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UNIVERSITY OF CALIFORNIA, SAN DIEGO

SAN DIEGO STATE UNIVERSITY

Healing Effects of the Built Environment

A Dissertation submitted in partial satisfaction of the
Requirements for the degree of Doctor of Philosophy

in

Clinical Psychology

by

Sandra Anne Sherman

Committee in charge:

University of California, San Diego

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San Diego State University

Professor Vanessa Malcarne, Chair
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Professor James Sallis

2008

The Dissertation of Sandra Anne Sherman is approved, and it is acceptable in quality and form for publication on microfilm:

Chair

University of California, San Diego

San Diego State University

2008

DEDICATION

To the children who asked for more buttons on their remote controls.

And to the ones who will use them.

EPIGRAPH

"'All the doors… have a cheerful and sunny disposition. It is their pleasure to open for you, and their satisfaction to close again with the knowledge of a job well done.' As the door closed behind them it became apparent that it did indeed have a satisfied sighlike quality to it. *'Hummmmmmyummmmmmmah!'* it said... *'Thank you… for making a simple door very happy.'"*

--Douglas Adams

"He perceived that he was up against French red tape, compared to which that of Great Britain and America is only pinkish. Where in the matter of rules and regulations London and New York merely scratch the surface, these Gauls plumb the depths. It is estimated that a French minor official, with his heart really in his work, can turn more hairs grey and have more clients tearing those hairs than any six of his opposite numbers on the pay rolls of other nations."

--*P.G. Wodehouse*

"First do no harm"

--*Not Hippocrates, but close enough*

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VITA

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ABSTRACT OF THE DISSERTATION

Healing Effects of the Built Environment

by

Sandra Anne Sherman

Doctor of Philosophy in Clinical Psychology

University of California, San Diego, 2008
San Diego State University, 2008

Professor Vanessa Malcarne, Chair

Research shows that adult hospital built environments can affect physical and psychological outcomes and healthcare satisfaction, but research on pediatric built environments is sparse. This study investigated the effects of the built environment on pediatric hematology-oncology patients, their parents, and nursing staff at a Southern California children's hospital serving a predominantly Latino population. Hospital built environment was evaluated subjectively through satisfaction questionnaires and objectively by quantifying environmental features. All subjects completed a questionnaire battery measuring the constructs of present functioning (PF), positive affect (PA), and negative affect (NA). Healthcare satisfaction (HS) was assessed for parents. Co-worker satisfaction (CS) and multidimensional fatigue (F) were assessed for staff. Patient medical data were obtained from charts. Structural equation modeling (SEM) was used to test the hypothesis that environmental satisfaction (ES) would mediate the relationship between objective environment (OE) and PF, PA, and NA (with HS, and CS and F included as outcomes in the parent and staff models, respectively), such that the presence of more environmental features thought to be beneficial would predict greater ES and better outcomes. For less-acculturated Latinos, we hypothesized that ES and outcome measures would be more strongly associated with "visitor facilitating features" (VFFs) than for more acculturated Latinos. Subjects were 90 hematology-oncology patients, 149 parents, and 113 staff. The mediational hypothesis was not supported for children, but partially supported for parents (i.e., OE → ES → HS), and fully supported for staff (i.e., OE → ES → PF, F, NA, PA, CS), with all relationships in the expected directions. Exploratory post-hoc SEMs that maximized statistical power by excluding covariates revealed a significant positive relationship between OE and ES for children, and significant negative relationships between ES and PF, and ES and NA for parents, in predicted directions. Significant relationships opposite than expected emerged between OE and parental PA, and between OE and staff CS. For less acculturated Latino parents, the presence of VFFs was more predictive of greater HS and lower NA, than for more acculturated Latinos. Results of exploratory analyses probing effects of individual environmental features are discussed.

Introduction

The Healing Environment and Hospital Design

A growing body of data supports the notion that the different environments in which people live, work, and heal can affect physical and psychosocial functioning. Researchers postulate four components that contribute to a restorative, or "healing," environment. These include: 1) the quality of "being away," in a place separate from stressors; 2) the extent to which it is possible to "enter" a space; 3) the fascination a space holds for a person; and 4) the compatibility between a space and the person within. They further speculate that a restorative environment, as the term implies, "restores" the mental and emotional processes drained by directed, task-oriented attention (Hartig, Book, Garvill, Olsson, & Garling, 1996; Kaplan, 1995; Laumann, Garling, & Storkmark, 2001). Most research investigating the effects of restorative, or healing, environments, has been conducted in natural, home, or business environments (Friedman & Wachs, 1999; Leather, Pyrgas, Beale, & Lawrence, 1998).

Beyond the effects of the general environment, the notion of the hospital built environment as a factor in both physical as well as psychosocial recovery has begun to receive empirical attention in terms of measuring how the built environment may affect mood, stress level, and perceived overall satisfaction of patients, their families, and hospital staff (Beauchemin & Hays, 1996; Rubin, Owens, & Golden, 1998; Ulrich, 1991; Varni et al., 2004; Whitehouse et al., 2001). From a theoretical perspective, investigators posit that the built environment may impact patients on either of two levels: 1) the built environment can enhance the quality of care and make a patient feel more relaxed, and/or 2) environmental factors may directly impact the physiological recovery process of patients (Malcolm, 1992). In a comprehensive literature review on the relationship between the built environment and patient outcomes, Rubin et al. found a preponderance of articles linking environment with a number of health and satisfaction outcomes, but few studies that had been conducted in a scientifically valid manner. Ulrich's 2004 review of the role of the physical environment on hospital design identified more rigorously scientific studies, focusing almost exclusively on adult environments, and on issues of medical safety, and hospital-acquired infection rates. Their conclusions linked environmental features such as noise to increased perceived stress, and physiological arousal; exposure to natural light to reduction in depression, length of hospital stay, and pain medications, and to improved sleep; and the association between hospital gardens and improved physical and psychosocial functioning (Ulrich, Quan, Zimring, Joseph, & Choudhary, 2004).

Taking the body of research as a whole, benefits seem to accrue from access to windows and attractive nature views, art that is nature focused that engages the imagination, cleanliness of facilities, spaciousness of rooms, a sense of control over the environment, and a sense of privacy (Beauchemin & Hays, 1996; Rubin et al., 1998; Varni et al., 2004; Whitehouse et al., 2001; Ulrich, 1991, 1999; Ulrich et al., 2004). Rubin et al. identified the need for future research in: 1) patient groups that would most likely benefit from environmental changes; 2) the environmental features that should be changed; and 3) outcomes that one would expect to improve as a result of changes in the built environment. Rubin et al. suggested elderly residents of long-term facilities, and seriously ill children in acute or chronic health facilities as target populations who might especially benefit from environmental interventions. They further recommended that in studies targeting chronically ill children, environmental features should be evaluated to determine whether or not the facility conveys the notion of a "special place" for children, whether the child and family feel a sense of control in the environment, and whether the built environment promotes the family's role in helping the child cope. Ulrich (1999) also emphasizes the importance of considering the existence of cultural differences in what constitutes a healing environment, allowing, for instance, spaces suitable for the larger family groups prevalent in the Latino community.

The Impact of Children's Environments

Sherman, Shepley, and Varni (2005) reviewed the architectural, environmental, medical, and psychological literature pertaining specifically to pediatric hospital environments as well as more general children's environments on health and/or HRQOL outcomes. They identified 16 pediatric (hospital) studies that investigated the effects of noise, lighting, music, and hospital gardens on a number of health and HRQOL outcomes. The majority of these studies were set in the neonatal intensive care units (NICUs). Neonates demonstrated significant and measurable physiological reactivity, increased supplemental oxygen requirements, and poorer sleep when in noisier environments (Johnson, 2001; Trapanotto et al., 2004). Likewise, cycled lighting and introduction of quiet/dark vs. active/light sessions were associated with more normal circadian rhythms and arousal vs. calm in neonates (Rivkees, Mayes, Jacobs, & Gross, 2004; Slevin, Farrington, Duffy, Daly, & Murphy, 2000). Exposure to music in the NICU was similarly associated with improved physiological changes (e.g, increased non-nutritive sucking, feeding rates, weight gain, oxygen saturation) in addition to improved psychosocial functioning (e.g., measures of parental empowerment, parent-child bonding, and increased visiting time) (Standley 1998; 2000; 2002). In older hospitalized children, exposure to music has been associated with affective benefits, improved play activity, and positive distraction (Barrera, Rykov, & Doyle, 2002). Finally, access to hospital gardens has been associated with improved mood and hospital satisfaction (Whitehouse et al., 2001).

Sherman et al. (2005) also identified 24 studies measuring the impact of environmental variables on children in more general environments. The environmental features under investigation included nature, noise, crowding (spatial and social), and school environments, with outcomes more focused on psychosocial than physiological functioning. Exposure to nature was found to moderate the effects of life stressors in children, and linked to reduced symptoms of attention-deficit hyperactivity disorder (ADHD) and to more behaviorally appropriate play behaviors (Faber Taylor, Kuo, & Sullivan, 2001; Wells, 2000; Wells & Evans, 2003). Noise, at both extreme and normal-to-moderate levels, was associated with higher levels of urinary cortisol, resting blood pressure, learned helplessness, annoyance, perceived stress, reading deficits, and memory performance (Boman & Enmarker, 2004; Evans & Maxwell, 1997; Evans, Lercher, Meis, Ising, & Kofler, 2001; Haines et al., 2001; Haines, Stansfeld, Job, Berglund, & Head, 2001a, 2001b). Where measured, these effects generally did not habituate over time. Spatial crowding, referring to the amount of space allotted per person, was associated with decreased performance on a cognitive task for girls, and with increased behavioral disturbance for boys (Maxwell, 2003). Social crowding, referring to the number of people with whom an individual shares space and resources, was associated with increased perception of stressful events and hassles, increased psychological symptoms and learned helplessness in some groups, and decreased functioning on a word identification task, and with off-task behavior in young children (Evans, Saegert, & Harris, 2001; Kantrowitz & Evans, 2004; Maxwell). Several studies focused specifically on the school and daycare environments. Results indicated that permanent display of students' artwork was associated with increased sense of ownership in their school (Killeen, Evans, & Danko, 2003). Another school study found that higher cortisol levels were associated with greater spatial crowding (Legendre, 2003). A study of furniture arrangements found that arrangements restricting access to adults affected the play behavior of some groups, as did an environmental design that was either completely invariant, or in which both wall and ceiling features varied, with intermediate environmental variation levels associated with optimal play (Legendre, 1999; Read, Sugawara & Brandt, 1999).

From these studies it is clear that environmental elements can affect both physiological and psychosocial function in children, and, as previous studies (e.g., Ulrich et al., 2004) have demonstrated, environmental features can impact adult health and HRQOL as well. What is less clear is the mechanism through which these effects take place. In their 2005 review, Sherman and colleagues proposed a conceptual model that situates environmental appraisal or satisfaction as a mediator between the environment and health/HRQOL. They draw on Lazarus and Folkman's (1984) work on how one's perception or appraisal of a given situation, rather than the event itself determines, in part, the experience of stress and related health outcomes, and cite environmental studies in which appraisal of environmental features was associated with changes in affect (Boman & Enmarker, 2004; Thurber & Malinowski, 1999; Whitehouse et al., 2001).

Quantifying the Environment and Environmental Satisfaction

With the current state of the science, the task now turns to designing effective studies to clarify the environment-health outcomes relationship. The task is daunting given the potential number of confounds likely to be present in the whole of an environment. Lawton (1999) proposes a theoretical framework for measuring the effects of the physical environment focusing on the intersection between the physical and interpersonal dimensions of environmental design. He divides the effects of the physical environment into different "tesserae" which include the personal, small group, suprapersonal, and megasocial aspects of a designed space. For each of these, there can be both objective and subjective measurement. Objective measurement involves documenting the actual amount of space, amenities, and other physical components of the environment, while subjective measurement focuses on the user's perception of and satisfaction with the environment.

In studies of the built environment, adult patients' satisfaction with their physical surroundings has been significantly associated not only with better physical outcomes, as mentioned above (Ulrich, 1984, 1991; Ulrich et al., 2004), but also with greater satisfaction with general healthcare services (Pilpel, 1996; Verdeber & Reuman, 1987). Perceptions of healthcare quality and healthcare satisfaction are increasingly studied outcomes in a progressively more competitive healthcare marketplace (Varni et al., 2004). In the arena of pediatrics, however, research is rather sparse. Judkins (2003) documented the impact of the construction of a dedicated pediatric emergency department, demonstrating a significant increase in families' perceptions that the environment helped to reduce anxiety compared to prior ratings of families of children treated in a non-pediatric emergency department. In a recent study, Varni et al. found large significant positive correlations between the satisfaction of patients' parents with the built environment and their satisfaction with healthcare services in a pediatric convalescent hospital for severely developmentally disabled children.

Because no measures for evaluating pediatric medical settings existed, Varni et al. (2004) designed the PedsQL™ Built Environment Modules for Parents and Staff specifically for the convalescent hospital. These instruments were developed in accordance with the PedsQL™ Measurement Model methodology (Varni, Seid, & Rode, 1999; Varni et al., 2001; Varni, Burwinkle, Katz, Meeske, & Dickinson, 2002; Varni, Seid, Knight, Burwinkle, et al., 2002; Varni, Seid, Knight, Uzark, & Szer, 2002; Varni, Burwinkle, Jacobs et al., 2003). This involves a literature review, focus interviews to identify pertinent domains of interest, module development, and pilot item testing through instrument completion and cognitive interviews, in which subjects report on their understanding of each question to ensure that an item is tapping the intended domain. This iterative procedure resulted in instruments (the Built Environment Modules) that demonstrated excellent internal consistency reliability ($\alpha = 0.92$ for parent report, $\alpha = 0.93$ for staff report). The strong relationships found between satisfaction with the built environment and satisfaction with healthcare services (r = .54-.50, $p < .01$), coupled with the fact that the environment under consideration was invariant, seems to lend support to the notion of a mediational model, in which perception of (i.e., satisfaction with) the built environment acts as a mediator between objective environmental features and outcomes like healthcare satisfaction or HRQOL.

Notwithstanding its noteworthy advances in valid measurement of environmental satisfaction, the Built Environment Modules (Varni et al., 2004) and the study for which they were used had three major flaws: 1) many of the questions in these instruments were developed specifically for the pediatric convalescent hospital and its unique population, thus reducing the generalizability of these instruments for use in other hospital settings; 2) because of the convalescent hospital's unique population of severely developmentally disabled children, child self-report was impossible to obtain, and thus child-self report instruments were not developed; and 3) no objective measurement or quantification of the built environment was attempted. To address these shortcomings, it was necessary to develop and test more general environmental assessment instruments that could be used across hospitals and across hospital settings, and by all their users (patients, parents, and nursing staff).

Extensive studies with both healthy children as well as in pediatric populations with a variety of illnesses (e.g., asthma, chronic headache, limb deficiencies, arthritis, and cancer) have documented the discrepancy between child self-report and parent-proxy report in measuring health-related quality of life (HRQOL). This difference is larger with internalizing problems (e.g., emotional functioning), and smaller for more observable issues (e.g., physical functioning). In previous studies, the PedsQL™ Generic Core Scales' Total Score and many of the disease specific modules (independent instruments targeted at specific HRQOL issues associated with different chronic conditions) have demonstrated excellent internal consistency, and the ability to distinguish between known-groups of different health status for child self-report in children of ages 5-18 (more details below in methods section), and for parent-proxy report for children of ages 2-18. The Generic Core Scales have been validated with more than 10,000 families, with child and young child self-report internal consistency approaching .09 (Varni, Burwinkle, Seid, & Skarr, 2003). Given the dichotomy between child and parent report, the PedsQL™ Measurement Model emphasizes the necessity of obtaining both child and parent report. While it is important to measure HRQOL in children through self-report, it is their parents who influence decisions in their child's health-care utilization (Varni et al., 1999; Varni, Seid, & Kurtin, 2001; Varni, Burwinkle et al., 2002; Varni, Seid, Knight, Burwinkl et al., 2002; Varni, Seid, Knight, Uzark et al., 2002; Varni, Burwinkle, Jacobs, & et al.; Varni, Burwinkle, Seid, et al., 2003).

Likewise, in studying the effects of the built environment, it is important to obtain both child and parent report. Studies have documented reduced parental stress associated with parental beds in the PICU (Smith, Hefley, & Anand, 2007) and improved sleep patterns in parents whose hospitalized children were not sharing a room with other patients (McCann, 2008). Mean parental sleep levels in this study reached criteria for classification of sleep deprivation. Such impacted sleep habits may also impact parental ability to cope with their child's illness and negatively affect their interactions with nursing staff (McCann). In sum, both parents and pediatric patients inhabit the hospital environment and can be expected to have their own unique reactions to and evaluations of it.

The Role of Staff Satisfaction

Studies both in the healthcare and other industries have shown a relationship between the built environment, staff well-being, and job satisfaction (Leather et al., 1998; Malloch, 1999; Varni et al., 2004; Verdeber & Reuman, 1987). With respect to pediatric settings, in their pre-post study investigating the impact of building a dedicated pediatric emergency department, Judkins (2003) found that emergency department staff ratings reflected significantly improved departmental functioning in the new environment, improved patient management, increased confidence and decreased stress associated with patient care compared with their prior ratings of the general non-pediatric emergency department. In the pediatric convalescent hospital study discussed above, staff satisfaction with the built environment also correlated strongly and significantly with co-worker relationship satisfaction (see above; Varni et al., 2004). Again, the fact that the physical environment was invariant, and that satisfaction with the built environment was correlated with co-worker relationship satisfaction lends further support to the mediational model hypothesis in which satisfaction with the built environment mediates the relationship between objective environmental features and satisfaction with the workplace. In a study about the correspondence of patient satisfaction and nurse burnout (Leiter, Harvie, & Frizzel, 1998), investigators found that patients were more satisfied with every aspect of quality of care in departments where nurses found their work meaningful. Patients were less satisfied with the overall quality of care in departments where nurses were more exhausted and had greater intent to quit. Interestingly, professional efficacy in terms of nurse skill was not significantly correlated with patient satisfaction. Investigating staff satisfaction and how the built environment affects staff is thus important not only to provide valuable information for improving staff's quality of life and well-being, but also because staff satisfaction may also affect the interpersonal environment of patients and their families.

Summary

Rubin et al. (1998) have identified seriously ill children as a target population for further hospital environment research. Past research has shown that features of the hospital environment have been associated with both physiological and psychosocial functioning in pediatric patients and their parents. Parents' satisfaction with the hospital environment has also been correlated with their satisfaction with their child's healthcare. For nursing staff, satisfaction with the built environment has been associated with co-worker satisfaction. Although evidence in support of an environment-outcome relationship in these populations continues to accrue, the mechanism of action for these associations remains unclear. Sherman and colleagues (2005) proposed a conceptual model that situated environmental appraisal as the mediating factor between the presence of environmental features and physical and psychological outcomes. The goal of this study was to investigate this model in pediatric hematology-oncology patients, their parents, and nursing staff.

Specific Aims and Hypotheses

The purpose of this study was to elucidate the relationship between the built environment and physical and emotional functioning in pediatric hematology-oncology patients, their parents, and hospital staff. For parents, healthcare satisfaction was also measured, and for staff, job satisfaction in terms of co-worker relationships was measured. This study expanded on work done previously in three essential ways: 1) operationalizing the latent constructs of the "built environment" and "satisfaction with the built environment;" 2) anchoring these constructs within a testable conceptual model that situates healing environment satisfaction as a mediator between objective physical features and health, quality of life, and healthcare satisfaction outcomes; and 3) obtaining child self-report (in addition to parent and staff report) on measures of environmental satisfaction and physical and psychological functioning.

The overarching models for patients, parents, and staff are presented in Figures 1-3. The models begin with objective features that were found in prior research and/or are hypothesized in this study to be associated with health or satisfaction outcomes. For patients and parents, these include the "stand alone" features of nature and room size, in addition to an amalgamated "Environmental Sum" variable based on a checklist quantifying a number of environmental features (for the full list of environmental features, see Table 1). For nursing staff, the objective features factor is operationalized as a combination of workspace features and breakroom features, each of which are quantified by environmental checklists (see Tables 2-3).

The next step in the models is environmental satisfaction, quantified by a number of self-report questionnaires. For children and their parents, the questionnaires assess satisfaction with their hospital room, perceived control over their hospital room, and satisfaction with the general environment of the hospital. For nursing staff, questionnaires assess built environmental satisfaction, the degree to which environment increases satisfaction with the hospital, and the degree to which environment decreases satisfaction with the hospital.

Outcome variables were all assessed via self-report questionnaire, and were slightly different for each of the subject groups. For children, outcome variables included positive and negative affect, and present functioning. For parents, these variables were also assessed, in addition to a measure of healthcare satisfaction (i.e., how satisfied were parents with the healthcare their children received). For nursing staff, outcome measures included positive and negative affect, present functioning, co-worker satisfaction, and a measure of multidimensional fatigue.

