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First results of self-reported health and comfort of staff in outpatient areas of hospitals in the Netherlands

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ABSTRACT

It is well known that the demand on hospital staff is increasing and that their comfort and health may be affected negatively by dose and building-related aspects. Comfort and health may differ between hospital departments. However, outpatient areas are understudied. To better understand comfort and health of staff in outpatient areas a survey was performed in which social comfort, personal and work-related aspects were all accounted for. This study aimed to identify comfort and health in relation to different room types. Of the 1694 invitations that were sent to outpatient staff of six buildings, 566 respondents (33%) were included in the analysis. There was little difference in the prevalence of the main self-reported symptoms, dry eyes and headache, and indoor air complaints, whereas acoustical, visual, thermal and social comfort differed statistically significantly between those working in different room types. Compared to other (inpatient) hospital and office studies, the prevalence of symptoms and dissatisfaction with comfort was high, especially dissatisfaction with daylight. Considering the dynamic use of workplaces in outpatient areas and the high ERI, this study reinforces the necessity for inclusion of personal and work-related characteristics in studies on comfort and health of occupants.

1. Introduction

With an accumulated demand on hospital staff, due to staff shortage and the expanding complexity of tasks, the understanding of health and comfort of staff becomes increasingly important. A review on field studies in hospitals showed that staff was generally less satisfied with comfort than patients [1]. In several Scandinavian studies, a higher prevalence of building-related symptoms and complaints on indoor environmental quality (IEQ) was found among hospital staff workers than office workers [2–4]. More recently, staff working at inpatient departments in a hospital in the Netherlands, was less satisfied than patients with IEQ-aspects, control of IEQ-aspects and privacy [5,6].

Rashid and Zimring [7] suggested that IEQ-related problems may vary between hospital departments, as performed activities and the occupancy hours vary. Furthermore, Sadatsafavi et al. [8] indicated in a field study that different comfort needs of hospital staff are associated with different room types, such as resting rooms for staff or patient bedrooms. For example, thermal comfort was for hospital staff more important when they were working or resting in rooms only used by staff, than when they were working in patient rooms. Previous studies on IEQ and building-related symptoms focused mainly on inpatient areas, while outpatient areas have been understudied [1]. Therefore, there is a need for a better understanding of comfort and health of staff in relation to the specific context of rooms in a department.

At outpatient areas consultation, diagnostic services and treatment are provided to patients who, usually, don't stay overnight in the building. The patients who stay overnight in hospitals, stay at inpatient departments. Outpatient departments comprise of room types with different functions, such as reception areas, consultation rooms, treatment rooms, and offices. At the reception desk, which is usually adjacent to the waiting area, patients are welcomed and can make appointments. In the consultation rooms interviews and examination are performed for diagnostics. Medical investigation and treatment, such as endoscopy, are performed in the treatment rooms. Most administration and phone calls occur in the offices. Due to the function, the characteristics of the different room types may vary, regarding the number of persons in the room, duration of stay, and performed activities. These aspects may affect health and comfort of hospital staff. For example, previous studies in other hospital departments, indicated associations with the number of persons in patient rooms and privacy [9], the duration of stay at inpatient areas provided with daylight, and work strain and job satisfaction [10] and differences in performed activities in operating rooms with

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thermal comfort [11].

It has been suggested by several authors that IEQ as well as social comfort aspects, are important to understand health and comfort better within a specific context [12,13]. For example, privacy, acoustical and visual distraction and (the perception of) crowding, have been included in previous field studies [14–18] to study relations with comfort, health and building characteristics. According to Altman [19] crowding is closely related to privacy and occurs when people cannot regulate the extent of social interaction and seclusion. Previous field studies have shown associations with stress, crowding and appraisal of the environment (PEQ) [20,21].In addition, personal aspects, such as gender, age, work strain, may affect IEQ [22] and building-related symptoms as well [23,24]. Bluyssen (2019) recommended to study comfort and health integrally, including time-related aspects, personal aspects and interactions between stressors and occupants, in order to capture a view which is more representative for the complexity of a real-world context [25].

To take all of the above-mentioned aspects into account, the aim of the study reported here was to study comfort and health of hospital staff in outpatient areas in relation to different room types. For this purpose, a questionnaire was designed including social comfort, personal and work-related aspects, to answer the following research questions:

- Is it likely that the proportion of staff suffering the most prevalent building related symptoms, varies between different room types?
- Is it likely that dissatisfaction with the IEQ and social comfort aspects, which bother most outpatient staff, varies between different room types?
- Is it likely that PEQ varies between the different room types?

This questionnaire was distributed to the staff of six top clinical hospital buildings during the spring of 2019. In addition, to explore associations of workplace characteristics at outpatient areas with comfort and health of staff, the buildings were inspected with the use of a newly developed checklist, of which the outcome will be reported elsewhere. This paper reports the first results of the questionnaire and explores comfort and health of staff associated with different types of workplaces.

2. Method

2.1. Design questionnaire

To address personal and social characteristics that may affect the relations between comfort, health and building-related aspects, as part of a larger PhD study, the questionnaire consisted of five components: personal, workplace, health, comfort and importance related questions (Table 1). For the study reported here, the personal and work-related questions were included in order to analyse if and which aspects were associated with different buildings and needed to be adjusted for in the comparison between room types. The questions on building-related symptoms and comfort were included, to determine the most prevalent symptoms, least satisfying aspects and the PEQ, which were included in the comparison between different room types. The questionnaire comprised of validated instruments added with newly designed sets of questions.

The components personal, health and subcomponent IEQ were retrieved from the OFFICAIR questionnaire [16]. OFFICAIR was developed to gain more insight in complaints and building-related symptoms of occupants in European offices, with respect to psychological and health aspects. The extent to control IEQ-aspects and the category "noise from (medical) apparatus" were added. For the expression of the actual mood state, during completion of the questionnaire, a new validated version of the visual scale was used [26].

PEQ, used in previous studies to assess the subjective appraisal of the environment in relation to crowding and physiological stress [20,21],

Table 1
Components of the questionnaire.

Component	Subcomponent	Instrument
Personal	Demographics: age, sex, education,	OFFICAIR
	Lifestyle: smoking, sports, etc.	OFFICAIR
	Mood	Pick-A-Mood
	Affect	I-PANAS-SF, scale 1-5
	Recent stressful life events	OFFICAIR
	Effort reward imbalance	ERI, scale 1-5 OV, scale 1-4
Workplace	Social characteristics: e.g. function, department, activities	5 questions
	Time-related characteristics: e.g. time spent in the room, weekly working hours at outpatient area	5 questions
	Place characteristics: e.g. (mostly) used room type, number of persons in the room	4 questions + 10 embedded questions
	General satisfaction with work	1 question, 1-10 scale
Health	Health status	OFFICAIR
	Building-related symptoms	OFFICAIR, 13 symptoms
	Sick leave	3 questions
Comfort	General satisfaction with building	1 question, 1-10 scale
	IEQ	OFFICAIR, 1-7 scale
	Social comfort	14 questions, 1- 7 scale
	Environmental satisfaction	PEQ 12 questions, 1-7 scale
Importance	Psychosocial aspects	3 items selected from 12
	Physical environment	3 items selected from 15

formed a subcomponent of comfort. The instrument comprises bipolar adjective items, such as "stimulating-boring" or "bright-dull". Because the scale was only available in English, the adjectives were translated from English to Dutch and back by one native Dutch speaker and two native English speakers. The same words "drab", "tense", "cheerful" and "unlively", were translated differently back by both speakers. After discussion, the Dutch translation of the words, "tense" and "unlively" were adapted.

