Construction and Validation of a Hospital Environmental Rating Scale

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Abstract

The purpose of this study is the construction and validation of a Hospital Environmental Rating Scale (HERS) for use in studies measuring the effect of physical environmental stimuli on patients in a hospital. This HERS can contribute a uniform way of rating the environment in studies on healing environments and provide insight into the psychologically mediated influence of the physical environment. Healing environments are environments that contribute to the well-being and speed of recovery of patients. The HERS will measure rating of the environment in a mostly cognitive way and contain dimensions of environmental perception.

Eighty-four participants from seven wards in a hospital in Enschede took part in the study, 32 male and 57 female, average age 46.7. The survey included a list of 49 bipolar items from which the HERS was to be constructed and several control measures such as anxiety, pain, rating of care and number of hospital visits per year. Hospital rooms were also rated on several physical characteristics such as use of colour, number of windows and type of view.

For construction of the HERS exploratory factor analysis was conducted. This did not yield a complete HERS that could be based on the dimensions of environmental perception. For further analysis in this study an HERS-10 was constructed containing the dimensions pleasantness and professional quality.

Results show that pleasantness is related to pain, rating of received care, wall colour, floor colour, type of view, type of sunlight, number of occupied beds and number of windows. Professional quality is related to rating of received care, sunlight and number of windows. The results of this study provide a starting point from which to construct a standard HERS for use in hospitals.

Introduction

The physical aspects of a hospital room can have a profound effect on the patient. This influence can be very direct (mainly physiological in nature), but can also be more indirect and take a psychological pathway. This study is mainly interested in the psychologically mediated effect the hospital room has on a patient's health. Several studies have been carried out to try and summarize this effect but as of yet the exact influence remains uncertain. This is mainly due to the fact that the analyzed studies were not well put together methodologically and were not suitable for meta-analysis (Dijkstra, Pieterse & Pruyn, 2006). This problem could be solved by making sure there is a standard instrument that can be used in this type of studies. Instead of looking only at the health of the patient (for example at the speed of recovery) this instrument should focus on the psychologically mediated effects of the hospital room. The purpose of this study is the construction and validation of such an instrument: a Hospital Environmental Rating Scale (HERS). Using the HERS studies will not only be more comparable, it will also provide insight in the psychologically mediated influence of the hospital room on the patient.

Physical Environment and Health

Many studies have been carried out that investigate the interaction between environment and behaviour (Russel & Ward, 1982). The findings from these studies can also be relevant to the study of the influence of the environment on health. In this study the type of environment studied is very specific: the physical aspects of a hospital room.

The interaction between person and environment is complicated. There is of course a very obvious direct interaction between person and environment; a person can change his or her environment, he can move things around or remove items from a room. The environment can also determine the behaviour of an individual. For example when a person arrives at a building and needs to get to the top floor, the obvious behaviour might be to take the elevator. If however the elevator is out of order, he will be forced to engage in a different kind of behaviour: climbing the stairs. The second way the environment can influence a person's behaviour is more indirect, through psychological pathways. For example, consider a person at work. If this person likes the way his work environment looks and feels, it can make him feel good, which in turn can influence his behaviour.

In this study the interest lies not only in the effect of the environment on the behaviour of a person, but also in the effect on his health. The physical environment that a patient is in can contribute to the healing process (Dijkstra et al., 2006). Hospitals however are often designed in terms of functionality and efficiency (Ulrich, 1991 & Gesler, Bell, Curtis, Hubbard & Francis, 2004). This type of design has its benefits; for example it can help to reduce the number of nurses and doctors needed (Stichler, 2001) and make sure the patient receives his care as quickly and effectively as possible (Shumaker & Pequegnat, 1989). It has been suggested though, that this method of design '*can make hospitals psychologically hard'* (Leather et al., 2003). So, these effective and functional hospitals may have a negative psychological effect on patients (Ulrich, 1991). Hospitals are *'strange and alien places*' for most people, and often generate negative emotions in patients and visitors (Leather et al., 2003). What then, constitutes a well designed hospital in the psychological sense?

When designing an environment so that it contributes to health and well-being the term 'healing environment' is used. The idea behind a healing environment is that the environment in a hospital can contribute to the speed with which a patient recovers (Stichler, 2001). There seems to be a growing interest towards designing hospitals in a way that supports the healing process (Devlin & Arneill, 2003). Before designing a hospital that is a healing environment, one has to know what exactly healing environment is. The effects of specific physical stimuli in the environment on health and well-being need to be studied. In the case of this study: the psychologically mediated effect of the physical aspects of the hospital room will be the focus, the type of influence that is *'a result of sensory perception'* (Dijkstra et al., 2006) Note that it is often very difficult to separate indirect from direct influence. If a gray carpet is replaced by a blue vinyl floor and after a period of time it is found that patients in that room recover faster, how can we be certain what caused this? Was it the more sterile environment, or the relaxing blue color? It is safe to say that it was probably a combination of both. This combined influence through direct and indirect pathways is illustrated below in figure 1, a model of the relationship between person, environment, behaviour and health. The model was adapted from the environment-behaviour model constructed by Greenland & McGoldrick (2005) in order to fit the healthcare setting.

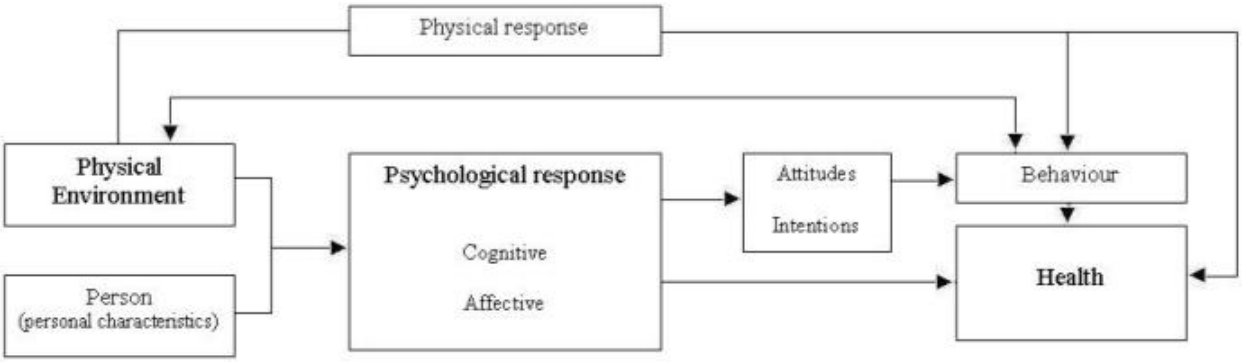

Figure 1
Environment-Behaviour-Health Model

The pathway this study is concerned with is from the physical environment, through the psychological response to health. The HERS to be designed should be situated just behind the psychological response.

Which physical environmental stimuli affect a person's health through a psychological response, and are their effects beneficial or detrimental? There are several reviews available that attempt to summarize these effects (e.g. Ulrich & Zimring, 2004; Dijkstra et al., 2006, Devlin & Arneill, 2003). Ulrich & Zimring (2004), state that, in light of the current *'hospital building boom'* in the United states, hospital design should be reconsidered so that it can help *'reduce staff stress and fatigue and increase effectiveness in delivering care, improve patient safety, reduce patient and family stress, improve outcomes and improve overall healthcare quality'*. With regard to the physical environment contributing to the health and well-being of patients through indirect (psychological) pathways, the reduction of patient stress seems the most relevant of these

suggestions. Stress is mostly defined as *'an imbalance in perceived demands and perceived coping resources'* and can be used to explain how physical environmental stimuli can influence health and well-being (Leather et al., 2003). Evans (as cited in Leather et al., 2003) described three different ways in which the physical environment might contribute to stress. First, the environment may act directly as a stressor on the system of an individual. Second, the physical environment may damage or ameliorate coping responses and finally, it might elicit coping strategies that lead to poor health and well-being. As Leather et al. (2003) point out; this is relevant to the hospital setting in several ways. The hospital environment can be a source of stress, for example because all the complicated equipment at the patients' bedside are stressing. The hospital environment could also be used as a source of coping strategies and help the patient in using adaptive coping strategies. An example of this is when the hospital provides a space where the patient can talk privately with family and friends. The physical aspects of a hospital should be designed in such a fashion that they are low stressors, or preferably not stressors at all, and help patients cope with the obvious stress associated with the need to stay in a hospital (illness, operations and even fear of death).

For the reduction of stressful qualities of the physical environment of a patient Ulrich & Zimring (2004) make suggestions in several areas. Of relevance to this study are their suggestions for (a) reducing depression in patients by exposure to natural (morning) light, (b) providing nature and other positive distractions (e.g. music, art) and (c) to help patients seek social support by providing single-bed rooms that allow patients the presence of family and friends.

In a review of the literature on the role of the environment in the healing process Devlin and Arneill (2003) devote a section to the ambient environment (sound, views and lighting). They review studies that have investigated the effects of noise, music, windows and views, nature elements, lighting and color. In these studies, they find suggestions for the beneficial effects of; (a) noise reducing elements, (b) music, (c) presence of windows, (d) natural views from windows, (e) pictures or paintings of natural scenes, (f) bright indirect lighting, natural or residential-type lighting and (g) use of bright colors for attracting attention and pale colors for restricted area's.

Other reviews in this area (e.g. Rubin, Owens & Golden, (1998) & Van den Berg (2005)) report similar findings and make the same suggestions for the physical environment.

In a recent review of the psychologically mediated effects of physical environmental stimuli on health and well-being Dijkstra et al. (2006) state that; *'The previously conducted reviews clearly support the general notion that environmental stimuli in the healthcare environment affect patient outcomes. But it is still unclear for which environmental stimuli, or which specific type of patients, and in which specific healthcare settings, there is conclusive evidence.'* This conclusion is due in part to the fact that the previously discussed reviews did not cover all environmental stimuli, and did not systematically select on methodological quality. In Dijkstra et al.'s (2006) review only randomized and controlled clinical trials were included. Using this criterion, only 30 suitable studies were found. Reviewed studies reported beneficial effects of sunlight, music, ocean sounds, noise reduction, odour (essential oils; orange), windows, nature views, private rooms, spatial layout (bay wards), seating patterns (sociopetal, mixed), nature, and manipulation of multiple stimuli (e.g. remodeling entire wards, refurbishing,

normalizing a ward, increasing comfort in waiting area's). However, since only 30 studies met the criteria for inclusion in this review, many features are investigated in only one or two studies. It appears that there is a lack of well-conducted controlled clinical trials in the field, and therefore, it is not yet possible determine what exactly a healing environment is.

