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The impact of office design on medically certified sickness absence

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Objective The aim of this study was to determine the impact of three different office designs (cellular office, shared office, and open-plan workspace) on the risk of medically certified sickness absence and the number of days, respectively, of medically certified sickness absence over a 12-month follow-up period.

Methods The study relied on a combination of self-report survey questionnaire data on office design supplemented with official registry data number of days with sickness absence from the Norwegian Labor and Welfare Administration. The sample comprised 6328 Norwegian office workers (57% women, age range: 19–70 years, mean age: 44 years).

Results Adjusting for survey year, employees working in a shared office [risk ratios (RR) 1.18, 95% confidence interval (CI) 1.10–1.27] and an open-plan workspace (RR 1.12, 95% CI 1.02–1.22) had significantly higher risk of having had medically instances of certified sickness absence when compared to employees working in a cellular-office. Office design was not related to the number of days with absence. The associations were consistent across organizational affiliation, age, gender, whether the respondent had leadership responsibility, and educational level.

Conclusion The use of shared offices and open-plan workspaces is a risk factor for medically certified sickness absence. Providing employees with the opportunity to work in cellular offices may reduce absence rates.

Key terms cellular office; health; open office; open-plan office; registry data; shared office; shared workstation; sick leave; workability.

The change from cellular offices to open-plan and shared workspaces is a common trend in contemporary working life (1–3). Previous research has established associations between office design and outcomes such as health, well-being, and self-reported sickness absence (4–6). A prospective study of Swedish employees found a significant excess risk of short- and long-term self-reported sickness absence for employees working in open-plan workspaces (7). Similarly, a study from Denmark found that occupants of a shared office and those working in an open-plan workspace had significantly more days of self-reported sickness absence than occupants of cellular offices (8). Explanations for why open-plan or shared workspaces are risk factors for sickness absence are reduced personal control and privacy, increased noise, higher risk of infections, and different group dynamics when compared to cellular offices (7).

As the majority of previous studies on the health outcomes of office designs have been based on self-report survey data, often with cross-sectional designs, the potential for causal inferences is limited. There is, therefore, a need for prospective studies that link office designs with objective absence data (7, 9).

Using official registry data on sickness absence, this study determined the impact of three different office designs (cellular office, shared office, and open-plan workspace) on the risk and number of days of medically certified sickness absence over a 12-month time period. Following the findings from self-report studies, it was expected that employees in shared offices and open-plan workspaces would have both higher risk medically certified absence and more days of sickness absence compared to employees in cellular offices.

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Methods

Study design

This study was a part of the research project "The new workplace II: work factors, sickness absence, and exit from working life among Norwegian employees". The study protocol provides a full description of the research project, procedure, and data material, including demographic information (10). The project was based on a questionnaire survey combined with official registry data on disability benefits. The survey part comprised data from a large sample of adults employed in a full- or part-time position. Subjects were recruited from organizations in Norway that accepted to participate in the study. All employees, excluding those on sick leave, were mailed a letter that explained the aims of the project and assured that responses would be treated confidentially. The survey was web-based, although participants with limited access to computers were given the option of completing a paper version of the questionnaire.

From November 2004 to 15 December 2014, 97 organizations participated in the project. A total of 31 823 employees were invited to participate in the survey. Altogether 15 282 persons responded (response rate 48%), and 14 501 (95%) respondents permitted linking survey questionnaire data to registry data. About 85% of the respondents answered the questionnaire using the electronic survey form, and about 15% used the paper form. After removing respondents that did not work in an office, the final sample for this study comprised 6328 respondents.

The Regional Committees for Medical and Health Research Ethics (REC) in Norway (REC South East) and the Norwegian Data Protection Authority approved this study, which was conducted in accordance with the World Medical Association Declaration of Helsinki. All study participants provided their informed consent. Only respondents who permitted the linking of their answers to sickness absence registries were included.

Registry data and questionnaire instruments

Office design was assessed with a single item question that asked "Do you work…." (i) "alone in your own office"; (ii) "in a shared office with one or more colleagues"; (iii) "in an open-plan workspace"; (iv) "in a shop/service station etc."; (v) "in a treatment institution"; (vi) "outdoors"? Respondents who reported the last three alternatives were not included in this study as they do not work in an office.