The sets of questions for the component workplace and subcomponent social comfort were specifically designed for this study, as no standardized appropriate instruments were found. The set of questions for 'work' was based on visits of outpatient areas in seven hospitals and information retrieved from one healthcare architect and the project leaders of the hospitals. Questions about social comfort, time and place-related aspects were designed to identify workplace characteristics. Two examples of questions are: "In which types of rooms do you work?" and regarding the mostly used room "How many hours do you stay in the room without leaving, except for interruptions which are shorter than 5 min?"

The set of questions for social comfort was based on literature. In previous studies crowding was related to the number of people in the room, psychological stress and the social context [27,28]. Privacy supported by building aspects was studied previously in relation to visual and acoustical isolation and distraction, as well as interaction [14, 29–31]. Therefore, thirteen questions and one embedded question were composed for satisfaction with crowding, privacy, interaction and distraction. The questions consisted of a 7-point rating scale for equivalent assessment with IEQ-questions, from completely disagree (1) to completely agree (7). Examples are: "At my workplace I am too much distracted by sounds", and, "I perceive my workplace as too crowded with other people". The embedded question for those who worked with patients was "My workplace offers patients sufficient privacy".

As the importance of cleaning has been indicated in previous studies of hospitals [32] and the national cleaning guidelines for hospitals differ in relation to the function of the room [33], satisfaction with cleanliness of the workplace and of the building were questioned separately.

Additionally, two questions were composed to explore differences of

the importance of comfort aspects between occupants. The questions were derived from the subcomponents IEQ and social comfort. The first question consisted of twelve psychosocial aspects, the second question fifteen physical aspects. For both questions the participants were asked to select the three most important items.

2.2. Validation of the questionnaire

The questionnaire was tested in November 2018 by four researchers and two health care architects. After adjustment a pilot of the questionnaire was conducted in December 2018 with 25 outpatient workers (36 invitations, 30 started, 25 completed) of a general hospital. The pilot was necessary to check the categories, order and consistency of the newly designed questions. Additionally, the contact persons of two of the participating hospitals provided feedback on the questionnaire during the pilot study.

After analysis and discussion of the descriptive statistics of the data, the questionnaire was adapted. Two questions were found unnecessary and therefore deleted. The categories of five questions were adapted and small changes were made in the order of the questions. The results of the pilot were not included in the analysis reported here. The final questionnaire comprised of 148 questions, including 32 embedded questions, one open question for additional remarks and one voluntary question for participation in a follow-up study. Whether the embedded questions were displayed, depended on previous answers.

2.3. Selection of the population and buildings

The studied population was restricted to staff members working in outpatient areas. To receive a representative overview of the complete staff group, both sexes of all ages were invited for the survey. Moreover, staff working only in outpatient areas and staff working both in outpatient and in other areas of the hospital (e.g. inpatient area, operation room) were asked to participate. With regards to statistical power, a minimum of 400 respondents was calculated, based on a 95% confidence level, with maximum variety (50%), and a population size >100000, according to the formula [34]:

$$n1 = \frac{N}{1 + N(e2)}$$

($n1$ = sample size, N = population size, e = level of confidence)

Sixteen top clinical hospitals were approached with telephone calls and follow up e-mails, between September 2018 and February 2019. By selecting only top clinical hospitals, the intention was to exclude the type of hospital as a confounding variable. Top clinical hospitals in the Netherlands differ from academic and general hospital, in capacity for research and teaching, in specialization and in size. Teaching of physicians and conduction of research are facilitated at top clinical hospitals, although in contrast to academic hospitals, they are mostly specialized in one or a few specialities and are not directly related to universities. Top clinical hospitals are generally larger than general hospitals and smaller than academic hospitals.

Selection criteria for the buildings were: different regions (west, middle, east), differences in HVAC systems (e.g. heating with radiators, fan-coil units, supplied air, floor heating), differences in individual control of the indoor environment (manual or automatic), differences in the dimensions of building wings (12–15 m, 15-20 m, >20 m), different building ages (between 1980 and 2018). Buildings should have been operating in their current form for minimum 1 year prior to the start of the study. Main similarities between the buildings were the finishing materials, such as suspended acoustic ceilings and vinyl floor finishing, presence of internal solar shading at windows in the consultation and treatment rooms, presence of external solar shading, openable windows. The outpatient areas were mainly on the ground floor and the first floor, a part was on the second floor of the buildings.

The main reason for hospitals which refused to participate was the heavy workload of staff. One hospital was kindly rejected by the researchers, as only one department, with 45 employees, showed interest in participation. During the selection process five hospital organizations were visited for explanation and discussion of the research protocol. Finally, three hospitals participated, all with two locations per hospital organization. In two hospitals a presentation was delivered for over twenty department heads, in order to obtain commitment from staff. For each hospital there was one contact person (project leader) involved for planning and procedures. The letter of consent, text on the intranet and questionnaire were discussed with the departments for human resources, communication and facilities. Participation of hospital organizations was on voluntary basis.

2.4. Procedure survey

In the first week an invitation letter, first aligned with the contact person of the hospital organization, was published on the intranet. The purpose of the study, content of the survey and privacy of the participants were explained, as well as details on the invitation for the survey and the building inspection dates.

On Monday of the second week all employees, working in outpatient wards, received an e-mail with a brief explanation of the survey, the time frame for filling in the questionnaire and a link to the digital questionnaire on the Qualtrics XM platform, from the contact person of the hospital. The e-mail was sent for hospital 1 on February 18, for hospital 2 on March 18, for hospital 3 on April 1, 2019. One hospital provided a link to the questionnaire on Intranet as well, in order to enable all persons working at outpatient areas of the two locations to participate. All participants were obligated to agree with the consent form, before they were able to start the questionnaire. The questionnaire was only available in Dutch. The completion of the questionnaire took around 25 min according to Expert Review of Qualtrics XM. Participants could save their answers to the survey and resume later (within 14 days). After one week, feedback was provided to the hospitals about the response rate. Reminders to fill in the questionnaires were sent for one hospital once, for the other two hospitals twice. Two hospital organizations allowed to leave leaflets as a reminder to the questionnaire in rooms during building inspection.