Hospital Environmental Rating Scale

The existence of a HERS is important for two reasons. First the hospital environmental should be rated in a uniform way in all studies to ensure that they are suitable for meta-analysis. This could help in determining what physical stimuli constitute a healing environment. Second the psychological influence of the physical environment could be clarified with this HERS. The relationship between the scores on the HERS and objective health outcomes (such as duration of stay) could be studied. This could show what percentage of health is determined by the psychological influence of the environment. Moreover, if the relationship between the scores on the HERS and health outcomes proves to be strong, the HERS could be used as a quick and easy way to determine whether a hospital room has 'healing qualities' or not.

This study constitutes the development and validation of such a HERS for use in hospitals. Several Environmental Rating Scales (ERS) already exist, such as the Early Childhood Environmental Rating Scale (Sakai, Whitebook, Wishard & Howes, 2003). However, there seem to be none that can be used to rate the physical environment in a hospital. Moreover, most ERS rate many different aspects of the environment, including for example socialization and presence of structure in the subject's life (e.g. van Bourgondien, Reichle, Campbell & Mesibov, 1998). The HERS constructed in this study will be used solely for the rating of the physical environment inside a hospital room. Patients will be asked to rate their environment on subjective factors such as pleasantness, beauty, homelikeness, depressiveness and relaxing quality. Situating the HERS in the model in figure 1, it will focus on the cognitive and affective response to the environment. To determine the factors incorporated in the HERS, the dimensions people use when they perceive an environment should be studied.

When people are in a certain environment, they are assumed to create an internal representation of this environment. A lot of research has been done to try and understand what this internal representation is like, and what categories or dimensions are used (e.g. Pedersen, 1978, Ward & Russell, 1981). There are three dimensions often assumed to be important in the affective response to an environment; pleasure, arousal and dominance. These dimensions have been proposed by Mehrabian and Russell (1974) to be a more affective replacement for the semantic dimensions of meaning; evaluation, activity and potency. However, these dimensions have not come forward in all studies. For example Pedersen (1978) finds the dimensions of Evaluation, Spiritual, Activity and Aesthetic appeal. In table 1 the results of a few factor analytic studies trying to identify the dimensions used in environmental perception of environments are shown.

Table 1
Dimensions of Environmental Perception from Factor Analytic Studies

Autors	Russel, Ward & Pratt(1981)	Acking (1971)	Honikman (1972)	Pedersen (1978)	Kuller (1972)
Dimensions	Pleasure Arousal Dominance	Personal evaluation Social evaluation Spatial appearance Unity Originality Liveliness	Descriptive Potency Spatial Quality Mood	Evaluation Spiritual Activity Aesthetic appeal	Pleasantness Social Status Complexity Unity Enclosedness Potency Originality Affection

In addition to these many dimensions shown in table 1, in some unpublished Dutch research concerning hospital environments the dimensions of pleasantness, familiarity and professional quality have been used.

Although there is considerable overlap between the dimensions, particularly concerning the personal evaluation dimension and the spatial evaluation dimension, there is also a lot of discrepancy. In this study the HERS will be based on all of these possible dimensions, as long as they could be seen as relevant to a hospital environment. All of the studies in table one included long lists of items sorted by dimension, and these were used for inspiration. Further construction of the HERS will be discussed in the method section of this report.

In sum, the purpose of this study is the construction and validation of a Hospital Environmental Rating Scale (HERS) for use in studies measuring the effect of physical environmental stimuli on patients in a hospital.

Method

Participants

Participants were selected in a hospital (Medisch Spectrum Twente, city of Enschede). Seven wards participated, two medium care thoracic wards (A2,D2), two pulmonary wards (A4,C4), one vascular surgery ward (C3), one cardiology ward (E2) and one gynecology/maternity ward (E4). This relatively large amount of wards was chosen to provide many different types of hospital rooms and many possible participants. Wards E2 and E4 were in a different building but belong to the same hospital. Patients who were unable to complete the questionnaire by themselves were excluded, as were patients with COPD (chronic obstructive pulmonary disease) as these patients were already participating in two other studies.

The survey was completed by 90 patients in total, 32 male and 57 female. After exploring the data 6 participants were excluded due to their extreme scores on pain (3 participants) and rating of care (3 participants). This brings the total to 84 participants, 30 male and 53 female. The average age was 47 with a standard deviation (SD) of 19.4. Distribution of patients across the wards can be seen in table 2.

Table 2
Distibution of Participants sex and age Across the Wards

Ward	Patients	Male	Female	Av. age	SD
A2 (thoracic)	7	71.4%	28.6%	59.0	5.9
D2 (thoracic)	6	66.7%	33.3%	63.2	13.8
A4 (pulmonary)	7	57.1%	42.9%	52.1	24.6
C4 (pulmonary)	11	45.5%	54.5%	58.6	16.4
E4 (maternity)	36	0%	100%	30.0	5.5
C3 (vascular)	11	72.7%	27.3%	62.3	13.3
E2 (cardiology)	6	66.7%	16.7%	62.4	23.2
Total	84	35.7%	63.1%	46.7	19.4

Of these patients 82.1% visited the hospital once a year or less, for 13.1% this rate was 2 to 5 times per year. In total, 44.0% had already had surgery, 4.8% was awaiting surgery, 35.7% would not have surgery during this stay and 9.5% did not yet know if they were to have surgery. Distribution of these groups across wards can be seen below in table 3.

Table 3
Number of Hospital Visits per Year and Presence or Absence of Surgery

Ward	Hospital visits per year		Surgery			
	1 or less	2 to 5	Done	Awaiting	None	Unsure
A2 (thoracic)	100%		100%			
D2 (thoracic)	66.7%	33.3%	100%			
A4 (pulmonary)	57.1%	28.6%	14.3%		42.9%	28.6%
C4 (pulmonary)	63.6%	18.2%			90.9%	
E4 (maternity)	91.7%	8.3%	38.9%	2.8%	44.4%	13.9%
C3 (vascular)	81.8%	18.2%	72.7%	18.2%		9.1%
E2 (cardiology)	83.3%	16.7%	16.7%	16.7%		16.7%
Total	82.12%	13.1%	44.0%	4.8%	35.7%	9.5%

Hospital environment

Across the seven wards 42 different rooms were included in the study. These rooms varied in many aspects, but only those of interest to the study were recorded. Distribution of important aspects across the wards can be seen below in tables 4-7.

Table 4
Distribution of the Number of Windows and Type of View Across the Wards

Ward	Number of windows			Type of view			
	1	2	4	blocked	partially blocked	rural	rural +nature
A2 (thoracic)	28.6%		71.4%			57.1%	28.6%
D2 (thoracic)			100%			100.0%	
A4 (pulmonary)	28.6%		71.4%		71.4%	28.6%	
C4 (pulmonary)	27.3%		72.7%		54.5%	45.5%	
E4 (maternity)	44.4%	55.6%		25.0%	36.1%	38.9%	
C3 (vascular)	27.3%		72.7%	72.7%	18.2%		9.1%
E2 (cardiology)	33.3%	66.%		16.7%	83.3%		
Total	33.3%	28.6%	38.1%	21.4%	36.9%	36.9%	3.6%

Table 5
Distribution of the Cardinal Orientation of the Rooms Across the Wards

Ward	Cardinal orientation							
	N	NE	E	SE	S	SW	W	NW
A2 (thoracic)		28.6%		14.3%				57.1%
D2 (thoracic)				66.7%				33.3%
A4 (pulmonary)		28.6%		42.9%				28.6%
C4 (pulmonary)			9.1%	54.5%				36.4%
E4 (maternity)			41.7%		33.3%		25.0%	
C3 (vascular)				54.5%		9.1%		36,4%
E2 (cardiology)			16.7%		66.7%		16.7%	
Total		4.8%	20.2%	23.8%	19.0%	1.2%	11.9%	19.0%

Table 6
Distribution of the Size of the Rooms and Number of Beds per Room Across the Wards

Ward	Room size				Number of beds			
	$20m^2$	$24m^2$/ $25\ m^2$	$32m^2$	$35m^2$	1	2	3	4
A2 (thoracic)		28.6%	71.4%		28.6%	28.6%		42.9%
D2 (thoracic)			100%			100.0%		
A4 (pulmonary)		28.6%	71.4%			28.6%	14.3%	57.1%
C4 (pulmonary)		27.3%	72.7%		9.1%	18.2%		72.7%
E4 (maternity)	33.3%	11.1%		55.6%	33.3%	11.1%		55.6%
C3 (vascular)		27.3%	72.7%			27.3%		72.7%
E2 (cardiology)		33.3%		66.7%		33.3%		66.7%
Total	14.3%	19.0%	38.1%	28.6%	17.9%	25.0%	1.2%	56.0%

Table 7
Distribution of the Wall Colors Across the Wards

Ward	Wall Color			
	White	*yellow*	*Light blue*	*Light green*
A2 (thoracic)	14.3%	14.3%		71.4%
D2 (thoracic)		33.3%	66.7%	
A4 (pulmonary)	100%			
C4 (pulmonary)	100%			
E4 (maternity)	100%			
C3 (vascular)	100%			
E2 (cardiology)	100%			
Total	85.7%	3.6%	4.8%	6.0%

Design

All participants completed the survey while in their hospital room. None of the researchers were present in their rooms while the patients completed the survey but other patients, visitors and hospital staff regularly were. Participants were asked to participate in the survey on their third day in the hospital, and completed the survey the same day. As an exception to this, patients on the thoracic wards participated on their fourth day of stay, as these patients undergo surgery on their second day, returning on their third day

and thus having spent approximately the same time in their rooms on the fourth day as the other patients would have on their third day. Also, most of these patients would still be recovering from surgery on their third day, and thus unable to complete the survey.

Measures

Environmental rating scale

The HERS contains items that attempt to measure the patient's subjective rating of his environment. Items consist of words commonly used when describing an environment. These words are assumed to belong to several dimensions of environmental perception and are derived from many studies that attempted to find these dimensions (Russel, Ward & Pratt,1981; Acking, 1971; Honikman, 1972, Pedersen, 1978 & Kuller, 1972). In addition some words were added that were suspected to be relevant in a hospital environment. Finally, a list of 49 bipolar items was constructed. Items were rated on a 5 point semantic differential.

