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A pilot study

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Comfort and satisfaction of patients, visitors and staff with patient rooms at inpatient wards, a pilot study

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Abstract. The indoor environmental quality, control, layout and appearance may affect comfort and satisfaction of patients, as well as visitors and staff in hospitals. Due to differences in activities, duration of stay and health status, needs of the different groups may vary. In order to design hospitals, which positively support comfort and satisfaction of all occupants, information is needed about satisfaction and the perceived importance of different factors. This study compared comfort and satisfaction of patients, visitors and staff with inpatient bedrooms (single and multiple bedrooms). A questionnaire was designed with rating scale questions; 499 respondents participated. The groups varied in their satisfaction. Staff was the least satisfied group. All groups were most satisfied with the appearance of the patient room and least satisfied with control. A qualitative study on control may strengthen the validity of the questionnaire for future research. In order to gain more insight in the importance of different aspects, an extension of the questionnaire, regarding questions about health.

1 Introduction

It is well known that the built environment, and specifically the indoor environmental quality (IEQ), control, layout and appearance, affects comfort and satisfaction of occupants in hospitals [1-4]. Environmental stimuli, which may cause a negative or positive stress reaction, are an inseparable part of the environment [5, 6]. In order to better understand the relations between comfort, health and the indoor environment, an integrative approach is required according to Bluyssen [7]. An integrative approach may contribute to unravelling the complexity and interrelations between occupant and the built environment. Specific requirements from different users are essential to design a hospital that supports the care and working process best. Due to differences in role, duration of stay and health status, the needs of a patient or visitors can be contradicting to the needs of staff in a hospital [8,9].

Few studies have been conducted on both patients as well as staff in hospitals [10]. In order to identify differences in comfort and satisfaction related to the built environment, it is necessary to study the perspective of staff, patient and visitors equally. Therefore, this study compared satisfaction and comfort from different user perspectives with building factors of the bedrooms at inpatient wards in a Dutch hospital. Within the perspective of this study, comfort contained three types of indicators: occupant related, dose-related and building related aspects [7]. E.g. control and independency are occupant related factors, layout and appearance are building related, and IEQ is currently described by dose-related indicators. The building factor 'appearance' in this study described the way the studied object or environment looks like, for instance the colours on the wall.t

2 Methodology

2.1 Study design

The study was conducted in February and March 2016 among 195 nurses, 154 patients and 150 visitors in a tertiary hospital. For the study a questionnaire was created, based on questions in the Pembury questionnaire, which studied relations between ward design and staff experience in the UK [11]. The questions had been translated into Dutch for a pilot study in an academic hospital in the Netherlands. In addition, questions on comfort were based on OFFICAIR [6], in which the occupants' comfort and health in European offices was studied. As the Pembury questionnaire was designed only for staff at inpatient wards, and OFFICAIR was designed only for offices, a new questionnaire was created. The wards were visited before and during occupancy. In addition, the project architect of the hospital provided information about the design of the building. The first and second author created the questionnaire in 2015. Five nursing students were involved and added a few questions.

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The language of the questions was Dutch, the national language of the hospital. A small pilot was conducted, before the study started.

The questionnaire consisted of different parts: building-related aspects (such as the view from the patient room or place to provide care), dose-related aspects (such as daylight or temperature) and occupant-related aspects (such as gender, age, education, independency of the patients). The participants had the opportunity to add remarks, suggestions or an explanation at the end of each part. Questions were formulated as neutral as possible, in order to avoid bias.

Questions rating satisfaction or importance had a five-points rating scale (very unsatisfied, unsatisfied, neutral, satisfied, very satisfied, or, strongly disagree, disagree, neutral, agree, strongly agree). If participants considered the question unsuitable for their situation, they could choose 'not applicable'. Examples of questions are: 'To which extent are you satisfied with the light in the room during the day?' or, 'To which extent are you satisfied with the ease of use of the thermostat?' In addition, patients and visitors could indicate one or more occupant-related, building-related or dose-related aspects, that contributed to their comfort. Nurses indicated which building-related or dose-related aspects hindered their working performance. The questionnaires for the patients, visitors and staff were similar, except for questions related to the work performance of the nurses.

