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As members of the Practice Inquiry Project Committee, we certify that we have read the practice inquiry project prepared by Kelly Bartlett Linebaugh entitled ‘A Systematic Literature Review on Healing Environments in the Inpatient Health Care Setting’ and recommend that it be accepted as fulfilling the practice inquiry project requirement for the Degree of Doctor of Nursing Practice.

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SIGNED: Kelly Bartlett Linebaugh
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In appreciation to my committee chair, Dr. Mary Koithan, co-chair Dr. Barbara Brewer and special member, Dr. Gerri Lamb for their dedication and support for this project.
DEDICATION

To my parents for their faith and support throughout this project.
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Health care settings are generally regarded as stress inducing environments. Stress can alter the immune response, impair wound healing and create a greater risk for asthma, diabetes, gastrointestinal disorder and myocardial infarction. Since the 1980s and 1990s, there has been increasing interest in healing environments and evidence-based design concepts. Yet, there has been little progress developing healing environments and using evidence-based design for psychiatric inpatient units, a uniquely stressful environment. Psychiatric units today continue to use designs such as caged in outdoor patio areas that resemble facilities that incarcerate rather than facilities which reduce stress and facilitate healing. The purpose of this systematic literature review was to identify design features that are evidence-based which can be used to create an optimal inpatient psychiatric patient room by: (1) analyzing the research literature for evidence of architectural and design elements that could be used in the inpatient psychiatric care setting to reduce stress and improve the well-being; (2) identifying design elements that are consistent with accreditation and licensing standards for inpatient psychiatric units; and (3) designing a psychiatric inpatient room that has evidence-based elements to reduce stress and improve well-being.

A systematic literature review was conducted to identify factors in the inpatient healthcare environment that support an optimal healing environment. The PICO question for this review was what design factors in the inpatient healthcare environment support an optimal healing environment? A search of five databases and a hand search of reference lists were conducted. The search included studies from 1980 to the present, original research conducted on inpatient units with adult patients that investigated an intervention with an outcome that
promotes a healing environment. Experimental, quasi-experimental, non-experimental, systematic literature reviews and expert opinions were sought and evaluated using a scale to analyze scientific rigor and research quality.

A total of 6,874 articles were identified in the search. Seventy-six articles were eligible for full text screening. After review of the full text, 38 articles were determined to be eligible for evidence analysis. After removing 11 inadmissible articles due to poor quality, 27 articles were included in the final synthesis. The search found research on eight hospital design features which may support optimal healing environments: artwork (n = 7), building configuration (n = 2), finish materials (n = 7), interior details (n = 6), lighting (n = 11), nature and view (n = 8), noise (n = 10), and room configuration (n = 6). More than 50% of the research on optimal healing environments used quasi-experimental and non-experimental designs with rare use of experimental research designs. Overall, the quality of the research on optimal healing environments is not high, but results were reasonably consistent across studies.

Evidence suggests seven design features for healing inpatient psychiatric environments, including: (a) single rooms, (b) calm, naturalistic and domestic artwork or photographs, (c) east facing windows, (d) plants, (e) acoustic ceiling tiles, (f) patient rooms removed from noise producing unit areas, and (g) a window view of nature. These seven recommendations were examined for consistency with existing Arizona statutes and industry standards for behavioral health care environments. Recommendations found to be inconsistent with these statutes and standards were modified to reach congruency with the statutes and guidelines, and then an evidence-based design of a psychiatric inpatient room design was formulated and is illustrated.
Future research on interventions to create healing environments at the greatest scientific rigor is needed along with measurement techniques to quantify stress responses to the environment.
CHAPTER ONE: BACKGROUND

Internal and external environments are clearly associated with stress and the development of a range of stress-induced pathological responses affecting both psychological and physical health (Devlin & Arneill, 2003; Evans, 1987; Liberman & Yager, 1994; Rashid & Zimring, 2008). Internal stressors such as work stress, financial difficulties and personal loss can lead to alterations in the immune response as well as greater risk for asthma, diabetes, gastrointestinal disorder, myocardial infarction, cancer and viral infections (Glaser & Kiecolt-Glaser, 2005; McEwen & Stellar, 1993). Thus both common stressors and chronic stress can adversely affect health through a deleterious effect on endocrine and immune function (Glaser & Kiecolt-Glaser, 2005).

Stress also occurs from interaction with the external environment. Poverty, exposure to violence, crowding, noise, substandard housing, family turmoil and exposure to violence are all examples of external stressors (Evans, 1987). These external environmental stressors are associated with a full spectrum of alterations in physiology, task performance, affect, mood and interpersonal behavior that combine with internal stress, worsening overall stress and creating chronic stress conditions (Evans, 1987; Marin et al., 2011). Specifically, external stress can produce changes in mood and interpersonal behavior with reports of negative affect, decreased social cooperation and increased aggression and hostility (Evans, 1987). Both internal and external stress produce physiological changes including elevations in stress hormones, blood pressure, and cardiac output (Evans, 1987; Marin et al., 2011).

A specific area linked with environmental stress is the physical environment (Devlin & Arneill, 2003; Evans, 1987, 1998; Evans & McCoy, 1998; Gulwadi, Joseph & Keller, 2009;
Joseph, 2006; Rashid & Zimring, 2008; Veitch, 2011). Evans (1998) found that stress was induced by architectural design features associated with overstimulation in the environment, a lack of understanding of the purpose of the space, a lack of ability to govern the space and a lack of provision for restoration. For example, impoverished built environments are linked to boredom, while over-stimulating built environments are linked to problems with focus (Evans & McCoy, 1998). Architectural design that is ambiguous or lacks cues regarding its purpose can invoke annoyance or helplessness (Evans & McCoy, 1998). Conversely, a built environment, which offers a certain amount of mystery and complexity, challenges our senses (Evans & McCoy, 1998).

The effects of noise, natural light, and window views on physical and psychological well-being are all specific examples of the effects of the built environment (Joseph, 2006; Rashid & Zimring, 2008; Veitch, 2011). Indoor office environments have been linked to stress; noise affects individual’s sense of annoyance, task performance, and level of emotional exhaustion (Rashid & Zimring, 2008). The amount of light emitted into the indoor environment has significant effects on individual outcomes, including the hospital length of stay, depression reports, sleep quality, and levels of agitation in dementia patients and use of pain medication (Joseph, 2006). Daylight is associated with a more positive mood, whereas poor lighting was associated with eyestrain, headaches and seasonal affective disorder (Rashid & Zimring, 2008). Sunlight penetration into the built environment is also associated with greater worker productivity (Rashid & Zimring, 2008; Veitch, 2011). Other moderators of stress in the indoor environment are related to the aesthetic quality of the environment such as a view of nature (Veitch, 2011). Nature views are associated with lower worker discomfort (Veitch, 2011).
Sunlight and nature views offer such robust benefits that many European countries mandate by law that workers must have some amount of window access (Veitch, 2011).

These are important implications for a person’s health and well-being and are of great importance to specialized indoor environments such as healthcare settings and hospitals. Hospitals represent a special case of the built environment, as a person in the hospital is in a fragile state of health. It is crucial that the impact of the physical environment is understood and where possible leveraged to facilitate healing.

**Hospital Physical Environments and Well-being**

The built environment in the hospital setting has been studied and has been found to mediate physical and psychological well-being. A seminal study by Ulrich (1984) found that the provision of a window view of a landscape following surgery was associated with a reduction in the use of pain medications. Windows with a view of nature have been shown to result in fewer reports of discomfort in the work setting (Aries et al., 2010). Window views of nature were also shown to result in improved physical and mental health in residential rehabilitation centers (Raanaas et al., 2011). Similarly, viewing indoor plants following surgery was found to lower blood pressure, reports of pain, anxiety, and fatigue compared to those who were not afforded a view of indoor plants (Park & Mattson, 2009). Dijkstra et al. (2008) found that indoor plants in the hospital room reduced perceived stress. Sunny psychiatric hospital rooms had a reduced inpatient length of stay by 2.6 days (Beauchemin & Hays, 1996).

One specialized hospital environment that is particularly subject to architectural design flaws is the inpatient psychiatric hospital environment (Doherty & Sell, 2011). Safety issues that arise on inpatient psychiatric units are due to the risk of suicide or physical assault and are the
most often cited reasons for inpatient admission to psychiatric units (Bowers, 2005). These risk factors result in an architectural design aesthetic that is impoverished and based on a disciplinary design model similar to that used in prison architecture (Architects/Designers/Planners for Social Responsibility, n.d.). This type of indoor building design incorporates an enclosed central nursing station due to the perceived need for continuous staff surveillance of the patients to ensure safety and control of the unit (Architects/Designers/Planners for Social Responsibility, n.d.). The resultant design infringes on patients’ rights and promotes the impression that staff has sovereign power over the patients (Architects/Designers/Planners for Social Responsibility, n.d.).

Other factors affecting psychiatric unit design are the age of the facility and the lack of funding for renovations or fabrication of new facilities (Doherty & Sell, 2011; Fisher, Geller & Pandiani, 2009; SAMSHA, 2009). Several trends contribute to decreased mental health funding as well as increased competition for the available funding. Mental health funds are diverted to jails and prisons, which now provide a substantial amount of mental health care in the U.S. (Lamb & Weinberger, 2005). Also, prescription drug costs are rising (SAMSHA, 2009). In particular, increases in Medicaid enrollment have resulted in a greater proportion of mental health treatment being publically financed (SAMSHA, 2009). In most cases, an increase in state Medicaid funding would be a welcome payer source, however, state psychiatric hospitals with greater than 16 inpatient beds that treat patients with a primary psychiatric diagnosis are prohibited from receiving Medicaid payments under the federal Institutions for Mental Disease regulation (Fisher, Geller & Pandiani, 2009). This results in no reimbursements for inpatient psychiatric hospital stays for a large portion of state psychiatric hospital clients (Fisher, Geller & Pandiani, 2009).
With falling reimbursements for inpatient psychiatric hospitals, dwindling funds for mental health in general and competition among the available treatment facilities, there have been few advances in addressing architectural design flaws found in psychiatric hospitals and units (Fisher, Geller & Pandiani, 2009). Despite the acceleration in research about evidence-based healthcare design and despite the large body of research that now suggests that the built environment can improve patient outcomes in pain, sleep, stress, mood, hospital inpatient length of stay and overall patient satisfaction (Ulrich et al., 2008), mental health facilities lag behind in employing the current research on evidence-based healthcare design.

Therefore, the purpose of this practice inquiry is to: (a) analyze the research literature for evidence of architectural and design elements which will reduce stress and improve the well-being of people currently admitted to the inpatient psychiatric care setting; (b) identify design elements that are consistent with accreditation and licensing standards for inpatient psychiatric units; and (c) design a psychiatric inpatient room that is evidence-based.

**Background**

**Hospitalization and Stress**

Though hospital and health care practitioners are well known for their ability to significantly reduce physiological disease by providing treatments and cures, the hospital environment can also provoke the stress response (Codinoto et al., 2009; Devlin & Arneill, 2003). The hospital is a pillar in the community that most community members have entered to visit loved ones or perhaps have been a patient there themselves. Though considered by many to be a monument to medicine and technology, the hospital environment also stands as a testament to the long-held association between hospitals and suffering and death (Horsley, 2008). Deeply
personal memories experienced within the walls of the hospital affect a person’s appraisal of this unique environment. Individuals pass through major life cycle events such as birth, death, or survival of illness within the walls of a hospital (Long, 2008). The hospital serves as the unique site of initiation rites of passage related to major life cycle events (Long, 2008).

Research suggests that hospitals induce stress (Codinhoto et al., 2009; Devlin & Arneill, 2003). When the hospital environment is studied from an anthropological point of view, the hospital environment is seen as a world unto itself, separate from the everyday world and forming a microcosm of the biomedical model (Long et al., 2008). Within the hospital, a distinct language is spoken that is unique to the hospital staff, forming an asymmetrical knowledge differential between the patient and the hospital staff (Hughes, 2001). The hospital is also home to unfamiliar equipment, invasive procedures, painful treatments and regimented routines that exist outside the patient’s normal world (Hughes, 2001; Wilson-Barnett, 1990). The patient is removed from friends, family, and occupation and held in suspension between worlds (Long, 2008). In the hospital, the patient is stripped of their identity, made to occupy different clothes, inhabit a new role and follow a regimented hospital routine (Long, 2008).

The patient, unable to perform daily tasks independently, surrenders control to the hospital staff. Patient freedom is also restricted by the limitations induced by illness, hospital routines, expectations, and staff directives (Taylor, 1979). Staff frequently observes the patient for frequent routine assessments and monitoring responses to treatment resulting in many patients experiencing feelings of depersonalization and loss of liberties (Fredriksen & Ringsberg, 2007).
Some research suggests that the health care environment creates deleterious effects on patients’ stress levels (Hughes, 2001). Noise, windowless patient rooms and window views of manmade rather than naturalistic views all contribute to patient stress (Hughes, 2001; Ulrich, 1984). Lack of normal environmental cues, such as daylight and an environment filled only with unfamiliar machines, are also thought to contribute to Intensive Care Unit (ICU) psychosis (Hughes, 2001).

**Hospitalization and Stress-related Outcomes**

Having been deprived of their usual roles and identities and separated from their support system, patients assume new roles to cope with the hospital’s depersonalized environment and mobilize their efforts to regain lost control (Taylor, 1979). These new patient roles manifest in two broad forms of possible patient behaviors. The compliant patient is one who proceeds through the course of hospitalization in an inert, passive state not wanting to disrupt the regimented hospital style (Taylor, 1979). Taylor (1979) attributes this patient behavior to feelings of helplessness, anxiety and depression. Prevalence of depression in general hospital patients ranges from 21 to 58% (Vaeroy & Hoivik, 2003).

Alternatively, a patient may become more assertive or angry in an effort to regain perceived loss of control and renounce the systematized biomedical complex that characterizes the hospital environment (Taylor, 1979). The aggressive patient style can take the role of entitled consumer, demanding the restoration of rights they perceive as transgressed (Winstanley, 2005). In its more severe form, an aggressive patient style can result in the outbreak of violence against hospital staff (Winstanley, 2005). This response stems from the physiological state of arousal brought on by an anxiety and a reduced cognitive ability to accurately interpret their environment.
(Evans, 1987; Winstanley, 2005). Violence can occur against staff when the patient misinterprets the staff’s intent to treat as being malicious, perceiving an imminent threat (Winstanley, 2005).

Stress and its resulting negative emotions also cause deleterious alterations in human physiology such as suppressed immune response, increased susceptibility to infectious diseases and poor wound healing (Glaser & Kiecolt-Glaser, 2005; Graham et al., 2006). The field of psychoneuroimmunology has found that stress plays a complex role in central nervous endocrine and immune systems, function and communication (Glaser & Kiecolt-Glaser, 2005; Graham et al., 2006). This can lead to poorer health outcomes and longer inpatient lengths of stay (Glaser & Kiecolt-Glaser, 2005; Graham et al., 2006).

One of the most serious manifestations of poor coping and stress is suicide. A 15-year study of successful suicides and serious attempts in the general hospital setting shows that they are the result of stressors (Shapiro & Waltzer, 1980). The stressors most often associated with suicide in the general hospital setting are recent abandonment, a severe physical impairment such as pain, withdrawal from substances, or a response to hallucinations or delusions (Shapiro & Waltzer, 1980).

**Psychiatric Hospitals and Stress**

The psychiatric hospital or psychiatric in-patient unit within the general hospital has always been considered to be a unique hospital environment in part due to the patient population. Patients on psychiatric units, in addition to being deprived of their usual roles and identities, being separated from loved ones, entering the hospital’s unfamiliar and depersonalized environment and attempting to mobilize their exhausted coping resources, must also cope with alterations in mood and/or thought processes (Taylor, 1979). Psychiatric disorders such as major
depression and posttraumatic stress disorder are associated with dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis (Marin et al., 2011). The HPA axis activation results from stress and causes the release of a class of stress hormones called glucocorticoids (GCs) (Marin et al., 2011). An internal environment of depression, acute and chronic stress impact the person’s perception of stress, increase their stress reactivity and result in cognitive impairments that affect their appraisal of the circumstances surrounding stress (Marin et al., 2011).

Psychiatric disorders such as schizophrenia are brain disorders characterized by altered thought processes, disorganized thinking, and altered perceptions of their environment and delusions or false beliefs about the world or people around them (National Institutes of Mental Health, 2009). The environment is an important cue for these patients to orient them to reality. An environment that miscues a patient experiencing hallucinations and delusions can contribute to their distorted perception of the environment and weaken their already tenuous grasp of reality. An environment, which is benign and does not elicit the perception of harm or threat, will better serve to orient the patient to reality. Many inpatients on the psychiatric unit are those with personality disorders such as borderline personality. Patients with borderline personality have enduring patterns of behavior characterized by problems regulating emotions and thoughts, impulsive behavior, extreme reactions, distorted and unstable self-image, and stress related paranoid thoughts (National Institutes of Mental Health [NIMH], 2012). These symptoms may be brought on by seemingly ordinary events (NIMH, 2012). Patients with borderline personality disorder experience significant and unremitting internal stress. An environment which contributes to the overstimulation and stress of an already taxed internal environment will likely perpetuate this internal turmoil and serve to deepen their stress. Conversely, an environment,
which is calm and serene, is likely to reduce stimulation and reduce the likelihood of eliciting an extreme emotional reaction.

In addition to the burden of psychiatric illness, patients admitted to inpatient psychiatric facilities carry a heavy burden of stigma (Holmes & River, 1998). This stems from historical associations linked to the asylums in the late 19th century. Although originally conceived to ethically treat mental illness through asylum environments in pastoral settings that had a family atmosphere, asylums eventually degraded into massive institutions brimming with treatment-resistant advanced cases of severe mental illness (Morrissey & Goldman, 1984). By the late 19th century, asylums served primarily indigent populations in overcrowded facilities with negligible cure rates (Morrissey & Goldman, 1984). This poor public perception of the asylum persisted through the “Dark Ages” of mental health (1890 to 1950), an era when “institutional care in this period was uniformly stagnant, repressive and monolithic” (Morrissey & Goldman, 1984, p. 788). This trend continued into the 1970s leading to the 1974 court case, Wyatt v. Stickney in Alabama (Treatment Advocacy Center, 2011). In this case, clients won the right to receive effective treatment from an institution in which they were kept involuntarily or be released from the hospital (Treatment Advocacy Center, 2011). These historical images of the psychiatric hospital and of people with mental illness are deeply embedded in the cultural fabric of the United States, affecting everyone’s perceptions of mental illness and the psychiatric hospital/treatment facility perpetuating the stigma of mental illness (Holmes & River, 1998). The practice of involuntary commitments to psychiatric facilities continues today though for shorter periods of time (Treatment Advocacy Center, 2011) and can potentiate a negative perception of the psychiatric hospital. With the physical structure commanding the loss of liberty, the built
environment comes to symbolize a breach of trust (Goldblatt, 1994), and a person’s physical removal from society enforces the stigma of mental illness (Holmes & River, 1998). Here, the built environment plays a powerful role in potentiating the stress response.

**Psychiatric Hospitalization and Stress-related Outcomes**

Patients and nurses in acute care psychiatric units often report feelings of confinement, jitteriness, boredom and agitation (Shattell et al., 2008). Other responses to this stressful environment include “powerlessness, intimidation, harassment, suffocation and control” (Shattell et al., 2008, p. 245). The stress of hospitalization and fear of violence can result in the perception of imminent physical or psychological injury, posing a significant risk factor for patient-on-patient or patient-on-staff violence (Simon, 2011). In suicidal patients, the stress of hospitalization often results in regression and greater risk of self-inflicted harm (Goldblatt, 1994).

In addition to these psychosocial responses to stress on a psychiatric in-patient unit, dangerousness (to self and others) can often result in the need for physical restraints on the unit (Nielssen & Large, 2012). Stress caused by a chaotic internal environment (inappropriate, intense anger, problems controlling anger, or extreme paranoia) may spill over into inappropriate interactions with peers and staff (Kaltiala-Heino, Tuohimaki, Korkeila & Lehtinen, 2003). This can rapidly result in the threat of violence or an outbreak of violence (against self or others) on the inpatient psychiatric unit necessitating the use of seclusion or restraints (Kaltiala-Heino, Tuohimaki, Korkeila & Lehtinen, 2003).

Seclusion is defined as “the involuntary confinement of a person alone in a room or an area where the person is physically prevented from leaving,” whereas restraint is defined as “a
physical restraint is any manual method or physical or mechanical device, material or equipment that immobilizes or reduces the ability of a person to move his or her arms, legs, body or head freely” (American Psychiatric Nurses Association, 2007, p. 1). The overall goals of seclusion and/or restraints are to: (a) prevent harm, (b) remove a patient from a provocative situation, and (c) reduce sensory overload (Kaltiala-Heino, Tuohimaki, Korkeila & Lehtinen, 2003). While separating the patient from the source of his or her distress may help the patient overcome an impending risk of danger or improve their psychic state, the use of seclusion and restraint also carries safety risks to both patients and staff (Kaltiala-Heino, Tuohimaki, Korkeila & Lehtinen, 2003) as well as induction of iatrogenic trauma and stress in the patient (Cohen-Cole, 2002). The use of seclusion and/or restraint is viewed as an intervention of last resort to be utilized only after less restrictive measures have failed (National Association of State Mental Health Program Directors, 2007).

The use of seclusion and restraint is often at odds with the goals for inpatient psychiatric treatment and the role of psychiatric nursing to provide for the identified patient needs for respite, safety, security, management, observation, assessment, personal care, and treatment (Bowers, 2005). Therefore, identifying alternative methods that will reduce stress and decrease perceived threat will improve well-being by breaking the stress-stress response cycling in this population. Literature suggests that a healing environment offers one potential way to mitigate both the internal environmental stress as well as the external environmental stress experienced by patients treated in inpatient psychiatric units without the excessive use of pharmacotherapeutics and restraints, holding the greatest promise for aiding the client in reaching treatment success
(Beauchemin & Hays, 1996; Dijksta et al., 2008; Evans & McCoy, 1998; Joseph, 2006; Raanaas et al., 2011; Rashid & Zimring, 2008; Ulrich, 1984; Ulrich et al., 2004, 2008; Veitch, 2011).

**Summary**

Hospital environments add to the stressors experienced by both general and psychiatric hospital patient populations. Environmental factors such as unfamiliar noises and language, changes in daily routines, loss of personal freedom and identity, all have been associated with increased stress in patient populations. Both populations report outcomes linked with stress, including feeling helpless, confined, agitated, and anxious coupled with a loss of privacy and being observed (Fredriksen & Ringsberg, 2007; Shattell et al., 2008; Taylor, 1979). Psychiatric in-patient facilities have unique factors that add even more stress to their patient populations, including threats of violence, altered cognition and loss of trust. Outcomes of stress in psychiatric inpatient units, use of restraints (seclusion and isolation) often contribute to escalating stress, anxiety and mood disturbance, further exacerbating the problem. Since a major focus of inpatient psychiatric treatment is to alter how a person perceives and responds to stressful stimuli, health care providers must identify ways to mitigate sources of stress in the treatment environment.

**Reducing Stress through the Physical Environment**

Intuitively, when a person is in pain or distress they seek a quiet, restful, peaceful, calming environment. They may turn off the lights, find a soft blanket and settle in. The early Greeks soothed the human spirit by tending physical, spiritual and emotional needs in their earliest hospitals (Gibson, 1966). In 350 BC, they created the Asclepius, a healing environment informed by the principle that physical illness can induce spiritual and emotional crises, which
must also be mended. The Asclepius was located on the island of Kos in the Aegean Sea located atop a hill overlooking the sea (Ball, 1887). With a campus of about 50 green and lush acres, there was a temple with a statue crafted from gold and ivory of the god of healing, Asclepius (Ball, 1887). There were sacred, healing springs, temples for worship and prayer, ocean views, and gardens in the secluded environs, all integral to healing of the body, spirit and the mind of those who traveled to the Asclepius (Ball, 1887).

Healthcare professionals today, as in the time of Hippocrates, are the stewards of the healing environment and have a responsibility for crafting an environment, which promotes healing rather than induces stress. The modern hospital environment remains one of the most influential yet underutilized domains to affect a person’s response to stress (Evans & Cohen, 1987). Further, the internal physical environment (the patient unit, room and immediate environs) is one of the domains where the transformation can be easily accomplished.

A Conceptual Framework: The Link between Physical Environment and Stress

Rashid and Zimring (2008) offer a conceptual framework that links environment and stress that proposes how indoor environments can either contribute to or alleviate the stress (Figure 1). This framework proposes that the built environment falls into two broad categories: the indoor environment and the architectural and/or interior design (Rashid & Zimring, 2008). The indoor environment is defined as noise, lighting, ambient temperature and air quality. The architectural and interior design is defined as spatial layout, furniture, fixtures, finishing materials, color, artwork, window placement and ornamentation (Rashid & Zimring, 2008). Architectural and interior design factors are further distinguished by their degree of permanence (global or local). Architectural and interior design features that are global pertain to building
configuration and layout and functional relationships. Local architectural and interior design elements are defined more easily moved and include room configuration, furniture arrangement, interior accessories or finishing materials, color, artwork, nature, window views and ornamentation.

**FIGURE 1.** Linkages between Stress and Physical Environments. Reprinted with permission (pending) (Rashid & Zimring, 2008).