The complete survey consisted of the HERS, followed by some additional measures. These measures were added because they could influence how patients rate their environment (for example; a patient that is in a lot of pain might rate his environment in a negative way) and will be used to asses the internal validity of the HERS. Directly following the HERS were three 11 point scales (0-10), asking the patient to rate how much pain he felt, how tired he was and how much shortness of breath he was experiencing. Then a combined version of the Positive and Negative Affect Scale (Panas) and the dimension 'tension' of the Profile of Mood States (POMS) followed. Here patients were asked to rate the presence of several emotions on a 5 point scale. Then, patients were asked to rate the care they have received so far in the hospital on a scale of 1-10. Also, they were asked how many beds were in their room, how many of these beds were occupied at the time of completing the survey, how long the patient expected his hospital stay to be from this point, what the weather was like at the time of completion of the survey and what the time was. Then, patients were asked if they had changed anything in their rooms during their stay, if they had any suggestions concerning their rooms. Finally, sex and age were recorded, as well as the number of hospital stays per year, and if there was need for an operation during this stay. The survey consisted of a total of 88 items on 10 pages including instructions. The complete survey can be found in Appendix A (Dutch version).

Scoring form

Several characteristics of the rooms were recorded on a scoring form by the researcher. The characteristics where those corresponding to the physical environmental stimuli that are most likely have influence on patients' health and well being (see introduction). These characteristics included the number of windows, type of view, cardinal direction, size of the room, number of beds, presence of plants and presence of TV's. The form used for scoring the rooms consisted of one page with 9 items and can be found in Appendix B (Dutch version).

Analysis

Reliability and descriptive statistics

The statistical analysis of the survey started with a reliability analysis of the Panas and Poms scale using cronbachs alpha. Frequencies and averages (when possible) were examined for all measures other than the HERS.

Item reduction

Exploratory factor analysis was conducted on the HERS to try and determine how many factors could be found, and which dimensions these factors could represent, as well as which items the final HERS should contain. For each factor a score will be calculated for each individual. This score will range from 1-5, in which 1 will be negative (e.g. unpleasant) and 5 will be positive (e.g. pleasant). As the construction of the HERS is one of the main purposes of this study, this analysis will be discussed further in the results section of this report.

Internal validity

To determine whether the HERS in fact measures the rating of patients' environment, several control measures were included in the survey. These measures were of factors that were expected to influence the way a patient rates his or her environment. Ideally the HERS measures only the patients rating their environment, and is not influenced by these factors. If any factor is found to have a possible influence it will be considered a possible confounder. It will then be added as a covariate in the analysis of external validity. The control factors and their measures include positive affect (PA) measured by the PanasPA, negative affect (NA) measured by the PanasNA, tension measured by the POMS-tension subscale, pain (0-10 point scale), tiredness (0-10 point scale), shortness of breath (0-10 point scale), rating of care (1-10 point scale), expected duration of stay (open question), number of hospital visits per year (once a year or less, two to five times per year, six to ten times per year, more than 10 times per year) and presence or absence of surgery (already been in surgery, surgery still to come, no surgery this stay, not sure yet). For each of these measures a hypothesis was formed on its correlation with the factors from the HERS. These hypotheses and their method of testing are described below.

H1. There is a positive correlation between positive affect and the score on the HERS.
H2. There is a negative correlation between negative affect and the score on the HERS.
H3. There is a negative correlation between tension and the score on the HERS.

In the survey affective states are measured using PanasPA/NA and a subscale of the POMS; tension. Positive affect (PanasPA) is expected to be positively correlated with the scores on the HERS, negative affect (PanasNA and POMS-tension) is expected to be negatively correlated with the HERS. There are two possible explanations for the expected correlation. First patients' affective state can influence the way they see their environment. Second the way patients feel about their environment can affect their affective state. Most likely both types of influence occur at the same time. This hypothesis will be tested by calculating a Spearman correlation between the HERS factors and the score on the PanasPA scale, PanasNA scale and POMS-tension subscale.

Because high scores on the PanasPA scale represent high positive affect a positive correlation that is statistically significant ($p < 0.05$) will confirm H1. H2 and H3 will be

confirmed if a negative correlation with the HERS scores that is statistically significant ($p < 0.05$) is found.

H4. There is a negative correlation between pain and the score on the HERS.
H5. There is a negative correlation between tiredness and the score on the HERS.
H6. There is a negative correlation between shortness of breath and the scores on the HERS.

It is expected that if patients are in a lot of pain, are very tired or are very short of breath this can influence the way they see their environment in a negative way, thus resulting in a lower rating of their environment and low scores on the HERS. These hypotheses will be tested by calculating a Spearman correlation between the HERS factors and the score on the pain, tiredness and shortness of breath scales. Because high scores on these scales represent a lot of pain, tiredness or shortness of breath negative correlations that are statistically significant ($p < 0.05$) will confirm these hypotheses.

H7. There is a positive correlation between the rating of received care and the scores on the HERS.

It is expected that if patients rate the care (from nursing staff and doctors) they are receiving as high this can influence the way they see their environment in a positive way, thus resulting in a higher rating of their environment and high scores on the ERS. It may also be that the influence acts the other way around; when a patient likes the room he is in he could also rate the care he receives in that room higher. This hypothesis will be tested by calculating a Spearman correlation between the ERS factors and the score on the received care scale. A positive correlation that is statistically significant ($p < 0.05$) will confirm this hypothesis.

H8. There is a negative correlation between the expected duration of stay and the scores on the HERS.
H9. There is a negative correlation between the number of hospital visits per year and the score on the HERS.

It is expected that if patients are expecting to stay for a long period of time or have been in the hospital for many times in the past year this can influence the way they see their environment in a negative way (e.g. because they feel negative about the fact that they won't be going home soon or they have been here so often), thus resulting in a lower rating of their environment and low scores on the HERS. These hypotheses will be tested by calculating a Spearman correlation between the HERS factors and the expected duration of stay and the number of hospital visits per year. Negative correlations that are statistically significant ($p < 0.05$) will confirm these hypotheses.

H10. In the groups sorted by presence or absence of surgery, the score on the HERS will be highest for patients that will not have surgery during this stay, followed by patients that have already had surgery, then patients that are not sure if they are to have surgery and lowest for patients that are still awaiting surgery.

It is expected that the anxiety (e.g. will the surgery go well or will there be complications) experienced while waiting on a pending surgery will affect the scores on the HERS the most. Waiting for the decision whether or not the patient will have surgery

is expected to have a similar, if less pronounced effect. Finally, patients that have already undergone surgery are expected to rate their environment higher as do patients that are still awaiting (possible) surgery as they already know their surgery outcome, but will rate the environment lower than patients that already know they will not have surgery. This hypothesis will be tested by analysis of variance (ANOVA). The hypothesis will be confirmed if a statistically significant ($p < 0.05$) difference is found in score on the HERS factors between the four operation groups and if the difference between groups follows the pattern suggested in the hypothesis.

External validity

To determine the external validity of the HERS the HERS scores will be correlated with several environmental characteristics. Using the data from the scoring form and the summary six factors will be studied. These factors were chosen because they are known or expected to influence a patients rating of their environment. The factors include the color of the walls (white, yellow, light blue or light green), color of the floors (brown, black, light brown or yellow), the type of view (blocked, partially blocked or rural), type of sunlight determined by cardinal orientation of the windows (North, Northeast, East etc.), number of occupied beds (1-4) and number of windows (1-3). For each of these measures a hypothesis was formed on its correlation with the factors from the HERS. These hypotheses and their method of testing are described below.

H11. The presence of colour on the walls of the hospital room has a positive effect on the score on HERS.

H12. The score on the HERS will be higher for light coloured than for dark coloured floors.

In a hospital room the color of the walls and floors determines a large part of the atmosphere of the room. Colours can have many different effects on people, for example they can influence the way a person feels (Ou, Luo, Woodcock & Wright, 2004) or people can prefer one colour over the other. In this study, due to the low number of rooms that actually had coloured walls, the effect of white vs. coloured walls will be studied. The hospital rooms used in this study had four different types of floors; black, brown, light brown and yellow. These floor colours will be divided into two groups; light floors (yellow and light brown) and dark floors (black and brown). In the case of walls it is expected that patients in rooms with colour on the wall rate the room better than patients in white walled rooms do. In the case of floors it is expected that patients in rooms with light coloured floors rate the room better than those in rooms with dark floors. These hypotheses will be tested using a T-test for independent samples or univariate analysis when controlling for confounders. H11 will be confirmed if a statistically significant ($p < 0.05$) difference is found between coloured and white walls and if the mean score on the HERS factors is higher for the colour than the white group. H12 will be confirmed if a statistically significant ($p < 0.05$) difference is found between light and dark floors and if the mean score on the HERS factors is higher for the light than the dark group

H13. The score on the HERS will be highest for rooms with a rural view, followed by rooms with a partially blocked view and lowest for rooms with a completely blocked view.

The view from a hospital room has been shown to have an effect on patients, with natural views being most beneficial (Dijkstra et. al, 2006). In this study no truly natural views were available, only rural views including a few trees. There was however a noticeable difference in the degree to which the view was blocked by walls or other buildings. For this hypothesis, it is assumed that views with the most variety (the rural views) will correlate with the highest scores on the HERS factors. This hypothesis will be tested by analysis of variance (ANOVA) or univariate analysis when controlling for confounders. The hypothesis will be confirmed if a statistically significant ($p < 0.05$) difference is found in score on the HERS factors between the three view-groups and if rural views are associated with higher scores on the HERS than partially blocked views, and if partially blocked views in are turn associated with higher scores than completely blocked ones.

H14. The score on the HERS will be highest for rooms with morning sunlight, followed by rooms with evening sunlight and lowest for rooms with no direct sunlight.

There is some evidence that sunlight coming into a room has a beneficial effect on patients, with morning sunlight being most effective (Dijksta et. al., 2006). The type of sunlight coming into a room was determined by using the cardinal orientation of the windows in a room. Three groups were formed; morning sunlight (East and Southeast), evening sunlight (South, Southwest and West) and no direct sunlight (Northwest, North and Northeast). This hypothesis will be tested by analysis of variance (ANOVA) or univariate analysis when controlling for confounders. The hypothesis will be confirmed if a statistically significant ($p < 0.05$) difference is found in score on the HERS factors between the three sunlight groups and if morning sunlight is associated with higher scores on the HERS than evening sunlight, and if evening sunlight is in turn associated with higher scores than no direct sunlight.

