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Office Type in Relation to Health, Well-Being, and Job Satisfaction Among Employees

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This article investigates the hypothesis that office type has an influence on workers' health status and job satisfaction and 469 employees in seven different types, defined by their unique setup of architectural and functional features, have rated their health status and job satisfaction. Multivariate regression models were used for analysis of these outcomes, with adjustment for age, gender, job rank, and line of business. Both health status and job satisfaction differed between the seven office types. Lowest health status was found in medium-sized and small open plan offices. Best health was among employees in cell offices and flex offices. Workers in these types of offices and in shared room offices also rated the highest job satisfaction. Lowest job satisfaction was in combi offices, followed by medium-sized open plan offices. The differences between employees could possibly be ascribed to variations in architectural and functional features of the office types.

Keywords: *office type; employees; health; well-being; job satisfaction*

Introduction

A limited amount of research has focused on the influence the building environment and its architectural features have on human health (Evans & McCoy, 1998). The majority of research projects illuminating environmental influences on health and well-being have either focused on natural environmental features (e.g., Hartig, Mang, & Evans, 1991; Kaplan, 1995) or

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on ambient conditions such as light, noise, and air quality (e.g., Bengtsson, 2003; Byström, 1999; Heerwagen, 1990; Küller & Lindsten, 1992; Lahtinen, Sundman-Digerts, & Reijulas, 2004; Veitch, 2001). The influence of color (e.g., Dahlin, 1999; Erikson & Küller, 1983; Hård, Küller, Sivik, & Svedmyr, 1995) and density (e.g., Evans, 1979; Stokols, 1976; Wochel & Teddlie, 1976) on human behavior and physiology has also been studied.

Some research studies have focused on therapeutic environmental factors (see review by Fischl, 2004) in built environments. The research that exists in this field concerns health care facilities of some sort (e.g., Canter & Canter, 1979; Fischl, 2004; Shepley & McCormick, 2003; Ulrich, 1984, 2001), and there is little emphasis on the built environment's influence on employees' health and well-being in office environments. In fact, most occupational health and stress research is conducted among blue-collar workers and workers in health care and service occupations, such as cashiers and bus drivers, and not among white-collar workers.

Most of the research that deals with the office environment is found in the field of management-oriented research (McCoy, 2002). According to McCoy (2002), it is primarily focused on organizational and business trends, organizational structure, and strategies. Employee performance has been of specific interest in this field of office research (see e.g., Becker, 1995; de Croon, Sluiter, Kuijer, & Frings-Dresen, 2005; Sundstrom, Burt, & Kamp, 1980; Sundstrom, Town, Rice, Osborn, & Brill, 1994; Weinstein & Weinstein, 1979; Veitch & Gifford, 1996). Within this field, the office environment is seen as a management tool and the physical setting as a device to achieve higher work efficiency, better interaction among employees, and a change in managerial behavior. The aim is to have more motivated employees, which will result in the generation of higher profits (e.g., Becker, 1982; Brill,

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Margulis, & Konar, 1984; Brill, Weidemann, Alard, Olson, & Keable, 2001; Davis, 1984; Herzberg, Mausner, & Bloch Snyderman, 2003; Mazumdar, 1992; Steele, 1973; Vischer, 1996).

Job satisfaction has been defined as a "pleasurable or positive emotional state, resulting from the appraisal of one's job experiences" (Locke, 1976, p. 1300). In striving to achieve a more motivated and better performing workforce, job satisfaction plays a key role. Job satisfaction and health status among employees are most likely related to each other.

We know that psychosocial environment,[1] which is a fundamental part of job satisfaction, has a well-documented influence on health among employees (Beehr, 1995; Kahn & Byosore, 1992; Karasek & Theorell, 1990; Lu, 1999; Siegrist, 2003). There is, however, a lack of knowledge about the influence of the office environment on different aspects of job satisfaction. Though the perception that privacy influences job satisfaction has been investigated, and a relation between reduced privacy and low job satisfaction in open workplaces has been detected (e.g., de Croon et al., 2005; Duvall-Early & Benedict, 1992), these reviews do not investigate differences between various types of open plan offices.

Some environmental psychology and architectural research has been concerned with the influence of office environments on creativity and interaction (de Croon et al., 2005; McCoy, 2000; McCoy & Evans, 2002; Proshansky, Ittelson, & Rivlin, 1976; Rapoport, 1990; Stokols, Clitheroe, & Zmuidzinas, 2002; Söderberg, 1993, 2003). With regard to environmental satisfaction in offices, the characteristics of the physical environment have been of interest, for example specific design features in office environments, such as workstation size, partition height, etc. (Charles & Veitch, 2002), or furniture design and office layout (Marquardt, Veitch, & Charles, 2002). Here, a special concern has been environmental satisfaction with open plan offices (e.g., Hedge, 1982; Sundstrom et al., 1994). The empirically based office research that does exist mainly deals with attitudes toward organizational changes. A large part of this research consists of postoccupational evaluations to compare attitudes among employees (Marans & Spreckelmeyer, 1981). The attitude between employees in conventional, closed offices to those among workers in open plan office environments has been of specific interest in this context (e.g., Brookes & Kaplan, 1972; Oldham & Brass, 1979). In this context, the study by Stokols and colleagues on the experience of different levels of changes between different office environments is worth mentioning (Stokols, Churchman, Scharf, & Wright, 1990).

As this review shows, the field of office research is comprehensive and spans a variety of different aspects of the office environment in its search

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for knowledge about the influence of the environment on employees. To the best of our knowledge, there is, however, no research comparing different open plan offices when studying environmental influence on employees, apart from studies on the cell office compared to open plan offices in general. In reality, there exist a wide variety of office types, where employees share workspaces that differ from each other not only in whether they have an open plan layout but also with regard to other distinctive features.

Purpose

This article attempts to approach the question raised by Evans and McCoy (1998) by investigating the influence of office environment on employee health status and job satisfaction. The question raised is, "Is there any difference in self-reported health status and job satisfaction among employees in different office types (here defined by their architectural and functional features)? If so, can these differences be traced to the architectural and functional features that define the different office types?" The hypothesis is that office type has an influence on employees' health status and job satisfaction.

Aiming to fill the gap in our knowledge on how the physical environment in offices influences employees' health status and job satisfaction, it is important to recognize architectural and functional features other than plan layout. This study, therefore, applies more distinctive definitions of office types when comparing health status and job satisfaction among employees in different offices.

Because there appears to be a relationship between job satisfaction and the general health and well-being of the individual, both issues are of interest in this study.

The office environment is complex, and there is more than one environmental factor influencing an individual. Environmental factors may act additively or symbiotically, and they may have a mediating effect on each other. This study, therefore, relates the physical and functional features of the seven identified office types—and not just one single environmental factor—to self-reported health, well-being, and job satisfaction among employees. Office type is to be considered as a multifactorial variable manifesting a combination of architectural and functional features that, additively or symbiotically, defines the unique office type.

In summary, the main hypothesis of this article is that office type has an impact on employees' self-reported health status and job satisfaction.