2.2 Hospital building

The hospital building studied was completed in March 2015 and in use since August 2015 (Figure 1). The building comprised of outpatient and treatment areas and inpatient wards (480 beds). A combination of single bedrooms and shared bedrooms was realized at the inpatient wards on the upper three floor levels of the building. Both types of patient rooms had all sorts of orientation: north, east, south, and west.

Figure 1. The exterior of the hospital.

The views from the patient rooms varied, from a wide view, to a view on another wing of the hospital building, mostly at a distance of 28 m, incidental at 21 or 15 m. The colours, finishing materials, and furniture in the various bedrooms were similar (Figure 2). Finishing of the cupboards and bed panel had a light coloured, wood like appearance. Patients in the single bedrooms had their own, direct accessible bathroom. From the four-bedrooms, the bathroom was accessible from the corridor. Control of temperature, access sunlight and general lighting was possible on building and on room level (Figure 3). In each bedroom, the occupants could decrease or increase the temperature with 2 ºC. Blinds between the glass blades provided sun protection. The occupants could lower or raise the blinds, according to their needs. The blinds were available on the east, west and south facades.

Figure 2. Single bedroom.

Figure 3. Thermostat and control blinds.

2.3 Procedure

A week before the study started, the hospital organization published an announcement and explanation of the study on the Intranet, which is accessible to the complete staff of the hospital. Additionally, the team leaders received an email, in order to motivate the nurses for participation. The questionnaires for patients and visitors were distributed

at nine different inpatient wards (e.g. neurology, lung care). Hardcopies of the questionnaire were distributed personally to patients and visitors by the research assistants; a digital version was accessible for staff (nurses). During distribution, the researchers informed the nurses of each ward, before they started to invite participants. The researchers invited all patients and visitors personally for participation. Patients who were sleeping or had their bed curtains closed, were not disturbed. The participants needed 10-15 minutes to complete the questionnaire

2.4 Data management and analysis

The data from the questionnaires of the patients and visitors were manually fed in SPSS 25.0. A second person systematically checked the input of the data. The digital questionnaires of the nurses were imported in SPSS from Survey Monkey. This paper presents only the differences in satisfaction and importance between patients, visitors and staff. In order to indicate differences in general satisfaction with the patient room (based on a ten-point scale), a one-way ANOVA test was performed. For the one-way ANOVA test, it was assumed that a ten-point scale was continuous and the distribution normal. Additionally, for identification of differences between the specific groups, a post-hoc test was performed. For the post-hoc test, Hochberg's GT2-procedure was completed, as the size of the groups varied [12].

Section 3 provides an overview of differences between the groups for each question regarding IEQ, control, layout and appearance. Therefore, the tables in section 3.2 report the numbers of participants as well as the numbers and percentages of dissatisfaction (based on very unsatisfied and unsatisfied), neutral and satisfaction (based on satisfied and very satisfied). Spider web diagrams show the importance of aspects, based on the position of each chosen aspect in relation to the most rated aspect at 100%.

2.5 Ethical aspects

A Medical Ethical Test Committee approved the study and questionnaire in the autumn of 2015.

3 Results

3.1. Participants

The number of respondents was 532. Exclusion of incomplete questionnaires (30%), resulted in 499 participants (195 nurses, 154 patients, 150 visitors).

Gender and age of nurses were different compared to patients and visitors (see Table 1). More than 94% of the nurses was female, which is representative for the complete nursing staff in the hospital.

Table 1. Personal characteristics of the respondents.