H15. The number of occupied beds in a room will be negatively correlated with the scores on the HERS.

H16. The number of windows in a room will be positively correlated with the scores on the HERS.

When a room has a high number of occupied beds this not only means that a patient has to share his or her room with other patients, but also with their visitors and doctors. So, the less occupied beds in a room, the more privacy a patient has. In general it is recommended to allow a patient as much privacy as possible as this has many beneficial effects (Ulrich et. al., 2004).

The more windows there are in a hospital room, the more sunlight gets in and the more varied the view is. It is therefore assumed that many windows in a hospital room will result in a high rating of the room.

These hypotheses will be tested by calculating a Spearman correlation between the HERS factors and the number of occupied beds/number of windows in a room or univariate analysis when controlling for confounders. The hypotheses will be confirmed if a statistically significant ($p < 0.05$) negative correlation is found.

Results

Reliability and descriptive statistics

First the reliability of the PANAS and tension subscale of the POMS were calculated. Below in table 8 cronbachs alpha for the separate scales are shown.

Table 8
Conbachs Alpha for PANAS and Poms Tension

Scale	α
PANAS: PA	0.84
PANAS: NA	0.87
POMS tension	0.86

These scales are considered to have enough reliability to be used in further analysis.

Means and standard deviations for the measures of pain, tiredness, shortness of breath and the rating of received care have been calculated and are shown below in table 9.

Table 9
Distribution of Scores on Pain, Tirednes and, Shortness of Breath Scales and Rating of Care Across the Wards

Ward	Pain		Tiredness		Shortness of breath		Rating of care	
	mean	SD	mean	SD	mean	SD	mean	SD
A2 (thoracic)	2.0	1.2	3.7	2.7	3.1	1.9	8.6	1.1
D2 (thoracic)	1.7	2.4	2.5	2.6	2.7	2.3	7.8	1.3
A4 (pulmonary)	3.0	3.2	3.6	3.0	2.9	2.0	8.4	1.1
C4 (pulmonary)	2.4	2.3	4.2	3.1	4.6	2.8	8.1	1.1
E4 (maternity)	2.7	2.3	4.1	2.5	1.5	2.0	8.1	1.2
C3 (vascular)	3.6	2.5	3.2	2.1	0.9	1.5	8.4	1.6
E2 (cardiology)	1.0	1.3	4.0	2.1	1.0	1.3	8.4	1.1
Total	2.5	2.3	3.8	2.5	2.1	2.3	8.2	1.2

Item reduction

An exploratory factor analysis using principal components analysis was conducted. This analysis included all participants (n=84) and all HERS items (n=49). After varimax rotation 11 factors were extracted. These factors and the items they contain are shown in table 10 in appendix C. These 11 factors explained a total of 77.00% of the variance. For interpretation of these factors ambivalent items were first removed (items that had a high factor loading on one or more other factors than their primary factor). This method yielded factors that were un-interpretable, they contained items that seemed to have little or nothing in common. Combined with the fact that 84 participants on a list of 49 items do not provide adequate power for this kind of factor analysis this led to the decision to try another method.

In the second factor analysis Cattell's scree test was used, in other words; the 'hump' or 'elbow' in the eigen-value curve was located (McCroskey & Young, 1979). This bend occurred at 5 components (eigenvalue= 2.03), suggesting that five factors

should be extracted. An attempt was made to use this information in two ways. First all items that did not belong to the first 5 factors were removed from the HERS. This served as a means to improve the power of the analysis. The HERS now contained 37 items. Subsequent factor analysis yielded 7 factors explaining a total of 74.15% of variance. Unfortunately it proved to be impossible once more to interpret the factors as dimensions of environmental perception. The same can be said for the second attempt with the 5 components. This time all HERS items were used and were forced in to 5 factors. These 5 factors explained 60.98% of variance but where again un-interpretable. Also it should be noted that in both these methods there was still no adequate power because of the high number of items compared to the number of participants (ratio of approximately 2.3 participants for each item in the first method, 1.7 to 1 for the second).

Implications and possible explanations for the lack of clear and interpretable factors within the HERS will be discussed later. For the purpose of this study it was decided to continue with a shorter version of the HERS in which clear factors could be found. In this case, instead of empirically attempting to determine the number of dimensions in the data the number of dimensions was theory-based. In previous, unpublished research there are three dimensions that have often been used, namely pleasantness, familiarity and professional quality. These three dimensions have been found to be very reliable and consistent. A previously used list containing items from these dimensions was compared to the items in the HERS. Each item within the HERS was assessed for its compatibility with these three dimensions on face value. A short scale containing the items that seemed to represent the three dimensions the most was constructed. This initial list contained 14 items which are show below in table 11.

Table 11
Dimensions of Pleasantness, Familiarity and Professional Quality and Their Items

Dimension	Pleasantness	Familiarity	Professional quality
Items	3 prettig - onprettig (enjoyable)	20 rustig-onrustig (calm)	35 vies-schoon (dirty)
	4 vriendelijk-onvriendelijk (friendly)	14 privé-openbaar (private)	36 professioneel-onprofessioneel (professional)
	10 gezellig-ongezellig (pleasant/cozy)	12 veilig-onveilig (safe)	33 goed onderhouden-slecht onderhouden (well kept)
	7 gevoelig-ongevoelig (sensitive)	9 gewoon-ongewoon (normal)	37 praktisch-onpraktisch (practical)
	5 plezierig-onplezierig (pleasant)		34 efficiënt-inefficiënt (efficient)

Factor analysis was conducted and using varimax rotation a 3 factor solution was found. These factors explained a total of 64.28% of variance. The factor loadings for each item are shown below in table 12.

Table 12
Factor Loadings per Item on Three Extracted Components

Item	Factor loading		
	Factor 1	Factor2	Factor 3
3 prettig-onprettig	.871		
4 vriendelijk-onvriendelijk	.843		
5 plezierig-onplezierig	.832		
10 gezellig-ongezellig	.831		
7 gevoelig-ongevoelig	.696		
37 onpraktisch-praktisch		.769	.301
36 onprofessioneel-professioneel		.738	.304
9 gewoon-ongewoon		-.693	
34 inefficiënt-efficiënt		.644	
12 veilig-onveilig		.571	
33 slecht -goed onderhouden			.804
14 prive-openbaar	.345		.726
35 vies-schoon		.499	.645
20 rustig-hectisch		.431	.517

Table 12 shows that finding the first dimension, pleasantness, provides no difficulty. The first factor contains all items attributed to this dimension. The items that were assigned to the dimensions familiarity and professional quality however seem to have been scattered among factors two and three, making these factors un-interpretable. To find a clear and usable factor structure the decision was made to drop one of the three dimensions from the scale. Earlier, when attributing the items to the three dimensions on face value, the dimension of familiarity was most difficult. The HERS contained very few items that are commonly used in the dimension familiarity. Also a reliability analysis of these four items in the dimension of familiarity showed very low reliability as a scale (α = 0,246). Therefore the four items belonging to the dimension familiarity (9, 12, 14 and 20) were removed.

Using the 10 remaining items principal component analysis was again conducted using varimax rotation. Two factors were found explaining a total of 68.04% of variance. The factor loadings for each item are shown below in table 13.

Table 13
Factor Loadings per Item on Two Extracted Components

Item	Factor loadings	
	Factor 1	Factor 2
3 prettig-onprettig	.883	
4 vriendelijk-onvriendelijk	.858	
5 plezierig-onplezierig	.850	
10 gezellig-ongezellig	.847	
7 gevoelig-ongevoelig	.708	
35 vies-schoon		.846
36 onprofessioneel-professioneel		.822
37 onpraktisch-praktisch	.318	.763
33 slecht -goed onderhouden		.724
34 inefficiënt-efficiënt		.660

This solution shows two clear and interpretable factors, the first representing the dimension pleasantness and the second the dimension professional quality. These factors also proved to have high reliability as a scale, with cronbachs alpha = 0.90 for pleasantness and 0.84 for professional quality. These factors will be used for the further analysis in this report and from now on be referred to as the HERS-10. For each participant a score for both factors was calculated to be used in the rest of the analysis.

Internal validity

To determine whether the HERS-10 in fact measures the rating of patients' environment, several control measures were included in the survey. These measures were examined for correlation with the two factors, pleasantness and professional quality. These correlations are shown below in table 14.

Table 14
Correlations and significance for factors and control measures

Measure	Pleasantness		Professional quality	
PanasPA	$r(70) = .11$	$p = .37$	$r(71) = .20$	$p = .09$
PanasNA	$r(74) = -.06$	$p = .62$	$r(74) = -.09$	$p = .45$
Poms tension	$r(75) = -.09$	$p = .47$	$r(76) = -.08$	$p = .48$
Pain	$r(78) = -.26$*	$p = .02$	$r(78) = -.13$	$p = .27$
Tiredness	$r(78) = -.12$	$p = .29$	$r(78) = -.20$	$p = .09$
Shortness of breath	$r(78) = -.05$	$p = .68$	$r(78) = -.14$	$p = .23$
Rating of care	$r(67) = .41$**	$p = .00$	$r(67) = .27$*	$p = .03$
Expected duration of stay	$r(70) = .05$	$p = .71$	$r(69) = .04$	$p = .74$
Number of hospital visits per year	$r(76) = .11$	$p = .36$	$r(75) = -.00$	$p = .99$
Presence or absence of surgery	$F(3,70) = 1,33$	$p = .27$	$F(3,69) = 1,31$	$p = .28$

*$p < .05$ and **$p < .01$

The only statistically significant correlations are between pain and pleasantness, rating of care and pleasantness, and rating of care and professional quality. None of the hypotheses for internal validation that are not related to pain or rating of care can thus be confirmed. Hypotheses four and seven need to be investigated further before they are confirmed or rejected. H4 states that there is a negative correlation between pain and the scores on the HERS factors. In table 14 it can be seen that the correlation is indeed negative, but that this correlation is only statistically significant with the pleasantness subscale. This means that the hypothesis can be confirmed for pleasantness but is rejected for professional quality. H7 states that there is a positive correlation between the rating of received care and the scores on the HERS factors. Table 14 shows that there is a statistically significant positive correlation for pleasantness and professional quality. The hypothesis is thus confirmed for both pleasantness and professional quality. The implications of these rejections and confirmations will be discussed in the discussion section of this report. In the analysis of external validation the scores for pain and rating of care will be used as covariates as they can be considered possible confounders in light of their correlation with pleasantness and professional quality.