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Method

Sample

A convenience sampling method was used. Prior to data collection, the first author inspected 30 offices to examine whether they fitted one of the seven office definitions (see the section on "Office definitions" below). The management of the offices that fitted the definitions was then asked whether they wanted to take part in the study, which the majority ($n = 26$) decided to do. The companies who decided to take part in the study appointed a contact person, usually a middle manager at the specific office division that was of interest, or someone from the human resource department. The individual respondents were asked, either by the company management or by the contact person, whether they wanted to take part in the study. Participation was voluntary. Information about the purpose of the study was given either by e-mail to each respondent or in a personal presentation given by the first author, depending on the individual company's requirements.

The response rate was 72.5% (men 68%, women 74%). Questionnaires were received back from 491 office employees (men $n = 247$, women $n = 236$, no information on gender $n = 8$; mean age 41 years, range 21-64 years) and form the base of the study. Twenty-six different companies or divisions in larger companies in the Stockholm area, Sweden, participated. The characteristics of the companies varied because some were small, local companies, whereas others were large, international companies. The number of employees in the offices represented in the sample ranged from 10 to about 100 employees. Great importance was given to selecting companies that belonged to different lines of business. This was done to achieve a variety of different corporate cultures and values.

Some companies/divisions included up to four different office types, whereas others consisted of a single office type (see Table A1 in the appendix). In the multivariate analysis, 22 subjects were excluded because of (a) employment in the service sector (three subjects; too few to be analyzed), (b) missing information on the prespecified confounders (16 subjects), and (c) missing information on office type (three subjects). Consequently, 469 out of the 491 subjects remained for the analysis (see Figure 1). The number of employees in the different office types varied, ranging from 131 employees in cell offices to 26 employees in shared room offices.

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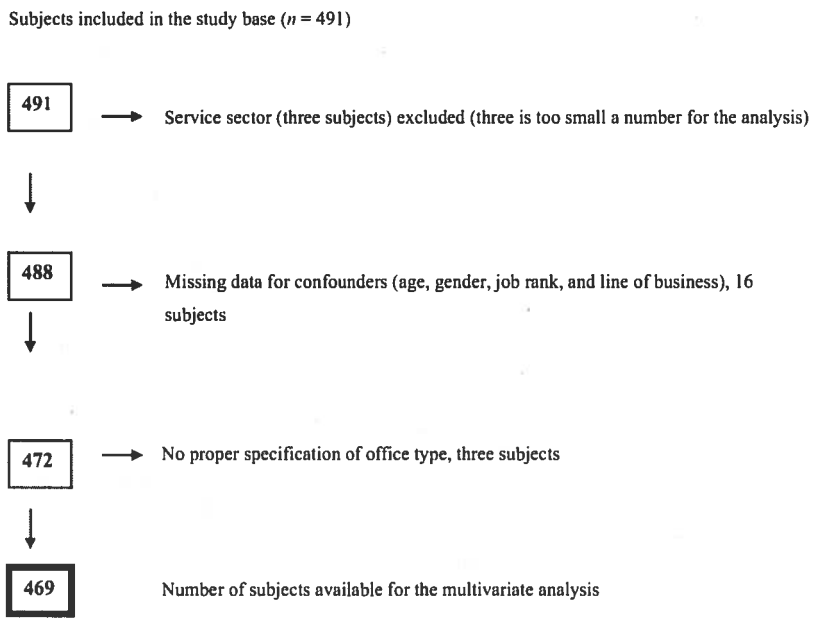
Figure 1
Exclusion of Subjects From Study Base for Multivariate Analysis



Office Definitions

To compare the different office environments it was necessary to categorize them. Traditionally, there are two main methods of defining office environments, either by spatial organization or by work organization. There are limitations to using only one method because both factors influence the office employees. The office definitions used here are unique combinations of *architectural features* and *functional features* that define each of the seven office types (see Table 1).

The most dominant architectural feature is spatial organization. The functional features are based on the actual work taking place in the office. The seven office types used in the study are drawn from work by Ahlin and Westlander (1991) and Duffy (1999). The office types are the *cell office*, *shared room office*,[2] *small open plan office*, *medium-sized open plan office*, *large open plan office*, *flex office*, and *combi office*.[3] Open plan offices exist

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Table 1
Office Types Defined by Different Architectural and Functional Features

Office Type	Characteristics
1. Cell office	Single room office
Architectural features:	Rooms along the façade of the building offering every room access to a window; consequently, long corridors that connect small offices to each other distinguish the plan layout.
Functional features:	Most of the amenities are found within the room. The office work is characterized by independence and is of concentrated nature.
2. Shared room office	2 to 3 people share a single room
Architectural features:	Workstations are often freely arranged in the room, sometimes with screens or other divisional elements to provide privacy at the individual workstation. Roommates share a window or windows.
Functional features:	Most of the amenities are normally found outside the shared room office. The shared room office for team-based work often has work facilities in the room. People sharing a room tend to have similar work assignments. The team-based shared room office is characterized by interactive project work.
Comments:	This office type is often a consequence of lack of space
Open plan offices:	
3. Small open plan	4 to 9 persons/room
4. Medium-sized open plan	10 to 24 persons/room. This is the most common size for open plan offices in Sweden.
5. Large open plan	>24 persons/room. This type of office is not very common in Sweden but fairly common in the U. S.
Architectural features:	A shared room with workstations that are often freely arranged in groups. Screens between different workstations reduce noise and provide some privacy at the individual workstation. There are no individual windows.
Functional features:	Sometimes amenities can be found at the individual workstation. Employees mainly work individually, with routine-based work and low levels of interaction.
Comments:	The purpose of the open plan office is to be flexible to organizational change and to handle changes without any need for reconstruction.

(continued)

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Table 1 (continued)

Office Type	Characteristics
6. Flex office	No individual workstation
Architectural features:	Often an open plan office, though not a defining feature, the flex office includes "backup spaces" that enable concentrated work, private phone calls, meetings, etc. Dimensioned for <70% of the workforce to be present simultaneously; based on expected illness, work outside the office, etc.
Functional features:	Depends on good information technology to enable employees to choose workstation freely—in the office as well as outside the office. Shared amenities in common spaces. No ability to "personalize" the workstation.
Comments:	This is the most flexible office type—both furniture and employees are flexible.
7. Combi office	Employees spend >20% of their time at workstations other than their "own," team-based work.
Architectural features:	No strict spatial definition, but the combi office does contain individual workstations in either an individual room or an open plan office. There is access to "backup spaces" that enable work activities that cannot take place at the personal workstation, such as specific work functions, full-time project rooms, meeting rooms, etc.
Functional features:	Teamwork and the sharing of common amenities define this office type. The office work is independent in its character, as well as interactive with colleagues in teamwork. The teams move around in the office on an "as-needed basis" to take advantage of a wide range of common facilities. Shared work facilities in common spaces.

in a great variety, with different subdivisions, ranging from four persons to a room to more than 100 people in a shared, common space. Consequently, a further subdivision of this office type was made into three groups based on the number of people sharing the same workspace: The small open plan office is said to have between four and nine persons to a room, whereas the medium-sized open plan office has between 10 and 24, and the large open plan office has >24 persons sharing the office space. The small open plan office is based on group psychological theories, which suggest that this smaller group size enhances group identity (Svedberg, 1992). The medium-sized open plan is an established office type in office design in Sweden called "storrum" (large room office; Christiansson & Eiserman, 1998).