2.5. Ethical aspects

The Ethics committee of Delft University of Technology approved the study design on October 5th, 2018. Data security was assessed by a data manager from Delft University of Technology. To respect privacy of the participants, measures were taken for protection of contact information, safe data storage and withholding of personal information. Therefore, sending and receiving of the questionnaire were separated; an anonymous link to the questionnaire was sent by the hospital organizations, individual e-mail addresses were not shared with the researchers. The data were stored on a secured server. If participants had shared their e-mail address for follow up, it was separated from the dataset and saved in a secured separate document. Additionally, participants could withhold personal information, as they could leave out questions. Finally, only the data of the participants who confirmed submission at the end of the questionnaire, were saved and included in the study.

2.6. Data management and analysis

Data of the survey were imported from the Qualtrics XM platform to IBM SPSS Statistics 25 for analysis of the data. For error analysis the data were checked systematically; textboxes, such as the answer "other, namely …. ." for the question "what is your highest education level?" were interpreted and, if possible, assigned to an appropriate category. For calculation of the PANAS-SF and overcommitment, the values of the questions were summed to negative affect (NA), positive affect (PA) and

overcommitment (OV). Negative scales were recoded from negative to positive and summed to calculate PEQ. The following calculation was performed for calculation of ERI: SUM effort/SUM reward * 3/7, after recoding scales from negative to positive. Reliability of aforementioned scales was checked with Cronbach's alpha. Missing value analysis was performed with the values for PA, NA, ERI and PEQ and all items, except the embedded questions.

Building-related symptoms were identified as symptoms which improved when away from the building, based on the question: "Did you ever experience one of the following symptoms during work at your workplace in this building (today included)?" (dry eyes, watering eyes, irritated eyes, …). If one or more symptoms were indicated the following question was exposed, "How many days in the last four weeks (and today) did you experience the following symptoms?" (not in the last four weeks, 1-3 days in the last 4 weeks, 1-3 days a week in the last 4 weeks, every or nearly every working day). If the frequency was at least 1-3 days in the last four weeks, the question "Did it improve or worsen when you were away from your workplace (e.g. holidays, weekend, etc.)?" (better, no difference, worse) appeared. If the answer was "better", the symptom was counted as a building related symptom.

For calculation of bipolar comfort scales, such as the perception of dry or humid air, the two last scales on both sides were recoded, similar to OFFICAIR. For calculation of negative scales, such as: "I am too much distracted at my workplace by noise", the scales were recoded from negative (1) to positive (7). Subsequently, comfort aspects were recoded; IEQ aspects to "dissatisfied" for the values 1-3 and "not dissatisfied" for the values 4-7, and social comfort aspects to "disagreed" for the values 1-3 and "not disagreed" for the values 4-7.

Descriptive analysis was performed to provide an overview of the main personal and work-related characteristics, comfort aspects and building-related symptoms. Differences between the six buildings and between room types were calculated with a Pearson Chi Square (with Bonferroni correction) for categorical questions and Kruskall Wallis for the continuous scales, as the continuous scales were not normally distributed, (Shapiro Wilk <0.001). Due to the low number of participants in Building C2, differences were calculated and compared with and without C2.

Multivariate logistic regression was performed to assess prediction of the most prevalent building-related symptoms and the highest dissatisfying comfort aspects related to those working mostly in an office, reception, consultation or treatment room. Identification of covariables was based on literature, differences in the population between the buildings and correlation. First, age was recalculated as a categorical value in three groups (<35, 35-50, >50), ERI in two groups (≤ 1, >1), satisfaction with work in two groups (≤ 5, >5), PEQ in two groups ((≤ 48, >48). Then, correlation between covariables was checked with Cramer's Phi for the categorical scales and Spearman rho for the continuous scales. Values for Cramer's Phi >0.10 or Spearman's rho >0.40 were assessed as moderate correlation and excluded as covariable [35]. Next, the odds ratio with a confidence interval of 95% (CI 95%), was calculated separately for the room types and covariables. The value of categorical variables which was likely to change statistically significantly for most health or comfort aspects, was used as the baseline value in the multivariate logistic regression. Subsequently, the odds ratio (CI 95%) was calculated for room types with the covariables included. Statistical significance of the odds ratio was checked with the Wald Statistic. To check the reliability, the number of events per variable (EPV) was calculated as degrees of freedom divided by the lowest number of participants per aspect, e.g. number of workers dissatisfied with privacy [36]. Multicollinearity between the independent, included covariables was checked with the Variance Inflation Factor (VIF); values below 10 were considered as low multicollinearity. Goodness of fit was checked with the Hosmer and Lemeshow test (p-value >0.05).

3. Results

3.1. Respondence

The questionnaire was completed by 560 (33%) of 1694 invited participants. Four participants were excluded, as they did not work at a hospital location or department which was part of the study. The number of respondents of the three hospital organizations were distributed evenly, but the number of respondents varied between the locations, as shown in Fig. 1. Although the number of respondents of location C2 was low, they were included, as the provided information was useful for comparison of room type related aspects.

Of the 556 participants, 460 (83%) responded to all questions, excluding embedded questions. Missing values were scattered among the questions; only 7.4% of the questions were completed by all respondents. Missingness of the variables reported in this paper was completely at random (MCAR = 0.324). No variables and constructs had more than 5% missing values. Due to inconsistency in answers one participant (no. 149) was excluded from the analysis related to age or year started in building, as for both questions the same year was reported. Within this study, the reliability of the scales was acceptable for the psychometric scales PA and NA (Cronbach's alpha respectively 0.74, 0.73), good for the effort-reward imbalance (ERI 0.80, OV 0.83) and excellent for environmental satisfaction (PEQ 0.94).

3.2. Personal aspects

Table 2 shows that 91% of the respondents were female, and 53% had finished intermediate education. Only 37 participants, mainly physicians, did nightshifts (in other parts of the hospital). 76% of the participants were in a positive mood while completing the questionnaire. Their emotions were generally positive as well, as the mean NA was 8.0 (sd 2.5) and the mean PA was 20.0 (sd 2.6), both on a scale from 5 to 25. The ERI ranged from 0.58 to 3.03.78% of the participants reported an ERI larger than 1.00, indicating that they felt their effort was higher than the reward they receive. Additionally, 71% of the respondents was overcommitted (OV > 15), while only 8% of the respondents was dissatisfied with their work. Personal aspects were overall balanced at the different locations, except for the following aspects: education level ($P < 0.01$), nightshifts ($P < 0.01$) and ERI ($P < 0.05$).

3.3. Work-related aspects

Almost two third of the respondents reported to work at different locations of the hospital; they commuted between different cities. The proportion of the commuters varied between locations. Only one in four worked in one specific room type, the others worked in at least two different room types. Consultation rooms were mostly used, second offices, third reception desks, and fourth treatment rooms. The majority of the physicians, physician assistants, diagnostic researchers, supportive staff and specialized nurses worked most of the time in consultation rooms. More than half of the general nurses worked in consultation rooms, almost one third in treatment rooms. Managers, administrative staff and coordinators worked mainly in offices. Three quarter of the reception desk workers worked at the reception desk, one quarter in offices.