The general rules for sickness absence in Norway provide employees with the ability to self-declare sickness absence for ≤3 continuous calendar days at a time. Sickness absence for >3 calendar days must be certified by authorized medical personnel and are reported to the Norwegian Labour and Welfare Administration (NAV). Self-declared sick leave can be used four times in the course of a 12-month period.

We accessed information on medically certified sickness absence from the Norwegian Labour and Welfare Administration (NAV). The registry provides complete registrations of all medically certified sickness absence. The current study had access to data on total number of days with medically certified absence over a 12-month period, but not on the number of absence spells, duration of spells, or medical diagnosis. Hence, the analyses included whether or not the respondents had ≥1 instance of medically certified sickness absence and the total number of days over a 12-month period. The registry should be accurate since correct registration is required for the transfer of payments by the social insurance scheme.

We aggregated data on sickness absence over the 12 months following the survey. Registry information of sickness absence was linked to the survey data by the unique 11-digit national individual identity number. The time period the employees were eligible for sickness absence was considered the same for all respondents within each company, starting from the day the electronic forms were closed. The registry was checked for inconsistencies. Overlapping or duplicate spells of sickness absence were merged.

Statistical analysis

Data were analyzed with Stata 15.1 (StataCorp, College Station, TX, USA). Risk ratios (RR), incidence rate ratio (IRR) and 95% confidence intervals (CI) were calculated with a negative binomial hurdle (NBH) model. The NBH model is capable of capturing both over-dispersion and excess of zero-values (11) and allows for analysis of data in a two-part process. First, a log-binomial regression analysis estimates the RR of having ≥1 day of medically certified sickness absence. Second, a zero-truncated negative binomial analysis produces IRR for the number of days absent among the sub-sample having medically certified sickness absence. Interaction analyses were conducted to determine whether the associations between office design and sickness absence were moderated by the following demographical factors: gender, age, having leadership responsibility, and educational level. All analyses were adjusted for survey year. In order to determine the impact of non-independency of observations due to cluster sampling, analyses were conducted both with and without adjustment for organizational affiliation.

Results

Demographic characteristics of participants by office type are presented in table 1. Altogether 56.5% of the sample worked in a cellular office, 27.1% worked in a shared office, and 16.5% worked in an open plan workspace. Based on official registry data, 38.8% of the sample had medically certified sickness absence during the 12 months following the survey. The average number of days with absence the year following the survey was 21.65 [standard deviation (SD) 61.40; median=0; mode=0, range 0–365). Table 1 displays the findings from the NBH model on direct effects of office design on subsequent medically certified sickness absence. Adjusting for survey year (RR 0.99, 95% CI 0.98–1.00), employees working in a shared office (RR 1.18, 95% CI 1.10–1.27), and an open-plan workspace (RR 1.12, 95% CI 1.02–1.22) had significantly higher risk of having had ≥1 instance of medically certified sickness absence when compared to employees working in a cellular office. Type of office design was not related to the number of sickness absence days.

Analyses were replicated with adjustment for organizational affiliation. The findings were consistent with the main analyses. Employees working in a shared office (RR 1.18, 95% CI 1.10–1.27) had a significantly higher risk of having medically certified sickness absence compared to employees working in cellular offices, whereas the difference in risk of absence between open-plan workspaces and cellular offices was borderline significant (RR 1.12, 95% CI 1.00–1.26) after adjusting for organizational affiliation. Office design was unrelated to the number of days with the absence also when adjusting for organizational affiliation.

Table 1. Demographic characteristics of participants by office type.

Variable	Cellular office		Shared office		Open-plan workspace		Statistical difference between office designs
	Mean	%	Mean	%	Mean	%	
Absence rate		34		40		39	<0.001
Number of day with absence [a]	19.77		25.17		22.37		<0.05
Age	46.19		42.84		41.33		<0.001
Gender							<0.05
Male		58.3		26.7		15.1	
Female		55.2		27.2		17.6	
Leadership responsibility							<0.001
No		52.5		29.2		18.3	
Yes		67.7		21.6		10.7	
Educational level (years)							
<12		48.1		35.3		16.6	<0.001
13–16		58.0		26.4		15.6	
>16		65.7		15.8		18.6	

[a] The median/mode/range for number of days with absence were 0/0/0–365 for all office designs

Sensitivity analyses with shared offices and open-plan workspaces, respectively, as reference groups confirmed that employees in shared offices and open-plan offices had a significantly higher risk of absence compared to employees in cellular offices. There were no differences in absence risk between employees in shared offices and open plan workspaces (see supplementary material, www.sjweh.fi/show_abstract.php?abstract_id=3859).