As shown in Figures 1-3, a direct relationship was conceptualized between the objective environment factor and all outcome variables for each of the three groups of subjects. The environmental satisfaction factor was built into the model as a mediator variable, with a direct relationship between the objective environment factor and environmental satisfaction, and then between environmental satisfaction and all outcome variables.

Consistent with the proposed model (see Figures 1-3), and based on the literature, we hypothesized that:

1 – For child patients, presence of a greater number of objective physical features predicted to be beneficial would be associated with better present functioning, higher ratings of positive affect, and lower ratings of negative affect.

2 – For parents, presence of a greater number of objective physical features predicted to be beneficial would be associated with better present functioning, higher ratings of healthcare satisfaction, higher ratings of positive affect, and lower ratings of negative affect.

3 – For staff, presence of a greater number of objective physical features predicted to be beneficial would be associated with better present functioning, higher ratings of co-worker satisfaction, higher ratings of positive affect, and lower ratings of negative affect and multi-dimensional fatigue.

4 – The relationships between antecedent variables (objective environmental features) and the outcome variables (present functioning, positive/negative affect, and healthcare/co-worker satisfaction, and multidimensional fatigue) would be mediated by satisfaction with the built environment.

5 – (Exploratory) For Latino patients and their parents, acculturation would moderate the relationship between features that facilitate visiting and environmental satisfaction and outcome measures, such that visitor-facilitating features would be more predictive of satisfaction and outcomes in less acculturated Latinos.

6 – (Exploratory) Specific environmental features (e.g., size of room, natural views) will be associated with better health and satisfaction outcomes. Most of the research on specific environmental features has been conducted in adult settings. In the structural equation model analyses, environmental features were aggregated for a summed effect. To learn more about the individual relationship between each environmental feature and satisfaction and outcome variables, in a pediatric environment, we performed a series of exploratory secondary analyses. Concerning

medical outcomes, research in adult environments has indicated that length of stay and amount of pain medications have been associated with features of the built environment. These relationships were also explored in this study through secondary analyses, but not in the primary structural equation model analysis.

Chapter 1 – Research Design, Methods, and Measures

1.1 – Research Design and Methods

Data were collected to address every part of the conceptual model (see Figures 1-3). Objective environmental features were quantified via environmental checklists (see Tables 1-3). Environmental satisfaction and all outcome measures were assessed via self-report questionnaires. All data collection procedures were approved by the institutional review boards of the participating institutions.

All patients who participated in the study carried a hematology-oncology diagnosis, were inpatients at the time of their participation in the study, were at least into their fourth week (i.e., 21 days) post-diagnosis, were not in acute medical crisis at the time of participation, and were conversant in English or Spanish. Subjects were recruited from the main hem-onc floor, as well as the rehabilitation unit in which hem-onc patients were routinely seen. Patients in the bone-marrow transplant (BMT) unit were not included in the study due to more rigorous contact restrictions for this population. Subject recruitment involved identification of patients who met study criteria by a charge nurse. Parents of these patients were approached by study personnel and the study was described. If parents were willing, parental consent and child assent procedures were initiated. Children were eligible to participate if they were between the ages of 5-18, however, only data on 8-18 year olds are included in the analyses presented here due to differences in the questionnaire battery given to 5-7 year olds. Parents were eligible to participate if they had children who met study criteria who were between the ages of 2-18. In some cases, parents agreed to participate but their children chose not to participate or were not available at the time of questionnaire administration. After consent/assent procedures parents and children (age 8-18) were given the assessment battery to complete, but were also given the option to complete the questionnaires via interview format.

All nurses on units in which hem-onc patients were treated were eligible to participate, from both inpatient and outpatient units. Nursing staff were recruited either through direct approach on their units, at nursing team meetings, or by returning the questionnaires left in their box or nursing station accompanied by written instructions for completion.

1.2 – Measures

Table 4 lists all of the measures used in the study.

Objective Environment Factor: Environmental Checklists

Environmental checklists were used to assess patient rooms, staff workspaces, and staff breakrooms from which subjects were recruited. Because the study aimed to link the environment in which the subject spent their time to subjects' environmental appraisal, the decision was made to include only patient room data in the parent and child analyses, since tracking patient/parent use of supplemental areas (e.g., playroom, kitchens) was not feasible for this study. A literature review and consultation with Roger Ulrich, Ph.D., a leader in the field of empirically driven healthcare design, (R.S. Ulrich, personal communication, 2003), revealed that no gold standard instrument or methodology for evaluating objective physical features of the pediatric hospital environment existed. The limited research that has been done using objective design features has been either focused on one feature (e.g. window view, as in Ulrich, 1984) or by generating checklists of features of the type proposed by Lawton (1999). Thus, the Environmental Checklists that were used were methodologically exploratory and conceptually driven. They include environmental features that have been identified as having potential health effects based on the literature review and expert consultation. Originally, we attempted to quantify levels of controllability of features in addition to simply presence/absence of features, but could not establish adequate inter-rater reliability for the "control" measure. Instead we focused on readily quantifiable aspects of the environment.

Patient and Parent Environmental Checklists. For patients and parents, the "Environmental Sum" aggregate variable was constructed by quantifying each environmental feature as listed in Table 1. Each raw score was then converted into a *z*-score, so that no feature would be weighted more heavily than any other simply on the basis of different rating scales. The *z*-scores were then summed to form the Environmental Sum variable. The Objective Environment latent variable utilized in the structural equation model analyses was comprised of the Environmental Sum aggregate variable, in addition to Roomsize, and Nature (a continuous variable scored 0-100 quantifying the percentage of view that was natural – as opposed to urban or built – in content). The Roomsize and Nature features were not included in the aggregate since these were each identified in prior research and by consultation as features strongly hypothesized to have a positive impact. As such, they were included as separate variables. Thus, for entry in a SEM model, the presence/absence of target features were tallied to give a quantitative measure of the richness of the environment, while also allowing for separate secondary analyses by each feature (e.g., comparing environmental satisfaction of patients with nature views vs. those with urban views or regression analyses determining whether size of room has any effect on environmental satisfaction or health outcomes).

Staff Environmental Checklists – Workspace and Breakroom. For staff, the Objective Environment latent variable was indicated by two different environmental aggregates: the "Work Space" sum, and the "Break Room" sum. Determination of the staff objective environment differed from the patient/parent environment in three notable ways. First, there were two separate environments to quantify (workspace and breakroom) for each member of the staff, and both workspaces and breakrooms had nature scores associated with them. For the purposes of model testing, it was necessary to incorporate each space's nature view into its own aggregate variable to keep them linked to their given environments. Second, it was not possible to obtain accurate size measurements for all staff spaces. In order to avoid further reducing the sample size by limiting analyses to those spaces for which measurements were available, the decision was made to omit spatial data from the analyses. As it was impossible to include measures of spatial crowding because size dimensions were not available, we accounted for social crowding/density in the construction of the staff objective environment variables. Therefore, the third difference between the staff and patient/parent variables arose from the fact that multiple staff members shared the same space and resources, and that different numbers of staff and resources are allotted to different environments. Thus, for features that involved active use by many (e.g., chairs, computers), the number of each particular feature were tallied and then divided by the number of staff who shared that environment in a given shift, and it was this “resource per person” score for which a *z*-score was obtained and used in the aggregate. For features unlikely to be impacted by the number of people sharing them (e.g., nature view, number of windows, light fixtures), a simple tally was taken and converted to a *z*-score without adjusting for the number of people in that environment. Thus the aggregate sum for both breakroom and workspace are a sum of z-scores reflecting both the resource per person, and absolute quantity of a given feature, as appropriate. Of note, since some spaces were shared by staff who worked in different units, the resources in those shared units were divided by the total number of people per shift expected to use those spaces. Tables 2-3 list each variable included, how it was quantified, and whether average “per person” scores were generated for that feature.

Environmental Satisfaction Measures

Hospital Healing Environment (for Patients and Parents). The PedsQL™ Hospital Healing Environment Module, parent report (of children ages 2-18) and child report (ages 8-18) consists of three conceptually organized subscales: satisfaction with the built environment of their room (17 items); satisfaction with control over the built environment of their room; and satisfaction with the built environment of the overall hospital (20 items for parents, 17 items for children). The items for each form are essentially identical, with slight variations to accommodate for developmentally appropriate language. For the hospital environmental satisfaction subscale, the parent report asks both about the “kid-friendly” focus of decorations and activities as well as their “age-appropriateness” (items 4-7). These concepts were collapsed in the child form to “The way Children’s Hospital is decorated for kids my age” (item 5) and “The things to do at Children's Hospital for kids my age" (item 6). Additionally, the parent form asks about the hospital lay-out and design (item 8) which was not found to be a meaningful concept during interviews with children. All items are in the first person tense, since parents are asked about their perceptions of the environment, not asked to provide proxy measures for their children. The instructions ask how happy you are with each item. A 5-point response scale is used, and there is also a N/A (not applicable) answer that can be selected. These instructions and scoring procedures were also used with the formerly validated PedsQL™ Built Environment Modules (Varni et al., 2004). Scale scores were computed (so long as at least 50% of the items in that scale had been completed) by dividing the total for a given scale by the number of items completed for that scale. In developing the PedsQL™ Hospital Healing Environment Modules, focus and cognitive interviews were conducted in both English and Spanish resulting in the simultaneous development of both forms. No substantive differences in topic area were identified through this process, resulting in the same questions and content domains emerging in each language. In addition to these procedures, the Spanish instrument was translated and back-translated and given to Spanish speaking patients to test for conceptual equivalence. For our sample, alphas for both parent and child reports were adequate (.65-.98; see Tables 5-6 for all values) indicating good internal consistency and reliability. Few differences emerged between English and Spanish reports.

Hospital Healing Environment (for Staff). For staff, the PedsQL™ Healing Environment Module consists of three conceptually organized subscales. The first of these consists of 22 items asking about satisfaction with features in the built environment (e.g., "How happy are you with the availability of personal storage space"). The instructions for this scale ask "How happy are you with" and use a 5-point response scale, with a N/A (not applicable) answer that can be selected). The second set of questions (10 items, five pairs of questions) divide into perceived positive and negative environmental effects (e.g., Item 5: "The physical environment of the department makes me feel connected to my patients;" Item 6: "The physical design/layout of the department makes me feel isolated from my patients"). The instructions for these questions ask how true each item is. A 5-point response scale is used, with a N/A (not applicable) answer that can be selected). These are scored identically to the parent and child modules, however no total score is generated. As with the other PedsQL™ scales, items are linearly transformed to a 0-100 scale, though they are not reverse scored. So, for the Built Environment Satisfaction scale and for the Satisfaction Increasing Features scale, higher scores indicate greater satisfaction, but for the Satisfaction Decreasing Features scale, higher scores indicate lower satisfaction. For our sample, alphas were adequate (.88-.95; see Table 6 for all values) demonstrating good internal consistency and reliability.

Outcome Measures

Present Functioning (for Patients, Parents, and Staff). The PedsQL™ Present Functioning Scales (PFS) are comprised of six items that ask about anxiety, sadness, anger, worry, tiredness, and pain in the present moment. The PFS has four versions: a Parent-Self Report (e.g., "I worry about what will happen to my child"); a Child and Teen Self-Report (e.g., "I worry about what will happen to me"); and a Staff Self-Report (e.g., "I worry about what will happen to my patients"). Additionally, for the

Child and Teen Self-Report there is an additional item assessing nausea. All versions of the PFS utilize visual analogue scales – 10 cm lines anchored at one end with a happy face and at the other end with a sad face to answer each of the items. The instructions ask subjects to “Please put a mark on each line that best shows how you feel now.” The location of the mark is then measured in millimeters, thus generating a score between 0-100, with higher scores indicating greater dysfunction. The PFS are further divided into two subscales – a Total Symptom Score generated by taking the mean of all scores, and the Emotional Distress Summary Score, generated by taking the mean of the anxiety, sadness, anger, and worry items, Preliminary reliability and validity were established in a previous study (Sherman, Eisen, Burwinkle, & Varni, 2006) for the parent-proxy report PFS (not reported in this study) and child self-report (excluding nausea item), with Cronbach alphas between .76-.84 for the parent-proxy report, and between .72-.80 for child self-report. Visual analogue scales (VAS) have been shown to be reliable in children as young as age 5 (e.g., Thompson, Varni, & Hanson, 1987; Varni & Bernstein, 1991; Varni, Thompson, & Hanson, 1987). The validity of VASs in assessing pain as well as depression and anxiety has been well established (e.g. Bond, Shine, & Bruce, 1995; McCormack, Horne, & Sheather, 1988), and others have used them to validate pediatric questionnaires assessing cancer symptoms (Collins et al., 2002). In support of the cross-cultural validity of VASs, there are studies using Spanish VAS scales (e.g., Badia, Monserrat, Roset, & Herdman, 1999), and studies demonstrating the equivalence of HRQOL constructs across cultures (e.g., Gaston-Johansson, Albert, Fagan, & Zimmerman, 1990). Additionally, when the original PedsQL™ scales were being translated, VASs were used by bilingual respondents to ensure that English and Spanish response items fell on the same place on the VAS line, anchored between the English "Never" and "Almost Always," and the Spanish "Nunca" and "Casi Siempre" (Varni, Seid, & Kurtin, 2001).

For our sample, alpha scores for the full parent sample were adequate for the Total Symptom Score (.69), but low (.59) for the Emotional Distress Summary Score, with wide discrepancies between English and Spanish forms (see Table 5). Alphas were considerably higher for the English than Spanish forms. Interestingly, statistics demonstrated that the alpha discrepancy would disappear were the anger item to be removed, with new alphas ranging from .79 to .81 for both language groups, suggesting that the anger question may have functioned differently in the English and Spanish groups. The decision was made to retain the anger item to keep the construct equivalent across studies, but results should be interpreted with appropriate caution.

For child self-report, alphas were in the acceptable range (.75-.80) for total sample, with acceptable internal consistency reliability for both English and Spanish groups (see Table 6).

For staff report, alphas were in the acceptable range (.68-.75; see Table 7) indicating adequate internal consistency and reliability for both Total Symptom Score and the Emotional Summary Distress Score for this group.

Positive and Negative Affect (for Patients, Parents, and Staff). The Positive and Negative Affect Schedule (PANAS) is a 20 item (10 positive affect; 10 negative affect) self-report measure that postulates positive and negative affectivity as separate factors, instead of as a continuum (Watson, Clark, & Tellegen, 1988). Positive affect

(PA) items include such terms as: active, enthusiastic, excited, interested, proud, and strong; where negative affect (NA) items include such terms as: afraid, distressed, guilty, irritable, nervous, and scared. The directions ask the extent to which one has experienced each mood state. Different forms exist for reporting across different time periods, including “right now,” all of which have shown good internal consistency ($\alpha = .89$ for PA; $\alpha = .95$ for NA, for “right now” version), and the factorial stability has been established across samples (Mackinnon et al., 1999; Watson, Clark, & Tellegen). The PANAS utilizes a 5-point response scale. A Spanish language version of the PANAS exists, for which the underlying factor structure has been replicated (Sandin et al., 1999). The PANAS-C for children (Laurent et al., 1999) has been used with children as young as third graders, though the factor structure has shown to be more stable in children aged 10 and older (Crook, Beaver, & Bell, 1998; Kiernan, Laurent, Joiner, Catanzaro, & MacLachalan, 2001; Laurent et al., 1999). A Spanish language version of the PANAS-C exists with which the underlying factor structure has been replicated (Kiernan et al).

For all three groups (parents, patients, and staff), alphas were adequate (.82-.97; see Tables 5-7) demonstrating good internal consistency and reliability, with few differences between English and Spanish forms.

Healthcare Satisfaction (for Parents). The PedsQL™ Healthcare Satisfaction Module assesses parent satisfaction with the healthcare their child is receiving. The version of the instrument to be used in this study is comprised of 24 items and six scales: 1) five items measuring Information; 2) four items measuring Inclusion of Family; 3) five items measuring Communication; 4) three items measuring Technical

Skills; 5) four items measuring Emotional Needs; and 6) three items measuring Overall Satisfaction (e.g., “The overall care your child is receiving”). The original scale developed in the Pediatric Hematology/Oncology Parent Satisfaction survey included 25 items, one of which assessed satisfaction with staff’s helping a child get ready to leave the hospital, which is inappropriate for the current study. The internal consistency for the individual scales ranged from .82-.91 (Varni, Quiggins, & Ayala, 2000). A tailored version of the instrument was used in the convalescent hospital study with slightly modified items for the convalescent hospital population. These modified scales also demonstrated excellent internal consistency (α = .82-.96; Varni et al., 2004). The instructions ask how happy are you with each item. A 5-point response scale is utilized, and scores are linearly transformed to a 0-100 scale, with higher scores indicating greater satisfaction, and scale scores computed when at least 50% of the scale items have been completed. This instrument has been translated into Spanish through an iterative translation and back-translation procedure and has been approved for use by the official hospital translator. In our sample, alphas were adequate (.82-.97; see Table 5 for all values) indicating good internal consistency and reliability, and evidencing few differences between English and Spanish forms.

Co-Worker Satisfaction (for Staff). The PedsQL™ Staff Satisfaction Scale – Co-workers includes four items designed to assess staff satisfaction with co-worker relationships. This scale was shown to have good internal consistency reliability (α = .88, Varni et al., 2004). The instructions ask “how happy are you with each item, and utilizes a 5-point response scale with an N/A option. The answers are linearly transformed to a 0-100 scale, with higher scores indicating better functioning, and the scale score computed only when at least 50% of the items have been completed. Our sample exhibited excellent internal consistency and reliability (α = .91; see Table 7).

Multidimensional Fatigue (for Staff). The PedsQL™ Multidimensional Fatigue Scale includes 18 items designed to measure fatigue. It is comprised of three subscales, that measure General Fatigue (six items), Sleep Fatigue (six items), and Cognitive Fatigue (six items), and yields a Total Fatigue Score by using the mean of all items. The instructions ask how much of a problem each item has been during the past one month, utilizing a 5-point response scale. The answers are reverse-scored and linearly transformed to a 0-100 scale, with higher scores indicating better functioning. The scale scores are computed only when at least 50% of the iterms have been completed. Previous research has yielded Cronbach's alphas ranging from .76-.92 (Varni & Limbers, 2008). In our study, alphas were acceptable, ranging from .63 - .90 (see Table 7).

Demographic and Control Measures

Severity of Reason for Hospitalization Scale. A severity score was developed to quantify severity of reason for hospitalization. Data on reason for hospitalization were collected from patient charts resulting in a list of 32 different reasons for hospitalization. Three hem-onc nurses were then given the list of reasons and asked to rate the severity of each reason from 1 (least severe/traumatic) to 3 (most severe/traumatic). At least two of the three nurses agreed on severity level for 29/32 reasons, with an intraclass correlation coefficient of .77 ($p < .05$). The remaining three reasons were not typical reasons for hospitalization, each present in only one patient in the sample. Since consensus could not be reached for these cases, severity information was not included for these subjects.

Family/Staff Information Form. The PedsQL™ Family Information Form was completed by the parents. It asks about demographic information about the parent and child, the child's diagnosis, and reason for hospitalization. This information was later verified by looking in the child's medical records. Parents also reported their marital status, educational level, and type of employment on this form, which we used to determine SES using the Hollingshead Four Factor Index of Social Status (Hollingshead, 1975). Additionally, the form asks the room number that the child is occupying and whether the child is sharing the room with a roommate. The PedsQL™ Staff Information Form asks for similar demographic information in addition to amount of time staff has worked at the hospital.

Previous Month's Health-Related Quality of Life. The PedsQL™ Generic Core Scales measure children's HRQOL in the previous month. They were included in the assessment battery to control for children's functioning during the previous month, and to determine whether the HRQOL of children in this study was comparable to that previously published for oncology patients (Varni et al., 2007).

The Generic Core Scales are comprised of 23 items that encompass: 1) Physical Functioning (eight items), 2) Emotional Functioning (five items), 3) Social Functioning (five items), and 4) School Functioning. There are both child self-report forms and parallel parent proxy-report formats. The form for parents of toddlers (ages 2-4) is identical to the other versions except that it only includes three three items on the School Functioning scale. (Varni et al, 1996). The items for each form are essentially identical, with slight variations to accommodate developmentally appropriate language. Child self-report forms are written in the first person tense, while the parent form is written in the third-person tense. The instructions ask how much of a problem each item has been during the past one month. For all parent forms and for child forms for ages 8-18, a 5-point response scale is used. Items are reverse-scored and linearly transformed to a 0-100 scale so that higher scores indicate better HRQOL. Scale Scores are computed as the sum of the items divided by the number of items answered (this accounts for missing data). If more than 50% of the items in the scale are missing, the Scale Score is not computed (Fairclough, 2002). The PedsQL™ has been validated for use in both healthy children and in oncology populations, as well as in English and Spanish with data on more than 13,000 children and parents accrued over the course of development. No systematic differences have been found between English and Spanish forms (e.g., Varni, Seid, & Kurtin, 2001; Varni, Burwinkle, Seid, & Skarr, 2003).