The results show that the proportion of participants who performed a specific activity differed between the room types. For example, of those working mostly at the reception desks 99% made appointments with patients, versus 46% of those working mostly in consultation rooms. Concentrated deskwork was mostly performed in offices, routine deskwork in offices and receptions. Meetings and tele-consults with patients and physical investigation of patients were mainly performed by those working mostly in consultation rooms, medical operations by those working in treatment rooms. The activities differed all statistically

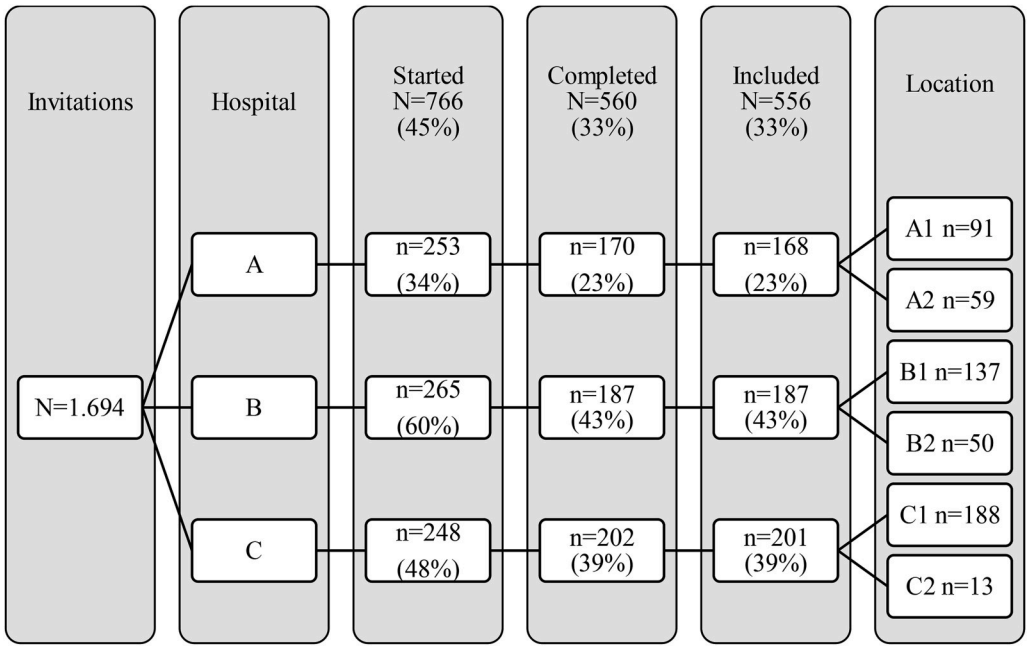

Fig. 1. Response per hospital organization and location.

Table 2
Comparison personal and work-related aspects in the six buildings.

Item	Category/scale	A1	A2	B1	B2	C1	C2	Mean	P
N		91	59	137	50	188	13	566	
Personal									
Age (mean. sd)	Years	47.6 (11.6)	44.8 (12.5)	47.9 (11.1)	46.6 (12.0)	45.7 (11.4)	48.7 (10.4)	46.6 (11.6)	0.419
Sex (%)	Women	91.2	98.3	86.9	92.0	91.0	100.0	91.0	0.150
Education level (%) **	MSc, PhD	7.7	11.9	24.8	16.3	13.5	7.7	15.0	< **0.000**
	Applied	25.3	18.6	11.7	14.3	24.9	15.4	20.5	
	Intermediate	45.1	55.9	57.7	53.1	52.4	76.9	53.3	
	Secondary	22.0	13.6	5.8	16.3	9.2	0.0	11.2	
Mood (%)	Negative	15.4	15.3	12.9	22.2	13.4	8.3	15.0	0.863
	Neutral	8.8	11.9	11.4	6.7	7.3	8.3	9.0	
	Positive	75.8	72.9	75.8	71.1	79.3	83.3	76.0	
Positive affect (mean, sd)	5–25	20.3 (2.4)	20.5 (2.4)	20.0 (2.8)	19.7 (2.2)	19.9 (2.7)	19.7 (2.8)	20.2 (2.4)	0.335
Negative affect (mean, sd)	5–25	7.9 (2.2)	7.8 (1.9)	8.1 (3.0)	8.0 (2.4)	8.2 (2.4)	8.0 (2.1)	8.0 (2.5)	0.867
Recent positive stress (%)	Yes	26.4	27.1	27.9	32.0	20.7	15.4	24.9	0.466
Recent negative stress (%)	Yes	40.7	39.0	38.0	46.0	31.0	38.5	37.1	0.380
Work									
Contract (%)	Part-time	75.8	72.9	78.1	84.0	72.2	92.3	76.2	0.328
Nightshift (%) • (A1, A2, B1, B2, C1**)	Yes	2.2	3.4	13.1	10.2	4.3	0.0	6.5	**0.003**
ERI (mean, sd) *	(3-15)/(7-35) *7/3	1.3 (0.4)	1.3 (0.4)	1.5 (0.5)	1.3 (0.4)	1.4 (0.4)	1.6 (0.5)	1.4 (0.5)	**0.011**
Overcommitment (mean, sd)	6–24	17.2 (3.6)	17.0 (3.1)	16.7 (3.5)	16.9 (3.5)	17.3 (3.2)	15.2 (3.5)	17.0 (3.4)	0.465
Sick leave in the last year (%)	None	39.6	54.2	46.7	48.0	37.1	46.2	42.2	0.325
	1–7 days	46.2	35.6	38.7	30.0	47.8	38.5	42.8	
	>7 days	14.3	10.2	14.6	22.0	15.1	15.4	14.8	
Satisfaction with work (mean, sd)	1–10	7.5 (1.3)	7.5 (1.4)	7.6 (1.3)	7.6 (1.7)	7.6 (1.2)	8.2 (1.2)	7.6 (1.3)	0.705

*P- value < 0.05 for both C2 included and excluded, ** P-value<0.01 for both C2 included and excluded • due to the value of C2 test violated.

significant between the room types (Pearson Chi-square <0.05), except lab work (only performed by 5% of outpatient staff, P = 0.322) and telephone calls, specifically not with patients (P = 0.130). For an overview of the activities per room type see Appendix A.

Flexibility of working places differed between the room types (Pearson Chi-square p < 0.000). For example, 61% of those working at the reception had a fixed working place versus 7% in the treatment room. Duration of stay differed between room types as well (Pearson Chi-square p < 0.000); 61% stayed shorter than 4 h in a treatment room versus 16% of those working at the reception desk. In all rooms the number of persons varied between one to more than nine, except for the treatment room. In the treatment room there were at least two persons present. The proportion of number of persons differed (Pearson Chi-square p < 0.000), 21% of the workers in the consultation room worked most of the time alone, versus 8% in the office and 5% at the reception Table 3.