	Nurses	Patients	Visitors
n	195	154	150
Female	94.3%	53.3%	63.3%
Age			
18-40 years	50.0%	5.1%	18.3%
40-65 years	50.0%	39.7%	40.4%
>65 years	0%	55.1%	41.3%

In line with the ageing society and the generally decreasing care needs related to age, more than half of the patient population was older than 65 years. As the language of the questionnaire was Dutch, for nearly all participants (up to 98%), Dutch was 'the language most used at home'.

The response rate of the questions varied between the groups and building aspects (see Table 2). The number of responses about control was low; about appearance was high. A large number of nurses answered questions on IEQ aspects, compared to patients and visitors.

Table 2. Response percentages per category respondents.

	Nurses	Patients	Visitors
IEQ	93.3%	58.3%	68.8%
Control	56.3%	49.6%	45.9%
Appearance	97.3%	95.6%	93.0%
Layout	97.0%	97.8%	83.0%
Explanation on control	-	49%	60%

3.2 Satisfaction

The difference in general satisfaction with the patient room of staff was statistically significant compared to patients and visitors ($p<0.01$), due to differences in ratings between nurses and the other two groups. There was no statistically significant difference in satisfaction between patients and visitors. The average satisfaction of staff on a scale of 1 to 10 with the bedroom was 6.2 (sd 1.56), visitors 7.5 (sd 1.1) and patients 7.8 (sd 1.2).

The satisfaction with IEQ-aspects was lower for the nurses, except for satisfaction with the protection from the sun with blinds. The latter was the same as the patient's and visitor's satisfaction. In comparison to the differences between visitors and patients, the differences in satisfaction of nurses were larger. All groups were most unsatisfied with temperature and noises during the evening or night. All groups were most satisfied with the lighting during the day and the performance of the blinds (see Table 3).

Acoustical discomfort reported by patients differed from discomfort reported by visitors. Talking as well as noises produced by building systems, or by other patients, contributed all equally to discomfort of patients. In contrast to visitors, who were not hindered by talking of staff .

Table 3. Satisfaction with IEQ aspects.

	Staff **n** *(%)*				Patients **n** *(%)*				Visitors **n** *(%)*			
Aspect	n	-	0	+	n	-	0	+	n	-	0	+
Noises during the day	**192**	**71** *(37.0)*	**46** *(24.0)*	**75** *(39.1)*	**144**	**17** *(11.8)*	**52** *(36.1)*	**75** *(52.1)*	**121**	**17** *(14.0)*	**40** *(33.1)*	**64** *(52.9)*
Noises during the night	**162**	**86** *(53.0)*	**39** *(24.1)*	**37** *(22.8)*	**132**	**22** *(16.6)*	**52** *(39.4)*	**58** *(43.9)*	**78**	**9** *(11.5)*	**29** *(37.2)*	**40** *(51.3)*
Lighting during the day	**192**	**54** *(28.2)*	**31** *(16.1)*	**107** *(55.7)*	**149**	**12** (8.0)	**22** (14.8)	**115** *(77.1)*	**132**	**2** *(1.5)*	**22** *(16.7)*	**108** *(81.8)*
Lighting during the night	**164**	**52** *(31.7)*	**28** *(17.1)*	**84** *(51.2)*	**133**	**16** *(12.1)*	**30** *(22.6)*	**87** *(65.4)*	**80**	**9** *(11.3)*	**21** *(26.2)*	**50** *(62.5)*
Performance sunscreen	**188**	**6** *(3.2)*	**36** *(19.1)*	**146** *(77.7)*	**95**	**6** *(6.4)*	**20** *(21.1)*	**69** *(72.6)*	**88**	**3** *(3.4)*	**18** *(20.5)*	**67** *(76.1)*
Darkening curtains during the night	**181**	**18** *(9.9)*	**38** *(21.0)*	**125** *(69.0)*	**119**	**2** *(1.6)*	**22** *(18.5)*	**95** *(79.8)*	**93**	**4** *(4.3)*	**27** *(29)*	**62** *(66.7)*
Temperature	**194**	**107** *(55.2)*	**51** *(26.3)*	**36** *(18.6)*	**133**	**19** *(14.3)*	**30** *(22.6)*	**84** *(63.1)*	**130**	**25** *(19.2)*	**37** *(28.5)*	**68** *(52.3)*

Note: '-' represents values 1 and 2, '0' represents the neutral position, '+' represents values 4 and 5

Table 4. Satisfaction with control.

