Hospital Rooms and Patients' Well-being: Exploring Modeling Variables

- Final Report -

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Cover image
Hospital da Luz (PT)

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Contents

Abstract

Abstract

The quality of the physical environment of hospital rooms contributes to patients' well-being, but little attention has been paid to the modeling processes involved in this relationship. This study tested the mediating role of psychological variables (perceived control, social support, and positive distraction; Ulrich, 1991), and the moderating role of contextual variables (country; expectations towards the hospital service) using objective and subjective measures and an international sample. A total of 236 orthopedic patients participated in the study: 78 American patients (23 on an un-renovated unit; 55 in a renovated unit) of a private, not-for-profit acute care general hospital, and 158 Portuguese patients (34 in a old public hospital; 68 patients in a newer private hospital; and 56 patients in an older private hospital). The numbers of favorable elements for perceived control, social support, and positive distraction were assessed with an objective coding scheme and inter-rater reliability was established. On the inpatient unit, patients responded to survey questions about 1) expectations of care 2) stress 3) perceptions of control, positive distraction, and social support 4) overall evaluation and satisfaction and 5) demographics. Health status data (blood pressure, heart rate, perception of pain, and medication use) were obtained from the electronic medical record. Cross-culturally, and related to our hypotheses, the greater the number of favorable elements in the hospital room, the greater the patients' perceptions of perceived control, social support, and positive distraction provided by the room. Similarly, there were positive correlations between the number of favorable elements in the room and 1) greater satisfaction with the service and 2) intention to select the room again and a negative correlation with 3) stress (i.e., more elements and lower stress). Evidence was found for Ulrich's theoretical model. Mediational analyses showed that perceived social support and perceived positive distraction predict satisfaction with the service, whereas perceived control does not. Moreover, for American patients, it is social support and perceived control that mediate this relationship; for Portuguese patients, it is social support and positive distraction that mediate the relationship. Patients' qualitative comments chiefly point to the importance of positive distraction, particularly large windows, the view, and natural light, on well-being, and of perceived control (e.g., functionality, private room, accessibility of equipment, cleanliness, bathroom). Implications of the results for healthcare architecture are discussed.

Keywords
hospital rooms, supportive design, well-being, modeling processes, cross-cultural comparisons

Introduction

Introduction

The influence of the quality of the hospital physical environment on patients' outcomes is well established in the literature (see Ulrich et al., 2008, for a review). However, research has paid little attention to the mediating processes through which this influence occurs, as well as to possible moderators (for an explanation of the importance of the modeling processes, see Winkel, Saegert, & Evans, 2009). Interventions in the health care physical environment will be more effective if the intervening factors that affect the success of those interventions are known. Accordingly, the present study sought to identify some of the modeling variables involved in the relationship between the quality of hospital rooms and patients' well-being.

For patients, the hospital is a peculiar, uncertain, and unfamiliar environment to which they must quickly adapt. This experience often adds even more stress to the anxiety associated with the illness, the suspension of normal activities, and the uncertainty about the future (Taylor, 1986). However, both field studies and laboratory experiments have shown that the physical environment of the hospital rooms (specific attributes, or global conditions) can support patients in dealing with the discomfort associated with the hospitalization. For example, Ulrich (1984) showed that patients in a room with a view of everyday nature recovered more rapidly and with more emotional well-being (received fewer negative evaluative comments in nurses' notes) than did patients in similar rooms with a view of a brick wall; Swan, Richardson, and Hutton (2003) found that patients recovering in appealing rooms rated their rooms and the hospital significantly higher, evaluated physicians more positively, and reported stronger intentions to use the hospital again, and to recommend it to others, than did patients in typical rooms in the same hospital. In a study with non-patients, and using a scenario describing a possible hospitalization, Dijkstra, Pieterse, and Pruyn (2008) found that a photo of a hospital room with indoor plants generated less perceived stress to participants than did a room with a painting of an urban environment on the wall.

These results can be interpreted in light of Ulrich's theory of supportive design, which provides a broad conceptualization of the ways the healthcare physical-social environment can affect patients' stress. Ulrich (1991) proposes that healthcare physical and social environments will not produce stress, but instead will promote well-being if they are designed to foster a) sense of control over physical-social surroundings, b) access to social support, and c) access to positive distractions (see Figure 1). The basic assumption is that an unknown and uncontrollable hospital

environment might be appraised as harmful and demanding, thus causing stress, but the patient's evaluation that he or she has the adequate coping resources and the environmental options to deal with it may ease the situation. Consequently, stress may be reduced or even prevented if patients feel that they can use and adjust the physical conditions in the hospital room according to their needs.

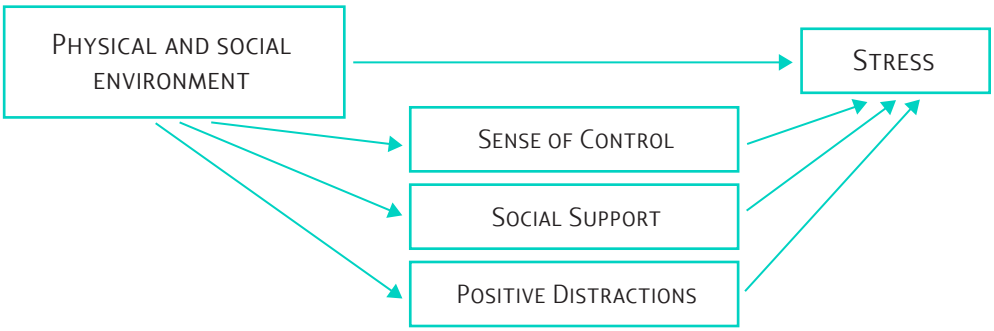

Figure 1
Adaptation of Ulrich's Theory of Supportive Design

These three psychological variables – sense of control, social support, and positive distraction – have been a focus of study by environmental psychologists, but never together. In short, *perceived control* can result from the opportunity to influence aspects of one's environment, by altering, modifying, or transforming it in some manner (Lee & Brand, 2005); *social support* has been defined as information from others that one is loved and cared for, esteemed and valued (Cohen & Wills, 1985), and the physical environment can foster it by providing the proper conditions for satisfying interpersonal interactions. Finally, *positive distraction* is elicited by stimuli that have a "directly fascinating quality" (e.g., static stimuli such as photographs, representational posters, or paintings of nature, and active stimuli such as music, and companion animals). Positive distraction is based on involuntary attention: it does not demand mental effort and helps people attend to stimuli other than their own discomfort, anxiety, and pain (e.g., Malenbaum, Keefe, Williams, Ulrich, & Somers, 2008).

Ulrich's theory is well established in the field and is often used to describe and interpret the patients' needs, or to suggest strategies or approaches for achieving a supportive design. Further, the Planetree model of patient care incorporates many aspects of supportive design (Martin, Hunt, Hughes-Stone, & Conrad, 1990). Nevertheless, no study to our knowledge has focused on investigating which design features of an inpatient room lead to perceptions of sense of control, social support, and positive distraction. Additionally, no study has tested a mediation model in which these fulfilled needs explain a decrease in perceived stress.

Therefore, in the current study we proposed to test Ulrich's theory, by investigating which design features of an inpatient room have stress-reducing effects because they improve the perception of control, social support, and positive distraction. Our team has recently tested this hypothesis

through a laboratory study (Andrade & Devlin, 2013). Participants were asked to imagine going to a hospital because of appendicitis symptoms; participants were told that they were subsequently hospitalized as they recovered from surgery. The experiment employed a between-subjects design with participants randomly assigned to a condition consisting of an illustration of a hospital room accompanied by one of eight sets of amenities and features intended to produce perceptions of control (PC) (e.g., adjustable light), social support (SS) (e.g., sleeper sofa for family and friends), positive distraction (PD) (e.g., paintings of nature), PC+SS, PC+PD, PD+PSS, PC+SS+PD (all), or none of these dimensions (control condition). Results showed that a) in the condition with the highest number of elements provided, the lowest level of stress was reported and the highest levels of perceived control, social support, and positive distraction were reported, b) only social support and positive distraction had both a reducing effect on stress, and a mediation role on the effect of the number of elements provided and stress. Although these preliminary results are enlightening, this laboratory study has several limitations. Namely, participants were non-patients and were exposed to a very limited description of the environment. At this point, a field study was needed to verify if the particular importance of positive distraction and social support holds true, and to specify which specific features of the environment contribute to these effects.

There is another important but neglected group of variables that need to be included in research on healthcare environments, namely variables related to the sociocultural context. The sociocultural context in which the hospital physical environment is embedded can change how its physical features affect people (Winkel et al., 2009), for example by setting different levels of expectations. Whereas in the US health care is often provided in private facilities, in other countries, such as Portugal, health care delivery is based on both public and private providers. All Portuguese residents have access to health care provided by the National Health Service (NHS), financed mainly through taxation. Although people prefer the public to the private services (Cabral & Silva, 2009), the use of private health care providers has been increasing over the last few years (Cabral, Silva, & Silva, 2014). Reasons for this shift to private providers may include: less waiting time, better physical conditions, and more personal attention from professionals (Cabral & Silva, 2009).

Contrary to what happens with private providers, the Portuguese population may have low expectations regarding the quality of the service in public hospitals, probably because of the association between gratuity and poor service (Portugal, 2005). This relationship is especially true for aspects such as waiting time and quality of the facilities. On the other hand, as the US population is accustomed to evaluating and purchasing health care services from the point of view of a client/consumer (Devlin, 2010; Sloane & Sloane, 2003), citizens might not only have high expectations about the service, but also react more negatively when these expectations are not fulfilled (Devlin, 1995). In fact, patient satisfaction is considered the result of the gap between expected and perceived characteristics of a service (Gotlieb, 2002). Following this reasoning, we expected that non-ideal conditions in a hospital room would probably be more easily tolerated,

accepted, and minimized by Portuguese patients in a public hospital than by Portuguese patients in a private hospital, and by Portuguese patients in a private hospital than by American patients. Therefore, we hypothesized that the relationship between physical conditions and well-being would be stronger in 1) private hospitals than in public hospitals, and in 2) American hospitals than in Portuguese hospitals. Research, including work from members of our team, has shown that the attractiveness and modernity of the hospital environment (often associated with the age of the facilities) is associated with higher expectations about the quality of care (e.g., Arneill & Devlin, 2002; Devlin, 2008) and with more positive evaluations of the quality of the hospital's physical and social environment (Andrade, Lima, Fornara, & Bonaiuto, 2012; Andrade, Lima, Pereira, Fornara, & Bonaiuto, 2013), than is true of facilities judged less modern and attractive. Accordingly, in addition to country (Portugal vs. US) and funding model (Private vs. Public), this contextual variable (Recent vs. Old) was also taken into account, to the extent possible given the facilities in the study.

As dependent variables we used vital signs, medication dosage, and subjective indicators of well-being. More specifically, our outcome measures were heart rate, blood pressure, type and amount of medication, self-reported pain ratings, perceived stress, satisfaction with the service, and the intention to return and recommend the facility. Originally we had hoped to use salivary cortisol measures, at least in our US sample, but patients had a negative reaction to being asked for a saliva sample from a non-staff member, which jeopardized patients' willingness to complete the questionnaire. For that reason, we discontinued this component of the study.

In sum, this study sought to explore the recognized relationship between hospital physical condition and patients' well-being by a) testing the role of perceived control, social support, and positive distraction as mediators (Ulrich, 1991), and by b) investigating the influence of previous expectations according to the culture, the health care funding model, and the modernity of the hospital. Moreover, including these contextual variables in the study allowed us to have diversity in terms of the qualities of hospital rooms, as well as to test the generalization of the results.

Method

Method

Research Design

We had hoped to compare public and private hospitals in Portugal with a private hospital in the US, in older and modern facilities, and in rooms with a different range of the elements that were the focus of our study (social support, positive distraction, and perceived control), as specified in Table 1.

Hospital	Room	Portugal		US
		Public	Private	Private
Older	More elements	*n*=20	*n*=20	*n*=20
	Fewer elements	*n*=20	*n*=20	*n*=20
Modern	More elements	*n*=20	*n*=20	*n*=20
	Fewer elements	*n*=20	*n*=20	*n*=20

Table 1
Proposed Study Sample

However, as is often the case in field research, what is available to study does not perfectly match the ideal research design.

For example, in Portugal we did not receive permission by the time the study began to include a more modern Public hospital. Also, the range of elements in each hospital room did not vary as widely as would have been useful to fully test the research model. Table 2 presents the actual study sample, which reflects the contrasts in culture (Portugal v. United States), the contrasts in modernization, and the more limited contrast for the public v. private dimension. Even with these limitations, we were able to compare hospitals with a diversity of types of room elements (see Table 3).

Hospital	Portugal		US
	Public	Private	Private
Older	Hospital Curry Cabral *n*=34	Hospital dos SAMS *n*=56	Lawrence + Memorial Hospital (before renovation) *n*=23
Modern		Hospital da Luz *n*=68	Lawrence + Memorial Hospital (after renovation) *n*=55

Table 2
Obtained Study Sample

The final sample consisted of four hospitals: one in New London, Connecticut, in the United States, and three in Lisbon, Portugal. The US hospital sample consisted of two units on the same floor in the same hospital: one un-renovated unit temporarily housing orthopedic patients and one renovated unit housing orthopedic patients. In Lisbon there was an older Portuguese public hospital, an older Portuguese private hospital, and a modern Portuguese private hospital. Only orthopedic units were selected to provide consistency across unit type. In the US, 76.9% of the patients were hospitalized for hip (25.6%) or knee (51.3%) replacements. In Portugal, the surgeries were somewhat more varied, but 68.4% of the patients were also hospitalized for hip (14.6%) or knee (53.8%) replacements.

Research Sites

Lawrence + Memorial Hospital (The United States)

Lawrence + Memorial Hospital in New London, Connecticut is a general, not-for-profit, acute care private hospital with 252 beds, dating its roots in the community to 1912 (see Figure 2).

Figure 2
Lawrence + Memorial Hospital (US) - exterior

In 2013 it completed a 5.5 million dollar renovation of its orthopedic unit. The focus of the comparisons in the US sample were what we labeled the "old unit," a 24 single room inpatient medical surgical unit where orthopedic patients were housed during the renovation and the "new orthopedic unit," with 26 inpatient rooms (22 singles, 4 doubles) renovated by Moser, Pilon, and Nelson Architects. In addition to the images of the unit provided in this document, the Moser, Pilon, and Nelson website (http://www.mpn-arch.com; see Health Care, Lawrence and Memorial Hospital) presents additional images of the renovated unit. The renovation involved 12,000 existing square feet and an expansion of 4500 square feet to an adjacent rooftop. Only single rooms were included in this study.

The prototypical inpatient room in the old unit is 246.7 sq. feet (42 sq. ft. of which is an inboard toilet room with no shower; see Figure 3). The rooms are all painted a pale pink and have from 0-3 art elements, one of which is typically a wallpaper border (see Figure 4). The décor might be considered dated.

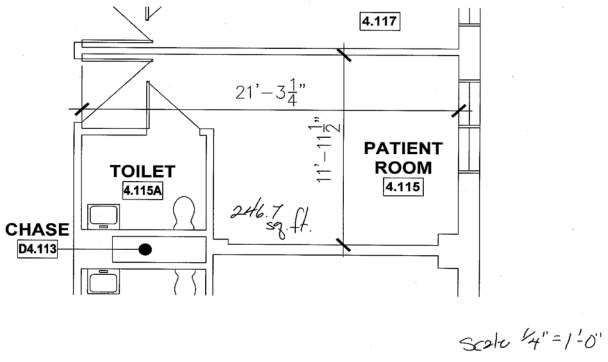

Figure 3
Lawrence + Memorial Hospital (US) - Old Unit Plan

Figure 4
Lawrence + Memorial Hospital (US) - Old Unit
Typical patient room

A prototypical room in the new unit is 234.5 sq. feet (42 sq. ft. of which is an inboard toilet and shower room; see Figure 5). The array of art is consistent and includes a representational nature image as part of the white board, a separate image of a flower (both of these typically on the wall across from the patient), and a triptych of a fern, typically positioned above the headboard (see Figures 6 and 7). The room contains a window seat that provides additional seating for visitors (see Figure 8). The new unit also has a closet to house soiled linens (see Figure 9).

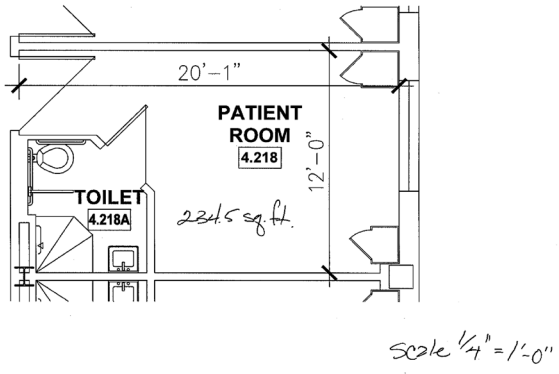

Figure 5
Lawrence + Memorial Hospital (US) - New Unit Plan

Figure 8
Lawrence + Memorial Hospital (US) - New Unit
Window seat

Figure 6
Lawrence + Memorial Hospital (US) - New Unit
Art surrounding the whiteboard

Figure 7
Lawrence + Memorial Hospital (US) - New Unit
Fern Triptych used in patients rooms

Figure 9
Lawrence + Memorial Hospital (US) - New Unit
Closet for soiled linen

Rooms in both units have a whiteboard for updating patient status, clock, television and Wi-Fi, bedside table and phone, patient chair, visitor chair, closet for belongings, and room service menu on demand (see Figures 10, old, and 11, new). On both units, rooms had either a view to some nature (a streetscape with trees) or to adjacent buildings (see Figures 12 and 13, respectively, for examples).

Figure 10
Lawrence + Memorial Hospital (US) - Old Unit
Wall with whiteboard and television

Figure 11
Lawrence + Memorial Hospital (US) - New Unit
Wall with whiteboard and television

Figure 12
Lawrence + Memorial Hospital (US)
Example of streetscape

Figure 13
Lawrence + Memorial Hospital (US)
Example of roofscape

The new unit contained a shower in addition to a toilet (see Figures 14 and 15), whereas the old unit was only a toilet room (see Figure 16).

Figure 14
Lawrence + Memorial Hospital (US) - New Unit
Entrance to shower and toilet

Figure 15
Lawrence + Memorial Hospital (US) - New Unit
Shower in new unit

Figure 16
Lawrence + Memorial Hospital (US) - Old Unit
Example of toilet room

An expansion of 4500 square feet to an adjacent rooftop included a second nursing station (see Figure 17) and a family lounge (see Figure 18). Typical corridor artwork for the new unit is seen in Figure 19, whereas an example of the corridor artwork in the old unit is visible in Figure 20.

Figure 17
Lawrence + Memorial Hospital (US) - New Unit
Second nursing Station

Figure 18
Lawrence + Memorial Hospital (US) - New Unit
Family Lounge

Figure 19
Lawrence + Memorial Hospital (US) - New unit
Hallway art

Figure 20
Lawrence + Memorial Hospital (US) - Old Unit
Hallway art

Hospital da Luz (Portugal)

Hospital da Luz, opened in 2006, is the largest private hospital in Portugal (Figure 21). Located in Lisbon (as are all of the Portuguese research sites in this study), the hospital has 168 rooms (see Figures 22, 23, and 24) and an adjacent 115 apartment residences for seniors.

Figure 21
Hospital da Luz
(PT)
- exterior

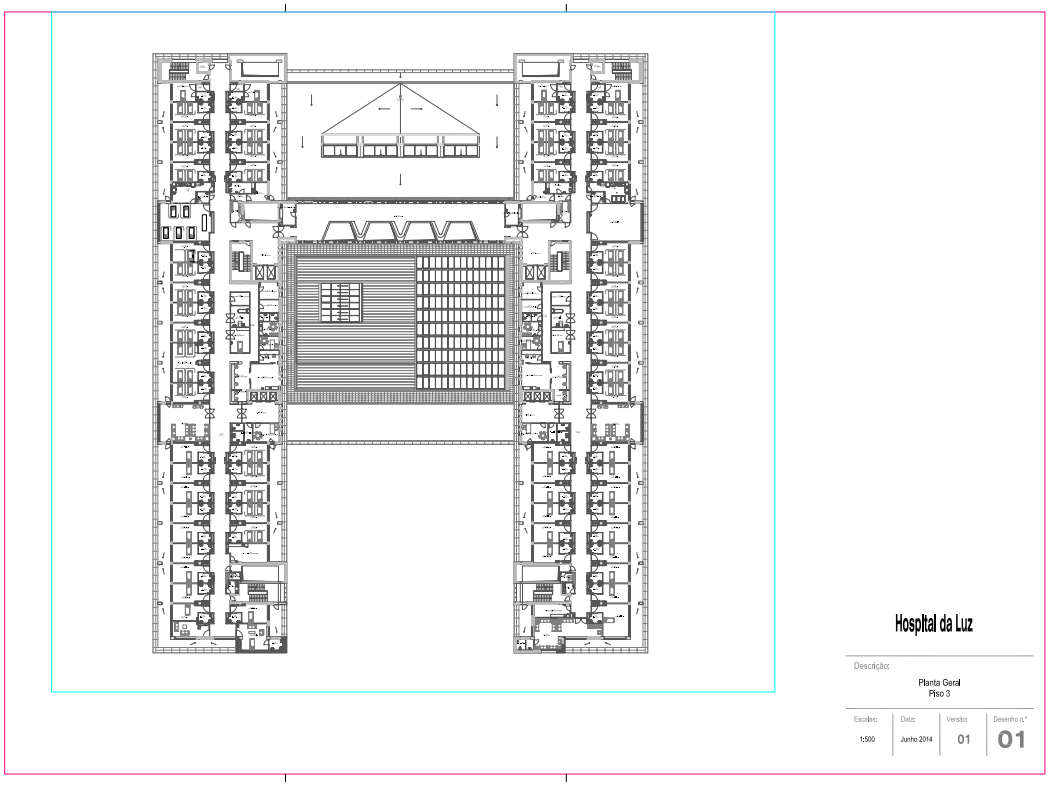

Figure 22
Hospital da Luz
(PT)
Plan

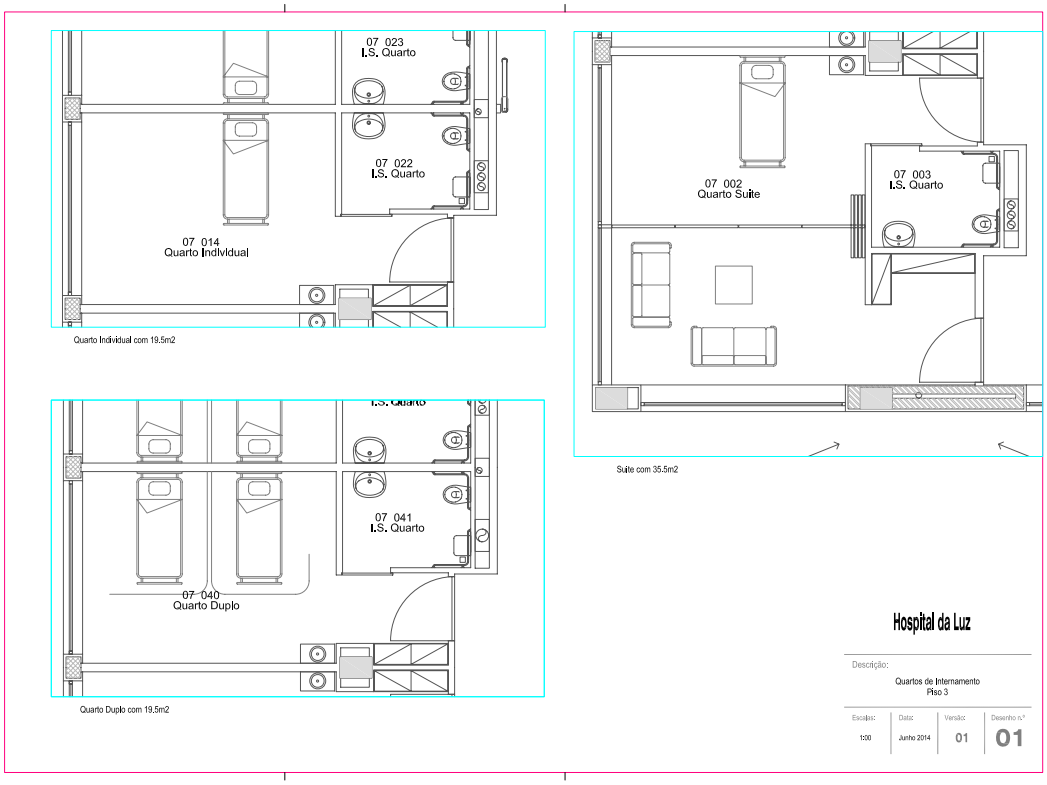

Figure 23
Hospital da Luz
(PT)
Plan

Figure 24
Hospital da Luz
(PT)
Nursing station

The data were collected on an inpatient unit for surgery patients that has two units, with 3 large suites (size: 399.9 sq. ft.) (see Figure 25), 25 singles (see Figure 26), and 35 double rooms (both with the size: 263.1 sq. ft.) (see Figure 27). The suites and the single rooms had a private toilet and shower room (see Figures 28 and 29); the doubles had a shared private toilet and shower room (inboard) (see Figure 30).