3.4. Prevalence of health symptoms

Almost three quarter of the hospital staff (72%) suffered in the last four weeks at least from one symptom, that improved when away from the building. As shown in Fig. 2, the two most prevalent symptoms were dry eyes (50%) and headache (38%). Regarding seasonal differences, one quarter experienced dry eyes and headache (respectively 24% and 23%) in particular season(s), namely the winter (respectively 20% and 19%). Dry eyes and headache occurred for at least to one on two

Table 3
Comparison workplace characteristics related to the six buildings and four room types.

		A1	A2	B1	B2	C1	C2	Differences between locations P-value	Office	Reception	Consultation	Treatment	Differences between room types P-value	Overall
	N	91	59	137	50	188	13		160	115	215	43		566
Work at different locations (%)	Yes	18.7	10.2	38.0	20.0	53.2	23.1	< **0.000**	66.3	66.1	63.3	51.2	0.299	62.9
Years working at the location (mean, sd)	Years	14.1 (10.0)	5.2 (4.6)	10.3 (7.6)	12.7 (8.6)	12.4 (9.3)	17.8 (11.4)	< **0.000**	11.6 (9.6)	11.2 (8.6)	10.5 (8.2)	12.3 (10.6)	0.888	11.2 (8.9)
Working hours at outpatient (%)	<17 h	19.8	11.9	21.2	16.0	15.0	30.8	0.389	15.7	22.6	15.3	18.6		17.7
	17–32 h	65.9	64.4	63.5	72.0	70.6	69.2		67.3	63.5	69.8	74.4		67.4
	>32 h	14.3	23.7	15.3	12.0	14.4	0.0		17.0	13.9	14.9	7.0		15.0
Number of room types used (%)	>1	73.6	78.0	78.8	76.0	69.1	58.3	0.303	71.3	79.1	65.1	90.7	**0.001**	72.8
Mostly used room type (%)	Office	48.9	20.7	15.0	12.5	39.7	8.3	< **0.000**						29.4
	Reception	21.1	22.4	40.6	35.4	5.4	16.7							21.8
	Consultation	24.4	48.3	37.6	50.0	40.8	66.7							39.9
	Treatment	5.6	8.6	6.8	2.1	14.1	8.3							8.9
Mostly used room type														
Duration of stay (%)	<4 h a day	42.9	40.7	29.2	38.0	43.1	30.8	0.164	36.3	15.7	45.1	60.5	< **0.000**	38.5
Flexibility workplace (%)	Flexible	69.0	63.2	62.4	61.7	73.9	58.3	0.255	63.5	38.9	78.5	92.7		66.5
Persons (incl. patients) in room (%)	1 person	11.0	5.1	16.8	10.0	9.6	0.0	**0.014**	7.5	5.3	20.5	0.0	< **0.000**	11.4
	2 to 4 persons	54.9	50.8	35.0	46.0	47.1	84.6		51.9	53.5	38.1	48.8		46.5
	>4 persons	34.1	44.1	48.2	44.0	43.3	15.4		40.6	41.2	41.4	51.2		42.2

participants during the afternoon (respectively 50% and 60%), while at least one on three participants did not experience these on a specific part of the day (respectively 45% and 35%). Other ocular symptoms, burning, irritated eyes (27%) and watering eyes, were reported to a lesser extent (13%). With regards to mucus membranes of nose and throat, dry throat was the most prevalent symptom (21%). Lethargy, or unusual tiredness, while working in the building, was experienced by 16% of the outpatient workers.

3.5. Dissatisfaction with comfort and main complaints

60% of the respondents were dissatisfied with cleanliness of their mostly used workplace. Cleanliness of the building was assessed by more than half as insufficient (55%). Also, more than half of the respondents was not satisfied with the PEQ of their workplace. On a scale from 12 to 84, with 12–48 as negative, and 49-84 as positive, 53% of the workers perceived PEQ negatively.

As shown in Fig. 3, almost half of the outpatient staff was dissatisfied with the temperature (49%); for almost one third the workplace was too cold (30%), for around one in eight it was too hot (12%). 23% found the temperature variation large. Regarding the indoor air quality, almost half of the staff was dissatisfied (46%). Main complaints were dry indoor air (56%) and stuffy air (34%). With regards to the visual quality, most workers were dissatisfied with daylight (48%), one third was dissatisfied with artificial light (31%) and the overall quality of light (32%). Of those who had a window in the façade (n = 254) or to the corridor (n = 372), two in five was dissatisfied with their view (both 38%). Satisfaction with overall noise was similar to overall light. Noise from other people was the main complaint (40%), second was noise from apparatus (25%).

Fig. 4 presents the dissatisfaction with social comfort aspects. More than one third of the outpatient staff perceived insufficient privacy at their workplace (36%) and was distracted by noise (36%). Of those who worked with patients (n = 382), also more than one third was dissatisfied with the privacy they could provide to patients at their workplace (37%). Almost one third perceived their workplace too crowded (32%). Also, one third (32%) was distracted visually, e.g. by people walking along. With regards to the sizes of rooms, around one in three was dissatisfied with the size of their workplace (28%) and available place to storage amenities (32%).

3.6. Comparison of reported comfort and health between room types

For comparison of comfort and health associated with work-related characteristics, comfort and health of groups according their mostly used room type, were analysed by multivariate logistic regression. The results of the logistic regression were adjusted for demographic variables as presented in Table 4.

Inclusion criteria for variables were based on literature, statistically significant differences of demographic variables between the six buildings ($p < 0.05$) and absence of a moderate or strong correlation between the variables. Due to a strong correlation of nightshifts and gender with education (Cramer's Phi = 0.567, respectively 0.419) and the low percentage of men (9%) and persons working in nightshifts (7%), education was selected as covariable for adjustment. Overall, more men were high educated than women (almost 90% applied or academic education of men versus 30% of the women). Furthermore, over 90% of the night shift workers had an academic grade. Inclusion of ERI, mood and NA was based on previous studies. Satisfaction with work was included as it was related to headache, dry eyes, indoor air, noise from other people, cleanliness workplace and building, privacy, distraction by noise, crowding and PEQ. The analysis was performed with complete cases (N = 479-484) for abovementioned variables. Subsequently, the results were compared with gender and nightshift instead of education as covariable. The results were similar, with slight differences for the OR and CI values.