Neither the quality of architectural details and environmental differences (e.g., height and material on partitioning systems and amount of window space available) nor differences in density define the office types. The seven

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office types act as broad categories, and there are variations between, as well as within, the office types concerning these aspects. The cell office stands out as the clearest definition because all other office types mean sharing the workspace and amenities between employees to varying degrees.

Sociodemographics

Background data on age, gender, job rank, and line of business for respondents is given in Table 2.

The 469 office workers had a fairly uniform distribution with regard to age and gender, the middle-low job rank being the largest category, including 50% of the subjects. Media/Information Technology (IT) was the most frequent line of business. The four background factors described above were considered as confounders in the multivariate analysis. Specific characteristics of the office types represented, and substantial deviations of these from the total group, are described below.

Cell office. There were more men than women and higher job ranks in this office type compared to the total group. The cell offices in the sample dominated in the technical/professional sector and were underrepresented in the media/IT sector.

Shared room office. This category was the one with two to three persons to a room. Compared to the total figures, this group was younger, with slightly more men, a tendency toward lower job ranks, and a lower percentage in the media/IT sector.

Small open plan office. This was the category with four to nine persons to an office. Respondents in this category were somewhat older, and had middle-low and low job ranks. Very few worked within the technical/professional sector. There were slightly more women than men in this type of office.

Medium-sized open plan office. This category was the one with 10 to 24 persons sharing the office space. This category included fewer young people and had the highest percentage of women. There were few high job ranks and few technical professions in this category.

Large open plan office. This was the category with >24 persons to a room. With respect to age and gender, this group was similar to the medium-sized open plan group, and as a specific feature, it had the largest deviations from the total group with respect to having a high percentage of subjects in business and administrative management and a low percentage in personal and economic guidance.

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Table 2
Sociodemographic Data and Job Characteristics for 469 Office Workers, Available for Multivariate Analysis

	Cell Office (Reference Category) (n = 131)	Shared Room (n = 26)	Small Open Plan Office (n = 43)	Medium-Sized Open Plan Office (n = 56)	Large Open Plan Office (n = 75)	Flex Office (n = 81)	Combi Office (n = 57)	Total (n = 469)
Age								
21-34 years	38 (29%)	15 (58%)	12 (28%)	12 (21%)	19 (25%)	26 (32%)	33 (58%)	155 (33%)
35-49 years	49 (37%)	6 (23%)	14 (33%)	23 (41%)	29 (39%)	31 (38%)	18 (32%)	170 (36%)
>49 years	44 (34%)	5 (19%)	17 (40%)	21 (38%)	27 (36%)	24 (30%)	6 (11%)	144 (31%)
Gender								
Male	78 (60%)	14 (54%)	20 (46%)	23 (41%)	35 (47%)	35 (43%)	35 (61%)	240 (51%)
Female	53 (40%)	12 (46%)	23 (54%)	33 (59%)	40 (53%)	46 (57%)	22 (39%)	229 (49%)
Job rank								
High job rank	34 (26%)	3 (12%)	9 (21%)	4 (7%)	13 (17%)	17 (21%)	13 (23%)	93 (20%)
Middle-high job rank	8 (6%)	3 (12%)	3 (7%)	9 (16%)	14 (19%)	9 (11%)	18 (32%)	64 (14%)
Middle-low job rank	70 (53%)	14 (54%)	20 (47%)	32 (57%)	37 (49%)	41 (51%)	23 (40%)	237 (51%)
Low job rank	19 (15%)	6 (23%)	11 (26%)	11 (20%)	11 (15%)	14 (17%)	3 (5%)	75 (16%)
Line of business								
Media/IT	10 (8%)	8 (31%)	18 (42%)	27 (48%)	36 (48%)	42 (52%)	47 (82%)	188 (40%)
Personal & econ. guidance	43 (33%)	7 (27%)	14 (33%)	17 (30%)	5 (7%)	38 (47%)	3 (5%)	127 (27%)
Technical professions	73 (56%)	7 (27%)	1 (2%)	2 (4%)	8 (11%)	1 (1%)	2 (4%)	94 (20%)
Business adm./management	5 (4%)	4 (15%)	10 (23%)	10 (18%)	26 (35%)	0	5 (9%)	60 (13%)

Note: Distribution of age, gender, job ranks, and line of business, stratified for office type.

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Flex office. This category had an overrepresentation of women and almost everyone was working in the media/IT line of business, or in the personal or economic guidance line of business. The distribution of job ranks in flex offices was similar to the overall distribution of job ranks in all office types, with the majority of employees in this category occupying middle-low job ranks. The next largest group was found in high job ranks.

Combi office. This group deviates from the total group in every way, with younger people and men dominating it. It included fewer low-ranked jobs and had a high percentage of respondents working in the media/IT.

Questionnaire

The questionnaire used was a combination of three questionnaires that together covered the domains of (a) health and well-being, (b) satisfaction with the psychosocial work environment and the work itself, and (c) the physical environment and architectural design (see appendix for details). For each domain, well-known and validated questionnaires were used (Lindström et al., 1997; Söderberg, 1993; Vischer, 1996). In total, the questionnaire covered 141 items, some of which had subquestions. The scales varied from two-scaled items to six-scaled items. Out of all of the questions, 20 covered the general background of the respondent and 86 covered health and job satisfaction. These 106 questions will be analyzed here. The 35 questions covering architecture and physical environment are analyzed elsewhere (Danielsson & Bodin, in press).

The questionnaire was distributed directly to the respondents by the contact person or to their mailboxes at the office. The respondents returned the questionnaires to the first author by mail.

Outcome variables. The following three indicators measured the respondents' health status: (a) *sick leave*, which was subdivided into "no sick leave" and "long sick leave"; (b) *general health*; and (c) *physical and psychological problems*.

Emotional health was measured by the following variables: (a) *efficiency*, (b) *accuracy*, (c) *calm and harmony*, (d) *energy*, and (e) *sadness and depression*. Also, *quality of sleep* was measured by one outcome variable.

Here, job satisfaction is defined as satisfaction with the psychosocial work environment and attitude toward work itself. The psychosocial work environment was measured by three outcome variables, (a) *work demands*, (b) *leadership*, and (c) *cooperation*. The attitude toward work itself was

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measured by two variables, (a) *goals at work*, and (b) *satisfaction with work* (see appendix for details).

The outcome variables were categorized into two categories, which were determined before the analysis. Details of this dichotomization can be found in the appendix.

In addition to the outcomes defined from individual items, we formed three summary scales as sums of the number of items, with inferior outcomes for health, emotional health, and job satisfaction, respectively. For health, this sum had a possible range of 0 to 3 ("sick leave >7 days" was included in the sum, but not "any sick leave"). For emotional health (including quality of sleep), possible scores ranged from 0 to 6, whereas for job satisfaction, they ranged from 0 to 5. In effect, the range shows the number of questions within each outcome domain. These summary scales are an attempt to analyze the overall outcome in the three domains of health and job satisfaction.