	Staff n *(%)*				Patients n *(%)*				Visitors n *(%)*			
Aspect	n	-	0	+	n	-	0	+	n	-	0	+
Ease of use of the sunscreen	**192**	**60** (31.2)	**50** (26.0)	**82** (42.7)	**53**	**10** (18.8)	**21** (39.6)	**22** (41.5)	**63**	**8** (12.7)	**21** (33.3)	**34** (54.0)
Ease of use of the thermostat	**194**	**89** *(45.9)*	**51** *(26.3)*	**54** *(27.9)*	**63**	**7** *(11.1)*	**28** *(44.4)*	**28** *(44.4)*	**64**	**15** *(23.5)*	**23** *(35.9)*	**26** *(40.6)*
The extent of temperature regulation	**194**	**106** *(54.6)*	**43** *(22.2)*	**45** *(23.3)*	**62**	**12** *(19.4)*	**24** *(38.7)*	**26** *(41.9)*	**71**	**19** *(26.8)*	**26** ***(36.6)***	**26** *(36.7)*
Ease of use of bed light and cupboard	**184**	**64** *(34.8)*	**30** *(16.3)*	**90** *(48.9)*	**141**	**16** *(11.3)*	**27** *(19.1)*	**98** *(69.5)*	**111**	**11** *(9.9)*	**25** *(22.5)*	**75** *(67.6)*
Agreement on operation of the indoor climate	**171**	**68** *(39.8)*	**70** *(40.9)*	**33** *(19.3)*	**63**	**23** *(36.5)*	**20** *(31.7)*	**20** *(31.7)*	**35**	**13** *(37.2)*	**11** *(31.4)*	**11** *(31.4)*

Note: '-' represents values 1 and 2, '0' represents the neutral position, '+' represents values 4 and 5

Table 5. Satisfaction with appearance.

	Staff n *(%)*				Patients n *(%)*				Visitors n *(%)*			
Aspect	n	-	0	+	n	-	0	+	n	-	0	+
Appearance of the room	**194**	**7** *(3.6)*	**23** *(11.9)*	**164** *(84.5)*	**153**	**2** *(1.4)*	**18** *(11.8)*	**133** *(86.9)*	**147**	**2** *(1.4)*	**24** *(16.3)*	**121** *(82.3)*
Colours on the wall	**194**	**12** *(6.2)*	**21** *(10.8)*	**161** *(83.0)*	**148**	**6** *(4.1)*	**24** *(16.2)*	**118** *(79.7)*	**146**	**3** *(2.1)*	**26** *(17.8)*	**117** *(80.2)*
Colours on the cupboard	**177**	**2** *(1.1)*	**18** *(10.2)*	**157** *(88.7)*	**144**	**5** *(3.5)*	**16** *(11.1)*	**123** ***(85.5)***	**141**	**0**	**23** *(16.3)*	**118** *(83.7)*
View from the window	**194**	**102** *(52.6)*	**48** *(24.7)*	**44** *(22.7)*	**144**	**23** *(16.0)*	**42** ***(29.2)***	**79** *(54.9)*	**124**	**24** ***(19.3)***	**40** *(32.3)*	**60** *(48.4)*

Note: *'-' represents values 1 and 2, '0' represents the neutral position, '+' represents values 4 and 5*

Table 6. Satisfaction with layout.

