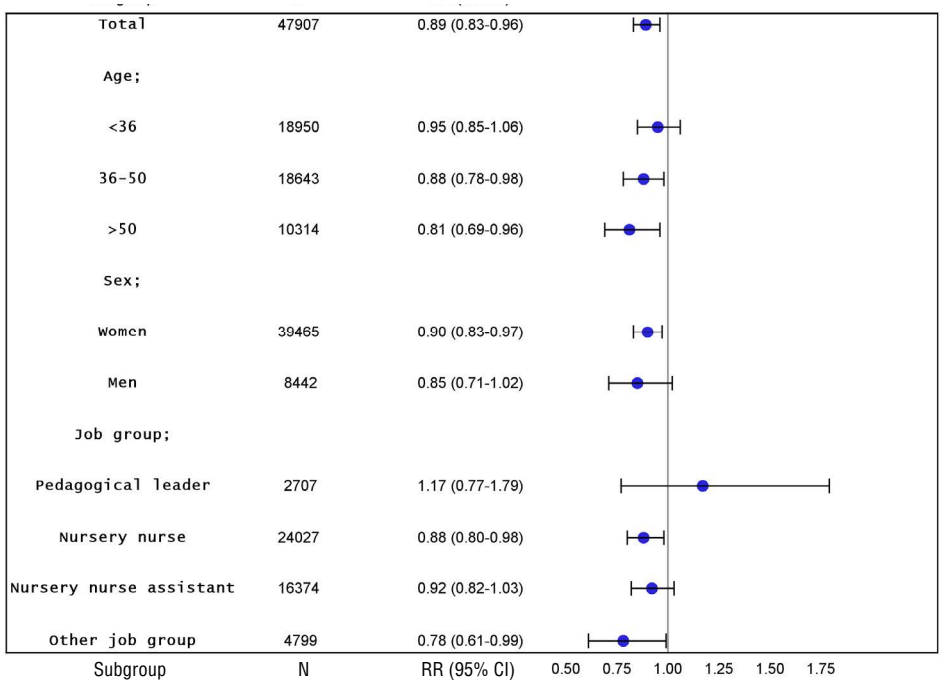

Figure 3. Post-hoc analyses showing rate ratios (RR) comparing rates of short-term sickness absence in intervention and control group, stratified for participants' characteristics. Poisson regression, adjusted for sex and age (continuous), job group (pedagogical leader, nursery nurse, nursery nurse assistant, other job group) type of workplace (integrated, day care, kindergarten), workplace size (continuous) and workplace average level of short-term sickness absence during the 12 months preceding the intervention (continuous). Workplace and anonymized personal identification number are included in a repeated statement.

the core task at work leads to a reduced risk of sickness absence. The result concurs with the key assumption of the SOS theory that focusing on the core task at work is beneficial for employees' health and wellbeing (9, 10).

Reviews of the literature have emphasized that increasing employees job control may be key for the success of organizational interventions (3). Although increasing job control was not an explicit aim of the Pioneer intervention, it is possible that the intervention's participatory component, where intervention activities were shaped in accordance with employee needs and knowledge, had increased employees' job control.

We analyzed the effect of the intervention by testing differences in short-term sickness absence incidence rates in the intervention and control groups, allowing us to also include employees who entered or left the workplaces during the follow-up period. When comparing number of sickness absence days per person-year of the follow-up period with the number of sickness absence days per person-year of the year preceding the randomization, we found that the numbers in the year before the intervention were markedly higher, both in the intervention (11.65 versus 8.68 days, a 2.97 day difference) and control (11.43 versus 9.17 days, a 2.26 day difference) groups. We do not know what caused this difference, but we suspect that Municipality of Copenhagen's initiatives to improve core pedagogical processes and their general strong focus on sickness absence in this time period including the implementation of mandatory sickness absence dialog meetings with the managers may have played a role. Further, we cannot rule out that intervention knowledge has spread from some intervention group pre-schools to some control group pre-schools due to contacts and exchange on the pre-schools' management level.

Intervention effects in subgroups

The analyses examining differential intervention effects in subgroups have to be viewed with caution not only because they were post-hoc but also because some of the subgroups were relatively small, resulting in wide confidence intervals. While none of the analyses showed statistical significant differences between the subgroups, there was a tendency that older compared to younger employees may have benefited more. This result corresponds to a recent study reporting that the association of unnecessary tasks at work with declining mental health was stronger among older than younger workers (14).

Strengths and limitations

The main strength of this study is the RCT design with 78 workplaces. The intervention was implemented by eight professional working environment consultants, with one consultant managing the implementation and securing that all workplaces received the same overall intervention. Using employer register data on sickness absence eliminated recall bias and allowed us to include all workplaces in intention-to-treat analyses. Access to monthly updates on employment status and number of days with sickness absence enabled us to take time-

at-risk into account. A limitation is that we had only one data entry per participant per month per sickness absence type. Thus, the monthly number of sickness absence days could reflect one sickness absence spell or several spells that were added up. Further, we had no information on participants' holidays and periods of non-sickness related leave.

Because of the intention-to-treat design, we do not know whether different approaches in the 44 intervention-group pre-schools had resulted in different effects. Thus, we do not know whether it was indeed the focus on the core tasks at work that resulted in the reduced risk of short-term sickness absence or if other mechanisms were at work. It might be argued that some intervention group activities were specifically targeted towards reducing sickness absence and that these activities may have had a particularly strong impact on reducing sickness absence. However, we do not think that this is a likely explanation for the lower risk of sickness absence in the intervention compared to control group during follow-up because there was, as described above, a general strong focus on sickness absence in both intervention and control group pre-schools.

Our study was conducted within public sector pre-schools and therefore we cannot generalize results to other settings. Future studies should examine the intervention concept in private sector pre-schools and among employees doing work other than pre-school work.

Concluding remarks

We conclude that pre-school employees participating in an organizational-level occupational health intervention focusing on the core task at work had a lower incidence of short-term sickness absence during a 29-month follow-up than control group pre-school employees.

Acknowledgements

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