This framework proposes that when needs of the individual person (e.g., physiological, psychological, and cognitive) are not addressed by the physical environment, outcomes are immediately impacted, thwarting achievement of positive outcomes. For example, a patient who is hospitalized with a contagious infection physiologically requires a private room with a particular airflow. When a hospital is unable to provide such a room, the patient as well as other patients may suffer (cross-contamination) which can be a negative physiological outcome for other patients exposed to a contagious infection. The environment can negatively impact positive
patient outcomes in the psychiatric inpatient setting when the unit interior design utilizes multiple interior glass walls. The reflections from the glass create excess stimulation from multiple reflections of people, windows, and light and serve to create visual distortions in a person who is already experiencing altered perceptions and hallucinations from a brain disorder (Spivak, 1984). This can negatively impact the patient’s physiological as well as psychological outcomes.

This process is mediated by demographic variables (e.g., age, education, cultural background, and trauma history) and organizational factors (e.g., accreditation standards, work flow/performance, agency policy regarding safety, organizational culture and patient-to-staff ratios). In the case of the person with a contagious infection, if the patient is a minor and the parent wants to stay with the child in the room, the organizational culture can have a mediating effect on patient outcomes. If the organization takes a rigid stance that it is against agency policy for the parent to be in the room with the child, then the child could be at risk of greater stress that could have an impact on their health outcome. Similarly, organizations can have an impact on patients in inpatient psychiatric units. For example, a female psychiatric patient becomes too frightened to return to her room to sleep after a male peer suffering from psychosis wanders into her room and attempts to get into her bed. Organizational policy and patient-to-staff ratios will have an impact on the patient’s perception of safety on the unit. If she becomes too fearful to sleep, she could refuse all of her psychiatric medication because she fears being too sedated, thus impacting mental health outcomes.

Several categories of immediate outcomes have been identified by Rashid and Zimring (2008), including environmental outcomes (e.g., sick building, poor lighting and poor
temperature control) and personal outcomes (individual or collective). Personal outcomes are identified as occurring within the psychological, cognitive, psychosocial, social and physiological domains. For example, if a child with asthma enters a healthcare facility with poor air quality, negative physiological responses (impaired airway) could ensue. Further, if this young child had to be placed in isolation and separated from her mother for a period of time, significant psychosocial responses (fear and anxiety) could occur. Over time, without the development of effective coping skills, long-term stress disorders could occur anytime this child is separated from a parent or when again experiencing hospitalization. However, if the physical and organizational environment could support close contact by the parent, fewer negative outcomes may be experienced. In the example of the female psychiatric patient who is subject to fears sleeping in her room, a nurses’ station that is open to the unit may ease the patient’s fears if she is relocated to a room right outside the station.

Thus, environmental changes that create comforting, welcoming and familiar spaces may mitigate the negative psychological and psychosocial outcomes typically associated with psychiatric inpatient settings. Alternatively, physical spaces that are isolating, confining, invading or threatening could perpetuate and heighten negative psychological and physiological responses, adding to the already overwhelming stress burdens that these patients face. This is especially important for psychiatric patients who often possess few skills, knowledge or experience employing effective coping strategies, and therefore are at even greater risk for stress which will exacerbate their psychiatric symptoms.
Trends in Healing Spaces and Evidence-based Hospital Design

Linking the hospital environment with health promotion and improved health outcomes was first envisioned by Florence Nightingale (1860/1980). Nightingale claimed “bad sanitary, bad architecture and bad administrative arrangements often make it impossible to nurse” (Nightingale, 1860/1980, p. 2). Based on this philosophy, Nightingale advocated the Pavilion Style Hospital that optimized sunlight and fresh air (Dossey et al., 2005). This tradition was continued through the 1920s-1930s in the design of sanatoria for the treatment of tuberculosis; a modernist design featuring floor to ceiling walls of windows and balconies with a focus on sunlight and cross-ventilation for the treatment of tuberculosis (Campbell, 2005). Over time, these humane hospital designs were dismantled once it was discovered that sunshine, fresh air, and pastoral settings could be replaced with antibiotics to cure tuberculosis (Campbell, 2005; Prior, 1988). Technology supplanted the modernist ideals that had valued natural daylight, views of the landscape, and fresh air (Campbell, 2005; Prior, 1988).

Prior (1988) argues that hospital architecture is forged as a reflection of the medical knowledge and practices employed at the time. An examination of the built hospital environment reveals priorities of the health care professions, their relative influence and the emerging science. As healthcare technologies increased in the 1950s-60s, hospitals took on the shape of the aseptic/sterile institution, protected from the outer environment thought to be “infective” or imperfect. However, by 1973, research on the effects of physical environment on human behavior began to appear in the literature in both the U.S. and the United Kingdom (Center for Health Design, n.d.). With the 1970s research that linked the effect of the physical environment on human behavior (Center for Health Design, n.d.), more targeted research in the 1980s linked
the environment to health outcomes. For example, Ulrich determined that the type of
environment the patient was placed in could affect healing (Ulrich, 1984). Further, Ulrich
suggested what type of environment could facilitate healing leading to a focus on the benefits of
nature in the healing.

This led to the development of evidence-based guidelines for healing environments,
including the birth of the key organizations that included accreditation and certification agencies,
specialty hospitals and the integrative medicine movement (Center for Health Design, 2012;
Health Environments Research and Design Journal, 2011; Nursing Institute for Healthcare
Design, 2011; Planetree Designation Criteria, 2011; Samuei Institute, 2006). One of the most
enduring and far-reaching organizations is Planetree. In 1978, Planetree was founded to
emphasize the patient’s perspective on the health care environment in order to improve health
care outcomes (Planetree Designation Criteria, 2011). The Planetree guidelines emphasize the
 provision of an environment of care which is evidence-based, promotes dignity, values human
interaction and family involvement, allows patient choice, is sustainable and environmentally
friendly, provides access to nature, reduces the need for coercive interventions and provides a
low stimulus environment, specifying common areas which are spacious and light (Planetree
Designation Criteria, 2011). Planetree aids organizations in making the organizational changes
necessary to become truly patient centered health care organizations (Planetree Designation
Criteria, 2011). Although Planetree guidelines have been adopted by many acute care general
hospitals, Planetree certified its first behavioral health facility (Weill Cornell Medical College)
as recently as 2011. Though late in entering the realm of psychiatric facilities this recent
certification does signify Planetree’s intention to ensure optimal healing for all patients (Planetree, 2012).

In addition, several key studies kept the focus on healing environments in front of both the public and the health care industry. In 1984, Ulrich published a landmark study on the effects of different window views on patient’s experience of pain. It was the first study to demonstrate the link between a healing hospital environment and a positive health outcome. The study was conducted by review of medical records spanning nearly 10 years. It compared the number and strength of analgesia doses used by patients who had undergone a cholecystectomy and who, post-surgery, had a window view of trees versus a window view of a brown brick wall. A statistically significant difference was found at post-surgery days 2-5 between the two patient groups. Those with the view of trees used fewer numbers of and lower doses of analgesia.

The Center for Health Design (CHD), begun in 1993, serves as a professional resource center for researchers and designers. It provides a forum for ideas and is a repository for evidence-based design research (Center for Health Design, 2012). CHD’s mission is to demonstrate that design can improve health outcomes (Center for Health Design, 2012). In 2000, CHD began the Pebble Project to provide guidance regarding the use of evidence-based design, professional resources and access to expert opinions during hospital planning (Center for Health Design, 2012). In 2009, CHD began its Evidence-based Design Accreditation and Certification (EDAC) program for health care and design professionals and certified 100 professionals the same year (Center for Health Design, 2012). Currently, there are 2709 professionals now EDAC certified (Center for Health Design, 2012).
There have been additional advances in the field, demonstrating the interest in healing environments and the link between physical environment and stress reduction and healing outcomes. The Samueli Institute started the Optimal Healing Environments Initiative (OHE) in 2005. The goal of the Samueli program is to transform healthcare environments into healing environments (Samueli Institute Optimal Healing Environments, 2006). The peer-reviewed journal Health Environments Research and Design Journal (HERD) published its first issue in 2007 with a goal to improve knowledge of evidence-based design and facilitate translation of research findings into practice (HERD, 2007). Nursing entered the evidence-based design trend in 2011 with the launch of the Nursing Institute for Healthcare Design (NIHD) website to promote the role of nurse leaders in health care design (NIHD, 2011).

Most recently, the Samueli Institute collaborated to develop extensive guidelines for the Veterans Administration (VA) based on the work of a task group of architects, health care professionals and engineers charged with investigating and documenting state of the art environments for healing (Samueli, 2009). The task force included recommendations for VA facilities, including ways to optimize access to daylight and natural ventilation and include biophilic design to promote the relationship between people and nature (Samueli, 2009). These organizations share a common vision to develop knowledge about evidence-based design, healing environments, the human response to architecture, or patient centered care and to promote its adoption by health care facilities worldwide (Center for Health Design, 2012; Health Environments Research and Design Journal, 2011; Nursing Institute for Healthcare Design, 2011; Planetree Designation Criteria, 2011; Samueli Institute, 2006).
Problem

While there has been considerable progress in the hospital re-design and incorporation of healing spaces into their architectural and organizational design, there has been minimal progress in this direction among psychiatric hospitals. To date, there is only one Planetree-accredited inpatient behavioral health facility (Planetree, 2012). Additionally, there have been few design studies about psychiatric facilities and healing environments (Bowers, 2005; Sine & Hunt, 2009).

This is a significant safety and quality problem because psychiatric inpatient populations have a heightened sensitivity to stressful situations. In particular, they have significant individual needs (e.g., physiological, psychological and social) that increase the potential for negative immediate outcomes (e.g., paranoia, anxiety, suicidal ideations, and violence) when placed in a stressful physical environment. Demographic and organizational factors, combined with reduced coping resources, further amplify their risk of stress-related responses.

This is further complicated by aging facilities and dwindling fiscal resources for psychiatric care. For example, one southwestern psychiatric hospital is located on a large campus landscaped with mature trees and a green lawn stretching between its clusters of behavioral health buildings. Though this campus offers a lush landscape, the patients are offered access to the outside environment only through an enclosed patio with a cement floor and no vegetation (Figure 2).
Another design still in use in a Southern California psychiatric hospital features a circular nursing station encased in glass that is accessed through a single locked door. This station is centrally located in the unit where three different hallways intersect. This structure communicates the hierarchical power differential between staff and patient, their separateness and their primary role to survey or monitor the environment and its inhabitants. Foucault (1965) describes this type of environment as a *panopticon* (Figure 3) developed as a model for prison surveillance. This design can be seen as a clear impediment to nurse-patient relationship and establishing trust and communication, which are pre-requisite to positive patient outcomes.
FIGURE 3. Panopticon

Though many psychiatric units and hospitals have undergone renovations and new facilities have been constructed, evidence-based design supportive of healing environments have not been incorporated. Additionally, while general hospitals are renovating inpatient units to create healing spaces for patients and staff, psychiatric facilities are lagging behind. Reasons for this lag are not well documented although speculation may offer several possible causes. First, there is less money to renovate aging psychiatric facilities or to construct new facilities that incorporate anything beyond the basic needs. Second, psychiatric hospitals require strict adherence to safety issues due to risk of self-harm, suicides, and physical assault on the inpatient units. Yet, a lack of literature that synthesizes evidence-based design and psychiatric safety and facilities standards suggests that this may be an area of practice that has been “forgotten.” This also reflects the persistence of thought that psychiatric patients should be merely confined rather than treated humanely (Foucault, 1965).

Purpose and Aims

Therefore, the purpose of this practice inquiry (PI) was to: (a) analyze the research literature for evidence of architectural and design elements which will reduce stress and improve
the well-being of people currently admitted to the inpatient psychiatric care setting; (b) identify design elements that are consistent with accreditation and licensing standards for inpatient psychiatric units; and (c) design a psychiatric inpatient room that is evidence-based.

To accomplish these aims, PICO question(s) were identified and a systematic literature review was conducted to identify data about inpatient hospital and clinic designs with outcomes of decreased patient and staff stress and anxiety and improved patient mood. The data were then critically analyzed for their: (a) scientific rigor, (b) strength of the evidence demonstrating design effectiveness, and (c) potential generalizability to psychiatric unit design. Identified design principles were then analyzed to determine their individual appropriateness for translation to an inpatient psychiatric unit. Only evidence which complied with available safety standards and guidelines and sound clinical judgment was considered for translation. Using the appropriate evidence-based design principles; an inpatient psychiatric room with a private bathroom was designed and illustrated.
CHAPTER TWO: REVIEW OF RELEVANT THEORIES AND STANDARDS

Conceptually, stress and environment are linked. Chapter 1 introduced Rashid and Zimring’s model (2008) that conceptualized how indoor environments may lead to stress by obstructing the individual from attaining his healthcare needs. Rashid and Zimring’s model (2008) also proposed how the health care staff’s ability to provide care to the patient and to perform their functions can be impeded by the environment and how this can increase patient and staff stressors in the long term (Rashid & Zimring, 2008). Rashid and Zimring (2008) identified immediate outcomes such as physiological, psychological, cognitive, psychosocial, and social changes that can be tied more directly to positive and negative environmental features (Rashid & Zimring 2008).

Yet, Rashid and Zimring’s model (2008) does not explain how environments create stress or how a person might respond to stressful stimuli once encountered. Chapter 2 will examine various stress and coping models in order to more fully explore these processes in order to understand the implications of a healing environment on health and the potential of stress reduction as a result of environmental re-design. Specifically, the Lazurus and Folkman stress and coping model (1984) and the revised stress and coping model (Folkman, 2008) will be discussed. Next, current environmental guidelines for psychiatric facilities will be reviewed for their implications on staff and patient safety and healthcare re-design. Lastly, standards and guidelines for healing environments will be described. The theoretical basis regarding the environment and stress, a review of safety constraints of hospital environments, and the guidelines for creating healing environments will provide a basis for understanding how to create
a healing environment for psychiatric inpatient facilities that can positively impact patient stress, anxiety, and mood.

**Stress and Coping**

The phenomenon of stress and a person’s responses to stressors has been widely studied. Several models of stress, adaptation and coping have been applied in health care, each defining and providing different interpretations as to the causes of stress, the human and environmental responses to stress and various ways that stress is managed or altered. Most models indicate that there are varied human responses to stress, including physiological, mental, emotional and spiritual (Butler, 1993; Folkman, 2008; Lazarus & Folkman, 1984; Lazarus, 1993; Rashid & Zimring 2008).

Models of stress fall into two broad categories and can be identified as biological (Selye’s General Adaptation Syndrome) and biobehavioral (McEwen & Stellar’s Allostatic Load; Folkman and Lazarus’ Stress and Coping Model) (Lazarus & Folkman, 1984; McEwen & Stellar, 1993; Selye, 1950). The earliest models of stress were stimulus-response based and describe stress as a biological response to a toxic stimulus (Butler, 1993). Hans Selye’s (1950) general adaptation syndrome (GAS) is an example of a stimulus-response based biological model of stress. Biological models of stress have largely given way to biobehavioral models, and the two biobehavioral stress models that have received the most attention in the health literature are the Allostasis Model (McEwen & Stellar, 1993) and Lazarus and Folkman’s (1984) Model of Stress and Coping. The Allostasis model is an ecological model which describes the complex relationships between environmental factors and genetic predispositions that lead to a wide variation in individual’s responses to stress (McEwen & Stellar, 1993). Lazarus and Folkman’s
Stress and Coping model (1984) model emerged from the cognitive movement in the 1960s and 1970s and was responsible for radically changing how stress was conceptualized (Lazarus, 1993). The cognitive movement stresses that cognitions or thoughts are central to stress reactions, and the role of appraisal of one’s environment takes primary importance in this conceptualization of the stress response (Lazarus, 1993). Selye’s GAS model (1950), McEwen’s Allostasis Model of Stress, and Lazarus and Folkman’s Stress and Coping model (1984) will be discussed here.

Hans Selye’s (1950) general adaptation syndrome (GAS) is a stimulus-response model that describes the physiological responses to stress. The process begins with an alarm stage (‘fight or flight’) when the body is alerted to the presence of a noxious stimulus (Selye, 1950). The alarm stage is when the body’s autonomic nervous system predominates which in turn initiates the endocrine system (Selye, 1950). The endocrine system signals the pituitary gland to secrete adrenocorticotropic hormone (ACTH), which results in the adrenal gland producing adrenal hormones (Selye, 1950). In the alarm stage, smooth muscle contractility is increased, blood pressure rises, and there is increased cardiac volume (Selye, 1950). Additionally, blood is shunted to the kidney to promote renal pressor substances that induce peripheral vasoconstriction, causing blood pressure to increase. The alarm stage exacts a toll from the body and can reduce immunity (Glaser & Kiecolt-Glaser, 2005; Selye, 1950) and accelerate aging (Glaser & Kiecolt-Glaser, 2005).

Selye’s model then proposes a second stage (resistance) when the parasympathetic nervous system returns to governance of the body (Selye, 1950). In this stage, the body retains higher than normal blood glucose, cortisol and adrenaline levels that prepare the body to respond
to the re-emergence of stress (Selye, 1950). The final stage is exhaustion when the ability of the organism can no longer sustain the high levels of “adaptation energy” (Selye, 1950, p. 1383). Selye’s model (1950) predicted correctly the body’s inability to withstand long-term stress, and contemporary studies show that chronic stress can produce disease states including metastasis of cancer, viral infections, coronary heart disease, sudden death, obesity, diabetes, and hypertension (Glaser & Kiecolt-Glaser, 2005; McEwen & Stellar, 1993).

McEwen and Stellar’s (1993) ecological stress model is referred to as the Allostasis Model. The allostasis model is a dynamic model that considers the influence of behavioral and biological responses to a stressor challenge (McEwen & Stellar, 1993). Stress is the product of the individual’s interpretation of behavioral and physiological responses to environmental stressors (McEwen & Stellar, 1993). Biological and behavioral responses to stressors operate in the context of the society including social status (McEwen & Stellar, 1993). This model acknowledges that information processing and an individual’s interpretation of a stimulus and evaluation of a threat is biased by genetics, developmental history and age, learning, socioeconomic status and gender (McEwen & Stellar, 1993).

In the Allostasis Model, the behavioral response to a threat and the cost of the response to stress varies for the individual (McEwen & Stellar, 1993). If an individual is unable to respond to a threat, aggression or helplessness (anxiety) may result (McEwen & Stellar, 1993). Behavioral responses have neural and neuroendocrine reactions (mediators) that affect the immune system, cardiovascular system, adipose tissue and muscle tissue (effectors) and can produce health disease states including metastasis of cancer, viral infections, coronary heart disease, sudden death, obesity, diabetes, and hypertension (outcomes) (McEwen & Stellar, 1993). Chronic stress
is from two sources of threat: (1) repeated obstructed responses to stress causing helplessness and anxiety, and (2) high-cost responses to stress such as aggression or self-damaging behaviors. These sources of threat can negatively impact the immune system, cardiovascular system, adipose tissue and muscle tissue (effectors) (McEwen & Stellar, 1993). This cumulative effect of recurrent stress results in damaging behavioral and biological stress responses and produces the allostatic load of stress (McEwen & Stellar, 1993). Allostatic load refers to the aggregate strain on the physiological systems from repeated stress, which can cause an organism to be vulnerable to disease (McEwen & Stellar, 1993).

The most prominent biobehavioral stress and coping model is the one proposed by Lazarus and Folkman (1984). Lazarus and Folkman (1984) and Folkman (2008) state that the interaction between environmental stressors and stress outcomes is mediated by the individual’s perception of the environment, their cognitive appraisal of the environment, and their means of coping with stress. Perceptions and cognitions serve as the primary means of determining the presence and meaning of a possible threat (Lazarus & Folkman, 1984). The person-environment relationship is perceived as stressful if the person assesses that their coping resources are exceeded threatening their well-being (Lazarus & Folkman, 1984). A person is vulnerable to stress when both the person-environment relationship is perceived as a threat and a self-assessment of one’s own coping resources is determined to be inadequate (Lazarus & Folkman, 1984). This view emphasizes how stress is manifest as a product of perceived environmental stressors, cognitions or appraisal of the environment, internal and external demands, and coping resources (Lazarus & Folkman, 1984). Once stress has been identified, the person mobilizes both
cognitive and behavioral efforts to manage the demands of the stress (Lazarus & Folkman, 1984; Folkman 2008).

This biobehavioral model with its focus on perception and cognitions is well suited to this practice inquiry. Patients’ experience of the stress of the psychiatric hospital environment is mediated by cognitive appraisal and coping with their environment (Lazarus & Folkman, 1984; Folkman 2008). Interpretations (appraisals) of the environment are critical to the overall stress outcomes and coping abilities of this patient population. As discussed in Chapter 1, persons with psychiatric or mood disturbances often have alterations in their cognitive appraisal and perception processes that can affect their ability to respond constructively to stress. Therefore, any intervention that could positively alter perceptions of threat or decrease perceived environmental stressors associated with hospitalization has the potential to reduce the burden of stress and improve outcomes.

Rashid and Zimring’s (2008) model suggests that the healing environment can influence the patient’s cognitive appraisal and coping with their environment (psychological, psychosocial and social outcomes), thereby affecting the primary and secondary appraisal processes suggested by Folkman and Lazarus’ model of stress and coping (1984). By decreasing worry, anxiety, fear, sadness, helplessness, discomfort, perceptions of crowding and threat, and increasing a sense of control, privacy, territoriality and safety hospitalized patients may have a reduced stressor load, perceive/appraise the situation in a more positive fashion and thus be better able to employ effective coping skills to mitigate other challenging stressors (Rashid & Zimring, 2008). Thus, Rashid and Zimring’s (2008) model of environment and stress and Folkman and Lazarus’ (1984; 2008) models of stress and coping suggest that changes to the healing environment impact both
the stressor load and the stress perception-appraisal process to improve coping and outcomes. This practice inquiry will identify literature that links architectural and design elements to reduced stress.

**Lazarus and Folkman’s Stress and Coping Models**

The original theoretical model was first introduced by Lazarus and Folkman in 1984 (Figure 4) and then later revised by Folkman in 2008 (Figure 5). The central theme in these models is the process of appraisal where cognitions function to mediate environmental demands and stress reactions (Lazarus & Folkman, 1984). As a cognitive model, stress is understood from the vantage of thought processes and how thoughts or cognitions have a central role in how stress is appraised (Lazarus, 1993; Lazarus & Folkman, 1984). Perceptions and cognitive appraisal of the environment have a distinct advantage as a model when describing how the environment is understood by an individual and the process of how a person seeks to cope with stress. The model is far more comprehensive than the GAS model, which focuses on a narrow view of stress as a stimulus-response reaction. The stress and coping model (Lazarus & Folkman, 1984) is far more complex and dynamic and describes the process from perception to cognition to appraisal and coping. Most importantly, by understanding the richness of the process of how perceptions lead to cognitions and appraisal of a stressor and how coping is employed, then interventions can be crafted that work in accordance with this appraisal and coping process.
The key characteristic of this stress and coping model (Figure 4) is the transaction between the person and the environment, which forms each individual’s unique perception of their environment (Lazarus & Folkman, 1984). Each person has innate coping abilities, varying degrees of experience with effective use of coping strategies, an existing threshold of stress induction based on previous life events, and an ability to apply meaning focused coping (Lazarus & Folkman, 1984). These individual differences influence the person’s perception of stress and influence the person’s perception of their available coping mechanisms from which the person chooses (Lazarus & Folkman, 1984).

There are many factors that influence a person’s perception and evaluation of their environment. Internal factors such as emotions of fear, anxiety, and anger affects one’s perception of the environment as threatening or harmful (Lazarus & Folkman, 1984). External
factors that can dominate the person’s perceptions include places, types of physical surroundings, events in the community, economic climate and occupation (Lazarus & Folkman, 1984). This reflects that stress is a dynamic process that is affected by a person’s thoughts or cognitions (Lazarus & Folkman, 1984).

The person-environment relationship is perceived as stressful when the person assesses that their own resources are exceeded and their sense of well-being is threatened (Lazarus & Folkman, 1984). The person-environment transaction is mediated by the individual’s perception and results in the appraisal of whether the environment is a threat, harm or a challenge (Lazarus & Folkman, 1984). Depending on the evaluation of a threat, harm or challenge, a potential stressor may produce a range of individual responses and coping strategies. Some people may perceive harm as an opportunity for a challenge, and their response to stress may be a sense of exhilaration (Lazarus & Folkman, 1984). Another person may feel their coping is overwhelmed and their coping resources depleted resulting in distress (Lazarus & Folkman, 1984). In a psychiatric patient population, a person with major depressive disorder characterized by hopelessness may tend to view the environment as a threat or harm and is less likely to view the environment as a favorable challenge to overcome. This potentially negative perception could be overcome by designing an environment that is safe and neutral facilitating a positive appraisal of the environment and the secure knowledge that no resources need to be diverted to coping with the environment at the present time. This would be a welcome perception to the person who is experiencing hopelessness and a lack of energy and motivation.

Lazarus and Folkman (1984) proposed that the stress-response process is cognitive in nature; people continually scan their environment as events are ongoing and ever-present. Once
an event (stressor) is recognized, an initial primary appraisal of a stressor for its relevance occurs (Lazarus & Folkman, 1984). The first evaluation of a stress (primary appraisal) determines whether the person perceives the stressor event to be a harm, a loss or challenge (Lazarus & Folkman, 1984). A person’s beliefs, goals and dispositions as well as competing demands affect this perceiving process. In the case of psychiatric patients, dispositions and beliefs are often affected by existing psychiatric disorders such as borderline personality disorder characterized by stormy interpersonal relationships or beliefs that others are not to be trusted. In addition, there may be demands on the system (addictions and medication side effects) that tax the system and drain any available resources.