	Staff n *(%)*				Patients n *(%)*				Visitors n *(%)*			
Aspect	n	-	0	+	n	-	0	+	n	-	0	+
Place for visitors	**186**	**53** *(28.5)*	**55** *(29.6)*	**78** *(42.0)*	**141**	**8** *(5.6)*	**20** *(14.2)*	**113** *(80.1)*	**143**	**6** *(4.2)*	**23** *(16.1)*	**114** *(79.7)*
Place for storage	**192**	**71** *(36.9)*	**38** *(19.8)*	**83** *(43.2)*	**140**	**22** *(15.7)*	**20** *(14.3)*	**98** *(70)*	**129**	**21** *(16.3)*	**37** *(28.7)*	**71** *(55.1)*
Place for providing care	**194**	**44** *(22.7)*	**38** *(19.6)*	**112** *(57.7)*	**146**	**5** *(3.4)*	**22** *(15.1)*	**119** *(81.5)*	**108**	**5** *(4.6)*	**23** *(21.3)*	**80** *(74.1)*
Place of toilet and shower	**185**	**42** *(22.7)*	**33** *(17.8)*	**110** *(59.9)*	**144**	**7** *(4.9)*	**24** *(16.7)*	**113** *(78.5)*	**118**	**8** *(6.7)*	**22** *(18.6)*	**88** *(74.6)*

Note: '-' represents values 1 and 2, '0' represents the neutral position, '+' represents values 4 and 5

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Nurses were less satisfied with control as well, compared to patients and visitors (Table 4). When comparing the percentages of very unsatisfied and unsatisfied participants, patients and visitors were least satisfied with negotiations about temperature regulation. Staff was least satisfied with the extent of temperature regulation. All groups were most satisfied with the ease of use of the bed light and cupboard, compared to other aspects of control.

The satisfaction of patients, staff and visitors with the appearance of the patients' room and furniture, was generally equal between the groups, except the view from bed or chair to the outside (see Table 5). All groups were least satisfied with the view from the window, compared to other aspects, although patients and visitors were more satisfied than staff.

Staff was least satisfied with the layout, compared to the other groups, which is consistent with lower satisfaction for IEQ-aspects, control, appearance and general satisfaction (Table 6). Based on the percentage of very unsatisfied and unsatisfied, all groups were the least satisfied with the place for personal possessions (patient and visitor) or medical stuff (nurses), Based on the percentage of satisfied and very satisfied, patients and staff were most satisfied with the location of the shower and the toilet, as well as place to provide care. Visitors were satisfied with the location of the shower and toilet as well, but most satisfied with the location for visitors.

3.3 Ability to control

In order to understand satisfaction with control better, the questionnaire comprised questions whether the use of equipment was explained and the level of independent use of the equipment by the patients.

Satisfaction of patients and visitors with the level of explanation and the level of personal control of the temperature and sunlight access was low, compared to satisfaction with layout, appearance and IEQ-aspects (Table 7). The answering rate was low as well, 60% of the visitors and 49% of the patients rated the question not applicable.

Table 7. Explanation during admission.

	n	-		0	+
	Use of blinds				
Patients n *(%)*	77	19 *(24.7)*		27 *(35.1)*	31 *(40.3)*
Visitors n *(%)*	46	14 *(30.4)*		14 *(30.4)*	18 *(39.1)*
	Use of thermostat				
Patients n *(%)*	74	23 *(31.3)*		25 *(33.8)*	26 *(35.1)*
Visitors n *(%)*	42	14 *(33.3)*		12 *(28.6)*	16 *(38.1)*

Note: *'-' represents values 1 and 2, '0' represents the neutral position, '+' represents values 4 and 5*

According to staff, patients were generally not able to operate the blinds or thermostat without help, although they considered the independency of the patients very important (Table 8).

Table 8. Independency patient.

	n	-	0	+
Use of blinds without help				
Staff n *(%)*	179	156 *(87.2)*	15 *(8.4)*	8 *(4.5)*
Use of thermostat without help				
Staff n *(%)*	179	148 *(82.7)*	17 *(9.5)*	14 *(7.8)*
Importance independency				
Staff n *(%)*	187	1 *(1.1)*	24 *(14.4)*	160 *(84.5)*

Note: '-' represents values 1 and 2, '0' represents the neutral position, '+' represents values 4 and 5

3.4 Importance of aspects

With respect to the different roles, the question on the importance of aspects was different for staff, compared to patients and visitors. Staff was asked which aspects hindered their work. Patients and visitors indicated which aspects were supportive to their satisfaction and comfort. They could select one or more aspects.