Statistical Methods

Univariate as well as multivariate regression was used to analyze the outcome variables. For the dichotomous outcomes, a logistic regression model was used; for the summary scales, we used a Poisson regression model. For both models, the same set of explanatory variables was used. In accordance with the aim of this study, the main explanatory variable was office type. The seven office type categories defined previously were used, and prior to the analysis, cell office was chosen to represent the reference category with which the other office types were compared.

In the univariate analyses, office type was the only explanatory factor included. Other factors known to affect health and job satisfaction could not, however, be controlled for by the study design and therefore had to be treated as confounders. Consequently, gender, age, job rank, and line of business were added to the multivariate regressions. All the model's confounders were treated as categorical variables, with age defined as a three-categorical variable with the age groups 21 to 34 years, 35 to 49 years, and >49 years. These cutoff points were chosen to form groups of about equal size.

Gender is, by definition, a categorical variable. The categories used for job rank were (a) high job rank, which included specialists and higher executives; (b) middle-high job rank, which included project leaders and department supervisors; (c) middle-low job rank, including white-collar workers and academics; and (d) low job rank, that is, lower white-collar workers and the service professions (e.g., janitors). Both high job rank and middle-high

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job rank are job positions that include leadership of some sort, or specialist competence. Line of business had four categories, namely, (a) the media/IT; (b) personal and economic guidance; (c) technical professions; and (d) business administration/management.

The statistical outcome parameter in the logistic regression is the odds ratio (OR), whereas in the Poisson model, it is the relative risk (RR). Both these parameters estimate differences in risk from the prechosen reference category, that is, the cell office. ORs and RRs = 1.0 indicate no difference, whereas ORs or RRs >1.0 indicate a higher risk for inferior health and low job satisfaction compared to the cell office. The estimates are supplemented with 95% confidence intervals (95% CIs). Statistical significance for the hypothesis that the variation in outcome between the seven office types is greater than chance is reported using probability values (p values), and the statistical significance was set at $p < 0.05$.

In both regression models, the special feature of the sampling design was considered, and all estimates were calculated with allowance for this fact. This sampling design included a primary sampling unit, the company, and a secondary sampling unit, the subjects, that is, clustered observations within the primary sampling units. Hence, our analysis was consistent with the multilevel or hierarchical structure of the data.

Processing of statistical data and the estimation of regression models were done using the statistical software packages STATA, version 9 (StataCorp, College Station, TX, USA), and Statistix, version 8 (Analytical Software, Tallahassee, FL, USA). The structure used to specify the regression models is given in Vittinghoff, Shiboski, Glidden, and McCulloch (2005).

Results

Perceived Health and Well-Being

In Table 3, the univariate analysis showed statistical significance for office type for any sick leave and general health (p = 0.006 and 0.018, respectively). For physical/psychological problems, there was borderline significance ($p = 0.07$), whereas the variation in the proportion of sick leave for more than 1 week did not differ significantly between the office types (p = 0.43). With allowance for confounders in the multivariate analysis, a statistically significant difference was still found for the outcome of any sick leave (1-365 days/year) (p = 0.02). In other words, confounding affected the univariate analysis for all other outcomes.

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Table 3
Health Among 469 Office Workers

	Cell Office (Reference Category) (n = 131)	Shared Room (n = 26)	Small Open Plan Office (n = 43)	Medium-Sized Open Plan Office (n = 56)	Large Open Plan Office (n = 75)	Flex Office (n = 81)	Combi Office (n = 57)	Total (n = 469)	p value for Office Type[a]	
Sick leave:	61%	73%	71%	80%	62%	57%	84%	67%	Univariate	**0.006**
Any sick leave	1.0	1.2	1.1	1.8	0.8	**0.6**	2.2		Multivariate	**0.02**
(1-365 days/year)		(0.5-2.6)	(0.6-2.1)	(0.8-4.0)	(0.4-1.4)	**(0.3-1.0)**	(0.8-5.6)			
Sick leave:	14%	15%	10%	24%	21%	12%	14%	16%	Univariate	0.43
>7 days/year	1.0	1.0	0.4	1.3	1.3	0.6	1.0		Multivariate	0.54
		(0.3-3.5)	(0.1-1.5)	(0.5-3.3)	(0.6-3.1)	(0.2-1.5)	(0.4-2.6)			
General health:	32%	54%	56%	55%	49%	38%	40%	43%	Univariate	**0.018**
Not very good	1.0	**2.3**	**2.2**	**2.2**	1.7	1.2	1.5		Multivariate	0.20
		(1.1-4.9)	**(1.0-4.7)**	**(1.1-4.3)**	(1.0-3.1)	(0.6-2.3)	(0.7-3.1)			
Physical/ psychological	8%	12%	23%	18%	20%	12%	21%	15%	Univariate	0.07
problems:	1.0	1.1	**2.3**	1.6	**2.3**	1.0	1.9		Multivariate	0.44
Interference in social life because of physical and psychological problems		(0.4-2.9)	**(1.1-4.9)**	(0.5-5.1)	**(1.1-4.5)**	(0.4-2.5)	(0.7-5.4)			

Note: Percentage of subjects with specified self-reported outcome in each office type and Odds ratio (OR), with 95% confidence intervals (CIs) in parenthesis. Cell office was used as reference category, and ORs were calculated after adjustment for age, gender, job rank, and line of business, using multivariate logistic regression. Statistical significances are marked in bold.

a. Test of the hypothesis of no difference between office types. The first p value is without consideration of confounders, the second is with age, gender, job rank, and line of business in a multivariate analysis. p values < 0.05 are marked in bold.

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Table 4
Emotional Health and Quality of Sleep Among 469 Office Workers

	Cell Office (Reference Category) (n = 131)	Shared Room (n = 26)	Small Open Plan Office (n = 43)	Medium-Sized Open Plan Office (n = 56)	Large Open Plan Office (n = 75)	Flex Office (n = 81)	Combi Office (n = 57)	Total (n = 469)	p value for Office Type[a]	
Efficiency:	15%	19%	37%	34%	23%	24%	23%	23%	Univariate	**0.048**
Less efficiency[b]	1.0	1.0	**2.7**	**2.1**	1.3	1.2	1.0		Multivariate	0.17
		(0.3-3.4)	**(1.0-7.2)**	**(1.1-3.8)**	(0.6-2.8)	(0.6-2.2)	(0.4-2.6)			
Accuracy:	7%	23%	30%	27%	20%	16%	26%	18%	Univariate	**0.004**
Less accuracy[b]	1.0	2.6	**4.0**	**3.3**	2.5	1.4	2.4		Multivariate	0.12
		(0.7-9.3)	**(1.6-9.9)**	**(1.4-7.9)**	(0.8-7.8)	(0.7-3.0)	(0.8-7.4)			
Calm and harmony:	40%	54%	58%	64%	51%	46%	56%	50%	Univariate	**0.05**
Less calm and harmony[b]	1.0	1.3	1.6	**2.1**	1.4	0.9	1.3		Multivariate	0.32
		(0.7-2.3)	(0.8-3.2)	**(1.2-3.8)**	(0.8-2.4)	(0.6-1.4)	(0.6-2.9)			
Energy:	56%	65%	72%	73%	65%	60%	70%	64%	Univariate	0.25
Less energy[b]	1.0	1.0	1.7	1.7	1.3	0.8	1.2		Multivariate	0.56
		(0.4-2.5)	(0.8-3.6)	(1.0-2.9)	(0.7-2.3)	(0.5-1.5)	(0.4-4.1)			
Sadness and depression:	18%	31%	37%	30%	31%	25%	30%	27%	Univariate	0.19
Sad and depressed most of the time[b]	1.0	1.5	1.7	1.1	1.3	0.9	1.2		Multivariate	0.77
		(0.7-3.1)	(0.9-3.3)	(0.6-1.9)	(0.7-2.5)	(0.5-1.5)	(0.5-2.7)			
Quality of sleep:	28%	31%	35%	46%	43%	30%	37%	35%	Univariate	0.13
Less good quality of sleep[b]	1.0	1.1	1.3	**2.1**	**2.1**	1.0	1.6		Multivariate	0.26
		(0.5-2.4)	(0.7-2.7)	**(1.1-4.0)**	**(1.1-3.9)**	(0.6-1.8)	(0.7-3.8)			