The results indicate that it is not likely that complaints for dry eyes

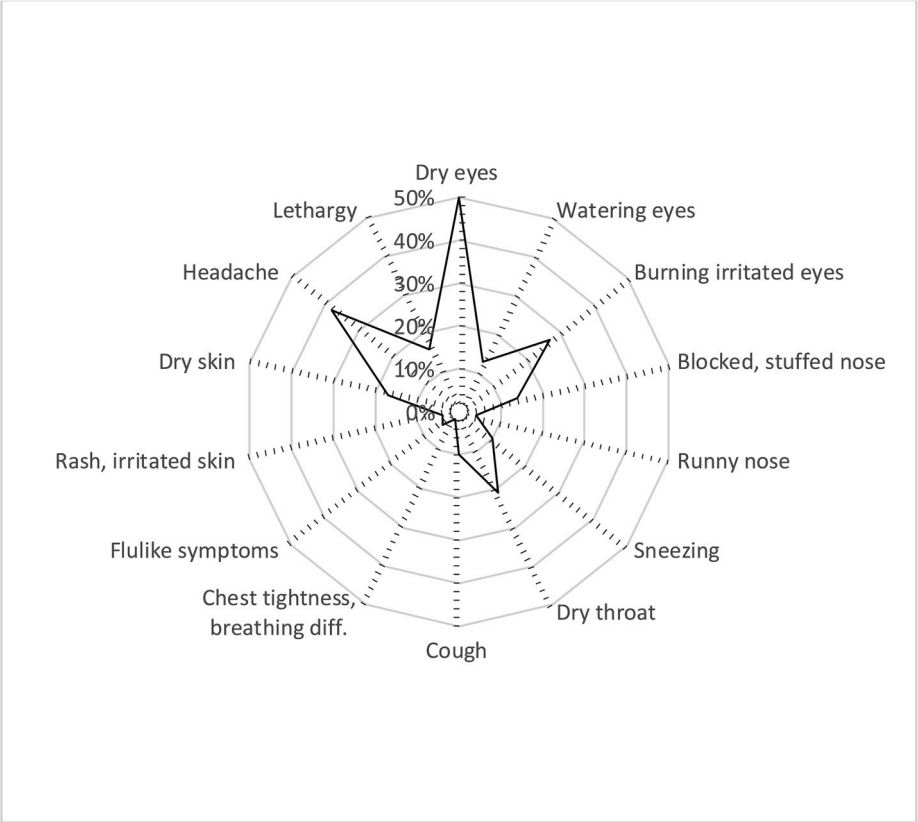

Fig. 2. Prevalence of health symptoms of all respondents in the last four weeks, that improved when away from the building.

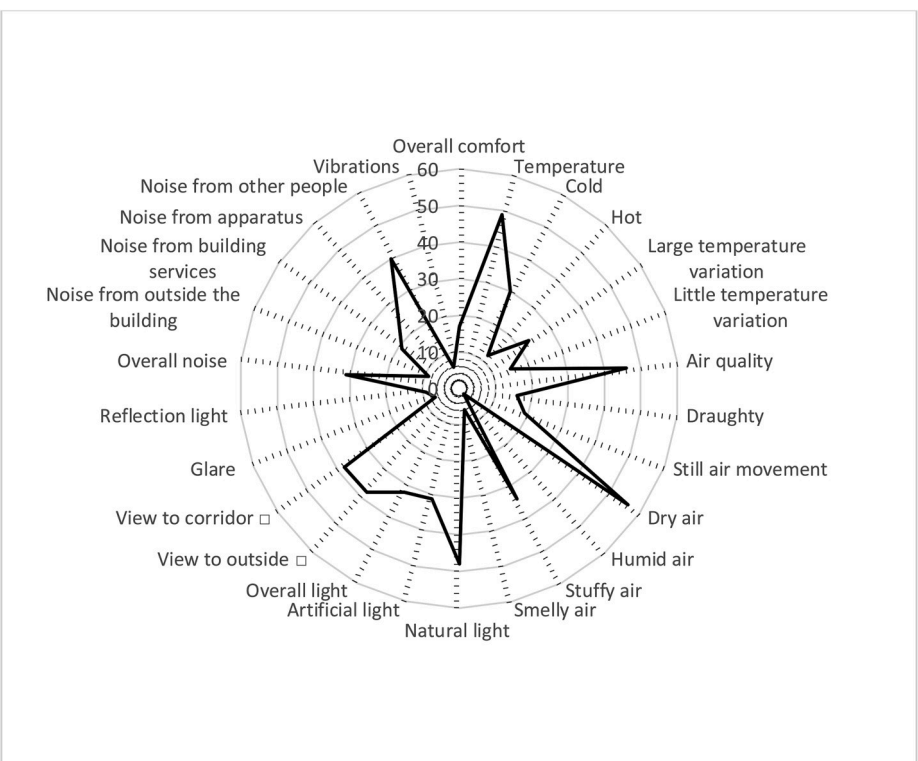

Fig. 3. Dissatisfaction with IEQ-aspects of all respondents. □ embedded question.

Fig. 4. Dissatisfaction with social comfort aspects of all respondents. □ embedded question, N = 382.

Table 4
Differences of comfort in mostly used room.

	office vs reception		office vs consultation		office vs treatment		reception vs consultation		reception vs treatment		consultation vs treatment	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Health												
Dry eyes	0.82 (0.48–1.38)	0.448	**0.62 (0.39-0.99)**	**0.047**	1.04 (0.49-2.19)	0.918	0.76 (0.44-1.32)	0.332	1.28 (0.58-2.81)	0.544	1.67 (0.80-3.50)	0.172
Headache	0.77 (0.45–1.31)	0.331	0.62 (0.38-1.01)	0.055	1.09 (0.52-2.30)	0.817	0.81 (0.46-1.43)	0.477	1.43 (0.65-3.16)	0.380	1.75 (0.83-3.69)	0.139
Comfort												
Temperature	0.82 (0.49–1.38)	0.451	0.70 (0.46-1.17)	0.193	**2.30 (1.04-5.10)**	**0.040**	0.90 (0.52-1.54)	0.69	**2.81 (1.22-6.49)**	**0.015**	**3.14 (1.43-6.89)**	**0.004**
Quality indoor air	**0.53 (0.31-0.89)**	**0.017**	**0.63 (0.39-0.99)**	**0.049**	1.12 (0.53-2.37)	0.758	1.19 (0.69-2.06)	0.527	2.15 (0.97-4.73)	0.058	1.80 (0.86-3.76)	0.118
Dry indoor air	0.92 (0.54–1.56)	0.755	**0.56 (0.35-0.90)**	**0.016**	1.23 (0.57-2.64)	0.602	0.61 (0.36-1.05)	0.075	1.33 (0.60-2.99)	0.485	**2.17 (1.02-4.63)**	**0.044**
Stuffy air	0.82 (0.48-1.41)	0.468	**0.52 (0.32-0.86)**	**0.010**	0.55 (0.24-1.23)	0.146	0.64 (0.36-1.14)	0.127	0.67 (0.28-1.58)	0.358	1.05 (0.46-2.38)	0.912
Natural light	**1.73 (1.02-2.95)**	**0.042**	**2.28 (1.42-3.66)**	**0.001**	**3.78 (1.75-8.14)**	**0.001**	1.31 (0.77-2.25)	0.321	2.18 (0.98-4.85)	0.057	1.66 (0.78-3.52)	0.188
Noise from people	1.18 (0.68–2.04)	0.555	**0.58 (0.35-0.95)**	**0.031**	0.51 (0.23-1.14)	0.100	**0.49 (0.28-0.87)**	**0.015**	0.43 (0.18-1.01)	0.053	0.88 (0.39-1.98)	0.759
Privacy	**2.71 (1.55-4.73)**	**< 0.000**	**0.46 (0.26-0.76)**	**0.003**	0.58 (0.26-1.33)	0.199	**0.17 (0.09-0.30)**	**< 0.000**	**0.22 (0.09-0.52)**	**0.001**	1.31 (0.56-3.05)	0.530
Crowded workplace	0.81 (0.49-1.45)	0.532	**0.61 (0.37-0.99)**	**0.049**	**0.27 (0.10-0.69)**	**0.007**	0.72 (0.40-1.29)	0.270	**0.32 (0.12-0.86)**	**0.023**	0.44 (0.17-1.15)	0.095
Distraction by noise	1.16 (0.68–2.00)	0.582	0.70 (0.43-1.15)	0.158	**0.23 (0.09-0.61)**	**0.003**	0.61 (0.34-1.07)	0.083	**0.20 (0.07-0.54)**	**0.002**	**0.33 (0.13-0.86)**	**0.024**
Clean workplace	1.24 (0.72–2.12)	0.439	1.31 (0.82-2.10)	0.258	1.19 (0.56-2.53)	0.648	1.06 (0.61-1.85)	0.835	0.96 (0.43-2.15)	0.928	0.91 (0.43-1.91)	0.800
Clean building	0.79 (0.46–1.34)	0.377	1.52 (0.94-2.45)	0.087	1.16 (0.55-2.47)	0.700	**1.93 (1.11-3.36)**	**0.020**	1.48 (0.66-3.27)	0.340	0.76 (0.36-1.62)	0.483
PEQ	0.71 (0.41–1.23)	0.221	1.08 (0.67-1.74)	0.757	1.92 (0.85-4.31)	0.115	1.51 (0.87-2.64)	0.661	**2.69 (1.15-6.30)**	**0.022**	1.78 (0.80-3.97)	0.159