Staff indicated which aspects (one or more than one) hindered their work performance. For patients, as well as for visitors, occupant-related aspects were more important for their satisfaction, compared to building-related aspects or dose-related aspects, as is shown in Figure 4. Kindness of staff was the most important aspect for both patients and visitors. Patients rated the view from the window the least important aspect. Visitors rated air quality as the least important aspect. Contrary to visitors, staff considered the air quality most hindering for their work performance (Figure 5). Staff considered noise as the least hindering aspect, although, as mentioned in section 3.2 compared to lighting, they were less satisfied with the acoustics.

Figure 4. Supportive aspects for patients and visitors.

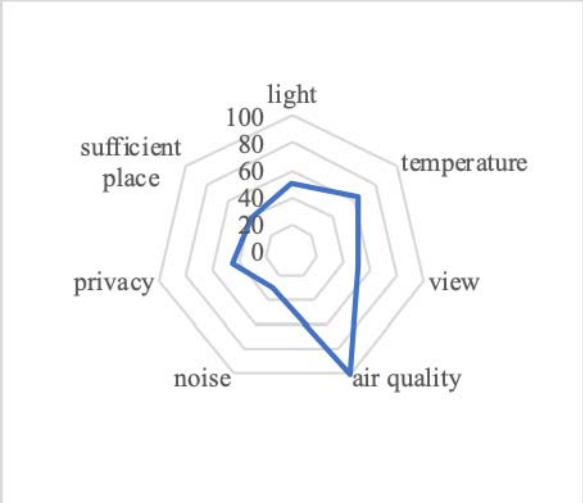

Figure 5. Supportive aspects for staff.

4 Discussion

4.1 Strengths and limitations

The aim of this pilot study was to gain more insight, if and which dose-related, occupant-related and building-related aspects contribute to differences in comfort and satisfaction of staff, visitors and patients with the patient rooms. Comparison of the results for visitors with other field studies was difficult, due to a lack of previous studies with visitors [10].

This study was limited to perception of the occupants; measurements of indoor conditions were not performed. As the occupants were least satisfied with the temperature and noise during the night, monitoring of temperature in the same season when the study was performed, as well as measurements of the sound pressure level during the night, may contribute to a better understanding of the relatively low satisfaction with temperature and noise during the night.

The findings may have been affected by differences in age and gender between staff and patients or visitors. Due to the relatively small number of female patients and visitors, aged 40-65, a comparison between gender and age groups could not be made. In future, study of only female participants, aged between 40 and 65, is relevant, in order to exclude these confounding variables.

Differences between the types of care needs due to different diseases of the patients, may also affect the findings. The study was conducted at nine different wards, such as lung functioning and orthopaedics. A comparison between the wards could not be made, due to the small number of participants from the different wards. Future research on one or two specific departments may identify potential differences in satisfaction with the bedrooms of patients and staff, related to type of care and health status of the patient.

4.2 Validation questionnaire

Although previous validated questionnaires formed the basis for the questionnaire designed, this study comprised additionally new questions, specific for patients, visitors and staff. Because the questionnaire reflects on the integral perception of the bedroom, and the intention to limit the time needed for completing the questionnaire, the questions on IEQ aspects were limited. Satisfaction with thermal quality is for instance a single question, without inquiring whether the temperature was too high or too low. Differences in satisfaction with lighting and noises during the day or night indicate the relevance of questions for day and night. Definition of the start time of an evening/night or day, for instance ‘between 7 AM and 8 PM’, may contribute to a better understanding of the questionnaire. Over 50% of the visitors, who were allowed to visit until 7.30 PM, answered these questions. As sunset was around 6 PM during the study, night was probably assumed to start at sunset. The questionnaire served its purpose, although a longer, more extended version of the questionnaire could provide information that is more specific. Because the questionnaire needs improvement, tests of significance of dose-related or building aspects were not performed.