A series of interaction analyses were conducted to determine whether the magnitude of the associations between office design and sickness absence were conditioned by demographical background variables. The results from these analyses showed no significant interaction effect between office design and gender, age, having leadership responsibility, and educational level as moderator variables with regard to risk of, and number of days with, sickness absence.

Discussion

The results from this registry-based study show that, compared to employees working in cellular offices, those working in shared offices and open-plan workspaces have an 18% and 12% higher risk, respectively, of medically certified sickness absence. There were no differences in the number of days of sickness absence between the office designs.

The magnitude of the associations were consistent across several demographic factors, indicating that shared offices and open-plan workspace designs are associated with higher risk of sickness absence irrespective of age, gender, leadership responsibility, and educational level. The findings are in line with previous studies that have found significant associations between office design and self-reported sickness absence (7, 8), and suggest that the use of shared offices and open-plan

Table 2. Negative binomial hurdle analysis of associations between office design and medically certified sickness absence as outcome variable, unadjusted (N=6328). [CI=confidence interval; RR=risk ratio; IRR=incidence rate ratio].

Predictor variables	N	Log-binomial regression for risk of absence		Negative binomial regression for number of days with absence	
		RR	95% CI	IRR	95% CI
Survey year		0.99	0.98–1.00	1.01	0.99–1.04
Office design					
Cell office (reference)	3575				
Shared office	1712	1.18 [a]	1.10–1.27	1.08	0.94–1.24
Open-plan workspace	1041	1.12 [b]	1.02–1.22	1.01	0.85–1.20

[a] P<0.001.
[b] P<0.05.

workspace designs may be considered as risk factors for sickness absence.

Although shared workspaces may be cost-effective in some areas, the increased risk of sickness absence in shared- and open-plan offices suggests that employers, employees, and society in general may be paying a significant price in the form of more health problems and higher absence rates (9).

The prospective study design, large sample size, and use of official registry data to measure sickness absence are strengths of this study. As data was collected over several years (organizations participated at different time-points between 2004–2014, but all employees within the same organization responded at the same time and their data were analysed in a 12-month period consistent with the registry data), we can be relatively sure that factors such seasonal variation and economic trends had little impact on the examined associations. There were no changes in national regulations of sickness benefits during the survey period that would have influenced our findings. While the mode and the median values for days of absence were zero, the arithmetic mean was 21.65 days. This relatively high value indicate that the overall mean, as compared to mode and median values, could be inflated due to inclusion of some respondents with long-term absence. Although the survey had a response rate in correspondence with the estimated average for organizational surveys (12), altogether 52% of invited respondents did not participate to the questionnaire survey. The external validity of the findings may therefore be questioned. While the sample was large, the non-random recruitment of participating organizations limits the external validity of the findings. However, there was probability sampling at the individual level as all employees in the participating organizations were invited to participate in the survey (13).

Another limitation of this study is that we did not have access to information about number of employees sharing offices or workspaces, diagnoses for sickness absence, and the length of each absence incidence. Results with stronger validity would have been obtained if this kind of information had been included in the analyses.

This kind of information could have important practical implications and should therefore be included in future studies on the associations between workspace design and sickness absence. Previous research has established organizational characteristics, such as ethical culture, as a risk factor for sickness absence (14). In the current study, the findings of shared offices and open-plan workspaces as predictors of sickness absence remained consistent after adjusting for the respondent's organizational affiliation, thus indicating that the established associations were consistent across the participating organizations. Although we found that the associations between office design and absence were consistent across some demographical factors and organizational affiliation, it is likely that other factors, such as specific psychological, social, and physical factors (15–17), type of occupation, and the personality characteristics of the workers, could influence the magnitude of the associations. Despite these limitations, our findings indicate that shared offices and open-plan workspace designs are associated with an increased risk of medically certified sickness absence when compared to cellular offices. Providing employees with the opportunity to use cellular offices may therefore be beneficial with regard to reducing sickness absence rates.

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Conflicts of interest

The authors declare no conflicts of interest.

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