External validity

To determine the external validity of the HERS-10 pleasantness and professional quality will be correlated with several environmental characteristics. Six external characteristics will be studied. First the relationship between the characteristics and pleasantness and professional quality was examined without the use of any covariates. These relationships were examined using a T-test for independent samples for wall and floor colour, analysis of variance (ANOVA) for type of view and sunlight and Spearman correlation for number of beds and windows. The results of this analysis are shown below in table 15.

Table 15

Correlations and Significance for Factors and External Measures

Measure	Pleasantness		Professional quality	
Wall colour (white vs. colour)	$t(16) = -1.03$	$p = .32$	$t(15) = -1,00$	$p = .33$
Floor colour (light vs. dark)	$t(39) = -0.53$	$p = .60$	$t(31) = -1,19$	$p = .24$
Type of view (blocked vs. partially blocked vs. rural)	$F(2,74) = 1.44$	$p = .24$	$F(2,74) = 0.77$	$p = .47$
Sunlight (morning vs. evening vs. none)	$F(2,75) = 0.93$	$p = .40$	$F(2,75) = 1.01$	$p = .37$
Number of occupied beds	$r(77) = .09$	$p = .44$	$r(77) = -.22$	$p = .05$
Number of windows	$r(78) = .25$*	$p = .03$	$r(78) = -.09$	$p = .45$

*$p < .05$ and **$p < .01$

As can be seen in table 15 only one statistically significant correlation had been found in this initial analysis. This is the correlation between the number of windows and pleasantness. Note also that the correlation between the number of occupied beds and professional quality is marginally statistically significant. It is possible that the external characteristics interact, so to test the hypotheses univariate analysis will be used. This makes it possible to control for confounders by using them as covariates in the analysis. Because of the correlations shown in table 15 the number of occupied beds and the number of windows in a room may be possible confounders for the relationships between

the other external characteristics and the HERS-10 factors. So, these two characteristics will be used as covariates along with the two measurements from the internal validity analysis (pain and rating of care). In total this brings the number of possible covariates to 4. Each confounder will only be used as a covariate in the analysis of the relationships of the external characteristics with the factor they correlate with. Table 16 below gives an overview of which covariate will be used in which analysis.

Table 16
Use of Covariates in the Analysis of External Validity

	Pleasantness	Professional Quality
Wall colour	pain	rating of care
	rating of care	number of occupied beds
	number of windows	
Floor colour	pain	rating of care
	rating of care	number of occupied beds
	number of windows	
Type of view	pain	rating of care
	rating of care	number of occupied beds
	number of windows	
Sunlight	pain	rating of care
	rating of care	number of occupied beds
	number of windows	
Number of occupied beds	pain	rating of care
	rating of care	
	number of windows	
Number of windows	pain	rating of care
	rating of care	number of occupied beds

The results of the external validity analysis when controlling for confounders can be seen in table 17 below.

Table 17
F-Values and Significance for Factors and External Measures when controlling for possible confounders

Measure	Pleasantness	*means*	Professional quality	*means*
Wall colour	$F(4,66) = 4.40$**	(1) 3.34	$F(3,66) = 2.50$	(1) 3.79
(1) white (2) colour		(2) 3.44		(2) 3.92
Floor colour	$F(4,66) = 4.64$**	(1) 3.35	$F(3,66) = 2.52$	(1) 3.81
(1) light (2) dark		(2) 3.36		(2) 3.80
Type of view	$F(5,65) = 3.48$**	(1) 3.21	$F(4,65) = 2.23$	(1) 3.64
(1) blocked (2) partially blocked		(2) 3.31		(2) 3.74
(3) rural		(3) 3.49		(3) 3.96
Sunlight	$F(5,66) = 5.81$**	(1) 3.25	$F(4,66) = 3.91$**	(1) 3.64
(1) morning (2) evening (3) none)		(2) 3.59		(2) 4.10
		(3) 3.20		(3) 3.71
Number of occupied beds	$F(6,66) = 3.01$*	(1) 3.27	$F(4,66) = 2.18$	(1) 3.97
(1) one bed (2) two beds (3) three		(2) 3.41		(2) 3.90
beds (4) four beds		(3) 3.37		(3) 3.78
		(4) 3.31		(4) 3.34
Number of windows	$F(4,66) = 5.14$**	(1) 3.13	$F(4,66) = 4,54$**	(1) 3.77
(1) one window (3) three windows		(3) 3.45		(3) 4.12
(4) four windows		(4) 3.52		(4) 3.58

*$p < .05$ and **$p < .01$

Using these results the hypotheses for external validity can now be tested.

There is a statistically significant difference in pleasantness score for rooms with coloured walls versus rooms with white walls (H11). The same can be said for rooms with light coloured floors versus dark floors (H12). Since the mean score for pleasantness is higher in rooms with coloured walls and this difference is statistically significant H11 can be confirmed for pleasantness. In the case of H12 the mean scores for pleasantness indicate that rooms with light coloured floors are actually rated as less pleasurable as opposed to more pleasurable as the hypothesis suggests. Therefore H12 has to be rejected for pleasantness.

As the difference in mean professional quality score is not statistically significant between either wall or floor groups both H11 and H12 are rejected for professional quality.

The difference between mean pleasantness and professional quality scores in rooms with different types of view was also examined (H13). The difference is statistically significant for mean pleasantness scores only, so the hypothesis can be rejected for professional quality. To determine if the hypothesis can be confirmed for pleasantness the mean pleasantness scores for each group were examined. In the group with completely blocked views the mean pleasantness score was 3.21, for the partially blocked view group this mean score was 3.31 and for rural views 3.49. This shows that the difference between groups is not only statistically significant but also follows that pattern suggested in H13, which can thus be confirmed for pleasantness.

Table 17 shows a statistically significant difference in both pleasantness and professional quality scores between the sunlight groups. To determine if these differences follow the pattern suggested in H14 (highest mean scores for rooms with morning sunlight followed by rooms with evening sunlight and lowest for rooms with no direct sunlight) the mean scores for pleasantness and professional quality in each group were examined. Table 17 shows that the mean scores for both pleasantness and professional quality are actually highest in the evening sunlight group as opposed to in the morning sunlight group as the hypothesis suggests. The hypothesis is therefore rejected for both pleasantness and professional quality.

Regarding the correlation of the number of occupied beds with the mean scores for pleasantness and professional quality (H15) it can be seen that the mean score for pleasantness is significantly different for rooms with different numbers of beds. The difference in mean professional quality score between rooms with different numbers of beds is not statistically significant so H15 is rejected for professional quality. If H15 is to be confirmed for pleasantness more beds should equal a lower pleasantness score. The means in table 17 show that this is not true; the mean pleasantness score is highest in rooms with two beds, followed by rooms with three beds and actually lowest in rooms with one bed. Therefore the hypothesis is also rejected for pleasantness.

To confirm H16 it should be true that the more windows there are in a room, the higher the mean scores for pleasantness and professional quality are. In this case there is a statistically significant difference in both pleasantness and professional quality between rooms with different numbers of windows. For pleasantness the mean scores in rooms with one window was 3.13, in rooms with three windows this mean was 3.45 and in rooms with four windows it was 3.52. For professional quality the mean scores in rooms with one window was 3.77, in rooms with three windows this mean was 4.12 and in rooms with four windows it was 3.58. This shows that the hypothesis is confirmed for pleasantness but has to be rejected for professional quality because in this case the means do not follow the pattern suggested in the hypothesis.

Discussion

The purpose of this study is the construction and validation of a Hospital Environmental Rating Scale (HERS) for use in studies measuring the effect of physical environmental stimuli on patients in a hospital. The existence of such an HERS is important because it provides a uniform way in which patients could rate their hospital rooms in studies concerning healing environments. This would make studies more comparable and would allow meta-analysis directed at discovering the physical environmental stimuli that constitute a healing environment. The HERS could also provide insight in the psychologically mediated effects of the physical environment. It could and determine whether the effects of the physical environment are indeed psychologically mediated or if they take a different route. If the relationship between the HERS and health outcome measures proves to be strong the HERS could be used as a quick and easy measure for healing environments.

HERS development

For the development of the HERS a list of 49 items was constructed. The goal was to discover a number of underlying factors in this list that correspond to the dimensions of environmental perception shown in table 1. Several attempts were made to discover meaningful factors that correspond to any of these dimensions, but this proved to be impossible with the data in this study. The items that loaded on one specific factor often seemed to have no relation to each other and thus it was not possible to attribute them to one dimension. There are several possible explanations for the fact that dimensions that are often found in other studies were not found here.

The first explanation is that the number of participants was possibly not high enough. The list used as a basis for the HERS contained 49 items, and the number of participants was only 84 (after elimination of 6 outliers). Opinions on the sample size necessary in factor analysis vary, some authors have suggested a ratio of 4 participants to one item (Hinkin,1998), others state that 200 participants should be sufficient for almost any survey (McCroskey & Young, 1979). However with a ratio of only 1.7 participants per item it is clear that the sample size in this study meets none of these suggested criteria. As a consequence the factor analysis has low power, possibly leading to factors produced by chance correlations (alpha error) or possibly missing factors that actually do exist (McCroskey & Young, 1979). If a usable HERS is to be constructed a larger sample size should definitely be taken, containing preferably at least 200 participants.

Second, none of the other studies that report dimensions of environmental perception were conducted in a hospital or in any other medical setting. This means that both the environment the participants were in and the type of participants were different from previous studies. While many studies are carried out among (psychology) students, this was done in a hospital among patients. So the participants were not only older than most participants in other studies, they were also in a very specific situation (sick and in a hospital), all of which might lead them to perceive their environment in a different way. The dimensions students use when rating an environment might not be comparable to the dimensions patients in hospitals use. Also, in contrast to psychology students, most of these participants had never taken part in this type of research before, which may have caused them to have difficulty understanding the type of questions (e.g. rating the room by marking a point on a scale). The solution to this is not to go back to the students, but to conduct more research in an actual hospital situation. If the hospital is the place where the HERS is to be used, it is also the place to construct it. More research in the hospital environment might clarify whether there is truly a difference between students and patients in the case of environmental rating. If this difference indeed exists this implicates that while the research done with students might be a good contribution to other environmental rating studies it is not usable in the case of hospital rating. To ensure that a valid and reliable HERS is constructed all future research should then be performed in hospital settings.