Figure 25
Hospital da Luz (PT) - Suite

Figure 26
Hospital da Luz (PT) - Single room

Figure 27
Hospital da Luz (PT) - Double room

Figure 28
Hospital da Luz (PT) - Toilet

Figure 30
Hospital da Luz (PT) - Toilet (from double room)

Figure 29
Hospital da Luz (PT) - Toilet

Walls are white, and furniture (2 small tables and a chair) is constructed of a phenolic material that imitates wood with an oak grain. The bed is electric and adjustable with a remote. All rooms have green curtains over large windows (the entire expanse of the wall), and electric blackout blinds. The view from the window is either of the interior of the hospital (predominantly to buildings) (one view), or to the street (with some view to nature) (the other view) (see Figures 31 and 32). There is a piece of art (a collage) on the wall, and a cockpit with TV (40 channels) and Internet (see Figures 33 and 34). Private rooms have a lamp, one green sofa, and one green sofa-bed, a small table in the center, and all bathrooms have a hairdryer.

Figure 31
Hospital da Luz (PT) - View 1

Figure 32
Hospital da Luz (PT) - View 2

Figure 33
Hospital da Luz (PT) - Art

Figure 34
Hospital da Luz (PT) - Monitor

Hospital dos SAMS (Portugal)

The Hospital dos SAMS in Lisbon, opened in 1994, is dedicated to serve individuals who are bank employees, including current or retired employees and their families. The facility has 121 inpatient beds (see Figures 35 and 36).

Included in this research were 13 single rooms (between 156.1 sq. ft. and 239.0 sq. ft.) (see Figure 37) and 5 double rooms (size: between 241.1 sq. ft. and 274.5 sq. ft.) (see Figure 38), and 1 triple room (324.0 sq. ft.), and all patients included in the study received orthopedic services. The single rooms had a private toilet and shower room; the doubles and the triple had a shared private toilet and shower room (see Figures 39 and 40).

Figure 35
Hospital SAMS
(PT)
- exterior

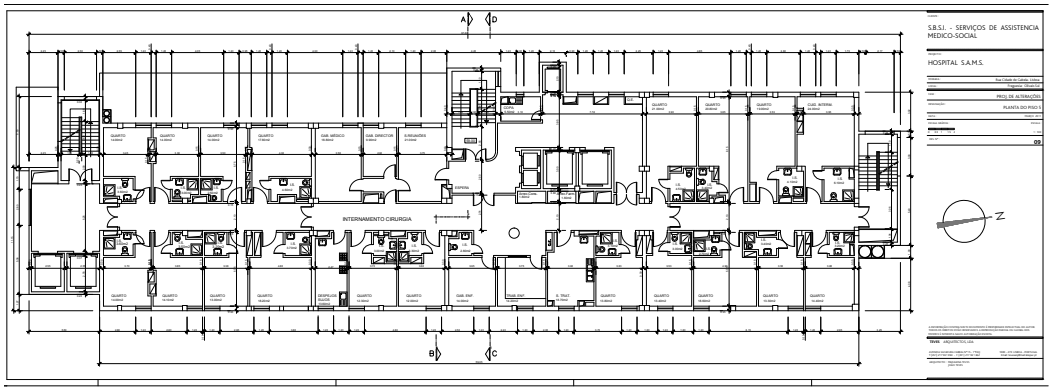

Figure 36
Hospital SAMS
(PT)
- Plan

Figure 37
Hospital SAMS (PT)
Single room and example of art

Figure 38
Hospital SAMS (PT)
Double room

Figure 39
Hospital SAMS (PT) - Toilet

Figure 40
Hospital SAMS (PT) - Toilet 2

Walls are beige, and the furniture (table and chair) is dark wood. Single rooms have a blue lounge chair. The bed is electric and adjustable with a remote. The view from the window is of the interior of the hospital/ buildings and some nature (one view), or to a park with a high level of nature (the other view) (see Figures 41 and 42). Every room has a TV (40 channels) and a print on the wall, most of them representing nature. There was a wireless connection, but at the time of the study it was not working well in all rooms.

Figure 41
Hospital SAMS (PT)
View of the interior of the hospital

Figure 42
Hospital SAMS (PT)
View to a park with a high level of nature

Hospital Curry Cabral (Portugal)

Hospital Curry Cabral in Lisbon opened in 1998 (see Figure 43). It is a public hospital with around 500 inpatient beds. The orthopedic unit has 70 beds (see Figure 44 and 45). Included in this research were 8 single (between 160.4 sq. ft. and 241.1 sq. ft.) (see Figure 46), 1 double (159.3 sq. ft.) (see Figure 47), and 1 triple room (385.3 sq. ft.) (see Figure 48). Of the single rooms, 7 had a private toilet and shower room; 1 had no private toilet room (see Figure 49). The double had no private toilet and shower room; and the triple had a shared private toilet and shower room. Only this limited number of rooms took part in the study because all the other rooms in the unit had four beds.

Figure 43
Hospital
Curry Cabral
(PT)
- exterior

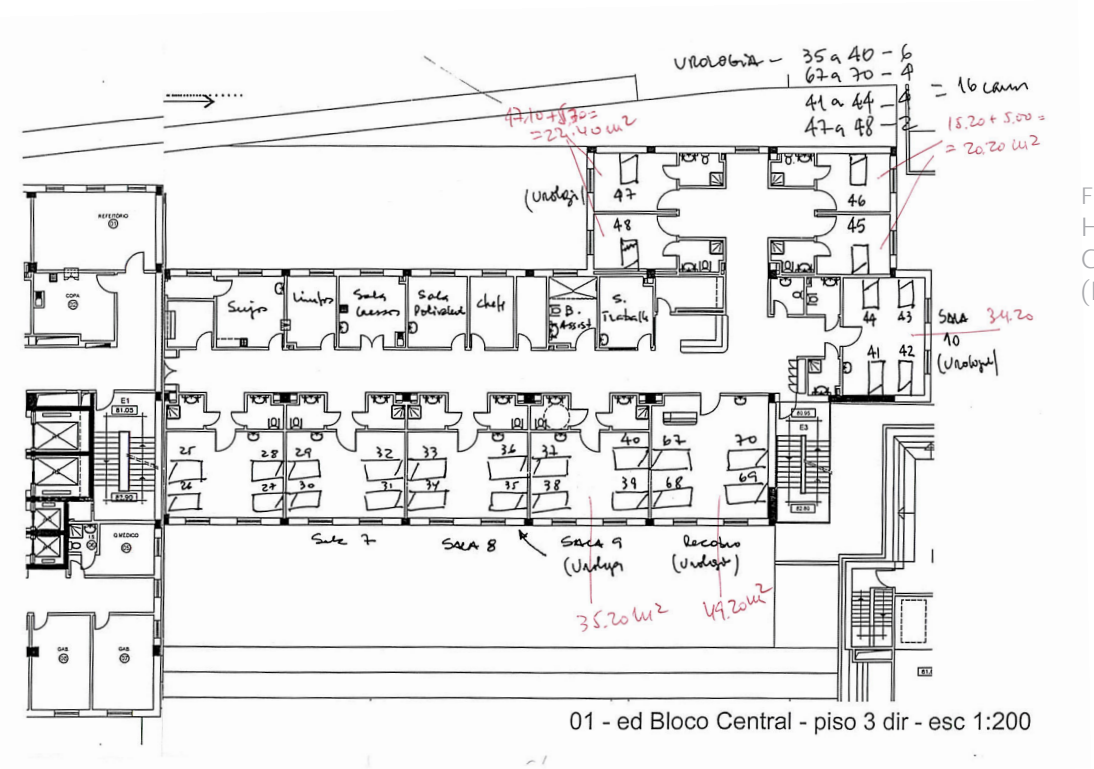

Figure 44
Hospital
Curry Cabral
(PT) - Plan

Figure 45
Hospital
Curry Cabral
(PT)
Nursing station

Figure 46
Hospital Curry Cabral (PT)
Single room

Figure 47
Hospital Curry Cabral (PT)
Double room

Figure 48
Hospital Curry Cabral (PT)
Triple room

Figure 49
Hospital Curry Cabral (PT)
Toilet

Walls are beige and the furniture is in light grey. There is a chair and a dark-blue lounge chair. The closet is a light grey metallic locker, and the bed is adjusted mechanically, with the help of the healthcare professionals. The view from the window is to a train line, buildings, and some nature (one view) (see Figure 50), or to buildings and nature (the other view) (see Figure 51). There are no prints or art elements on the wall; some rooms have no TV and those that have TV do not have a remote. There is no Internet.

Figure 50
Hospital Curry Cabral (PT)
View to train line, buildings and some nature

Figure 51
Hospital Curry Cabral (PT)
View to buildings and nature

Measures

Room Element Assessment

The rooms in each hospital were objectively assessed by the researchers in terms of number and type of environmental elements provided (i.e., in terms of social support, positive distraction, and perceived control). Earlier laboratory research (Andrade & Devlin, 2013) provided the initial framework to document the room elements. Table 3 presents the room elements that were assessed, while the mean numbers of elements for each hospital are visible in Table 4.

Perceived control	Social Support	Positive distraction
· Closet for belongings · Lighting is adjustable by patient · White board in front of the bed (for professionals to write notes about patients' plan of care and progress) · Bedside table · Call button · Television is adjustable by patient · Additional table · Clock · Room service menu · Private toilet · Temperature is adjustable by patient	· Room type (suite, single, double) · Chairs for visitors · Internet (WI-FI) · Bench to sit/sleep (sofa-bed) · Bedside phone · Chair for patient	· Television · Prints/posters of nature/landscapes · View to nature · Space to put photos · Closet for laundry · Window is large (~whole wall)

Table 3
Room Elements Assessed

These elements (social support, positive distraction, and perceived control) were our independent variables. We awarded 1 point for each favorable element, with exceptions when the element either exceeded the standard (fraction of point added; e.g., when the room size exceeded the size of the average room on the unit; when the windows covered the entire window wall) or failed to meet the standard (fraction of point subtracted; e.g., when there was a limited rather than full menu service).

Appendix A (Table of Elements by Hospital) provides the scoring of the elements in the three categories (social support, positive distraction, and perceived control) for each hospital.

Table 4 presents the mean number of elements for perceived control, positive distraction, and social support in the rooms by hospital. Hospital Curry Cabral (Portugal) is the hospital with the fewest elements providing perceived control, social support, and positive distraction. For example, the TV (when present) was not adjustable by patients; rooms had no Internet and no bedside phone; and no prints of nature. Compared to the other hospitals, the L+M units have many more elements providing perceived control. This difference is due to the fact that the US units have a white board, rooms (and toilets) are all private, have a clock in the wall, and offer a room service menu – which are not available in the Portuguese hospitals. Finally, we should highlight that the L+M new unit has more positive distraction than all the other units primarily due to the number of separate pieces of art displayed.

	Perceived control (0-11)	Social Support (0-6)	Positive distraction (0-6.5)
L+M Old Unit	10.75	5.00	3.66
L+M New Unit	10.00	6.00	6.35
Hospital Curry Cabral	4.46	2.60	2.06
Hospital dos SAMS	8.23	5.73	3.76
Hospital da Luz	8.12	5.67	3.15

Table 4
Mean Number of Elements for Perceived Control, Social Support, and Positive Distraction by Hospital

Of course an "objective" classification such as this one would always have subjective aspects: the selection of the elements, in which category to classify them, and the value or weight given to the attribute.

To partially validate our classification of the room elements in terms of providing perceived control, social support, or positive distraction, we asked two independent judges to classify each room element observed in each of those three categories. From the 23 elements that

were observed, 17 were classified in agreement with our classifications by both judges, 2 were classified in agreement with our classifications by one judge, and 4 were classified differently than our classifications by both judges. Across judgments, the degree of agreement is 78%.

Patients' survey

The survey consisted of four sections: 1) what patients expected, 2) how patients felt at the moment and their experience, 3) overall evaluations, and 4) background information.

Four questions assessed what people had anticipated before they entered the hospital (α=.85). These questions were the quality of care they expected to receive in the hospital (1-low level of care to 9-high level of care); how comfortable they expected the hospital room to be (1-not at all comfortable to 9-very comfortable); how competent they expected the health care providers on the unit to be (1-not at all competent to 9-very competent); and how interpersonally warm they expected the health care providers on the unit to be (1-not at all warm to 9-very warm).

In the second section, patients answered questions about stress, and then they were asked to assess the perceived control, social support, and positive distraction, of elements in their hospital room.

Perceived stress was measured using Spielberger's 20-item State Anxiety Inventory (Spielberger, Gorsuch, & Lushane, 1970), which indicates the level of stress or anxiety an individual is feeling at the present moment. Scores range from 20 to 80, with higher scores reflecting greater anxiety. A sample item is "I am tense", which is measured from 1 ("not at all") to 4 ("very much so"). Principal component analyses suggested that items 4 (regretful) and 18 (rattled) should be removed, similar to what was done in Andrade and Devlin (2013), which means 18 items were kept, explaining 39% of the variance (α=.90).

Patients were then asked, "Please tell us what you think about the features of your hospital room." *Perceived positive distraction* provided by the physical environment was measured through eight items adapted from scales used to measure fascination (Hartig, Korpela, Evans, & Gärling, 1997; Laumann, Gärling, & Stormark, 2001) (e.g., "In this room my attention is drawn to interesting things"). To measure the *perceived level of control* over the physical environment, we used seven items from scales used in other studies (Lee & Brand, 2005; Veitch & Gifford, 1996) (e.g., "I can control the physical features of my hospital room"). Finally, to measure the *perceived social support* provided by physical environment we created six items (e.g., "This hospital room provides good opportunities for engaging in social activities). All the items were answered on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). The 21 questions dealing with the categories of Social Support, Positive Distraction, and Perceived Control were mixed to reduce the possibility that respondents would form hypotheses about the underlying purpose of the

study. Using confirmatory factor analyses, we removed 8 items in total, and kept 4 items to measure Positive Distraction (α=.80), 5 items to measure Perceived Control (α=.83), and 4 items to measure Social Support (α=.89) (see Table 5).

Perceived control
1. In this hospital room, I am able to control my environment.
3. I can personalize my hospital room. (*)
4. Health care providers have complete control over my hospital room during my hospitalization. (*)
7. I can control the physical features of my hospital room.
11. There are choices I can make about the physical features of my hospital room.
15. In this room I can adjust, re-arrange, and re-organize things as needed.
21. I determine the organization/appearance of my hospital room.
Social Support
2. In this hospital room there are possibilities to keep in contact with close others. (*)
5. This hospital room allows me to interact with visiting family and friends.
9. This hospital room provides good opportunities for engaging in social activities. (*)
12. My family and friends can feel comfortable in this hospital room.
17. In this hospital room I can enjoy the company of visiting family and friends.
20. This hospital room provides a supportive environment for visiting family and friends.
Positive Distraction
6. In this room my attention is drawn to interesting things.
8. There is much to explore and discover in this room. (*)
10. In this room I can spend time looking at the surroundings. (*)
13. In this room there are objects that attract my attention.
14. In this room I am absorbed by the surroundings.
16. There is plenty that I want to keep looking at here.
18. In this room time passes quickly. (*)
19. Being in this room helps ease the experience of being sick in the hospital. (*)

Table 5
Items Measuring Perceived Control, Social Support, and Positive Distraction Provided by the Hospital Room

Note:
(*) indicates that an item was removed through confirmatory factor analyses

Next, questions in the overall evaluation asked 1) whether patients would choose to stay in the room again (1-definitely no to 9-definitely yes); whether they would recommend this hospital room to their friends and family (1-definitely no to 4-definitely yes). Then they were asked to list in rank order 3 characteristics of their hospital room that influenced their level of satisfaction with their hospital experience, and to indicate whether the factor was positive or negative, and to describe it.

Following this section patients then answered four questions assessing their satisfaction with their experience more generally (α=.91): 1) considering their global experience on the care unit, in general, how satisfied they were (0-very unsatisfied to 10-very satisfied); 2) to what extent the care unit met their expectations (0-not at all to 10- totally); 3) to what extent the care unit met their needs (0-not at all to 10-totally); and 4) to imagine a perfect care unit, in all its aspects. How far did they think this care unit was from a perfect care unit? (0-very distant to 10-very close). These four questions were taken from the work of Raposo, Alves, and Duarte (2009).

An additional question about noise was asked of the US patients because of on-going construction in one corner of the unit. However, this item was not used in the analyses because few of the patients indicated they were bothered by noise to any extent (the median and mode were both 0; 57% said they were not bothered at all by noise).

The demographic section asked age, gender, race/ethnicity; estimate of family income; highest level of education; number of times hospitalized overnight; and, in the case of the US patients, whether hospitalized at that particular hospital previously. These questions were asked in order to describe the samples.

Health status data were: a) measures of self-reported pain (from 0 to 10); blood pressure and heart rate used to monitor patients, and b) the amount of daily medication for pain that patients took during hospitalization.

Procedure

Permission to Conduct Research

At each of the hospitals, appropriate permissions were obtained. In the case of the US hospital, this involved IRB review at both the researcher's home institution and the hospital.

In Lisbon, the study was approved by the members of the administration and the directors of the orthopedic care units of the hospitals, to whom the purpose and method of the study was described in detail.

Data Collection

In the United States, patients in the old unit participated between mid-December, 2012 and mid-February, 2013. Data collection in the old unit unfortunately was limited by the opening of the new unit in February, at which time all of the orthopedic patients were henceforth housed in the new unit. In the new unit, patients participated between early June, 2013 and the end of July, 2013.

In Portugal, data were collected between early October, 2013 and mid-January, 2014. We started in Hospital da Luz, moving then to Hospital Curry Cabral, and finally to Hospital dos SAMS.

All questionnaires were delivered to patients at least 24 hours after surgery (i.e., patients had spent at least a day on the unit) (M=2.74, SD=3.27).

Researchers identified themselves as conducting a study to evaluate the effects of the inpatient rooms on patients' levels of satisfaction, stress, and health status responses. Both in the United States and Portugal, two researchers (the lead researcher and her research assistant) were involved in collecting data. After the lead researcher had trained the assistant for an initial period, the assistant then collected data by him/herself. Participants were told they were being asked to do two things: 1) fill out a questionnaire and 2) permit their heart rate levels, blood pressure, use of medication, and length of hospitalization (recorded on their medical record) to be reported to the researchers.

If patients agreed to participate, an informed consent was signed and patients were asked whether they wanted to complete the questionnaire on their own or have the questions asked by the researchers. Most patients preferred to be interviewed, given the difficulty of writing following surgery, for some, and the degree of fatigue, for others. In Portugal, in particular, some people had insufficient education to do it by themselves. At the completion of the interview, patients were given an explanation of research form that included a more detailed description of the research project.

In the US, health status data were made available from the IT staff from targeted sections of the electronic medical record after all survey data had been collected. Health status data covered the length of hospitalization. Of the total number of patients, the physiological data were available for most of the patients (93%). In the other cases, illegible handwriting and the use of pseudonyms by patients on informed consent prevented the IT staff from identifying the individuals.

In Portugal, the availability of the health status data was more limited because the nurses were only permitted to print out the medical data (sometimes in a screen shot because the system did not allow printing) on the day the survey was conducted for that patient. Thus, in Portugal, health status data were not available for the length of hospitalization, nor was the length of

hospitalization itself. Further, nurses in Portugal often forgot to separate the information about medication into scheduled medications and PRN medications. As a result of these limitations, our analyses for the medication data employed a combined scheduled and PRN total, through the day of the survey.

For the US sample, the level of pain medication (low, medium, strong) was classified by the nurse manager on the new orthopedic unit. In Portugal nurses in each hospital helped to do this classification. Appendix B presents the classifications of pain medications.

Participants

Two hundred and thirty-six people participated in this study, 78 (33.1%) American, and 158 (66.9%) Portuguese patients.

In the US, all the participants were orthopedic patients at the L+M hospital, 23 (29.5%) participants stayed on the old unit, and 55 (70.5%) participants stayed in the renovated unit. All rooms were private. Sixty-five (83.3%) said that were hospitalized before at L+M, with an average of 2.90 times.

The age of the American subjects ranged from 34 to 86 years with a mean age of 64.80 years and a standard deviation of 10.58 years. Forty-three (55.1%) of the participants were women. In terms of education, most of them had a college degree or some college (n=42, 53.8%), 16 (20.5%) had an advanced degree (MA, PhD, or MD), 14 (17.9%) had a high school diploma, and only 2 (2.6%) had less than a high school diploma.

In Portugal all the participants were orthopedic patients in the one of three different hospitals: 34 (21.5%) in Hospital Curry Cabral (old public), 56 (35.4%) in Hospital dos SAMS (old private), and 68 (43.0%) in Hospital da Luz (new private). Less than half (n=71, 44.9%) said that were hospitalized before in that hospital, with an average of 1.80 times.

In Hospital Curry Cabral, 18 participants were in a private room, 10 participants were in a double room, and 6 participants were in a 3-bed room. In SAMS, 25 participants were in a private room, 23 participants were in a double room, and 8 participants were in a 3-bed room. In Hospital da Luz there were only private and double rooms. Eighteen participants were in a private room, and 50 participants were in a double room.

The age of the Portuguese patients ranged from 19 to 87 years with a mean age of 56.27 years and a standard deviation of 17.37 years. Ninety-five (60.1%) of the participants were women. In terms of education, the majority had less than a high school diploma (*n*=77, 53.5%). Twenty-three (16.0%) had a high school diploma, 36 (25.0%) had a college degree or some college, and only 8 (5.6%) had an advanced degree (MA, PhD, or MD).