Once the stressor has been perceived, a secondary level of appraisal occurs wherein coping strategies (problem or emotion-focused) are used to address the stressor (Lazarus & Folkman, 1984). If a person has adequate coping skills for the scope of the stressor, favorable outcomes occur. However, if a person appraises a stress as overwhelming, the result is distress. This distress feeds back into the stress-coping-response process potentially complicating an already overwhelming situation and yet providing the system the opportunity to identify additional resources to learn coping skills that could alter the appraisal and perception processes, reducing perceived stress. In the psychiatric population with patients who have schizophrenia, this thought disorder has a profound effect on the patients’ ability to cognitively process information as the brain has impaired functioning. In this instance, problem or emotion-focused coping requires clear thinking, which may be impaired at early points in a hospitalization. Thus, an accurate perception of the environment and the use of coping skills can be enhanced by an environment which is easily and readily perceived as benign so minimal coping skills are
required to cope with environmental stressors. Thus, accurate appraisal of an environmental stressor is of utmost value on an inpatient unit.

The appraisal of environmental stressors affects coping, and coping is responsible for the formation of emotions (Lazarus, 1993; Lazarus & Folkman, 1984). Coping is defined “as constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person” (Lazarus & Folkman, 1984, p. 141). Coping is primarily framed in terms of the person’s cognitions about the stressor. The implementation of coping strategies forms the person’s thoughts, actions, and behaviors in a dynamic process of changing cognitions in response to the stressful event. Two broad ways of coping may be employed and often overlap. One is problem-focused coping and occurs most often when the person perceives that the environmental stress can be overcome by employing specific strategies (Lazarus, 1993; Lazarus & Folkman, 1984). At other times if the person perceives the environmental stress cannot be addressed through specific tactics, they may employ emotion focused coping (Lazarus, 1993; Lazarus & Folkman, 1984). The effectiveness and appropriateness of the chosen coping strategy varies by the individual, their experience and preference for a specific method of coping with the stressor and situation (Lazarus, 1993; Lazarus & Folkman, 1984).

In the psychiatric population in patients with varying intelligence, emotional reactivity, cognitive functioning and impairments, there is wide variation in a person’s ability to adequately cope by either problem or emotion-focused coping. People with long-term substance use often have significant cognitive impairments preventing effective utilization of problem-focused coping. People with borderline personality and exaggerated emotional reactivity may not be
readily able to harness their emotions to employ emotion-focused coping. Depending on a patient’s level of wellness they may have few skills available to cope adequately with an environmental stress necessitating an environment that does not increase the person’s perception of stress. A healing environment would lessen the likelihood that a person perceives their ability to cope exceeds their available resources. In this way healing environments reduce the patients’ overall stress burden and allows ample opportunities for the patient to feel more positive emotions and respond less negatively.

**Model Revisions: The Folkman Stress and Coping Model**

In 1993, Lazarus placed the Lazarus and Folkman stress and coping model (1984) in the historical context of stress models with influences stemming back to the 17th century up to the models of the 1990s. In this article, Lazarus suggested strategic directions for stress and coping models and asserted “inclusion of emotion in the study of coping provides a much richer perspective” (Lazarus, 1993, p. 16). Lazarus also suggested that emotions play a central role in the coping process and influence the outcomes of stress and coping (Lazarus, 1993). In 1997, Folkman stated that “the co-occurrence of positive and negative psychological states throughout enduring and profoundly stressful circumstances challenges us to consider a model of coping that takes positive states into account” (Folkman, 1997, p. 1207). Folkman found that 95% of 1794 study participants who were experiencing bereavement and chronic stress after the death of their life partner reported experiencing positive meaningful events that helped them cope despite the context of significant life stress (Folkman, 1997). The effect of positive emotions on coping served to further facilitate the coping process and improve emotional outcomes (Folkman, 1997). In 2008, Folkman finalized the revisions to the original stress and coping model to include
positive emotions, meaning focused coping, sustenance of coping and restoration of resources (Figure 5).

FIGURE 5. Revised Stress and Coping Model (Folkman, 2008)

Leveraging the benefit of positive emotions is key to meaning-focused coping. Positive emotions serve as a moment away from the acute stressor and serve to sustain the efforts of the person reassuring their value (Folkman, 1997, 2008). Positive emotions also have a restorative quality helping people feel connected (Folkman, 1997, 2008). Meaning-focused coping includes several stages of action: (a) finding and interpreting the stress more positively, (b) aligning the stressor in a way that is in accordance with the person’s values and beliefs, (c) seeking understanding which upholds a sense of purpose and control, (d) applying goal directed planning, and (e) facilitating spiritual and existential meaning (Folkman, 2008). Folkman (2008) extends the original model by proposing that this process of creating meaning from a distressing
situation provides a way of shifting the system from negative to positive outcomes and further strengthening the system’s resources and positive coping strategies.

Therefore, Folkman (2008) concluded that there are actually four types of coping processes associated with positive psychological states (Folkman, 1997, 2008). First is positive reappraisal and reframing a stressor in a favorable light (Folkman, 1997, 2008). Second is strategic use of goal directed, problem-focused coping such as information gathering, decision making, planning and resolving conflicts (Folkman, 1997, 2008). Problem-focused coping seeks to remove obstacles that create distress (Folkman, 1997, 2008). The third type of coping associated with positive psychological states is related to spiritual beliefs and practices that may be expressed as beliefs, experiences or rituals (Folkman, 1997, 2008). These may make one feel they are part of being of a higher intelligence, purpose or order (Folkman, 1997, 2008). Lastly, a form of coping associated with positive psychological states is infusing every day events with meaning (Folkman, 1997, 2008).

Positive emotions play a very important role in the stress process serving to fuel the coping process and act to support adaptation to a stressor (Folkman, 2008). When a person’s appraisal and coping meet with an unfavorable outcome, a new strategy of meaning-focused coping is triggered (Folkman, 2008). Research demonstrates that stress has the capacity to generate both positive and negative emotions (Folkman, 2008). The positive emotions augment the person’s coping strategies by refocusing their attention and expanding their behavioral range, which serves to restore a person’s coping resources (Folkman, 2008). Meaning-focused strategies are based on core strategies described below.
The first and most common meaning-focused coping is benefit-finding. Benefit-finding restores confidence and self-esteem replenishing coping resources and sustaining coping (Folkman, 2008). Benefit-finding increases wisdom, patience and competence, facilitates assessment of priorities and the value of life, and increases use of spirituality and faith to cope (Folkman, 2008). These coping strategies may or may not confer real benefits, but if the person perceives real benefit, it still confers self-confidence and becomes a future resource for appraisal and coping (Folkman, 2008). Another form of meaning-focused coping involves infusing ordinary events with positive meaning (Folkman, 2008). This is largely a creative and purposeful endeavor to find or prolong joy in an effort to cope with stress (Folkman, 2008).

Positive emotions and meaning-focused coping sustain and replenish the person’s positive coping resources (Folkman, 2008). A healing environment can promote this positive cycle of coping by using the environment to foster positive emotions and meaning-focused coping. A healing environment is perceived as benign and never threatening in its most passive form. As an active participant in the healing process, the environment can promote meaning-focused coping by offering respite from stress and allowing the opportunity for an accumulation of moments of positive emotions that would allow the person’s innate abilities to employ meaning-focused coping. For instance, the introduction of a garden on a psychiatric unit or a window view of nature may allow moments of freedom from emotional liability, hopelessness and sadness. These moments allow for reflection perhaps of the meaning of one’s children in a woman’s life and the reason she has chosen not to commit suicide. Reflection allows moments to be infused with meaning and serves to facilitate the process of meaning-focused coping and the attainment of positive emotions. Sustaining positive emotion is the essential goal of a psychiatric
inpatient stay for a patient who suffers from mood disorders. Provision of a healing environment works in concert with the Folkman model (2008) which tells us that people will naturally strive to assemble meaning of one’s life from ordinary events. An environment which promotes positive coping will succeed in fostering positive emotions (Folkman, 2008).

**Application of the Stress and Coping Models to Psychiatric Inpatient Settings**

The stress and coping models (Lazarus & Folkman, 1984; Folkman, 2008) can be applied to stress experienced in psychiatric inpatient settings. Specifically, these models help us understand the influence of healing environments on a patient’s perception, cognition and appraisal processes and mental health outcomes. The following is an illustration that compares how a current inpatient psychiatric unit design is perceived and appraised by patients in contrast to the perceptions and appraisals of a healing design.

Psychiatric patients are admitted to the inpatient psychiatric unit involuntarily for danger to self or others or impairment in self-management due to mental illness so severe the patient is rendered unable to reliably provide for their own safety (Bowers, 2005). An example of a typical psychiatric inpatient admission is a patient in a state of mania who has not slept for one week. He might be brought into the emergency room by the police after assaulting a family member. He may have been treated with a major tranquilizer. The patient is then medically cleared in the emergency room and brought to the inpatient psychiatric unit in a state of hyper-arousal. Because of this state of hyper-arousal, his sense of smell, hearing, sight, and touch are heightened (Selye, 1950). The stress and coping model indicates that the patient upon entering the unit will immediately make a primary appraisal of his environment to determine the presence of threat or harm (Folkman, 2008). This appraisal is affected (or mediated by) environmental cues, including
the people, the configuration of the unit, the colors, the jangle of keys, the slam of doors, and the
drone of the television. The environment can either positively or negatively affect this appraisal
process, impacting whether the person perceives threat or harm or comfort and safety.

This is the first and most important opportunity for the healing design to make an impact
on the patient’s primary appraisal of the environment. The impact of the person-environment
transaction will determine what the patient thinks about the unit and how they will cope and
behave on the unit. Most importantly, will the environment be appraised as harm or a threat? If
the patient perceives a threat he may choose to confront the stress with anger and violence,
which could result in the necessity of seclusion and restraint. If the patient is cued by the
physical environment to appraise the unit as safe and serene, then the patient has an opportunity
to change his perception, appraisal and coping, which can have a positive outcome on his level of
stress. Thus positive appraisal and coping allows for the possibility of more positive emotions to
emerge and for these positive emotions to influence patient behaviors and responses.

Imagine a second patient who presents to the unit after a manic episode. He has not slept
for one week after an outbreak of violence against a loved one. Upon entry into the unit, does the
door to the locked unit close with a sound that signifies his loss of freedom and being held
against his will on a locked psychiatric unit? Does his escort rattle the keys that distinguishes
patients from the staff; the inpatients from those who are free? Or does the door close gently? In
a healing environment noise is kept to a minimum (Samueli, 2009). The GAS model tells us that
this patient’s sympathetic nervous system ("fight or flight") predominates at this time and the
patient has high levels of stress hormones in his body (Selye, 1950). This means that his senses
are heightened to facilitate his fight or flight response to stress he is experiencing (Selye, 1950).
Additionally, the Rashid and Zimring model (2008) tells us that noise can result in negative perceptions of the environment which can then lead to negative physiological and psychological outcomes such as anger or fear. These can lead to negative immediate outcomes and possibly poor coping and stress in the long term. Folkman’s stress and coping model (2008) tells us that the patient’s internal environment in a state of fight or flight will likely be perceived as a threat. Excess noise in the external environment has the potential to be appraised as a stress or possibly a threat. The combination of internal and external environments perceived as stressful by this patient may be appraised as a threat or harm and could possibly overwhelm the patient’s available coping resources.

Another person enters the unit after a night spent with police and then in the Emergency Department. They enter at 5:00 am through a doorway to a long hallway lit with bright fluorescent lighting. Windows offer no indication of the coming dawn and no appreciable view of the outdoors. They are covered in metal grates with a padlock that impresses the lack of access to even a visual reprieve from the confines of the inpatient unit. An important aspect of a well-crafted healing environment is the thoughtful use of materials and natural lighting (Samueli, 2009). Materials that are also used to confine animals or used in correction facilities such as metal grates would be strictly avoided due to the negative association these materials may conjure. A thoughtful design would demonstrate a keen awareness of the historical context of power and control as well as the history of stigma surrounding psychiatric hospitals (Foucault, 1965; Holmes & River, 1998). This awareness would guide material choices and promote a design ethos that conveys warmth and respect. The Rashid and Zimring model (2008) suggests that if the individual’s physiological and psychological needs for light and his psychosocial and
social needs for respect and control are thwarted, then negative immediate outcomes are experienced. The stress and coping model (Folkman, 2008) explains why this occurs as poor lighting and material choices could be appraised as sinister; a threat or harm. Thus, appraisal and coping could be adversely affected and lead to an outcome of a negative emotion.

All the patients entering the unit are confronted with the nurses’ station, which serves as an architectural symbol of the nurse-patient relationship and can physically communicate the unit hierarchy and staff and patient segregation on the unit. An open nursing station provides an important signal to patients regarding how staff relates to patients (Samueli, 2009). The open nursing station design can foster the nurse-patient relationship. A healing design would signify an egalitarian relationship between staff and patients (Samueli, 2009). If the patient enters the unit and perceives that the staff is physically distanced from the patients, it can create the perception that staff is unavailable. According to Rashid and Zimring’s model (2008), a closed nursing station design can hinder the person’s perceived availability of psychological support by preventing patients from reaching a nurse who is educated, trained and available to provide this support to their patients. These obstructed needs may lead to negative immediate outcomes in these domains, which could lead to stress (Rashid & Zimring, 2008). Folkman’s stress and coping model (2008) further explains that if the person perceives their environment to be stressful and appraises threat or harm, coping can mediate the outcome of stress. Staff on the psychiatric unit can facilitate positive coping and can offer development of meaningful relationships with staff. At a minimum, available staff should be easily accessible should patient require their support. By obstructing access to staff these coping mechanisms may not be realized leading to stress and negative emotions (Folkman, 2008).
Information from the inpatient psychiatric unit, including the physical environment, is all taken in during the first sweeping perception and appraisal of the environment. This primary appraisal of the physical environment of the inpatient unit is a crucial opportunity for the environment to facilitate a perception of safety, dignity, and respect that would promote positive coping strategies. The first primary appraisal of the environment should reassure the patient through visual and audible cues. To reduce the patient’s fears, a healing environment eliminates or reduces a sense of confinement, conveys a message that staff are open and accessible, provides for refuge so he can remove himself from harm’s way, promotes a connection to nature, and provides a serene, quiet environment (Samueli, 2009; Sternberg, 2009). Secondary appraisals involve consideration of the use of coping strategies to address the perceived environmental stressor and allows for problem solving (Folkman, 2008). Problem solving can be emotion or problem focused resulting in a favorable outcome of a positive emotion or an unfavorable outcome of a distressing emotion (Folkman, 2008). If distress results, then the process begins anew through the mechanism of meaning-focused coping. The final stage of coping is meaning-focused coping which offers an important opening for the healing environment to assert its benefits on mental health outcomes (Ulrich et al., 2008). The primary method of meaning-focused coping is through benefit finding, when the person’s sense of the value in life is restored leading to a decrease in stress (Folkman, 2008). A healing environment offers a rich environment and the opportunity for positive meaning to emerge during the hospital stay (Samueli, 2009).
Summary

The interchange between healing environments and the person-environment relationship offers a chance to positively influence patients’ perceptions, appraisal and coping. Rashid and Zimring’s conceptual framework (2008) identifies the link between environment and immediate responses/outcomes. They proposed that negative environmental factors (noise, poor lighting, windowless rooms, and crowded common areas) lead to anxiety, fear, helplessness, sadness, and discomfort, a reduced sense of control, territoriality and safety concerns. The Stress and Coping Model (Lazarus & Folkman, 1984; Folkman 2008) describes how environments are perceived and appraised and how a person seeks to cope with stress through the use of positive emotions. Healing environments affect the stress and coping process in several ways. There is an opportunity during primary appraisal to portray the inpatient unit as safe and respectful, decreasing stress appraisal of the situation as stressful through visual and auditory clues. Subtle, positive environmental cues affect patient appraisal and coping can also affect meaning-focused coping. For instance, the most common meaning-focused coping is benefit finding. A psychiatric inpatient environment that promotes healing will ensure that a person’s innate meaning-focused coping processes are not disrupted by the environment. Rather, a healing environment fosters the individual’s innate ability for benefit finding in difficult life circumstances (Folkman, 2008). A serene, contemplative healing environment allows the individual to assesses their priorities, the value of life and foster a sense of spirituality and faith to cope (Folkman, 2008). Seemingly small nuances of the healing environment, taken collectively, offer a valuable way of reducing the patients’ overall stress burden while replenishing and sustaining the coping process (Butler, 1993; Folkman, 2008). This meaning-focused coping process allows the opportunity for the
person to perceive value in life, thus increasing the likelihood for positive emotions to emerge (Folkman, 2008).

**Environmental Standards and Guidelines for Psychiatric Hospitals**

The healthcare industry clearly acknowledges that hospitalized patients with psychiatric disorders have special needs that impact stress associated with hospitalization (Taylor, 1979). These needs include alterations in mood and/or thought processes, an internal environment characterized by depression, stress, and chronic stress, dysregulation of the HPA axis and increased levels of stress hormones (Marin et al., 2011), increased stress reactivity (Marin et al., 2011), impaired cognitions affecting accurate appraisal of their environment (National Institutes of Mental Health, 2012), stress of stigma associated with psychiatric hospitalization (Holmes & River, 1998) and fear associated with the psychiatric milieu (Bowers et al., 2009). Facilities’ guidelines (licensure, certification, and accreditation) address these special needs by establishing environmental standards that try to ensure patient and staff safety. However, measures that improve safety must be balanced with measures that reduce stress and improve well-being, quality outcomes and healing. This section will explore the environmental safety regulations and facilities guidelines that have been developed and are required when designing an inpatient psychiatric hospital environment.

**State Facility Legal Guidelines for Inpatient Psychiatric Facilities**

Each state in the U.S. promulgates laws and regulations which set minimal requirements that must be met by all hospitals, including behavioral health inpatient facilities. These laws ensure that adequate safety and quality guidelines are enacted by facilities within the state and
serve as the basis for facility inspection and licensure. Licensing requirements are in place to protect the health of the public.

In Arizona, these laws are found in the Arizona Department of Health (ADH), Arizona Revised Statutes (ARS), Title 9, Health Services Chapter 20, Department of Health Services Behavioral Health Service Agencies: Licensure, Environmental Standards R9-20-405 section (Appendix A) (Arizona Department of Health, 2012). Licensing requirements for behavioral health facilities (Article 5) identify information regarding the hospital interior (http://www.azsos.gov/public_services/Title_09/9-20.htm, 2012). These standards provide a list of requirements such as: the premises are to have available a television and a radio, one toilet for every six inpatients, a private or shared room of 50 square feet, storage space, a surface or table, a mattress and linens, sufficient lighting, doors and windows that provide privacy. These are minimum environment of care standards required by the state of Arizona.

Federal law provides additional standards/laws with which facilities must comply. The Americans with Disability Act (ADA) of 1990 design standards revised in 2010 (http://www.ada.gov/regs2010/2010ADASTandards/2010ADASTandards.pdf, 2010) identifies the accessibility requirements for public facilities, including social service agencies, correction facilities, educational facilities, and hospitals. The ADA protects the civil rights of those with disabilities, ensuring that individuals with disabilities have the same opportunities as those who are not disabled (http://www.ada.gov/, 2012). The ADA (2010) design standards for patient bedrooms include doorway clearance and obstruction removal; plumbing specifications for accessibility including fixture placement and clearance handrails, ramps and stair specifications. Because psychiatric facilities do not specialize in the treatment of mobility disturbances, only
10% of the inpatient rooms are required to provide mobility features (http://www.ada.gov/regs2010/2010ADASTandards/2010ADASTandards.pdf, 2010).

**Accreditation Standards for Inpatient Psychiatric Settings**

The Joint Commission (JC), founded in 1951, is an independent non-profit agency responsible for accrediting more than 19,000 health care organizations in the United States (JCAHO, 2012). The agency evaluates health care organizations’ abilities to achieve and maintain specific standards in order to ensure that healthcare agencies attain a level of excellence in the provision of effective health care (JCAHO, 2012). The commission works with health experts, health care professionals, and the Centers for Medicare and Medicaid (CMS) (JCAHO, 2012). The commission provides on-site surveys every three years to evaluate the care provided including the environment of care (JCAHO, 2012).

The Joint Commission Comprehensive Accreditation Manual for Behavioral Health Care (Appendix B) identifies a broad range of safety risks that exist in the environment of care and requires risk reduction through a proactive analysis of potential risks and management of those risks (JCAHO, 2012). The Commission requires the appointment of a risk manager, prohibits smoking except in defined circumstances, requires proper handling of hazardous materials, requires regular fire drills and inspections, and requires utility management including electrical functioning and emergency power (JCAHO, 2012). The Commission also acknowledges that the environment can have an impact on patient satisfaction and outcomes and requires that the following features be managed: quality of light, privacy, size and layout of the space, patient security, security for patient’s belongings, clear access through doorways, level of noise, and staff working space that aids efficiency (JCAHO, 2012).
Industry Standards for Inpatient Psychiatric Settings

The Design Guide for the Built Environment of Behavioral Health Facilities (5th edition) (Appendix C) provides guidelines for the safe design of an inpatient psychiatric unit (Hunt & Sine, 2012). This design guide is distributed by the National Association of Psychiatric Health Systems and is a recommended standard, appearing in the Department of Veterans Affairs Office of Construction and Facilities Management Design Guide: Mental Health Facilities 2010 under the VA Guidelines for Codes and Standards (sections 4.1 and 4.1.2) (Department of Veterans Affairs, 2010). This document outlines a design that focuses on comfort and safety, with support for an environment that reflects a residential quality (Hunt & Sine, 2012).

The authors clearly state that an “institutional” appearance is to be avoided (Hunt & Sine, 2012). The standards provide an exhaustive materials list of supplies (i.e., ligature resistant hinges and door alarms) that can be used to minimize the risk of an adverse outcome. These standards caution against the fervor that has developed in the industry; an industry which promotes building and interior finishing products for psychiatric facilities that are unwelcome, sterile and institutionalized design aesthetic in an attempt to create environments that are safe and secure. Hunt and Sine (2012) also identify aesthetic design concepts based on an ethos of creating a home-like environment wherever possible and safe to introduce. For instance, if two material choices are available and one offers a less institutional sense, these guidelines suggest the designer weigh the risks and benefits, and whenever possible strive to maintain a home-like design aesthetic as a priority as well.

The second industry guideline in use today is the Department of Veterans Affairs Office of Construction and Facilities Management Design Guide: Mental Health Facilities 2010 under
the VA Guidelines for Codes and Standards (Appendix D) (Department of Veterans Affairs, 2010). The guidelines have a clear stated mission to incorporate a patient-centered, therapeutic, healing environment that reduce environmental factors such as noise, poor lighting, privacy or poor ventilation that may cause patients to feel vulnerable, agitated or stressed (Department of Veterans Affairs, 2010). Specifically, the guidelines recommend reducing patient and staff stress by integrating design features that include natural light, noise control, open layout without barriers, adequate space to avoid overcrowding, use of natural materials, a calming color palette, window views of nature and a home-like environment (Department of Veterans Affairs, 2010).

These guidelines focus on maintaining a healing environment and creating a home-like setting (Department of Veterans Affairs, 2010). The guidelines also include a full list of finishing materials list such as exterior windows with integral blinds, wood grain sheet vinyl flooring, lighting options, ligature resistant fixtures, furniture recommendations as well as scale drawings.

**Summary**

Federal and state statutes and regulations, as well as industry standards, affect the construction of the inpatient psychiatric facilities and impose constraints on whether a healing environment can be realized. Efforts to reduce patient anxiety and stress and maintain regulatory and healing environment standards may appear to be incongruent goals. Additionally, many aspects of buildings are immutable, and if alteration were possible, then this may afford greater compatibility with healing design. Folkman’s Stress and Coping Model (2008) emphasizes that patient perception and appraisal of the environment as non-threatening is critical to meaning-focused coping that can reduce stress. Intelligent design solutions, that also adhere to regulatory and industry standards are needed in order to create a healing environment that minimizes stress.
responses in the psychiatric inpatient setting. Intelligent design solutions such as those identified in the Department of Veterans Affairs Office of Construction and Facilities Management Design Guide: Mental Health Facilities 2010 (Department of Veterans Affairs, 2010) offers a good starting point for the use of thoughtful and humane design solutions to reduce patient stress.

**Guidelines for Optimal Healing Environments**

Planetree and Samueli Institute are the two organizations focused on defining and promoting optimal healing environments. Planetree sets standards for patient-centered care by challenging organizations, setting measureable standards of care and providing organizational consultation and support for quality improvement (Frampton & Guastello, 2010). Their goal is to define patient centered care and provide a framework for health care facilities to reach the goal of patient centered care (Frampton & Guastello, 2010).

A Planetree designation marks achievement on both qualitative and quantitative measures with requirements that exceed Center for Medicare and Medicaid Services. Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) was the first standardized set of measures that recorded patients’ perspectives of their experiences. Comparison of HCAHPS scores enables healthcare consumers to compare patient experiences at different healthcare centers. Planetree designated hospitals score 8% higher on HCAHPS items measuring patients who reported that they are “highly satisfied” with their hospital experience (Frampton & Guastello, 2010). Planetree also sets standards for healing design and place the physical design of the healthcare environment as a priority for patient-centered care (Planetree, 2011).