Finally it is possible that even though patients were asked specifically to rate their rooms at the beginning of the survey they incorporated many other things in their rating. For example, when a patient rates his room as being unpleasant, is he really only thinking of the physical aspects of the room? Or is he, perhaps unconsciously, also thinking about that one nurse that just always seems to be in bad mood? The fact that patients evaluate their room in a much broader way than a physical environment may have influenced their

rating of the room. In hypothesis 7 the correlation between the rating of received care and the HERS factors is examined. The rating of received care is one of these factors other than the physical environment that people might incorporate in their rating of the room. As this hypothesis was confirmed for both HERS-10 factors it is likely that this problem occurs. In future studies it is advised to always control for factors like these and to remind patients to rate only the physical environment they are in.

In sum it was not possible to create a complete HERS from this data. For the use of this study the HERS-10 was constructed, containing only 10 items representing two dimensions; pleasantness and professional quality. This HERS-10 shows good internal and external validity and was analyzed in order to discover if there were any interesting relationships that might be worth studying in future HERS studies.

Internal validation

For the original construction of the HERS several control measures were added in the survey. Any correlation of the HERS-10 with these measures might indicate that the HERS-10 was measuring something other than the rating of the physical environment. Several hypotheses were formed about the relationship between the HERS-10 and these measures which will now be discussed.

H1 There is a positive correlation between positive affect and the score on the HERS.
H2 There is a negative correlation between negative affect and the score on the HERS.
H3 There is a negative correlation between tension and the score on the HERS.

These three hypotheses are all about the relationship between emotional states and the HERS. The scores for PanasPA, PanasNA and Poms-tension were correlated with the scores for pleasantness and professional quality using a Spearman correlation. All three hypotheses were rejected because of the lack of significant correlations. This means that the HERS-10 does not appear to be sensitive to feelings of tension or positive/negative affect. This is unexpected because it would seem logical for the emotional state a person is in to affect the way a patient sees his environment. For example when a person is very sad or scared it can be expected that he doesn't particularly like the environment which he is in at that point. Also it might be expected that the way a patient feels about his room affects his emotional state. If this lack of any correlation holds in future HERS studies however, it would be good news since the HERS is designed to measure environmental rating, not affect.

H4 There is a negative correlation between pain and the score on the HERS.

This hypothesis was confirmed for pleasantness but rejected for professional quality. There was a statistically significant negative correlation between pain scores and scores on the pleasantness subscale, but not between pain and professional quality. The relationship between pain and pleasantness seems obvious. The amount of pain a patient feels might influence how pleasurable he feels his room to be. The room might even be contributing to his pain, for example through an uncomfortable bed. In future HERS studies it would be wise to always include a measure of pain so the results can be corrected for this factor afterwards.

H5 There is a negative correlation between tiredness and the score on the HERS.

H6 There is a negative correlation between shortness of breath and the scores on the HERS.

These hypotheses were rejected due to the lack of a statistically significant correlation between tiredness, shortness of breath and pleasantness or professional quality. This suggests that the fact that a patient is tired or out of breath does not affect the way they rate their environment as far as pleasantness and professional quality go. This result is promising as the HERS would ideally not be influenced by physical problems like these. It seems then that it is not necessary to include a measure of tiredness or shortness of breath in future HERS studies. However, future HERS studies will likely contain more factors than pleasantness and professional quality, and it is not possible to know if these factors will also be unrelated to tiredness and shortness of breath. Because of this uncertainty and the fact that these measures are quick and easy to fill out it might be wise to include them in future studies alongside a measure of pain until more evidence is found that they don't influence environmental rating.

H7 There is a positive correlation between the rating of received care and the scores on the HERS.

This hypothesis was confirmed for both pleasantness and professional quality, suggesting that the way a patient rates the care he receives influences the way he rates his environment. This might mean that when a patient is asked how he feels about his room he also takes into account the care he receives (e.g. from nurses) in that room. It might be difficult for patients to separate the social from the physical environment. In this respect it is interesting that out of the two HERS factors pleasantness correlates highest with rating of care. This might indicate that patients rate the care they receive mainly in terms of pleasantness (Do the doctors and nurses treat me nicely?) rather than quality of care. An effort might be made to eliminate the influence of the rating of care by specifically asking patients to rate only the physical environment and try not to think of the hospital staff and the care they receive from them. The possibility that the influence is the other way around should also be considered; if a patient likes his room he might also rate the care he receives in that room higher. This phenomenon is interesting; if it is really true and the influence of the room on rating of care is strong, creating a healing environment might no longer be the main reason for changing the physical aspects of a room. It might also help improve patients' view of the care they receive in the hospital and have a positive effect on quality surveys. It is because of this possibility and the difficulty patients might have to separate the physical from the social environment that including a measure of care is always recommended in future HERS studies.

H8 There is a negative correlation between the expected duration of stay and the scores on the HERS.

There was no statistically significant correlation between the expected duration of stay and the rating of the room as pleasurable or of professional quality, so this hypothesis was rejected. It seems that the time a person expects to have to spend in a room doesn't influence how they feel about it. The time they have been in the room might have more of an effect which is why all patients completed the survey after the same length of stay. This procedure is also recommended for future studies.

H9 There is a negative correlation between the number of hospital visits per year and the score on the HERS.

No statistically significant correlation between the HERS-10 and the number of hospital visits per year was found. This could indicate that when a patient has to visit the hospital a lot this doesn't affect the rating of their rooms. Possibly this is because they are never in the same room in the hospital. Also this question had only four possible answers; once a year or less, two to five times per year, six to ten times per year and more than ten times per year. Only the first two categories were checked in the survey, so there were no patients that had been in the hospital more than five times in a year. It is possible that five times per year simply isn't enough to influence patients rating of the environment. Also it might be that patients that checked the two to five times per year answer were only in the hospital twice, making the difference with the first category quite small. It might be difficult to investigate if patients that are in the hospital more than five times per year rate their environment as less pleasurable because patients that are in the hospital that much might well be too ill to complete the survey. Because of the uncertainty of the influence of the number of hospital visits per year it would be wise to include this measure again in future HERS studies and investigate the relationship further. Future studies may show that there is no correlation at all between the number of hospital visits per year and the scores on the HERS or that the relationship is more complicated than this hypothesis suggests.

H10 In the groups sorted by presence or absence of surgery, the score on the HERS will be highest for patients that will not have surgery during this stay, followed by patients that have already had surgery, then patients that are not sure if they are to have surgery and lowest for patients that are still awaiting surgery.

There was no statistically significant correlation between the undergoing of surgery and the score on the HERS-10. This indicates that whether a person has had or will have surgery or not does not affect the way they see their room. The difference that there was between the groups did not follow the pattern suggested in the hypothesis. For example, pleasantness scores were actually highest for patients that were still awaiting surgery. An explanation for this unexpected pattern and the absence of a statistically significant different might lie in the difference in group sizes. The group of patients still awaiting surgery contained only 4 patients, while there were 35 patients that had already had surgery, 27 that did not need surgery and 8 that weren't sure yet. This difference is probably caused by the fact that all patients received the survey on their third day in the hospital. By this time most scheduled surgeries have been done (these are usually scheduled for day 2) or a decision has been made whether or not the patient needs surgery. Also it could simply be the case that because the actual presence or absence of surgery doesn't have an effect only the effects of surgery, e.g. pain and anxiety, should be studied and their corresponding HERS scores compared.

External validation

For the external validation of the HERS-10 several physical characteristics of the room were recorded. These characteristics were chosen for expected or proven effect on the health and well being of a patient. If there is a correlation between the HERS-10 and

these characteristics this might indicate that not only is the HERS-10 measuring the rating of the physical environment, it is also sensitive to physical stimuli that actually have an effect on health. This would mean that the HERS-10 is a valuable tool for the study of healing environments. Several hypotheses were formed about these relationships and they will now be discussed. All these hypotheses were tested after correction for possible confounders (pain, number of windows, rating of care and number of occupied beds).

H11 The presence of colour on the walls of the hospital room has a positive effect on the score on HERS.

This hypothesis was confirmed for pleasantness but rejected for professional quality. In the case of pleasantness a statistically significant difference was found between rooms with white walls and rooms with coloured walls and the mean pleasantness score was higher in the rooms with coloured walls. The difference between groups was only statistically significant after controlling for the factors pain, rating of care and number of windows. This might for instance be caused by the fact that pain influences the pleasantness rating of the room so much that the effect of wall colours on the rating can only be seen when controlling for pain scores. The difference might indicate that colour on the wall makes a room more pleasurable. The effect of colour on the wall on the health and well being of a patient is still unclear, but the HERS-10, when developed further, might be a good tool to investigate this effect. It should be noted here that the number of rooms with white walls (57) was considerably higher than the number of rooms with coloured walls (10). In future research a more even distribution of white and colour is recommended.

In the case of professional quality there was no statistically significant difference between rooms with white walls or rooms with coloured walls. This could indicate that the colour of the wall has no influence on whether the patient thinks the room is of high quality. Because of the uneven distribution of wall colour and the small sample size this should be investigated further before it can be said that there is no actual relationship between the colour of the wall and the rating of professional quality.

H12 The score on the HERS will be higher for light coloured than for dark coloured floors.

This hypothesis was rejected for both pleasantness and professional quality. In the case of professional quality this was because there was no statistically significant difference between the group with light coloured floors and the group with dark coloured floors. In the case of pleasantness there was a statistically significant difference between groups but the mean pleasantness score was higher for rooms with dark coloured floors. This result is counterintuitive as dark (brown & black) floors would seem to make a room dark and less spacious. There are two possible explanations for this result. First there was a rather big difference in the group sizes, 51 floors with light rooms and only 16 with dark rooms. This difference may have affected the result. Second, all rooms with light floors also have white walls and the rooms with dark floors have both white and coloured walls, with a higher occurrence of coloured walls. It could be that the higher pleasantness score is not so much a result of floor colour as of wall colour. Walls are obviously much more visible to a patient lying in a hospital bed. However, adding the wall colour as a possible

confounder in the univariate analysis of effect of floor colour did not yield a statistically significant result. To ensure that this confounding truly does not occur the effect of floor colour should be studied in a group where wall colours are the same for all rooms.

H13 The score on the HERS will be highest for rooms with a rural view, followed by rooms with a partially blocked view and lowest for rooms with a completely blocked view.

This hypothesis was rejected for professional quality due to lack of statistically significant difference between the three view groups. This indicates that the type of view has no influence on how the patient feels about the professional quality of the room. This is most likely because the view technically has little to do with the quality of the room, it mainly provides distraction.