Alphas for our total study sample for both parent-proxy and child self-report were adequate (.92-.93) with little difference between English and Spanish reports, and demonstrating good internal consistency and reliability (see Tables 5-6).

Acculturation (for Latino Parents). The Acculturation Rating Scale for Mexican Americans-II (ARSMA-II) is a self-report bilingual measure with items in both languages available. The measure is comprised of two scales: Scale 1 (30 items) yields measures of integration and assimilation, and Scale 2 (18 items) yields measures of marginality and separation. Items from both of these scales are combined to calculate two subscale scores: Anglo Orientation Scale (AOS; 13 items), and the

Mexican Orientation Scale (MOS; 17 items). The MOS mean is subtracted from the AOS mean, resulting in a continuous acculturation measure, with lower scores indicating a more Mexican orientation and higher scores associated with Anglo orientation. The ARSMA-II utilizes a 5-point response scales, for which subjects are asked to "circle a number between 1-5 to each item that best applies." The ARSMA-II has been shown to have good internal consistency (α = .86 for AOS; .88 for MOS) and its validity has been established for individuals of first to fifth generation Mexican American origins (Cuéllar, Arnold, & Maldonado, 1995).

We selected this measure, since the majority of Latino families at the children's hospital under study were Mexican American. For this sample, alphas for the total sample were acceptable (.88-.93). Spanish language forms likewise yielded adequate alpha scores, as did the English language MOS (see Table 5). The English language AOS yielded a low alpha (.25), although it should be noted that only 11 parents completed the English version of the AOS.

1.3 – Statistical Analyses

Preliminary Analyses

Scale internal consistency reliabilities were determined by calculating Cronbach coefficient alphas. Basic descriptives (means, standard deviations) were calculated for all measures.

Our original intent had been to include all demographic variables as covariates in the structural equation models. Because of the large number of relationships involved relative to our comparatively small sample sizes, when we attempted to run the original models, our analyses failed to converge after 500 iterations thus rendering their results uninterpretable. In order to enable us to test our central hypotheses (i.e., environmental satisfaction mediating the relationship between environmental features and outcome measures), we included only demographic variables that were shown to be significantly related to the environmental satisfaction or outcome variables. To this end, bivariate correlations were calculated between continuous demographic variables and environmental satisfaction and outcome measures. One-way ANOVAs were performed with categorical demographic variables (e.g., gender, diagnosis, ethnicity) as the IVs and environmental satisfaction and outcome measure scale scores as the DVs. Ethnicity emerged as the only significant predictor (for parental environmental satisfaction scores only). However, the decision was made not to include ethnicity as a covariate in the structural equation model due to the fact that the addition of the dummy-coded ethnicity variable would have added four additional variables into our model. Rather, the role of ethnicity was explored in exploratory analyses under Hypothesis 5.

Statistical power may have been limited in the full models that included covariates. In order to maximize our ability to detect the existence of relationships between the main study variables (i.e., objective environment, environmental satisfaction, and outcome measures), a second set of post-hoc, exploratory analyses were conducted with structural equation models identical to the first set except that no covariates were included thus increasing the sample size to number of parameters ratio and therefore our statistical power to detect relationships between core variables. The goal of these analyses was not to compare overall fit with the "full models" described above, but simply to learn more about the potential relationships between study variables to help guide future research.

Structural Equation Model Analyses

Hypotheses 1-4 were tested through a structural equation model analytic approach using EQS software (Bentler, 1995).

Assessment of Model Fit. Model fit refers to how well the relations specified in a model "fit" with or reproduce the observed variance-covariance matrix. To test the statistical model fit, chi square goodness-of-fit statistics were used, however use of chi square alone as a means of evaluating model fit is not recommended since even small discrepancies between the data and proposed model often yield significance in larger samples. Instead, examining a number of indicators of descriptive model fit is recommended (Klem, 2000). To test descriptive model fit, the root mean square error of approximation (RMSEA, Browne & Cudeck, 1993; Steiger & Lind, 1980) and the comparative fit index (CFI, Bentler, 1990) were used. RMSEA values of less than .08 and CFI values greater than .93 are considered to be reasonable indicators of good fit (Thompson, 2000). After model fit was determined, factor loadings (relationship between observed variables and latent variables) and structure coefficients (relationship between latent variables) were evaluated for magnitude and significance.

Development of Latent Variables. In order to test the measurement model for each latent variable, factorial validity was assessed by determining whether individual measures strongly indicated their target latent variable. Latent variables were developed and tested for Objective Physical Environment (as indicated by nature, roomsize, and "environmental sum" for room quality for patients and parents, and break room and workspace features for staff), Environmental Satisfaction (as indicated by the three healing environment satisfaction subscales for patient and parents, and two healing environment satisfaction subscales for staff), Present Functioning (as indicated by current tiredness, pain, nausea, and the Emotional Distress Summary Score), and Healthcare Satisfaction (as indicated by the six Healthcare Satisfaction subscales). Latent variables were not specified for Co-worker Satisfaction, or Positive and Negative Affect, because these were operationally defined by single measures.

Secondary Analyses

To test Hypothesis 5, we conducted hierarchical multiple regression analyses to investigate whether “family friendly” aspects of design and healthcare satisfaction were stronger predictors of present functioning for less-acculturated Latino patients and their parents than for more acculturated Latinos. One-way ANOVAs were performed to determine the presence of significant difference between ethnic/cultural groups on environmental satisfaction and outcome variables.

To test Hypothesis 6, specific environmental features were examined through various analyses. These included regression correlational analyses for continuous environmental variables, ANOVAs for categorical environmental variables with multiple groups, and independent between-group *t*-tests for dichotomous environmental variables. Correlational analyses were used to determine whether environmental features and/or environmental satisfaction were associated with differential length of stay or pain medication usage.

Chapter 2 – Child Results

2.1 – Sample Characterization

Of 175 parents/gaurdians of patients who were approached, 21 declined to participate or to allow their children to participate in the study. The most common reasons for declining included: parents not wishing to have their child's medical records accessed, and not wishing to take the time to complete the questionnaire battery. An additional 27 parents agreed to participate but their children were too young to participate (ages 2-4). Of the remaining 127 potential patients whose parents gave consent to participate, 5 were excluded from analyses as they did not meet study eligibility criteria or had incomplete data or consent/assent paperwork, 18 were young children (ages 5-7) who completed an alternative questionnaire battery and were therefore not included in these analyses, and 14 children who were otherwise eligible did not participate for a variety of reasons (e.g., feeling too ill or tired, though not in acute crisis, declined to participate).

The final group of participants consisted of a convenience sample of 90 inpatients in the hematology-oncology unit of a large children's hospital in Southern California (see Table 8). More boys than girls participated in the study, with a mean child age of 12.4. Consistent with national pediatric oncology statistics, leukemia was the most prevalent diagnosis followed by solid tumors (National Cancer Institute, 2008). Patients in the study typically came from lower middle class families (Hollingshead, 1975). More than half of the patients who participated in the study were Latino, which is consistent with the larger patient population at the children's hospital in which the study was conducted. Patients who participated varied widely with respect time since diagnosis and length of hospitalization. Previously published research that included a sample of cancer patients who completed the PedsQL™ Generic Core Scales reported a mean Total Score of 71.97 (SD = 16.12, N = 393; Varni et al., 2007). Scores for children in this study were significantly lower [$t(479) = -5.80$, $p < .001$] reflecting lower HRQOL functioning in the previous month compared with the sample used for the published mean that included both in- and outpatients.

2.2 – Descriptive Statistics

Descriptive statistics for child self-report on all scales completed are presented in Table 9. Based on the absolute value of their scores, children reported a moderate level of environmental satisfaction, with highest satisfaction reported for the general hospital environment, and lowest satisfaction for perceived room control. The present functioning scales reflected relatively low levels of distress, with the most severe score for current tiredness. Children's scores reflect relatively low levels of negative affect, and moderate levels of positive affect.

2.3 – Correlational Analyses

Bivariate correlations were calculated between child self-report total scale scores on environmental satisfaction and outcome measures and demographic variables to determine whether demographic variables should be incorporated into structural equation model analyses as covariates. Analyses revealed that age was significantly negatively correlated with Total Hospital Environment Satisfaction ($r = -.24$, $p < .05$). Number of days of hospitalization at the time of questionnaire administration (henceforth called "number of days at administration") was significantly positively correlated with child positive affect ($r = .27$, $p < .05$), indicating better affect with increased time in hospital when recruited for the study. For self-report, the PedsQL™ Core scales, which were included in the questionnaire battery to allow us to control for children's HRQOL in the previous month, Total Functioning scores (for the previous month) were significantly negatively correlated with the outcome measures of Total Symptom Score ($r = -.58$, $p < .01$) of the Present Functioning Scales, and the Negative Affect Scale ($r = -.57$, $p < .01$). No significant correlations emerged between the child self-report variables and SES, time since diagnosis, or total length of stay.

2.4 – Structural Equation Models

Full Child Model

The five-factor model described in Figure 1, along with the inclusion of age and number of days at administration as covariates, was tested using the structural equation modeling procedure in EQS. Three of the factors were latent factors: the "Objective Environment" (OE) factor was indicated by three observed variables (roomsize, environmental sum, and nature); the "Environmental Satisfaction" (ES) factor was indicated by three observed variables (room satisfaction, room control, hospital environment satisfaction); and the "Present Functioning" (PF) factor was indicated by four observed variables (current tiredness, current pain, current nausea, and emotional distress). The remaining two factors were the observed variables "Positive Affect" (PA) and "Negative Affect" (NA). The variables were hypothesized to be related as specified in Figure 4: with direct paths specified between OE, and PF, PA, NA; and between ES and PF, PA, and NA. To control for demographic variables found to be correlated to study measures in the previous section (see Section 2.3), paths were also specified between age and ES, previous month's HRQOL and PF and NA, and between number of days at administration and PA. No significant correlations were found among the covariates (age, previous month's HRQOL, and number of days at administration). Finally, interfactor correlations were specified between the outcome factors (PF, PA, and NA). This model did not fit well statistically (χ^2 [81, n = 79] = 120.34, $p < .01$), but fit reasonably well descriptively (*CFI* = .89, *RMSEA* = .08; see Figure 4 for all standardized coefficients).

All standardized factor loadings were generally large and statistically significant for all three latent factors. For OE, values ranged from .53 to 1.00; for ES, values ranged from .80 to .90; and for PF, values ranged from .45 to .76.

Hypothesis 1, which posited that a greater number of positive objective environmental features would be associated with better present functioning and affect, was tested by creating direct paths between OE to PF, between OE and PA, and between OE and NA. None of these paths were significant, showing no direct relationship between objective environmental features present functioning, or affect. Therefore, Hypothesis 1 was not supported.

The child component of Hypothesis 4, which predicted that the association between objective environmental features and present functioning/affect would be mediated by environmental satisfaction, was tested by creating a path from OE to ES, and a second series of paths from ES to PF, ES to PA, and ES to NA. None of these paths were significant. Therefore, Hypothesis 4 was not supported.

With respect to the covariates included in the model, HRQOL in the previous month significantly predicted PF (γ = -.69, $p < .05$) and NA (γ= -.49, $p < .05$), such that lower self-reported HRQOL functioning in the previous months was associated with a higher Total Symptom Score on the Present Functioning Scales, and higher negative affect score. Number of days at administration did not predict PA. Only the interfactor correlation between PF and NA was statistically significant ($r = .73$, $p < .05$) indicating a strong significant positive relationship between Total Symptom Score and negative affect. The specified interfactor correlations between PF and PA, PA and NA, number of days at administration and age were not significant.

In sum, although the SEM for the full covariate model for child report fit reasonably well descriptively, neither the path between OE and ES nor the paths between ES and outcome factors were significant, thus providing no support for the mediational hypothesis.

Post-Hoc Exploratory Structural Equation Model Analyses

The five-factor model of Figure 1, now with no covariates, was re-tested using the structural equation modeling procedure in EQS. As above, the variables were hypothesized to be related as shown in Figure 5: with direct paths specified between OE and PF, PA, NA, and ES; and between ES and PF, PA, and NA. Interfactor correlations were specified between PF, PA, and NA. This model did not fit well statistically (χ^2 [46, $n = 81$] = 72.28, $p <. 01$), but fit reasonably well descriptively (*CFI* = .92, *RMSEA* = .09; see Figure 5 for all standardized coefficients).

All standardized factor loadings were generally large and statistically significant for all three latent factors. For OE, values ranged from .57 to .91; for ES, values ranged from .77 to .91; and for PF, values ranged from .42 to .84.

As above, Hypothesis 1 was tested by creating direct paths between OE to PF, between OE and PA, and between OE and NA. As with the covariate model tested above, none of these paths were significant, showing no direct relationship between objective environmental features present functioning, or affect.

As previously stated, the child component of Hypothesis 4 was tested by creating a path from OE to ES, and a second series of paths from ES to PF, ES to PA, and ES to NA. As opposed to the "full" covariate model above, in this more parsimonious model Hypothesis 4 was partially supported in that the direct path from OE to ES was statistically significant ($\gamma = .27$, $p < .05$), indicating that children whose rooms had more "beneficial" objective environmental features were more satisfied with the built environment. The paths from ES to PF, PA, and NA remained non-significant, showing no direct relationship between environmental satisfaction and present functioning or affect. Thus, even in this simplified model, the role of environmental satisfaction as a mediator between these variables was not supported.

As with the covariate model, only the interfactor correlation between PF and NA was statistically significant in the simplified model (PF,NA: $r = .78$, $p < .05$).

In sum, compared to the covariate model, the more parsimonious model yielded a significant relationship between OE and ES indicating a significant positive relationship between the presence of "beneficial" environmental features and children's environmental satisfaction, but no significant relationships between ES and outcome factors.

2.5 – Acculturation

Effects of Acculturation – Within Group Analyses

Hypothesis Five predicted that for Latino patients and their parents who were less acculturated, components of the built environment that facilitated visiting and space for families would be more predictive of physical and emotional health variables and environmental satisfaction than for more acculturated Latinos. The "visitor-facilitating features" were a subset of the features used to determine the "Environmental Sum" variable, namely: type of bed available for visitors and amount of storage space, in addition to single vs. double occupancy rooms. The *z*-scores for these features were summed to create a "Visitor Facilitating Feature" variable (VFF).

To test the moderation effect (VFF*acculturation) suggested in Hypothesis 5, a series of hierarchical multiple regression analyses were performed in which visitor-facilitating features (VFF) and acculturation were each centered and then entered in the first step, and the interaction between VFF*acculturation score was entered in the second step. The analyses were repeated with environmental satisfaction, present functioning, and affect measures as the respective DVs.

Environmental Satisfaction Scales. When entered in step 1, VFF and acculturation together accounted for a significant amount of overall variance of the child Total Environment Satisfaction score [$F(2,33) = 4.25$, $p = .023$, $R^2 = .21$]. Step 2 was likewise significant, with VFF, acculturation, and the VFF*acculturation interaction term together accounting for a significant amount of the overall variance [$F(3,32) = 3.13$, $p = .039$, $R^2 = .23$]. Only the partial regression coefficient for acculturation was significant in the first step (step 1: $\beta = -.39$, $p = .017$) indicating greater environmental satisfaction in children of less acculturated parents. The interaction term was not significant and did not account for additional variance

[$F\Delta(1,32) = .35$, $R^2\Delta = .02$, *NS*], so the hypothesis of a moderation effect was not supported.

The same analysis was repeated for the Room Satisfaction and Room Control subscale scores. For Room Satisfaction, only the first step was significant [step 1: $F(2,33) = 3.49$, $p = .042$, $R^2 = .17$] with only the partial regression coefficient for VFF emerging as signifcant (step 1: $\beta = .33$, $p = .046$). Thus, higher environmental satisfaction was associated with a greater number of visitor-facilitating features. For the Room Control subscale, neither step was significant.

Finally, For the Hospital Environment Satisfaction subscale, both steps were significant [step 1: $F(2,33) = 4.85$, $p = .014$, $R^2 = .23$; step 2: $F(3,32) = 3.60$, $p = .024$, $R^2 = .18$]. As with Total Environment Satisfaction, the interaction term was not significant [$F\Delta(1,32) = 1.08$, $R^2\Delta = .03$, *NS*]. Only the partial regression coefficients for acculturation were significant for each step (step 1: $\beta = -.47$, $p = .004$), demonstrating that higher hospital environment satisfaction in children was associated with lower levels of parental acculturation.

In sum, the prediction of a moderation effect such that the presence of visitor-facilitating features would be more predictive of environmental satisfaction for less acculturated Latino patients was not supported. Rather, higher satisfaction with the general hospital environment (i.e., the environment *outside* of one's hospital room) as well as global environmental satisfaction for patients was associated with lower levels of parental acculturation, but not with visitor-facilitating features, while children's satisfaction with their hospital rooms was related to the number of visitor-facilitating features in their rooms, but not with parental acculturation.

Present Functioning and Affect Scales. None of the hierarchical multiple regression analyses to test the VFF*acculturation interaction effect were significant for the Present Functioning Scales or positive affect, such that neither visitor facilitating features, parental acculturation, nor the interaction between these variables were shown to predict children's present functioning or positive affect. For negative affect, step 1 was significant [$F(2,34) = 3.32$, $p = .048$, $R^2 = .16$]. However, neither the partial regression coefficient for acculturation nor the one for VFFs reached significance.

Ethnic Differences – Between Group Analyses

In addition to exploring the role of acculturation on environmental satisfaction and outcome variables within the Latino group, we conducted *t*-tests comparing Caucasian and Latino patients on environmental satisfaction and outcome measures. The tests were limited to the Caucasian and Latino patients due to the small number of patients from other ethnic groups who participated in the study. No significant differences emerged between these Latino and Caucasian patients on environmental satisfaction, present functioning, or affect.

2.6 - Environmental Features

Exploratory Analyses of Environmental Features

An aim of Hypothesis 6 was to gain a better understanding of the relationship between each specific feature and environmental satisfaction and outcome measures. Table 10 presents frequencies for each environmental feature. For children, higher Total Environment Satisfaction was significantly positively associated only with not having a roommate, rather sharing a room [$t(86) = 2.57$, $p < .05$; no roommate: M = 71.86, SD = 17.98; roommate: M = 61.13, SD = 16.62].

For children, the only environmental variables that significantly predicted affective and/or present functioning status were whether or not they had a roommate [$t(87) = -2.14$, $p = .035$], and whether wall TV channel control worked[present functioning: $F(2,87) = 3.36$, $p < .039$; negative affect: $F(2,86) = 3.14$, $p = .048$]. Children with no roommate reported significantly lower ratings of negative affect compared to children with roommates [no roommate: M = 1.34, SD = .39; roommate: M = 1.65, SD =.64]. Tukey post-hoc tests revealed that children with a dysfunctional wall channel control endorsed significantly higher ratings than children whose wall channel controls worked or children who did not have wall channel controls on the Present Functioning Scales, indicating poorer functioning (dysfx control: M = 32.30, *S.D.* = 14.37; fx control: M = 18.73, *S.D.* = 16.22; no control: M = 18.20, *S.D.* = 14.37). Children with a dysfunctional wall channel control also had significantly higher ratings of negative affect than those with no wall channel controls (dysfx control: M = 1.96, *S.D.* = .76; no control: M = 1.41, *S.D.* = .45).

Chapter 3 – Parent Results

3.1 – Sample Characterization

As stated above, 175 parents/guardians were approached for study participation. Of these, 21 declined, most commonly as they did not wish to have their child's medical records accessed or did not wish to take the time to complete the questionnaire battery. An additional 5 parents was not included in the analyses due either to problems with eligibility criteria or incomplete data or consent paperwork. Data on parents declining to participate (and reasons for non-participation) were not systematically collected, and so comparisons between participants and non-participants were not possible. Of the 149 parents who participated in the study, only the children of 90 parents participated and were included in the child sample.

Participants were a convenience sample of parents of inpatients in the hematology-oncology unit of a large children's hospital in Southern California (see Table 11). Participants were predominantly women. More parents of boys than girls participated in the study, with a mean child age of 9.67. Consistent with national pediatric oncology statistics, leukemia was the most prevalent diagnosis among the children of participating parents, followed by solid tumors (National Cancer Institute, 2008). Study participants were typically of lower middle-class SES (Hollingshead, 1975). More than half of the parents who participated in the study were Latino, which is consistent with the larger patient population at the children's hospital in which the study was conducted. Parents who participated in the study had children who varied widely with respect time since diagnosis and length of their hospitalizations. Previously published research that included a sample of cancer patients who completed the PedsQL™ Generic Core Scales reported a mean Total Score of 68.47 (*SD* = 19.22, *N* = 561; Varni et al., 2007). As with child self-report, parent-proxy scores for children's HRQOL in this study were significantly lower [$t(701) = -8.34$, $p < .001$] reflecting lower functioning in the previous month compared with the published mean. As noted above, this result likely reflects the reduced functioning of our hospitalized sample compared to the published mean which included both in and outpatients.