The second organization which proposes standards for the physical design of healing environments is The Samueli Institute, located in Alexandria, Virginia. The Samueli Institute
(2006) is dedicated to research and translation of theory and research into practice. The use of complementary and alternative therapies as well as the whole person/whole system healing practices are among their primary research interests. The Institute describes healing practice within four domains: integrated medicine; optimal healing environments; military medical research; and brain, mind, and healing. Optimal healing environments must be addressed within two domains: inner and outer environments. The inner environment is focused on developing healing intention, experiencing personal wholeness and cultivating healing relationships. The outer environment includes practicing healthy lifestyles, applying collaborative medicine, creating healing organizations and building healing spaces (http://www.siib.org/research/research-home/systems-wellness-system.html, 2006).

**Planetree Standards for Optimal Healing Environments**

There are approximately 500 general hospitals that carry the Planetree designation (Planetree, n.d.). The Planetree Designation Criteria for healing environments/architecture (Appendix E) offer a core list of requirements (Planetree, 2011). The first is for clients to have available options for control over creating their own personal expression in the environment. Second is the provision of electrical lighting and access to sunlight. This provision calls for access to the out of doors, to daylight and to a garden. Third is visual privacy. Next is the provision of comfort to the senses such as no noxious odors or noises. Lastly is having a comfortable temperature.

Additionally, the Planetree Designation Criteria (2011) include the following principles applicable to design of the hospital environment. The design should foremost be patient-centered and convey respect and dignity and should be based on evidence. The design should be home-
like, spacious and well lit. Specifically regarding psychiatric environments, the design should be free of coercion and should minimize stimulation. Also, a “comfort room” should be provided for clients needing to take time away from staff and peers for relaxation, privacy or safety reasons (Planetree, 2011).

Primarily, the Planetree designation criteria are based on healing concepts that include patient-centered care, human interactions, education, family involvement, nutrition, meaningful activities, spirituality, integrative therapies and enhancement of life journeys. The development of the Planetree designation criteria is not reported to be evidence-based but Planetree does endorse, generate and utilize research evidence (Frampton & Guastello, 2010). Despite the lack of documented evidence supporting the Planetree designation criteria, Planetree-designated hospitals do outperform other hospitals on Center for Medicare and Medicaid core measures (Frampton & Guastello, 2010).

**Application of Planetree Standards to Psychiatric Inpatient Settings**

The following is an illustration of a psychiatric unit that adheres to the Planetree Designation Criteria. Upon entry, the inpatient psychiatric unit should feel welcoming. This is achieved by attendance to the senses and ensuring a home-like architectural design with a keen attention to acoustics, material choice and staff training on the importance of a quiet, low stimulus inpatient environment. Lighting is equally pleasing to the senses in keeping with a low stimulus environment and a mandate for access to daylight. The initial view of the unit should be expansive and free of obstructions, including the nursing station. The unit offers a range of seating options to choose from to afford opportunities to have intimate conversations or to come together as a group. The public area of the unit should offer secured access to the out of doors,
nature and a garden, which reinforces the patient-centered approach to care. There is a comfort room with a reclining chair, stereo controls and a window. Additionally, the nurses’ station design, open and with low counters, would also reflect this criteria as well. Planetree patient rooms offer lighting controls, daylight, window shade controls, temperature controls and visual privacy. Patient rooms offer space for personal expression and displays. The patient-centered health care is evident in the Planetree environmental standards to facilitate a feeling of respect, dignity, and comfort.

One of the most comprehensive integrative literature reviews on the current state of evidence-based design literature (Ulrich et al., 2008) shows that Planetree’s environmental standards are consistent with the current research literature. For instance, low levels of noise, adequate lighting, furniture arrangement, control of lighting and temperature, exposure to daylight, and access to nature and nature views, all as mandated by Planetree standards, are demonstrated in the research to have positive effects on patient outcomes (Ulrich et al., 2004).

It also appears that the inpatient unit design recommended by the Planetree criteria is theoretically consistent with Rashid and Zimring’s (2008) and Folkman’s (2008) models of environment, stress and coping. The Planetree standards for the inpatient hospital design mediate the effects of the appraisal and coping process by reducing the likelihood that the environment will be perceived as stressful. By supporting a positive appraisal of the environment by focusing design on patient-centeredness, Planetree designated hospitals positively impact the emotional outcomes of their patients.

Lastly, Planetree environment standards are compliant with state and accreditation safety standards. However, Sine and Hunt (2012, p. 10), in their Design Guide for the Built
Environment of Behavioral Health Facilities, caution that the Planetree “features do not adapt well to behavioral health units and hospitals.” Planetree’s promotion of a residential, home-like environment with lamps, drapes, light fixtures and toilet accessories represent a hazard to many people with psychiatric disorders and inpatient staff (J. Hunt, personal communication, 8-26-12). However, it is clear that Planetree is attempting to enter into the arena of behavioral health having made their first Planetree designation of a psychiatric facility in 2011 (Planetree, n.d.). The first Planetree Behavioral Health designation belongs to Weil Cornell Psychiatry at New York- Presbyterian Hospital Westchester Division in White Plains, New York. It is an academic research center that provides psychiatric treatment for a diverse population of general, geriatric, child and adolescent, addiction recovery, eating disorders, anxiety, mood disorders, and neuropsychological disorders (New York Presbyterian, n.d.). At this juncture with only a single psychiatric facility meeting the Planetree Designation Criteria, it remains to be seen if the Planetree Designation Criteria are appropriate for the psychiatric setting and if the criteria promote healing in this special population.

The Samueli Institute’s Guidelines for Optimal Healing Environments

At this time Samueli Institute has no published guidelines for optimal healing environments (Samueli Institute optimal healing environments, 2009).

Summary

Guidelines for Optimal Healing Environments emphasize a patient-centered approach to patient care and the provision of an environment, which serves to minimize stress and promote healing. These recommendations for optimal healing environments also serve to modify/decrease the patient’s perception of harm or threat during the primary appraisal phase when admitted to
the inpatient unit. Recommendations cite the importance of access to nature, gardens, sunlight, meaningful activity, a sense of control and self-expression in one’s environment, noise reduction, spirituality, and finding meaning in everyday occurrences. These are all integral parts facilitating a positive perception and appraisal of the environment, which foster the development of positive emotions in an effort to reduce stress (Folkman, 2008; Rashid & Zimring, 2008).

The link between the environment and stress is explained by two theories. The first model by Rashid and Zimring (2008) illustrate how hospital staff and patients’ needs can be thwarted by the environment leading to stress. Rashid and Zimring (2008) proposed that the interaction between the environment and the person’s needs mediate short-term outcomes related to physiological, psychological, cognitive, psychosocial and social outcomes. The Stress and Coping Model by Lazarus and Folkman (1984) and Folkman (2008) further explicate how this response occurs, describing how a person’s perception and appraisal of the environment as well as their coping resources and the meaning ascribed to the environment effect ultimate stress outcomes. The two models taken together provide a theoretical perspective that explains the significance of environments on stress reduction and mental health outcomes. Current trends in optimal healing environments have led to the development of architectural design guidelines such as those offered by Planetree. Optimal healing environments recognize the influence of stress on healing and attempt to limit stress by providing comfort, control of basic utilities such as light and temperature and provision of a home like environment which values human dignity. Additionally, any environmental re-design must also meet industry standards, governmental and accreditation standards, which support dual outcomes of providing for safety as well as comfort and stress reduction.
CHAPTER THREE: METHODS

Evidence-based Practice (EBP) is defined as “a problem solving approach to clinical decision making within a health-care environment that integrates the best available scientific evidence with the best available experiential (patient and practitioner) evidence” (Newhouse et al., 2007, p. 3). This practice inquiry used an evidence-based approach to design a psychiatric inpatient healing environment. The process used to guide EBP began with formulation of a practice question to discover the available evidence, which was then followed by translation of the evidence for practice (Newhouse et al., 2007). This chapter describes the methods used to systematically review, analyze, synthesize the research literature and translate the evidence used to inform the design process.

Practice Question and Project Overview

The purpose of this practice inquiry (PI) was to: (a) analyze the research literature for evidence of architectural and design elements shown to reduce stress and improve the well-being of people currently admitted to the inpatient psychiatric care setting; (b) identify design elements that are consistent with accreditation and licensing standards for inpatient psychiatric units; and (c) design an evidence based psychiatric inpatient room. To accomplish these aims, three PICO questions were used to conduct a comprehensive literature review to identify research on inpatient hospital and clinic designs with outcomes of decreased patient and staff stress and anxiety and improved patient mood. The evidence was then critically analyzed for its: (a) scientific rigor, (b) strength of the evidence demonstrating design effectiveness, and (c) its potential generalizability to psychiatric unit design. An examination of the identified design principles was conducted to determine their individual appropriateness for translation to an
inpatient psychiatric unit. Only evidence which complied with available safety standards and guidelines and sound clinical judgment was considered for translation. Using the appropriate evidence-based design principles; an inpatient psychiatric room with a private bathroom was designed and illustrated.

The first phase of EBP activities was identifying the practice question in a fashion that facilitated the evidence search (Newhouse et al., 2007). The method used for structuring the practice question is called a “PICO format” (Newhouse et al., 2007, p. 55). PICO is an acronym. ‘P’ is for population, patient, or problem of clinical interest (Newhouse et al., 2007). ‘I’ is for intervention (Newhouse et al., 2007). ‘C’ is for comparison of treatments or interventions (Newhouse et al., 2007). ‘O’ is for outcome of clinical interest (Newhouse et al., 2007).

Although the purpose of this practice inquiry was to analyze the research literature for evidence of architectural and design elements that reduce stress and improve the well-being of people admitted to the inpatient psychiatric care setting, there was very little evidence about the effect of a healing environment on this population. In order to broaden the research literature search, a more generalized PICO question was used to conduct a search. The literature was also closely assessed for its generalizability to the psychiatric inpatient population. For this project, the clinical practice issue involved hospitalized patients (population) and whether elements of a healing environment (intervention) can mitigate stress, anxiety, and alterations in mood (outcome). Most succinctly the clinical questions were: Do healing environments reduce stress? Do healing environments reduce anxiety? Do healing environments alter the mood? Therefore, to facilitate the search for evidence the PICO questions were: 1) In hospitalized patients, which elements of a healing environment reduce stress? 2) In hospitalized patients, which elements of a
healing environment reduce anxiety? 3) In hospitalized patients, which elements of a healing environment elevate the mood. Once the evidence for a generalized acute care population was synthesized, it was translated for use in the psychiatric inpatient unit through a process of refinement using various standards of care, safety and environmental care guidelines, accreditation standards and expert clinical guidance.

**Outcome Definitions**

The outcomes of stress, mood and anxiety were chosen for their theoretical and clinical relevance to clinical practice issues for the acutely ill psychiatric population. Specifically, indoor environments such as hospital environments are linked to stress, imposed on hospitalized patients and can adversely affect patient outcomes (Codinhoto et al., 2009; Devlin & Arneill, 2003; Rashid & Zimring, 2008). Patient outcomes related to mental health such as stress and anxiety levels and overall mood can be affected by hospital environments (Codinhoto et al., 2009; Devlin & Arneill, 2003; Folkman, 2008; Rashid & Zimring, 2008).

Rashid and Zimring’s (2008) model describes how indoor environments may lead to stress by preventing the individual from reaching their healthcare needs. Further, Lazarus and Folkman (1984) and Folkman (2008) describe how cognitive appraisal and coping are mitigated by the patients’ experience of the hospital environment and how environments can impact emotional outcomes such as stress, anxiety and lower mood states. These outcomes are valuable to patient care, and in a psychiatric population already experiencing stress, anxiety, and depression, it is crucial that hospital environments not contribute to stress, anxiety or depression. Operational definitions of these outcomes served to delineate definitions and boundaries of the
terms and facilitated a strategic review of the literature and produced homogenous results when searching different databases (Newhouse et al., 2007).

The outcomes of stress, anxiety and mood have some common physiological mechanisms with different clinical manifestations (Marin et al., 2011). Over time, both stress and anxiety can have a kindling effect on depression, representing a causal effect of stress and anxiety on mood (NIMH, 2009). The three outcomes of stress, anxiety and mood also have similar negative impacts on the stress and coping process by thwarting patients’ attempts to reach positive emotions which are the final outcome of the coping process (Folkman, 2008; Marin et al., 2011). As each of the outcomes have different characteristics and symptom manifestations, operational definitions developed to clarify the differences between the outcomes will facilitate the literature selection and review process.

**Stress**

Stress is defined as the “relationship between the person and environment that is appraised by the person as taxing or exceeding his or her coping resources and endangering his or her well-being” (Lazarus & Folkman, 1984). Stress often precipitates a depressive episode; once a person’s ability to cope with a stressor is exceeded, the body’s stress response is triggered (Marin et al., 2011). Patients who are already experiencing stress have an altered internal environment, increasing their stress reactivity which results in cognitive impairments that can result in a negative appraisal of their environment (Marin et al., 2011). Intact cognitive processes and an ability to accurately appraise the environment are vital in mobilizing the appropriate coping resources to mitigate stress (Folkman, 2008; Lazarus & Folkman, 1984).
Mood

Mood was defined as a prevailing emotional tone or general attitude (http://dictionary.reference.com/browse/mood?s=t, 1997). This definition was chosen over the diagnostic criteria for mood disorders to highlight the range of emotion that encompasses mood and to assure that evidence from the full range of possibilities would be reviewed. Severe alterations in mood (e.g., Major Depressive Disorders) are the reason for the greatest number of psychiatric in-patient admissions (AHRQ, 2009), and its most serious potential adverse outcome is suicide (Kaltiala-Heino, Tuohimaki, Korkeila & Lehtinen, 2003). Patients with depression also have an altered internal environment which impacts the person’s perception of stress, increases their stress reactivity and produces cognitive impairments that can result in a negative appraisal of their environment (Marin et al., 2011). Intact cognitive processes and an ability to accurately appraise the environment are also needed to employ the appropriate coping resources to reduce stress (Folkman, 2008; Lazarus & Folkman, 1984).

Anxiety

While, Lazarus and Folkman (1984) claim that anxiety and stress are interchangeable terms, anxiety is more accurately defined within the context of mental health disorders as “distress or uneasiness of mind caused by fear of danger or misfortune” (http://dictionary.reference.com/browse/anxiety?s=t, 2005). Therefore, anxiety was operationalized as a perception of distress that exceeds a person’s ability to cope (Folkman, 2008; Lazarus & Folkman, 1984), as well as a cognitive process that results in an emotional outcome that ranges from mild to severe along a continuum. In its most severe form, anxiety may affect a person’s ability to function (NIMH, 2009). Unabated anxiety can become an internal
stressor leading to depression and is often found within the psychiatric population as co-morbid with depression (NIMH, 2009). High levels of anxiety also affect cognition, affecting a person’s ability to accurately appraise the environment and utilize the appropriate coping resources (Folkman, 2008; Lazarus & Folkman, 1984).

Sample and Sampling

Newhouse et al. (2007), state that once the PICO question has been identified and the outcomes have been defined, the search for evidence begins with the identification of key terms. The key terms were derived from the PICO questions and facilitated database inquiries (Newhouse et al., 2007). For this study, the selection of key terms for the PICO questions was informed by several seminal pieces of literature. Two integrative healthcare design literature reviews by Ulrich et al., (2004, 2008) identified the following key search terms: patient and staff outcomes (infection, medical error, pain, sleep, depression, stress, and privacy), physical environmental factors (hospital, hospital units, healthcare facility, etc.), as well as patient-centered care and family-centered care as relevant. Additionally, Gulwaldi, Joseph and Keller’s (2009) systematic review utilized these search terms: ambulatory care, outpatient, clinic, community health centers, design, staff outcomes, patient outcomes, pain, anxiety, satisfaction, distress, waiting areas, music and anxiety in waiting rooms, visual distraction, communication, access to parking, energy savings, navigate, family, efficiency, standardization, process improvement, staff interaction, medical home model, and Health Insurance Portability and Accountability Act (HIPAA). Malkin (1992) identified ten key terms in outlining the creation of a healing environment. They were noise control, air quality, thermal comfort, privacy, natural and full spectrum light, communication, views of nature, color, texture, and accommodation for
family (Malkin, 1992). These same key concepts were also endorsed by Samueli Institute (n.d.). Therefore, the key terms chosen for the literature review to be used alone and in various combinations were: inpatients, hospitalized patients, psychiatric inpatients, evidence-based design, hospital design, healthcare design, built environment, healing environments, mental health, stress, depression, emotion, anxiety, mood, satisfaction, nature, biophilia, plants, daylight, garden, nature views, landscape, windows, sunlight, color and art. Synonyms and related terms were also used and included hospital and interior design, facility design, optimal healing environments, horticulture, daylight, and artwork.

The selected search terms alone and in various combinations were entered into a selection of databases including CINAHL, PubMed, University of Arizona Health Sciences Library’s Evidence-based Medicine Database (EBM), PsycINFO, Web of Science and Google Scholar to identify relevant literature. Websites that specialize in healing environments and patient-centered care including Samueli (www.siib.org/) and Planetree (www.planetree.org/) were also searched for evidence, as they promote both evidence-based design and optimal healing environments. The Center for Health Design (www.healthdesign.org/) website was also searched as this site serves as a repository for evidence-based design research articles and offers a library with a search function.

Lastly, a search by hand was conducted by reviewing the reference lists of the major study authors such as Ulrich et al. (2004, 2008), Gulwadi, Joseph and Keller (2009) and Rashid and Zimring (2008) in order to discover additional primary sources. A synopsis of the search strategy results including search terms used, number of articles found, and number of articles retained was provided (Newhouse et al., 2007).
Inclusion and Exclusion Criteria

Inclusion and exclusion criteria delineate the boundaries of how well the PICO question is answered by a research article (Newhouse et al., 2007). Terms of inclusion should aid the search for an answer to the PICO question while other terms are excluded based on a lack of relevance to the PICO question (Newhouse et al., 2007). Article titles and abstracts were screened based on the following inclusion and exclusion criteria (Newhouse et al., 2007).

Inclusion Criteria

a. Search limits included peer reviewed journals, articles in English, human subjects, dates ranging from 1980 to 2012.

b. Types of studies included experimental, quasi-experimental, non-experimental, qualitative, systematic literature reviews, meta-analyses and healing environment guidelines.

c. Types of participants included in the studies are adult inpatients in general and psychiatric hospitals, age 18 and older, diagnosed and being treated inpatient for any medical and/or psychiatric diagnosis.

d. Types of interventions included changes to the physical environment, changes in furniture arrangement, availability of window views, garden or courtyard views, daylight, interior light, and introduction of plants, color or artwork.

e. Outcomes studied included stress, anxiety, and mood or depression. Research study outcome definitions were consistent with PI outcome definitions.

Exclusion Criteria

a. Types of articles excluded were opinion and editorials.
b. Studies in which the participants were diagnosed with dementia or seasonal affective disorder.

c. Studies when the interventions were related to outdoor design or activities, therapy activities, way finding, or waiting areas.

Once the literature was selected, a database of articles that met the inclusion criteria was saved in an electronic file and shared with the PI chairperson. The chairperson reviewed all the articles to ensure that they met the inclusion/exclusion criteria. Additionally, a summary of the search terms used and the number of articles screened for inclusion and exclusion criteria was maintained. A record of articles excluded including reasons for exclusion from the systematic review during the appraisal process was also kept.

**Literature Appraisal**

This section describes the literature appraisal processes and the criteria that were used to guide and select the evidence. There were three main types of evidence including quantitative, qualitative, and non-research evidence (e.g., metasynthesis, systematic literature reviews, and guidelines). There were separate appraisal processes and criteria for each type of literature (Newhouse et al., 2007). Three types of evidence synthesis tables were used to appraise the different types of individual research studies, each with discrete elements for critique. Once the literature was analyzed and appraised, it was rated. The rating scales developed by Johns Hopkins were used for this process (Newhouse et al., 2007).
Evidence Review Criteria

Quantitative Designs

Quantitative research examines a phenomenon in such a way as to measure the circumstances of interest under a controlled investigation (e.g., experimental, quasi-experimental, and non-experimental research) (Newhouse et al., 2007; Polit & Beck, 2008). Collection of quantitative research literature was organized into a table that was adapted from Newhouse et al. (2007) and Polit and Beck (2008). There were three different tables, one for each of the outcomes (stress reduction, anxiety reduction, and mood elevation) (Appendix F). The headings on the horizontal columns of table identified the content to be entered. First, the article was identified (column 1). Next, the article was classified (column 2) according to the three main types of quantitative research: experimental, quasi-experimental and non-experimental. Experimental research has a random sample, manipulates a variable, and has a control group that does not undergo the intervention or treatment (Newhouse et al., 2007). The hallmark of experimental studies is its internal validity, which attempts to show cause and effect between the independent and dependent variables (Newhouse et al., 2007). External validity is also important as it informs how well the study results are expected to be true in different settings, populations, and with different procedures (Newhouse et al., 2007). Quasi-experimental research does not have randomization and the control group is not an analogous control group. For instance to serve as a control in a quasi-experimental research study the control group may be the participant group but the measurements are taken before and after the intervention or just after the intervention. Another quasi-experimental control group may be measured at varying times during the research, or study participants have multiple treatments and serve as their own
control at varying times in the treatment process. Quasi-experimental research does have a study
group that is subject to an intervention or treatment. The final type of quantitative research is
non-experimental. Non-experimental research does not have randomization and there is no
intervention or treatment. Some control may be present in the study design (Newhouse et al.,
2007). There are two types of non-experimental research. The first is descriptive which seeks to
answer certain questions about a phenomenon and provides quantitative answers typically in the
form of frequencies and averages (Newhouse et al., 2007). The second is a correlational study
which provides information about how two variables are related and is expressed as a correlation
coefficient that falls between negative one and positive one (Newhouse et al., 2007). A positive
correlation coefficient means as one variable increases so does the other while a negative
correlation coefficient means as one variable increases the other decreases (Newhouse et al.,
2007). A correlation coefficient closer to either positive or negative one represents a strong
correlation between the two variables (Newhouse et al., 2007).

The sample and setting for the study was described (column 3). The intervention or
environmental change that was introduced in the study was described (column 4). The study
method or how data were collected and analyzed (column 5) which includes the use of
measurement tools to quantify the results was described (Newhouse et al., 2007; Polit & Beck,
2008). A brief summary of the results (column 6) of the study was entered (Newhouse et al.,
2007). After a critical appraisal of the research study weaknesses, a brief statement summarizing
the study’s weaknesses (column 7) was entered (Newhouse et al., 2007). Study strengths and
weaknesses were appraised by assessing the following: assessment of the research question and
causal relationship between the independent and dependent variables, assessment of the research
design choice and the strength of design, adequacy of the control description, adequacy of the explanation of the randomization procedures and its success or failure, the rigor and appropriateness of the research design, assessment of the intervention and the correct implementation of the intervention, assessment of the risk of bias on the part of the study staff, assessment of the appropriateness of timing of data collection, and assessment of type of comparisons made and the adequacy of the comparisons to demonstrate the relationship between the independent and dependent variables (Polit & Beck, 2008).

**Qualitative Designs**

Qualitative research explores narrative data about a particular phenomenon of interest (Polit & Beck, 2008). This section will discuss the appraisal of qualitative studies to be entered in the evidence synthesis table for qualitative research (adapted from Newhouse et al., 2007; Polit & Beck, 2008). The evidence synthesis table for qualitative research had three versions for each of the three outcomes of stress, anxiety, and mood (Appendix G). The headings for the evidence synthesis table for qualitative research included: the citation, research question, design and research tradition, sample and setting, data collection, rigor, data analysis, findings, theoretical integrity, interpretation and implications. These major headings will be discussed in detail.

The citation including the study authors, title of the article, date of publication, and name of the journal or publication was entered (column 1) followed by the research question (column 2), (Newhouse et al., 2007). The research question was reviewed for its conformity with the underlying philosophy, conceptual framework, and research tradition (Polit & Beck, 2008). Next is the design and research tradition (column 3). There are several research traditions and designs,
such as phenomenology, hermeneutics, ethnology, ecologic psychology, and grounded theory (Polit & Beck, 2008). Each has a specialized area of inquiry. For instance, ecologic psychology is concerned with how the environment affects behavior while phenomenology focuses on how an individual experiences their world (Polit & Beck, 2008). The sample population, sample size and setting were identified (column 4) followed by data collection (column 5). A review of data collection methods (e.g., interviews, recordings, videos or photographs) was noted. Assessment of whether data were collected by other methods to enhance rigor was also noted (column 6) (Polit & Beck, 2008). In qualitative research, there are several methods to enhance trustworthiness of the study findings (Polit & Beck, 2008). The studies were reviewed for researcher credibility and evidence of prolonged engagement of the researcher in the field collecting enough data to ensure saturation (Polit & Beck, 2008). Other strategies to enhance rigor is the technique of triangulation when several points of reference are used make inferences (Polit & Beck, 2008). Triangulation can be achieved through collection of multiple data sets or multiple timeframes or by having several investigators analyze the same data sets (Polit & Beck, 2008). Rigor is also enhanced through data with rich and extensive depictions. Qualitative data analysis (column 7) was identified according to the three main strategies of analytic styles (template analysis, editing analysis, and immersion style), (Polit & Beck, 2008). Each research tradition has an accompanying method of data analysis (Polit & Beck, 2008). A review of the data analysis included how the data were organized, the analysis process used, and whether it was consistent with the research tradition. Most importantly, the data analysis should demonstrate fidelity to a single data analysis tradition (e.g., phenomenological analysis, grounded theory analysis) (Polit & Beck, 2008). The analysis was assessed for its development
of a theme or classification of terms or a theory (Polit & Beck, 2008). A review of qualitative research findings for its effective use of quotations and supporting detail to summarize the findings was assessed (column 8) (Polit & Beck, 2008). Additionally, an assessment of the display of findings was made to verify the author’s conclusions (Polit & Beck, 2008). The findings were assessed in its ability to convey a meaningful and perceptive view of the phenomenon of interest. An assessment was made of theoretical integrity as evidenced by logical flow of ideas to create a cohesive theme including the use of a theoretical or conceptual framework (column 9) (Polit & Beck, 2008). Also, an assessment was made for the presence of maps, models or figures to aid a full understanding of the themes and patterns and the relationships between the ideas. A discussion of interpretation of findings and the implications of the results was assessed (column 10) (Polit & Beck, 2008). Interpretation should be within the research tradition or frame of reference and should be presented within the context of research literature (Polit & Beck, 2008). The discussion should include if the findings are generalizable or transferable to other settings or populations (Polit & Beck, 2008).