Staff answered the questionnaire most completely, probably caused by the ease of use of a digital version (as compared to the paper version for visitors and staff). Alternatively, the nurses might have considered participation more important, as the hospital is their daily working environment. The low number of participants answering questions about control is probably related to the not so successful explanation of these features by the staff during admission of the patient at the patient ward. Alternatively, the participants considered control not important at all, which is consistent with the low ranking of importance of dose-response related aspects. A qualitative exploration of the patients’ needs and understanding about control of the IEQ in the bedroom may contribute to the development of the questionnaire and strengthen the validity of the questionnaire for future research. Further exploration of aspects that relate to control may contribute to a better understanding of the best fit between working processes and building aspects in hospitals. As a large percentage of the nurses found independency of the patients important, and most nurses agreed that the patients are not able to operate the control features, it is relevant to study which factors contribute to the inability or impossibility for controlling.

4.3 Differences in comfort

The findings on lower satisfaction of staff compared to patients are consistent with field studies on both patients and staff for thermal comfort [13-16], acoustical comfort, dimensions of the bedroom and privacy [18, 19] and the views of windows [8, 19] or lighting [8]. The importance of air quality for staff was consistent with findings of previous studies [20, 21]. Interpretation of the differences between staff and visitors in rating of the importance of air quality is difficult, due to limited

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studies with visitors. An additional question about satisfaction with air quality in the questionnaire may contribute to a better understanding of the difference between staff and visitors. As wellbeing of staff is beneficial for patient outcomes as well, it is important to improve the satisfaction of staff [22, 23].

4.4 Applicability

The differences in satisfaction found between IEQ-aspects, control, layout and appearance may contribute to a better understanding of the needs during the programming, design and engineering process of hospitals. The ranking of importance of different aspects however needs careful consideration. Although participants ranked specific building aspects less important, these building aspects contribute to the health of occupants. For instance, although patients ranked a view from the window least important, the quality of the window view may affect their health. Ulrich (1984) performed a field study with patients, recovering after cholecystectomy. Patients in bedrooms with a view on nature stayed shorter and used less pain analgesics, compared to those with a view on a closed brick wall [24].

Another example is the relatively low importance of daylight, as reported by staff. Previous studies found relations between daylight and health. For instance, nurses who had been exposed longer to daylight were more satisfied with their job and reported lower job stress [25]. An extension of the questionnaire regarding questions about health of the occupants, may contribute to a better understanding of the importance of different aspects.

4.5 Research and education

Within the hospital organization, the study had a positive spin-off. The research strengthened the cooperation between the education and science department and quality management. Besides, due to the involvement of students in the questionnaire design and distribution of the questionnaires among patients and staff, the connection with the nursing school improved, which is relevant to gain high-qualified personnel.

5 Conclusions

For all we know, this was the first study with patients, visitors and staff at inpatient wards, with regards to IEQ aspects, control, layout and appearance. The overall satisfaction with the patientroom of staff was statistically significant lower in comparsion to both patients and staff. As the differences between visitors and patients were relatively small, and satisfaction of staff is beneficial for patients as well, future study with staff appears to be most relevant. Although patients and visitors considered social factors, such as kindness of staff, most supportive to their comfort and satisfaction, the appearance of the patient room was rated important as well. Staff rated air quality as the most important aspect for their work performance. For all groups satisfaction with appearance was largest, layout second, IEQ third and control fourth. Ranking of satisfaction with various dose-related and building related aspects was generally the same for all groups. Further study of the importance of control, in coherence with occupant-related, dose-related and building-related aspects, is relevant in order to improve the overall satisfaction in the future.

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