Note: The table shows the percentage of subjects with self-reported outcome in each office type and odds ratios (ORs), with 95% confidence intervals (CIs) in parenthesis. Cell office was used as reference category, and ORs were calculated in a multivariate logistic regression analysis, after adjustment for age, gender, job rank, and line of business. Statistical significances are marked in bold.

a. Test of the hypothesis of no difference between office types. The first p value is without consideration of confounders; the second is after adjustment for age, gender, job rank, and line of business. p values < 0.05 are marked in bold.

b. Negative outcome on aspects of emotional health during the previous 4 weeks.

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Table 5
Psychosocial Work Environment and Opinion About Work Among 469 Office Workers

	Cell Office (Reference Category) (n = 131)	Shared Room (n = 26)	Small Open Plan Office (n = 43)	Medium-Sized Open Plan Office (n = 56)	Large Open Plan Office (n = 75)	Flex Office (n = 81)	Combi Office (n = 57)	Total (n = 469)	p value for Office Type[a]	
Psychosocial work environment										
Work demands:	23%	27%	26%	29%	27%	32%	32%	27%	Univariate	0.83
Too much work to do most of the time	1.0	1.5 (0.6-3.5)	1.1 (0.4-2.6)	1.3 (0.6-3.1)	1.2 (0.5-2.5)	1.3 (0.6-2.6)	1.2 (0.6-2.5)		Multivariate	0.99
Leadership:	28%	19%	49%	34%	38%	22%	47%	33%	Univariate	**0.007**
No good relationship with closest supervisor	1.0	0.6 (0.2-1.9)	**2.7 (1.4-5.2)**	1.4 (0.8-2.2)	**1.7 (1.0-2.9)**	0.8 (0.5-1.1)	**2.4 (1.1-5.1)**		Multivariate	**0.01**
Corporation:	11%	8%	14%	23%	10%	10%	7%	12%	Univariate	0.17
No good cooperation within work group	1.0	0.7 (0.2-2.4)	1.5 (0.5-4.2)	**2.4 (1.0-5.6)**	0.9 (0.3-3.0)	0.9 (0.5-1.7)	0.6 (0.2-1.7)		Multivariate	0.27
Attitude toward work itself										
Goals at work:	28%	46%	42%	39%	45%	27%	47%	36%	Univariate	**0.036**
No good goals at work most of the time	1.0	2.0 (0.7-5.3)	1.5 (0.9-2.5)	1.4 (0.8-2.7)	1.8 (1.0-3.3)	0.9 (0.6-1.6)	**2.4 (1.1-5.5)**		Multivariate	0.18
Satisfaction:	17%	23%	33%	34%	22%	20%	33%	24%	Univariate	0.057
Dissatisfaction with the work	1.0	1.4 (0.5-4.1)	2.3 (0.8-6.7)	**2.5 (1.0-6.0)**	1.2 (0.6-2.7)	1.3 (0.7-2.4)	2.4 (0.8-7.1)		Multivariate	0.19

Note: Odds ratios (ORs), with 95% confidence intervals (CIs) in parenthesis, with cell office as reference category, and after adjustment for age, gender, job rank, and line of business in a multivariate logistic regression analysis. Statistical significances are in bold.

a. Test of the hypothesis of no difference between office types. The first p value is without consideration of confounders; the second is given after adjustment for age, gender, job rank, and line of business. p values < 0.05 are marked in bold.

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A closer look at the variation in outcomes reveals additional interesting details. Overall, the cell office and flex office were associated with better self-reported health. Shared room offices, and small and medium-sized open plan offices were found to be inferior office types with respect to general health, and small and large open plan offices were inferior with respect to physical and psychological problems.

The percentage of inferior emotional health for the whole group varied from 18% (less accuracy) to 64% (less energy), see Table 4. For *efficiency*, *accuracy*, and *calm and harmony*, the variation in outcomes between the office types was high enough for statistical significance before the introduction of confounders ($p = 0.048$, $p = 0.004$, and $p = 0.050$, respectively). With the introduction of the confounders, the variation in outcomes could not be statistically attributed to office type in general. All p values were >0.05 (the lowest for accuracy; $p = 0.12$).

Altogether, the effect of office type was within a normal range, as shown above by the nonsignificant results. In the prespecified comparison with the cell office, there were significant differences, however. Open plan offices had significantly inferior results compared to the cell office, with medium-sized open plan offices ranking lower for *efficiency* (OR 2.1), *accuracy* (OR 3.3), *calm and harmony* (OR 2.1), and *quality of sleep* (OR 2.1). For small open plan offices, the ORs for *efficiency* and *accuracy* were elevated (2.7 and 4.0), and the flex office showed results largely similar to those of the more highly ranked cell office.

Perceived Job Satisfaction

Table 5 shows that there were only minor variations between the office types with regard to work demands (range 23%-32%) and no statistical significance. Leadership, on the other hand, varied from 19% (shared room office) to 49% (small open plan office) and was significant in both the univariate and the multivariate analyses ($p = 0.007$ and $p = 0.01$, respectively). The cell office did not show the best outcome (28%), but the differences in OR in relation to the worst cases (small open plan office and combi office) were sufficiently high to be statistically significant (OR = 2.7 and 2.4, respectively), with 95% CIs indicating difference from unity. Cooperation within the work group had a somewhat higher variation than work demands (total 12%, range 8%-23%) and a borderline significance for the medium-sized open plan office in comparison to the cell office (OR = 2.4).