Results

Results

As mentioned previously, in Portugal we were not able to secure permission to do this study in a more modern Public hospital by the time the study commenced. For that reason, we do not have an adequate representation of the public hospital dimension in Portugal to do a comparison of Public vs. Private facilities. Thus, our comparisons will be: between Portuguese and American patients, and between each of the hospitals (and their variability in favorable elements) in each country.

Perceived control, social support, and positive distraction provided by the hospital room - Descriptive and comparative analyses

Perceived control

Although the objective evaluation indicated that the American hospital units under study had more elements that provided control than did the Portuguese hospitals (see Table 4), in the US, patients perceived the rooms as providing less perceived control (*M*=3.19, *SD*=1.14) than did the Portuguese patients (*M*=3.79, *SD*=0.92; *F*(1,234)=18.58, *p*<.001).

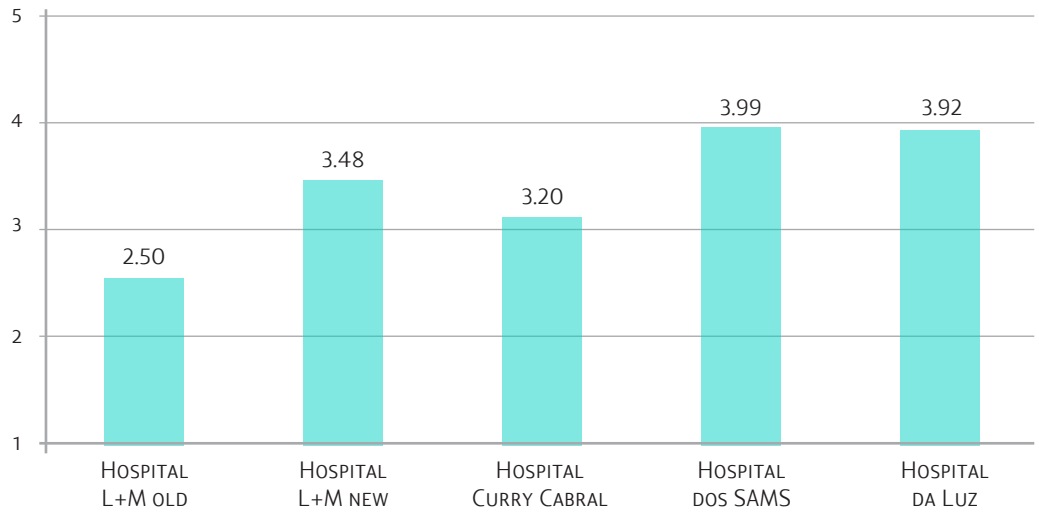

Figure 52
Mean level of perceived control by hospital (where 1 = lowest control and 5 = highest control)

In the US, patients in the new L+M unit perceived that they had more control (*M*=3.48, *SD*=1.00) than did the patients in the L+M old unit (*M*=2.50, *SD*=1.17) (*F*(1,76)=15.69, *p*<.001), **although the objective evaluation did not indicate that.**

In Portugal, patients in Hospital dos SAMS (*M*=3.99, *SD*=0.91) and Hospital da Luz (*M*=3.92, *SD*=0.74) perceived that they had significantly more control (*p*<.001 and *p*=.001, respectively) compared with the patients in Hospital Curry Cabral (*M*=3.20, SD=1.02) (*F*(2,155)=9.99, *p*<.001), **which is consistent with the objective analysis.**

Social Support

Results showed that American (*M*=4.52, *SD*=0.61) and Portuguese patients (*M*=4.40, *SD*=0.85) had similar perceptions of the rooms in terms of providing social support.

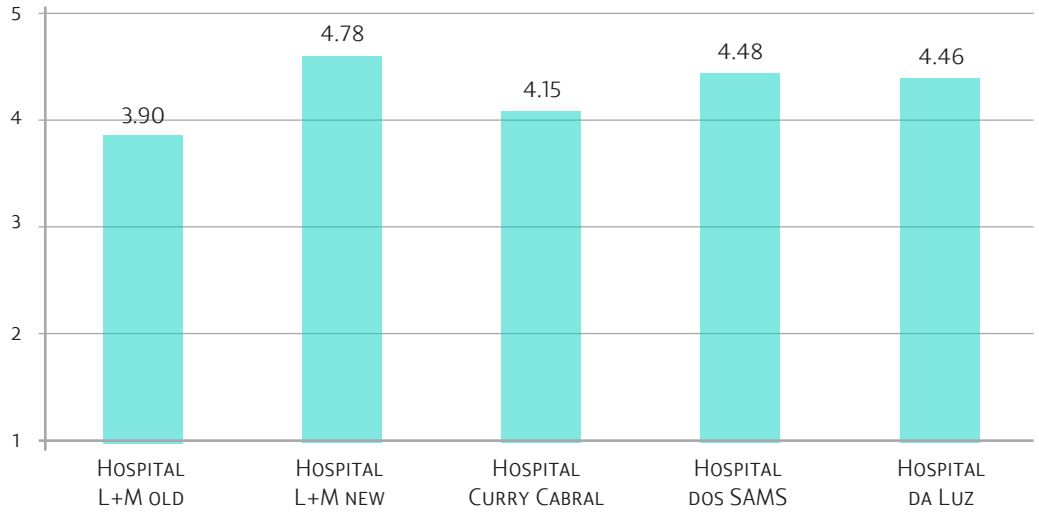

Figure 53
Level of social support by hospital (where 1 = lowest support, and 5 = highest support)

Whereas in the US the patients in the new L+M unit (*M*=4.78, *SD*=0.40) perceived the rooms as providing more social support than did the patients in the old L+M unit (*M*=3.90, *SD*=0.59) (*F*(1,76)=58.98, *p*<.001), **the objective analyses did not predict that difference in perception.** In Portugal, there were no significant differences between patients in Hospital da Luz (*M*=4.46, *SD*=0.87), Hospital dos SAMS (*M*=4.48, *SD*=0.73), and Hospital Curry Cabral (*M*=4.15, *SD*=0.95) regarding perceived social support, **although our objective analyses indicated that Hospital Curry Cabral has fewer elements promoting social support than did the other two Portuguese hospitals under study.**

Positive distraction

In the US, patients perceived rooms as providing less positive distraction (*M*=3.20, *SD*=1.04) than did the Portuguese patients (*M*=3.48, *SD*=1.00; *F*(1,234)=4.01, *p*=.046), **which is not completely in line with the objective analyses**, which suggested that the US patients might perceive more positive distraction, given the large number of favorable elements of positive distraction in the new unit.

In fact, when comparing the old and new units in the US, the patients in the new L+M unit (*M*=3.47, *SD*=0.94) did perceive the rooms as providing more positive distraction than did the patients in the old L+M unit (*M*=2.55, *SD*=1.00) (*F*(1,76)=14.84, *p*<.001), **which is consistent with the objective analyses.** In Portugal, patients in Hospital dos SAMS (*M*=3.62, *SD*=0.85) and Hospital da Luz (*M*=3.76, *SD*=0.93) perceived significantly more positive distraction in their rooms than did patients in Hospital Curry Cabral (*M*=2.70, *SD*=0.97, all *p*<.001) (*F*(2,155)=16.32, *p*<.001), **which also matches the objective analyses.**

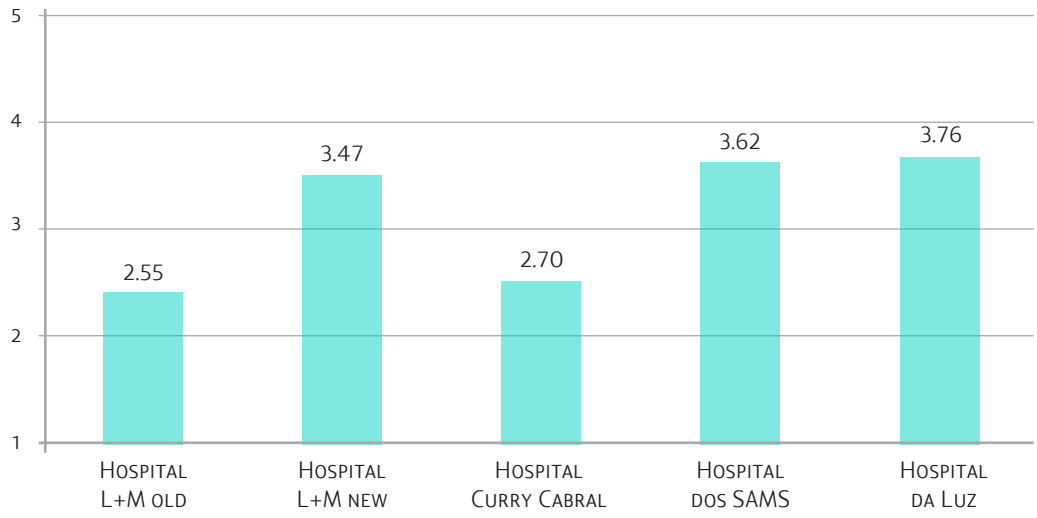

Figure 54
Level of positive distraction by hospital (where 1 = lowest distraction and 5 = highest distraction)

In general, from the point of view of patients, hospital rooms seem to be providing more social support than they do perception of control or positive distraction. Another result that stands out is that patients in the L+M old unit and patients in Hospital Curry Cabral have similar perceptions about the perceived control, social support, and positive distraction provided by the room, perceptions that are less positive than those of the patients in the L+M new unit, Hospital dos SAMS, and Hospital da Luz. However, although the perceptions of patients in the L+M old unit and patients in Hospital Curry Cabral are similar across dimensions, rooms in the L+M old unit have more favorable elements than do rooms in Hospital Curry Cabral.

This difference between the objective measurement of the elements (i.e., that an element is

present) and the lower level of perception may be related to the physical condition of the hospital units themselves. In the case of both the old unit at L+M and Hospital Curry Cabral, the units might be described as outdated and in need of renovation (modernization). It is possible that not only the presence of an element influences perception, but also the actual physical condition of the surroundings in which the element is placed.

Correlations between what the room provides and what patients perceive (subjective and objective PC, SS, and PD)

The perceptions of patients regarding the social support provided by the hospital rooms were significantly correlated with the number of elements providing such social support (r=.24, p<.01). This significant relationship did not happen with the perceived control (r=-.20, p<.05, correlation in the opposite direction) and positive distraction (r=.03, n.s.) dimensions.

It is possible that an objective count of the favorable elements (their presence) may not fully relate to the perceptions of those elements, at least with regard to perceived control and positive distraction. An explanation for this discrepancy may be that the nature of the elements also matters, and that some elements may have more influence than is true of others. For example, for providing positive distraction, a large window to the outside may be more influential in people's perceptions than is a representation of nature in a white board. Future research will need to address that issue.

The hospital service experience: Expectations, global satisfaction, anxiety, and choosing the room again - Descriptive and comparative analyses

Expectations

Results showed that, overall, American (M=8.15, SD=1.04) and Portuguese patients (M=7.93, SD=1.05) had similar and high expectations regarding different aspects of the hospital service (in terms of quality of care; comfort of the room; competence of health care providers; and warmth of health care providers). Considering that US patients are more accustomed to evaluate and purchase health care services from the point of view of a client/customer than are Portuguese patients, and for that reason they might have been expected to have higher expectations, the similarity in expectations is contrary to our prediction. It may also be the case that we are seeing something of a ceiling effect with regard to the very high means because 9 was the highest anchor (see Figure 55).

Analyses by item showed that the only exception was the expectations regarding the quality of care. In this case, American patients had slightly higher expectations (*M*=8.18, *SD*=1.37) compared to Portuguese patients (*M*=7.81, *SD*=1.29; *F*(1, 231)=4.02, *p*=.046).

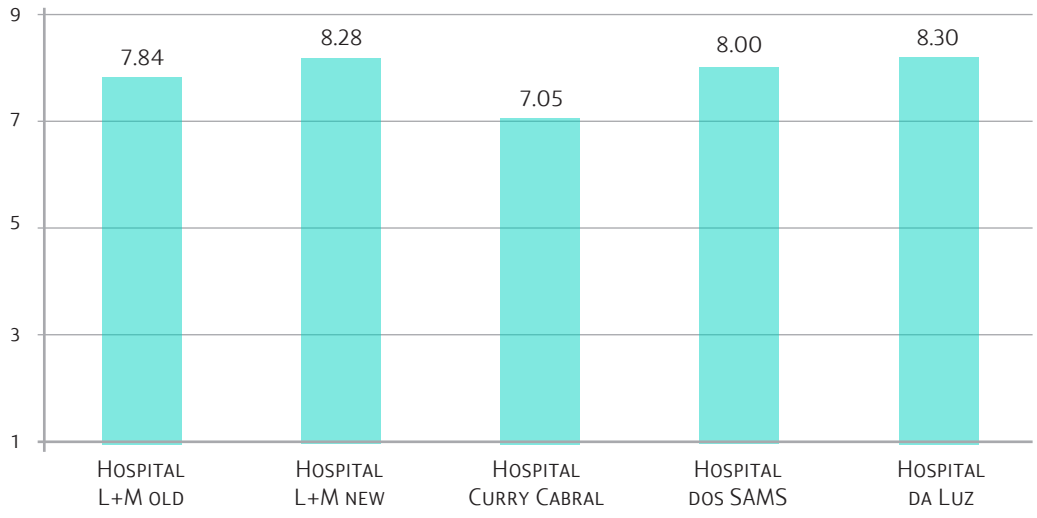

Figure 55
Level of global expectations by hospital (on a scale where 1 = low level to 9 = high level)

In particular, American patients in the L+M new unit tended to have higher expectations (*M*=8.28, *SD*=1.08) than did the patients in the old unit (*M*=7.84, *SD*=0.87), but – significantly – only with regard to the expected comfort in the hospital room (*M*=8.00, *SD*=1.21 vs. *M*=7.13, *SD*=1.28; *F*(1, 75)=8.02, *p*=.006).

In Portugal, patients in Hospital Curry Cabral had lower expectations (*M*=7.05, *SD*=1.45) than did patients in Hospital da Luz (HL) (*M*=8.30, *SD*=0.68) and Hospital dos SAMS (HS) (*M*=8.00, *SD*=0.83) (*F*(2,154)=19.65, *p*<.001). This is true with regard to the expected quality of care (*M*=6.79, *SD*=1.87 vs. *M*=8.26, *SD*=7.87 (HL) and *M*=7.87, *SD*=0.94 (HS), respectively, all *p*<.001), the expected comfort of the room (*M*=6.06, *SD*=2.03 vs. *M*=8.07, *SD*=0.82 (HL), and *M*=7.69, *SD*=1.17 (HS), all *p*<.001), and the expected competence of the healthcare providers (*M*=7.79, *SD*=1.41 vs. *M*=8.46, *SD*=0.76 (HL), and *M*=8.32, *SD*=8.86 (HS), all *p*<.001). In relation to the expected warmth of the healthcare providers, patients in Hospital Curry Cabral had significantly lower expectations (*M*=7.58, *SD*=1.71) than did patients Hospital da Luz (*M*=8.40, *SD*=1.01, *p*=.01), but not different expectations than did the patients of Hospital dos SAMS (*M*=8.05, *SD*=1.23).

Global satisfaction

In terms of satisfaction, results show that American patients (*M*=9.22, *SD*=1.17) were significantly more satisfied with the care unit than were the Portuguese patients (*M*=8.42, *SD*=1.62) (*F*(1, 232)=15.10, *p*<.001).

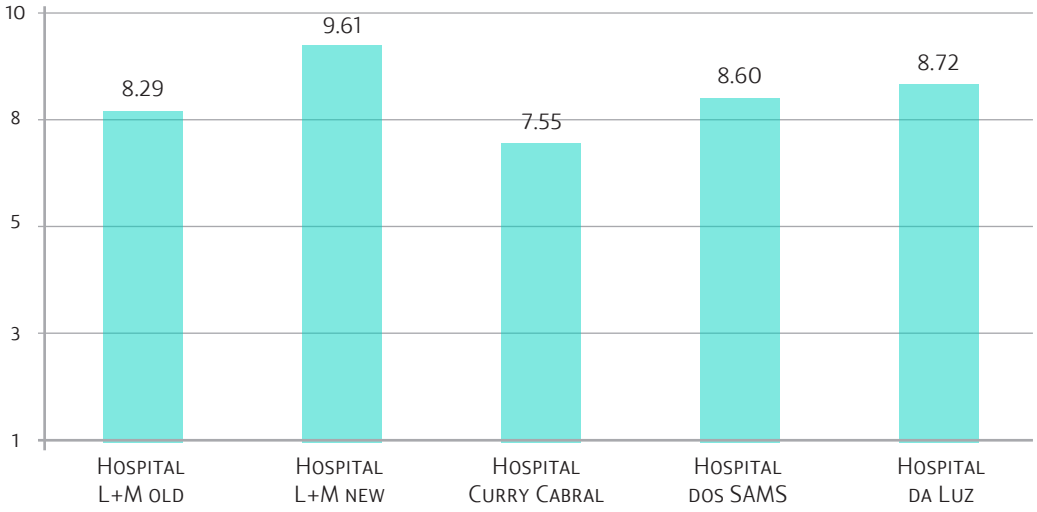

Figure 56
Level of global satisfaction by hospital on a scale where 0 = no satisfaction to 10 = highest satisfaction

In the US, patients in the new unit were significantly more satisfied (M=9.61, SD=0.56) than were the patients in the old unit (M=8.29, SD=1.65) (F(1,76)=27.72, p<.001). In Portugal, patients in Hospital Curry Cabral (M=7.55, SD=1.78) were significantly less satisfied than were patients in Hospital dos SAMS (M=8.60, SD=1.38, p=.008) or in Hospital da Luz (M=8.72, SD=1.58, p=.002) (F(2,153)=6.80, p=.001). These results seem to indicate that patients had confirmed their expectations, and that their evaluation of the service was consistent with the expectations they reported having had before entering the service (see Figure 56).

Anxiety

American patients reported feeling less anxious (M=1.46, SD=0.44) than did the Portuguese patients (M=1.74, SD=0.52; F(1, 234)=16.94, p<.001).

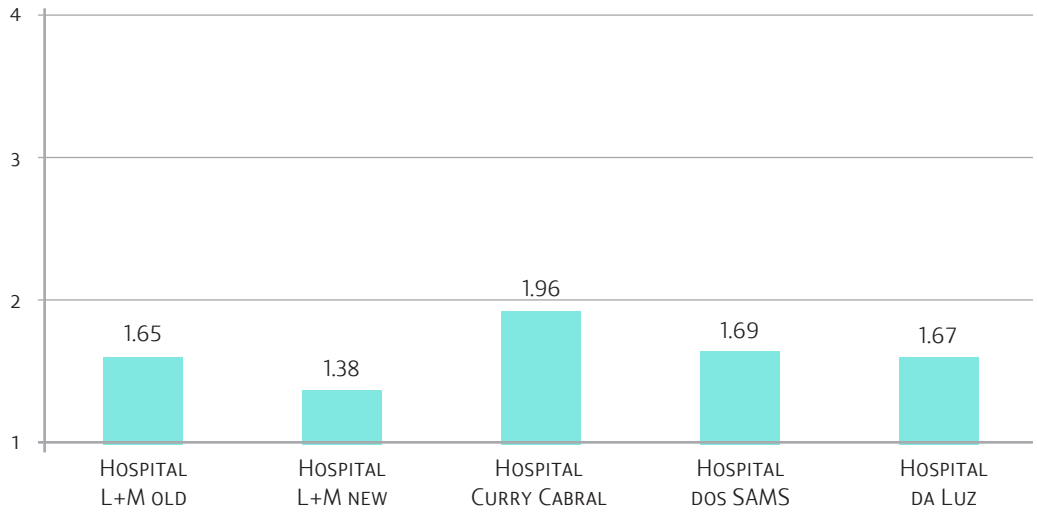

Figure 57
Mean level of anxiety by hospital (where 1 = not at all anxious to 4 = very anxious)

In particular, patients in the L+M new unit (M=1.38, SD=0.39) reported feeling less stress than did patients in the L+M old unit (M=1.65, SD=0.50; F(1,76)=6.54, p=.013). In Portugal, patients in Hospital Curry Cabral (M=1.96, SD=0.68) reported feeling more stress than did patients in Hospital dos SAMS (M=1.69, SD=0.68, p=.037) and patients in Hospital da Luz (M=1.67, SD=0.44, p=.016) (F(2,155)=4.30, p=.015) (see Figure 57).

Choosing the room again

There were no differences between Portuguese (M=7.63, SD=2.09) and American (M=7.97, SD=1.84) patients regarding the possibility of choosing the same room in a hypothetical next visit if they needed to be hospitalized in the same hospital in the future (on a scale where 1= definitely no to 9= definitely yes).

In the US, patients in the L+M new unit (M=8.65, SD=1.23) reported higher intentions to choose the same room than did patients in the L+M old unit (M=6.39, SD=2.08) (F(1,75)=35.05, p<.001). On the other hand, in Portugal, there were no differences between patients in Hospital da Luz (M=7.61, SD=2.12), Hospital dos SAMS (M=7.80, SD=1.73), or Hospital Curry Cabral (M=7.42, SD=2.56) regarding choosing the same room again.

Correlations between the perceived control, social support, and positive distraction provided by the hospital room and the hospital service experience

Table 6 presents, for each country, the correlations between the number of favorable elements in the room, the perceived control, social support, and positive distraction perceived to be provided by the hospital room, and the overall hospital service experience.

Most important for our hypothesis is that the greater the number of favorable elements in the hospital room, the greater the Portuguese and American patients' perceptions of social support, perceived control, and positive distraction provided by the room. Also, as expected, the greater the number of favorable elements in the hospital room, the greater the satisfaction with the service and the intention to choose the room again, and the less the stress. Interestingly, the higher the patients' expectations, the better their evaluations, which may be related to the fact that they were both stating expectations and evaluating experience within the same timeframe.

	Favorable elements in the room	Social Support	Perceived control	Positive distraction	Stress	Satisfaction	Choose the room	Expectations
Favorable elements in the room	1	.617***	.380**	.390***	-.184	.389***	.507***	.143
Social Support	.205**	1	.420***	.519***	-.389***	.592***	.601***	.183
Perceived control	.342***	.585***	1	.581***	-.411***	.571***	.430***	.282*
Positive distraction	.366***	.548***	.588***	1	-.356**	.565***	.471***	.184
Stress	-.212**	-.309***	-.287***	-.430***	1	-.641***	-.262*	-.189
Satisfaction	.267**	.612***	.532***	.517***	-.519***	1	.513***	.165
Choose the room	.181*	.590***	.398***	.385***	-.311***	.511***	1	.111
Expectations	.293***	.337***	.339***	.332***	-.296***	.390***	.113	1

Table 6
Correlations of Favorable Elements in the Room, Psychological Variables, and Hospital Service Experience for American (above the diagonal) and Portuguese Patients (below the diagonal)

Note: Values above the diagonal are correlations for American patients, and values below the diagonal are correlations for Portuguese patients.
*p <.05, **p<.01, ***p<.001.

Do favorable elements of hospital rooms affect well-being?

To test whether the presence of favorable elements in the hospital room affected patients' well-being, we used satisfaction with the service and **reported stress** as indicators. We performed two separate sets of analysis for each of these well-being indicators.

In both cases, to test the hypothesis that the relationship between the favorable elements of the hospital room and patients' well-being is mediated by the perceived control, social support, and positive distraction provided by the hospital room, we followed the procedures commonly recommended for the analysis of mediation using structural equation models (e.g., Kenny & Judd, 1984). The hypotheses were tested on a series of structural equation models (SEM) using the AMOS 22 software.