The hypothesis was confirmed for pleasantness. Rooms with rural views showed the highest mean pleasantness score, followed by rooms with partially blocked views and the lowest mean pleasantness score was found in the rooms with completely blocked views. In previous research it has been suggested that a natural view may be beneficial (Dijkstra et al., 2006). Most hospitals however are built in a rural environment, so the fact that rural views at least seem to be better than blocked views is interesting. When building a new hospital in a rural environment builders should make sure that each room has as open a view as possible.

The fact that this statistically significant difference occurred only after controlling for the confounders pain, rating of care and number of windows is interesting. In the case of pain and rating of care it could be that the correlation with these two factors is so large that the effect of views can only be seen after controlling for these factors. The same might be said for the number of windows, but it is also clear that the number of windows and the type of view have some correlation. A room with only one window is more likely to also have a completely blocked view or partially blocked view, the rooms with rural views most commonly had 3 or 4 windows.

H14 The score on the HERS will be highest for rooms with morning sunlight, followed by rooms with evening sunlight and lowest for rooms with no direct sunlight.

This hypothesis has been rejected for both pleasantness and professional quality. There was no statistically significant difference between groups for professional quality. Though there was a statistically significant difference between groups for pleasantness scores, the means did not follow the pattern suggested in the hypothesis. The mean pleasantness score was actually highest in rooms with evening sunlight and lowest in rooms with morning sunlight. These results are confusing as morning sunlight is often considered to be most beneficial to patients' health (Dijkstra et al., 2006). However the fact that morning sunlight is beneficial to a patient's health does not mean the patient feels morning sunlight makes his room more pleasurable. In other words: it is possible that the effect of morning sunlight is not cognitively mediated. Also the rooms with evening sunlight are mostly on the south side of the hospital which means that they have the most hours of sun. Finally it should be noted that the study was carried out over the course of several months in which many different weather types were present, ranging from sunny to thunderstorm and that not every patient filled out the survey at the same

time of day. The beneficial effect of morning sunlight is assumed to be an effect that occurs when patients are exposed to this type of light for a longer period of time, but the HERS survey takes only 20 minutes to fill out. It assesses the effect of the room at that specific moment only. When a patient is in a room with morning sunlight, but fills out the survey in the afternoon it is likely that the effect that the sunlight might have on the way he rates his room is no longer present. The same can be said for filling out the survey on a clouded day. In future HERS studies it might be wise to make sure that all patients fill out the survey at the time of day when their room receives the most sunlight to make the scores more comparable.

H15 The number of occupied beds in a room will be negatively correlated with the scores on the HERS.

This hypothesis was rejected for professional quality as there was no statistically significant difference in professional quality score between rooms with 1, 2, 3 or 4 occupied beds. This might be due to the fact that the number of people in a room has little to do with the rooms' professional quality. The hypothesis was also rejected for pleasantness because although there was a statistically significant difference between groups the mean pleasantness score did not follow the pattern suggested in the hypothesis. That is the statement 'the more occupied beds the higher the pleasantness score' is not true. In fact the highest pleasantness score was found for rooms with 2 beds, followed by rooms with three beds, then rooms with four beds and the lowest mean pleasantness score was found for rooms with only one occupied bed. This result might be caused by the fact that the beneficial effect of a single bed room is mainly based on increased privacy and the pleasantness scale did not include any items related to privacy. In terms of pleasantness, a roommate might be more beneficial. Also hospital staff has explained that the rooms with single beds are often reserved for the sickest patients. There might be some confounding factor that was not included in this study that plays a role in these patients in single-bed rooms. This result raises the question just why double-bed rooms seem to be better. Is it because of the presence of a roommate, or maybe because double-bed rooms are generally more spacious than single-bed rooms? It seems wise to investigate this phenomenon further. If rooms with two beds are actually better than single-bed rooms this might be good news for hospitals, it could save space. It should be noted here that the number of occupied beds in a room actually is more of a social than a physical aspect of the environment. Possibly it should be used as a control measure in future research instead of a control for external validity. The reason this study uses the number of occupied beds in a room was that there were no real one-, two-, three- or four-bed rooms in this hospital. Whenever a bed was free it was removed from the room. Thus room 103 could be a two-bed room today but a four-bed room tomorrow.

H16 The number of windows in a room will be positively correlated with the scores on the HERS.

In the investigation of this hypothesis statistically significant difference between groups was found for both pleasantness and professional quality. In the case of professional quality the highest mean score was found for rooms with three windows, followed by rooms with one window and the lowest mean score for four windows (there were no rooms with two windows). This shows that the pattern suggested in the hypothesis; more

rooms equals a higher score, was not confirmed and the hypothesis has to be rejected for professional quality. For pleasantness the highest mean score was found for rooms with four windows, followed by rooms with three windows and the lowest mean score for rooms with only one window. This indicates a positive correlation between the number of windows and pleasantness score which means that the hypothesis is confirmed. The fact that more windows seem to make a room more pleasurable might have several reasons. First more windows will let in more light. Second the more windows there are, the more varied the view is. And finally it might simply be that a patient thinks 'I don't like this room because it only has one window'. These results suggest that care should be taken to add a high number of windows to each room when designing a new hospital as this might help patients like their room better.

Overall conclusion

Using the data available for this study it was not possible to create a complete HERS. A short version of an HERS was created and this HERS-10 revealed some interesting relationships. First the HERS-10 factor pleasantness was related to pain and rating of care. This could indicate that pain and rating of care are two things that are difficult to separate from the pleasurable quality of a room. Second the HERS-10 factor professional quality was related to rating of care. This seems an obvious relation as they are both concerned with quality. It would seem worthwhile to investigate if it is even possible to separate these two or if they are so interrelated that when rating professional quality one should always control for rating of care. The HERS-10 factor pleasantness also showed a relationship with wall colour, floor colour, type of view, type of sunlight, number of occupied beds and number of windows. This shows that pleasantness is a dimension that is related to many environmental characteristics and would be a valuable dimension to include in an HERS that is to be used in a hospital. The HERS-10 factor professional quality shows a relationship with sunlight and number of windows. The low number of characteristics this dimension is related to suggest that it should be investigated further before it is used in a hospital HERS.

In sum this study has provided the field with good starting point from which to create an HERS for use in the hospital environment, shows some interesting relationships between environmental characteristics and environmental rating and makes some useful suggestions for hospital design.

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Appendix A: Survey

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Voor u ligt een vragenlijst over de inrichting van de patiëntenkamers in het Medisch Spectrum Twente. Met deze vragenlijst willen we vaststellen wat de patiënten vinden van de kamer waar ze in verblijven.

Probeert u zich tijdens het invullen van de vragenlijst steeds te concentreren op wat u van uw kamer vindt. Hierbij zijn andere zaken, zoals het personeel of het eten, dus even niet belangrijk. Het is de bedoeling dat u steeds de kamer als geheel beoordeelt.

Vult u de vragenlijst alstublieft zo goed en volledig mogelijk in. De resultaten van de vragenlijst worden anoniem verwerkt.

Hoe vult u de vragenlijst in?

De vragenlijst start nu eerst met een lijst van woorden waarin steeds twee woorden tegenover elkaar staan. Tussen deze twee woorden staan steeds 5 keuzevakjes. U kunt dan steeds aangeven wat u van de kamer vindt door een van de 5 hokjes tussen de twee woorden aan te kruisen. Zo kunt u bijvoorbeeld kiezen of u uw kamer groot of klein vindt.

U kunt dan bijvoorbeeld op de volgende manier aangeven dat u de kamer groot vindt:

Groot ☒ ☐ ☐ ☐ ☐ Klein

Vindt u de kamer eerder klein, maar niet heel erg klein, dan kunt u dat zo aangeven:

Groot ☐ ☐ ☐ ☒ ☐ Klein

Vindt u de kamer niet groot, maar ook niet klein, dan kunt u dat op deze manier aangeven:

Groot ☐ ☐ ☒ ☐ ☐ Klein

Kies steeds bij ieder woordenpaar het hokje dat uw beoordeling het beste weergeeft. Vergeet niet daarbij steeds aan de kamer in zijn geheel te denken.

De vragenlijst start op de volgende pagina.

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Ik vind deze kamer:

1	Aangenaam	☐	☐	☐	☐	☐	Onaangenaam
2	Warm	☐	☐	☐	☐	☐	Kil
3	Prettig	☐	☐	☐	☐	☐	Onprettig
4	Vriendelijk	☐	☐	☐	☐	☐	Onvriendelijk
5	Plezierig	☐	☐	☐	☐	☐	Onplezierig
6	Helder	☐	☐	☐	☐	☐	Dof
7	Gevoelig	☐	☐	☐	☐	☐	Ongevoelig
8	Verrassend	☐	☐	☐	☐	☐	Voorspelbaar
9	Gewoon	☐	☐	☐	☐	☐	Ongewoon
10	Gezellig	☐	☐	☐	☐	☐	Ongezellig
11	Comfortabel	☐	☐	☐	☐	☐	Oncomfortabel
12	Veilig	☐	☐	☐	☐	☐	Onveilig
13	Versterkend	☐	☐	☐	☐	☐	Verzwakkend
14	Privé	☐	☐	☐	☐	☐	Openbaar
15	Prikkelend	☐	☐	☐	☐	☐	Kalmerend
16	Eerlijk	☐	☐	☐	☐	☐	Oneerlijk
17	Vertrouwd	☐	☐	☐	☐	☐	Onvertrouwd
18	Stimulerend	☐	☐	☐	☐	☐	Ontspannend
19	Discreet	☐	☐	☐	☐	☐	Indiscreet
20	Rustig	☐	☐	☐	☐	☐	Hectisch

Controleer nu of u op deze pagina bij alle vragen één hokje hebt aangekruist. Ga daarna door naar de volgende bladzijde.