3.2 – Descriptive Statistics

Descriptive statistics for parent report on all scales completed are presented in Table 12. Based on the absolute value of their scores, parents' ratings reflected a moderate level of environmental satisfaction, with highest satisfaction reported for the general hospital environment and almost equal ratings of room satisfaction and perceived room control. Healthcare Satisfaction ratings were high, with a comparatively lower score on the Emotional Needs Subscale. The present functioning scales reflected moderate levels of distress, with the most severe score for current tiredness, and least for current pain. Parent scores reflect relatively low levels of negative affect, and moderate levels of positive affect.

3.3 – Correlational Analyses

Bivariate correlations were calculated between parent report total scale scores on satisfaction and outcome measures and demographic variables to determine whether demographic variables would be incorporated into structural equation model analyses as covariates. Analyses revealed that children's age was significantly negatively correlated with parental positive affect ($r = -.17$, $p < .05$). SES was significantly negatively correlated with Total Environmental Satisfaction ($r = -.35$, $p < .01$); and significantly positively correlated with parental negative affect ($r = .22$, $p < .05$), indicating higher environmental satisfaction, and lower negative affect were associated with lower SES. Number of days at times of administration was significantly positively correlated with positive affect ($r = .20$, $p < .05$). For proxy-report PedsQL™ Core Scales parents' perceptions of their child's HRQOL in the previous month was significantly negatively correlated with the outcome measures of Total Symptoms on the Present Functioning Scales ($r = -.35$, $p < .01$) and the Negative Affect Scale ($r = -.32$, $p < .01$). Parental proxy-report of their child's HRQOL in the previous months was also significantly positively correlated with parental positive affect ($r = .19$, $p < .05$). Finally, increased time since diagnosis was associated with decreased Total Healthcare Satisfaction ($r = -.17$, $p < .05$). [Of note, time since diagnosis was not included in the final structural equation model analysis due to the fact that when it was included as a covariate the model failed to converge. Because increased time since diagnosis was not significantly related to any other parent satisfaction or outcome variables, the decision was made to exclude it from the analyses.] No significant correlations emerged between parental-report variables and severity of reason for child's hospitalization or child's total length of stay in the hospital.

3.4 – Structural Equation Models

Full Parent Model

The six-factor model described in Figure 2, along with the inclusion of age, SES, number of days at administration, and previous month's HRQOL as covariates (see Section 3.2), was tested using the structural equation modeling procedure in EQS. Four of the factors were latent factors: the “Objective Environment” (OE) factor was indicated by three observed variables (roomsize, environmental sum, and nature); the “Environmental Satisfaction” (ES) factor was indicated by three observed variables (room satisfaction, room control, hospital environment satisfaction); the “Present Functioning” (PF) factor was indicated by three observed variables (current tiredness, current pain, and emotional distress); and the “Healthcare Satisfaction” (HS) factor was indicated by six observed variables (information, inclusion of family, communication, technical skills, emotional needs, overall satisfaction). The remaining two factors were the observed variables “Positive Affect” (PA) and “Negative Affect” (NA). The variables were hypothesized to be related as specified in Figure 6, along with the covariates identified in the preliminary correlational analyses, and interfactor correlations specified between the outcome factors (PF, HS, PA, and NA). Finally, paths were specified between covariates for which significant correlations were observed, including: age and number of days at administration ($r = .18$, $p < .05$); age and SES ($r = -.22$, $p < .01$); age and parental report of children’s previous month’s HRQOL ($r = -.31$, $p < .01$); and children’s previous month’s HRQOL and number of days at administration ($r = -.19$, $p < .05$). The resulting model did not fit well statistically ($\chi^2[169, n = 104] = 260.42$, $p < .001$), but fit reasonably well descriptively (*CFI* = .91, *RMSEA* = .07; see Figure 6 all standardized coefficients).

All standardized factor loadings were generally large and statistically significant for all four factors. For OE, values ranged from .66 to .87; for ES, values ranged from .81 to .92; for PF, values ranged from .44 to .80; and for HS, values ranged from .69 to .91.

Hypothesis 2 predicted a direct relationship between beneficial environmental features and present functioning, affect, and healthcare satisfaction. It was tested by creating direct paths between OE to PF, OE to HS, OE to PA and OE to NA. Only the path between OE and PA was statistically significant ($\gamma = -.24$, $p < .05$), but in the opposite direction than expected, indicating that a greater number of environmental features thought to be "beneficial" were associated with lower positive affect.

The parent component of Hypothesis 4, examining the role of environmental satisfaction as a mediator between objective environmental features and present functioning, affect, and healthcare satisfaction, was tested by creating a path from OE to ES, a second series of paths from ES to PF, ES to HS, ES to PA, and ES to NA. Hypothesis 4 was partially supported in that the direct path from OE to ES was statistically significant ($\gamma = .39$, $p < .05$), indicating that parents whose rooms had more environmental features hypothesized to be beneficial were more satisfied with the built environment. Only the path from ES to HS ($\gamma = .63$, $p < .05$) was significant, indicating that greater satisfaction with the built environment was associated with higher healthcare satisfaction. The paths from ES to PF, ES to NA, and ES to PA were not significant, indicating no direct relationship between environmental satisfaction and affect or present functioning.

Regarding the covariates included in the model, parental report of their child's HRQOL in the previous month significantly (*p*s $< .05$) predicted PF ($\gamma = -.42$) and NA ($\gamma = -.32$), indicating that worse child functioning in the previous month was associated with poorer parental present functioning and higher ratings of parental negative affect . SES significantly (ps $< .05$) predicted ES ($\gamma = -.40$) and NA ($\gamma = .19$), such that higher SES was associated with lower environmental satisfaction and higher ratings of negative affect. Number of days at administration significantly predicted PA ($\gamma = .23$, $p < .05$), with higher positive affect ratings associated with longer hospital stays. Age did not significantly predict PA. Only the interfactor correlations between PF and NA ($r = .59$, $p < .05$) and between PF and HS ($r = -.42$, $p < .05$) were statistically significant, such that lower Total Symptoms scores on the Present Functioning Scales were associated with lower ratings of negative affect, and higher healthcare satisfaction.

In sum, the SEM for the full covariate model for parent report fit reasonably well descriptively. The path between OE and ES was statistically significant indicating that greater environmental satisfaction was associated with the presence of a greater number of environmental features thought to be beneficial. The mediational hypothesis was only supported for healthcare satisfaction, as the path between ES and HS was statistically significant. No other paths between ES and outcome factors were significant. The only direct relationship observed between OE and any of the outcome factors was between OE and PA. Contrary to expectations, the presence of more environmental features thought to be beneficial was associated with lower ratings of positive affect.

Post-Hoc Exploratory Structural Equation Model Analyses

The six-factor model of Figure 2, now with no covariates, was re-tested using the structural equation modeling procedure in EQS. As above, the variables were hypothesized to be related as shown in Figure 7: with direct paths specified between OE and PF, PA, NA, HS, and ES; and between ES and PF, PA, NA, and HS. Interfactor correlations were specified between PF, PA, NA, and HS. This model did not fit well statistically ($\chi^2[106, n = 123] = 179.44, p < .05$), but fit well descriptively (*CFI* = .94, *RMSEA* = .08; see Figure 7 for all standardized coefficients).

As with the "full" model, all standardized factor loadings were generally large and statistically significant for all four factors. For OE, values ranged from .63 to .91; for ES, values ranged from .82 to .95; for PF, values ranged from .43 to .83; and for HS, values ranged from .73 to .92.

The direct relationship between environmental features and outcome measures posited in Hypothesis 2 was tested by creating direct paths between OE to PF, OE to HS, OE to PA and OE to NA. As above, only the path between OE and PA was statistically significant ($\gamma = -.28, p < .05$), and again in the direction opposite what was hypothesized, indicating that more theoretically "beneficial" environmental features were associated with lower ratings of positive affect.

The mediational relationship proposed in Hypothesis 4 was tested by creating a path from OE to ES, a second series of paths from ES to PF, ES to HS, ES to PA, and ES to NA. As was found with the "full model," the direct path from OE to ES was statistically significant ($\gamma = .39, p < .05$), showing that parents whose rooms had more "beneficial" objective environmental features were more satisfied with the built environment. As above, the path from ES to HS ($\gamma = .65, p < .05$) was significant. In this reduced model, however, the paths from ES to PF ($\gamma = -.28$) and ES to NA ($\gamma = -.30$) also reached significance (*p*s < .05). Thus, in this model, greater environmental satisfaction was associated not only with greater healthcare satisfaction, but also with better parental present functioning and less parental negative affect, lending additional support to the mediational hypothesis. The path from ES to PA remained non-significant, indicating no direct relationship between environmental satisfaction and positive affect.

Regarding the specified interfactor correlations, only the relationships between PF and NA ($r = .66$, $p < .05$) and between PF and HS ($r = -.32$, $p < .05$) were statistically significant, demonstrating that better parental functioning was associated with lower parental negative affect and higher healthcare satisfaction.

In sum, the relationships observed in the full covariate model were replicated in the parsimonious model, such that OE predicted ES, and ES predicted HS. The significant negative relationship between OE and PA was likewise observed. In this reduced model, however, additional significant relationships emerged between ES and PF, and ES and NA, in the expected directions, providing additional support for the mediational hypothesis.

3.5 – Acculturation

Effects of Acculturation – Within Group Analyses

Hypothesis 5 posited that for Latino parents, acculturation would moderate the relationship between visitor-facilitating features (VFF) and environmental satisfaction and outcome measures, such that visitor-facilitating features would be more predictive of satisfaction and outcomes in less acculturated Latinos. To test this moderation effect (VFF*acculturation), a series of hierarchical multiple regression analyses were performed for only the Latino parents in which VFF and acculturation were entered in the first step, and the interaction between VFF*acculturation score in the second step, to test for a moderation effect. Both predictor variables were centered, and for analyses in which the interaction term was significant, post-hoc regression analyses were performed to explore the interaction further. The analyses were repeated with parental environmental satisfaction, healthcare satisfaction parental present functioning, and parental affect measures as the respective DVs.

Environmental Satisfaction Scales. When entered in step 1, VFF and acculturation together accounted for a significant amount of overall variance of the parent Total Environment Satisfaction score [$F(2,61) = 5.60$, $p = .006$, $R^2 = .16$]. Step 2 was likewise significant, with VFF, acculturation, and the VFF*acculturation interaction term together accounting for a significant amount of the overall variance [$F(3,60) = 4.84$, $p = .004$, $R^2 = .20$]. However, as with the child analyses, the interaction term did not significantly account for additional variance [$F\Delta(1,60) = 2.98$, $R^2\Delta = .04$, *NS*] only the partial regression coefficient for acculturation was significant in each of the steps (step 1: $\beta = -.33$, $p = .007$) demonstrating greater environmental satisfaction in less acculturated parents. Because the interaction term was not significant, the hypothesis of a moderation effect was not supported.

The same analysis was repeated for the Room Satisfaction subscale score. Both steps were significant indicating that together the variables accounted for a significant part of the variance of the Room Satisfaction subscale score [step 1: $F(2,61) = 5.69$, $p = .005$, $R^2 = .16$; step 2: $F(3,60) = 4.63$, $p = .006$, $R^2 = .19$]. Addition of the interaction term in step 2 did not account significantly for additional variance [$F\Delta(1,60) = 2.28$, $R^2\Delta = .03$, *NS*]. For each of the steps, both the partial regression coefficients for acculturation (step 1: $\beta = -.26$, $p = .029$) and VFF ($\beta = .28$, $p = .023$) were significant, demonstrating that higher environmental satisfaction and a higher number of visitor facilitating features were associated with lower acculturation.

The Room Control subscale and Hospital Environment Satisfaction subscale followed the same pattern as the Total Environment Satisfaction scale, where both steps were significant [Room Control: step 1 – $F(2,61) = 7.48$, $p = .001$, $R^2 = .20$; step 2 – $F(3,60) = 5.22$, $p = .003$, $R^2 = .21$] [Hospital Environment Satisfaction: step 1 – $F(2,60) = 5.32$, $p = .007$, $R^2 = .15$; step 2 – $F(3,59) = 3.76$, $p = .015$, $R^2 = .16$]. The VFF*acculturation interaction did not account for significant variance in either scale [Room Control: $F\Delta(1,60) = .78$, $R^2\Delta = .01$, *NS*; Hospital Environment Satisfaction: $F\Delta(1,59) = .69$; $R^2\Delta = .01$, *NS*]. Only the partial regression coefficients for acculturation were significant in each step (Room Satisfaction: step 1 – $\beta = -.39$, $p = .001$, Hospital Environment Satisfaction: step 1 – $\beta = -.32$, $p = .009$) indicating that higher perceived room control and greater parental satisfaction with the general hospital environment were associated with lower levels of parental acculturation.

In sum, the predicted moderator effect (i.e., that visitor-facilitating features would be more predictive of environmental satisfaction for less acculturated Latino parents) was not supported with respect to environmental satisfaction. For Latino parents, level of acculturation was predictive of total environmental satisfaction and all of its subscales, such that lower acculturation was associated with greater satisfaction. As was the case with the child report, the presence of VFFs was predictive only of room satisfaction.

Healthcare Satisfaction Scales. To test whether acculturation moderated the relationship between VFFs and healthcare satisfaction, a series of hierarchical multiple regression analyses were repeated for the Total Healthcare Satisfaction score, and for all of its component subscales. Step 1 did not reach significance for the Total Score or any of the subscales. Step 2 accounted for a significant amount of the overall variance for Total Healthcare Satisfaction, and for the Information, Communication, and Emotional Needs subscales (see Table 13). The VFF*acculturation interaction significantly predicted Total Healthcare Satisfaction, as well as the Information, Communication, and Emotional Needs subscales To explore this interaction further, simple regression lines were computed and statistically evaluated (see Table 13). Simple regression lines were computed for the relationship between Healthcare Satisfaction scales and VFF at specific values of acculturation (low = 1 *SD* below mean, medium = at the mean, high = 1 *SD* above the mean). Statistically significant slopes were found in the low acculturation condition between VFF and Total Healthcare Satisfaction, and between VFF and Information and Communication subscales. These slopes were all positive indicating that in the low acculturation condition, the presence of more visitor-facilitating features was associated with higher healthcare satisfaction in each of the domains. No statistically significant slopes were found in the medium acculturation condition. In the high acculturation condition, statistically significant slopes were found between VFF and Total Healthcare Satisfaction, and for the Emotional Needs subscales. These slopes were negative indicating that in the high acculturation condition, the presence of more visitor-facilitating features was associated with lower healthcare satisfaction in both of these domains. Thus, for the Healthcare Satisfaction Scales, the predicted relationship was found, such that level of acculturation moderated the relationship between visitor-facilitating features and several aspects of healthcare satisfaction. In the low acculturation condition, more VFFs predicted higher healthcare satisfaction, and in the more acculturated condition, more VFFs were significantly associated with lower healthcare satisfaction.

Present Functioning and Affect Scales. To test whether acculturation moderated the relationship between VFFs and affect or present functioning, a series of hierarchical multiple regression analyses were repeated for the Present Functioning Scales and the PANAS. No significant relationships emerged between the predictor variables and the Present Functioning Scales, or for Positive Affect. For Negative Affect, step 1 accounted for a significant amount of the overall variance [$F(2,59) = 6.14$, $p = .004$, $R^2 = .17$], with only the partial regression coefficient for acculturation reaching significance ($\beta = .38$, $p = .002$). Step 2 accounted for a significant amount of overall variance for Negative Affect (see Table 13), with a significant VFF*acculturation interaction term, indicating the presence of the moderator effect. To further explore the interaction, simple regression lines were computed and statistically evaluated (see Table 13). A statistically significant slope was found only in the low acculturation condition. This slope was negative, indicating that in the low acculturation condition, fewer visitor-facilitating features were associated with higher negative affect.

Exploratory Analyses. To explore the specificity of the VFF*acculturation effect, we reran the hierarchical multiple regression analyses with two different sets of predictors. First, we replaced acculturation with SES to determine whether SES moderated the relationship between visitor facilitating features and environmental satisfaction/outcome measures (i.e., VFF*SES). In the second set of analyses, we replaced the specific visitor-facilitating features variable (i.e., VFF) with the aggregate of all environmental features (i.e., Environmental Sum), to determine whether acculturation moderated the relationship between all environmental features and healthcare satisfaction and negative affect (i.e., all environmental features*acculturation). In neither case did the interaction term predict healthcare satisfaction as was found with VFF and acculturation. This supports the notion of the specificity of the predictive power of the visitor features*acculturation relationship particularly with respect to predicting Latino parents' healthcare satisfaction.

With respect to negative affect, it was not significantly predicted by the VFF*SES interaction, but was predicted by the Environmental Sum*Acculturation interaction [$F(3,62) = 7.03$, $p < .001$, $R^2 = .25$; $F\Delta(1,62) = 4.72$; $R^2\Delta = .06$, $\beta = .25$, $p = .034$]. Post-hoc probing of this effect revealed a significant negative slope for the low acculturation condition ($\beta = -.33$, $p < .05$) such that for less acculturated Latino parents, the presence of a higher number of total environmental features thought to be beneficial were associated with lower ratings of negative affect.

Ethnic Differences – Between Group Analyses

In addition to exploring the role of acculturation on environmental satisfaction and outcome variables within the Latino group, we conducted one-way ANOVAs to determine whether ethnicity was associated with differential outcomes in Environmental Satisfaction and/or present functioning or affect. One-Way ANOVAs revealed that Latino parents reported significantly higher environmental satisfaction compared to Caucasian and Asian parents with no other significant differences on parent variables (Table 14).

3.6 – Environmental Features

Exploratory Analyses of Environmental Features

To determine the effect of specific environmental features on environmental satisfaction and outcome measures as specified in Hypothesis 6, exploratory analyses were conducted between each feature and parent-report variables. Tables 15-16 present statistics for each feature and its relationship to environmental satisfaction and outcome measures. Higher Total Environment Satisfaction was significantly associated with bigger roomsize and increased storage space. Higher environmental satisfaction was also associated with having a dimmer switch, bathrooms with more features (i.e., toilets and a shower/tub), being on the same side as the sink, bedlight controls, and wall TV channel controls (of note, wall channel controls were dichotomized subsequent to a one-way ANOVA that demonstrated no significant differences between parents with functional or dysfunctional controls). Higher ratings of healthcare satisfaction were associated with having a functional TV. Thus, parental environmental satisfaction and healthcare satisfaction were associated with the presence of more "beneficial" environment features.

For parents, several environmental features were associated with affective and present functioning outcomes in the direction opposite to what would be expected based on satisfaction ratings. Scores on the Present Functioning Scales were significantly higher (indicating poorer functioning) for parents whose children's bathrooms, sinks, and thermostats were on the opposite side of the room A significant one-way ANOVA for three groups was followed up by a Tukey post-hoc test, the results of which are presented in Table 16. Finally, ratings of positive affect were significantly lower for whose children's bathrooms had more features (these were collapsed into a "toilet only" vs. "toilet + other feature" for the purposes of this analysis).

Chapter 4 – Pain Medications and Length of Stay

4.1– Pain Medications

As specified in Hypothesis 6, secondary analyses were conducted to determine whether environmental features were associated with differential prescription of pain medications for children. Number of prescribed pain medications was not significantly related to the "Environmental Sum" aggregate variable, to nature view, or roomsize. Of the environmental features that comprised the aggregate variable, only placement of thermostat controls and bathroom features were significantly associated with number of pain medications. A one-way ANOVA with thermostat control as the predictor variable indicated significant differences in numbers of prescribed pain medications [$F(2,141) = 3.64$, $p = .029$]. Tukey-post hoc tests revealed that children whose thermostat controls were functional and on the same side of their rooms were prescribed significantly more pain medications ($M = 1.44$, $SD = 1.08$, $n = 34$) than children whose thermostat controls were on the other side of the room ($M = .88$, $SD = .91$, $n = 26$). A significant *t*-test [$t(146) = -2.50$, $p = .014$] revealed that children whose bathrooms had a shower or tub in addition to a toilet were prescribed significantly more medications ($M = 1.48$, $SD = .95$, $n = 29$) than those who only had a toilet ($M = 1.04$, $SD = .85$, $n = 119$). The *t*-test comparing prescribed pain medications for children whose bathrooms were on same/other side of their room almost reached significance [$t(142) = -1.96$, $p = .053$], with those who had their bathroom on the same side of the room requiring more pain medications ($M = 1.21$, $SD = .88$) than those whose bathroom was on the other side of the room ($M = .91$, $SD = .79$, $n = 45$). As such our tentative hypothesis that beneficial environmental features would be associated with fewer pain medications was not supported.