Structural equation modeling allows researchers to specify and estimate models of relationships between measured (observed) and latent variables (constructs that are not directly measured) (MacCallum & Austin, 2000). Our independent variable ''favorable elements in the room'' is an

observed variable, and is the sum of the number of elements providing control, social support, and positive distraction in each hospital room. On the other hand, perceived control, social support, and positive distraction provided by the hospital room and satisfaction with the care unit and stress were defined as latent variables with five, four and four indicators, respectively (see Figure 58). Regarding stress, this measure has a large number of items (i.e., 18); for that reason, we created three parcels (with 6 items each) by aggregating together items with higher and lower loadings.

In SEM the objective is to obtain the most parsimonious summary of the relationships between the variables that accurately represents the associations observed in the data (Weston & Gore, 2006). Specifying a model including latent variables is important because it allows estimating the parameters that represent the relationships between the variables while controlling for error of measurement (Bollen, 1989). Initially, we estimated the parameters of the model for the whole sample considering both American and Portuguese patients. We then repeated the procedure using multi-group analyses to compare between countries. In all the analyses, standard errors of parameters were estimated according to the method of maximum likelihood.

In all the analyses, standard errors of parameters were estimated with a bootstrapping procedure because of the small size of the American sample. The independent variable ''favorable elements in the room'' was standardized to remove any difference between American and Portuguese ranges.

To evaluate the global adjustment quality of the model we considered the CFI (Comparative Fit-Index) above .90, the X^2/degrees of freedom ratio around 2, and the RMSEA (Root Mean Square Error of Approximation) below .05 as indicating a good fit of the model to the data (e.g., Schumacker & Lomax, 1996).

Do favorable elements of a hospital room affect satisfaction with the service?

Results show that the total effect of the number of favorable elements in the room on satisfaction is positive and significant (β=0.30, p<.001), which means that, as predicted, the greater the number of favorable elements in the hospital room, the greater the patients' satisfaction with the care unit.

...Are there any differences between American and Portuguese patients?

To compare this relationship between US and Portugal, we used multi-group analysis. Results show that the total effect of the number of favorable elements in the room on satisfaction is significant both for American (β=0.39, p<.001) and for Portuguese patients (β=0.29, p<.001), and that these coefficients are not significantly different.

Do favorable elements of a hospital room affect satisfaction with the service because patients perceive it as providing control, social support, and positive distraction?

As one can see in Figure 58, once we added the perceived control, social support, and positive distraction to the model, results showed that the relationship between number of favorable elements in the room and those perceptions are positive and significant, i.e., more favorable elements in the room implies greater perception that the room provides control (β=0.39, p<.001), social support (β=0.33, p<.001), and positive distraction (β=0.44, p<.001). On the other hand, the effect of the perceived social support (β=0.45, p<.001) and positive distraction (β=0.25, p=.042) provided by the room on satisfaction are significant, whereas the perceived control does not reliably predict satisfaction.

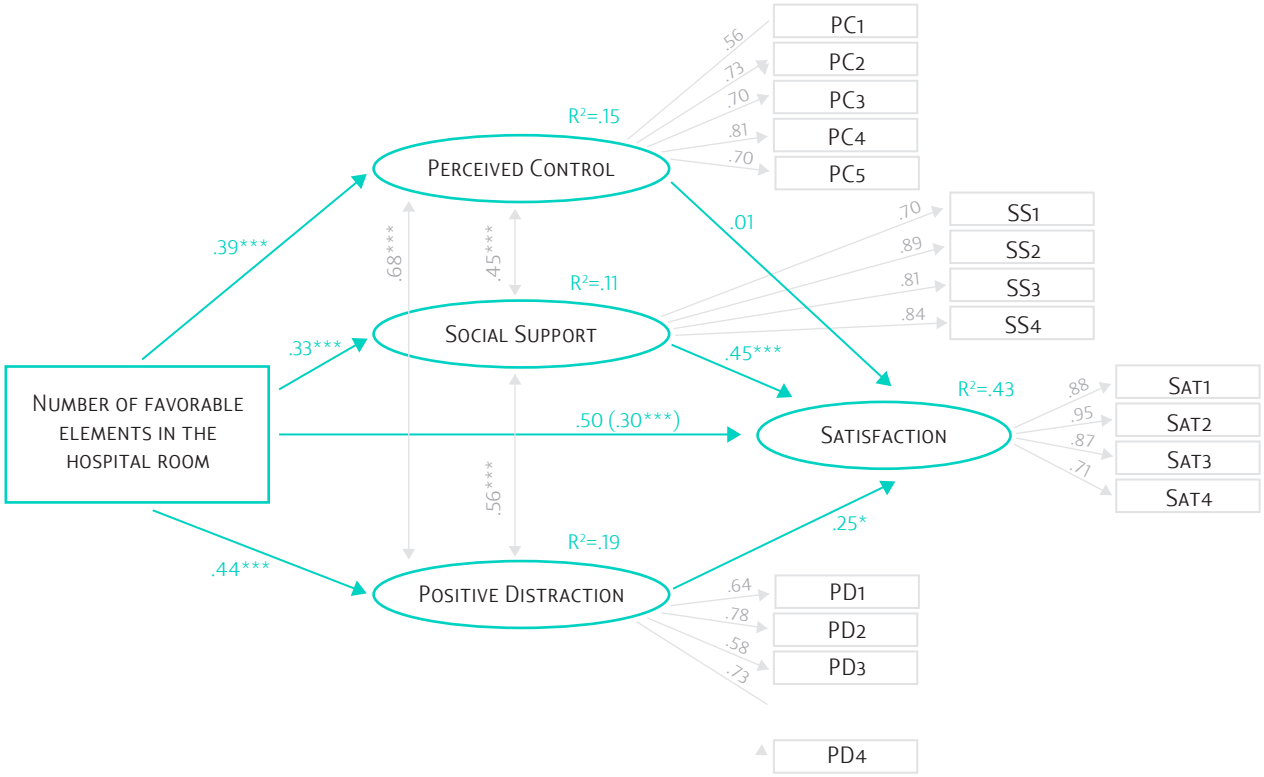

Figure 58
Standardized maximum likelihood coefficients for the structural equation model depicting the relationship between number of favorable elements in the hospital room and patients' satisfaction, mediated by perception of control, social support, and positive distraction.
Note: Coefficient in brackets is the total effect and it was estimated before considering the two mediators in the model. *p<.05, **p<.01, ***p<.001.

Also, the direct effect of the favorable room elements on satisfaction is no longer significant, suggesting that the effect of room elements on satisfaction could be mediated. Of greater importance for the mediation test, the analysis of the indirect of the effects of room elements

on satisfaction indicates that social support (Indirect effect= 0.147; CI 90%: 0.075; 0.246) and positive distraction (Indirect effect= 0.110; CI 90%: 0.034; 0.218) mediate this relationship.
The three independent latent variables accounted for 43% of the variance in satisfaction and analyses of the goodness-of-fit indices for the proposed model show a good fit to the data (X^2(126, *N*=236)= 279.55, *p*<.001, X^2/df=2.22, *CFI*=.94, *RMSEA*=.07).

...Are there any differences between American and Portuguese patients?

We analyzed whether the psychological process going from number of favorable elements in the room to satisfaction occurs in the same way for both American and Portuguese patients. In other words, we tested if the mediation process between number of favorable elements in the room and satisfaction is moderated by country.

We calculated a baseline model where we allowed the structural parameters to be freely estimated between groups of American and Portuguese patients, and the goodness-of-fit for this model is good (X^2(252, *N*=236)= 535.79, *p*<.001, X^2/df=2.21, *CFI*=.89, *RMSEA*=.07), showing that the proposed model is a good fit to the data (see Figures 59 and 60).

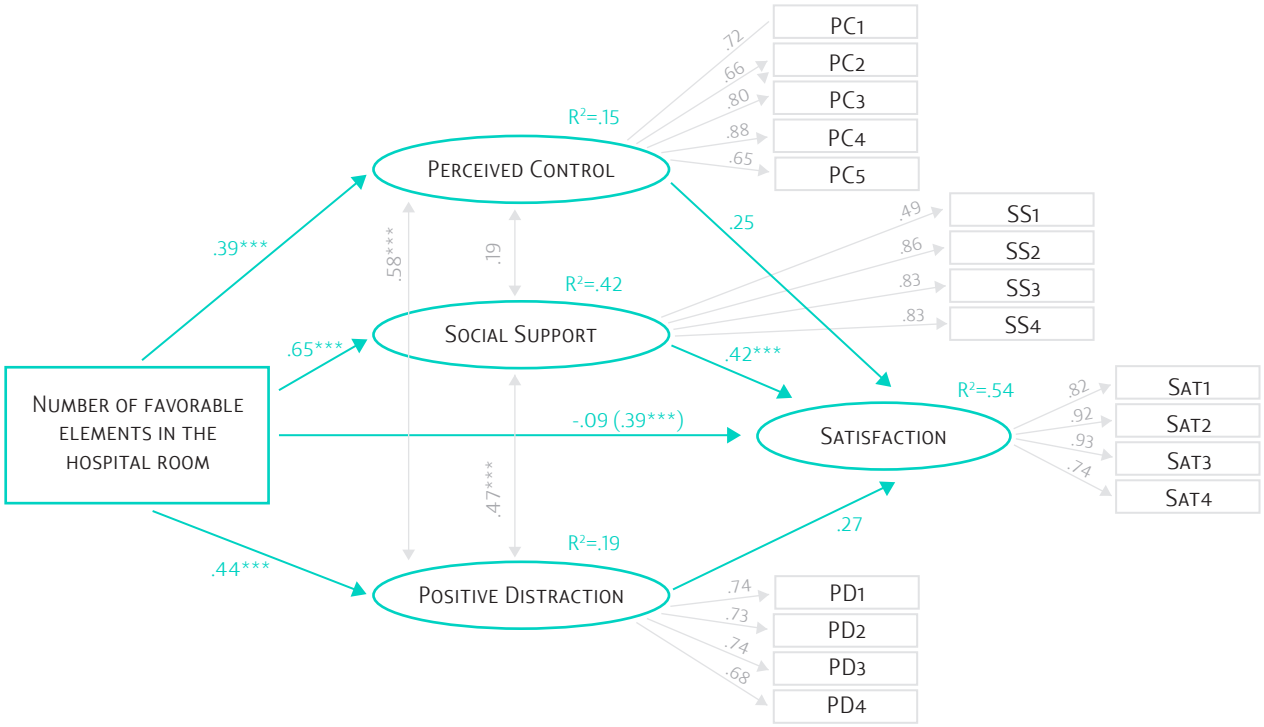

Figure 59
Standardized maximum likelihood coefficients for the multi-group analyses for American patients.
Note: Coefficient in brackets is the total effect and it was estimated before considering the two mediators in the model. *p<.05, **p<.01, ***p<.001.

For both American and Portuguese patients, the number of favorable elements in the room predicts perceived control, social support, and positive distraction (all $p<.01$). Moreover, for American patients the relationship between social support and satisfaction is positive and significant ($\beta=0.42$, $p=.009$), whereas for Portuguese patients the relationships between social support and satisfaction ($\beta=0.32$, $p=.002$), and between positive distraction and satisfaction ($\beta=0.31$, $p=.035$) are positive and significant. Both for American and Portuguese samples, the direct effect of favorable room elements on satisfaction is not significant, suggesting that this effect could be mediated.

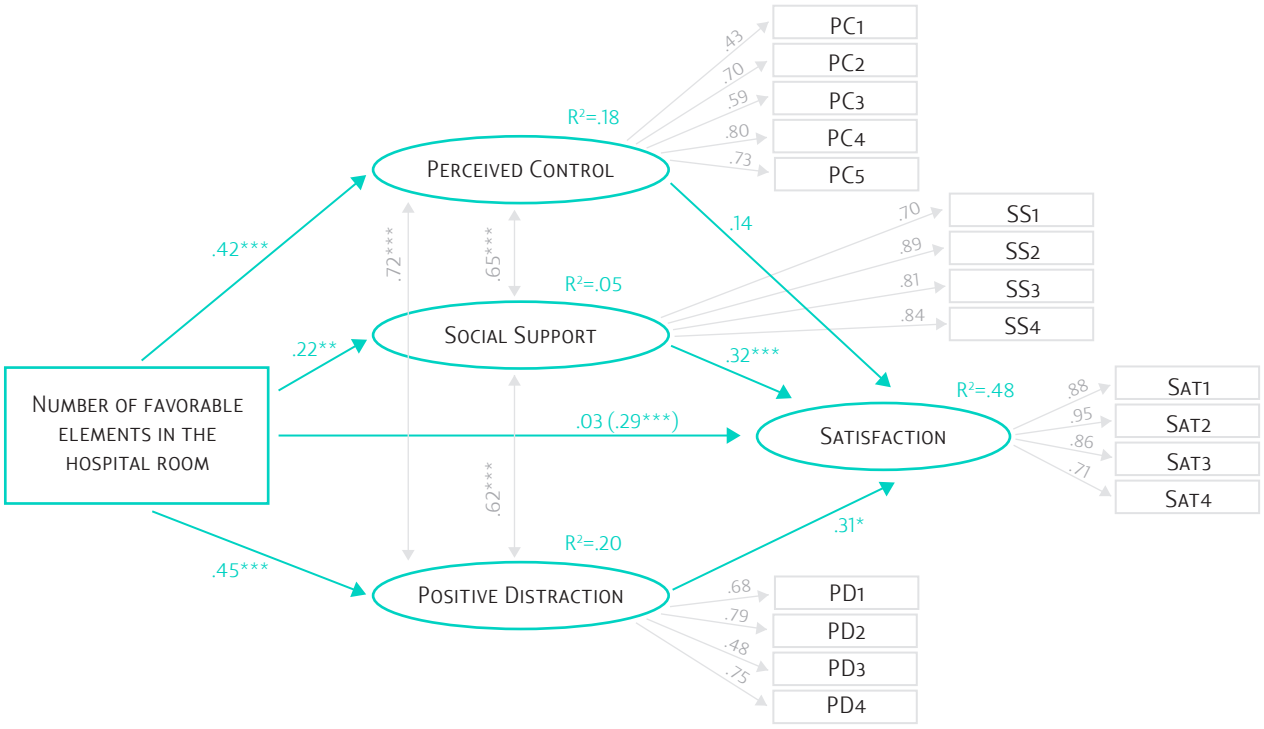

Figure 60
Standardized maximum likelihood coefficients for the multi-group analyses for Portuguese patients.
Note: Coefficient in brackets is the total effect and it was estimated before considering the two mediators in the model. *$p<.05$, **$p<.01$, ***$p<.001$.

The analysis of the indirect effects of room elements on satisfaction indicates that, for American patients social support (indirect effect= 0.273; CI 90%: 0.004; 0.676) but also perceived control (indirect effect= 0.096; CI 90%: 0.031; 0.274) mediate this relationship, whereas for Portuguese patients mediators are social support (indirect effect= 0.069; CI 90%: 0.013; 0.179) and positive distraction (indirect effect= 0.140; CI 90%: 0.045; 0.318).

Do favorable elements of a hospital room affect self-reported stress?

Results show that the total effect of the number of favorable elements in the room on satisfaction is negative and significant ($\beta=-0.21$, $p<.001$), which means that, as predicted, the greater the number of favorable elements in the hospital room, the lower the patients' stress.

...Are there any differences between American and Portuguese patients?

To further compare this relationship between the US and Portugal, we used multi-group analysis. Results show that the total effect of the number of favorable elements in the room on stress is not significant for American patients (β=-0.20, *p*=.082), whereas it is significant for Portuguese patients (β=-0.23, *p*=.005). However, multi-group analysis indicates that this effect is not significantly different between countries.

Do favorable elements of a hospital room affect self-reported stress because patients perceive it as providing control, social support, and positive distraction?

As one can see in Figure 61, once we added the perceived control, social support, and positive distraction to the model, results showed that the relationship between number of favorable elements in the room and those perceptions are positive and significant, i.e., more favorable elements in the room implies greater perception that the room provides control (β=0.39, *p*<.001), social support (β=0.33, *p*<.001), and positive distraction (β=0.44, *p*<.001). On the other hand, the effect of the perceived social support (β=-0.22, *p*=.016) and positive distraction (β=-0.36, *p*=.013) provided by the room on stress are significant, whereas the perceived control does not reliably predict stress.

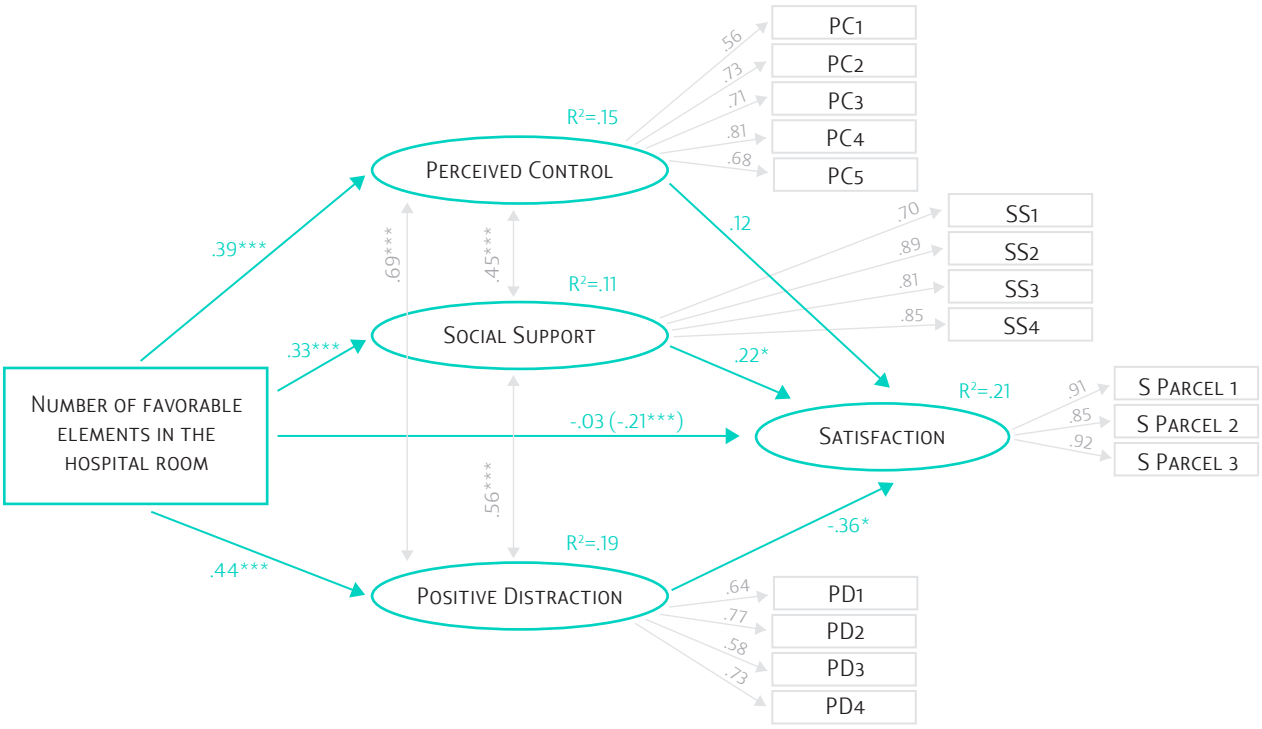

Figure 61
Standardized maximum likelihood coefficients for the structural equation model depicting the relationship between number of favorable elements in the hospital room and patients' self-reported stress, mediated by perception of control, social support and positive distraction. Note: Coefficient in brackets is the total effect and it was estimated before considering the two mediators in the model. *p<.05, **p<.01, ***p<.001.

Also, the direct effect of the favorable room elements on stress is no longer significant, suggesting that the effect of room elements on stress could be mediated. Of greater importance for the mediation test, the analysis of the indirect effects of room elements on stress indicates that social support (Indirect effect= -0.072; CI 90%: -0.156; -0.016) and positive distraction (Indirect effect= -0.158; CI 90%: -0.302; -0.056) mediate this relationship.
The three independent latent variables accounted for 21% of the variance in stress and analyses of the goodness-of-fit indices for the proposed model show a good fit to the data (X^2(110, N=236)= 218.58, p<.001, X^2/df=1.99, *CFI*=.95, *RMSEA*=.065).

...Are there any differences between American and Portuguese patients?

We analyzed whether the psychological process going from the number of favorable elements in the room to stress occurs in the same way for both Americans and Portuguese. In other words, we tested if the mediation process between the number of favorable elements in the room and reported stress is moderated by country.

We calculated a baseline model where we allowed the structural parameters to be freely estimated between groups of American and Portuguese patients. The goodness-of-fit for this model is good (X^2(220, N=236)= 402.43, p<.001, X^2/df=1.83, *CFI*=.92, *RMSEA*=.06), showing that the proposed model is a good fit to the data (see Figs. 11 and 12) (see Figures 62 and 63).

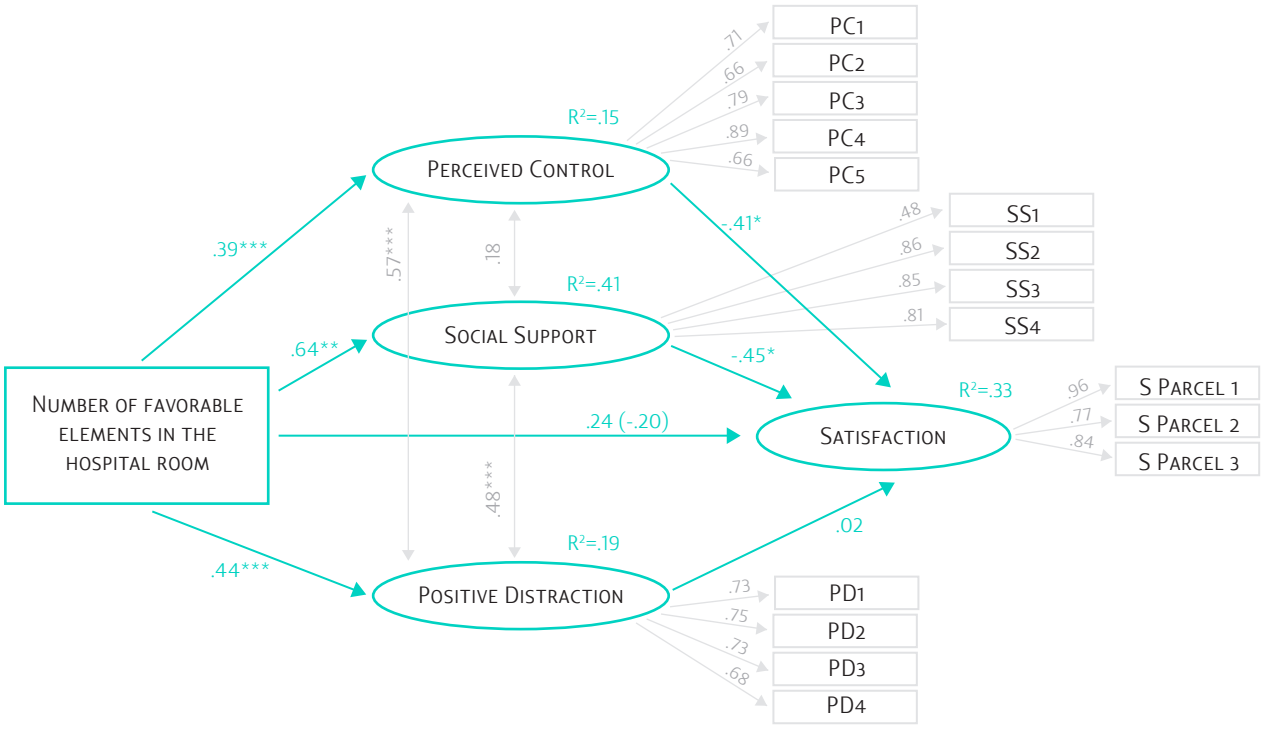

Figure 62
Standardized maximum likelihood coefficients for the multi-group analyses for American patients. Note: Coefficient in brackets is the total effect and it was estimated before considering the two mediators in the model. *p<.05, **p<.01, ***p<.001.