Adjusted for age (baseline 35-50 years), education (baseline master), mood, NA, ERI, satisfaction with work. Significant values in **bold.** OR = odds ratio, 95% CI is the confidence interval at 95%. EPV between 13 and 20. N = 479-484. VIF between 1.022 and 1.052.

and headache were associated with those working in different room types. Only those who were working in consultation rooms were less likely to perceive dry eyes than those working in offices. The proportion of dissatisfied staff with cleanliness of the workplace was equal for all groups. However, differences in comfort were identified between those working in different room types. Those who worked mostly in the treatment rooms were more likely to be dissatisfied with temperature than the others and experienced more variation in temperature. The chance to be more satisfied with the quality of the indoor air, stuffiness of air and humidity was higher for those working mostly in consultation rooms than those working mostly in offices. In contrast, more workers in the offices were satisfied with daylight than those who worked mostly in other places. The workers in the treatment rooms experienced less distraction by noise than the others. Of those working at the reception

desks, more were dissatisfied with privacy than those working in other rooms. PEQ was for all groups equal, except the reception workers who were more likely to appraise their workplace than staff working in the treatment rooms.

4. Discussion

4.1. Study design

The broad range of questions in the questionnaire provided a comprehensive overview of the perceived comfort and health of outpatient staff. To our knowledge, no previous study in hospitals on health and comfort of staff has provided such an extensive overview of personal and work-related variables. The use of workplaces in outpatient areas of hospitals is different from offices, as outpatient staff tends to perform a wide range of activities at different places in the building. The analysis showed differences for those working in different room types, duration of stay at a workplace, number of persons in the room and flexibility of workplaces. Inclusion of these characteristics in the questionnaire was relevant, as these aspects may be associated with the indicated differences between the room types.

A limitation was the inequality in sample size between the buildings. A possible explanation is that staff was asked to report their perception of building-related symptoms and comfort of the building they worked mostly. There was a tendency that they worked mostly in the largest buildings of the organization (location A1, B1 and C1). Furthermore, the room types were not equally divided between the buildings. At location C1 only 5% worked at the reception desk versus 40% at location B1. This could be explained by organizational factors, as at location C1 the main part of the receptions was automatic. However, the differences in the population between the buildings, which may occur through unequal sample size, were taken account of in the analysis.

4.2. Response

The response rate of approximately one third was in line with OFFICAIR (144 questions) [16], but lower than the response on the MM040 questionnaire (35-37 questions) in Swedish, Finnish and Greek hospitals [3,4,37] (68%, 82% and 75%). These differences can be related to the length of the questionnaire and the way of distribution (digitally versus on paper). However, the fact that four out of five respondents, who started participation, completed the questionnaire and one out of four participants provided their e-mail address for participation in future studies, indicate that the outpatient staff who did start, found the study relevant.

Presentation of the survey to the coordinators of the outpatient departments and leaflets with information left in the inspected rooms, as performed in hospital B and C, may have contributed to a higher response rate in hospital B and C than in hospital A. In a review on the response rate of 490 surveys between 2000 and 2005 [38], the promotion of the survey within the organization contributed to an increased response rate. The review also suggested that representativeness of the respondents was more important than the response rate. Comparing the average age and gender of nurses and physicians to the average of all nurses and physicians working in top clinical and general hospitals in the Netherlands in 2017 [39], the gender ratio of both groups in the present study deviated 3% from the average. The age of the physicians was similar, nurses were in the present study slightly older than the average (48 versus 40-45).

The sample size of 566 respondents (more than the minimum required of 400) was adequate for multiple logistic regression of the main symptoms and dissatisfying aspects, as the EPV was more than 10.

4.3. Personal and work-related aspects

Due to the large proportion of female outpatient workers the results were not adjusted for gender. In contrast to the previous hospital studies, which excluded male workers from the analysis [4,40], males were included in order to provide a representative overview of the population. It should be noted that gender ratio was not reported in all of the aforementioned previous studies. Also, the analysis with gender and work shift as covariables instead of education did not differ.

The average score of ERI in the present study was higher than in previous studies in Swiss, German and Dutch hospitals that included the ERI [41–43]. Also, the average ERI-score in OFFICAIR was lower. Similar to the findings in OFFICAIR, a high ERI was not strongly related to working hours: 77% of the part-time and 82% of the fulltime workers had an ERI larger than one. Furthermore, the correlation of satisfaction with work and ERI in the present study was low (Spearman's Rho 0.174). The high working pressure in hospitals in the Netherlands may explain the high ERI in the present study. According to the database of Statistic Netherlands, almost half of the workers in independent outpatient centres, general and top clinical hospitals, experienced in 2018 too high working pressure and almost three out of four reported an increased working pressure in the last twelve months [44]. Nevertheless, in line with the present study, a large group (78%) was satisfied or very satisfied with their work in 2018.

4.4. Health symptoms

For comparison of previous studies on building-related symptoms of hospital staff in European hospitals, differences in study design need to be accounted for, as these aspects may contribute to differences in reported symptoms. The MM040 questionnaire used in studies [3,4,37] comprised 12-15 symptoms, including symptoms which were not part of the present study, such as "heavy headed", "nausea/dizziness" and "difficulties concentrating". In comparison with the present study, some symptoms were combined in MM040. For example, instead of the symptom "dry eyes", MM040 comprised one category for "itching, burning or irritation of the eyes" [45]. Also, the MM040 respondents were questioned: "Do you believe that it is due to your work environment?", while in the present study: "Was it better, when you were away from your work?" However, Raw et al. (1996) found no differences in the prevalence of symptoms between these two questions [46].