4.2 – Length of Stay

Length of hospitalization was not significantly associated with the "Environmental Sum" aggregate variable, nature view, roomsize, or any of the individual environmental features comprising the aggregate variable.

Chapter 5 – Staff Results

5.1 – Sample Characterization

Nursing staff were approached in person for study participation on all units in which hem-onc patients were treated, whether from in- or outpatient units. Nurses were also recruited at staff meetings, or via questionnaires left in their boxes/stations with envelopes to return to the investigators. Since many staff members were often not recruited individually, data on those who chose not to participate were not obtained. Thus, comparisons between participants and non-participants were not possible.

Participants were a convenience sample of 113 nursing staff in the hem-onc department of a large children's hospital in Southern California (see Table 17). Although 113 nurses completed the survey, only 99 of these worked in specified clinical environments, with the remaining 14 working in varied office spaces without direct patient contact and so were not included in the analyses. Nurses were overwhelmingly female, predominantly Caucasian, and with an average age of 35 years. Nurses who participated in the study had worked at the hospital an average of 6 years and worked nearly 40 hours per week. A broad range of nursing levels are represented in the study's sample. More nurses who participated worked in inpatient than outpatient units, and most of them worked the dayshift.

5.2 – Descriptive Statistics

Descriptive statistics for staff report on all scales completed are presented in Table 18. Based on the absolute value of their scores, staff ratings reveal a moderate level of environmental satisfaction, with lower endorsement of items associating the hospital environment with dissatisfaction. Co-worker satisfaction ratings were fairly high. Scores on the Multidimensional Fatigue Scale were indicative of moderate to moderately high levels of functioning. Present Functioning scores were mostly low with the exception of current tiredness that was in the moderate range. Levels of staff positive affect were in the moderate range while staff negative affect was slight.

5.3 – Correlational Analyses

Bivariate correlations were calculated between staff report total scale scores and demographic variables to determine whether demographic variables would be incorporated into structural equation model analyses as covariates. Analyses revealed that number of months worked at the hospital was significantly negatively correlated with decreased co-worker satisfaction ($r = -.23$, $p < .05$, $n = 109$). No other significant correlations emerged between age or months worked at the hospital and other total scale scores for outcome variables.

5.4 – Structural Equation Models

Full Staff Model

The seven-factor model described in Figure 3, along with the inclusion of months worked at the hospital as a covariate (see Section 5.3), was tested using the structural equation modeling procedure in EQS. Five of the factors were latent factors: the “Objective Environment” (OE) factor was indicated by two observed variables (workspace features, breakroom features); the “Environmental Satisfaction” (ES) factor was indicated by three observed variables (built environment satisfaction, satisfaction associated features, dissatisfaction associated features); the “Present Functioning” (PF) factor was indicated by three observed variables (current tiredness, current pain, and Emotional Distress Summary Score); the multidimensional "Fatigue" (F) factor was indicated by three observed variables (general fatigue, sleep fatigue, cognitive fatigue). The remaining three factors were observed variables: "Coworker Satisfaction" (CS); "Positive Affect" (PA); and "Negative Affect" (NA). The variables were hypothesized to be related as specified in Figure 8: direct path were specified between OE, PF, PA, NA, CS, F, and ES; and between ES and PF, PA, NA, CS, and EF. To control for months worked at the hospital at the time of questionnaire administration, a path was specified between months worked and CS. Interfactor correlations were specified between outcome factors (PF, PA, NA, CS, and F). This model did not fit well statistically (χ^2[72, n = 93] = 117.22, $p < .05$), but fit well descriptively (*CFI* = .93, *RMSEA* = .08; see Figure 8 for all standardized coefficients).

All standardized factor loadings were generally large and statistically significant for all of the latent factors. For OE, values ranged from .95 to 1.0; for ES, values ranged from -.22 to .88; for PF, values ranged from .60 to .77; and for F, values ranged from .61 to .91.

Hypothesis 3 posited that better present/affective functioning, higher co-worker satisfaction, and lower multidimensional fatigue would be predicted by greater numbers of "beneficial" environmental features. This was tested by creating direct paths between OE and PF, OE and F, OE and CS, OE and PA, and OE and NA. Only the path from OE to CS was significant ($\gamma = -.22$, $p < .05$), but in the opposite direction than hypothesized, demonstrating a negative relationship between number of environmental features posited to be "beneficial," and the outcome measure of coworker satisfaction.

The staff component of Hypothesis 4 predicted that the relationship between objective environmental features and present functioning, affect, multidimensional fatigue, and co-worker satisfaction would be mediated by environmental satisfaction. To this end a path was created from OE to ES, and a second series of paths from ES to PF, ES to F, ES to CS, ES to PA, and ES to NA. Hypothesis 4 was supported in that the direct path from OE to ES was statistically significant ($\gamma = .36$, $p < .05$), indicating that staff whose workspaces and breakrooms had more "beneficial" objective environmental features were more satisfied with the built environment. The paths from ES to PF ($\gamma = -.31$), ES to F ($\gamma = .37$), ES to CS ($\gamma = .71$), ES to PA ($\gamma = .29$), and ES to NA ($\gamma = -.27$) were all significant (*p*s < .05), indicating that greater satisfaction with the built environment was associated with higher present functioning, lower multidimensional fatigue, higher co-worker satisfaction, lower negative affect, and higher positive affect, fully supporting the mediational hypothesis.

The covariate "months worked at the hospital" did not significantly predict CS. Only the interfactor correlations between PF and F ($r = -.74$, $p < .05$), F and NA ($r = -.39$, $p < .05$), and PF and NA ($r = .76$, $p < .05$) were statistically significant, indicating that better staff present functioning was associated with higher multidimensional fatigue scale scores (indicating better functioning) and lower negative affect. Higher negative affect scores were associated with lower multidimensional fatigue scale scores (indicating poorer functioning).

In sum, the SEM for the full covariate model for staff report fit reasonably well descriptively. The mediational hypothesis was fully supported for all outcome variables, with the paths between OE and ES, and between ES and PF, F, NA, PA, and CS all statistically significant and in the expected directions. The only path that was significant between OE and outcome factors was the one between OE and CS. This path was in the opposite direction than expected, such that the presence of more environmental features thought to be beneficial was associated with lower ratings of co-worker satisfaction.

Post-Hoc Exploratory Structural Equation Model Analyses

The seven-factor model of Figure 3, now with no covariates, was re-tested using the structural equation modeling procedure in EQS. The variables were hypothesized to be related as specified in Figure 9, with interfactor correlations specified between PF, PA, NA, CS, and F. This model did not fit well statistically ($\chi^2[59, n = 96] = 93.36, p < .05$), but fit well descriptively ($CFI = .94$, $RMSEA = .08$; see Figure 9 for all standardized coefficients).

All standardized factor loadings were generally large and statistically significant for all four latent factors. For OE, values ranged from .96 to 1.0; for ES, values ranged from -.24 to .90; for PF, values ranged from .57 to .76; and for F, values ranged from .60 to .91.

The direct environment-outcome relationship posited by Hypothesis 3 was tested by creating direct paths between OE and PF, OE and F, OE and CS, OE and PA, and OE and NA. As in the full model, only the path between OE and CS was statistically significant ($\gamma = -.23, p < .05$), again in the direction opposite than expected, indicating that the presence of a greater number of environmental features thought to be beneficial was associated with lower co-worker satisfaction.

The staff component of Hypothesis 4 was re-tested by creating a path from OE to ES, and a second series of paths from ES to PF, ES to F, ES to CS, ES to PA, and ES to NA.

The pattern found in the full model was replicated, supported the mediational hypothesis. Namely, the direct path from OE to ES was statistically significant (γ = .39, $p < .05$), indicating that staff whose workspaces and breakrooms had more beneficial objective environmental features were more satisfied with the built environment, and the paths from ES to PF (γ = -.31), ES to F (γ = .37), ES to CS (γ = .73), ES to PA (γ = .28), and ES to NA (γ = -.26) were all significant (ps < .05), indicating that greater satisfaction with the built environment was associated with higher present functioning, lower multidimensional fatigue, higher co-worker satisfaction, lower negative affect, and higher positive affect.

As with the full model, the interfactor correlations between PF and F (r = -.76, p <.05), PF and NA (r = .75, $p < .05$), and F and NA (r = -.39, $p < .05$) remained statistically significant. In this reduced model, the path between F and PA (r = .24, p < .05) also reached significance, indicating that better functioning with respect to multidimensional fatigue was associated with higher ratings of staff positive affect.

In sum, the pattern of relationships observed in the full covariate model were replicated in this reduced model, such that OE predicted ES, and ES predicted all staff outcome measures, fully supporting the mediational hypothesis. The significant negative relationship between OE and CS was likewise replicated.

5.5 – Environmental Features

Exploratory Analyses of Environmental Features

Exploratory analyses were conducted to determine the relationship of each workspace and breakroom feature to staff-report variables, in accordance with the aim of Hypothesis 6. A number of features were excluded from these analyses since they were present only in one area. As such, *t*-tests would not have presented the impact of the specific feature, but rather one whole area (and all of its features) vs. all the other staff areas. Excluded features included personal storage space and radios at workspaces, and art, radios, restrooms, and personal storage space in break rooms. Tables 19-22 present frequency data and statistics for each workspace and breakroom feature and each feature's relationship to staff report variables.

Workspace Features. For workspace features (see Table 19), built environment satisfaction was significantly positively associated with the number of distinct areas, decorations, windows, light fixtures and controls, desktop computers and deskspace, hallway computers, personal and medical storage space, telephones, and radios. Scores on the Satisfaction Increasing Features subscale were significantly positively correlated with number of areas, windows, light controls, desktop and hallway computers, personal storage space, and radios. Scores on the Satisfaction Decreasing Features subscale were significantly negatively correlated with number of desktop computers per person. Ratings of Negative Affect were significantly correlated with number of phones, with poorer affect associated with fewer phones. Ratings of functioning on the Multidimensional Fatigue scale (with lower scores indicating poorer functioning) were significantly positively correlated with number of decorations, light fixtures, desktop and hallway computers, and deskspace, but significantly negatively correlated with number of artworks, contrary to expectations.

Present Functioning and Positive Affect were not significantly related to any individual environmental features. All correlations were small to moderate in magnitude (*r*s ranged from .20-.37; See Table 20). Correlations were mostly in the expected directions with the exceptions of artwork, which was significantly inversely correlated with multidimensional fatigue.

Breakroom Features. For breakroom features (see Table 21), ratings of Built Environment Satisfaction were significantly associated with number light fixtures, chairs and armchairs, desktop computers and deskspace, and toasters, but significantly negatively correlated with number of telephones and tables. Scores on the Satisfaction Increasing Features subscale were significantly positively correlated with number of chairs and armchairs, deskspace, and toasters, but negatively correlated with number of telephones. Positive Affect ratings of staff who had personal mailboxes in their breakroom were significantly higher than those who did not. Ratings of multidimensional fatigue (with lower scores indicative of poorer function) were significantly positively correlated with number of chairs and armchairs, desktop computers and deskspace, refrigerators, and toasters, but negatively correlated with number of microwaves. Co-Worker Satisfaction, the Satisfaction Decreasing Features subscale, Negative Affect, and Present Functioning were not related to any individual environmental features. All correlations were small to moderate in magnitude (*r*s ranged from .20-.39; see Table 22). Correlations were mostly in the expected direction with the exceptions that number of telephones and were significantly inversely correlated with environmental satisfaction variables, and greater number of microwaves significantly predicted poorer multidimensional fatigue scores.

Discussion

Past research has shown a relationship between elements of hospital design and aspects of physical and psychological functioning in pediatric and adult patients. Studies on the hospital built environment have typically focused either on the variation of a single feature and an associated outcome, or have considered environmental satisfaction as the outcome without considering actual health correlates. Guided by the conceptual model proposed by Sherman and colleagues (2005), the purpose of this study was to learn whether, in a pediatric hematology-oncology unit, environmental satisfaction varied by exposure to different environmental features, and whether environmental features were directly associated with health outcomes. An additional goal was to determine whether environmental satisfaction mediated the relationship between exposure to environmental features and a number of outcomes in three populations: pediatric hem-onc patients, their parents, and nursing staff. Specifically, we investigated the relationships among environmental features, environmental satisfaction, and physical and psychological functioning in addition to healthcare satisfaction and co-worker satisfaction for parents and staff, respectively. As discussed in detail below, we found varying degrees of support for the mediational hypothesis for parents and staff. Further, individual features that were hypothesized to be beneficial were generally found to be so. Additionally, acculturation moderated the relationship between visitor-facilitating features and a number of outcomes, for parents but not in children.

The Influence of Built Environment and Environmental Satisfaction on Outcomes

For children, the full model that included covariates showed no significant relationships between the objective environment and environmental satisfaction, or between environmental satisfaction and physical or emotional functioning. When we removed the covariates from the model, a significant positive relationship between environmental features and environmental satisfaction was revealed. Thus, although neither environmental features nor environmental satisfaction directly affected health outcomes in this group of hem-onc patients, our findings demonstrate cautious support for the idea that pediatric patients responded differently to different environments. In other words, patients reported higher or lower levels of satisfaction with their environment depending on the quality of the environment in which they were placed.

Several factors may have contributed to the non-significance of the remaining paths in the children's mediational model. First, the analyses may have been underpowered due to the relatively small sample size. None of the samples in this study met the minimum recommended sample size of 150 (Klem, 2000). However, for both child models, descriptive model fit indices indicated relatively good fit and all of the standardized path coefficients that approached .3 were significant suggesting adequate power. It is also possible that environmental satisfaction simply played no role in determining affect or present functioning in children. Given the findings of environmental impact on child functioning from prior research in hospital and more general environments (Sherman et al., 2005), a third possibility for the present findings may lie in the context of their children's hospitalization. Children in this study reported HRQOL significantly poorer than what had previously been published on a sample of in- and outpatients with pediatric cancer (Varni et al., 2007). Poor HRQOL combined with the demands of a hospitalization (i.e., medical procedures, blood draws, side-effects of therapy, and anxiety related to these processes) may have obscured the impact of environmental satisfaction on the physical or psychological functioning of these very sick children.

While research in this new field (i.e., the impact of hospital design on patient functioning) has not yet established the magnitude of effect sizes that could be expected from environmental manipulation, it is important to realize that we are likely looking for small effects. That effects may be small should not diminish their importance. The mean length of stay for children in this study was 17 days, with hospital stays extending for hundreds of days for some patients, under constant stress of their life-threatening condition. If environmental design can incrementally improve physical or emotional functioning in these patients, the benefit is well worth obtaining.

As with their children, parents' environmental satisfaction was also related to the environmental features to which they were exposed, with greater satisfaction associated with a higher number of environmental features hypothesized to be beneficial. Moreover, for parents, the mediational hypothesis was partially supported in the full "covariate" model, such that the objective environment was associated with environmental satisfaction, which, in turn, was associated with parents' satisfaction with the healthcare their child was receiving. Parents reported greater confidence in their child's treatment and medical providers when they were happier with their hospital rooms and other elements of hospital design. Although the data collected here are cross-sectional and therefore no conclusions about causality may be made, these findings are consistent with the notion that improvements to the hospital built environment may lead not only to enhanced environmental appraisal, but also to parents' improved perceptions of their child's healthcare at a given institution – an important measure to consider in the increasingly competitive healthcare marketplace.

Distinct from the child model, several factors were found to contribute to parental well-being. In further support of the mediational model, when covariates were removed from the parent model, the paths between environmental satisfaction to both present functioning and negative affect emerged as significant. This suggests that parents who were more satisfied with their environment also felt better physically and emotionally, and that making positive changes in the environment could be associated with improved parental well-being.

Although parents in this study reported varying degrees of physical and emotional functioning, it is unlikely that many parents were as physiologically compromised as their children. Perhaps this difference in health status enabled the detection of the observed environmental satisfaction effect on functioning in parents but not their children. In other words, while the already compromised health of hospitalized hem-onc patients is vulnerable to the impact of countless variables from which it may be difficult to distinguish the effects of the built environment, it may be easier to detect a built environmental impact on parents of more normal health status who nevertheless are subjected to vast amounts of time in the hospital environment. It is also possible that the environmental effect on functioning was detected in parents but not children due to increased statistical power, given the greater number of parents who participated in the study.

For staff, the mediational model was fully supported in both the full covariate and reduced models. Environmental features predicted environmental satisfaction, which was, in turn, associated with present functioning, positive and negative affect, multidimensional fatigue, and co-worker satisfaction as hypothesized. As with children and parents, nurses were more satisfied with their environments when those environments were characterized by a greater number of the features hypothesized to be beneficial. When they were happier with their environment, staff felt better physically and emotionally, were less tired, and reported better relationships with their colleagues. Although our study design did not allow us to connect data from specific nurses to that of the specific children they cared for, evidence from other research suggests the importance of nurses' job satisfaction as a significant predictor of patients' own healthcare satisfaction (Leiter et al., 1998).

Although no causal conclusions can be drawn, our findings suggest the possibility that improvements to the built environment might result in improved job satisfaction as well as improvements in staff well-being via environmental satisfaction. As such, environmental interventions may prove a feasible tool in promoting both staff retention and optimal performance.

In addition to the mediational relationships described above for parents and staff, two paths between objective environment features and outcomes emerged as significant in both the covariate and full models, but in the direction opposite than predicted. For the parent model, the presence of a greater number of environmental features hypothesized to be beneficial was associated with less positive affect. In the staff model, the presence of more "beneficial" features was associated with lower co-worker satisfaction. For the parent model, this conundrum is somewhat clarified by exploration of individual features and their relations to pain medications described below. For the staff model, the situation is less clear, as will be discussed in the following section.

Effects of Child and Parent Environmental Features

For children, the only measured element of their environment that significantly predicted environmental satisfaction was whether or not they shared a room. Children in private rooms also reported better mood. Though requiring further investigation, this finding could have design implications in considering whether to create single or double-occupancy hospital rooms. The only other feature associated with child mood and present function was whether their “wall channel TV controls” worked. Of interest, children whose rooms had a broken control reported worse mood and function than children whose rooms had no control at all.

For parents, when significant relationships emerged between specific features and environmental and healthcare satisfaction they were in the expected direction. Parents who were more satisfied with their children’s environment were more likely to have their children be assigned to hospital rooms whose features promoted greater control over the environment (e.g., access to a dimmer switch, bedlight controls, “wall channel” controls) or access to resources (e.g., being on the same side as the sink, bathrooms with more features, storage space). Whether the television worked was the only environmental feature significantly related to parents’ ratings of healthcare satisfaction. While our data cannot tell us why this was, of all the features studied televisions are the most likely to serve as an entertaining distraction during a stressful hospitalization, and this may account for their relationship to healthcare satisfaction.

Although environmental features hypothesized to be beneficial were associated with higher parental ratings of satisfaction with their environment, the significant relationships found between specific environmental features and parental functioning and affect were all in the direction opposite than we expected. In several cases, poorer parental functioning was associated with features that were significantly predictive of higher levels of satisfaction (e.g., parents with access to bathrooms with additional features reported significantly lower positive affect; parents with greater access to the bathroom, sink, and thermostat reported significantly poorer present functioning).

These findings seem counter-intuitive given the parental satisfaction associated with the environmental features in question, and the tentative relationship found between environmental satisfaction and parental functioning. Probing the relationship between prescribed pain medication and environmental features may lend insight to this contradictory relationship. The exploratory hypothesis that the presence of beneficial environmental features would be associated with the prescription of fewer pain medications was not supported. However, our analyses revealed that the three features significantly associated with a greater number of prescribed pain medications (i.e., thermostat and bathroom on same side of room; and bathrooms with more features) were also among those that were associated with poorer parental functioning and affect. Thus, parents' affect and functioning may have been driven by a third variable – perceived child pain – which was also associated with the same specific environmental features.

Why a significant relationship existed between number of prescribed pain medications and these features is a difficult question, because it is unlikely that thermostat control or better equipped bathrooms would cause pain. The lack of significant correlation between the severity of the child's condition and any specific environmental features also speaks against the idea that sicker children are systematically placed in environments with "better" features, at least within the constraints of study participation that did not allow for participation of children in acute crisis who may well have been placed purposely in their own private rooms. It may be that children believed by healthcare staff to be in more pain (but not necessarily with more severe conditions) were assigned to "better" rooms and were also prescribed more pain medications. It is also possible that a subset of the children receiving pain medication (or their parents) may have been more vociferous about pain complaints, thus obtaining additional prescriptions from physicians. This same subset might also have been more vocal about other problems in their hospitalization, and, given that "the squeaky wheel gets the grease," it is possible that these children and their parents were placed in "better" rooms. We have no evidence to support either premise, but offer them as tentative hypotheses that may be investigated in future research.