**Non-research Evidence**

Two types of non-research evidence were included in this review. The first type included systematic reviews and meta-analyses (Appendix H). The second type included organizational standards, healing environment guidelines, and expert opinion (Appendix I). The two tables for “other evidence” will be reviewed here.

For systematic reviews and meta-analyses (Appendix H) the citation including the study authors, title of the article, date of publication, and name of the journal or publication was entered (column 1) (Newhouse et al., 2007). The research question was reviewed for its clarity
and its clear intent to answer a clinical question (column 2) (Newhouse et al., 2007). An assessment of the search strategy for its full articulation was assessed, demonstrating whether the research can be reproduced (column 3). For instance, the authors of a systematic review provide information on the databases searched, key terms used, operational definition of terms, and inclusion and exclusion criteria. The search strategies were reviewed for their appropriateness and breadth of search to assess if any important resources were omitted (Newhouse et al., 2007). Inclusion and exclusion criteria were assessed to see if they clearly delineated which research articles would and would not appear in the review (column 4) (Newhouse et al., 2007). The article was assessed for inclusion of enough details from the studies to be able to appreciate the quality and relevance of included research articles (column 5) (Newhouse et al., 2007). An assessment of the disclosure of limitations to the systematic review process was entered (column 6) (Newhouse et al., 2007). An assessment regarding the similarity of the variables across the studies included in the systematic reviews was entered (column 7) (Newhouse et al., 2007).

The second type of non-research evidence to be evaluated was organizational standards and healing environment guidelines. These are typically generated by experts who collect data from a variety of sources such as research, professional clinical experience, and patient preferences (Newhouse et al., 2007). For this section there were nine criteria for review (Appendix I).

First were the authors, title, date of publication, and name of the journal or publication if available (column 1) (Newhouse et al., 2007). Next was an evaluation of the guidelines and standards for their reproducibility (column 2) (Newhouse et al., 2007). An assessment of the clinical utility and decision making was made (column 3) (Newhouse et al., 2007). This is an
assessment of how applicable the guidelines and standards are to clinical practice (Newhouse et al., 2007). Additionally this was an assessment of clarity of the guidelines to aide decision making by healthcare professionals (Newhouse et al., 2007). The guidelines were assessed to see if they were developed by a multidisciplinary process (column 4) (Newhouse et al., 2007). An indication of evidence of professional endorsement by leading organizations for the guidelines and standards was noted (column 5) (Newhouse et al., 2007). An indication of documentation that the guidelines and standards were evidence-based and drawn from peer reviewed journals was reported (column 6) (Newhouse et al., 2007). An assessment of the age and availability of the guidelines and standards was made (column 7) (Newhouse et al., 2007). Ideally they are less than five years old and available in electronic or print form (Newhouse et al., 2007).

**Rating Scales**

The final column of the review of evidence tables (qualitative, quantitative, and non-research evidence) was the research strength score. Johns Hopkins Nursing Evidence-Based Practice Model and Guidelines (Newhouse et al., 2007) describes research according to a hierarchy of scientific rigor and a scoring system that ranges from one to five. A score of ‘1’ indicates the highest research standards and includes experimental, randomized controlled trials (RCT) and meta-analyses (Newhouse et al., 2007). A score of ‘2’ is assigned to quasi-experimental studies (Newhouse et al., 2007). A score of ‘3’ is for qualitative studies, non-experimental studies or meta-synthesis (Newhouse et al., 2007). Non-research studies earn strength of evidence score of ‘4’ or ‘5’ according to the Johns Hopkins Nursing Evidence-Based Practice Model and Guidelines (Newhouse et al., 2007). A score of ‘4’ is awarded to the non-research category, which includes opinion of nationally recognized experts based on research
evidence or systemic reviews or clinical practice guidelines (Newhouse et al., 2007). A score of ‘5’ is for non-research based on the opinion of an individual or expert that is based on non-research evidence (Newhouse et al., 2007). This category of non-research would also include clinical expertise (Newhouse et al., 2007).

The second grading criteria according to the Johns Hopkins Nursing Evidence-Based Practice Model and Guidelines (Newhouse et al., 2007) reflected the quality of research. A grade level of ‘A,’ ‘B,’ or ‘C’ is applied to the strength score and indicates overall research quality based on the overall consistency of the results with study conclusions (Newhouse et al., 2007). A grade of ‘A’ indicates consistent results that allows for unambiguous conclusions to be drawn from the research whereas a grade of ‘C’ reflects inconsistent results without a case for conclusions to be drawn from the research (Newhouse et al., 2007). A grade of ‘B’ would not meet the threshold of consistency in results but could not be considered to have inconsistent results either falling between a grade of ‘A’ and ‘B’ (Newhouse et al., 2007). The quality grade of ‘A,’ ‘B,’ or ‘C’ (Newhouse et al., 2007) is dependent upon the quality of the individual research study.

Summary

There are three types of literature used in this systematic review (quantitative research, qualitative research and non-research literature). Different review criteria were identified for each type of literature. So that the review was conducted in a systematic fashion that could be easily synthesized, three different data collection tables (Appendix F, G, H and I) were constructed using the appropriate criteria. Further, since there were three outcomes (anxiety
reduction, stress reduction, and mood elevation) unique data collection tables were constructed for each type of literature and each outcome (Appendices F-I).

**Analysis Procedures**

Critical appraisal of literature occurred in a systematic fashion. This section describes how the information was stored and organized, the analysis process, assurance of reliability and validity of the appraisal process, literature synthesis, evidence translation, assurance of reliability and validity of evidence translation, and design creation.

**The Analysis Process**

The first step of analysis was gaining ready access to the research materials. All the research and non-research materials were stored in End-Note Library Database as well as in an electronic file. Electronic files were shared with the PI committee members who approved the final database to be used in the systematic review of the literature. The electronic files were labeled according to the three types of research (quantitative, qualitative, non-research systematic reviews, non-research guidelines and standards) and the outcome (stress reduction, anxiety reduction, and mood elevation). The electronic file folders contained all the research and non-research material that met the inclusion criteria from the literature search. There were a total of 12 electronic file folders and hard copy file folders with the following headings:

1) Quantitative research with outcome of stress reduction
2) Quantitative research with outcome of anxiety reduction
3) Quantitative research with outcome of mood elevation
4) Qualitative research with outcome of stress reduction
5) Qualitative research with outcome of anxiety reduction
6) Qualitative research with outcome of mood elevation
7) Non-research systematic reviews with outcome of stress reduction
8) Non-research systematic reviews with outcome of anxiety reduction
9) Non-research systematic reviews with outcome of mood elevation
10) Non-research guidelines and standards with outcome of stress reduction
11) Non-research guidelines and standards with outcome of anxiety reduction
12) Non-research guidelines and standards with outcome of mood elevation

For the analysis process, print copies of the research and non-research materials were made. The articles were read to determine the type of research or non-research and the outcome. Then the articles were sorted according to the type of research or non-research and the outcome. The articles were then placed into the 12 categories as listed above and placed into one of the 12 files according to the appropriate heading.

Once the literature types were identified, the appropriate review criteria were used to guide the critical appraisal process. First the article was read and re-read and manual notes were taken. A full assessment of the article was made using the criteria noted in the evidence synthesis tables and results from this analysis were entered into the electronic form of the appropriate evidence synthesis table. This process was repeated until all 12 evidence synthesis tables were completed with reviews of the available research and non-research materials collected from the systematic review of the literature.

**Assuring reliability and validity of the appraisal process.** To ensure the literature review process was applied consistently, Dr. Koithan audited 20% of the articles in each
category. Dr. Koithan independently completed the appropriate evidence synthesis table and results were compared with the PI’s results, ensuring that there was agreement 90% of the time.

**Literature Synthesis**

Once the evidence was rated, evidence synthesis tables were completed. These tables synthesized the evidence according to the strength and quality of the research evidence. There were three evidence analysis tables, one for each of the outcomes of stress reduction, anxiety reduction, and mood elevation. Evidence summation tables quantified how many level 1-5 studies (1-experimental, 2-quasi-experimental, 3-qualitative, 4-guidelines and standards, 5-expert opinion and clinical experience) were found, a brief statement of the findings, and a composite quality grade for each level of evidence levels 1-5. Thus, evidence summation tables constructed a composite view of all the available evidence that facilitated an evaluation of the quantity, quality, and strength of the evidence (Newhouse et al., 2007).

Once the summary and synthesis was completed, the evidence was translated into clinical practice based on (a) evidence quality and (b) goodness of fit and feasibility for a psychiatric inpatient unit, comparing the evidence with the clinical setting and staffing procedures and policies (Newhouse et al., 2007). Newhouse et al (2007) recommends that evidence is (a) of high quality, (b) safe (no apparent risk to the patient or staff), (c) potentially beneficial patient and staff outcomes, (d) better for unit operations, and (e) cost effective in order to be considered appropriate for translation into clinical practice.

In this project, “appropriate” evidence used to construct an inpatient psychiatric healing environment was based on the following criteria.
Quality Criteria

Evidence which has a poor quality grade of ‘C’ was not translated to practice (Newhouse et al., 2007). Research receiving a ‘C’ grade has inconsistent results, inadequate sample size, offers no conclusive findings or represents poorly designed research studies (Newhouse et al., 2007). Once recommendations based on high-quality evidence were identified, each recommendation was rated as strongly recommended, recommended, or not recommended based on the quantity and quality of the available evidence. This information was recorded on the evidence summation tables for each of the three outcomes of anxiety reduction, stress reduction, and mood elevation.

Goodness of Fit and Feasibility Criteria

To be translated into clinical practice, even the most strongly recommended evidence must be feasible and practical in the particular setting. Newhouse et al. (2007), state that evidence must be safe for clients and staff; improve the conditions, operations and outcomes of the unit; and if possible, improve cost effectiveness. When considering evidence-based environmental design recommendations, this means assuring that the design elements conform to state law/regulations and industry standards that have been developed to assure safety and improve the quality of psychiatric inpatient units. State law/regulations and industry standards are derived from standards of care based on clinical experience and best practice (Henderson, 2012). Clinical experience and best practice are developed incrementally in the field to create a body of precedent that has evolved over time (Henderson, 2012). In the health care setting these precedent are often adopted as hospital policy or guidelines and standards for clinical practice (Henderson, 2012). Once becoming an established part of clinical practice and health care policy
at the agency level, these standards are often adopted to form the basis of state law (Henderson, 2012). To ensure recommendations are in compliance with these precedents, a filtering process was used to determine if the recommendations met state law and industry standards. This process is depicted in Figure 6.
This filtering process was completed using a series of tables (Appendices F-J). Arizona State statutes and regulations identify the legal requirements for inpatient unit rooms (Arizona Department of Health, 2012), including: size specifications, wall, window and door construction specifications, access and egress specifications, bedroom storage and table requirements, bed linens, lighting, window and door covers, fire safety requirements, unit locking procedures and mobility features.

Industry standards identify requirements necessary for accreditation and federal/state reimbursement for care (Joint Commission Comprehensive Accreditation Manual for Behavioral Health Care, Joint Commission, 2012). The environmental requirements include specifications about: safety and security risk management, interior spaces design, storage, bathrooms, lighting, ventilation, heating and cooling (interior temperatures and humidity), cleanliness, furnishings, locks, meet organization and program goals and are in compliance with the law, and organization keeps furnishings and equipment in safe and good repair.

Statutory requirements and standards were entered into comparison tables along the horizontal axis (Appendix K). The complete list of design recommendations was then be entered along the vertical axis. Each recommendation was rated according to its compliance with the state law and industry standard. Recommendations were scored as (a) “1” if it was within the guidelines or represented no challenge to the guideline; (b) “2” if the recommendation challenged the guidelines and there represented a critical or potential harm to patient or staff.

**Design Creation**

Evidence-based design elements for an inpatient psychiatric setting were identified at the conclusion of evidence translation. These elements were used to draw plans for an inpatient
psychiatric patient room. The drawing was executed using Computer Aided Design (CAD) program to create a floor plan with dimensions of the room, placement of the windows, doors, and walls. The placement of furnishings such as the bed, writing table, and chair was also illustrated in the floor plan. Suggested furnishings were made for the type of bed, table and chair to be used. A finishing schedule was also provided to specify finishing materials with specifications such as dimensions, manufacturers, and construction materials. Examples of the finishing materials to be included were the type of window, type of flooring, type of door hinges, and type of bathroom fixtures. This final step of the evidence translation process resulted in evidence for translation of research into clinical practice that was safe, appropriate, and beneficial.

**Conclusion**

This practice inquiry sought to solve a clinical practice problem by systematically searching for available evidence regarding the use of healing environments to create humane inpatient environments for patients with psychiatric disorders. Research and non-research evidence was critically appraised and evaluated for their appropriateness for translation into practice. Based on the available evidence, an inpatient psychiatric patient room was designed using a CAD program to illustrate the application of elements of a healing environment to an inpatient psychiatric room.
CHAPTER FOUR: RESULTS

This systematic literature review (SLR) was conducted to determine what factors in the inpatient healthcare environment support an optimal healing environment. This chapter describes the results of this analysis. The literature selection processes, including initial screening of titles and abstracts are discussed. The analysis of the research evidence is then reported with an evidence summary that identifies the strength and quality of the available research on the topic of healing environments. This is followed by a synthesis of the literature on healing environments. Eight synthesis tables, each depicting an intervention found in the research literature that supports a healing environment, are provided. Design implications for each intervention are thoroughly described and discussed, concluding with final recommendations for inpatient room design. These recommendations are then filtered through the laws and industry standards applicable to psychiatric in-patient environments in order to identify design recommendations consistent with both healing environments and safety/quality standards for inpatient psychiatric care.

Initial Search

A PICO question was devised to aid the search process. This systematic literature review began with the following three PICO questions:

1) In hospitalized patients, which elements of a healing environment effect stress?
2) In hospitalized patients, which elements of a healing environment effect anxiety?
3) In hospitalized patients, which elements of a healing environment effect mood?

The initial search terms used for the search are in Table 1.
TABLE 1. Initial Search Terms

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>i.</td>
<td>inpatients,</td>
</tr>
<tr>
<td>ii.</td>
<td>hospitalized patients,</td>
</tr>
<tr>
<td>iii.</td>
<td>psychiatric inpatients,</td>
</tr>
<tr>
<td>iv.</td>
<td>evidence-based design,</td>
</tr>
<tr>
<td>v.</td>
<td>hospital design,</td>
</tr>
<tr>
<td>vi.</td>
<td>healthcare design,</td>
</tr>
<tr>
<td>vii.</td>
<td>built environment,</td>
</tr>
<tr>
<td>viii.</td>
<td>healing environments,</td>
</tr>
</tbody>
</table>
(ix. | mental health, |
|x. | spiritual |
|xi. | stress, |
|xii. | depression, |
|xiii. | emotion, |
|xiv. | anxiety, |
|xv. | mood, |
|xvi. | satisfaction, |
|xvii. | nature, |
|xviii. | biophilia, |
|xix. | plants, |
|xx. | daylight, |
|xxi. | garden, |
|xxii. | nature views, |
|xxiii. | landscape, |
|xxiv. | windows, |
|xxv. | sunlight, |
|xxvi. | color and |
|xxvii. | art. |

(Synonyms and related terms were also used and included hospital and interior design, facility design, optimal healing environments, horticulture, daylight, and artwork)

The initial search strategy (Appendix I) and key search terms (Table 1) were applied to four databases (PubMed, CINAHL, PsycInfo, Web of Science). Additionally, search terms were used to search three peer reviewed journals (Health Environment Research and Design, BMC)
Complementary and Alternative Medicine and Environment and Behavior) and one website (www.healthdesign.org/). Hand searches were also conducted of eight reference lists of key research articles on the subject of OHEs. A flow chart of the initial search results is illustrated in Figure 7.

FIGURE 7. Flow Chart of Initial Search Results

This initial search yielded 4,144 research articles related to the PICO terms. After the PICO questions with the outcomes of stress, anxiety and mood were applied, only nine articles were found with these same outcomes. This preliminary result was discussed with the committee, and the committee decided that a systematic review of the literature could not be conducted with so few articles. The committee recommended revising the PICO question to a broader outcome of OHEs. The revised PICO question became: What design factors in the inpatient healthcare environment support an optimal healing environment?
The Samueli Institute’s definition of OHEs was chosen for its most comprehensive view of OHEs and its inclusion of the architectural design of the hospital (https://www.samueliinstitute.org/our-research/optimal-healing-environments/ohe-framework).

Therefore, optimal healing environment was defined as:

an environment in which the social, psychological, spiritual, physical and behavioral components of an organization are oriented toward the support and stimulation of inherent healing capacities of the participants (employees, patients and their families), their relationships and their surroundings. Optimal Healing Environments optimize all aspects of the inner, interpersonal, behavioral, and external environments that touch patients, employees and leaders—from their hopes and intentions, to their relationships, their health behaviors, their treatments, and the buildings where they work and receive care.

External Optimal Healing Environment was defined as:

Building healing spaces: Healing spaces are designed to optimize and improve the quality of care, outcomes and experiences of patients and staff. Design components that foster wellness and recovery include evidence-based architectural design; color choices; and access to nature, music, art and light (https://www.samueliinstitute.org/our-research/optimal-healing-environments/ohe-framework/external).

Based on this PICO question revision and the definition of OHE, the search terms were revised. Additionally, only three tables were needed for the analysis (qualitative, quantitative, systematic literature review) because of the single outcome of OHEs. No changes were made to the method of evaluation of the research. With these changes, a new search was conducted.

Search Strategy and Literature Selection

The search strategy (Appendix J) and key search terms (Table 2) were applied to six databases (PubMed, CINAHL, PsycInfo, Web of Science, Google Scholar, Avery Index to Architectural Periodicals).
<table>
<thead>
<tr>
<th>Search terms (used alone, in combinations and synonyms used):</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. inpatients,</td>
</tr>
<tr>
<td>b. hospitalized patients,</td>
</tr>
<tr>
<td>c. acute care</td>
</tr>
<tr>
<td>d. Intensive care unit</td>
</tr>
<tr>
<td>e. psychiatric inpatients,</td>
</tr>
<tr>
<td>f. evidence-based design,</td>
</tr>
<tr>
<td>g. hospital design,</td>
</tr>
<tr>
<td>h. healthcare design,</td>
</tr>
<tr>
<td>i. health facility environment,</td>
</tr>
<tr>
<td>j. built environment,</td>
</tr>
<tr>
<td>k. environment design,</td>
</tr>
<tr>
<td>l. spatial layout</td>
</tr>
<tr>
<td>m. healing environments,</td>
</tr>
<tr>
<td>n. holistic health,</td>
</tr>
<tr>
<td>o. mental health,</td>
</tr>
<tr>
<td>p. mental healing,</td>
</tr>
<tr>
<td>q. stress,</td>
</tr>
<tr>
<td>r. depression,</td>
</tr>
<tr>
<td>s. emotion,</td>
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<tr>
<td>t. anxiety,</td>
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<tr>
<td>u. mood,</td>
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<tr>
<td>v. satisfaction,</td>
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<tr>
<td>w. nature,</td>
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<tr>
<td>x. biophilia,</td>
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<tr>
<td>y. plants,</td>
</tr>
<tr>
<td>z. daylight,</td>
</tr>
<tr>
<td>aa. garden,</td>
</tr>
<tr>
<td>bb. nature views,</td>
</tr>
<tr>
<td>cc. landscape,</td>
</tr>
<tr>
<td>dd. windows,</td>
</tr>
<tr>
<td>ee. sunlight,</td>
</tr>
<tr>
<td>ff. color,</td>
</tr>
<tr>
<td>gg. artwork</td>
</tr>
</tbody>
</table>
The search resulted in the identification of 5,561 articles and after 19 duplicates were removed, there were 5,542 articles screened (Figure 8).

FIGURE 8. Database Searches
After screening titles and abstracts for the inclusion and exclusion criteria, 5,489 articles were excluded, and a review of the full text was completed on the remaining 53 articles. Of these 53 eligible articles, 27 articles were excluded from the systematic review for reasons that are described in Table 3.

TABLE 3. Rationale for Exclusion of Literature

<table>
<thead>
<tr>
<th>Reason for ineligibility after review of full text</th>
<th>Number of ineligible articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-empirical article (opinion or editorial and not research)</td>
<td>n = 3</td>
</tr>
<tr>
<td>Summary of original research</td>
<td>n = 1</td>
</tr>
<tr>
<td>Literature review but not a systematic literature review</td>
<td>n = 3</td>
</tr>
<tr>
<td>Population other than inpatients (e.g., staff, outpatients, healthy volunteers, patients with dementia that were cognitively impaired)</td>
<td>n = 9</td>
</tr>
<tr>
<td>Settings other than the hospital (e.g., nursing homes, dental offices, waiting rooms)</td>
<td>n = 3</td>
</tr>
<tr>
<td>Interventions other than an inpatient environmental feature (e.g., therapeutic interventions such as yoga, meditation or group therapy)</td>
<td>n = 5</td>
</tr>
<tr>
<td>Outcome other than healing environments (e.g., operating costs, infection control)</td>
<td>n = 3</td>
</tr>
</tbody>
</table>

Additionally, a hand search was conducted using the reference lists from four systematic literature reviews, including three from the Center for Health Design and one Cochrane review. This hand search of 1,311 titles yielded another 12 articles after duplicates were removed (Figure 9).
FIGURE 9. Hand Searches

Full text articles were then reviewed to determine eligibility. Of the 23 eligible articles, 11 articles were excluded from the systematic review for reasons that are described in Table 4.
TABLE 4. Rationale for Exclusion of Literature

<table>
<thead>
<tr>
<th>Reason for ineligibility after review of full text</th>
<th>Number of ineligible articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literature review but not a systematic literature review</td>
<td>n = 1</td>
</tr>
<tr>
<td>Population other than inpatients (e.g., staff, outpatients, healthy volunteers, patients with dementia that were</td>
<td>n = 5</td>
</tr>
<tr>
<td>cognitively impaired)</td>
<td></td>
</tr>
<tr>
<td>Settings other than the hospital (e.g., built environment or natural environment)</td>
<td>n = 1</td>
</tr>
<tr>
<td>Interventions other than an inpatient environmental feature (e.g., therapeutic interventions such as yoga, meditation</td>
<td>n = 4</td>
</tr>
<tr>
<td>or group therapy, administrative policy)</td>
<td></td>
</tr>
</tbody>
</table>

Following this hand search, a total of 12 articles were determined to meet the criteria for inclusion in this systematic review. Therefore, the total number of eligible articles for inclusion in this systematic literature review was 38 (Figure 10). The literature was then analyzed using evidence analysis tables described in Chapter 3. Completed tables, one for each research article (n = 38), are found in Appendix F.
FIGURE 10. Search Totals

Study Characteristics

Source Population

The source populations for the literature on OHE are from diverse geographic origins and are depicted in Table 5. Fourteen of the OHE studies (n = 38) reviewed or 37% originated in European countries, including the United Kingdom (n = 7 or 18%), the Netherlands (n = 2 or 5%), Norway (n = 1 or 3%), Sweden (n = 1 or 3%), Austria (n = 1 or 3%), Scotland (n = 1 or
3%) and Italy (n = 1 or 3%). Studies have also been conducted in Korea (n = 2 or 5%) and Canada (n = 2 or 5%). Nineteen (50%) of the identified literature were from the United States.