For both American and Portuguese patients, the number of favorable elements in the room predicts the perceived control, social support, and positive distraction (all $p<.01$). Moreover, for American patients the relationships between perceived control and stress ($\beta=-0.41$, $p=.015$) and between social support and stress ($\beta=-0.45$, $p=.014$) are negative and significant, whereas for Portuguese patients only the relationship between positive distraction and stress ($\beta=-0.53$ $p=.003$) is negative and significant. Both for American and Portuguese samples, the direct effect of favorable room elements on stress is not significant, suggesting that this effect could be mediated.

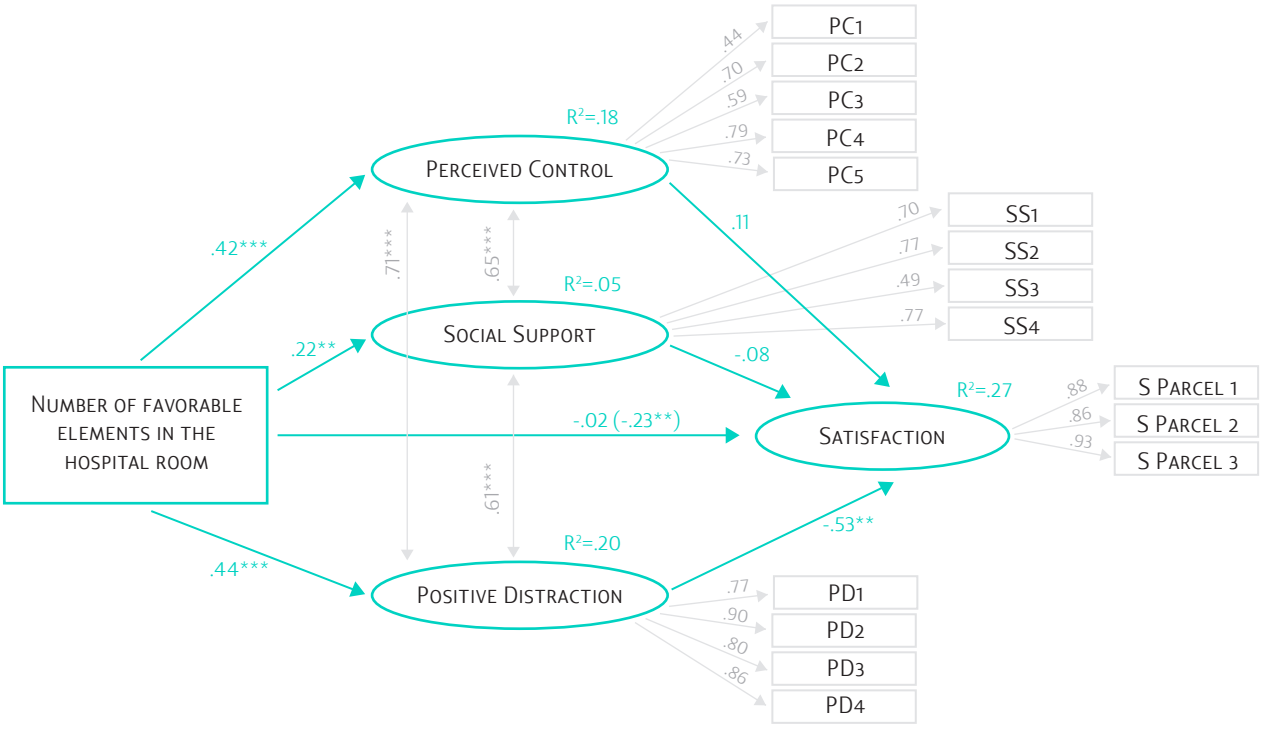

Figure 63
Standardized maximum likelihood coefficients for the multi-group analyses for Portuguese patients. Note: Coefficient in brackets is the total effect and it was estimated before considering the two mediators in the model. *$p<.05$, **$p<.01$, ***$p<.001$.

The analysis of the indirect effects of room elements on stress indicates that, for American patients perceived control (indirect effect= -0.160; CI 90%: -0.408; -0.056) and social support (indirect effect= -0.289; CI 90%: -0.646; -0.085) mediate this relationship, whereas for Portuguese patients the only mediator is positive distraction (indirect effect= -0.236; CI 90%: -0.434; -0.110).

Heart rate, blood pressure, self-rated pain, and pain medication - Descriptive and comparative analyses

Pulse (heart rate)

There were no differences between American (*M*=75.70, *SD*=10.88) and Portuguese (*M*=75.21, *SD*=10.32) patients in terms of the average pulse during hospitalization; no differences between American patients in the L+M old unit (*M*=78.05, *SD*=11.80) and the L+M new unit (*M*=74.72, *SD*=10.43); and no differences between Portuguese patients in Hospital Curry Cabral (*M*=77.00, *SD*=10.26), Hospital dos SAMS (*M*=76.47, *SD*=12.09), and Hospital da Luz (*M*=73.36, *SD*=8.64).

Considering that a normal heart rate is lower than 100 beats per minute and higher than 60 beats per minute (Laskowski, 2012), we divided patients into three categories: normal heart rate, low heart rate, and high heart rate: 21 (91.3%) patients in the L+M old unit, and 52 (94.5%) patients in the L+M new unit had (on average) normal heart rate; and 2 (8.7%) in the L+M old unit had high heart rate, and 3 (5.5%) in the L+M new unit had low heart rate.

In Portugal, 30 (88.2%) patients in Hospital Curry Cabral, 43 (76.8%) patients in Hospital dos SAMS, and 62 (91.2%) patients in Hospital da Luz had normal heart rate; 2 (5.9%) in Hospital Curry Cabral, 4 (7.1%) in Hospital dos SAMS, and 4 (5.9%) in Hospital da Luz had low heart rate; whereas 2 (5.9%) in Hospital Curry Cabral and 2 (3.6%) in Hospital dos SAMS had high heart rate.

Diastolic Blood Pressure

There were no significant differences between American (*M*=69.15, *SD*=9.31) and Portuguese (*M*=70.41, *SD*=9.54) patients in terms of the average of the diastolic BP during the hospitalization. In the US, patients in L+M old unit had higher diastolic BP (*M*=74.55, *SD*=8.61) than did patients in L+M new unit (*M*=66.90, *SD*=8.70) ($F(1,76)=12.59$, $p<.001$).

In Portugal there were no significant differences between Portuguese patients in Hospital Curry Cabral (*M*=72.22, *SD*=8.59), Hospital dos SAMS (*M*=67.83, *SD*=9.95), and Hospital da Luz (*M*=71.38, *SD*=9.44) for diastolic blood pressure.

Systolic Blood Pressure

There were no significant differences between American (*M*=127.22, *SD*=21.12) and Portuguese (*M*=124.38, *SD*=15.73) patients in terms of the average of the systolic BP during the hospitalization; no significant differences in the US between patients in the L+M old unit (*M*=131.52, *SD*=16.28)

and patients in the L+M new unit (*M*=125.43, *SD*=22.74); and no significant differences in Portugal between patients in Hospital Curry Cabral (*M*=128.07, *SD*=17.80), Hospital dos SAMS (*M*=126.59, *SD*=17.07), and Hospital da Luz (*M*=120.38, *SD*=12.80).

Considering that a normal diastolic blood pressure number is less than 80 and that a normal systolic blood pressure number is less than 120 (Thompson, 2013) we divided patients into four categories: normal blood pressure; high diastolic pressure; high systolic pressure; both high systolic and diastolic pressure. No patient had only high diastolic pressure. In the US 5 (21.7%) patients in the L+M old unit, and 24 (43.6%) patients in the L+M new unit had normal blood pressure; 13 (56.5%) in the old unit and 27 (49.1%) in the new unit had high systolic pressure; and 5 (21.7%) in the old unit and 4 (7.3%) in the new unit had both high diastolic and high systolic pressure.

In Portugal, 12 (35.3%) patients in Hospital Curry Cabral, 20 (35.7%) patients in Hospital dos SAMS, and 30 (44.1%) patients in Hospital da Luz had normal blood pressure; 17 (50.0%) in Hospital Curry Cabral, 24 (42.9%) in Hospital dos SAMS, and 21 (30.9%) in Hospital da Luz had high systolic pressure; and 5 (14.7%), 5 (14.7%) and 13 (19.1%) in Hospital Curry Cabral, Hospital dos SAMS, and Hospital da Luz, respectively, had high diastolic and high systolic pressure. In Portugal there were no significant differences between Portuguese patients in Hospital Curry Cabral (*M*=72.22, *SD*=8.59), Hospital dos SAMS (*M*=67.83, *SD*=9.95), and Hospital da Luz (*M*=71.38, *SD*=9.44) for diastolic blood pressure.

Pain

American patients reported feeling more pain (*M*=3.87, *SD*=2.16) than did the Portuguese patients (*M*=0.74, *SD*=0.95; $F(1, 172)=163.45$, $p<.001$) on a pain rating scale where 0 = the absence of pain and 10 is the strongest possible experience of pain. American patients in the L+M old unit (*M*=4.20, *SD*=2.51) reported similar levels of pain compared to patients in the L+M new unit (*M*=3.87, *SD*= 2.16).

In Portugal, patients in Hospital da Luz reported significantly less pain (*M*=0.01, *SD*=0.07) than did patients in Hospital dos SAMS (*M*=0.97, *SD*=1.24) and Hospital Curry Cabral (*M*=1.19, *SD*=0.57).

Medication

Pain meds by day

On a daily basis, American patients took less pain medication (irrespectively of whether the medications were low, moderate, or high) (*M*=2.99, *SD*=2.30) than did the Portuguese patients (*M*=4.21, *SD*=2.22; $F(1, 211)=14.61$, $p<.001$). Collapsed over medication categories, American

patients on a daily basis in the L+M old unit (*M*=4.26, *SD*=3.06) took more pain meds compared to patients in the L+M new unit (*M*=2.45, *SD*=1.65) (*F*(1,76)=11.42, *p*=.001).

In Portugal, there were no significant differences between Hospital Curry Cabral (*M*=4.10, *SD*=2.01), Hospital dos SAMS (*M*=4.76, *SD*=2.48), and Hospital da Luz (*M*=3.83, *SD*=2.22) in terms of the average daily number of taken pain medication doses, summed across categories.
In Portugal, patients in Hospital da Luz reported significantly less pain (*M*=0.01, *SD*=0.07) than did patients in Hospital dos SAMS (*M*=0.97, *SD*=1.24) and Hospital Curry Cabral (*M*=1.19, *SD*=0.57).

Low pain meds by day
On a daily basis, American patients took fewer low pain meds (*M*=1.13, *SD*=1.38) than did the Portuguese patients (*M*=2.03, *SD*=1.89; *F*(1, 210)=13.41, *p*<.001). American patients in the L+M old unit (*M*=1.60, *SD*=1.80) took more low pain meds compared to patients in the L+M new unit (*M*=0.93, *SD*=1.13) (*F*(1,76)=4.03, *p*=.048) on a daily basis.

In Portugal on a daily basis, patients in Hospital da Luz took significantly more low pain meds (*M*=3.16, *SD*=1.90) than did patients in Hospital Curry Cabral (*M*=2.33, *SD*=0.90); and patients in Hospital Curry Cabral took significantly more low pain meds than did patients in Hospital dos SAMS (*M*=0.39, *SD*=0.93) (*F*(2,132)=49.13, *p*<.001).

Moderate pain meds by day
American (*M*=1.59, *SD*=1.38) and Portuguese (*M*=1.95, *SD*=2.16) patients took similar doses of moderate pain meds on a daily basis. American patients in the L+M old unit (*M*=2.11, *SD*=1.93) took more moderate pain meds compared to patients in the L+M new unit (*M*=1.37, *SD*=1.03) (*F*(1,76)=4.84, *p*=.031) on a daily basis.

In Portugal, patients in Hospital dos SAMS took significantly more moderate pain meds (*M*=4.00, *SD*=2.12) than did patients in Hospital Curry Cabral (*M*=1.43, *SD*=1.21, *p*<.001); and patients in Hospital Curry Cabral took significantly more moderate pain meds than did patients in Hospital da Luz (*M*=0.58, *SD*=1.95, *p*=.058) (*F*(2,132)=67.54, *p*<.001) on a daily basis.

High pain meds by day
American (*M*=0.27, *SD*=0.70) and Portuguese (*M*=0.24, *SD*=0.64) patients took similar doses of high pain meds on a daily basis. American patients in the L+M old unit (*M*=0.55, *SD*=1.07) took more high pain meds compared to patients in the L+M new unit (*M*=0.15, *SD*=0.43) (*F*(1,76)=5.460, *p*=.002) on a daily basis.
In Portugal, there were no significant differences between Hospital Curry Cabral (*M*=0.34, *SD*=0.72), Hospital dos SAMS (*M*=0.37, *SD*=0.88), and Hospital da Luz (*M*=0.09, *SD*=0.25) in terms of the doses of high pain meds taken on a daily basis.

Pain doses by day (weighted meds)

To compare the doses of pain meds taken by Portuguese and American patients on a daily basis, we created a variable in which low pain meds were counted as 1, moderate pain meds were counted as 2, and high pain meds were counted as 3.

Results showed that American patients took fewer pain meds doses on a daily basis (M=5.12, SD=3.96) than did the Portuguese patients (M=6.63, SD=4.66; $F(1, 211)$=5.81, p=.017). American patients in the L+M old unit (M=7.47, SD=5.57) took more pain meds doses compared to patients in the L+M new unit (M=4.13, SD=2.53) ($F(1,76)$=13.36 p<.001) on a daily basis.

In Portugal, patients in Hospital dos SAMS took significantly more pain meds doses (M=9.50, SD=5.42) than did patients in Hospital Curry Cabral (M=6.21, SD=4.17, p=.005), and patients in Hospital da Luz (M=4.58, SD=2.75, p<.001) on a daily basis.

Notes about US meds - US Patients, Matched Medication Analysis

During the time our research was conducted, one of the physicians at L+M Hospital was running a study to evaluate the impact of a combination of pain medications on patients' need for medication. For that reason, the potential impact of the renovation of the inpatient unit on patients' use of pain medications must be understood within that particular context. To better understand the possible impact of the renovation, a sub-group analysis was done using patients matched for pain medication (for this one physician), comparing the old and new units. Three analyses (Total Low/Nr days; Total Med/Nr days; Total high/Nr days) showed no significant difference across units for Low [$F(1, 19) = 0.31$, p=.582, Medium [$F(1,19) = 1.89$, p=.185], or High levels of pain medication use [$F(1, 19) = 0.02$, p=.877). The small ns for this matched groups analysis (n=13 old; n=8 new) provide little power. It is possible that with a larger number of matched patients the medium level of pain medication would have yielded a significant difference (old, M=2.60, SD=2.14; new, M=1.47, SD=1.11).

Correlations between the perceived control, social support, and positive distraction provided by the hospital room and the health status measures

Table 7 presents, for each country, the correlations between the number of favorable elements in the room, the perceived control, social support, and positive distraction perceived to be provided by the hospital room and the health status.

Overall, heart rate, blood pressure, self-rated pain, and pain medication have low correlations between each other, except diastolic and systolic blood pressure (r(US)=.610, p<.001, r(Portugal)=.596, p<.001). One exception is the positive correlation between heart rate and diastolic pressure (r=.335, p<.001), and between heart rate and pain (r=.447, p<.001) in the American sample - which means that heart rate, diastolic pressure, and reported pain tend to increase or decrease together.

Regarding the relationship between the number of favorable elements in the room and the health status measures, in the US, the greater the number of favorable elements in the room, the less the diastolic pressure (r=-.312, p<.01), and the less the taken pain medication. The results are essentially the same whether we consider the total pain medication as a sum (r=-.298, p<.01), or in its weighted form, with high meds weighted 3, moderate meds weighted 2, and low meds weighted 1 (Weighted meds, r=-.305 p<.01). In Portugal, the greater the number of favorable elements in the room, the less the reported pain (r=-.278, p<.01).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Favorable elements in the room (1)	1	.617**	.380***	.390**	-.077	-.312**	-.097	-.048	-.305**	-.298**
Social Support (2)	.205**	1	.420***	.519**	-.147	-.225*	-.022	-.130	-.206	-.191
Perceived control (3)	342***	.585***	1	.581***	-.305**	-.160	-.187	-.188	.381**	-.343**
Positive distraction (4)	.366***	.548***	.588***	1	-.191	-.212	-.040	-.306**	-.291**	-.268*
Heart rate (5)	-.126	.023	-.056	-.081	1	.335**	.222	.447***	-.038	-.146
Diastolic pressure (6)	-.130	.019	.052	.020	.094	1	.610***	.163	.040	.035
Systolic pressure (7)	-.051	.155	.108	.047	.061	.596***	1	-.101	-.090	-.045
Pain (8)	-.278**	.015	-.026	-.066	.123	.020	.078	1	.209	.046
Weighted Meds (9)	.110	.128	.091	.005	.179*	.118	.098	.167	1	.943***
Total Meds (10)	.029	.110	.046	.004	.157	.141	-.215*	.090	.899***	1

Table 7
Correlations of Favorable Elements, Psychological Variables, and Health Status Measures for American (above the diagonal) and Portuguese patients (below the diagonal)

Note: Values above the diagonal are correlations for American patients, and values below the diagonal are correlations for Portuguese patients.
*p <.05, **p<.01, ***p<.001.

To test whether the presence of favorable elements in the hospital room affected patients' well-being in terms of heart rate, blood pressure, or pain, we selected blood pressure as the only dependent variable. Although reported pain and meds for pain have also shown some correlations with the presence of favorable elements in the hospital room, these variables have a large number of missing values in the Portuguese sample (39.2% and 14.6%, respectively), which could reduce the representativeness of the sample and therefore distort inferences about the population.

Do favorable elements of a hospital room affect blood pressure levels?

Results show that the total effect of the number of favorable elements in the room on blood pressure levels is negative and significant (β=-0.18, *p*=.003), which means that the greater the number of favorable elements in the hospital room, the lower the blood pressure.

...Are there any differences between American and Portuguese patients?

To further compare this relationship between US and Portugal, we used multi-group analysis. Results show that the total effect of the number of favorable elements in the room on stress is significant for American patients (β=-0.27, *p*=.002), whereas it is not significant for Portuguese patients (β=-0.13, *p*=.102), and that these coefficients are not significantly different.

Do favorable elements of a hospital room affect blood pressure levels because patients perceive it as providing control, social support, and positive distraction?

As one can see in Figure 64, once we added the perceived control, social support, and positive distraction to the model, results showed that (as previous analyses have already demonstrated) the relationship between the number of favorable elements in the room and those perceptions are positive and significant, i.e., more favorable elements in the room implies greater perception that the room provides control (β=0.34, *p*<.001), social support (β=0.27, *p*<.001), and positive distraction (β=0.44, *p*<.001). On the other hand, perceived control, social support, and positive distraction provided by the room do not predict blood pressure levels, and the direct effect of the favorable room elements on blood pressure is still significant (β=-0.21, *p*=.003), suggesting that the effect of room elements on blood pressure is **not mediated** by perceptions of perceived control, social support, and positive distraction.

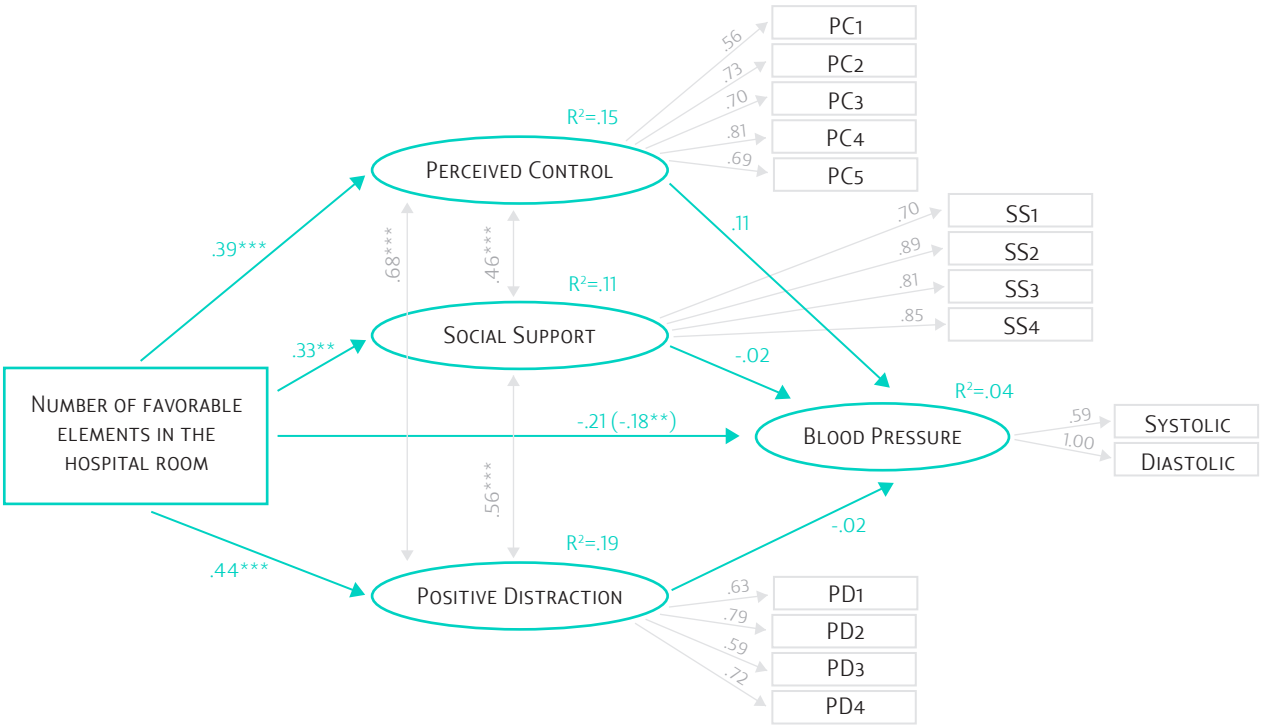

Figure 64
Standardized maximum likelihood coefficients for the structural equation model depicting the relationship between number of favorable elements in the hospital room and patients' blood pressure levels, mediated by perception of control, social support and positive distraction.
Note: Coefficient in brackets is the total effect and it was estimated before considering the two mediators in the model. *p<.05, **p<.01, ***p<.001.

The four independent latent variables accounted for 4% of the variance in blood pressure and analyses of the goodness-of-fit indices for the proposed model show a good fit to the data (X^2(96, N=236)= 220.12, p<.001, X^2/df=2.29, *CFI*=.92, *RMSEA*=.074).

...Are there any differences between American and Portuguese patients?

We analyzed whether the psychological process going from the number of favorable elements in the room to blood pressure occurs in the same way for both American and Portuguese. In other words, we tested if the mediation process between the number of favorable elements in the room and blood pressure is moderated by country.