Effects of Staff Environmental Features

For staff, the presence of features hypothesized to be beneficial was typically associated with higher environmental satisfaction, as expected, and also with better functioning on the multidimensional fatigue scale. For workspace, the most important feature seemed to be access to computers, while for breakroom, the presence of armchairs, chairs, toasters, and deskspace predicted better functioning across environmental satisfaction and multidimensional fatigue scales. Several features were significantly correlated with outcomes in the direction opposite than predicted. In the case of telephones in the breakroom, which were predictive of lower ratings of environmental satisfaction, it is plausible that the telephones were disruptive of staff's ability to relax. It is harder to understand why artwork or more tables and microwaves would be associated with poorer functioning, although simply adding "more" of these amenities in the limited space allotted for staff may contribute to feelings of crowding or clutter. Further content analyses of the art, and observation of how breakrooms are used, equipped, and laid out, may help us to better understand these findings. As was the case with the parents, it is possible that a third unmeasured variable was at play that has yet to be identified.

Acculturation

Given the prevalence of large family groups visiting Latino patients that has been previously suggested by other researchers (Sherman, Varni, Ulrich, & Malcarne, 2005; Ulrich, 1991), we predicted that quantity of "visitor-facilitating features" would be more predictive of outcome measures for less acculturated Latino patients and their parents than for more acculturated Latinos. Although no moderation effect was found for children, both acculturation and visitor-facilitating features each played a distinct role with respect to children's satisfaction with their environment. Children of parents who were less acculturated were more satisfied with their total environment, while the quantity of visitor-facilitating features significantly positively predicted room satisfaction in these children.

For parents, lower acculturation was significantly associated with higher environmental satisfaction on all scales, with visitor facilitating features also significantly positively predicting room satisfaction. The moderation effect was observed for healthcare satisfaction and negative affect, such that less acculturated Latino parents whose children's rooms were equipped with higher numbers of visitor-facilitating features also reported better mood and greater satisfaction with their child's healthcare.

Although acculturation predicted environmental satisfaction and moderated healthcare satisfaction and affective functioning outcomes in Latino parents, between group ethnic differences were only found on measures of environmental satisfaction (with Latinos reporting environmental satisfaction ratings significantly higher than Caucasian or Asian parents). Likewise, although parental acculturation was significantly inversely predictive of Latino children's environmental satisfaction, no significant between group ethnic differences were found for child measures. These findings underscore the importance of conducting "within group" cultural analyses to examine mechanisms of acculturative processes for different cultural groups rather than relying simply on between group ethnic comparisons or on proxy-variables (e.g., SES), which did not produce the same pattern of results, despite the fact that lower SES was associated with greater environmental satisfaction in the total parent sample.

Limitations and Future Directions

As with any novel field of inquiry, identifying appropriate constructs for measurement, both in terms of environmental features, and expected outcomes, is an iterative process that can only be refined by time and research. In addition, because of the incipient nature of this research, many of the instruments used had not yet been tested or validated. Although our results demonstrate adequate internal consistency reliability for most of our instruments in both English and Spanish further research is necessary to establish the validity of these measures and to determine best practices for measuring both objective environment and environmental satisfaction.

Two additional problems may be associated with the instruments used in this study. First, although alpha scores were generally adequate for both child and parent measures, child self-report is typically found to be less reliable, though important to obtain, in comparison with adult report. As such, the fact that responses to questionnaires resulted in the expected pattern of relationships that reached significance in adult participants but not in children, may be an artifact of the self-report methodology utilized in this study. Second, the exclusive use of self-report questionnaires to measure the hypothesized mediator as well as all outcome measures may have contributed to inflating the relationships found between these constructs due to shared method variance. The first limitation could be addressed by the addition of an adult-proxy report for corroborative information on child functioning, and the problem with method invariance could be addressed by the incorporation of behavioral observation measures or physiological indicators of stress or functioning (e.g., blood pressure, cortisol).

Another limitation of our study is its cross-sectional design. Although structural equation modeling helps to elucidate complex relationships among many variables, causality can only be established via experimental design, so we cannot validly address the question of whether the outcomes were caused by antecedent variables. Possible designs that would bolster confidence in causality might involve randomly assigning children to rooms that varied by only one feature (e.g., natural vs.

urban view; varying degrees of lighting control; full beds vs. single beds for parents; lightweight moveable furniture that allows for eating/playing together), or manipulating exposure to a feature across time (e.g., changing the artwork in a child's hospital room).to determine whether outcomes vary with exposure to that feature. Given the vulnerable nature of the pediatric hem-onc population and the minimal environmental requirements of hospitals (e.g., access to bathrooms, minimum space requirements, ventilation systems), care would need to be taken to select features ethically appropriate to study.

The lack of significant results in the child model raises another possible limitation. Given the likelihood that environmental effects will be small, very large sample sizes may be necessary to appropriately power similar studies, which will be difficult in the context of the pediatric hem-onc population. Additionally, determining an appropriate sample size is also difficult due to our general lack of knowledge about plausible effect sizes.

As has already been mentioned, the hem-onc patients in this study were quite ill. As the science of medical treatment of cancer and blood diseases continues to advance, so will the trend to hospitalize only the most severely ill children. The possibility of detecting an effect for the environment under the myriad of physical and psychosocial confounds necessarily dwindles, as the importance of providing an optimal environment for healing increases. This challenge can be addressed in two ways. First, we could refine our measurement instruments and work to identify the physiological and/or affective outcomes most likely to be responsive to environmental changes. Second, we could attempt to identify groups of children hospitalized under less severe circumstances to learn more about the environmental effect, and then apply these lessons to the environments of sicker children and their families. Hospital renovations are both expensive and infrequent. Increasing research on the effects of the hospital built environment to promote empirically supported hospital design is one way to ensure that these funds will be put to best use.

Parents are important stakeholders in children's hospitals, both in terms of their children's healthcare and their own functioning within these environments, as our study has suggested. As such, it is important to consider not only the patient, but parents and families as well in designing hospital environments. Although our study did not address this issue, a model that combines parent and child experiences will be richer and possibly allow for the identification of "trickle-down" environmental effects on child functioning from having better adjusted parents. It should be noted that many children were not able to participate in our study due to age or illness-related limitations, which would compromise the capacity to explore the spectrum of parent-child environmental effects.

Because of the ubiquitous presence of families on hem-onc units, hospitals routinely include supplemental spaces on these floors including kitchens, family rooms, laundry facilities, quiet rooms for napping, and playrooms for both patients as well as their healthy siblings. These areas could impact families' feelings of efficacy and control in caring for their child, as well as aid in providing more home-like settings. In addition to these spaces, Child Life specialists are common on hem-onc units, as well music therapists, teachers, and volunteers to help children and their families cope during their hospitalization, and for whom architectural design could promote or hinder activities. This study did not address any supplemental spaces, programs, or staff activities, but they are important areas that should be addressed in future research, particularly as we have observed the importance of "visitor-facilitating features" for the less acculturated participants in our study. Likewise, for children, it is possible that the immediate distraction or entertainment in front of them in the form of an art project from Child Life, a musician, pet therapist, or videogame is more salient than more permanent environmental fixtures (e.g., bathroom amenities, window view) and should likewise be incorporated into future studies.

With regard to staff, our study identified significant relationships between environmental satisfaction and many aspects of staff functioning, and previous research has noted the importance of nurses' job satisfaction in promoting healthcare satisfaction among patients (Leiter et al., 1998). As mentioned above, we were not able to connect data from specific patients to a nurse who would have cared for them. A study design that connects healthcare satisfaction to the job satisfaction of a patient's own healthcare provider in the context of their environment and environmental satisfaction would provide a fuller characterization of the hospital experience.

Finally, as with any study, there are problems of generalizability. While our study sample was representative of the population of the hospital in which it was conducted and we were able to conduct within-group analyses on our Latino/a subset, the lack of participants from other ethnic groups limits the generalizability of our findings. Likewise, most participants in our study were of relatively low SES. This is particularly problematic since SES was associated with our central study variable of environmental satisfaction. Higher SES was predictive of lower environmental satisfaction. Thus, further research that includes a higher SES sample to better identify appropriate environmental correlates and to investigate whether our pattern of results is replicated.

The Next Study

This study provided a global "overview" of the content of environmental features in children's hospital rooms, and the spaces where nurses work and try to rest, as well as general measures of environmental satisfaction, mood, and functioning. As such, it represents an attempt to characterize an environment and establish preliminary evidence for a plausible pattern of relationships between environmental, satisfaction, and outcome variables. Much work is left to do to learn about how people behave and react to these environments and about specific environmental modifications that can be implemented to effect positive changes. An interesting next study would track participant use of different supplemental spaces (e.g., playrooms, kitchens) in addition to activity patterns within hospital rooms (e.g., television or videogames, Child Life activity, visits from teachers, entertainers, or volunteers) to learn more about environmental usage patterns in addition to data on the availability of environmental amenities. By incorporating observational measures we could also learn more about how environmental features both hinder and enhance quality of life in these patients and staff. Measures of mood and satisfaction would also be administered at different points in the hospitalization and in different environments to learn more about specific environments and events in hospitalization that are associated with stress or more optimal functioning. This "next study" would involve a smaller number of patients and staff, who would be tracked more carefully across time but would continue to measure satisfaction and outcome data rather than rely on a purely qualitative approach.

Conclusions and Implications

To our knowledge this is the first study of its scope to attempt an evaluation of a hospital environment that incorporates both objective and subjective environmental appraisals, measures of physical and psychological functioning, and child self-report within the context of *a priori* models. We learned that pediatric hem-onc patients, their parents, and their nurses report different levels of satisfaction in different environments of variable quality. For parents and staff, their appraisals of their environments are associated with their physical and psychological functioning, albeit with effects of small magnitude. Although clearly in its nascent stages, this research suggests that improvements in the hospital environment as simple as fixing a television or providing additional storage space could enhance mood, functioning, and perceived quality of care in parents, and that improving access to work and rest amenities for staff could enhance their well-being and job satisfaction. We hope that by learning more about the hospital built environment and its function, we can alleviate stress caused by poor design, and optimize the capacity of hospital space to promote healing and well-being in all its inhabitants.

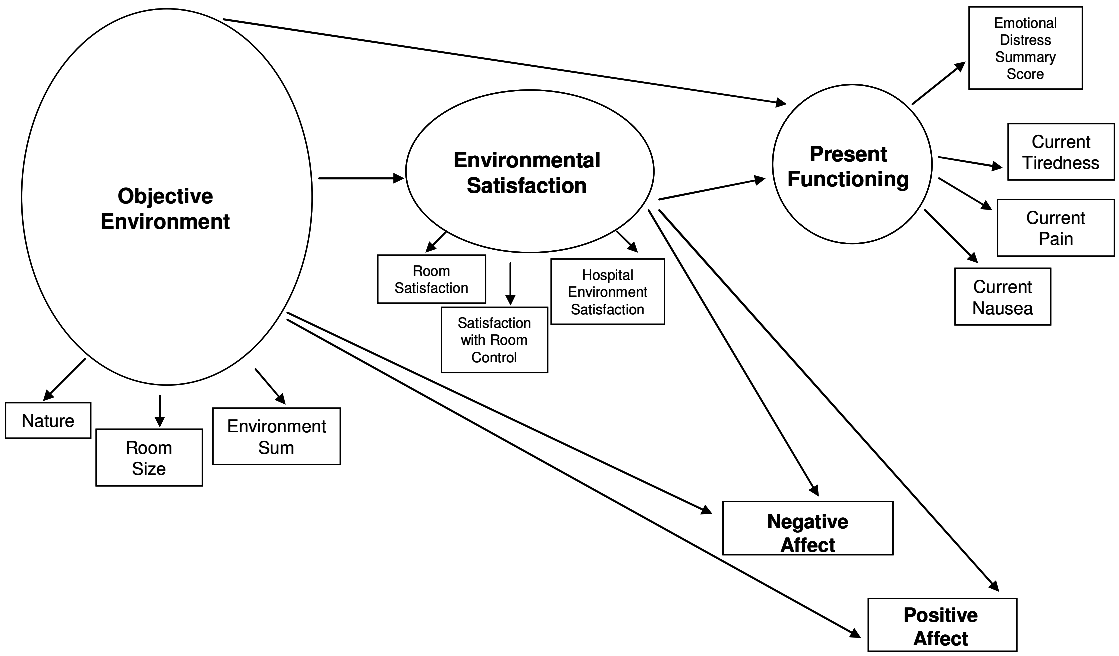


Figure 1. Child Model.

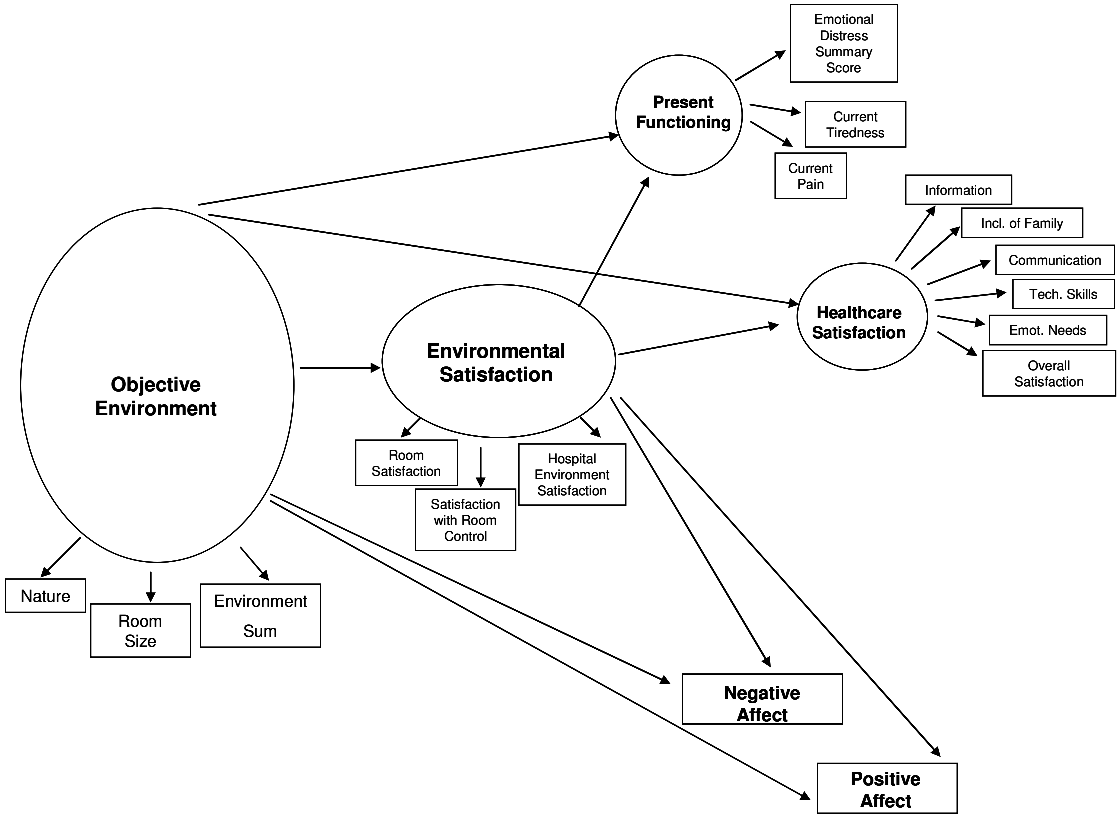


Figure 2. Parent Model.

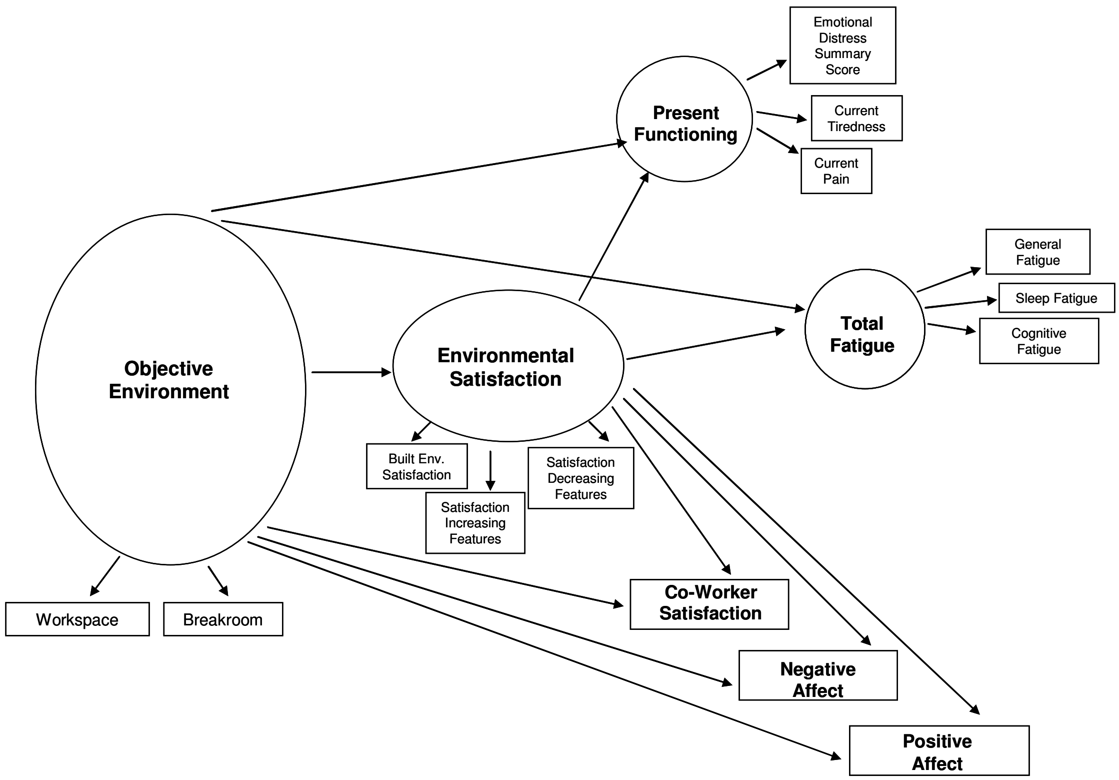
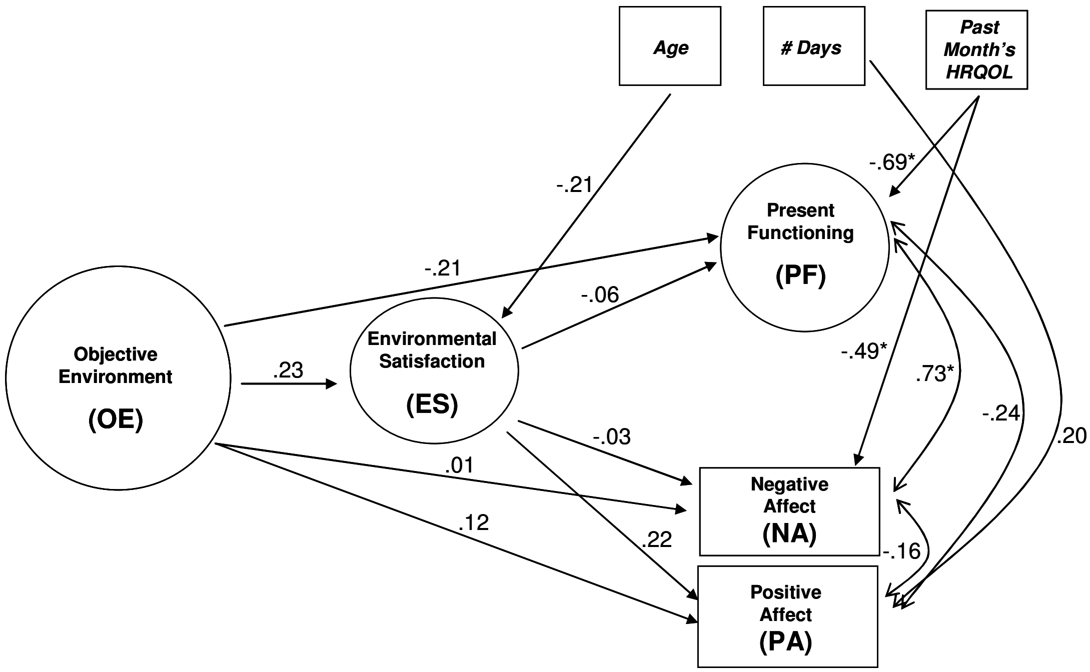
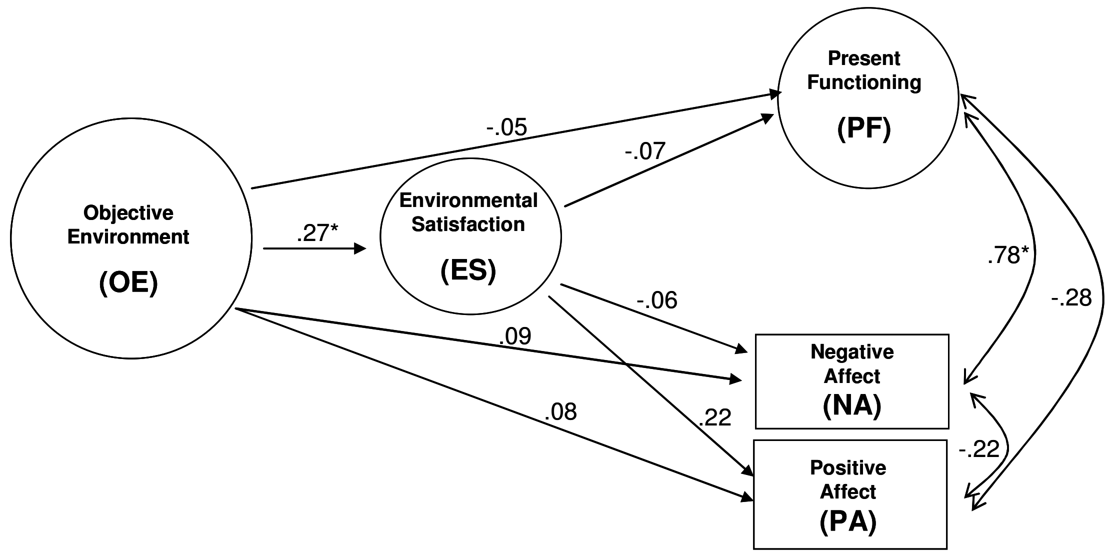


Figure 3. Staff Model.