**TABLE 5. Source Population of Research on Optimal Healing Environments**

<table>
<thead>
<tr>
<th>Country of Origin for Research</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>1</td>
</tr>
<tr>
<td>Canada</td>
<td>3</td>
</tr>
<tr>
<td>Italy</td>
<td>1</td>
</tr>
<tr>
<td>Korea</td>
<td>2</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2</td>
</tr>
<tr>
<td>Norway</td>
<td>1</td>
</tr>
<tr>
<td>Scotland</td>
<td>1</td>
</tr>
<tr>
<td>Sweden</td>
<td>1</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>7</td>
</tr>
<tr>
<td>United States</td>
<td>19</td>
</tr>
</tbody>
</table>

**Methodological Characteristics**

The most frequent study design in the OHE literature was non-experimental (n = 18). Descriptive, non-experimental studies (n = 7), provided information about interior lighting, noise levels and access to mirrors in the healthcare environment. These descriptive studies most frequently focused on noise levels in hospitals (n = 5), (Aitken, 1982; Baker, 1992; Balough, Kittinger & Hackl, 1993; Busch-Vishniac, West, Barnhill, Hunter, Orellana & Chivukula, 2005; Holmberg & Coon, 1999). Of these five studies, three were conducted in the Intensive Care Unit (Baker, 1992; Balough, Kittinger & Hackl, 1993; Busch-Vishniac, West, Barnhill, Hunter, Orellana & Chivukula, 2005;), one on general hospital unit (Aitken, 1982) and one in a psychiatric hospital (Holmberg & Coon, 1999). Other studies investigated the relationship between psychiatric hospital census and the incidence of seclusion and restraint of patients and patient satisfaction with a variety of environmental features, such as interior finishing materials, photographic exhibitions, paint, exposure to light, single or shared hospital rooms and

There were 10 quasi-experimental studies in the sample (Choi, Beltran & Hway-Suh, 2012; Christenfeld, Wagner, Pastva & Acrish, 1989; Duncan, 2011; Hagerman, Rasmanis, Blomkvist, Ulrich, Eriksen & Theorell, 2005; Moore, Nguyen, Nolan, Robinson, Ryals, Imbrie et al., 1998; Nanda, Eisen, Zadeh & Owen, 2011; Olsen, 1984; Overman Dube, Barth, Cmiel, Cutshall, Olson, Sulla et al., 2008; Park & Mattson, 2008; Southard, Jarrell, Shattell, McCoy, Bartlett & Judge, 2012). One quasi-experimental study investigated the effect of windows on length of stay (Beltran & Hway-Suh, 2012). Three quasi-experimental studies investigated noise. Two of these compared noise levels before and after nursing interventions to reduce noise (Moore, Nguyen, Nolan, Robinson, Ryals, Imbrie et al., 1998; Overman Dube, Barth, Cmiel, Cutshall, Olson, Sulla et al., 2008) and examined the effect of noise on physiological outcomes in patients in a coronary care unit (Hagerman, Rasmanis, Blomkvist, Ulrich, Eriksen & Theorell, 2005). Artwork (n = 1) was studied to determine patient preference for artwork, its effect on medication needs and medication costs in psychiatric inpatients (Nanda, Eisen, Zadeh & Owen, 2011). Artwork (n = 1) was also studied to determine its effects on labor and delivery times and medication use (Duncan, 2011). Three studies (Christenfeld, Wagner, Pastva & Acrish, 1989; Olsen, 1984; Southard, Jarrell, Shattell, McCoy, Bartlett & Judge, 2012) examined the effects of change to the physical environment. Open and closed nursing stations in a psychiatric inpatient
unit (n = 1) were investigated to measure their effect on ward atmosphere (Southard, Jarrell, Shattell, McCoy, Bartlett & Judge, 2012). Another study examined differences in patient satisfaction and behavior in response to unit types (progressive or home-like versus traditional) (Olsen, 1984). One study used a pre-posttest post occupancy interview to determine the effects of a psychiatric inpatient ward remodel on patient satisfaction, violence and self-esteem measures (Christenfeld, Wagner, Pastva & Acrish, 1989). Lastly, a single study compared the effects of having a plant in a post-operative hospital recovery room as compared to no plant post-operative hospital recovery room and its effects on pain medication usage, health outcomes and satisfaction (Park & Mattson, 2008).

Experimental studies (n = 3) were rare in the OHE literature, and it is significant to note that all investigated the same intervention of window orientation and daylight or bright light. These randomized controlled clinical trials (RCTs) investigated the effects of window orientation (east) and daylight on mood and LOS (n = 2), (Beauchemin & Hays, 1996; Benedetti, Colombo, Barbini, Campori & Smeraldi, 2001), and the effects of window orientation (bright light versus blocked daylight) and daylight on pain medication use and costs (n = 1) (Walch, Rabin, Day, Williams, Choi & Kang, 2005).

Four systematic literature reviews (Daykin, Byrne, Soteriou & O’Connor, 2008; Dijkstra, Pieterse & Pruyn, 2006; Rubin, Owens & Golden, 1998; van de Glind, de Roode & Goossenssen, 2007), two integrative literature reviews (Ulrich et al., 2004, 2008) and one meta-analysis about OHEs were identified (Drahota, Ward, Mackenzie, Stores, Higgins, Gal et al., 2012). Two SLRs and two integrative literature reviews broadly examined the literature to determine the state of the evidence for various characteristics of a healing environment (Dijkstra, Pieterse & Pruyn,
The meta-analysis is the Cochrane Review by Drahota et al. (2012), which investigated sensory environments, health outcomes and health care environments across a variety of settings. This meta-analysis included only randomized clinical trials, controlled clinical trials, controlled before and after studies and interrupted time series (n= 102). Ulrich et al. (2008) conducted an integrative literature review that examined how environmental characteristics influence patient, family and staff outcomes (n=459). Ulrich et al. (2004), conducted a similar study four years earlier to investigate the role of the physical environment in the 21st century hospital (n = 653). Settings under investigation in the research included inpatient, outpatient and non-patient healthcare areas. Dijkstra, Pieterse and Pruyn (2006) examined the characteristics of healing environments and included only controlled clinical trials (n = 30). Settings included in this review included inpatient hospital rooms, outpatient clinics, dental practices and waiting rooms. Rubin, Owens and Golden (1998) conducted a SLR to determine what evidence exists linking physical environment to physiological health, adverse events or complications and patient evaluation of their health, well-being or functional status (n = 84). Only fourteen studies were determined to have clinical application and were included in the review. This review included randomized clinical trials, experimental and observational studies. Settings included inpatient hospital rooms, outpatient clinics and dental practices.

Two additional SLRs were conducted on a single intervention. The first was a SLR that sought to investigate the impact of visual art on well-being of patients and staff in mental healthcare settings (n=19) (Daykin, Byrne, Soteriou & O’Connor, 2008; van de Glind, de Roode & Goossensen, 2007). The second SLR focused on a single intervention (single vs. shared
hospital rooms) and the following outcomes privacy, sleep quality, noise, satisfaction, infection rates, safety and recovery rates (n=25) (van de Glind, de Roode & Goossensen, 2007).

**Methods Quality**

Each of the articles were scored using the Johns Hopkins Nursing Evidence-Based Practice Model and Guidelines (Newhouse et al., 2007) which was described in Chapter 3, generating two scores. The first score indicates the strength of the evidence based on the research design used. A score of I refers to an experimental study/randomized controlled trial or meta-analysis of RCT. A score of II includes quasi-experimental studies. A score of III refers to non-experimental studies, qualitative studies or meta-syntheses. A score of IV refers to opinion of nationally recognized experts based on research evidence or expert consensus panel, systematic reviews and clinical practice guidelines. A score of V refers to opinion of individual expert based on non-research evidence including case studies, literature review and organizational experience such as quality improvement, financial data, clinical experience and personal experience. The second score (A, B or C) is a quality score summarizing the overall research quality (based on its adherence to design principles and scientific rigor). In this scale, a grade of A is awarded to the highest quality of research that shows consistent results with adequate sample size and control, and definitive conclusions (Newhouse et al., 2007). A score of B shows reasonably consistent results with adequate sample size, some control and moderately definitive conclusions (Newhouse et al., 2007). A grade of C reflects inadequate evidence and inconsistent results without a case for conclusions to be drawn from the research (Newhouse et al., 2007).
Summary

Overall, the most frequent types of research conducted on OHEs are quasi-experimental and non-experimental studies with non-experimental being the most frequent type of research on OHEs. Rarer in research on OHEs are RCTs. Additionally, there have been several SLRs and integrative literature reviews to investigate the effects of sensory or healing environments in the healthcare setting. Table 6 summarizes the quantity of research at each level of strength of research and the quality of the research.
<table>
<thead>
<tr>
<th>Evidence Strength and Type of Research/Non-research</th>
<th>Total Number of Admissible Articles (after C quality articles removed)</th>
<th>Total Number Reviewed</th>
<th>Brief Statement of Findings (primary author given/strength and quality grade)</th>
<th>Quality Grade A</th>
<th>Quality Grade B</th>
<th>Quality Grade C *Inadmissible</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Experimental</td>
<td>4</td>
<td>4</td>
<td>Beauchemin (1996), (IB): Evidence suggests eastern window exposure contributes to reducing LOS in depressed patients. (n = 174), setting: Edmonton, Alberta psychiatric hospital.</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Benedetti (2001), (IB): Evidence suggests east facing rooms contributes to reducing LOS in bipolar depression only. (n = 415 unipolar and n = 187 bipolar), setting: Canadian psychiatric hospital.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Drahota/Cochrane Review (2012), (IA): This meta-analysis of RCTs investigated the effects of the hospital environment on patient outcomes. 16 databases were searched and of the 102 articles reviewed, 85 were related to music. The review found support that music may help patient anxiety, but does not appear to effect physiological outcomes. Only 17 articles were found on other sensory environmental features. The remaining 17 articles on all other interventions do not meet the threshold to make evidence-based design decisions.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Walch (2005), (IA): Evidence supporting west facing rooms to decrease pain medication use and costs. (n = 89), setting: postoperative unit, general hospital, Bronx, NY.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evidence Strength and Type of Research/Non-research</td>
<td>Total Number of Admissible Articles (after C quality articles removed)</td>
<td>Total Number Reviewed</td>
<td>Brief Statement of Findings (primary author given/strength and quality grade)</td>
<td>Quality Grade A</td>
<td>Quality Grade B</td>
<td>Quality Grade C *Inadmissible</td>
</tr>
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</tr>
<tr>
<td>II. Quasi-experimental</td>
<td>6</td>
<td>10</td>
<td>Choi (2012), (IIB): This quasi experimental with some control, compares two different window orientations (SE vs. NW) and offers no clear evidence supporting window orientation to reduce hospital LOS. (n = 1167), setting: internal medicine otolaryngology, surgery, and gynecology units in a general hospital, Incheon, Korea.</td>
<td>0</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Christenfeld (1989), (IIB): This mixed methods study (pre and posttest study design and qualitative key informant post occupancy interview) provides some evidence to support complete psychiatric ward remodel to improve patient self-image, patient satisfaction and patient violence. (n = 36 pre and posttest and n = 44 control), setting: NY State psychiatric hospital.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Duncan (2011), (IIB): This controlled trial (without randomization) provides weak support for the use of visual art screens to shield emergency equipment from view in the labor and delivery room to decrease the duration of labor. (n = 26 treatment group and n = 32 control), setting: Labor and Delivery unit, two UK hospitals.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Hagerman (2005), (IIC): This quasi experimental study provides weak evidence that sound absorbing acoustic ceiling tiles may reduce the physiologic consequences of poor acoustical environments during acute illness. (n = 31 patients in the bad acoustics group and n = 63 in the good acoustics group), (setting: coronary care unit).</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Moore (1998), (IIC): This quasi-experimental study with pre and posttest design to investigate the effects of staff interventions on the level of noise on the unit. This study</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evidence Strength and Type of Research/Non-research</td>
<td>Total Number of Admissible Articles (after C quality articles removed)</td>
<td>Total Number Reviewed</td>
<td>Brief Statement of Findings (primary author given/strength and quality grade)</td>
<td>Quality Grade A</td>
<td>Quality Grade B</td>
<td>Quality Grade C</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
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</tr>
<tr>
<td>provides weak evidence that the closing patient’s doors decreases the perceptible noise levels in patients’ rooms. (2 intensive care units studied).</td>
<td>Nanda (2011), (IIC): This mixed methods study provides weak support for the display of realistic nature art on psychiatric inpatient units to reduce PRN incidents and costs. (average patient census n = 7 over 21 days).</td>
<td>Olsen (1984), (IIB): This quasi-experimental study compares traditional vs. progressive units and utilizes patient interview, behavior mapping and questionnaires to investigate patient responses to the units. There is some evidence to support progressive care settings with lounges, patient pantry and dining areas for surgical care patients are rated more favorably, and patients were more active and social than on traditional units. (n = 90), setting: medical/surgical unit, urban hospital, northeast US.</td>
<td>Overman Dube (2008), (IIB): This mixed method, quasi experimental study uses pre and posttest study and descriptive designs providing evidence supporting patient reports that mornings are the noisiest, most bothersome time of day. Evidence supports the use of interventions to reduce noise such as closing the patient doors, low light and reducing noises from equipment. (n = 775 pre-noise assessments and n = 704 post noise assessments).</td>
<td>Park (2008), (IIB): This controlled trial (without randomization) provides evidence supporting plants in the hospital room during post-operative recovery having positive effects on health outcomes and greater patient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evidence Strength and Type of Research/Non-research</td>
<td>Total Number of Admissible Articles (after C quality articles removed)</td>
<td>Total Number Reviewed</td>
<td>Brief Statement of Findings (primary author given/strength and quality grade)</td>
<td>Quality Grade A</td>
<td>Quality Grade B</td>
<td>Quality Grade C</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
<td>-----------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>----------------</td>
<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>III. Non-Experimental/Qualitative</td>
<td>11</td>
<td>18</td>
<td>satisfaction with their hospital rooms. (n = 90), setting: post-operative unit, suburban Korean hospital.</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Southard (2012), (IIC): No significant differences were found in the Ward Atmosphere scale from pretest to posttest of remodeled psychiatric units with renovated nurses’ station from closed to open stations.</td>
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<td>Aitken (1982), (IIIB): This descriptive study provides details about noise levels in the hospital. The results show that the quietest times were in the morning and the noisiest times were at night. The equivalent continuous sound levels ranged between 50—60 dBA. (n = 2 units in the hospital)</td>
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<td>Baker (1992), (IIIC). This descriptive study provides details about the noise levels in a surgical intensive care unit (SICU). The sound pressure level (SPL) ranged from 49.1 to 68.6 dBA. The grand mean SPL was 60.5-62.4 dBA. The loudest hour was during shift change, assessments and during procedures. The quietest hour was 7-8 pm. (n = 28 SICU patients).</td>
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<td>Balough (1993), (IIIB). This descriptive study provides details about noise levels in an intensive care unit (ICU). During the daytime dBA levels range from 60-65. At night dBA levels remain greater than 60. Most alarms reach 60-80 dBA and on average 2.1±0.8 alarms per patient per hour occurred. (n = 16 ICU patients).</td>
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<td>Brooks (1994), (IIB): This study investigated the correlation between hospital census and incidents of seclusion and restraint. Evidence supports 100 square feet of space or more per patient on psychiatric units to reduce</td>
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<td>seclusion and restraint incidences. (mean census across 6 units = 19.8), setting: large, urban psychiatric hospital.</td>
<td>Busch-Vishniac (2005). This descriptive study provides details about noise levels in the ICU environment. Acoustic tile did show consistently lower dBA levels. A closed door yielded a 2.2 dBA level reduction. Nurses’ stations were 1-2 dBA levels above other areas. Average sound equivalent SPL vary from 50-60 dBA. Observed sound levels are at least 20 dBA greater than World Health Organization Guidelines. Noise levels by time of day showed little to no variation. Hand held telecommunicators to replace overhead paging lowered dBA by 5.4 dBA. (n = 5 intensive care units).</td>
<td>Dolce (1985), (IIIC): This non-experimental study (medical record review) investigates narcotic pain medication usage in private and semi-private rooms. The data do not support the hypothesis that room type is a predictive variable for narcotic use. (n = 40 patients in private rooms and n= 40 patients in semi-private rooms).</td>
<td>Florey (2009), (IIIC): This study used a survey methods and found weak evidence showing a preference for shared rooms among patients with median age of 68 with median length of hospitalization of 5.5 days. (n = 80), (setting: general hospital)</td>
<td>Freysteinson (2008), (IIIB): Descriptive study provides detail about the mean number of hospitals with mirrors in hospital room (mean = 2.1), total mirror coverage (0.2 to 2.1 meters squared), magnet status hospitals built after</td>
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<td>1989 have greatest mirror coverage and multiple barriers prevent viewing of body. (n = 10 hospitals), setting: 200-900 bed US hospitals</td>
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<td>Douglas (2004), (IIIC): Patient interviews about the hospital experience found weak support for the following themes: sense of personal space, home atmosphere, meeting patient needs, usable physical design, access to out of doors, effective communication and recreational facilities.</td>
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<td>Dunn (2010), (IIIB): This descriptive study identifies light sources, which may unnecessarily cause light exposure in a surgical ICU (sink lights and overhead lights) as well as the activity associated with the most illumination (lab collection). (n = 21), setting: surgical ICU, Midwest US hospital.</td>
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<td>Harris (2002), (IIIB): Mixed methods study using description, interviews and surveys found some evidence that the strongest predictor of overall patient satisfaction with hospitalization included nursing care followed by perceived quality of clinical care and environmental satisfaction. Hospital environments are not the strongest predictor of satisfaction with hospitalization. (n = 380), setting: Intermountain Healthcare, Inc., US.</td>
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<td>Holmberg (1999), (IIIB): Descriptive study found that the mean sound level for the adult psychiatric units was 76.54 (dBA) with range from 74.85 dBA to 81.32 dBA. It is theorized that these sound levels may reduce reaction times and cognitive performance. (n = 1 hospital), setting:</td>
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<td>state psychiatric hospital.</td>
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<td>Nyrud (2010), (IIIB). The study utilized questionnaires to find some evidence that hospital employees prefer hospital rooms with an intermediate amount of wood interior furnishings. Very few patients (n = 6) responded to the questionnaire. Setting: Norwegian hospital.</td>
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<td>Pattison (1996), (IIIC): This non experimental questionnaire comparing Nightingale wards to bay wards provides weak flawed evidence that bay ward designs were preferable. Bay ward patients felt they were visible to nursing staff. There were statistically significant differences in noise between the two ward types and the bay wards were quieter. (n = 32 patients on a Nightingale ward and n = 32 patients on a bay ward).</td>
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<td>Rowlands (2008), (IIIC): This study conducted patient interviews and found weak support for the identification of the following themes regarding patients’ views of ward environments and health impacts: importance of the staff to the patients, the care environment effects mood, preference for multi-bedded wards and importance of contact with nature.</td>
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<td>Suter (2007), (IIIC): This study conducted interviews and found inconsistent evidence for the effects of a program, which allows patients to choose artwork for their hospital rooms.</td>
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<td>Trevisani (2010), (IIIB): Survey instruments and performance measurement scales were used to find some</td>
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<td>support for photographic exhibition in the hospital. Results supported patients felt it made their stay more pleasant. Restorative effects of the exhibit were associated with patient age, functional status, perceived prognosis, perceived wellness. (n = 239), setting: internal medicine unit, hospital in Bologna, Italy. Ulrich (1984), (IIIA): This non-experimental (randomization was assumed) retrospective record review/case control study investigated patient responses (23 matched pairs) to window views of natural environments resulted in decreased hospital stays post-surgery, lower analgesic use post-surgery and fewer negative comments post-surgery. Setting: 200 bed suburban Pennsylvania hospital.</td>
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<td>Daykin (2008), (IVA): This systematic literature review searched 14 databases. Some supportive evidence was found for the impact of visual art on well-being on patients and staff of mental healthcare settings. Key findings were: 1) reduction in anxiety and depression, 2) positive effects on way finding and perception of healthcare environment 3) natural environments are favored over urban 4) art that is calm, naturalistic, and domestic is favored over abstract or challenging art content 5) patients show high approval for the arts (n = 19), (mental health setting) Dijkstra (2006), (IVA): There is a lack of evidence found in the review on the effects of physical environmental</td>
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<td>stimuli on health outcomes to formulate evidence-based guidelines for designing healthcare environments. (n = 30), (multiple settings)</td>
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<td>Rubin (1998), (IVB). This review found that the literature offers little guidance to inform which features of the health care environment could improve patient outcomes (n = 14).</td>
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<td>Ulrich et al. (2004), (IVB). This integrative literature review searched 11 databases on a variety of interventions and settings both inpatient and outpatient. Over 600 articles reviewed and recommendations included windows with a view and bright light, single rooms for noise reduction, nature distractions, art in hospitals, and acoustic flooring, ceiling and floor materials.</td>
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<td>Ulrich et al. (2008), (IVB). This integrative literature review searched multiple databases on a wide variety of interventions and settings both inpatient and outpatient. Recommendations again included windows with a view and bright light, single rooms for noise reduction, nature distractions, art in hospitals, and acoustic flooring, ceiling and floor materials.</td>
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<td>Van de Glind (2007), (IVB): Search of five databases. Literature on the subject of single patient rooms is scarce, and the authors claimed no recommendations regarding single rooms could be made at this time (n = 25) (multiple settings).</td>
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<td>V. Single expert opinion, clinical experience.</td>
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Eleven articles had a quality rating of C. According to the Johns Hopkins Nursing Evidence-Based Practice Model and Guidelines (Newhouse et al., 2007) these studies should not be used to develop an evidence-based intervention. Also, as proposed in Chapter 3, C quality research is inadmissible to this review. Therefore, 11 studies were excluded from this SLR following the critical analysis of the literature, with 27 articles moving forward to evidence synthesis.

**Synthesis of the Systematic Literature Review Findings**

This SLR identified evidence for eight of the 15 environmental features identified in the Rashid and Zimring’s (2008) model (Chapter 1), suggesting a relationship between artwork, building configuration, finish materials, interior details, light, nature, noise, room configuration and improved patient outcomes. The environmental features for which no evidence was found include ambient temperature, air quality, layout of rooms, functional relations and furniture layout. This section will discuss the findings using a collection of synthesis tables, one for each of the environmental features.

**Art**

Art is defined as “the quality, production, expression, or realm, according to aesthetic principles, of what is beautiful, appealing, or of more than ordinary significance” (http://dictionary.reference.com/browse/art). Rashid and Zimring (2008) describe artwork as part of a larger category of interior design within the indoor environment that can impact psychological, physiological, cognitive, psychosocial and social outcomes. A total of seven articles were included in this synthesis (Appendix G).
One integrative literature review (Ulrich et al., 2008) found a single study on pediatric patients who respond positively to representational artwork in the healthcare setting (Eisen, Ulrich, Shepley, Varni & Sherman, 2008). A SLR investigating the effects of art in mental health settings by Daykin, Byrne, Sotoriou and O’Connor (2008) provided no definition of art, but the inclusion criteria did shed light on the breadth of art as investigated in this review. Architecture, design, participatory arts in healthcare and artists in residence were all inclusion criteria for this review. Daykin, Byrne, Sotoriou and O’Connor (2008) found that exposure to the arts may reduce anxiety and depression and those patients prefer calm, naturalistic artwork and artwork depicting the home environment. Additionally, a study on patient satisfaction (Harris, Ross, McBride & Curtis, 2002) included a qualitative analysis of open-ended questions regarding sources of satisfaction with the hospital room. Art was found to be a source of satisfaction with the hospital interior, but no description of the type of artwork that evoked this satisfaction was provided (Harris, Ross, McBride & Curtis, 2002). One mixed methods study and one quasi-experimental study investigating the effects of a total ward remodel of a psychiatric unit and a medical-surgical unit both included the addition of artwork to the unit as part of the renovation (Christenfeld, Wagner, Pastva & Acrish, 1989; Olsen, 1984). The effects of whole unit renovations are confounded by multiple interventions without controls to evaluate if one intervention is having a more profound effect than another. For these reasons, no design conclusions can be drawn from these total ward renovation studies.

One quasi-experimental study was conducted in a labor and delivery room that was equipped with a specially made art screen to shield the view of emergency equipment (Duncan, 2011). The abstract art screen design was executed in both cool and earth tones chosen after
anecdotal information was gathered from expectant mothers regarding their color preferences (Duncan, 2011). The choice for an abstract design was not disclosed except to report it was thought to allow for open interpretation by the viewer (Duncan, 2011). This study found significant differences between treatment and control groups in the shortening of their labor by 2.1 hours (Duncan, 2011).

Art is also described as art therapy within the larger realm of complementary medicine and consists of the scientific use of bi- or tridimensional visual elements, which are systematically made experienceable (art contemplation) or are created under an art therapist’s guidance (active artistic creation) (Trevisani et al., 2010). Lastly, in a study by Trevisani et al. (2010), art contemplation in the health care setting was encouraged with the installation of a photographic artwork exhibit of realistic images of people doing everyday activities such as walking down a street, enjoying a day at the beach or eating at a picnic. Trevisani (2010), in this non experimental study using patient questionnaires, found 72% of patients felt viewing a large installation of 25 photographic panels made their hospital stay more pleasant.

In summary, there is evidence supporting the use of artwork to reduce labor by 2.1 hours (Duncan, 2011), improve patient satisfaction and reduce anxiety and depression (Trevisani, 2010). Additionally, the research suggests that patients prefer calm depictions of natural or homelike settings (Daykin, Byrne, Sotoriou & O’Connor, 2008; Trevisani, 2010). One integrative literature review (Ulrich et al., 2008) included a study that suggests pediatric patients respond positively to representational artwork in the healthcare setting (Eisen, Ulrich, Shepley, Varni & Sherman, 2008). Based on this evidence, the recommendation is to provide artwork and photographs that are calm illustrations of natural or homelike settings.
Building Configuration

Building configuration is described by Harris, Ross, McBride and Curtis (2002) as an architectural feature. Building configuration is a more permanent aspect of the hospital such as the plan or layout of the hospital (Harris, Ross, McBride & Curtis, 2002). According to Rashid and Zimring (2008) the physical environment can impact the needs of the individual and if thwarted can lead to negative psychological, physiological, cognitive, psychosocial and social outcomes. Two research studies examined the effects of building configuration on patients (Appendix G).