Overall, fatigue and dry skin (on hands or face) were reported among the four most prevalent symptoms in the MM040 studies, whereas the prevalence of eye, nose or throat symptoms varied. These findings are in contrast to the present study, with dry eyes as main complaint and headache as second. Dry eyes and headache were also the main symptoms reported in OFFICAIR. Similar to the higher prevalence of symptoms in hospitals than in offices in previous studies with the MM040 questionnaire, the prevalence of symptoms was higher in the present study than in the European wide OFFICAIR: the prevalence of dry eyes and headache perceived in the last 4 weeks, were in OFFICAIR respectively 31% and 29% and in the present study 50% and 38% [22].

An explanation of the high prevalence of dry eyes in present study could be the high percentage of female respondents: more women tend to experience dry eyes than men [47], which was in line with the present study. In contrast to OFFICAIR [48], the prevalence of dry eyes was in the present study not associated with the ERI. The high prevalence of dry eyes and headache in the present study compared to the MM040 studies in hospitals might be related to differences between countries. In the OFFICAIR project the prevalence of dry eyes and headache of female workers in the Netherlands was higher than in the other European countries [49].

4.5. Comfort complaints

Comparison of comfort complaints with other studies is difficult, due to differences in study design, different scales and variation of included comfort aspects. For instance, the MM040 questionnaire included 11-13 IEQ items on a three-point scale, and the Padua hospital study [15]

included 11 comfort items on a scale from 1 to 7. The questionnaire for the Dutch inpatient study [5] comprised 20 comfort items on a scale from 1 to 5, and aspects of indoor air were beyond the focus of that study. In the MM040 studies and Padua hospital study "dry air", "stuffy air" and "poor air quality" were among the main complaints, which corresponds with the results of the present study. These findings do not differ from previous studies in European offices, were complaints with "dry air" and "stuffy air" were also among the main complaints. Complaints for dry air were higher in the present study than in OFFICAIR.

In contrast to previous hospital studies, dissatisfaction with visual aspects were more prevalent than dissatisfaction with acoustical aspects, which might be explained by differences between inpatient areas and outpatient areas, such as differences in activities, and, the 24 h occupancy of inpatient departments versus 8 h occupancy of outpatient areas. For example, noise during the night was by more than half of the staff negatively assessed in inpatient areas [5]. However, in previous office studies the prevalence of noise complaints was also higher than complaints of visual quality. For a comparison of the present study with OFFICAIR, noise from people and noise from apparatus were summed. This resulted in a similar proportion of the workers satisfied with the acoustical quality in OFFICAIR as in the present study.

Almost half of the outpatient staff experienced an uncomfortable temperature, which is in line with the inpatient study and Padua hospital study. One third of the workers in OFFICAIR was dissatisfied with temperature; half of them was too cold, half of them too hot. In the present study one third was too cold, one out of eight too hot. The differences can be explained by clothing guidelines. Hospital workers who have contact with patients are required to wear short sleeves, due to hygiene guidelines. They are not allowed to adjust their clothing when they are cold. Another explanation can be differences in the metabolic rate between females and males. Kingma and Van Marken Lichtenbelt [50] determined, based on analysis of biophysical parameters, that the metabolic rate of young females performing light office work, was lower than the ASHRAE standard values. However, as in the MM040 study in Greece [37] and Finland [3] more hospital workers were too hot than too cold, country or hospital department might also be associated with the perception of hot or cold temperature.

Previous hospital studies have reported differences in privacy needs between different departments, e.g. between inpatient and emergency departments [1]. The differences in satisfaction with privacy in the present study between those working in different room types, suggest that privacy can differ even within departments. Dissatisfaction with privacy at the reception areas can be explained by the enclosure of the reception desks. The reception desks in outpatient areas were from desk to ceiling open to waiting rooms or circulation areas. Surprisingly, although those working mostly in the offices were more satisfied with privacy than those working at receptions, a difference (after adjustment of confounding variables) in dissatisfaction with crowding and distraction by noises between these groups was not likely. This may be explained by the performed activities, e.g. most concentrated desktop work is performed in the offices, versus routine desk top work behind the reception desks. In contrast to the findings of Fisher [21], the PEQ of the groups who perceived their workplace as too crowded (offices and reception areas) or not too crowded (consultation and treatment rooms) was generally the same. It must be noted that in the study of Fisher variation in the perception of crowding was studied in only one room type.

5. Conclusions

This study presented the first results of a study on health and comfort of staff in outpatient areas. The study strengthens previous findings of larger prevalence of building-related symptoms and dissatisfaction with comfort aspects in hospitals than in offices. The main symptoms were dry eyes and headache. Dissatisfaction with air quality as main complaint corroborates with previous studies. Low satisfaction with daylight was specific for this outpatient study, in comparison to previously studied inpatient areas, general hospitals and office buildings. This study indicated that dissatisfaction with thermal, acoustical, visual and social comfort aspects can vary between groups working in different room types, whereas it was less likely that cleanliness and headache varied. The largest differences were found for privacy, the smallest for indoor air related aspects and dry eyes. Furthermore, as the use of workplaces in outpatient areas was dynamic and the ERI was high, this study reinforces the necessity for inclusion of personal and work-related characteristics in studies on comfort and health of occupants. Finally, the finding that main health symptoms were in general not related to room types (and indirectly to activities, duration of stay, and number of people in the room), shows the need for looking into possible associations with other building-related and/or occupant-related indicators.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix

Table A
activities in the workplaces.

	office	reception	consultation	treatment	P value
appointment with patient**	71,9%	99,1%	45,6%	51,2%	< **0.000**
get patient**	27,5%	39,1%	41,9%	62,8%	< **0.000**
meeting/diagnosis with patient**	24,4%	20,9%	69,8%	44,2%	< **0.000**
tele consult with patient**	26,3%	31,3%	52,6%	32,6%	< **0.000**
physical investigation patient**	10,0%	13,0%	56,3%	37,2%	< **0.000**
medical operation**	20,0%	33,0%	59,1%	76,7%	< **0.000**
planned meeting (not with patient) **	37,5%	21,7%	45,1%	39,5%	**0.001**
telephone calls (not with patient)	43,8%	32,2%	41,4%	30,2%	0.130
unplanned meeting (not with patient) **	37,5%	21,7%	35,3%	20,9%	**0.010**
concentrated desk work**	88,8%	77,4%	52,1%	39,5%	< **0.000**

(*continued on next page*)

Table A (*continued*)

	office	reception	consultation	treatment	P value
routine desk work**	75,0%	80,0%	39,1%	27,9%	< **0.000**
lay things out**	48,8%	65,2%	48,8%	83,7%	< **0.000**
lab work	2,5%	7,0%	5,6%	7,0%	0.322

*P- value < 0.05, ** P-value<0.01.

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