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Ik vind deze kamer:

21	Activerend	☐	☐	☐	☐	☐	Rustgevend
22	Levendig	☐	☐	☐	☐	☐	Saai
23	Geruststellend	☐	☐	☐	☐	☐	Beangstigend
24	Mooi	☐	☐	☐	☐	☐	Lelijk
25	Opwekkend	☐	☐	☐	☐	☐	Deprimerend
26	Leuk	☐	☐	☐	☐	☐	Niet Leuk
27	Ordelijk	☐	☐	☐	☐	☐	Chaotisch
28	Positief	☐	☐	☐	☐	☐	Negatief
29	Van hoge kwaliteit	☐	☐	☐	☐	☐	Van lage kwaliteit
30	Goed	☐	☐	☐	☐	☐	Slecht

31	Rommelig	☐	☐	☐	☐	☐	Netjes
32	Oninteressant	☐	☐	☐	☐	☐	Interessant
33	Slecht onderhouden	☐	☐	☐	☐	☐	Goed onderhouden
34	Inefficiënt	☐	☐	☐	☐	☐	Efficiënt
35	Vies	☐	☐	☐	☐	☐	Schoon
36	Onprofessioneel	☐	☐	☐	☐	☐	Professioneel
37	Onpraktisch	☐	☐	☐	☐	☐	Praktisch
38	Informeel	☐	☐	☐	☐	☐	Formeel

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Ik vind deze kamer:

39	Open	☐	☐	☐	☐	☐	Gesloten
40	Eenvoudig	☐	☐	☐	☐	☐	Ingewikkeld
41	Groot	☐	☐	☐	☐	☐	Klein
42	Leeg	☐	☐	☐	☐	☐	Vol
43	Flexibel	☐	☐	☐	☐	☐	Star
44	Modern	☐	☐	☐	☐	☐	Ouderwets
45	Duur	☐	☐	☐	☐	☐	Goedkoop
46	Tijdloos	☐	☐	☐	☐	☐	Gedateerd
47	Huiselijk	☐	☐	☐	☐	☐	Zakelijk
48	Nieuw	☐	☐	☐	☐	☐	Oud
49	Gebalanceerd	☐	☐	☐	☐	☐	Ongebalanceerd

Controleer nu of u op deze pagina bij alle vragen één hokje hebt aangekruist. Ga daarna door naar de volgende bladzijde.

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Hier onder staan enkele vragen die gaan over hoe u zich op dit moment voelt.

Hoeveel pijn heeft u op dit moment?
Wilt u dit aangeven door een kruisje te zetten boven het cijfer dat het best van toepassing is, waarbij 0 staat voor "helemaal geen pijn" en 10 voor "ondraaglijke pijn".

Helemaal geen pijn	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Ondraaglijke pijn
	0	1	2	3	4	5	6	7	8	9	10	

Hoe vermoeid voelt u zich op dit moment?
Wilt u dit aangeven door een kruisje te zetten boven het cijfer dat het best van toepassing is, waarbij 0 staat voor "helemaal niet vermoeid" en 10 voor "maximaal vermoeid".

Helemaal niet vermoeid	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Maximaal vermoeid
	0	1	2	3	4	5	6	7	8	9	10	

Hoe kortademig bent u op dit moment?
Wilt u dit aangeven door een kruisje te zetten boven het cijfer dat het best van toepassing is, waarbij 0 staat voor "helemaal niet kortademig" en 10 voor "helemaal geen adem meer".

Helemaal niet kortademig	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Helemaal geen adem meer
	0	1	2	3	4	5	6	7	8	9	10	

Controleer nu of u op deze pagina bij alle vragen één hokje hebt aangekruist. Ga daarna door naar de volgende bladzijde.

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Nu volgt een lijst van woorden die verschillende gevoelens en emoties beschrijven.
Geef bij elk woord aan in hoeverre het beschrijft hoe u zich op dit moment voelt. Gebruik de onderstaande schaal bij het geven van uw antwoorden.

1: helemaal niet
2: een beetje
3: enigszins
4: best wel
5: heel erg

Een voorbeeld: als u zich helemaal niet geïnteresseerd voelt, dan kruist u achter dit woord het vakje onder de 1 aan, wanneer u zich best wel geïnteresseerd voelt, kruist u het vakje onder de 4 aan.
U kunt nu beginnen aan het invullen van de lijst.

Ik voel me:

		1	**2**	**3**	**4**	**5**	
1	Helemaal niet geïnteresseerd	☐	☐	☐	☐	☐	Heel erg geïnteresseerd
2	Helemaal niet ontdaan	☐	☐	☐	☐	☐	Heel erg ontdaan
3	Helemaal niet opgewonden	☐	☐	☐	☐	☐	Heel erg opgewonden
4	Helemaal niet overstuur	☐	☐	☐	☐	☐	Heel erg overstuur
5	Helemaal niet sterk	☐	☐	☐	☐	☐	Heel erg sterk
6	Helemaal niet schuldig	☐	☐	☐	☐	☐	Heel erg schuldig
7	Helemaal niet angstig	☐	☐	☐	☐	☐	Heel erg angstig
8	Helemaal niet vijandig	☐	☐	☐	☐	☐	Heel erg vijandig
9	Helemaal niet enthousiast	☐	☐	☐	☐	☐	Heel erg enthousiast
10	Helemaal niet trots	☐	☐	☐	☐	☐	Heel erg trots

Controleer nu of u op deze pagina bij alle vragen één hokje hebt aangekruist. Ga daarna door naar de volgende bladzijde.

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Ik voel me:

		1	2	3	4	5	
11	Helemaal niet geïrriteerd	☐	☐	☐	☐	☐	Heel erg geïrriteerd
12	Helemaal niet alert	☐	☐	☐	☐	☐	Heel erg alert
13	Helemaal niet beschaamd	☐	☐	☐	☐	☐	Heel erg beschaamd
14	Helemaal niet geïnspireerd	☐	☐	☐	☐	☐	Heel erg geïnspireerd
15	Helemaal niet zenuwachtig	☐	☐	☐	☐	☐	Heel erg zenuwachtig
16	Helemaal niet vastbesloten	☐	☐	☐	☐	☐	Heel erg vastbesloten
17	Helemaal niet oplettend	☐	☐	☐	☐	☐	Heel erg oplettend
18	Helemaal niet nerveus	☐	☐	☐	☐	☐	Heel erg nerveus
19	Helemaal niet actief	☐	☐	☐	☐	☐	Heel erg actief
20	Helemaal niet bang	☐	☐	☐	☐	☐	Heel erg bang
21	Helemaal niet paniekerig	☐	☐	☐	☐	☐	Heel erg paniekerig
22	Helemaal niet gespannen	☐	☐	☐	☐	☐	Heel erg gespannen
23	Helemaal niet rusteloos	☐	☐	☐	☐	☐	Heel erg rusteloos
24	Helemaal niet onzeker	☐	☐	☐	☐	☐	Heel erg onzeker

Controleer nu of u op deze pagina bij alle vragen één hokje hebt aangekruist. Ga daarna door naar de volgende bladzijde.

Hier volgen nog enkele algemene vragen over het ziekenhuis

Kunt u aangeven - met een rapportcijfer van 1 tot en met 10 - hoe tevreden u bent over de zorg, die u tot nu toe ontvangen heeft van het personeel in het MST?

☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7	8	9	10

Hoeveel bedden staan er op de kamer waar u in verblijft?
Wilt u het aantal in het onderstaande vakje invullen.

Hoeveel van de bedden in de kamer zijn momenteel bezet?
Wilt u het aantal in het onderstaande vakje invullen.

Hoe lang verwacht u na vandaag nog in het ziekenhuis te moeten verblijven?
Wilt u de verwachte tijd in het onderstaande vakje invullen (dit mag in dagen, weken of maanden).

Kunt u aangeven welke omschrijving het weer op dit moment het beste weergeeft?
□ Zonnig
□ Licht bewolkt
□ Zwaar bewolkt

Zou u willen aangeven hoe laat het op dit moment is?

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Heeft u iets aan de inrichting van uw kamer veranderd sinds u hier ligt, en zo ja, wat heeft u veranderd?

Heeft u nog suggesties wat betreft de inrichting van uw kamer?

Tenslotte nog enkele vragen over uw persoonlijke situatie:

Bent u een man of een vrouw?
Aankruisen wat van toepassing is.

Man ☐
Vrouw ☐

Wat is uw leeftijd?

_____ jaar

Kunt u aangeven hoe vaak u per jaar ongeveer in het ziekenhuis verblijft?

☐ 1 keer per jaar of minder

☐ 2 tot 5 keer per jaar

☐ 6 tot 10 keer per jaar

☐ vaker dan 10 keer per jaar

Controleer nu of u op deze pagina alle vragen in heeft gevuld. Ga daarna door naar de volgende bladzijde.

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Bent u tijdens uw huidige verblijf in het ziekenhuis geopereerd, of gaat dit nog gebeuren?

☐ Ik ben al geopereerd

☐ Ik moet nog geopereerd worden

☐ Ik hoef niet geopereerd te worden tijdens dit verblijf

☐ Ik weet nog niet of ik geopereerd ga worden tijdens dit verblijf

Dit is het einde van de vragenlijst.
Hartelijk bedankt voor het meedoen aan dit onderzoek

Appendix B: Scoring form

Objectieve kenmerken patiëntenkamer

Afdeling:
Kamernummer:

Architectural features

Hoeveel ramen zijn er aanwezig? …… ramen

Wat is het uitzicht?
□ Geheel geblokkeerd (bv. gebouw dichtbij)
□ Deels geblokkeerd, deels stedelijk uitzicht
□ Stedelijk

Ligt de kamer op het:
□ Noorden
□ Oosten
□ Zuiden
□ Westen

Hoe groot is de kamer (m²)? ……. m²

Hoeveel bedden staan er in de kamer?
□ 1 bed
□ 2 bedden
□ 4 bedden
□ Anders, nl. ……. bedden

Interior design features

Zijn er planten in de kamer aanwezig? (niet: boeketten e.d.)
□ Ja
□ Nee

Wat is de kleur van de muren?
□ Wit
□ Anders, nl. …….

Overige kleuren in de kamer?

Kleur	Waarvan?

Is er een tv aanwezig?
□ Ja
□ Nee

Appendix C: Initial factor analysis

Table 10
Factors After Factor Analysis With all Items

Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10	Factor 11
aangenaam	van hoge	rommelig	discreet	gewoon	prikkelend	duur	inefficiënt	privé	huiselijk	warm
prettig	kwaliteit	slecht	rustig	comfortabel	stimulerend	tijdloos	informeel	leeg	gebalanceerd	
plezierig	oninteressant	onderhouden	ordelijk	veilig	activerend					
vriendelijk	nieuw	vies	open	eerlijk						
helder	modern	onprofessioneel	eenvoudig	groot						
gevoelig		onpraktisch								
verrassend		flexibel								
gezellig										
versterkend										
vertrouwd										
levendig										
geruststellend										
mooi										
opwekkend										
leuk										
positief										
goed										