We calculated a baseline model where we allowed the structural parameters to be freely estimated between groups of American and Portuguese patients. The goodness-of-fit for this model is good (X^2(192, N=236)= 374.459, p<.001, X^2/df=1.950, *CFI*=.89, *RMSEA*=.064), showing that the proposed model is a good fit to the data (see Figures 65 and 66).

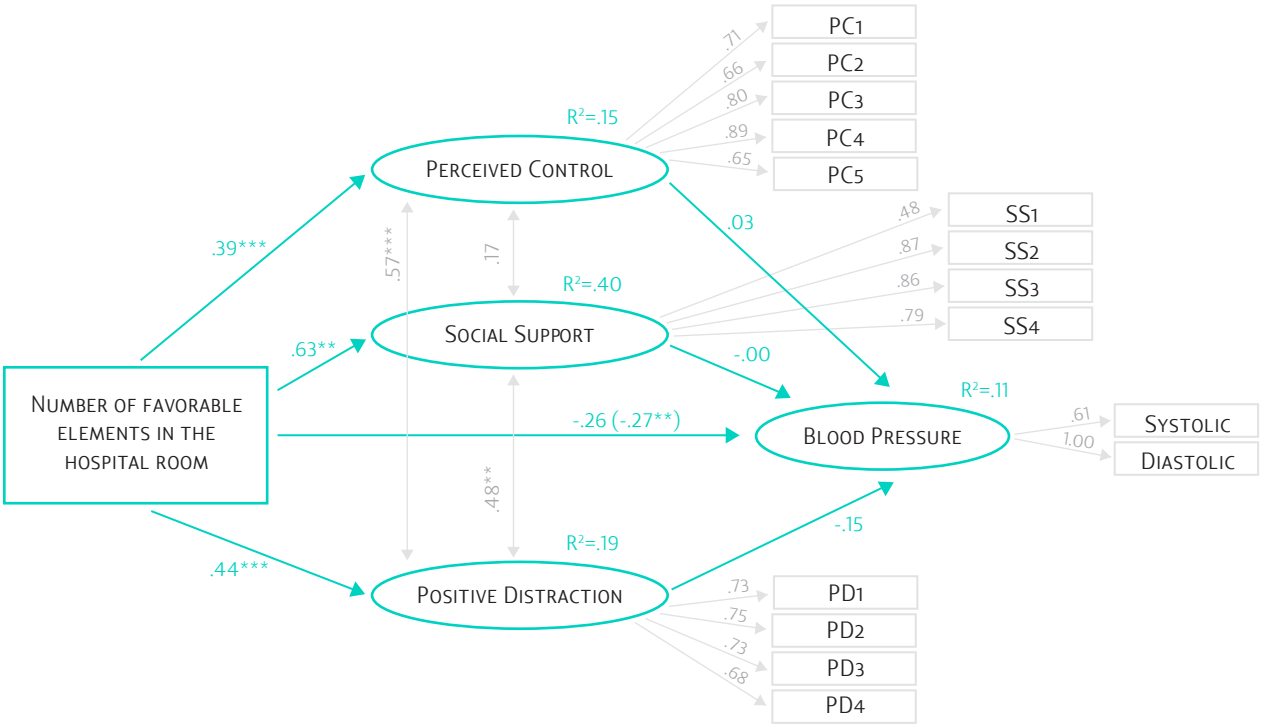

Figure 65
Standardized maximum likelihood coefficients for the multi-group analyses for American patients.

Note: Coefficient in brackets is the total effect and it was estimated before considering the two mediators in the model. *p<.05, **p<.01, ***p<.001.

Whereas for the American sample, the direct effect of favorable room elements on blood pressure is not significant, for the Portuguese sample this effect is significant. However, for both American and Portuguese patients, again, the number of favorable elements in the room predicts the perceived control, social support, and positive distraction (all p<.01), but these perceptions about the room did not affect the blood pressure values. This result suggests, again, that the effect of room elements on blood pressure is not mediated by perceptions of perceived control, social support, and positive distraction for our samples.

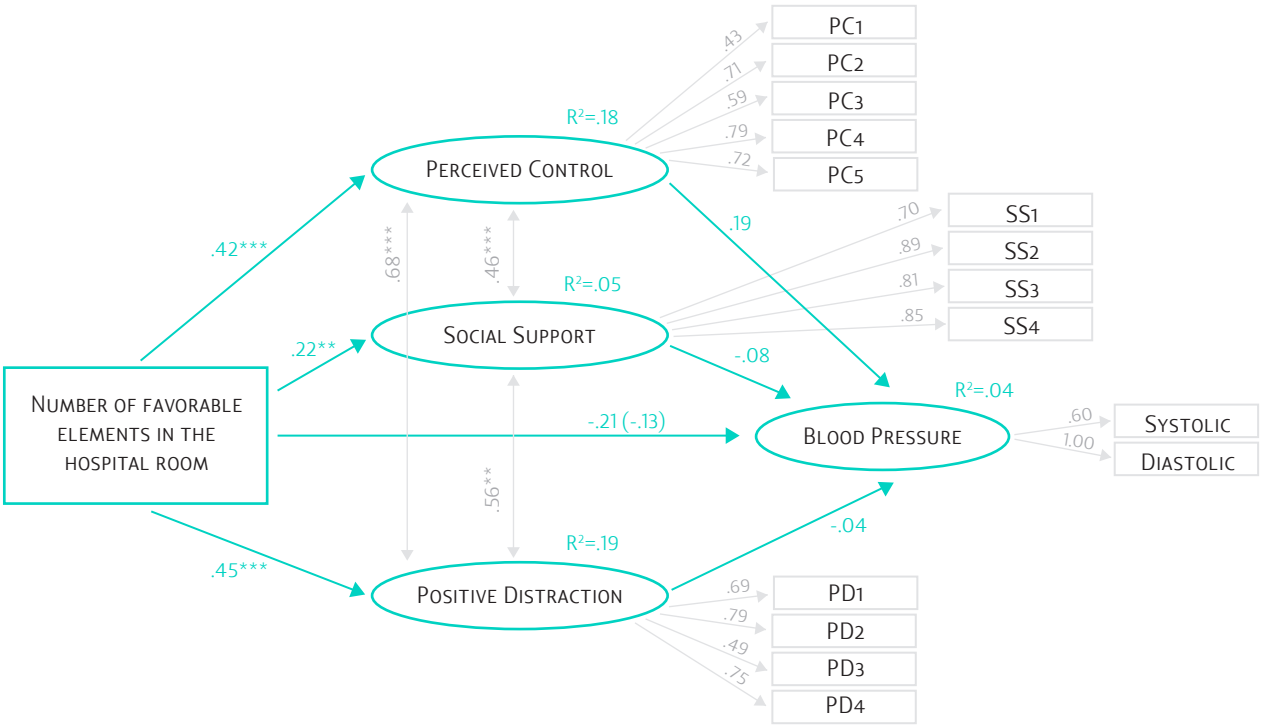

Figure 66
Standardized maximum likelihood coefficients for the multi-group analyses for Portuguese patients.
Note: Coefficient in brackets is the total effect and it was estimated before considering the two mediators in the model. *p<.05, **p<.01, ***p<.001.

The role of expectations

To test whether the effect of the number of favorable elements in the room on satisfaction and on stress was different for patients with lower or higher expectations regarding the hospital experience (regardless of the country), we performed multi-group analysis.

Considering the median of the variable expectations (Median = 8.25) (the variable could range from 1 to 10), we divided the sample into two groups: 73 (30.9%) with expectations below 8, and 161 (68.2%) with expectations of 8 or more.

Regarding the effect of the number of favorable elements on satisfaction, results show that this effect is positive and significant both for patients with lower expectations (β=0.43, p=.001) and for patients with higher expectations (β=0.17, p=.029), and that these effects are not significantly different (Dif X^2=3.418, p=.064). Analyses of the goodness-of-fit indices for the proposed model

show a good fit to the data (X^2(10, N=236)= 18.23, p=.051, X^2/df=1.82, CFI=.99, $RMSEA$=.060). This result indicates that irrespective of the level of expectations, the number of favorable elements always has a positive and significant effect on satisfaction.

In terms of reported stress, results show that the total effect of the number of favorable elements in the room on reported stress is negative and significant for patients with lower expectations (β=-0.37, p=.001), but not for patients with higher expectations (β=-0.04, p=.620), and that these effects are significantly different (Dif X^2=5.486, p=.019). Analyses of the goodness-of-fit indices for the proposed model show a good fit to the data (X^2(4, N=236)= 3.649, p=.456, X^2/df=0.912, CFI=1.00, $RMSEA$=.000).

This result means that, for patients with lower expectations (but not for patients with higher expectations), the greater the number of favorable elements in the room, the less the reported stress (irrespective of the country). This particular result is counter to our prediction that the patients with higher expectations would be more sensitive to the effect of the qualities of the room.

Which specific elements in the hospital room contribute to improving satisfaction and reducing stress?

The most consistent result in this study is that the number of favorable elements in hospital rooms has a positive effect on patients' well-being. We have shown that favorable elements in the room improve satisfaction, lower stress (Portugal) and lower blood pressure (US), and that perceptions of control, positive distraction, and social support are involved in this process. But which specific elements in the hospital room may contribute to improving satisfaction and reducing stress?

One of the ways to reflect on that question is to look at the qualitative data (the answers of patients about the factors that made them think more positively or negatively about the room).

Qualitative Comments: Overview

After finishing their overall evaluation of the room, patients were asked to list, in rank order, the three characteristics of their hospital room that influenced their level of satisfaction with their hospital experience. For each hospital, positive and negative factors mentioned by patients are presented in Appendix C.

First, to get an overview of patients' reactions, one can consider in which hospital units patients had more positive comments relative to the number of negative comments.

If we first look at the US data, patients in the new unit had more positive comments (n=130, 77.38%) relative to negative comments (n=38, 22.62%) than did patients in the old unit (n=43, 54.43% vs. 36, 45.47%), a significant difference, X^2 (1, N=247)=13.49, p<.001.

In Portugal, there were significantly more positive relative to negative comments in Hospital da Luz (n=148, 81.32% vs. n=34, 18.68%) compared to Hospital Curry Cabral (n=45, 50.0% vs. n=45, 50.0%), X^2 (1, N=272)=28.66, p<.001; and in Hospital dos SAMS (n=114, 76.00% vs. n=36, 24.0%) compared to HCC (53.3%), X^2 (1, N=240)=17.01, p<.001, but not between Hospital da Luz (81.32%) and SAMS (76.00%) (X^2 (1, N=332)= 1.40, p=.24).

It is clear that patients are more positive about the environments in the new unit in the US, in Hospital da Luz in Portugal, and in SAMS in Portugal, than in either the old unit in the US or HCC in Portugal. This result is congruent with what was found through the quantitative data in terms of satisfaction, reported stress; and perceptions of control, social support, and positive distraction provided by the room.

Themes

Qualitative comments are important because they help us understand the role a particular room element may play in the minds of patients. Turning to the specific comments that patients made, it is possible to extract a number of themes. If one considers the three predictors (positive distraction, perceived control, and social support) that were the focus of our research, what stands out in the qualitative comments is the primacy of perceived control (248 positive or negative comments from patients in all hospitals) and positive distraction (201 positive or negative comments from patients in all hospitals), compared to social support (138 positive or negative comments from patients in all hospitals).

We saw the importance of perceived control, especially in terms of functionality (i.e., whether one can interact with an element and the degree to which it works); of positive distraction, in terms of entertainment and view to the outside; and of social support, particularly in terms of the benefits of having a private room. First we will highlight the US data and then move to the Portuguese data.

United States

Both in the L+M old and new unit, most of the comments were related to perceived control (e.g., functionality, private room, accessibility of equipment, cleanliness, bathroom). Secondly,

patients made comments about the elements related to positive distraction (window/view, TV, art/décor). Relatively fewer comments were made about characteristics of the room related to social support, especially in the old unit. Interestingly, in both the old and new units, there was a pattern that the same element could possess both positive and negative qualities.

Regarding elements of perceived control, there were more positive comments about the whiteboard in the new (14.88% of the total number of comments in that unit) than in the old unit (3.80% of the total number of comments in that unit). In both the old and new units (refer to Figures 10 and 11, respectively, and see Figures 67 and 68), the whiteboard was on the footwall directly across from the patient's bed, and included information about the patient's medical status and plan of care. In fact, in the new unit the whiteboard received the highest number of positive comments of any element in the room (n=25; 19.23% of the total number of positive comments) (and a chi square comparing the two units with the number of comments about the whiteboard in relation to the total number of comments in each unit was significant, X^2 (1, N=275)= 4.47, p= .03, with Yates' correction). Although not every patient explained his/her mention of the whiteboard, the tendency was for patients to say that they liked knowing about the information it provided. For example, one patient said it made her feel she was participating in her care, and others made comments to the effect that it was "great to have patient information." These comments confirm that the whiteboard was viewed more in terms of perceived control.

What is apparent is that not all whiteboards are created equal. What might account for that difference in reaction to the whiteboard in the new vs. old unit? In the new unit, the whiteboard incorporated a clock and art (a small graphic or photo depiction of nature) (refer to Figure 67). Further, the board was clearly divided into just a few sections with one large area devoted to the plan of care. In contrast, the whiteboard in the old unit (refer to Figure 68) had many more sections (mobility level; assistance level; assistive device; safe patient handling needs; anticipated discharge plan; personal care by nursing or self; diet; vital signs) that essentially occupied the available space on the board, presumably making it more difficult for patients to actually read their current plan of care. In other words, the whiteboard in the new unit was probably more legible; to use Kevin Lynch's term (Lynch, 1960), relative to the whiteboard in the old unit, and the information may have been more accessible. What is noteworthy, then, is not simply the presence of an item (i.e., the whiteboard), but more importantly, whether it functions effectively, and provides a level of control that is meaningful to patients.

Regarding other aspects of **perceived control**, one can highlight the number of times the bathroom was mentioned. In the old unit, there was a toilet room and no shower, which produced no positive comments and only negative comments about the toilet room, with 3.80% of the total number of comments in that unit focused on this element, primarily the lack of a shower. Surprisingly, one of few negative factors in the new unit involved the shower stall. In the new unit, whereas 5.36% of the total number of comments involved positive references to the toilet room,

4.17% of the total number of comments were negative references to the toilet room. Most of these criticisms were from patients who thought there should have been a more clearly defined shower area (with more than a curtain) with a concave central drainage area to help guide the flow of water. Others commented on a lip into the toilet room that was difficult for those in wheelchairs or walkers to navigate (refer to Figure 14).

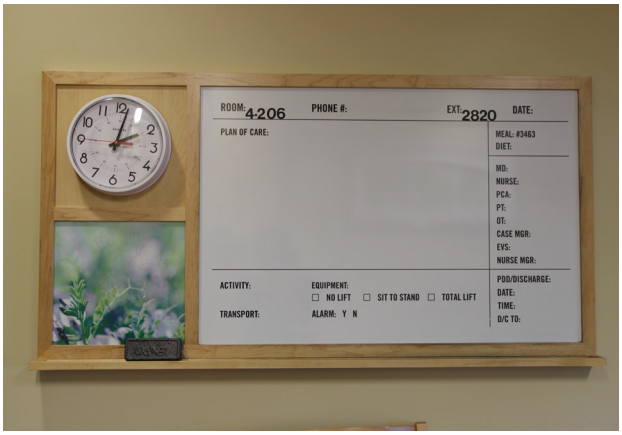

Figure 67
Lawrence + Memorial Hospital (US) - New Unit
New unit whiteboard

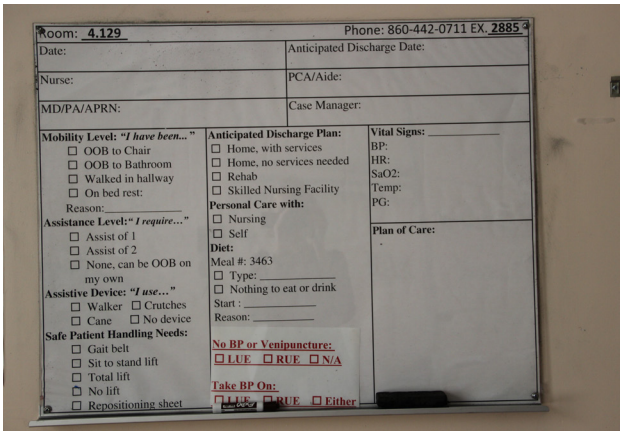

Figure 68
Lawrence + Memorial Hospital (US) - Old Unit
Old unit whiteboard

An amenity (here the introduction of a shower) may not have its full benefit if it does not function properly, in the patients' view, and therefore does not provide the full measure of possible control.

In the L+M old unit, we saw the primacy of **positive distraction** in the positive comments (8.86% of the total number of comments for that unit), and the negative comments (7.59% of the total number of comments for that unit) about the window and view. It is apparent that a particular factor, such as a view, can be evaluated positively or negatively, depending on its content. In this case, patients had a view of the streetscape or of another building. When they could look at the street, the evaluation of the view was generally positive; on the other hand, a view of a building was a negative experience for most patients.

In the L+M new unit, perhaps because there were other elements of positive distraction that attracted more attention than did the view, the view was mentioned positively and negatively less frequently than was true in the old unit. Only 3.57% (positive) and only 1.19% (negative) of the total number of comments on that unit focused on the view. Yet if we look at the distribution of the content of the view (how many people saw other buildings vs. a partial view of nature), the chi square approaches significance (X^2 (1, N=78)= 3.83, p=.050), with 67.2% of the patients in the new unit having a partial view to nature, whereas only 43.5% of those in the old unit did, compared to having a view of other buildings Thus, the fact that fewer people in the new unit

mentioned the view cannot be explained by the content of the view, because a higher percentage of them had a partial view to nature than was true in the old unit.

Every patient had a television – and it was similar in the two units – yet the television as an amenity (i.e., having one) received no comments in the old unit, whereas in the new unit, the television received 10.12% of the total number of positive comments and 1.79% of the total number of negative comments about the unit. What could account for this difference, given a similar TV? We don't know. It is possible that there was a halo effect of the whiteboard. That is, the location of the television in the vicinity of the legible whiteboard may have created a more positive reaction to the television than was true in the old unit, when the television was in the vicinity (and sometimes directly above) the illegible whiteboard.

Another explanation may be that in more attractive rooms (in this case, the rooms of the new unit), the evaluations tend to be inflated, and there may be a halo effect of the room itself.

Regarding **social support**, the category with the fewest comments overall, there were more positive comments made about social support (17.26% of the total number of comments) in the new unit than in the old unit (7.59% of the total number of comments), and this difference approached significance, X^2 (1, N=282)= 3.21, p=.07. Although the patients on both units were in private rooms, the benefits of having a single room were mentioned more in the new unit (6.55% of total comments about the unit) than in the old unit (2.53% of the total number of comments about the unit). In addition, the furnishings were also more prominent in the positive comments of patients on the new unit (4.17% of the total comments) than in the old unit (1.27% of the total comments). Ironically, the furnishings were also mentioned more negatively in the new (2.98%, n=5) than in the old unit (1.7%, n=1), although these ns are small.

One of the design changes for the new unit was a window seat (refer to Figure 8), which was added to provide additional seating. While patients appreciated this option, they seemed to think this bench had been added as a sleeping option for visiting relatives, and in that regard they found it deficient. For example, patients commented, "It would be nice to have a small cot for my wife to stay in the room; the window seat is not sufficient for sleeping; perhaps it could be wider at one end." Another commented, "the window seat MIGHT be good for someone visiting to nap, but it's pretty narrow." Yet another said, "It's hard for people to sleep over; the bench isn't enough."

If we recall the quantitative data, perceptions about the perceived control (the category with the largest number of comments) and social support (the category with the fewest comments) provided by the hospital room were important for improving satisfaction and reducing perceived stress in the American sample.

Portugal

Hospital da Luz

In Hospital da Luz, **positive distraction** emerges as a central theme in the positive comments that patients made (31.87% of the total comments), which corroborates the quantitative data. Only 2.20% of the total comments were negative aspects of positive distraction.

A primary category of positive distraction involved television. The television, part of the entertainment console (see Figure 34), was mentioned favorably in 11.54% of the total number of comments on this unit.

Secondarily, patients specifically mentioned natural light as a positive feature (8.24% of the total number of comments made about the unit). We had not specified this feature of the room in the observation checklist that gave rise to our independent variable (number of favorable elements in the room), essentially because this is not a feature of the room itself, but a feature of the ambient environment more generally. However, considering the number of comments about this environmental aspect in this and in the other two Portuguese hospitals (and Lisbon is a city famous for its sunlight), it made us think that natural light could probably provide patients a means of positive distraction. The entrance of different levels of natural light in the room during the day and the different tones and colors it produces may be visually distracting (besides the other benefits of natural light on mood and health in general). When looking at the rooms in Hospital da Luz, it is evident that there is abundant natural light provided by the window wall(s). In addition, this is the only hospital in the study where we felt it appropriate to create a separate category of comments to acknowledge window size itself (and not simply the presence of a window) (see Figure 26). Ironically, "Hospital da Luz" means, in Portuguese, "Hospital of Light".

Positive comments about **social support** received 19.23% of the total comments on the unit; only 6.04% of the total comments made were negative references to social support. Regarding positive aspects, patients commented on room size (5.49% of the total comments) and the availability of the Internet (6.04% of the total comments). The Internet was part of the entertainment console and was often mentioned as a feature of that integrated console. Hospital da Luz had large single rooms and offered even larger suites (399.9 sq. ft.). When negative comments were made, most comments were from patients who were not in private rooms and reacted negatively to sharing. As one patient said about the amount of space: "too small for two people."

Positive aspects of **perceived control** received 14.29% of the total number of comments; and negative aspects received 8.79%. Quietness (2.75%) and cleanliness (2.75%) received the largest number of positive comments in this category. Of negative comments in this category, the bathroom/WC received the largest percentage of total comments (3.30%). Patients complained there was no bidet, no seat in the shower, and no shelf next to the sink for toiletries. Also, the WC

was perceived to be too small for those in multiple occupancy rooms.

Of the total number of comments, 8.79% were classified in a general category (cozy, familiar, comfortable, good environment).

In general, there were relatively few negative comments made about Hospital da Luz, with the largest numbers (*n*= 6 in two cases; 3.30% of the total number of comments on the unit) involving the size of the room and the bathroom/WC. Patients who made the comments about size were in double rooms; a number of people who made the comments about the bathroom/WC were also in double rooms, and in those cases their comments related to sharing a bathroom.

Qualitative data from Hospital da Luz corroborates the results from the quantitative regarding the Portuguese sample: that positive distraction is an important factor for increasing satisfaction and reducing stress.

SAMS

In SAMS, we again saw the importance of **perceived control** (28% of positive comments and 8.67% of negative comments), with most of the positive comments about hygiene and cleanliness (6.67% of the total comments).

Positive distraction was the second most frequent category (23.33% of positive comments and 4.67% of negative comments), particularly in the role of the window and view in the number of positive comments (9.33% of the total number of comments on the unit) and the TV/ entertainment/console (8.0% of the total number of comments on the unit). Again, natural light is specifically mentioned (and favorably) by patients (6.0% of the total number of comment on the unit); while the windows are not as large as they are at Hospital da Luz, the windows do provide abundant natural light (see Figure 38).

With regard to **social support**, the room size was positively commented on most frequently (4% of the total comments).

Eight percent of the total number of comments on the unit were categorized as general (cozy, familiar, comfortable).