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Table 6
Number of Perceived Complaints With Respect to Health, Emotional Health, and Job Satisfaction for 469 Employees

Outcome (Complaints Raised/Less Satisfaction Shown)	Cell Office (Reference Category) ($n = 131$)	Shared Room ($n = 26$)	Small Open Plan Office ($n = 43$)	Medium-Sized Open Plan Office ($n = 56$)	Large Open Plan Office ($n = 75$)	Flex Office ($n = 81$)	Combi Office ($n = 57$)	All Office Types ($n = 469$)
Health								
Average number of complaints (Admissible range 0-3)	1.0	1.4	1.5	1.5	1.3	1.1	1.5	1.3
Relative Risk for complaints[a]	1.0	1.2 (0.9-1.6)	**1.3 (1.0-1.6)**	**1.3 (1.0-1.7)**	1.2 (1.0-1.4)	0.9 (0.7-1.1)	1.3 (1.0-1.6)	
Emotional health and quality of sleep								
Average number of complaints (Admissible range 0-6)	1.6	2.2	2.7	2.7	2.3	2.0	2.4	2.2
Relative Risk for complaints[a]	1.0	1.2 (0.8-1.6)	**1.4 (1.2-1.7)**	**1.4 (1.2-1.7)**	**1.3 (1.1-1.5)**	1.0 (0.9-1.2)	1.2 (0.8-1.7)	
Job satisfaction								
Average number of complaints (Admissible range 0-5)	1.1	1.2	1.6	1.6	1.4	1.1	1.7	1.3
Relative Risk for complaints[a]	1.0	1.1 (0.8-1.7)	**1.5 (1.1-1.9)**	**1.4 (1.1-1.9)**	1.2 (0.9-1.7)	1.0 (0.8-1.3)	1.5 (1.0-2.2)	

Note: The average number of complaints within each domain of investigation is shown, as is the Relative Risk (RR) for complaints, estimated from a Poisson regression model. 95% confidence intervals (CIs) for the RRs are given in brackets. Statistically significant findings are marked in bold.

a. Adjusted RR, with age, gender, job rank, and line of business included in the model.

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Table 7
Distribution of Low and High Risk With Regard to Inferior Health and Less Job Satisfaction in Different Office Types

Outcome	Cell Office	Shared Room	Small Open Plan Office	Medium-Sized Open Plan Office	Large Open Plan Office	Flex Office	Combi Office
Health							
Any sick leave (1-365 days/year)					o	o	●
Sick leave >7 days (8-365 days/year)			o	●	●		
General health	o	●	●	●			
Physical and psychological health	o		●		●	o	
Emotional health							
Efficiency	o	o	●	●			o
Accuracy	o		●	●			
Calm and harmony				●		o	
Energy			●	●		o	
Sadness and depression			●			o	
Quality of sleep	o						
Job satisfaction							
Work demands[a]							
Leadership		o	●		●	o	●
Cooperation		o		●			o
Goals at work						o	●
Satisfaction	o			●			●

Note: The Table presents a synthesis based on estimated Odds Ratios (ORs) in the multivariate analyses.
● = high risk; o = low risk.
a. Too small variation to be considered.

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Attitude toward work itself, measured in terms of goals at work and satisfaction with work, showed similar outcomes, with satisfaction at a somewhat lower general level, 24% compared to 36%. In the univariate analysis of office type, goals at work showed significant results ($p = 0.036$), whereas satisfaction had almost significant results ($p = 0.057$). The introduction of confounders raised the p values to 0.18 and 0.19, respectively. The cell office performed very well in both these outcomes and deviated significantly from the office type with the worst outcome, which, for goals at work, was the combi office (OR = 2.4), and for satisfaction with work, was the medium-sized open plan office (OR = 2.5).

The flex office, together with the shared room office and the cell office, was rated to be the best office type in terms of job satisfaction. Inferior results were found for all open plan offices and the combi office, although the latter showed high satisfaction with respect to cooperation.

The summary scales for inferior results for the three outcomes, health, emotional health, and job satisfaction were analyzed using multivariate Poisson regression models, as shown in Table 6.

The average number of inferior outcomes was lowest for job satisfaction and for health, around 1.3 complaints per individual, and higher for emotional health and quality of sleep. The RRs for inferior outcomes were smallest for the flex office, closely followed by the cell office. Elevated RRs were found, in particular, for small and medium-sized open plan offices. The combi office had an elevated risk with respect to complaints about job satisfaction, but as noted in the single item analysis, this office type had a good outcome on one of the specific items, namely, cooperation within the work group.

Finally, we summarized overall tendencies in Table 7, showing low and high risks for the items within self-reported health, emotional health, and job satisfaction. For each office type, we indicated whether the RR is low or high, using the cell office as the reference category. The flex office and cell office scored best, and the shared room office scored fairly well. By contrast, the large open plan office and combi office had more high-risk than low-risk results. The poorest results were found for the small open plan office and especially for the medium-sized open plan office. However, results on some specific items may differ from the overall scoring.

Discussion

Our results are consistent with the main hypothesis, showing that office type correlates to health, well-being, and job satisfaction among employees.

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The cell office and flex office both scored high with respect to good health and job satisfaction, whereas open plan office types generally scored low.

The self-reported health status and job satisfaction of employees is recognized to be mainly influenced by factors such as age, gender, and job rank. For instance, women tend to report poorer health status and also to have higher sick leave rates (e.g., Borrell, Muntaner, Benach, & Artazcoz, 2004; Frankenhauser, Lundberg, & Fredrikson, 1989; Lundberg & Frankenhauser, 1999; Lundberg, Mardberg, & Frankenhauser, 1994; Verbrugge, 1989). In the statistical analysis, we therefore adjusted for the influence of these three background factors, as well as for the influence of the line of business in which employees worked. Our results showed significant differences between workers in different office types, in many cases also after adjustment for these background factors. Based on this study alone, we cannot say which specific architectural or functional features played a decisive role in the outcomes in each office type, because it is the combination of these features that defines the office type and its effect on the outcome.

Office type as a general explanatory factor did not affect every outcome analyzed in this study. For example, after adjusting for the confounders, there was little variation between office types in the outcomes for sick leave >7 days, for emotional health with respect to energy and feeling sad and depressed, and for job satisfaction with respect to the work demands. However, for other outcomes, the effect is not only statistically significant but also substantial with respect to differences in the prevalence of inferior health and well-being. Besides the overall effect of office type, the differences between the prechosen reference category, cell office, and the other six office types reveal variations in outcome that can be viewed and interpreted with respect to architectural and functional features. A surprising result was the finding that there were substantial differences between the three different open plan offices (see Table 7). These office types differed only with regard to the size of the group sharing the workspace. Also, in small open plan offices, the supervisors often sit with the other employees, whereas in larger open plan offices, they do not always do this.

Our summary of the distribution of self-reported risk factors for the different office types (Table 7) shows that the highest RRs for reporting poorer health status altogether were found in medium-sized open plan offices, with 10 to 24 persons to a room, and small open plan offices, with between four and nine persons sharing the office space (see Tables 3 and 4). Workers in combi offices reported the highest prevalence of job dissatisfaction, followed by workers in medium-sized open plan offices (see Table 5). With regard to cooperation, workers in combi offices, however, reported the best cooperation

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with the work group. Because this office type is specifically designed for team-based work, it must be considered a success in this respect.

At the other end of the risk scenario, employees in cell offices and flex offices reported the best health and well-being among all employees in this sample. Those in flex offices showed somewhat better emotional health. With regard to job satisfaction, the employees in shared room offices and flex offices reported highest satisfaction. The workers in these different types of offices did not, however, have the same profile for the outcome variables (see Table 7).