Building configuration and its effects on crowding in a psychiatric inpatient hospital was found to have significant effects on the incidence of seclusion and restraint on the units (Brooks, Mulaik, Gilead & Daniels, 1994). This non-experimental study performed a chi square test revealing that as census rose above the maximum capacity for the unit (n = 28) there was a significant relationship (p < 0.001) between census and seclusion and restraint. When the census remained at 28 patients or less per unit this allowed a minimum of 100 square feet per patient.

Additionally, a study on patient satisfaction (Harris, Ross, McBride & Curtis, 2002) included a qualitative analysis of open-ended questions regarding sources of satisfaction with the hospital room. Patients’ responses to the physical environment referenced the following architectural features: size of the room, bathroom and location of the room. Satisfaction with the architecture could be characterized as having a larger room, an accessible bathroom and being located away from sources of unit noise.

In summary, there is evidence to suggest that hospital building configuration impacts patient satisfaction and that patients have preferences for spacious rooms, accessible bathrooms
and rooms that are located away from sources of unit noise. This suggests that noise producing
unit areas contiguous with patient rooms are a source of patient dissatisfaction (Harris, Ross,
McBride & Curtis, 2002). A second study provides evidence that supports psychiatric units with
no less than 100 square feet per patient (Brooks, Mulaik, Gilead & Daniels, 1994). Based on this
evidence, the first design recommendation would be for spacious hospital rooms with accessible
bathrooms strategically located to avoid having patient rooms contiguous with noise producing
unit areas. The second recommendation would be for a psychiatric unit to provide no less than
100 square feet per patient. This finding would support single occupancy inpatient psychiatric
rooms.

**Finish Materials**

Finish material is described by Rashid and Zimring (2008) as an interior design variable
and includes surface materials used in rooms. An interior finishing material can enhance light or
sound and patient interactions with this variable affect psychological, physiological, cognitive,
psychosocial and social outcomes (Rashid & Zimring, 2008). There were seven studies that
investigated finish materials (Appendix G).

One meta-analysis/systematic literature review found a single RCT investigating patient
falls and their relationship to flooring material of carpet vs. vinyl (Drahota et al., 2012). No
strong effect was found regarding flooring material and falls (Drahota et al., 2012). There is
currently insufficient evidence at this time to inform evidence based design decisions regarding
flooring materials and patient safety (Drahota et al., 2012). An integrative literature review
(Ulrich et al., 2004) found one quasi-experimental study investigating the use of acoustic tiles in
the hospital setting, and its effect on heart rate, heart rate variability and blood pressure
(Hagerman et al., 2005). This study did not assess hearing of its study sample, and this methodological flaw significantly impacts the study’s conclusions. A second integrative literature review included two quasi-experimental studies on the topic of finishing materials (Ulrich et al., 2008). The first quasi-experimental study in the review found the mean number of arousals from sleep was significantly lower in rooms with acoustic tiles (Berg, 2001). The second quasi-experimental study in the review found that a combination of staff behaviors to reduce noise and the placement of acoustic tiles significantly decreased noise levels in a neonatal unit (Philbin & Gray, 2002). This integrative literature review provides preliminary evidence to suggest that acoustic tiles may have positive impacts on sleep and noise levels (Ulrich et al., 2008).

One mixed methods study and one quasi-experimental study investigating the effects of a total ward remodel of a psychiatric unit and a medical-surgical unit both included finishing materials (curtains, carpet, wallpaper, floor tiles, ornamental bathroom tile, non-weight bearing shower heads) as part of the renovation (Christenfeld, Wagner, Pastva & Acrish, 1989; Olsen, 1984). Since, the effects of whole unit renovations are confounded by multiple, simultaneous interventions without controls to evaluate if one intervention is having a more profound effect than another, no individual design conclusions can be drawn from these total ward renovation studies.

Nyrud, Bysheim and Bringslimark (2010) provided a non-experimental study that surveyed patients and staff on the preference for wood as a finish material in the hospital setting. The amount of wood in the interior of the hospital room was illustrated in photographs of rooms with wood paneling on all four walls and the ceiling (all wood). The second photograph illustrated an
intermediate amount of wood with wood paneling on a single wall opposite the head of the bed. The third photograph was of a hospital room with no wood paneling. Hospital staff reported a hospital room with an intermediate amount of wood was pleasant, natural, calming and secure. Unfortunately, only six patients responded to the survey and did not agree with hospital staff (n = 102) that an intermediate amount of wood in the hospital room was favorable. No information was provided about the amount of wood found pleasing to these six patients.

A second study by Harris, Ross, McBride, and Curtis (2002), showed that finishing materials used in the hospital rooms are referenced by patients as a source of patient satisfaction with the health care environment. Unfortunately, there were no details regarding the description of finishing materials.

In summary, the study on wood as a finishing material found insufficient data about whether patients would prefer wood as an interior finishing material or the amount of wood preferred (Nyrud, Bysheim & Bringslimark, 2010). Additionally, the study on patient sources of satisfaction with the healthcare environment found insufficient detail to appreciate what finishing materials patients find satisfying (Harris, Ross, McBride & Curtis, 2002). The two studies of total ward remodels did not provide evidence to suggest that finishing materials have an impact on patient outcomes (Christenfeld, Wagner, Pastva & Acrish, 1989; Olsen, 1984). One meta-analysis/systematic literature review found there was insufficient evidence at this time to inform evidence based design decisions regarding flooring materials and patient safety (Drahota et al., 2012). One integrative literature review (Ulrich et al., 2004) provided preliminary evidence to suggest that acoustic tiles may have positive impacts on sleep and noise levels (Berg, 2001). A second integrative literature review (Ulrich, 2008) found a single flawed study investigating the
effects of acoustic tile in the hospital, but no design conclusions could be drawn due to methodological flaws in the study (Hagerman et al., 2005).

In summary, there is preliminary evidence to suggest the use of acoustic tiles for their impact on sleep and noise levels. According to the available evidence on OHEs, finishing materials were found to be a source of patient satisfaction, but this single study did not provide any details about the finishing materials which evoked patient satisfaction. Additionally, there is insufficient evidence at this time to make a design recommendation regarding wood as an interior finishing material in hospital rooms.

**Interior Detail**

Rashid and Zimring (2008) describe interior detail as part of the broader category of interior design. An interior detail includes room furnishings that the patient interacts with and can affect the person’s psychological, physiological, cognitive, psychosocial and social outcomes (Rashid & Zimring, 2008). There were six studies that examined interior details in the hospital. (Appendix G).

One integrative literature review (Ulrich, 2004) included two RCTs (Holahan, 1972; Melin & Gotestam, 1981) and two quasi-experimental studies (Peterson, Knapp, Rosen & Pither, 1977; Sommer & Ross, 1958) with evidence to suggest that furniture arrangement significantly increases social interaction. Three of the four studies were conducted between 32 and 55 years ago (Holahan, 1972; Peterson, Knapp, Rosen & Pither, 1977; Sommer & Ross, 1958), and one study’s flaws included under reporting of their statistical findings (Peterson, Knapp, Rosen & Pither, 1977). Despite the age of the studies, there is evidence to suggest that the provision of chairs around small tables facilitates conversation (Holahan, 1972; Melin & Gotestam, 1981;
Peterson, Knapp, Rosen & Pither, 1977; Sommer & Ross, 1958). One systematic literature review found a single controlled clinical trial that found no evidence to support the use of televisions (TV) in waiting rooms as there were no significant findings that the TV served as a positive distracter (Dijkstra, Pieterse & Pruyn, 2006).

One mixed methods study and one quasi-experimental study investigating the effects of a total ward remodel of a psychiatric unit and a medical-surgical unit both included addition of interior details (seating areas with furniture arranged for TV viewing, games, social interaction, non-institutional clocks, full length mirrors, upholstered furniture, dining room furniture, daybed and hotel like furniture) as part of the renovation (Christenfeld, Wagner, Pastva & Acrish, 1989; Olsen, 1984). Since, the effects of whole unit renovations are confounded by multiple, simultaneous interventions without controls to evaluate if one intervention is having a more profound effect than another, no design conclusions can be drawn from these total ward renovation studies.

A non-experimental, descriptive study on the topic of interior details quantified the availability and accessibility of mirrors for hospitalized patients (Freysteinson, 2008). This study queried 10 U.S. hospitals and found that mirrors for bed bound patients were not available in 70% of hospitals and that 90% of hospitals did not provide mirrors to view the entire body. At this time, the potential impact of mirrors and their effect on healing environments is not yet known.

Another study on patient satisfaction with the health care environment provides information on the interior details, which provide sources of satisfaction and dissatisfaction with the health care environment (Harris, Ross, McBride & Curtis, 2002). The qualitative analysis
portion of this study asked open-ended questions regarding their hospital room and found that patients referenced the following interior design features as sources of satisfaction: equipment (television), furniture (bed), color and décor. Respondents who were satisfied with the interior could be characterized as liking the room color, having a comfortable bed, and having a working telephone and TV (Harris, Ross, McBride & Curtis, 2002). Unfortunately, the study provided no further details or specifications regarding the interior details that the patients found satisfying.

In summary, one integrative literature review found evidence to suggest that the provision of chairs around small tables facilitates conversation. One systematic literature review found no evidence to support the use of televisions (TV) in waiting rooms as there were no significant findings that the TV served as a positive distracter. One mixed methods study and one quasi-experimental study investigating the effects of total ward remodels did not provide sufficient evidence to inform evidence based design conclusions. The single descriptive study on the availability and accessibility of mirrors in hospital rooms provided insufficient evidence for design recommendations using mirrors in the hospital setting (Freysteinson, 2008). Additionally, the study on patient sources of satisfaction with the healthcare environment provided insufficient detail to distinguish existing patient rooms from more satisfying patient rooms as patient rooms are routinely furnished with a bed, television, and telephone (Harris, Ross, McBride & Curtis, 2002). The study found room color was a source of patient satisfaction but did not specify the color (Harris, Ross, McBride & Curtis, 2002). Currently, there is evidence to suggest that the provision of chairs around small tables facilitates conversation and informs the design of common areas; however, there is insufficient evidence at this time to inform private inpatient psychiatric room design.
Lighting

Lighting conditions are described by Rashid and Zimring (2008) as part of the indoor environment that interacts with other architectural and interior design variables (interior wall color, window finishing materials, window placement) to affect the quality of the lighting condition. The quality of the lighting condition also impacts the patient’s psychological, physiological, cognitive, psychosocial and social outcomes (Rashid & Zimring, 2008).

Eleven studies examined the effects of lighting on patient outcomes (Appendix G).

There was one meta-analysis/systematic literature review, two systematic literature reviews and two integrative literature reviews which included evidence on the effects of daylight on patient outcomes. The meta-analysis/systematic literature review found one controlled clinical trial and found no strong evidence for the effect of daylight on the outcome of pain (Drahota et al., 2012). This meta-analysis/systematic literature review found insufficient evidence at this time to suggest evidence based design decisions regarding lighting and its effect on patient outcomes (Drahota et al., 2012). A second systematic literature review found four RCTs showing positive effects of lighting on patient outcomes of reduced LOS, reduced pain medication use and reduced pain medication costs (Dijkstra, Pieterse & Pruyn, 2006). This systematic literature review found evidence to suggest that daylight has positive benefits on patient outcomes of LOS, pain and pain medication cost (Dijkstra, Pieterse & Pruyn, 2006).

Another systematic literature review found two observational studies that may suggest that vitamin D levels in geriatric patients are positively affected by exposure to daylight, and neonates with jaundice may be positively affected by exposure to daylight (Rubin, Owens & Golden, 1998). This systematic literature review also found one RCT that provides evidence to
suggest that sunny hospital rooms with east facing windows may reduce LOS in psychiatric patients (Rubin, Owens & Golden, 1998). This systematic literature review provided preliminary evidence that daylight exposure may improve patient outcomes regarding vitamin D levels and jaundice in neonates (Rubin, Owens & Golden, 1998).

One integrative literature review found seven studies on lighting (Ulrich et al., 2004). The review found two RCTs with evidence suggesting positive effects of daylight on mood (Beauchemin & Hays, 1996; Benedetti, 2001) and one RCT with evidence suggesting positive effects of daylight on pain medication use and cost (Walch, 2004). This integrative literature review also found four studies which investigated the effects of artificial bright light therapy used in specific quantities of lux and for specific amounts of time. There were two quasi-experimental studies on artificial light therapy with one study showing positive effects on patients with dementia (Van Someren, Kessler, Mirmiran & Swabb, 1977; Lovell, Ancoli-Israel & Gervitz, 1995). The second study was flawed due to an insufficient sample size (n = 6), (Lovell, Ancoli-Israel & Gervitz, 1995). One controlled clinical trial found positive effects of light therapy on patients with seasonal affective disorder (Terman, Terman, Lo & Cooper, 2001) and one non-experimental study described artificial light exposure and sleep patterns in patients (Wallace-Guy et al., 2002).

A second integrative literature review found four studies on lighting (Ulrich et al., 2008). Three of the studies were on artificial bright light therapy (Martiny, 2004; Wakamura & Tokura, 2001; Walder, Francioli, Meyer, Lancon & Romand, 2000). There was one meta-analysis on the use of artificial bright light therapy used for specific amounts of time and specific quantities of lux that provided evidence supporting bright light therapy in patients with seasonal affective
disorder (Golden, Gaynes, Ekstrom, Hamer, Jacobsen, Suppes, et al., 2005). One RCT found in the review did not provide evidence to support the use of bright light therapy as an adjunctive treatment to antidepressants for treatment of non-seasonal depression (Martiny, 2004). One quasi-experimental study in this review found positive effects of bright light therapy on sleep patterns, however, the study was flawed with an insufficient sample size of seven (Wakamura & Tokura, 2001). The last study in the review was another flawed study due to an insufficient sample size of 18 but found ambient light exposure in an ICU decreases patient’s sleep (Walder, Francioli, Meyer, Lancon & Romand, 2000).

There was one mixed methods study which investigated the effects of a total ward remodel of a psychiatric unit (Christenfeld, Wagner, Pastva & Acrish, 1989; Olsen, 1984). The renovation included the installation of shaded lights as one of 14 design elements renovated in the unit (Christenfeld, Wagner, Pastva & Acrish, 1989; Olsen, 1984). Since the effects of whole unit renovations are confounded by multiple, simultaneous interventions without controls to evaluate if one intervention is having a more profound effect than another, no design conclusions can be drawn from this total ward renovation study.

Beauchemin and Hays (1996) randomly assigned 174 psychiatric inpatients to rooms with east (bright light) or west in a room with the daylight blocked. A two-year chart review found that patients in the bright rooms had an average 2.6 fewer days in the hospital than patients in the rooms where light was blocked. Benedetti, Colombo, Barbini, Campori and Smeraldi (2001) performed a three year chart review of randomly assigned unipolar patients (n = 415) and bipolar (n = 187) to east or west facing rooms. The study authors found significant differences in LOS for patients with bipolar in the east facing rooms during fall and summer admissions.
Patients with bipolar disorder in east facing rooms had a 3.67 day shorter LOS than patients in west facing rooms. The third RCT studied pain medication use in post-surgical patients (n = 89) randomly assigned to east (sunlight blocked) or west with 46% more bright sunlight (Walch, Rabin, Day, Williams, Choi & Kang, 2005). Mean opioid-equivalent analgesic use for the entire hospital LOS was 28.3% (p = 0.047) higher for patient on the east side (dim light) as compared to patients on the west side (bright daylight), (Walch, Rabin, Day, Williams, Choi & Kang, 2005). Additionally, at the time of discharge, patients on the west side (bright light) reported significantly less stress (p = 0.035) as compared to patients on the east side (dim light) (Walch, Rabin, Day, Williams, Choi & Kang, 2005).

Another study on light was from Choi, Beltran and Hway-Suh (2012) who performed a quasi-experimental study of 1167 patients in four medical units with either a southeast (SE) or northwest (NW) room orientation. Multiple independent t-tests were performed comparing the SE and NW room orientations. LOS was significantly impacted in only two of the 24 SE facing rooms providing scant evidence that SE window orientation effects LOS. Dunn, Anderson and Hill (2010) performed a non-experimental, descriptive study measuring light exposure in an intensive care unit (ICU). The light source emitting the longest duration of illumination (mean = 132.4 minutes) was the sink light and the activity associated with the most light exposure was obtaining lab samples. The sink light is not under patient control and lab sample collection requires adequate lighting for the task.

Harris, Ross, McBride and Curtis (2002) in their study on patient satisfaction with the health care environment found that a window was an architectural feature which provides a source of satisfaction with the health care environment (Harris, Ross, McBride & Curtis, 2002).
In summary, the meta-analysis/systematic literature review found insufficient evidence to suggest that daylight has positive effects on patient outcomes. One systematic literature review found evidence to suggest that daylight has positive effects on patient outcomes while another systematic literature review finds preliminary evidence to suggest that daylight may increase vitamin D levels in adults and reduce jaundice in neonates. One integrative literature review found evidence to suggest that daylight has positive effects on patient outcomes. The remaining evidence for bright light therapy was mixed and for a very specific psychiatric population. The second integrative literature review only reported findings on bright light therapy in a narrow psychiatric population. Overall, the reviews provide some evidence to suggest that daylight has positive effects on patient outcomes.

The single study on a ward remodel found insufficient evidence to inform evidence based design decisions regarding lighting (Christenfeld, Wagner, Pastva & Acrish, 1989; Olsen, 1984). Two RCTs investigating lighting indicate that east facing morning light is beneficial for mood and hospital LOS (Beauchemin & Hays, 1996; Benedetti, Colombo, Barbini, Campori & Smeraldi, 2001). A third RCT suggests that west facing rooms with bright light reduces stress, and east facing rooms with blocked sunlight have higher pain medication use (Walch, Rabin, Day, Williams, Choi & Kang, 2005). The quasi-experimental study on SE facing rooms provided weak evidence that SE facing rooms reduces LOS (Choi, Beltran & Hway-Suh, 2012). There appears to be evidence to support the use of east facing rooms that create an environment of bright, natural light. Evidence further suggests that conditions (mood and pain among them) improve more quickly in these types of rooms decreasing LOS.
Nature and View

Nature is defined as the elements of the natural world such as mountains, trees, animals, or rivers (http://dictionary.reference.com/browse/nature?s=t). View refers to range of sight or vision (http://dictionary.reference.com/browse/view?s=t). Studies most often examine a view of nature and for this reason the two elements were combined. There were eight studies that investigated the effects of nature and window view in healthcare environments with patients and in the academic setting with healthy volunteers (Appendix G).

There was one systematic literature review and two integrative literature reviews that included research studies on the effects of nature and window view on healthy volunteers and patient outcomes. The first systematic literature review found two Controlled Clinical Trials (CCT) with mixed results regarding the effect of windows worsening or improving mental status in patients (Dijkstra, Pieterse & Pruyn, 2006). The third CCT in this review found positive effects of a view of nature to reduce LOS, reduce pain medication use and reduce negative comments in post-operative patients (Dijkstra, Pieterse & Pruyn, 2006).

One integrative literature review included four studies on window view and nature (Ulrich et al., 2004). This review included one RCT finding positive effects of audio-visual distraction of nature and improved pain tolerance in outpatients (Diette, Lechtzin, Haponik, Devrotes & Rubin, 2003). This review also included a non-experimental study that found positive effects of a view of nature to reduce LOS, reduce pain medication use and reduce negative comments in post-operative patients (Ulrich, 1984). The review also included a non-experimental study that elicited patient preferences through the use of a photo questionnaire regarding desirable window views and found that patients desire an informative window view
(Verderber, 1986). An informative window view is defined as one that satisfies the human predilection for visual information about their environment to aid comprehension of their environment and facilitate coping with the environment (Verderber, 1986). The last non-experimental study also elicited patient preferences through the use of a photo questionnaire regarding desirable window views, however, the study was flawed in its inclusion of brain injured patients whose mental status was not evaluated (Verderber, 1987).

The second integrative literature review included no articles on window views and twelve studies on nature in both patients and healthy volunteers (Ulrich et al., 2008). Three RCTs in this review found evidence to support the use of audio-visual distraction of nature on outcomes of attention, heart rate, sedative medication use and pain (Lauman, Garling & Stormack, 2003; Lee et al., 2004; Tse, Ng, Chung & Wong, 2002). Five quasi-experimental studies included in this review used slides or video of nature and urban environments and found positive effects of nature on outcomes of stress recovery, immunization to stress, emotion and performance in healthy volunteers (Ulrich et al., 2008). One quasi-experimental study in this review found positive effects of nature over urban environments on stress recovery (Ulrich, 1981). One quasi-experimental study in this review found positive effects of virtual reality of nature during chemotherapy in outpatients to reduce the perception of time (Schneider, Prince-Paul, Allen, Silverman & Talaba, 2004). Another quasi-experimental study in this review found positive effects of pictures of nature to decrease agitation during shower time in patients with dementia (Whall, Black, Groh, Yankou, Kupferschmid & Foster, 1997). One poor quality non-experimental study in this review lacked sufficient detail for replication of the study in
describing and using a nature travelogue as an audio-visual distraction for patients undergoing an outpatient procedure (Kozarek, Raltz, Neal, Wilbur, Stewart & Ragsdale, 1997).

One mixed methods study and one quasi-experimental study investigating the effects of a total ward remodel of a psychiatric unit and a medical-surgical unit both included elements of nature and view (hanging baskets of flowers and plants, dining room with a window view of the city) as part of the renovation (Christenfeld, Wagner, Pastva & Acrish, 1989; Olsen, 1984). Since the effects of whole unit renovations are confounded by multiple, simultaneous interventions without controls to evaluate if one intervention is having a more profound effect than another, no design conclusions can be drawn from these total ward renovation studies.

Harris, Ross, McBride and Curtis (2002) found that hospital rooms with a view were a source of satisfaction among patients in the health care setting. Ulrich’s (1984) landmark study on window views continues to stand alone without replication of this study in the current literature. Ulrich’s (1984) study was a non-experimental retrospective record review/case control study of 23 matched pairs of patients who had undergone uncomplicated cholecystectomy. The patients were assigned to rooms as the rooms became vacant and were in a room with a view visible from the hospital bed of trees or a view of a brick wall. Significant differences between groups of patients with the window view of trees that had one full hospital day less than patients with a view of a brick wall. Additionally, statistically significant differences were found in the mean analgesic doses between patients with a view and patients without a view on post-operative days 2-5.

Park and Mattson (2008) investigated whether plants influence recovery in patients who have undergone appendectomy (n = 90). This quasi-experimental study designed treatment
rooms with a plant in the hospital room and compared them to control rooms without plants. There were significant differences ($p = 0.041$) between the treatment and control groups, with patients in the treatment groups using analgesia less frequently than the control group. Additionally, the treatment group had significantly lower systolic blood pressures (SBP) ($p = 0.04$), and heart rates (HR) ($p = 0.04$), when compared to the control group on day of and one day after the surgery. The treatment group reported significantly less anxiety ($p = 0.01$) and tension ($p = 0.02$) post-operatively. Lower ratings of pain intensity ($p = 0.01$), pain distress ($p = 0.01$) also showed significant differences in the treatment group.

In summary, one systematic literature review found some evidence to suggest a view of nature may reduce LOS, reduce pain medication use and reduce negative comments in post-operative patients. An integrative literature review also found this same evidence to suggest a view of nature may reduce LOS, reduce pain medication use and reduce negative comments in post-operative patients. This integrative literature review also found some preliminary evidence that audio-visual distraction of nature may improve pain tolerance. This review also found some preliminary evidence that patients desire an informative window view. A second integrative literature review found evidence to support the use of audio-visual distraction of nature to improve outcomes of attention, heart rate, reduce sedative medication use and decrease pain. This review also found evidence to support nature scenes over urban scenes to improve stress recovery, emotion, immunization to stress and performance. This review found some preliminary evidence that virtual reality of nature shortens the perception of time.

The evidence on nature and window view includes the study on a hospital room with a view of nature as well as the results from the systematic and integrative reviews which find the
positive effects of nature. These studies combine to provide evidence to support a design recommendation for view of nature visible from the hospital bed. Therefore the first recommendation is for view of nature visible from the hospital bed. With a single study on plants in the health care environment, there is a preliminary indication that plants in the inpatient room would be a positive design element at this time. Therefore the second recommendation is for plants to be in inpatient rooms.

**Noise**

Noise is sound that is loud, unpleasant, unexpected, undesired (http://www.thefreedictionary.com/noise). Noise can affect the person’s psychological, physiological, cognitive, psychosocial and social outcomes (Rashid & Zimring, 2008). There are ten studies on the topic of noise (Appendix G).

Two systematic literature reviews included studies on the effects of noise or noise reducing interventions on patient outcomes (Dijkstra, Pieterse & Pruyn, 2006; Rubin, Owens & Golden, 1998). The systematic literature review by Dijkstra, Pieterse and Pruyn (2006) found one controlled clinical trial which found statistically significant differences in the re-hospitalization rates of patients in the bad acoustics groups as compared to the good acoustics group. This study provides preliminary evidence supporting the use of acoustic tiles in the hospital (Dijkstra, Pieterse & Pruyn, 2006). The second systematic literature review included one quasi-experimental study conducted on healthy volunteers to assess sleep in those exposed to CCU noise (Rubin, Owens & Golden, 1998). The study in this review found statistically significant decreases in REM sleep, duration of REM sleep and increased duration of time between REM cycles in patients exposed to CCU noises (Rubin, Owens & Golden, 1998). This
study provides preliminary evidence that CCU noise affects REM sleep (Rubin, Owens & Golden, 1998).