In SAMS, the most frequently mentioned negative elements were spread across the three categories: positive distraction, social support, and perceived control. For positive distraction, 2% complained about the art and décor; for social support, 2% complained about room privacy and 2% about the Internet; for perceived control, 2.67% complained about the functionality/ arrangement of furniture and equipment, and 2.67% complained about the bathroom/WC.

With regard to the art, one person said, "I am afraid of the sea, so I don't like the painting," while another said "The decoration of the walls is very sad." Regarding social support, the Internet signal was apparently so weak that it was not always available to patients. Those who complained about privacy were in double rooms. Regarding perceived control, the arrangement of the room prevented some patients from being near the window; another complained that the wiring of the bed light provided limited maneuverability. The central complaint about the water closet (bathroom) was that it was too small.

In this particular Portuguese hospital, considering what was expected from the quantitative data, perceived control assumes more importance (in terms of the frequency of the comments) than does positive distraction.

Hospital Curry Cabral

The picture that emerges at HCC is different than at the other hospitals in the study. In particular, the dissatisfaction with a particular element of **positive distraction** (the television function) was the most striking aspect of patients' comments. Of the 45 negative comments made, 37.78% (*n*=17) involved patients who complained there was no television; this represents 18.89% of the total number of comments made about the unit. In addition, half the number of comments made about the control of equipment (in the category of perceived control), were about the television as well (6.67%; *n*=3). These patients complained there was no remote to control the television. In HCC, the only rooms with TVs were those in which a television had been donated by a previous patient; and in those rooms, there was no remote. Thus, even when patients had access to a television, they would need to ask for help every time they wanted to change the channel or the volume. Accordingly, 6.67% of the total comments were about the absence of the remote. In terms of positive comments, the window/view was the most frequently mentioned element, with 8.89% of the total number of comments on the unit focusing on this feature.

Perceived control was also frequently mentioned, especially in terms of the bathroom (7.78% positive comments; and 5.56% of negative comments). Patients were happy when they had a water closet and unhappy when they did not.

Finally, **social support** was the category with the fewest comments; most of the positive comments were about the room size/space and the room privacy. Almost all of these comments came from patients in private rooms.

Again – as in SAMS – both positive distraction and perceived control assume the most important role.

Discussion

Discussion

In much of the current research on healthcare environments, the emphasis on evidence-based design focuses on architectural features such as same-handed vs. mirror image rooms (e.g., Herman Miller, 2011) and location of sinks, as just two examples. Research on environmental psychology has shown the benefits of specific attributes of the physical environment (e.g., a view from the window, e.g., Ulrich, 1984), of overall environment attractiveness (e.g., Swan et al., 2003), or of the renovation of a setting (e.g., Leather et al., 2003). Other studies have demonstrated how relevant it is for patients' satisfaction with care and emotional well-being that they perceive the hospital physical environment as having quality (e.g., Harris, 2002), and still others focus on the inferences people make based on what they know about the physical environment (e.g., Arneill & Devlin, 2002). Recently, an experimental study has shown that the hospital environment has the particular capacity to reduce satisfaction when its quality is low (compared to its capacity to improve satisfaction when its quality is high) (Andrade, Lima, Devlin, & Hernandez, 2014). All together, the accumulating evidence is compelling: the hospital physical environment matters. But why?

What happens in people's cognition that makes them feel better about a good physical environment? What does the environment provide that promotes people's well-being?

We argue that hospital room design offers certain opportunities to patients, including a) the opportunity for control over amenities, such as lighting, b) the role of social support, manifested in the degree to which the room can accommodate visits from family groups, and c) the importance of positive distraction, which is a result of environmental elements that hold one's attention and interest, elicit positive feelings, and may block or reduce pain and worrisome thoughts (Ulrich, 1991). The research emphasizes what might be considered psychosocial variables in design, which have received less emphasis in the evidence-based design movement, despite the principles outlined in Ulrich's theory of supportive design. In our research, the elements of positive distraction, social support, and perceived control were used as psychological variables that would help us better understand the relationship between the physical environment, on the one hand, and its effect on well-being, on the other. In other words, we were less interested in the elements themselves present in the room capable of affecting patients' well-being, and more in what possibilities patients perceive that such elements provide. These perceptions in turn contribute to well-being. From the standpoint of intervention, we believe that if we better

understand how the environment influences perceptions, then it will be easier to decide what elements the environment should include.

To investigate whether the capacity of the rooms to provide perceived control, social support, and positive distraction explain the effect of hospital physical environment on patients' well-being, we used mediation analyses for three different independent variables: satisfaction with the service, self-reported stress, and blood pressure levels. Additionally, we tested if these psychological processes occur the same way for American and Portuguese patients.
Our results show that the greater the number of favorable elements in the hospital room, the greater the perceptions of social support, perceived control, and positive distraction provided by the room; and the greater the number of favorable elements in the hospital room, the greater the satisfaction with the service and the less the stress. Of greater importance to our main research question, we found that these three psychological constructs do, in fact, mediate the relationship between the physical environment and well-being – which was true for satisfaction with the service and for self-reported stress, but not for blood pressure levels.

In other words, we confirmed that a) favorable elements in the hospital room improve satisfaction and reduce stress, and that b) this happens because their presence enhances patients' perceptions of control, social support, and positive distraction. That is, our results corroborate Ulrich's theoretical model.

Interestingly, we found differences in specific aspects of these psychological processes between American and Portuguese contexts. Whereas patients' perceptions of how favorably the room contributes to social support is a more consistent determinant of well-being across the American and the Portuguese samples (it predicts satisfaction and stress in the American sample, and satisfaction in the Portuguese sample), perceived control and positive distraction are clearly distinguished in the two samples. Our results showed that perceptions of how favorably the room contributes to perceived control explain the American sample's satisfaction and stress (a specific result not found in the Portuguese sample), and that perceptions of how favorably the room contributes to positive distraction explain the Portuguese sample's satisfaction and stress (a specific result not found in the American sample). In short, more satisfaction and less stress depend on perception of control for US patients, whereas more satisfaction and less stress depend on feelings of positive distraction, for Portuguese patients. Ironically, if we look at the descriptive analyses we can see that, from the point of view of patients, overall, hospital rooms seem to be providing more social support than they do perception of control or positive distraction.

Of course this result raises the question "why" perceived control is more important for the American sample, and positive distraction more important to the Portuguese sample." We believe that this difference can be associated to cross-cultural differences, namely in terms of locus of

control (Smith, Trompenaars, & Dugan, 1997) and level of individualistic vs. collectivistic culture (Gouveia & Ros, 2000; Hofstede, 1980). In fact the studies where US and Portuguese samples are compared on these dimensions show that American participants always score higher on internality and individualism than do the Portuguese participants. Portuguese participants present a more externally oriented and collectivistic approach that is compatible with a lower need of personal control over the environment and a higher dependency on the external ambiance – namely distractors in the hospital room. Given these differences, we can also speculate that this difference is related to different traditions of health care in these two countries. In Portugal, there is still a more biomedical perspective on health, whereas in the US healthcare is guided by biopsychosocial principles (Pereira, Fachada, & Smith, 2009). In Portugal patients tend to have a passive role in their care, with low participation in decision-making. The responsibility for treatments rests with the healthcare providers, and professionals are considered to be experts whose recommendations must be followed in order for the treatment to be successful. In this process, patients' needs, interests, concerns, questions, ideas, and requests are often overlooked. Thus, it seems that positive distraction may be an adaptive coping strategy for patients that are not expected to understand or participate in their care. A clear example of this cross-cultural difference in the patient's involvement in his/her care is illustrated by the presence of the whiteboard in the US but not in Portugal. The whiteboard involves the patient in the healthcare process by clearly providing information about the patient's status and plan of care. This feature is positioned prominently in the patient's room, directly across from the patient's bed on the footwall. This kind of information was not readily available to the Portuguese patients. Thus, the importance of perceived control for American patients may also be understood from this point of view about the level of participation in the healthcare process. In a health care system where patients are in part responsible for their treatment, to have control – including control of the environment – is indeed critical.

Another contrasting result between American and Portuguese patients, which may also be related to this difference in the health care model, is that American patients report significantly more pain and take significantly less pain medication than do Portuguese patients. A simple explanation is that American patients actually experience more pain than do Portuguese patients, given that they are taking less pain medication. Whether this example is an anomaly or reflects a cross-cultural difference in the approach to managing pain in the two countries we do not know and is an issue that should be considered in future cross-cultural studies. Moreover, other researchers (e.g., Shepley, Gerbi, Watson, Imgrund, & Sagha-Zadeh, 2012) have discussed the difficulty in using self-reported pain as an outcome measure, and this approach needs further study.

Alternatively, it is possible that the research being conducted by one of the physicians at the US hospital concurrent with our data collection may explain this finding that Americans took less pain medication. We do not have enough information to explain this result, and there are simply too many competing hypotheses.

Regarding blood pressure, we found that the greater the number of favorable elements in the room, the lower the blood pressure (in the US sample), but that perceptions about the room do not mediate this relationship. That is, in our samples, perceived control, social support, and positive distraction are not responsible for this effect. It is possible that other psychological variables mediate the effect of the room elements on blood pressure, or that this effect is spurious. For example, recent research indicates that mindfulness meditation and yoga did not reduce blood pressure after an 8-week program in un-medicated stage 1 hypertensive participants (Blom et al., 2014).

Overall, our health status data were not as integral a part of the study as we had hoped, given the problems in the Portuguese sample with limited access to that information.

In terms of the elements of the hospital room that patients could identify as reflecting positive or negative aspects, these were mentioned in their qualitative comments. The study points to the importance of windows and light in patients' perceptions of positive distraction in the Portuguese sample. This favorable element was clearly seen in the number of times patients in the Hospital da Luz mentioned the importance of the window size, the window view, or natural light, a theme that also emerged strongly for the patients in Hospital dos SAMS, and for those in HCC. In much of the environmental literature, including research in healthcare settings, the role of light is pointed to as an important positive feature (see for example Walsh et al., 2005). At L+M Hospital, we can see that the view was a source of satisfaction to patients when it included some nature, but it was also a source of dissatisfaction when it included another building or a roofscape.

In addition, it is clear how important it is to patients – particularly American patients – to understand their recovery status, as seen in the positive reactions of patients to the re-configured whiteboard in the L+M renovated unit. The fact that this feature is a relatively inexpensive one also directs our attention to the quality of the feature and its functional role, rather than to its cost per se. Spending money on a feature does not guarantee a positive reaction from patients. An expensive aspect to the renovated rooms, a shower in the toilet room, drew a significant number of negative comments because it presented problems for the patients (the lip into the room; concerns about drainage).

In general, patients are critical of features that do not work well or in line with their expectations, such as the lack of television and the absence of remote controls at HCC.

Cross-culturally, it is informative to compare the old unit at L+M with Hospital Curry Cabral. Patients in the old L+M unit and patients in Hospital Curry Cabral had similar perceptions about their respective rooms in terms of perceived control, social support, and positive distraction, which were more negative than those of the patients in the L+M new unit, Hospital dos SAMS,

and Hospital da Luz. They also reported less satisfaction with the service and more stress. Accordingly, in both of these facilities, the number of positive relative to negative comments was similar (54.43 v. 45.57% L+M; 50.0% v. 50.0% HCC). These older facilities differed in that regard from the L+M new unit, Hospital da Luz (HL), and Hospital dos SAMS (HS), where the percentage of positive to negative comments was heavily weighted in favor of the positive (77.38% L+M new; 81.32% HL; 76.0% HS). The degree of modernization and attractiveness of a unit thus appears to have a consistent impact on patients, as other studies have described (e.g., Swan, Richardson, & Hutton, 2003).

The focus of our study is not the comparison of the subjective (from patients) and objective (from researchers) evaluations of the hospital environment. At the same time, we need to comment on the incongruence between the objective evaluation of the room in terms of the number of favorable elements potentially producing perceived control, social support, and positive distraction, on the one hand, and the resultant perceptions, on the other. Our independent variable (the number of elements present) was created in a rigorous and thorough manner, but despite this approach, a subjective aspect was also present. The specific elements included in our final checklist, and the value we attributed to them, involved subjective decisions. Although our methodology can be critiqued and improved, we believe that we employed an innovative and valid approach to measure the quality of the hospital rooms (instead of using the traditional simplified dichotomy of "new-old", or "before-after renovation"). At the same time, the results suggest that certain elements may have differential relevance and importance for perceived control, social support, and positive distraction – which should be investigated in future studies.

Closing Thoughts: Challenges of Research in Healthcare Settings

At the 45th annual conference of the Environmental Design Research Association held in New Orleans in May, 2014, a full day intensive entitled "Pragmatic Design Research: Emerging Theories and Methods in Practice" (EDRA, 2014) was held. This full-day intensive session looked at the challenge in healthcare settings of what was argued to be the dichotomy between traditional research, steeped in an emphasis on internal validity, and pragmatic research, which often tackles small, targeted questions that arise in a time-pressured context and of necessity, it was argued, might possess less internal validity than is true of traditional research. In pragmatic design research, the presenters argued, there is an emphasis on utility and knowledge transfer, with the understanding that "good evidence is efficacious" in the sense that it produces a useful outcome.

We would argue that traditional values in research must be integrated with the pragmatic emphasis if research in healthcare is to yield results that are valid. We also would argue that this dichotomy between traditional and pragmatic approaches is a false one, and that research in healthcare settings of necessity must retain the traditional emphasis on internal validity if results

are to be meaningful and generalizable. The ability to generalize results stems from the control with which the research is conducted (e.g., Banaji & Crowder, 1989).

Nonetheless, we agree that healthcare settings present enormous challenges for researchers. Our experience has pointed to at least one strong recommendation in the service of conducting high quality research. One of the clear lessons we learned is the difficulty in doing high quality research in healthcare settings in the absence of what might be called a "site champion." While we had the necessary permissions to conduct the research, there is a difference between having permission and having a site champion, or someone on site that intervenes (i.e., is a champion) on behalf of the researchers and helps to support and address problems that arise in the research process.

In New London, although the administration was fully supportive, a stipulation of the research was that the project could not create additional work for nurses. In Lisbon, a similar situation existed in that nurses could only provide limited help with the screen shots of the patients' electronic records on the day the survey was administered, and access to the full record through the course of hospitalization was not permitted. In addition, one planned aspect of our research in the US, the collection of salivary cortisol samples, had to be discontinued because patients were concerned about the researcher (not a hospital employee) collecting saliva samples. A coordinated investigation that had nurses collecting the samples would have been a workable solution, but it is understandable that the administration had reservations about the added workload.

While clinical data collection by nurses makes sense, it might be contraindicated for survey research. When patients provide responses to interview questions that might bear on the performance (even indirectly) of clinical staff, it is likely that social desirability would be an issue. For that reason, having researchers outside the clinical category would make sense for this aspect of research.

What emerges, then, is the need for a site champion and for a coordinated model in which each member of a team handles the responsibilities to which he/she is most suited. Researchers cannot always be "insiders," that is, employees of the healthcare setting, but if they are part of a team that includes such employees, the research process will benefit.

Implications for Practice

Increasing the number of favorable elements in the hospital room is important because there is a relationship between the number of such elements and satisfaction with the service, choosing the room again, and stress reduction. In the combined samples, of the three psychological variables, social support and positive distraction predict satisfaction with the service, whereas perceived

control does not. Increasing the number of elements that contribute to positive distraction (e.g., art) and social support (e.g., furniture) is feasible, particularly elements of positive distraction. It should also be noted that culture needs to be considered when implementing recommendations from this research, because for Americans, it was social support and perceived control that mediated both satisfaction and stress, whereas for the Portuguese it was social support and positive distraction that mediated satisfaction, and only positive distraction that mediated stress. For the Portuguese in particular, the role of natural light in patients' rooms (part of positive distraction) is pronounced in healthcare facilities, perhaps related to the country's climate.

It is possible that the role of perceived control for Americans and not for the Portuguese relates to a difference in cultural values. Americans are much more individualistic than are Portuguese and opportunities to exert control (e.g., of features in the hospital room) may be consistent with these different needs. Thus, cultural context is an important consideration in healthcare design, as this research demonstrates. At the same time, the research demonstrates that positive distraction, specifically in the form of windows and views, transcends culture and can be addressed as a need that is universal. This research is innovative in many ways, and thus the implications for practice should be considered with care. In particular, when addressing the issue of the number of positive elements in the room, we have been implicitly assuming that "more is better." However it is possible that this relationship is not linear and that overstimulation can have less positive effects. For this reason, future research should address the limits of positive environmental stimulation in health contexts. Most of all, more environmental and evidence-based interventions should be implemented to promote the well-being of patients during hospitalization.

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Appendix

Appendix A

Table of Room elements by Hospital

L+M old unit

	Rooms with a view to buildings & Art=0	Rooms with a view to buildings & Art=1	Rooms with a view to buildings & Art=1.39	Rooms with a view to buildings/ nature & Art=1	Rooms with a view to buildings/ nature & Art= 2	Rooms with a view to buildings/ nature & Art=3
# of rooms	*n*=4	*n*=1	*n*=8	*n*=1	*n*=7	*n*=2
Social Support						
Av. Sq. footage of room 2 for suite 1 for single 0.5 for double/triple	1	1	1	1	1	1
# chairs for patient	1	1	1	1	1	1
# chairs for visitor	1	1	1	1	1	1
Internet (Wifi)	1	1	1	1	1	1
Bedside phone	1	1	1	1	1	1
Window bench/sit/ sleep	0	0	0	0	0	0
TOTAL	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
Positive distraction						
Television	1	1	1	1	1	1
Space to put photos	1	1	1	1	1	1
# prints/ posters of nature/ landscapes 1 to nature 0.5 to nature elements	0	1	1.39	1	2	3
View nature 0 to no view to nature (interior of the hospital or buildings) 0.5 to some view to nature 1 to a lot view to nature	0	0	0	0.5	0.5	0.5
BIG WINDOW plus 0.5	0	0	0	0	0	0

Closet for laundry	0	0	0	0	0	0
TOTAL	**2.0**	3.00	3.39	3.5	4.5	5.5
PERCEIVED CONTROL						
White board	1	1	1	1	1	1
Clock	1	1	1	1	1	1
Toilet (sep. room) 1 for private shower and toilet 0.75 for private toilet 0.5 for share private toilet and shower (in a double room) 0 for no private toilet + shower	.75	.75	.75	.75.	.75	.75
Temperature adjusted by patient	1	1	1	1	1	1
Lighting adjusted by patient	1	1	1	1	1	1
Television adjusted by patient	1	1	1	1	1	1
Call button	1	1	1	1	1	1
Bedside table	1	1	1	1	1	1
Closet for belongings	1	1	1	1	1	1
Room service menu	1	1	1	1	1	1
Narrow table near window	1	1	1	1	1	1
TOTAL	**10.75**	**10.75**	**10.75**	**10.75**	**10.75**	**10.75**

L+M NEW UNIT

	Rooms with a view to buildings	Rooms with a view to nature and buildings
# of rooms	*n*=18	*n*=37
SOCIAL SUPPORT		
Av. Sq. footage of room 2 for suite 1 for single 0.5 for double/triple	1	1
# chairs for patient	1	1
# chairs for visitor	1	1
Internet (Wifi)	1	1
Bedside phone	1	1
Window bench/sit/sleep	1	1
TOTAL	**6.0**	**6.0**
POSITIVE DISTRACTION		
Television:	1	1
Space to put photos	1	1
# prints/posters of nature/landscapes 1 to nature 0.5 to nature elements	3	3
View nature 0 to no view to nature (interior of the hospital or buildings) 0.5 to some view to nature 1 to a lot view to nature	0	.5
Big window plus 0.5	0	0
Closet for laundry	1	1
TOTAL	**6.0**	**6.5**
PERCEIVED CONTROL		
White board	1	1
Clock	1	1

Toilet (sep. room) 1 to private shower and toilet 0.75 to private toilet 0.5 to share private toilet and shower (in a double room) 0 to no private toilet + shower	1	1
Temperature adjusted by patient	1	1
Lighting adjusted by patient	1	1
Television adjusted by patient	1	1
Call button	1	1
Bedside table	1	1
Closet for belongings	1	1
Room service menu	1	1
Narrow table near window	0	0
TOTAL	**10.00**	**10.00**

Hospital da Luz

	Suites with a view to cemetery +trees	Suites with a view to buildings	Single rooms with a view to cemetery +trees	Single rooms with a view to buildings	Double rooms with a view to cemetery + trees	Double rooms with a view to buildings
# of rooms	1	1	9	13	10	31
Social Support						
Av. Sq. footage of room 2 for suite 1 for single 0.5 for double/triple	2	2	1	1	0.5	0.5
# chairs for patient	1	1	1	1	1	1
# chairs for visitor	1.5	1.5	1	1	1	1
Internet (Wifi)	1	1	1	1	1	1
Bedside phone	1	1	1	1	1	1
Window bench/sit/ sleep	1	1	1	1	1	1
TOTAL	**7.5**	**7.5**	**6**	**6**	**5.5**	**5.5**
Positive Distraction						
Television	1	1	1	1	1	1
Space to put photos	1	1	1	1	1	1
# prints/posters of nature/landscapes 1 to nature 0.5 to nature elements	0.5	0.5	0.5	0.5	0.5	0.5
View nature 0 to no view to nature (interior of the hospital or buildings) 0.5 to some view to nature 1 to a lot view to nature	0.5	0	0.5	0	0.5	0
Big window plus 0.5	0.5	0.5	0.5	0.5	0.5	0.5

Closet for laundry	0	0	0	0	0	0
TOTAL	**3.5**	**3**	**3.5**	**3**	**3.5**	**3**
PERCEIVED CONTROL						
White board	0	0	0	0	0	0
Clock 0.5 if only in the cockpit	0.5	0.5	0.5	0.5	0.5	0.5
Toilet (sep. room) 1-private shower and toilet 0.75-private toilet .5 share private toilet and shower (in a double room) 0-no private toilet + shower	1	1	1	1	0.5	0.5
Temperature adjusted by patient	1	1	1	1	1	1
Lighting adjusted by patient	1	1	1	1	1	1
Television adjusted by patient	1	1	1	1	1	1
Call button	1	1	1	1	1	1
Bedside table	1	1	1	1	1	1
Closet for belongings	1	1	1	1	1	1
Room service menu	0	0	0	0	0	0
Narrow table near window	1	1	1	1	1	1
TOTAL	**8.5**	**8.5**	**8.5**	**8.5**	**8**	**8**

Hospital dos SAMS

	Individual rooms with a view to garden	Double rooms with a view to garden	Individual rooms with a view to street	Double rooms with a view to street	Triple rooms with a view to garden
# of rooms	3	4	10	1	1
Social Support					
Av. Sq. footage of room 2 for suite 1 for single 0.5 for double/triple	1	0.5	1	0.5	0.5
# chairs for patient	1	1	1	1	1
# chairs for visitor	1	1	1	1	1
Internet (Wifi)	1	1	1	1	1
Bedside phone	1	1	1	1	1
Window bench/sit/sleep	1	1	1	1	1
TOTAL	**6**	**5.5**	**6**	**5.5**	**5.5**
Positive Distraction					
Television	1	1	1	1	1
Space to put photos	1	1	1	1	1
# prints/posters of nature/ landscapes 1 to nature 0.5 to nature elements	1	1	1	1	1
View nature 0 to no view to nature (interior of the hospital or buildings) 0.5 to some view to nature 1 to a lot view to nature	1	1	0.5	0.5	1
Big window plus 0.5	0	0	0	0	0
Closet for laundry	0	0	0	0	0
TOTAL	**4**	**4**	**3.5**	**3.5**	**4**
Perceived Control					
White board	0	0	0	0	0
Clock	0	0	0	0	0