Therefore, the question is, why workers in medium-sized open plan offices stood out as being at higher risk for reporting less good health status and less job satisfaction compared to workers in other office types. The explanation can probably be traced to the architectural and functional features of the medium-sized open plan office, as well as its group size. The medium-sized open plan office with 10 to 24 persons to a room accommodates a group size that is probably not large enough to allow subgroups to form and not small enough to allow people to get to know each other very well (Lenéer-Axelsson & Thylefors, 1991; Svedberg, 1992). The prevalence of employees in small open plan offices reporting inferior health status may also be explained by the architectural and functional features of the office. Both the small and the medium-sized open plan office have a lack of "backup space" where workers can seek privacy when this is needed, for work as well as for personal reasons. On the other hand, the higher job satisfaction among workers in small open plan offices, compared to medium-sized open plan offices, could be related to smaller group size. There is, however, a significant risk of reporting less good leadership in small open plan offices, which is possibly explained by the fact that the supervisor sits among the workers. The only other office type where workers reported a significant risk for bad leadership is the combi office, where supervisors similarly often sit among the workers. In the larger open plan offices, supervisors tend to have private closed offices and, as with flex offices, there is a choice of whom to sit next to. The workers in combi offices reported significantly lower job satisfaction in terms of bad goals at work and satisfaction with work. These results, however, cannot be traced to the office type and are more likely because of organizational factors.

On the other hand, the good results in terms of health, well-being, and job satisfaction among employees in cell offices and flex offices are most likely because of the independence these office types offer the workers—in other words, their ability to meet the need for personal control. We find support for this hypothesis with regard to job satisfaction in the work by Lee

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and Brand (2005). They found that more personal control over the physical workspace (e.g., adjustment, variety of work environments available), as well as easy access to meeting places, increased job satisfaction. Both these needs are more easily satisfied in cell offices and flex offices compared to other types of offices. With regard to health status, lack of task control has been frequently found to be an important source of psychological and physiological strain at the workplace (e.g., Caplan, Cobb, French, Van Harrison, & Pinneau, 1975; Karasek & Theorell, 1990).

Independence and the ability to exercise personal control are enhanced by both architectural and functional features in these two office types. In the cell office, the individual has the opportunity to personalize the individual room and to close the door when there is the need for privacy. Also, there is less interference from conversations and general background noise from printers, etc. In this type of office, it is also possible to hold smaller meetings in the closed office. The fact that cell offices are mainly found in more traditional, male-dominated businesses cannot explain the dominance in reporting good health, well-being, and job satisfaction among the workers, because the tendencies for good outcomes persist for the cell office after adjustment for the confounders.

The flex office does not offer the opportunity to personalize the workstation, but it allows workers to choose their workstation according to personal preference or work tasks. It also gives the workers the opportunity to mix with different colleagues when they so wish and offers easy access to "backup space" for meetings.

Flex offices became popular during the early 1990s, mainly because they offered an opportunity to cut down on office space. By the late 1990s, they met with a great deal of criticism, however. It was claimed to be against human nature not to be able to have personal control over your own workstation (Christiansson & Eiserman, 1998; Duffy, 1999). Because the workers in flex offices scored high, in terms of both health and job satisfaction, we believe that the personal control may be exercised by other means, such as free choice of workstation and independence. The low rates of sick leave in flex offices could in part be because of undeclared sick leave, because workers in flex offices often have the option to work from home when it suits them. The flex offices in this survey were defined as requiring workers to spend at least 70% of their work time at the office. Another possible explanation for the finding that the flex offices did so well in terms of health, well-being, and job satisfaction, despite the criticism against them, could be that the flex offices, which have survived the criticism, have developed an organization that suits this unique office type.

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With regard to job satisfaction, employees in shared room offices and flex offices reported the highest prevalence of job satisfaction. The employees in these types of offices reported the highest satisfaction with leadership, though there were some differences in their profiles for other outcome variables (see Table 7). We propose that the different architectural and functional features of these office types can explain this internal difference. For example, the finding that workers in flex offices reported well on the item goals at work can probably be explained by the fact that this office type was defined by independent work assignments. The high rates for cooperation among employees in shared room offices may be explained by the small group size, of two to three people, which allows for strong cooperation to develop between colleagues sharing an office. Small groups are known to develop strong group identities (Svedberg, 1992).

Limitations

Some limitations of this study need to be pointed out. One is the fact that the research was conducted as an observational cross-sectional study, which means that the respondents were not studied over time. As a result, no definitive cause for the differences between the outcomes for health, well-being, and job satisfaction could be established. The results for the shared room offices should also be interpreted with some caution because the sample size for this office type was smaller, with only 26 people available for multivariate analysis.

There is also a limitation concerning the number of confounders, but because of the size of the sample, it was not possible to use a greater number because this would have reduced the sample size in the multivariate analysis. There are certainly more factors than the four chosen confounders which potentially affect perceived health and well-being, as well as job satisfaction. These include factors such as the general life situation, socioeconomic group, personality, and past experiences. Factors such as corporate culture and values were not controlled for, but they are to a great extent associated with line of business, which was controlled for. We do not, however, believe that these factors would cause a hugely uneven distribution for the seven office types, once our four confounders have been considered. With regard to measurements for health in the study, it should also be mentioned that self-reported health might deviate from actual, diagnosed health. A last factor to bear in mind is that the study was conducted in

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the Stockholm area, a typical urban setting that differs from life conditions in less populated areas.

Conclusion

This study shows that there are differences in individuals' perception regarding health status and job satisfaction in different office types. The differences persisted after adjustment for the confounders' age, gender, job rank, and line of business. The results so far give only little indication of which specific architectural or functional features in each office type play a decisive part in explaining the differences. Instead, it is the set of combined factors that define each unique office type, which seems to have an impact on the workers' health status and job satisfaction. How workers perceive individual environmental factors in different types of offices will be examined in further studies.

We believe that with improved knowledge about the office environment's influence on workers' health and job satisfaction, important gains can be achieved at an individual, organizational, and societal level.

Appendix

Questionnaire

The first part of the questionnaire dealt with questions concerning the respondent's individual background, including age, gender, level of education, line of business, job rank, years in the current profession, and years in current employment.

For evaluating health and well-being as well as job satisfaction, defined here as satisfaction with the psychosocial work environment and work itself, the QPSNordic questionnaire was used with additions from the AHA questionnaire, which has been developed by the Section of Personal Injury Prevention at Karolinska Institute, Sweden. The QPSNordic is a general questionnaire developed by the National Institutes for Working Life in Sweden, Finland, Norway, and Denmark. It is based on a British prototype (Lindström et al., 1997). QPSNordic has the advantage of focusing on work and organizational and individual factors at the same time. It also takes into account the new demands that organizations as well as individuals face today, and how

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they adapt to a new situation in working life. Combined, these two questionnaires measure self-rated health, the general life situation, the psychosocial work situation, work motivation, the organization, and leadership.

For evaluating the psychosocial work environment and its association with the perception of architecture of the workplace, a questionnaire developed by Söderberg (1993) was used.