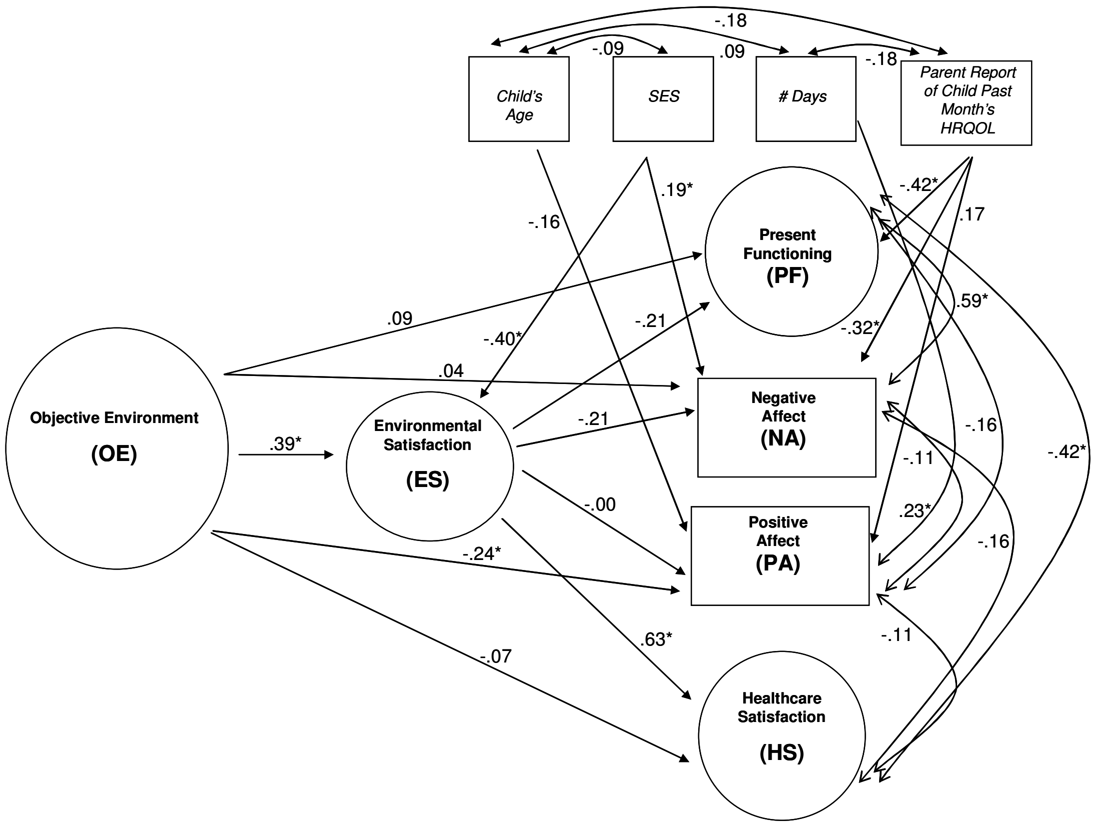
*$p < .05$

Figure 4. Child Model with Covariates.



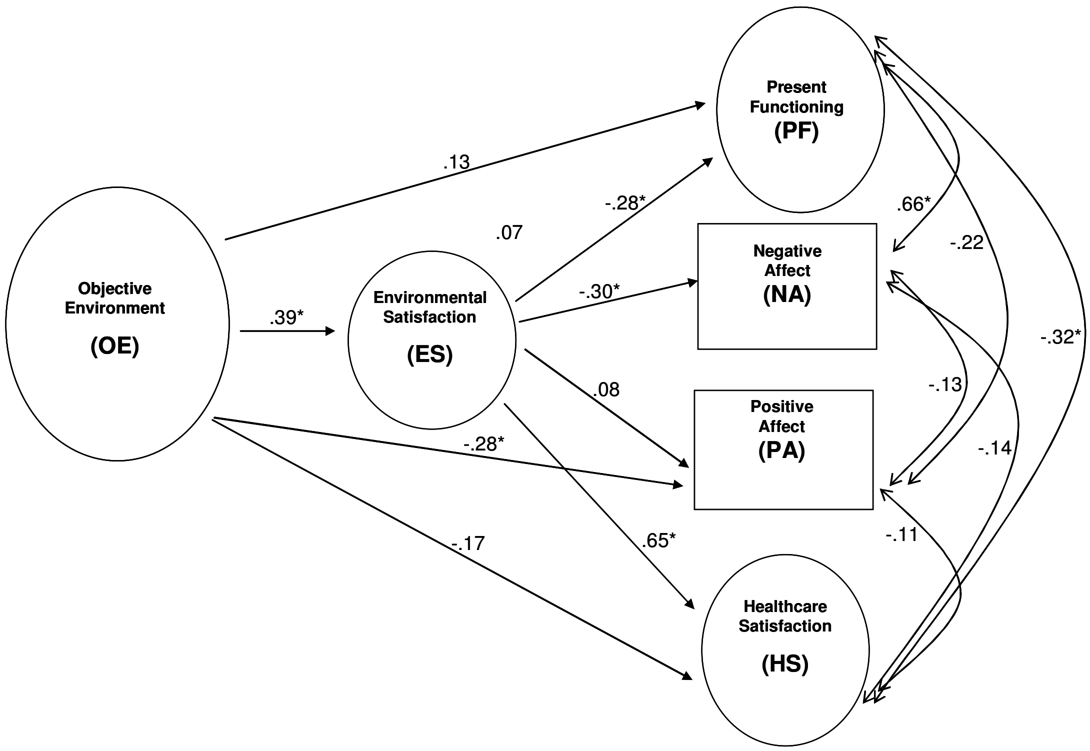
*$p < .05$

Figure 5. Child Model without Covariates.



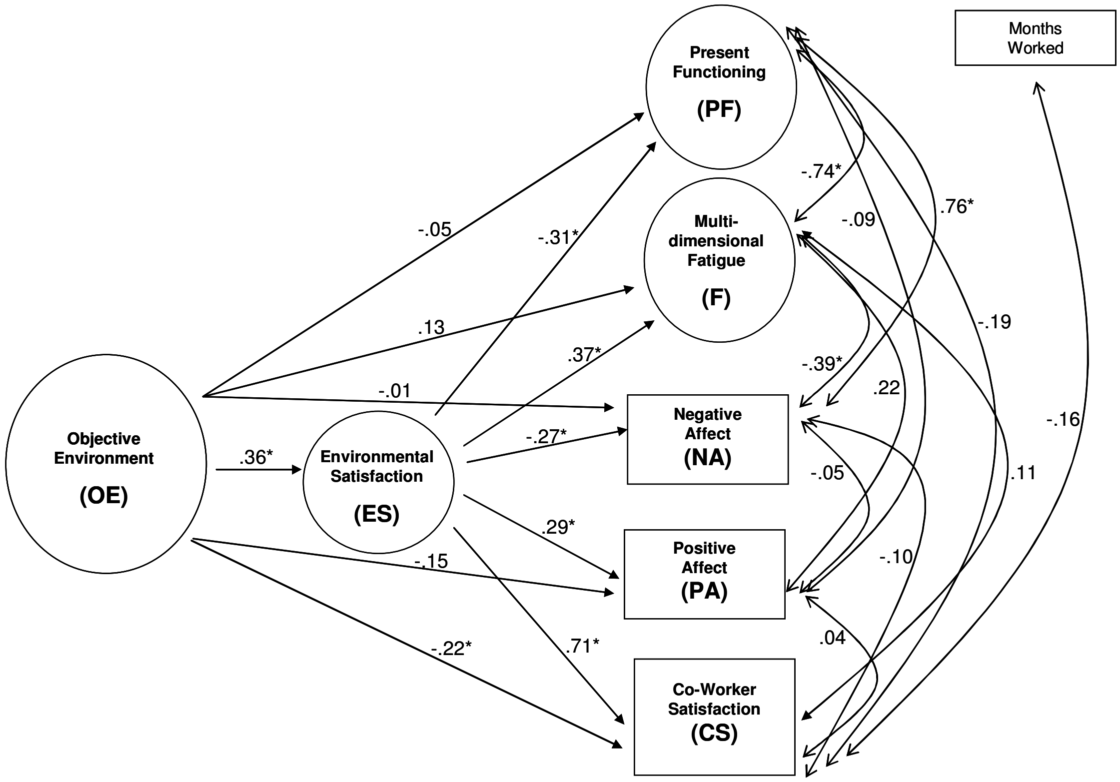
* $p < .05$

Figure 6. Parent Model with Covariates.



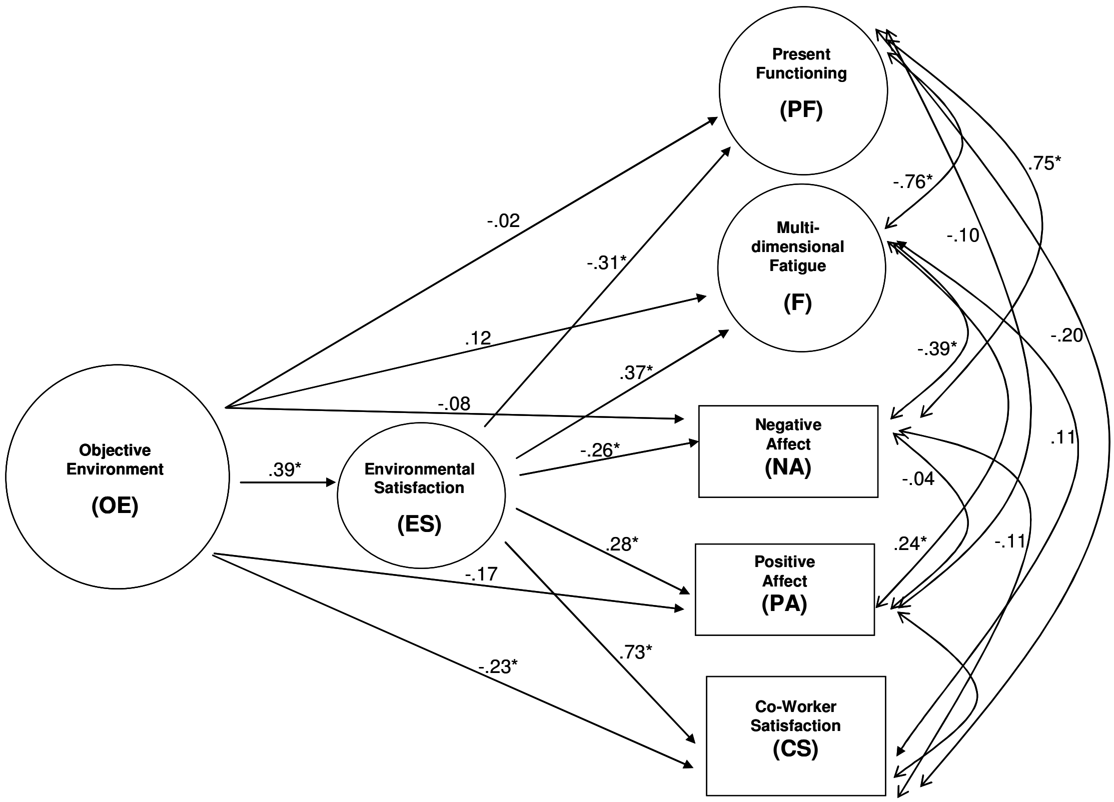
* $p < .05$

Figure 7. Parent Model without Covariates.



* $p < .05$

Figure 8. Staff Model with Covariates.



*$p < .05$

Figure 9. Staff Model without Covariates.

Table 1

Environmental Sum Features for Patients and Parents

Feature	Description of Feature	Scoring System
Window	Presence/Absence of window on patient's side of room. If blinds did not open, rated "dysfunctional"	0 = no window 1 = dysfunctional 2 = window
Visitor Sleep	Type of bedding available for visitor (usually parent)	0 = no bedding 1 = sleep chair 2 = sleep bed 3 = sleep chair & bed
Dimmer	Presence/Absence of dimmer switch on side of the room. If dimmer did not work, rated "dysfunctional"	0 = no dimmer 1 = dysfunctional 2 = dimmer
Bathroom	Location of bathroom in relation to side of the room	0 = other side 1 = middle 2 = same side
Bathroom Features	Amenities available in bathroom	0 = toilet only 1 = toilet, shower 2 = toilet, shower,tub
Sink	Location of sink in relation to patient's side of the room	0 = other side 1 = middle 2 = same side
Color Design	Presence/Absence and location of colored designs	0 = no designs 1 = wall or floor 2 = wall and floor
Overhead Light	Location of controls for main overhead light in relation to side of the room	0 = other side 1 = middle 2 = same side 3 = behind bed

Table 1 *(continued)*

Feature	Description of Feature	Scoring System
Bedlight Control	Location of control for patient's bedlight	0 = no control 1 = cord behind bed 2 = bedcontrol
Bedlight Settings	Number of settings for bedlight	0 to 3 settings
Television	Presence/Absence of TV. If TV did not work, rated "dysfunctional"	0 = no TV 1 = dysfunctional 2 = TV
VCR	Presence/Absence of VCR. If VCR did not work, rated "dysfunctional"	0 = no VCR 1 = dysfunctional 2 = VCR
Storage	Number of drawers and/or cabinets on side of room	0-9 storage units
Thermostat Control	Location of thermostat controls If control did not work, rated "dysfunctional"	0 = dysfunctional 1 = other side 2 = middle 3 = same
Booster Switch	Presence/Absence of booster switch. Location in relation to side or room	0 = no booster 1 = other side 2 = middle 3 = same side

Table 2

Staff Workspace Features

Name of Feature	Description of Feature	Scoring System
Nature (total)	Access to view that is natural view.	0-100% natural
Areas (per person)	# of distinct areas (e.g., reception, charting, supply)	2-6 distinct areas
Art (total)	# of works of art on the wall	0-12 works of art
Other decorations (total)	# of "non-art" decorations (e.g., mosaic tiles)	0-24 decorations
Windows (total)	# of windows anywhere on the unit	0-46 windows
Light fixtures (total)	# of light fixtures	5-29 fixtures
Light controls (total)	# of light switches	3-6 switches
Chairs (per person)	# of chairs	5-16 chairs
Computers (per person)	# desktop computers	4-11 computers
Laptops (per person)	# of laptops, excluding in hallway	0-1 laptops
Desk Space (per person)	# of horizontal work surfaces	4-17 surfaces
Hallway Computer Stations (per person)	# of hallway computers	0-8 computers
Hallway Medical Carts (per person)	# of hallway medical supply carts	0-3 carts
Patient-Staff Meeting Rooms (per person)	# of private staff-patient spaces	0-1 rooms
Personal Storage Space (per person)	# of personal cabinets and drawers	0-6 units
Work Storage Space (per person)	# of work cabinets, shelves, drawers	23-118 units
Display Space (total)	# of display areas for postings	2-9 spaces
Telephones (per person)	# of phones	4-9 phones
Medical Storage (per person)	# storage spaces for medical supplies	1-3 spaces
Washing Stations (per person)	# of washing stations	0-2 stations
Radio (per person)	# of radios	0-1 radios

Table 3

Staff Breakroom Features

Name of Feature	Description of Feature	Scoring System
Nature (total)	Access to view that is natural view	0-100% natural
Windows (total)	# windows in the break room	0-4 windows
Art (total)	# of works of art on walls	0-1 works of art
Light Fixtures (total)	# of light fixtures	1-8 fixtures
Light Controls (total)	# of light switches	1-2 switches
Chairs (per person)	# of upright chairs	2-5 chairs
Armchairs (per person)	# of padded armchairs	0-2 armchairs
Sofas (per person)	# of sofas	0-1 sofas
Computers (per person)	# of desktop computers	0-3 computers
Desk Space (per person)	# of horizontal work surfaces	0-2 surfaces
Personal Storage Space (per person)	# of personal cabinets and drawers	0-18 units
Mailboxes (total)	Presence/absence of staff mailboxes	0 = no, 1 = yes
Communal Storage Space (per person)	# of communal drawers, shelves, cabinets	0-9 units
Display Space (total)	# of display areas for postings	2-6 spaces
Telephones (per person)	# of phones	0-1 phones
Restrooms (per person)	# of restrooms in break room area	0-1 restrooms
Television (per person)	# of TVs	0-1 TVs
Radio (per person)	# of radios	0-1 radios
Refrigerator (per person)	# of refrigerators	1-2 refrigerators
Microwave (per person)	# of microwave ovens	1-2 microwaves
Toaster (per person)	# of toasters	0-1 toasters
Tables (per person)	# of tables	1-2 tables
Sink (per person)	# of sinks	0-1 sinks
Coffee maker (per person)	# of coffeemakers	0-1 coffeemakers

Table 4

List of Measures

	Patient Measures	Parent Measures	Staff Measures
Objective Environment	Patient/Parent Environment Checklist	Patient/Parent Environment Checklist	Workspace Checklist
			Breakroom Checklist
Environment Satisfaction	PedsQL™ Healing Environment Module Child Report	PedsQL™ Healing Environment Module Parent Report	PedsQL™ Healing Environment Module Staff Report
Outcome Measures	PedsQL™ Present Functioning Scales Child Report	PedsQL™ Present Functioning Scales Parent Report	PedsQL™ Present Functioning Scales Staff Report
	Positive & Negative Affect Schedule for Children (PANAS-C)	Positive & Negative Affect Schedule (PANAS)	Positive & Negative Affect Schedule (PANAS)
		PedsQL™ Healthcare Satisfaction Module	PedsQL™ Co-Worker Satisfaction Scale
			PedsQL™ Multi-Dimensional Fatigue Scale
Demographic Measures	Severity of Reason for Hospitalization Scale (in retrospect by staff)		
		PedsQL™ Family Information Form	PedsQL™ Staff Information Form
	PedsQL™ Self Report Generic Core Scales	PedsQL™ Parent-Proxy Generic Core Scales	
		Acculturation Rating Scale for Mexican Americans (ARSMA-II)*	

*Only Latino/a parents completed this instrument

Table 5

Internal Consistency Reliability for Parent Report

		Total Sample		English		Spanish	
	# Items	*N*	α	*n*	α	*n*	α
Healing Environment Scales							
Total Environmental Satisfaction	42	71	.98	39	.95	32	.98
Room Satisfaction	18	93	.96	47	.92	46	.95
Room Control Satisfaction	3	146	.83	85	.75	61	.75
Hospital Environment Satisfaction	21	101	.96	61	.94	40	.97
Healthcare Satisfaction Scales							
Total Healthcare Satisfaction	24	78	.97	45	.97	33	.96
Information Scale	5	143	.90	84	.91	59	.88
Inclusion of Family Scale	4	140	.94	84	.95	56	.89
Communication Scale	5	140	.94	82	.94	58	.95
Technical Skill Scale	3	130	.87	73	.88	57	.82
Emotional Needs Scale	4	91	.94	53	.92	38	.94
Overall Healthcare Satisfaction	3	146	.91	85	.92	61	.83
Present Functioning Scales							
Total Symptom Score	6	148	.69	87	.82	61	.61
Emotional Distress Summary Score	4	148	.59	87	.81	61	.49
PANAS							
Positive Affect Scale	10	138	.83	82	.82	56	.86
Negative Affect Scale	10	138	.87	79	.87	59	.85
PedsQL™ Core Scales							
Total Score	23	86	.93	52	.95	34	.90
ARSMA II							
Anglo Orientation Scale	13	42	.93	11	.25	31	.85
Mexican Orientation Scale	17	52	.88	17	.90	35	.83