Toilet (sep. room) 1-private shower and toilet 0.75-private toilet .5 share private toilet and shower (in a double room) 0-no private toilet + shower	1	0.5	1	0.5	0.25
Temperature adjusted by patient	1	1	1	1	1
Lighting adjusted by patient	1	1	1	1	1
Television adjusted by patient	1	1	1	1	1
Call button	1	1	1	1	1
Bedside table	1	1	1	1	1
Closet for belongings	1	1	1	1	1
Room service menu 0.5 for some food	0.5	0.5	0.5	0.5	0.5
Additional table	1	1	1	1	1
TOTAL	**8.5**	**8**	**8.5**	**8**	**7.75**

Hospital Curry Cabral

	Private rooms with a view to train station + nature	Private rooms with a view to nature	Private rooms with a view to nature; no TV, no toilet	Double rooms with a view to train station + nature	Triple rooms with a view train station + nature
# of rooms	5	2	1	1	1
Social support					
Av. Sq. footage of room 2 for suite 1 for single 0.5 for double/triple 0.25 for little space	1	1	1	0.25	0.5
# chairs for patient 0.5 for only 1 in a double room	1	1	1	0.5	1
# chairs for visitor 0.5 for only 1 in a double room	1	1	1	0	0
Internet (Wifi)	0	0	0	0	0
Bedside phone	0	0	0	0	0
Window bench/sit/sleep	1	1	1	0	0
TOTAL	**4**	**4**	**4**	**0.75**	**1.5**
Positive Distraction					
Television	1	1	0	0	0
Space to put photos	1	1	1	1	1
Prints/posters of nature/ landscapes 1 to nature 0.5 to nature elements	0	0	0	0	0
View nature 0 to no view to nature (interior of the hospital or buildings) 0.5 to some view to nature 1 to a lot view to nature	0.5	1	1	0.5	0.5
Big window plus 0.5	0	0	0	0	0
Closet for laundry	0	0	0	0	0
TOTAL	**2.5**	**3**	**2**	**1.5**	**1.5**
Perceived Control					
White board	0	0	0	0	0

Clock	0	0	0	0	0
Toilet (sep. room) 1 to private shower and toilet 0.75 to private toilet 0.5 to share private toilet and shower (in a double room) 0.25 to share private toilet and shower (in a triple room) 0 to no private toilet + shower	1	1	0	0	0.25
Temperature adjusted by patient	0	0	0	0	0
Lighting adjusted by patient	1	1	1	1	1
Television adjusted by patient	0	0	0	0	0
Call button	1	1	1	1	1
Bedside table	1	1	1	1	1
Closet for belongings	1	1	1	0	0
Room service menu 0.5 for some food	0.5	0.5	0.5	0.5	0.5
Additional table	0	0	0	0	0
Total	**5.5**	**5.5**	**4.5**	**3.5**	**3.75**

Appendix B

Medication Categorization by Hospital: Low (L), Medium (M), and Strong (S)

L+M	Luz	SAMS	HCC
L: Ibuprofen 600 mg		L - Ibuprofeno 400 mg Comp L - Ibuprofeno 600 mg Comp	L - (AI) Ibuprofeno 400 mg comp
L: Meloxicam 7.5 mg			
L: Tylenol extra strength 500 mg			
L: Pregabalin 25 mg 3x day; M: Pregabalin 75 mg; 2x day; 3x day			
		L – Algimat - Clorixinato de lisina (analgesic NSAID)	
L: Acetaminophen 650 mg 4x day M: Acetaminophen – codeine (Tylenol); Tylenol with codeine #3 equivalent 1 tablet every 4 hours (pain 1-4) S: Acetaminophen – codeine (Tylenol); Tylenol with codeine #3 equivalent 2 tablets every 4 hours (pain 6-10)	L: [Paracetamol 10 mg/ml Sol inj Fr 100 ml IV] 1000 mg IV-Perfusão 6/6h L: [Paracetamol 10 mg/ml Sol inj Fr 100 ml IV] (1 g bag) IV-Perfusão L: [Paracetamol 10 mg/ml Sol inj Fr 100 ml IV] 1 g IV-Perfusão 6/6h L: [Paracetamol 10 mg/ml Sol inj Fr 100 ml IV] 750 mg IV-Perfusão 6/6h L: [Paracetamol 10 mg/ml Sol inj Fr 100 ml IV] 1g IV-Perfusão 8/8h	L - Paracetamol 500 mg comp M - Paracetamol 1000 mg/ 100 ml Sol inj Fr IV (Acetaminophen in the US)	L - Paracetamol 10 mg/ml sol inj fr 100 ml IV L - Paracetamol 500 mg comp
L: Tramadol 50 mg every 6 hours (pain 1-4) L: Tramadol 100 mg every 6 hours (pain 5-10)	L: [Tramadol 100 mg/2ml Sol inj Fr 2 ml IM IV SC] (200 mg bag) IV-perfusão PRN STAT L: [Tramadol 100 mg/2ml Sol inj Fr 2 ml IM IV SC] (100 mg) IV-perfusão 8/8h	L - Tramadol 100 mg Comp LP L - Tramadol 50 mg Cáps M - Tramadol 100 mg/ 2 ml Sol inj Fr IV S – se for em perfusão	S - Tramadol 100 mg / 2 ml sol inj fr 2 ml IM IV SC

	L: [Metamizol magnésico 2000 mg/5ml Sol inj Fr 5 ml IM IV] 2 g IV-Perfusão 8/8h L: [Metamizol magnésico 2000 mg/5ml Sol inj Fr 5 ml IM IV] 2000 mg IV-Perfusão SOS PRN STAT [Metamizol magnésico 2000 mg/5ml Sol inj Fr 5 ml IM IV] 2g IV-Bolus SOS PRN STAT		M - Metamizol Magnésico 2000 mg / 5 ml Sol Inj FR 5 ml IM IV [This is a non-steroidal anti-inflammatory (Nolotil)]
M: Celecoxib 200 mg M: Celecoxib 400 mg	L (AI): [Parecoxib 40 mg Po sol inj Fr IM IV] 40 mg IV-Bolus 12/12h	M - Parecoxib – AI (similar to Ceterolac) (Dynastat in the EU)	
M: Ketorolac tromethamine (Toradol equivalent) 15 mg every 6 hours	M: [Cetorolac 30 mg/1ml Sol inj Fr 1 ml] 30 mg IV-Bolus 8/8h M: [Cetorolac 30 mg/1ml Sol inj Fr 1 ml] 30 mg IV-Bolus 6/6h M: [Cetorolac 10 mg/1ml Sol inj Fr 1 ml] 10 mg IV-Bolus 8/8h (This is Ketorolac in the US)	M - Toradol (cetarolac)	M - Cetorolac 10 mg/ 1 ml sol inj fr 1 ml IM IV M - Cetorolac 30 mg / 1 ml sol inj fr 1 ml IM IV
M: Oxycodone cr (Oxycontin equivalent) 10 mg M: Oxycodone acetaminophen 5/325 (~Percocet) every 6 hours (pain levels 4-7) M: Oxycodone (Roxicodone equivalent) 5 mg every 3 hours or every 4 hours (pain 1-5); also for pain >7 M: Oxycodone (Roxicodone equivalent) 10 mg every 3 hours or every 4 hours (pain 6-10)			

	S: [Ropivacaina 2 mg/ml IV Amp 20 ml] (80 mg bag) Epidural @3mL/ hour STAT S: [Ropivacaina 7.5 mg/ml Sol inj Fr 10 ml Epidural Perineural 75 mg Epidural continuo STAT S: [Ropivacaina 2 mg/ml Sol inj Fr 100 ml Epidural] (2 mg bag) Epidural @4mL/hour STAT [Ropivacaina is also called Naropin (local anesthetic nerve block)]		
	S: [Sufentanilo 0.005 mg/ ml Sol inj Fr 2 ml Epidural IV] 0.050 mg Epidural Continuo STAT (This is also called Sufenta and is an opioid analgesic drug that is more potent than morphine)		
		S - Petidina 50 mg/ 2 ml Sol inj Fr 2 ml IM IV SC – Ampola (This is a narcotic pain reliever ~ to Demerol in the US)	
		S - Levobupivacaina 50 mg/ 10 ml ml Sol inj Fr 10 ml Epidural IT (aparece sozinho) S - Levobupivacaina 25 mg/ 10 ml ml Sol inj Fr 10 ml Epidural IT (aparece sozinho) (The trade name is Chirocaine; this is used in post-operative pain)	

S: Morphine 2 mg every 4 hours (pain 8-10) S: Morphine 4 mg every 6 hours S: Morphine (PF) 30 mg		S - Morfina 10 mg/1ml Sol inj Fr 1 ml Epidural IM IT IV SC – Executado 20 S - Morfina 10 mg/1ml Sol inj Fr 1 ml Epidural IM IT IV SC – Executado 30 S - Morfina 10 mg/1ml Sol inj Fr 1 ml Epidural IM IT IV SC – Executado 40 S - Morfina 10 mg/1ml Sol inj Fr 1 ml Epidural IM IT IV SC – Executado 3	

S: Hydromorphone 2 mg S: Hydromorphone 1 mg every 2 hours (~Dilaudid equivalent) (for pain ratings 6-10) S: Hydromorphone 0.5 mg every 2 hours (~Dilaudid equivalent)(for pain ratings 1-5) M: Hydrocodone APAP 7.5 325 mg (~Norco) 1 tablet every 4 hours (pain 1-5) M: Hydrocodone APAP 7.5 325 mg (~Norco) 2 tablets every 4 hours (pain 6-10) S: Hydromorphone 4 mg every 3 hours (~Dilaudid equivalent) (for pain ratings 6-10) S: Hydromorphone 2 mg every 3 hours (~Dilaudid equivalent) (for pain ratings 6-10) S: Hydromorphone 1 mg every 2 hours (~Dilaudid equivalent) (for pain ratings 6-10) S: Hydromorphone 0.5 mg every 2 hours or every 3 hours (~Dilaudid equivalent)(for pain ratings 1-5)			

Appendix C
Qualitative Comments by Hospital

L+M old unit

Element	Frequency Positive Comments	% Positive of Total	% of Positive	Frequency Negative Comments	% Negative of Total	% of Negative
Positive Distraction						
Window/View	7	8.86	16.28	6	7.59	16.67
Television	0	0.00	0.00	0	0.00	0.00
Art/decor	4	5.06	9.30	3	3.80	8.33
Natural light	1	1.27	2.33	0	0.00	0.00
Total	**12**	**15.19**	**27.91**	**9**	**11.39**	**25.00**
Social Support						
Size of room	3	3.80	6.98	3	3.80	8.33
Private (room)	2	2.53	4.65	0	0.00	0.00
Furnishings/Furniture	1	1.27	2.33	1	1.27	2.78
Internet	0	0.00	0.00	0	0.00	0.00
Telephone	0	0.00	0.00	0	0.00	0.00
Total	**6**	**7.59**	**13.95**	**4**	**5.06**	**11.11**
Perceived Control						
Location on unit	4	5.06	9.30	1	1.27	2.78
Layout (room)	3	3.80	6.98	0	0.00	0.00
Whiteboard	3	3.80	6.98	0	0.00	0.00
Control (equip.)	2	2.53	4.65	3	3.80	8.33
Accessibility (equip.)	2	2.53	4.65	0	0.00	0.00

Functionality/ arrangement of equipment	2	2.53	4.65	8	10.13	22.22
Quiet/sound	1	1.27	2.33	1	1.27	2.78
Hygiene/ cleanliness	2	2.53	4.65	0	0.00	0.00
Maintenance/ upkeep	0	0.00	0.00	1	1.27	2.78
Bathroom	0	0.00	0.00	3	3.80	8.33
HVAC	1	1.27	2.33	3	3.80	8.33
Bed	0	0.00	0.00	0	0.00	0.00
Safety	0	0.00	0.00	1	1.27	2.78
Call Button	0	0.00	0.00	0	0.00	0.00
Total	**20**	**25.32**	**46.51**	**21**	**26.58**	**58.33**
OTHER ASPECTS						
Staff	3	3.80	6.98	2	2.53	5.56
Miscellaneous/ uncategorized	2	2.53	4.65	0	0.00	0.00
Total	**5**	**6.33**	**11.63**	**2**	**2.53**	**5.56**
Total Comments *N=79*	***n*=43**	**54.43**	**100**	***n*=36**	**45.57**	**100**

L+M NEW UNIT

Element	Frequency Positive Comments	% Positive of Total	% of Positive	Frequency Negative Comments	% Negative of Total	% of Negative
POSITIVE DISTRACTION						
Window/view	6	3.57	4.62	2	1.19	5.26
Television	17	10.12	13.08	3	1.79	7.89
Art/decor	10	5.95	7.69	5	2.98	13.16
Natural light	1	0.60	0.77	0	0.00	0.00
Closet for laundry	1	0.60	0.77	0	0.00	0.00
Total	**35**	**20.83**	**26.92**	**10**	**5.95**	**26.32**
SOCIAL SUPPORT						
Room (size)	7	4.17	5.38	0	0.00	0.00
Private (room)	11	6.55	8.46	0	0.00	0.00
Furnishings/Furniture/ Bench	7	4.17	5.38	5	2.98	13.16
Accommodations for visitors	2	1.19	1.54	0	0.00	0.00
Internet	0	0.00	0.00	0	0.00	0.00
Telephone	2	1.19	1.54	0	0.00	0.00
Total	**29**	**17.26**	**22.31**	**5**	**2.98**	**13.16**
PERCEIVED CONTROL						
Layout (room)	0	0.00	0.00	0	0.00	0.00
Location on unit	0	0.00	0.00	1	0.60	2.63
Whiteboard	25	14.88	19.23	1	0.60	2.63
Control (equip.)	0	0.00	0.00	1	0.60	2.63
Accessibility (equip.)	2	1.19	1.54	1	0.60	2.63

Functionality/ arrangement of equipment	6	3.57	4.62	6	3.57	15.79
Quiet/sound	1	0.60	0.77	2	1.19	5.26
Hygiene/ cleanliness	7	4.17	5.38	0	0.00	0.00
Maintenance/ upkeep	0	0.00	0.00	0	0.00	0.00
Storage	2	1.19	1.54	0	0.00	0.00
Bathroom	9	5.36	6.92	7	4.17	18.42
HVAC	1	0.60	0.77	0	0.00	0.00
Bed	4	2.38	3.08	0	0.00	0.00
Safety	0	0.00	0.00	1	0.60	2.63
Call Button	3	1.79	2.31	0	0.00	0.00
Total	**60**	**35.71**	**46.15**	**20**	**11.90**	**52.63**
OTHER ASPECTS						
Staff	6	3.57	4.62	0	0.00	0.00
Food	0	0.00	0.00	1	0.60	2.63
Miscellaneous/ uncategorized	0	0.00	0.00	2	1.19	5.26
Total	**6**	**3.57**	**4.62**	**3**	**1.79**	**7.89**
Total Comments *N=168*	***n*=130**	**77.38**	**100**	***n*=38**	**22.62**	**100**

Hospital da Luz

Element	Frequency Positive Comments	% Positive of Total	% of Positive	Frequency Negative Comments	% Negative of Total	% of Negative
Positive Distraction						
Window/View	8	4.40	5.41	2	1.10	5.88
Window size	6	3.30	4.05	0	0.00	0.00
TV/entertainment/ Internet console	21	11.54	14.19	2	1.10	5.88
Art/décor/materials/ colors	8	4.40	5.41	0	0.00	0.00
Natural light	15	8.24	10.14	0	0.00	0.00
Total	**58**	**31.87**	**39.19**	**4**	**2.20**	**11.76**
Social Support						
Room (size)	10	5.49	6.76	2	1.10	5.88
Room (privacy)	2	1.10	1.35	6	3.30	17.65
Furnishings/Furniture/ Bench	4	2.20	2.70	1	0.55	2.94
Accommodations for visitors	3	1.65	2.03	0	0.00	0.00
Internet	11	6.04	7.43	2	1.10	5.88
Telephone	5	2.75	3.38	0	0.00	0.00
Total	**35**	**19.23**	**23.65**	**11**	**6.04**	**32.35**
Perceived Control						
Whiteboard	0	0.00	0.00	0	0.00	0.00
Layout (room)	0	0.00	0.00	1	0.55	2.94
Location on unit	0	0.00	0.00	1	0.55	2.94
Control (equip.)	3	1.65	2.03	4	2.20	11.76
Accessibility (equip.)	0	0.00	0.00	0	0.00	0.00

Functionality/ arrangement of equip./furniture	3	1.65	2.03	0	0.00	0.00
Quiet/sound	5	2.75	3.38	2	1.10	5.88
Hygiene/cleanliness	5	2.75	3.38	0	0.00	0.00
Maintenance/upkeep	0	0.00	0.00	0	0.00	0.00
Storage	0	0.00	0.00	0	0.00	0.00
Bathroom/WC	4	2.20	2.70	6	3.30	17.65
HVAC	3	1.65	2.03	2	1.10	5.88
Bed	1	0.55	0.68	0	0.00	0.00
Safety	0	0.00	0.00	0	0.00	0.00
Call Button	2	1.10	1.35	0	0.00	0.00
Total	**26**	**14.29**	**17.57**	**16**	**8.79**	**47.06**
OLTHER ASPECTS						
Food	1	0.55	0.68	0	0.00	0.00
Miscellaneous/ Uncategorized	2	1.10	1.35	1	0.55	2.94
Staff/service	10	5.49	6.76	2	1.10	5.88
Total	**13**	**7.14**	**8.78**	**3**	**1.65**	**8.82**
General (cozy, familiar, comfortable)	16	8.79	10.81	0	0.00	0.00
attractiveness	16	8.79	10.81	0	0.00	0.00
Total Comments *N=182*	***n*=148**	**81.32**	**100**	***n*=34**	**18.68**	**100**

Hospital dos SAMS

Element	Frequency Positive Comments	% Positive of Total	% of Positive	Frequency Negative Comments	% Negative of Total	% of Negative
Positive Distraction						
Window/view	14	9.33	12.28	1	0.67	2.78
Window (size)	0	0.00	0.00	0	0.00	0.00
TV/entertainment/ Internet console	12	8.00	10.53	2	1.33	5.56
Art/décor/materials/ colors	0	0.00	0.00	3	2.00	8.33
Natural light	9	6.00	7.89	1	0.67	2.78
Total	**35**	**23.33**	**30.70**	**7**	**4.67**	**19.44**
Social Support						
Room (size; space)	6	4.00	5.26	2	1.33	5.56
Room privacy	4	2.67	3.51	3	2.00	8.33
Furnishings/furniture/ bench	3	2.00	2.63	1	0.67	2.78
Accommodations for visitors	3	2.00	2.63	1	0.67	2.78
Internet	1	0.67	0.88	3	2.00	8.33
Telephone	1	0.67	0.88	1	0.67	2.78
Total	**18**	**12.00**	**15.79**	**11**	**7.33**	**30.56**
Perceived Control						
Whiteboard	0	0.00	0.00	0	0.00	0.00
Layout (room)	0	0.00	0.00	0	0.00	0.00
Location on unit	0	0.00	0.00	0	0.00	0.00
Control (equip.)	1	0.67	0.88	0	0.00	0.00
Accessibility (equip.)	1	0.67	0.88	0	0.00	0.00

Functionality/ arrangement of equip./furniture	5	3.33	4.39	4	2.67	11.11
Quiet/sound/calm	5	3.33	4.39	2	1.33	5.56
Hygiene/cleanliness	10	6.67	8.77	0	0.00	0.00
Maintenance/upkeep	0	0.00	0.00	0	0.00	0.00
Storage	4	2.67	3.51	2	1.33	5.56
Bathroom/WC	6	4.00	5.26	4	2.67	11.11
HVAC	6	4.00	5.26	0	0.00	0.00
Bed	4	2.67	3.51	1	0.67	2.78
Safety	0	0.00	0.00	0	0.00	0.00
Call button	0	0.00	0.00	0	0.00	0.00
Total	**42**	**28.00**	**36.84**	**13**	**8.67**	**36.11**
OLTHER ASPECTS						
Staff/service	5	3.33	4.39	1	0.67	2.78
Food	1	0.67	0.88	1	0.67	2.78
Miscellaneous/ uncategorized	1	0.67	0.88	2	1.33	5.56
Total	**7**	**4.67**	**6.14**	**4**	**2.67**	**11.11**
General (cozy, familiar/comfortable)	12	8.00	10.53	1	0.67	2.78
attractiveness	12	8.00	10.53	1	0.67	2.78
Total Comments *N=150*	***n*=114**	**76.00**	**100**	***n*=36**	**24.00**	**100**

Hospital Curry Cabral

Element	Frequency Positive Comments	% Positive of Total	% of Positive	Frequency Negative Comments	% Negative of Total	% of Negative
Positive Distraction						
Window/view	8	8.89	17.78	0	0.00	0.00
Window (size)	0	0.00	0.00	0	0.00	0.00
TV/entertainment/ Internet console	2	2.22	4.44	17	18.89	37.78
Art/décor/materials/ colors	1	1.11	2.22	0	0.00	0.00
Natural light	3	3.33	6.67	0	0.00	0.00
Total	**14**	**15.56**	**31.11**	**17**	**18.89**	**37.78**
Social Support						
Room (size; space)	5	5.56	11.11	1	1.11	2.22
Room (privacy; single)	6	6.67	13.33	0	0.00	0.00
Furnishing/furniture/ bench	1	1.11	2.22	0	0.00	0.00
Accommodations for visitors	1	1.11	2.22	3	3.33	6.67
Internet	0	0.00	0.00	2	2.22	4.44
Telephone	0	0.00	0.00	0	0.00	0.00
Total	**13**	**14.44**	**28.89**	**6**	**6.67**	**13.33**
Perceived Control						
Whiteboard	0	0.00	0.00	0	0.00	0.00
Layout (room)	0	0.00	0.00	1	1.11	2.22
Location on unit	0	0.00	0.00	0	0.00	0.00
Control (equip.)	0	0.00	0.00	6	6.67	13.33
Accessibility (equip.)	0	0.00	0.00	0	0.00	0.00

Functionality/ arrangement of equip./furniture	0	0.00	0.00	1	1.11	2.22
Quiet/sound/calm	1	1.11	2.22	0	0.00	0.00
Hygiene/cleanliness	2	2.22	4.44	1	1.11	2.22
Maintenance/upkeep	0	0.00	0.00	0	0.00	0.00
Storage	0	0.00	0.00	3	3.33	6.67
Bathroom/WC	7	7.78	15.56	5	5.56	11.11
HVAC	2	2.22	4.44	0	0.00	0.00
Bed	0	0.00	0.00	0	0.00	0.00
Safety	0	0.00	0.00	0	0.00	0.00
Call button	0	0.00	0.00	1	1.11	2.22
Total	**12**	**13.33**	**26.67**	**18**	**20.00**	**40.00**
OLTHER ASPECTS						
Staff/service	3	3.33	6.67	2	2.22	4.44
Food	1	1.11	2.22	0	0.00	0.00
Miscellaneous/ Uncategorized	1	1.11	2.22	2	2.22	4.44
Total	**5**	**5.56**	**11.11**	**4**	**4.44**	**8.89**
General (cozy, familiar, comfortable)	1	1.11	2.22	0	0.00	0.00
attractiveness	1	1.11	2.22	0	0.00	0.00
Total Comments *N=90*	***n*=45**	**50.00**	**100**	***n*=45**	**50.00**	**100**

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