Outcome Variables

Health and well-being. The following indicator measured the workers' health status: *sick leave*, which was defined by two outcome variables, *general health* and *physical and psychological problems.*

Sick leave. This was defined by two outcome variables, each with a different dichotomization. Scores for self-rated sick leave were elicited by asking the question, "How many days have you been absent from work because of personal illness over the last 12 months?" The five response alternatives were "0 days," "1 to 7 days," "8 to 24 days," "25 to 99 days," and "100 to 365 days." The first outcome variable for sick leave indicated any sick leave by contrasting 0 days against 1 to 365 days (the last four categories) of sick leave, giving a dichotomized outcome. The second dichotomized outcome contrasted 0 to 7 days' sick leave (the first two categories), with 8 to 365 days' sick leave (the last three categories) to indicate longer periods of sick leave during the previous 12 months.

General health. This was measured by asking respondents to describe their general health using one of the five response alternatives, "excellent," "very good," "good," "fairly good," or "poor." The measure was simplified into a two-scaled measure by combining the three lowest categories "good," "fairly good," and "poor" into one category and the two highest categories "excellent" and "very good" into the alternative outcome.

Physical and psychological health. This was defined in terms of physical and emotional problems interfering with social activities over the previous 4 weeks and could be assessed using one of the following response alternatives: "all the time," "most of the time," "a large part of the time," "some of the time," "a small part of the time," and "at no time at all/never." The measure was dichotomized by collapsing "all the time" and "most of the time" into one category indicating that problems had interfered with social activities most of the time over the previous 4 weeks. The remaining four categories were combined into one contrasting category.

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Emotional health. This was measured by the following five outcome variables: *efficiency*, *accuracy*, *calm and harmony*, *energy*, and *sadness and depression.* The outcome variables were defined by the following questions:

Efficiency: "Have you been less efficient than you wish to be because of emotional problems over the past 4 weeks?"
Accuracy: "Have you been less accurate because of emotional problems over the past 4 weeks?"
Calm and harmony: "How much of the time have you felt calm and in harmony with yourself over the past 4 weeks?"
Energy: "How much of the time have you been full of energy over the past 4 weeks?"
Sadness and depression: "How much of the time have you felt depressed and sad over the past 4 weeks?"

The response alternatives for the first two questions were "yes" and "no"; therefore, this was a dichotomized variable in itself. The response alternatives to the three subsequent items were "all the time," "most of the time," "a large part of the time," "some of the time," "a small part of the time," and "at no time at all/never." The measures were dichotomized by collapsing "all the time" and "most of the time" into one category, indicating that the respondents "had the feeling of being calm and in harmony/full of energy/sad and depressed most of the time over the previous 4 weeks." Collapsing the remaining three alternatives into one category formed the contrasting alternative.

The general status of *quality of sleep* was measured by the following question: "How would you generally describe your quality of sleep?" The response alternatives were "very good," "fairly good," "neither good nor bad," "fairly bad," and "very bad." The measures were dichotomized by collapsing "very good" and "fairly good" into one category for "having good quality sleep." The contrasting category consisted of the other three response alternatives collapsed into one.

Job satisfaction. Job satisfaction was defined here as satisfaction with the psychosocial work environment and satisfaction with work itself. The time frame was set to the present time period of the survey. The following indicators were measured: *psychosocial work environment* and *attitude toward work itself.*

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Perceived psychosocial work environment was elicited by three outcome variables, which were defined by the following questions:

Work demands: "Do you have too much to do?"
Leadership: "Is your relationship with your closest supervisor working out positively?"

The response categories to the two items were "rarely/never," "quite rarely," "sometimes," "fairly often," and "very often/always." For the item measuring work demands, the measure was dichotomized by combining "fairly often" and "very often/always" as having too much to do most of the time; this was contrasted with the remaining three alternatives, collapsed into one. For the item measuring leadership, the same response alternatives were formed to indicate that the respondent had a "well-functioning relationship with the closest supervisor most of the time."

Cooperation: "How do you perceive the cooperation with your own work group?"

The response alternatives to this item were "very good," "fairly good," "fairly bad," and "very bad." The measure was dichotomized by combining "very good" and "fairly good" for "good cooperation within the work group," in contrast to the remaining two, less positive alternatives combined.

The attitude toward work itself was elicited by two outcome variables, which were defined by the following questions:

Goals at work: "Are the goals at your work challenging and realistic at the same time?"

The response alternatives for this item were "rarely/never," "quite rarely," "sometimes," "quite often," and "very often/always." The measure was dichotomized by combining "rarely/never" and "quite rarely" to indicate that most of the time, the goals are "not good"; the three remaining alternatives formed the contrasting category.

Satisfaction: "How satisfied or dissatisfied are you with your work?"

The response alternatives to this item were "very satisfied," "fairly satisfied," "fairly dissatisfied," and "very dissatisfied." The measure was dichotomized by combining "very satisfied" and "fairly satisfied" to indicate satisfaction with the work; the two remaining alternatives formed the contrasting category.

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Table A1
Distribution of Office Type Within Different Companies and Divisions in Larger Companies

Company/Division in Larger Company (n = 469 subjects)[a]	Line of Business	Cell Office (n = 131)	Shared Room (n = 26)	Small Open Plan Office (n = 43)	Medium-Sized Open Plan Office (n = 56)	Large Open Plan Office (n = 75)	Flex Office (n = 81)	Combi Office (n = 57)
Company 1	Media/IT			o	o	o		o
Company 2	Technical professions	o						
Company 3	Technical professions	o						
Company 4	Personal & econ. guidance	o	o					
Company 5	Technical professions	o						
Company 6	Technical professions	o			o	o	o	
Company 7	Personal & econ. guidance			o	o	o		
Company 8	Personal & econ. guidance	o	o	o				
Company 9	Media/IT	o		o	o	o		
Company 10	Technical professions	o	o					o
Company 11 (Division)	Business adm./management		o	o	o	o		
Company 12 (Division)	Business adm./management			o	o	o		
Company 13 (Division)	Business adm./management			o	o	o		
Company 14 (Division)	Business adm./management		o	o				
Company 15	Media/IT						o	
Company 16	Personal & econ. guidance						o	
Company 17	Media/IT			o				o
Company 18	Business adm./management						o	
Company 19	Media/IT			o				
Company 20	Media/IT							o
Company 21	Media/IT			o	o			o
Company 22	Media/IT			o	o			o
Company 23	Personal & econ. guidance			o	o			o
Company 24	Media/IT					o		o
Company 25	Media/IT					o		o
Company 26	Media/IT				o			o

a. From the study base of 491 subjects, 3 were excluded because they had no information on office type. The three subjects from the service sector were also excluded because this number was too small for analysis. In additional, 16 subjects were excluded because of lack of data on age, gender, job rank, and line of business.

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Notes

1. Here, the term "psychosocial work environment" is defined as the nonphysical work environment, including the relationship with colleagues and supervisors.

2. Ahlin and Westlander's (1991) definition of an office shared by more than one person. The original definition in Swedish is "delat flerpersonrum" (room shared by several people).

3. The traditional combi office was introduced as a combination of the cell office and the open plan office, where every person had an individual office, or cubicle, with windows facing the common space. Most of the office facilities were found outside the individual office/cubicle in the common space. Today, a strict spatial definition of "combi office" does not exist, because it is teamwork and the sharing of common facilities that define this type of office. In some combi offices, the employees have individual offices, whereas in others, they have an individual workstation in an open plan office layout.

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