Table 6

Internal Consistency Reliability for Child Report

	# Items	Total Sample *N*	Total Sample α	English *n*	English α	Spanish *n*	Spanish α
Healing Environment Scales							
Total Environmental Satisfaction	39	41	.94	37	.93	4	.98
Room Satisfaction	18	48	.90	43	.88	5	.98
Room Control Satisfaction	3	83	.66	75	.65	8	.74
Hospital Environment Satisfaction	18	66	.90	60	.90	6	.96
Present Functioning Scales							
Total Symptom Score	7	89	.80	81	.80	8	.77
Emotional Distress Summary Score	4	89	.75	81	.76	8	.70
PANAS-C							
Positive Affect Scale	12	80	.91	72	.91	8	.97
Negative Affect Scale	15	79	.86	71	.86	8	.90
PedsQL™ Core Scales							
Total Score	23	71	.92	65	.92	6	.93

Table 7

Internal Consistency Reliability for Staff Report

		Total Sample	
	# Items	*N*	α
Staff Healing Environment Scales			
Staff Total Environmental Satisfaction	32	71	.93
Staff Built Environment Satisfaction	22	77	.95
Satisfaction Increasing Features Scale	5	91	.88
Satisfaction Decreasing Features Scale	5	88	.90
Co-Worker Satisfaction Scale			
Staff Co-Worker Satisfaction	4	99	.91
Present Functioning Scales			
Total Symptom Score	6	99	.75
Emotional Distress Summary Score	4	99	.68
PANAS			
Positive Affect Scale	10	98	.91
Negative Affect Scale	10	96	.88
Multi-Dimensional Fatigue Scale			
Total Fatigue	18	95	.90
General Fatigue	6	97	.89
Sleep Fatigue	6	98	.63
Cognitive Fatigue	6	98	.90

Table 8

Child Demographic Information

Demographic Variable		*Range*	*Mean*	*SD*
Age		8-17	12.40	2.78
SES		8-66	31.87	17.86
Time since diagnosis (days)		21-6136	910.96	1275.73
Days hospitalized at study recruitment		1-127	9.63	16.57
Total length of hospital stay (days)		1-227	19.36	31.95
Child Self-Report of Previous Month's HRQOL		1.09-98.91	60.45	19.76
			n	*%*
Gender	Male		52	57.8%
	Female		38	42.2%
Ethnicity	Latino/a		51	56.7%
	Caucasian		21	23.3%
	Asian		8	8.9%
	African American		4	4.4%
	Other/Missing		6	6.7%
Diagnosis	Leukemia		42	46.7%
	Solid Tumors		26	28.9%
	Hematological		9	10.0%
	Neural Tumor		8	8.9%
	Lymphoma		5	5.6%
Severity of Reason for Hospitalization	Low		45	50.0%
	Medium		21	23.3%
	High		22	24.4%
	Missing		2	2.2%

Table 9

Scale Descriptives for Child Self-Report

Scale	# Items	*N*	*Mean*	*SD*
Healing Environment Scales				
Total Environmental Satisfaction	39	88	63.81	17.50
Hospital Room Satisfaction	18	88	62.03	18.53
Hospital Room Control	3	85	54.17	26.70
Hospital Environment Satisfaction	18	88	67.14	18.91
Present Functioning Scales				
Total Symptom Score	7	90	20.23	16.95
Emotional Distress Summary Score	4	90	17.53	17.38
Current Tiredness	1	90	33.72	31.84
Current Pain	1	90	17.31	22.90
Current Nausea	1	90	18.49	24.30
PANAS-C				
Positive Affect Scale	12	89	2.60	.99
Negative Affect Scale	15	89	1.57	.60

Table 10

Environmental Features – Frequencies for Children

Feature	Scoring System	*Frequencies*
Window	0 = no window	No window = 26
	1 = dysfunctional	Dysfunctional = 36
	2 = window	Window = 28
Visitor Sleep	0 = no bedding	Sleep chair = 34
	1 = sleep chair	Sleep bed = 56
	2 = sleep bed	
Dimmer	0 = no dimmer	No dimmer = 46
	1 = dysfunctional	Dysfunctional = 13
	2 = dimmer	Dimmer = 31
Bathroom	0 = other side	Other side = 24
	1 = middle	Middle = 1
	2 = same side	Same Side = 65
Bathroom Features	0 = toilet only	Toilet only = 72
	1 = toilet , shower	Toilet,shower = 11
	2 = toilet , shower , tub	Toilet, shower, tub = 7
Sink	0 = other side	Other side = 22
	1 = middle	Middle = 5
	2 = same side	Same side = 63
Color Design	0 = no designs	No designs = 1
	1 = wall or floor	Wall or floor = 10
	2 = wall and floor	Wall and floor = 79
Overhead Light	0 = other side	Other side = 20
	1 = middle	Middle = 1
	2 = same side	Same side = 16
	3 = behind bed	Behind bed = 53

Table 10 *(continued)*

Feature	Scoring System	*Frequencies*
Bedlight Control	0 = no control	No control = 2
	1 = pull cord behind bed	Pull cord = 37
	2 = bedcontrol	Bedcontrol = 51
Bedlight Settings	0 to 3 settings	0 = 2
		1 = 46
		3 = 42
Television	0 = no TV	No TV = 0
	1 = dysfunctional	Dysfunctional = 7
	2 = TV	TV = 83
VCR	0 = no VCR	No VCR = 0
	1 = dysfunctional	Dysfunctional = 2
	2 = VCR	VCR = 88
Wall Channel Control	0 = none	None = 27
	1 = dysfunctional	Dysfunctional = 11
	2 = wall channel control	Wall Channel Control = 52
Storage	0-9 storage units	0-3 = 22
		4-6 = 40
		7-9 = 28
Thermostat Control	0 = dysfunctional	Dysfunctional = 38
	1 = other side	Other side = 14
	2 = middle	Middle = 1
	3 = same	Same side = 18
Booster Switch	0 = no booster	No booster = 55
	1 = other side	Other side = 20
	2 = middle	Middle = 1
	3 = same side	Same side = 14

Table 11

Parent-Report Demographic Information

Demographic Variable		*Range*	*Mean*	*SD*
Age		2-17	9.67	4.53
SES		8-66	33.50	17.10
Time since diagnosis (days)		21-6136	689.59	1063.76
Days hospitalized at study recruitment		1-127	8.62	14.41
Total length of hospital stay (days)		1-227	17.33	26.95
Parent Report of Child's Previous Month's HRQOL		9.78-100	53.16	20.80
			n	*%*
Parent/Gaurdian Gender	Male		27	18.1%
	Female		122	81.9%
Child's Gender	Male		80	53.7%
	Female		69	46.3%
Ethnicity	Latino/a		91	61.1%
	Caucasian		31	20.8%
	Asian		11	7.4%
	African American		9	6.0%
	Other/Missing		7	4.7%
Child's Diagnosis	Leukemia		72	48.3%
	Solid Tumors		37	24.8%
	Hematological		10	6.7%
	Neural Tumor		21	14.1%
	Lymphoma		8	5.4%
	Missing		1	.7%
Severity of Reason for Child's Hospitalization	Low		80	53.7%
	Medium		38	25.5%
	High		28	18.8%
	Missing		3	2.0%

Table 12

Scale Descriptives for Parent Self-Report

Scale	# Items	*N*	*Mean*	*SD*
Healing Environment Scales				
Total Environmental Satisfaction	42	148	66.35	22.91
Hospital Room Satisfaction	18	148	61.17	25.68
Hospital Room Control	3	147	61.99	29.65
Hospital Environment Satisfaction	21	147	71.82	22.03
Healthcare Satisfaction Scales				
Total Healthcare Satisfaction	24	146	82.73	20.05
Information	5	146	85.23	19.90
Inclusion of Family	4	146	84.55	22.21
Communication	5	146	83.46	23.85
Technical Skills	3	147	83.99	21.52
Emotional Needs	4	137	71.90	29.03
Overall Healthcare Satisfaction	3	146	85.96	20.24
Present Functioning Scales				
Total Symptom Score	6	147	43.41	28.15
Emotional Distress Summary Score	4	148	44.44	33.90
Current Tiredness	1	147	56.05	34.14
Current Pain	1	147	25.56	30.48
PANAS				
Positive Affect Scale	10	146	30.59	8.95
Negative Affect Scale	10	145	21.92	8.56

Table 13

*Moderational Effects of Acculturation (VFF*Acculturation)*

Scale	F (df)	R^2	ΔF (df)	ΔR^2	β	p
Total Healthcare Satisfaction	3.45* (3,59)	.15	9.50** (1,59)	.14	-.40	
					Low: .45	< .05
					Medium: .00	*NS*
					High: -.42	< .05
Information Subscale	3.46* (3,59)	.15	7.86** (1,59)	.11	-.36	
					Low: .51	< .05
					Medium: .00	*NS*
					High: -.27	*NS*
Communication Subscale	3.74* (3,59)	.16	9.22** (1,59)	.13	-.39	
					Low: .52	< .05
					Medium: .08	*NS*
					High: -.33	*NS*
Emotional Needs Subscale	3.81* (3,55)	.17	8.77** (1,55)	.13	-.39	
					Low: .31	*NS*
					Medium: -.12	*NS*
					High: -.55	< .05
Negative Affect	7.25** (3,58)	.27	8.01** (1,58)	.10	.34	
					Low: -.45	< .05
					Medium: -.08	*NS*
					High: .29	*NS*

*$p < .05$

**$p < .01$

Table 14

Healing Environment Scale – Parent Means by Ethnicity

Scale	Total (*SD*) *N = 141*	Af Amer[a] (*SD*) *n = 9*	Asian[b] (*SD*) *n = 11*	Latino[c] (*SD*) *n = 90*	Caucasian[d] (*SD*) *n = 31*	
Healing Environment Scales						
Total Environmental	66.61	60.83	50.00	73.72	53.53	c>b*,d*
Satisfaction	(23.26)	(18.70)	(20.30)	(22.23)	(19.75)	
Hospital Room Satisfaction	61.34	55.22	45.56	69.00	46.51	c>b*,d*
	(25.90)	(24.29)	(21.50)	(25.24)	(20.55)	
Hospital Room Control	62.35	55.56	45.08	71.20	44.17	c>b*,d*
	(29.76)	(26.02)	(26.14)	(28.74)	(23.99)	
Hospital Environment	72.14	66.18	54.27	78.94	60.69	c>b*,d*
Satisfaction	(22.23)	(18.93)	(21.41)	(19.79)	(22.18)	

*$p < .05$

Table 15

Environmental Features – Frequencies for Parents

Feature	Scoring System	*Frequencies*
Window	0 = no window	No window = 44
	1 = dysfunctional	Dysfunctional = 59
	2 = window	Window = 45
Visitor Sleep	0 = no bedding	Sleep chair = 58
	1 = sleep chair	Sleep bed = 89
	2 = sleep bed	
	3 = sleep chair and bed	
Dimmer	0 = no dimmer	No dimmer = 78
	1 = dysfunctional	Dysfunctional = 21
	2 = dimmer	Dimmer = 49
Bathroom	0 = other side	Other side = 45
	1 = middle	Middle = 4
	2 = same side	Same Side = 99
Bathroom Features	0 = toilet only	Toilet only = 119
	1 = toilet , shower	Toilet, shower = 13
	2 = toilet , shower , tub	Toilet, shower, tub = 16
Sink	0 = other side	Other side = 38
	1 = middle	Middle = 12
	2 = same side	Same side = 98
Color Design	0 = no designs	No designs = 2
	1 = wall or floor	Wall or floor = 14
	2 = wall and floor	Wall and floor = 132
Overhead Light	0 = other side	Other side = 34
	1 = middle	Middle = 4
	2 = same side	Same side = 25
	3 = behind bed	Behind bed = 85

Table 15 *(continued)*

Feature	Scoring System	*Frequencies*
Bedlight Control	0 = no control	No control = 4
	1 = pull cord behind bed	Pull cord = 63
	2 = bedcontrol	Bedcontrol = 81
Bedlight Settings	0 to 3 settings	0 = 4
		1 = 77
		3 = 67
Television	0 = no TV	No TV = 0
	1 = dysfunctional	Dysfunctional = 12
	2 = TV	TV = 136
VCR	0 = no VCR	No VCR = 0
	1 = dysfunctional	Dysfunctional = 3
	2 = VCR	VCR = 145
Wall Channel Control	0 = none	None = 49
	1 = dysfunctional	Dysfunctional = 17
	2 = wall channel control	Wall Channel Control = 82
Storage	0-9 storage units	0-3 = 38
		4-6 = 61
		7-9 = 48
Thermostat Control	0 = dysfunctional	Dysfunctional = 85
	1 = other side	Other side = 26
	2 = middle	Middle = 4
	3 = same	Same side = 33
Booster Switch	0 = no booster	No booster = 89
	1 = other side	Other side = 29
	2 = middle	Middle = 4
	3 = same side	Same side = 26

Table 16

Relationships between Environmental Features and Parent Measures

Environment Feature	Tot Env Sat	Tot Hthcare Sat	Present Fx	Positive Affect
Room Size	r=.18*, n=139			
Dimmer (yes vs. no)	t(145)=-2.49* no=62.2(21.2) yes=71.4(24.0)			
Bathroom side (other vs. same)			t(140)=-2.11* oth=35.8(20.1) same=46.5(31.2)	
Bath features (toilet vs. toilet+)	t(145)=-3.21** toi=63.6(22.1) toi+=78.4(22.8)			t(143)=2.44* toi = 31.4(8.5) toi+=26.9(10.1)
Sink side (other vs. same)	t(133)=-2.10* oth=59.8(22.1) same=68.9(22.7)		t(133)=-2.26* oth=35.1(19.4) same=47.5(31.6)	
Bedlight Control (pullcord vs. bedcont)	t(141)=-2.26* pull=61.9(22.4) bed=70.6(23.1)			
# Bedlight Settings	t(141)=-2.37* 1 set=62.5(22.7) 3 set=71.6(22.9)			
TV (fx vs. dysfx)		t(143)=-2.53* dysfx=69.1(25.7) fx = 84.1(19.1)		
Wall Channel Control (yes vs. no)	t(145)=-2.83** no=59.1(21.1) yes=70.2(23.0)			

Table 16 *(continued)*

Environment Feature	Tot Env Sat	Tot Hthcare Sat	Present Fx	Positive Affect
Storage space	r=.17*, n = 146			
Thermostat (dysfx, other, same side)			F(2,139)=3.36* oth = 34.3(20.9) same=52.9(42.5)	

*p < .05
**p < .01

Table 17

Staff-Report Demographic Information

Demographic Variable		Range	Mean	SD
Age of nurse		19-65	34.91	9.63
Months worked at hospital		2-356	79.33	81.19
Hours worked per week		3-72	37.99	11.09

		n	%
Gender	Male	6	5.3%
	Female	107	94.7%
Ethnicity	Latino/a	26	23.0%
	Caucasian	49	43.4%
	Asian	22	19.5%
	African American	4	3.5%
	Other/Missing	12	10.6%
Unit	Inpatient – Blood Diseases	40	35.4%
	Inpatient – Rehabilitation	18	15.9%
	Inpatient – Solid Tumors	16	14.2%
	Inpatient – BMT	13	11.5%
	Outpatient - Day Hospital	9	8.0%
	Outpatient – Hem-Onc Clinic	3	2.7%
	Missing	14	12.4%
Nursing Level	RN Resident	4	3.5%
	RN I	6	5.3%
	RN II	37	32.7%
	RN III	12	10.6%
	RN IV	1	.9%
	Other/Missing	53	46.9%
Shift worked	Day Shift	92	81.4%
	Night Shift/Rotate	13	11.5%

Table 18

Scale Descriptives for Staff

Scale	# Items	*N*	*Mean*	*SD*
Staff Healing Environment Scales				
Staff Built Environment Satisfaction	22	113	50.48	22.34
Satisfaction Increasing Features Scale	5	112	48.90	26.20
Satisfaction Decreasing Features Scale	5	111	26.39	23.45
Co-Worker Satisfaction Scale				
Staff Co-Worker Satisfaction	4	113	70.24	21.48
Present Functioning Scales				
Total Symptom Score	6	113	24.33	15.53
Emotional Distress Summary Score	4	113	20.61	15.99
Current Tiredness	1	113	49.80	29.89
Current Pain	1	113	13.75	19.27
PANAS				
Positive Affect Scale	10	113	32.12	8.79
Negative Affect Scale	10	113	12.83	4.57
Multi-Dimensional Fatigue Scale				
Total Fatigue	18	112	65.83	13.15
General Fatigue	6	112	60.67	19.04
Sleep Fatigue	6	112	64.94	13.82
Cognitive Fatigue	6	112	71.80	14.94

Table 19

Workspace Features – Descriptives for Staff

Name of Feature	*Range*	*Mean*	*SD*
Nature (total)	0-14.5%	8.20	7.22
Areas (per person)	.38-.89	.68	.16
Art (total)	0-12	2.30	3.61
Other decorations (total)	0-24	14.36	8.92
Windows (total)	0-46	8.93	17.57
Light fixtures (total)	5-29	17.25	10.22
Light controls (total)	3-6	4.49	.83
Chairs (per person)	1.14-2	1.69	.32
Computers (per person)	.80-1.33	1.18	.18
Laptops (per person)	0-.22	.05	.09
Desk Space (per person)	.69-2.13	1.61	.48
Hallway Computer Stations (per person)	0-1.11	.74	.39
Hallway Medical Carts (per person)	0-.67	.25	.20
Work Storage Space (per person)	5.11-14.13	10.75	3.43
Display Space (total)	2-9	6.36	2.75
Telephones (per person)	.5-1.56	.96	.31
Medical Storage (per person)	.11-.44	.30	.12
Washing Stations (per person)	0-.44	.25	.11

Table 20

Correlations between Workspace Features and Staff Measures

Workspace Feature	Built Env Sat	Sat Inc Ftrs	Sat DecFtrs	Neg Aff	Multi-Dim Fatigue
Areas	32**	.24*			
Art					-.24*
Other decorations	.28**				.24*
Windows	.24*	.26**			
Light fixtures	.26**				.20*
Light controls	.21*	.28**			
Computers	.37**	.29**	-.22*		.20*
Desk Space	.25*				.23*
Hallway Computers	.31**	.21*			.21*
Telephones	.20*	.21*		-.22*	
Medical Storage	.24*				

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

Table 21

Breakroom Features – Descriptives for Staff

Name of Feature	*Range*	*Mean*	*SD*
Nature (total)	0-33.25%	21.28	15.00
Windows (total)	0-4	1.61	1.27
Light Fixtures (total)	1-8	5.57	2.86
Light Controls (total)	1-2	1.69	.47
Chairs (per person)	.21-.40	.35	.07
Armchairs (per person)	0-.24	.35	.07
Sofas (per person)	0-.13	.08	.04
Computers (per person)	0-.24	.16	.10
Desk Space (per person)	0-.16	.11	.07
Mailboxes (total; dichotomous variable)	No (*n* = 69), Yes(*n* =30)		
Communal Storage Space (per person)	0-.71	.27	.32
Display Space (total)	2-6	3.11	1.53
Telephones (per person)	0-.13	.07	.04
Television (per person; dichotomous variable)	No (*n* = 43), Yes (*n* = 56)		
Refrigerator (per person)	.07-.16	.14	.03
Microwave (per person)	.08-.14	.10	.02
Toaster (per person)	0-.12	.07	.04
Tables (per person)	.07-.25	.11	.06
Sink (per person)	0-.08	.05	.04
Coffee maker (per person)	0-.13	.08	.04

Table 22

Relationships between Breakroom Features and Staff Measures

Breakroom Feature	Built Env Sat	Sat Inc Ftrs	Pos Affect	Multi-Dim Fatigue
Light Fixtures	r = .20*			
Chairs	r = .31**	r = .22*		r =.25*
Armchairs	r = .39**	r = .33**		r = .21*
Sofas				
Computers	r = .27**			r = .23*
Desk Space	r = .33**	r = .22*		r = .24*
Mailboxes			t(97) = -2.05* No = 30.8(9.4) Yes = 34.7(6.3)	
Phones	r = -.31**	r = -.29**		
Refrigerator				r = .23*
Microwave				r = -.23*
Toaster	r =.39**	r =.33**		r = .21*
Tables	r = -.26*			

*p < .05
**p < .01

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