One integrative literature review included 21 studies on noise (Ulrich et al., 2004). Studies in this integrative review on noise and sleep disruption (n = 5), (Aaron, Carlisle, Carskadon, Meyer, Hill & Millman, 1996; Gabor et al., 2003; Schnelle, Ouslander, Simmons, Alessi & Gravel, 1993; Southwell & Wistow, 1995; Topf, 1993) included two poor quality studies with insufficient sample sizes which lead to a lack of power in statistical tests (Aaron, Carlisle, Carskadon, Meyer, Hill & Millman, 1996; Gabor et al., 2003). The first study found a significant correlation between noise and EEG arousal from sleep in ICU (n = 6), (Aaron, Carlisle, Carskadon, Meyer, Hill & Millman, 1996). The second study (n = 13) studied the effects of noise and patient care activities on sleep in ICU patients and found these factors account for less than 30% of sleep arousals and awakenings (Gabor et al., 2003). Another poor quality study found noise and incontinence care were responsible for 50% of four minute or longer waking episodes in nursing home patients however the study authors did not provide sufficient statistical data for the research consumer (Schnelle, Ouslander, Simmons, Alessi & Gravel, 1993). Because of the poor quality of these studies no design implications can be drawn. There were two studies of adequate strength and quality on sleep and noise included in this integrative review (Ulrich et al., 2004). The non-experimental study in this review found that 22% of inpatients who slept well at home had trouble sleeping in the hospital (Southwell & Wistow, 1995). The quasi-experimental study in this review found healthy subjects who were exposed to ICU noise recordings had decreased duration of REM and decreased REM activity
These studies on sleep and noise provide preliminary evidence that noise may disrupt sleep in the hospital.

A study on noise and unit design included in this integrative review (Ulrich et al., 2004) was one non-experimental descriptive study that found higher noise levels during visiting times on an open bay pediatric unit (Couper, Hendy, Lloyd, Gray, Williams & Bates, 1994). Generalizability of this study from children to adults is difficult. There were two studies noise and effects on nursing staff (n = 2), (Morrison, Haas, Shaffner, Garrett & Fackler, 2003; Blomkvist, Erikson, Theorell, Ulrich & Rasmanis, 2004) in this integrative review (Ulrich et al., 2004). One study of poor quality due to insufficient sample size (n = 11) found noise was shown to correlate with stress in ICU nurses (Morrison, Haas, Shaffner, Garrett & Fackler, 2003). Additionally, this study has a competing hypothesis of elevated unit noise may indicate patient acuity which affects nurse stress (Morrison, Haas, Shaffner, Garrett & Fackler, 2003). Another study found nursing staff perceived significantly lower work demands, pressure and strain in units with sound reflecting tiles (Blomkvist, Erikson, Theorell, Ulrich & Rasmanis, 2004). This one study provides preliminary evidence that sound reflecting tiles may improve staff outcomes.

There were five studies of staff interventions to reduce noise (Cmiel, Karr, Gasser, Oliphant & Neveau, 2004; Johnson, 2001; Moore et al., 1998; Slevin, Farrington, Duffy, Daly & Murphy, 2000; Walder, Francioli, Meyer, Lancon & Romand, 2000) included in this integrative review (Ulrich et al., 2004). Four of these studies were of poor quality (Cmiel, Karr, Gasser, Oliphant & Neveau, 2004; Moore et al., 1998; Slevin, Farrington, Duffy, Daly & Murphy, 2000; Walder, Francioli, Meyer, Lancon & Romand, 2000). One poor quality study found closing doors, lowering lights and decreasing TV volume found pre-intervention dBA levels = 42 and
post-intervention dBA levels = 45 (Cmiel, Karr, Gasser, Oliphant & Neveau, 2004). This study did not include presentation of statistical analysis for the research consumer (Cmiel, Karr, Gasser, Oliphant & Neveau, 2004). Another poor quality study found the staff intervention of closing patient doors reduced noise levels by 6 dBA (Moore et al., 1998). The study provided insufficient detail of staff education and interventions to replicate the study (Moore et al., 1998). Another poor quality study investigated staff intervention of quiet hour on noise levels in a neonatal ICU (n = 10) and found reduced median diastolic BP, mean arterial pressure and decreased infant movements (Slevin, Farrington, Duffy, Daly & Murphy, 2000). This study had an insufficient sample size (Slevin, Farrington, Duffy, Daly & Murphy, 2000). Another poor quality study investigated the effects of guidelines to reduce noise and light in an ICU (n = 17) and found noise levels were reduced but background noise levels remained unchanged (Walder, Francioli, Meyer, Lancon & Romand, 2000). This study also had an insufficient sample size (Walder, Francioli, Meyer, Lancon & Romand, 2000). The last study of adequate strength and quality was a quasi-experimental study which investigated the use of acoustical foam in incubators in a neonatal unit and found a statistically significant correlation between higher noise levels and oxygen support therapy (Johnson, 2001). Of the studies on staff interventions to reduce noise, there is insufficient evidence to inform evidence based design decisions at this time. The single study of adequate strength and quality cannot be generalized from neonates in incubators to adults in inpatient hospital rooms, and therefore cannot be used to inform evidenced based design at this time.

There was a single study on anxiety and noise (Gast & Baker, 1989) included in this integrative review (Ulrich et al., 2004). This non-experimental study found that mean annoyance
levels were higher during quiet hour (Gast & Baker, 1989). This study does not provide evidence to support evidence based design decisions.

There were four descriptive studies of noise (Hilton, 1985; Hodge & Thompson, 1990; Love, 2003; Robertson, Cooper-Piel & Vos, 1998) included in this integrative literature review (Ulrich et al., 2004). One study found sound levels in a neonatal ICU were greater than 90 dBA during peak noise times (Robertson, Cooper-Piel & Vos, 1998). One poor quality study recorded noise levels for five minutes in an operating theatre and found noise levels up to 108 dBA (Robertson, Cooper-Piel & Vos, 1998). Another poor quality study recorded noise levels during five surgeries in an operating theatre and found noise levels did not exceed the recommended 110 dBA (Love, 2003). One study found sound levels in an ICU ranged from 48.5 to 68.5 dBA (Hilton, 1985). This study in the ICU is the only study which provides preliminary evidence that there are opportunities to reduce noise levels in the environment through the use of design. The other descriptive studies on noise lack generalizability or were of poor quality to inform design.

There were three studies on noise and stress (Novaes, Aronovich, Ferraz & Knobel, 1997; Topf, 1985; Topf & Thompson, 2001) included in this integrative review (Ulrich et al., 2004). One poor quality study found noise was not a top five stressor in the ICU (Novaes, Aronovich, Ferraz & Knobel, 1997). This study did not include a literature review, a theoretical framework or tables of statistical findings. One quasi-experimental study found a statistically significant correlation between the greater person’s sensitivity to noise the greater was their ability to cope with noise (Topf, 1985). A non-experimental study investigated the effects of stress and sleep and found environmental stress accounted for a significant amount of sleep disruption (Topf &
Thompson, 2001). These three studies on noise and stress do not provide sufficient evidence to inform evidence based design at this time.

A second integrative literature review (Ulrich et al., 2008) included five studies on noise (Balough, Kittinger, Benzer & Hackl, 1993; Busch-Vishniac, West, Barnhill, Hunter, Orellana & Chivukula, 2005; Holmberg & Coon, 1999; Topf, Bookman & Arand, 1996; Zahr & de Traversay, 1995). One quasi-experimental study found time to fall asleep increased, time spent asleep decreased, awakenings increased and sleep quality decreased in healthy volunteers who slept with headphones playing ICU sounds (Topf, Bookman & Arand, 1996). One quasi-experimental study found significantly higher oxygen saturation, fewer behavior state changes and more time in quiet sleep in infants who wore earmuffs (Zahr & de Traversay, 1995). This study lacks generalizability to other patient populations. There were two non-experimental descriptive studies of noise levels in ICUs (Balough, Kittinger, Benzer & Hackl, 1993; Busch-Vishniac, West, Barnhill, Hunter, Orellana & Chivukula, 2005). Both studies found noise levels in the ICU range from 60-65 dBA (Balough, Kittinger, Benzer & Hackl, 1993). A second study found mean noise levels in a psychiatric hospital to range from 74.85 to 81.32 dBA (Holmberg & Coon, 1999). These studies provide preliminary evidence that ICU noise disrupts sleep and that there are opportunities to reduce noise levels in both the general and psychiatric hospital environment through the use of evidence-based design.

Patients do find noise to be a source of dissatisfaction with the health care environment (Harris, Ross, McBride & Curtis, 2002). Three non-experimental, descriptive studies on noise offered an overview on the noise levels found on hospital units (Aitken, 1982; Balough, Kittinger & Hackl, 1993; Holmberg & Coon, 1999). These three descriptive studies found noise levels
consistently greater than the sound pressure level of 45 recommended by the Environmental Protection Agency (Balough, Kittinger & Hackl, 1993) and observed sound levels are at least 20 dBA on average greater than the WHO guidelines (Busch-Vishniac et al., 2005). A descriptive study by Busch-Vishniac et al. (2005) also showed consistently lower dBA levels in areas with acoustical tiles (Busch-Vishniac et al., 2005). Additionally, a quasi-experimental study with pre- and post-test noise assessments showed that noise reduction interventions resulted in significantly reduced noise in all shifts but night shift (Overman Dube et al., 2008). Interventions to reduce noise included padding chart holders, padding pneumatic drop stations, installing quieter paper towel dispensers, adding signs requesting quiet and closing the patient room doors (Overman Dube et al., 2008). This preliminary evidence suggests use of a closed room door according to Overman Dube et al. (2008), however, according to Busch-Vishniac et al. (2005) a closed hospital room doors does not diminish noise by more than 2.2 dB(A) so alterations to doors are not indicated (e.g., self-closing doors). Noise levels are not perceptible unless greater than a 6 dB(A) level change (Busch-Vishniac et al., 2005). Additionally, doors, in the health care setting, are under individual control of the person residing in the room. Harris, Ross, McBride and Curtis (2002) also found that noise producing unit areas contiguous with patient rooms are a source of patient dissatisfaction as discussed in the section on building configuration.

In summary, one systematic literature review includes a study which provides preliminary evidence supporting the use of acoustic tiles in the hospital. A second systematic literature review provides preliminary evidence that CCU noise affects REM sleep. One integrative literature review provides the following evidence: Studies on sleep and noise provide preliminary evidence that noise may disrupt sleep in the hospital. One study provides preliminary
evidence that sound reflecting tiles may improve staff outcomes. One study found sound levels in an ICU ranged from 48.5 to 68.5 dBA and provides preliminary evidence that there are opportunities to reduce noise through evidence based design. A second integrative literature review provides preliminary evidence that ICU noise disrupts sleep and that there are opportunities to reduce noise levels in both the general and psychiatric hospital environment through the use of evidence based design. Evidence also supports use of acoustic ceiling tiles to reduce noise in the health care setting (Busch-Vishniac et al., 2005; Dijkstra, Pieterse & Pruyn, 2006; Ulrich et al., 2004). There is preliminary evidence to suggest that patient areas contiguous with noise producing areas are to be avoided (Harris, Ross, McBride & Curtis, 2002). This evidence provides the opportunity to use evidence based design which includes ceiling tiles to reduce noise and to design units which ensure patient areas are not contiguous with noise producing areas.

**Room Configuration**

Room configuration is an interior design feature that describes the layout of the room or spatial arrangements of the elements of the room (Rashid & Zimring, 2008). There were six studies which provided some examination of room configuration (Appendix G).

Two systematic literature reviews included studies on room configuration. One systematic literature review found one quasi-experimental study on room configuration which investigated the effects of room type on pain medication use (Dijkstra, Pieterse & Pruyn, 2006). No evidence was found to indicate that room type accounted for a significant amount of variance in the use of pain medication use (Dijkstra, Pieterse & Pruyn, 2006). The second meta-analysis/systematic literature review included one study and found patients in single rooms
acquired staphylococcus aureus infection at almost the same rate (23.9/1000 weeks) as patients in open wards (24.1/1000 weeks) (Drahota et.al 2012). These studies do not provide sufficient to make design recommendations for single rooms.

Two integrative literature reviews included studies on room configuration. The first integrative literature review (Ulrich et al., 2004) included one non-experimental observational study which found 1.5 to 3.4 breaches of confidentiality in the emergency department occurring every patient hour (Mlinek & Pierce, 1997). In the waiting and triage area, 81% of patient names were heard and 56% of patient’s diagnoses or presenting complaint was heard (Mlinek & Pierce, 1997). This non-experimental observational study found preliminary evidence to suggest that curtained and glass partitions in the emergency department did not prevent breaches of confidentiality, and that rooms with solid walls and doors did not allow for breaches of confidentiality in the emergency department (Mlinek & Pierce, 1997). The second integrative literature review (Ulrich et al., 2008) included one study which found evidence that 34% of patients felt other patients were a source of disturbance (Southwell & Wistow, 1995). Additionally this study in the review found 76% of patients felt other patients calling for help was a disturbance, and 54% of patients felt other patients using the toilet was a disturbance (Southwell & Wistow, 1995). This study provided preliminary evidence that patients prefer single occupancy rooms (Southwell & Wistow, 1995). A second non-experimental study in the review was of poor quality due to reporting statistics as estimates (Astedt-Kurki, Paavilainen, Tammentie, Paunonen-Ilmonen, 2001). This study found patient rooms were reported by nurses to be suitable places for discussion between the nurses and patients (Astedt-Kurki, Paavilainen, Tammentie & Paunonen-Ilmonen, 2001). Additionally, a small proportion of nurses reported
they had used the corridor, nearly half had used a ward office and one out of 10 nurses had used a separate room for discussion with a patient (Astedt-Kurki, Paavilainen, Tammentie & Paunonen-Ilmonen, 2001). This study did not provide sufficient evidence to inform evidence based design.

One mixed methods study and one quasi-experimental study investigating the effects of a total ward remodel of a psychiatric unit included elements of room configuration (room dividers to create separate seating areas, addition of a separate dressing room in patient rooms, addition of a pantry) as part of the renovation (Christenfeld, Wagner, Pastva & Acrish, 1989; Olsen, 1984). Since the effects of whole unit renovations are confounded by multiple, simultaneous interventions without controls to evaluate if one intervention is having a more profound effect than another, no design conclusions can be drawn from these total ward renovation studies.

Harris, Ross, McBride and Curtis (2002) found that private rooms were a source of satisfaction among patients in the health care setting. Private rooms were also supported by the evidence in two integrative literature reviews by Ulrich et al. (2004; 2008). van de Glind, de Roode and Goossensen (2007) conducted a SLR to examine the evidence associated with single versus multiple occupancy rooms in healthcare settings. After searching five databases as well as non-empirical (expert opinion and web pages of regulatory bodies) research literature, the authors reported that there were more opinion articles than empirical studies available. Based on these findings, the authors stated no conclusions could be made supporting single or multiple occupancy rooms. Though not a study on room configuration but on building configuration, Brooks, Mulaik, Gilead and Daniels’ (1994) study found a significant correlation between census patterns in an inpatient psychiatric unit and incidences of seclusion and restraint (p < 0.001).
This evidence suggested that single occupancy rooms in inpatient psychiatric wards may be indicated.

In summary, one integrative literature review provided preliminary evidence that solid walls as opposed to curtains or glass dividers confer greater confidentiality. The second integrative literature review provided preliminary evidence that patients regard other patients as a source of disturbance. Additionally, single patient rooms are supported by a patient satisfaction study (Harris, Ross, McBride & Curtis, 2002) and a correlation study on census patterns in an inpatient psychiatric unit and incidences of seclusion and restraint (Brooks, Mulaik, Gilead & Daniels, 1994). Based on this evidence, single occupancy rooms are recommended for general hospital rooms. The evidence is preliminary for psychiatric hospital rooms to be single occupancy but is recommended.

Summary

While greater strength, quality and quantity of evidence on OHEs is needed, the current evidence shows some repetitive studies that support use of specific design features to create optimal healing environments in the health care setting. The evidence appears to suggest that seven design recommendations have a positive effects on patient outcomes, including: (a) Provide calm, naturalistic and domestic artwork or photograph; (b) Provide east facing windows in the patient rooms to provide bright light; (c) Provide plants; (d) Use acoustic ceiling tiles; (e) Provide a window view of nature visible from the hospital bed; (f) Provide single occupancy rooms; and (g) Provide patient rooms not contiguous with sources of unit noise. These recommendations must be evaluated for translation to clinical practice. As the purpose of this paper is to translate evidence to identify features appropriate for a psychiatric inpatient healing
environment, the evidence was then evaluated based on current state and industry standards to ensure patient safety.

**Translating the Evidence for Use in Psychiatric Facilities**

Seven design recommendations: (a) Provide calm, naturalistic and domestic artwork or photograph; (b) Provide east facing windows in the patient rooms to provide bright light; (c) Provide plants; (d) Use acoustic ceiling tiles; (e) Provide a window view of nature visible from the hospital bed; (f) Provide single occupancy rooms; and (g) Provide patient rooms not contiguous with sources of unit noise) were evaluated for their consistency with Arizona state laws that regulate mental healthcare facilities and industry standards for behavioral health facilities to determine which evidence-based design recommendations are appropriate for inpatient psychiatric units (Tables 7 and 8). State laws and industry standards are based on safety data and clinical evidence that inform the essential mandates for facility safety.
TABLE 7. Arizona State Law and Recommendation Table
(Rating scale: 1 is within the guidelines or represents no challenge to the guidelines, 2 challenges the guidelines with potential or critical risk of harm to patient or staff.)

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Private Bedroom at least 60 sq. ft. not including closet</th>
<th>OR shared room with 60 sq. ft. for each person and no more than 4 to a room and 3 ft. between beds</th>
<th>Floor to ceiling walls</th>
<th>Bedroom door opens to hall, common area or outside</th>
<th>Bedroom is constructed and furnished without impediments to access to door</th>
<th>Bedroom is not used as a passage to another room</th>
<th>Bedroom contains storage space such as dresser or chest. Has a table or other surface</th>
<th>Has a clean pillow, linens, in good repair. Also sheets are large enough to tuck under the mattress. There is a waterproof mattress cover if needed, blanket or bedspread sufficient to ensure patient’s warmth</th>
<th>Sufficient lighting to read</th>
<th>Windows or doors with adjustable window or door covers to provide privacy. Working door or window for safe egress unless there is automatic sprinkler system. Doors meet fire safety requirement and doors no less than 20 inches, has area of at least 720 inches. Window sill no more than 44 inches off the floor</th>
<th>Client is not locked into a bedroom. If the door locks, a staff member has the key allowing access at all times</th>
<th>Facilities not specializing in treating conditions that affect mobility, at least 10% of patient sleeping rooms shall provide mobility features</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Provide calm, naturalistic and domestic artwork or photography</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<td>1</td>
</tr>
<tr>
<td>2) Provide east facing windows</td>
<td>1</td>
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<td>1</td>
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<tr>
<td>3) Provide plants</td>
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<tr>
<td>4) Use acoustic ceiling tiles</td>
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<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5) Provide a window view of nature visible from the hospital bed.</td>
<td>1</td>
<td>1</td>
<td>1</td>
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</tr>
<tr>
<td>6) Provide single occupancy rooms</td>
<td>1</td>
<td>1</td>
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<td>1</td>
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<tr>
<td>7) Provide patient rooms not contiguous with sources of noise</td>
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<td>1</td>
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<td>1</td>
</tr>
</tbody>
</table>
### TABLE 8. Industry Standards (Joint Commission Comprehensive Accreditation Manual for Behavioral Health Care) and Recommendations Table

(Rating scale: 1 is within the guidelines or represents no challenge to the guidelines, 2 challenges the guidelines with potential or critical risk of harm to patient or staff.)

| Recommendations | Leaders identify risks. Organizations manage safety, security risks. Organizations manages hazardous materials risks | Organization manages fire risks; minimizes risk of fire. Maintains free and unobstructed access to all exits. Conducts fire drills, maintains fire safety equipment and fire safety building features | Organization manages risks associated with utility systems, has reliable electric power source, and provides emergency power. Inspects, tests, and maintains utility and emergency power systems | Organization establishes and maintains a safe, functional environment | Interior spaces meet the needs of the individuals served for safety and suitability for the care, treatment, or services provided | Organization provides storage space to meet the needs of the individual | Restrooms are adequate in size and number for people using the facility | Lighting is suitable for care, treatment or services. Lighting is controlled by individuals served consistent with care, treatment or services provided | Organizations maintain ventilation, temperature, and humidity levels suitable for the care, treatment, or services provided | Areas used by individuals served are safe, clean, and comfortable | Furnishings and equipment should reflect the ability and needs of the individual served | Door locks and other structural restraints such as fences are consistent with the organization’s mission, program goals, program policy, and law and regulation, provide the least restrictive environment & meet the needs of the individual served. | Organization keeps furnishing & equipment safe and in good repair |
|----------------|-------------------------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| 1) Provide calm, naturalistic and domestic artwork or photograph (vinyl attaches to wall) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2) Provide east facing windows | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3) Provide plants | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 4) Use acoustic ceiling tiles | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5) Provide a window view of nature visible from the hospital bed. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 6) Provide single occupancy rooms | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7) Provide patient rooms not contiguous with sources of unit noise | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

(Adapted from Joint Commission, 2012)
The filtering process has a rating scale to rate the policy and standard compliance or safety challenge on a scale of 1-2. The rating scale is as follows: (1) is within the guidelines or represents no challenge to the guidelines and (2) challenges the guidelines with potential or critical risk of harm to patient or staff. Six recommendations: (a) provide calm, naturalistic and domestic artwork or photograph; (b) provide east facing windows in the patient rooms to provide bright light; (c) use acoustic ceiling tiles; (d) provide a window view of nature visible from the hospital bed; (e) provide single occupancy rooms; and (f) provide patient rooms not contiguous with sources of unit noise, received a rating score of one which is within guidelines or represents no challenge to the guidelines for state and industry standards for behavioral health facilities.

A single guideline (provide plants) received a score of two and represents a challenge to the Industry Standards (Joint Commission Comprehensive Accreditation Manual for Behavioral Health Care) for its critical or potential risk of harm to patient or staff. This recommendation was altered for safety concerns and now the recommendation is for plants to be moved to a planter directly outside the patient’s room window for a near outdoor view of plants. This new recommendation of having plants outside the facility; represents no challenge to the state or industry standards and receives a score of one for both the state and industry standards.

Although the other six recommendations for translation to clinical practice are in compliance with state and industry standards: (a) provide calm, naturalistic and domestic artwork or photographs; (b) provide east facing windows in the patient rooms to provide bright light; (c) provide plants in window box or low shrubs planted outdoors; (d) use acoustic ceiling tiles; (e) provide a window view of nature visible from the hospital bed; (f) provide single occupancy rooms; and (g) provide patient rooms not contiguous with sources of unit noise; it is also
necessary to filter these recommendations through the behavioral health guidelines. These six recommendations and the one new recommendation for a planter filled with plants directly outside the patient’s room window were filtered through the behavioral health guidelines.

Two available behavioral health guidelines (Department of Veterans Affairs Office of Construction and Facilities Management Design Guide: Mental Health Facilities, 2010) and Design Guide for the Built Environment of Behavioral Health Facilities (Sine & Hunt, 2012) provide resources for building and finishing materials safe for inpatient psychiatric facilities. These resources were used to inform building and finishing materials for the final design of the inpatient psychiatric room. The following table (Table 9) provides specifications necessary to apply the evidence-based recommendations into clinical practice.

TABLE 9. Criterion Based Specifications

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Behavioral health guidelines and finishing materials</th>
</tr>
</thead>
</table>
| Provide calm, naturalistic and domestic artwork or photograph | Vinyl Printed Artwork: Naturalistic or domestic setting  
Kennon Products, Inc.  
Sheridan, WY  
307-674-6498  
| Provide east facing windows | Window unit shall have integral blinds for sun control located between layers of glazing. Inside layer shall be shatterproof laminated glass (Department of Veterans Affairs Office of Construction and Facilities Management Design Guide: Mental Health Facilities, 2010)  
Safety glass  
Oldcastle Building Envelope  
Oldcastle Building Envelope  
5631 Ferguson Drive  
Los Angeles, CA 90022  
320 3887 6000  
Aluminum window with integral blind  
Manko Window Systems; 2450 Storefront with hinged sash and integral blind  
Manko Window Systems, Inc.  
800 Hayes Drive  
Manhattan, KS 66502  
800-642-1488  
The only recommendation, which requires careful planning, is the recommendation for a window box outside the patient room. This recommendation is only for outdoor areas that patients do not have access. If the window faces an outdoor patient area then low growing shrubs are recommended with ample space between them to prevent a hedge from developing which could become a hiding space. The other six recommendations: (a) provide calm, naturalistic and domestic artwork or photograph; (b) provide east facing windows in the patient rooms to provide bright light; (c) use acoustic ceiling tiles; (d) provide a window view of nature visible from the hospital bed; (e) provide single occupancy rooms; and (f) provide patient rooms not contiguous with sources of unit noise; can be met with specifications from either of the two behavioral health guidelines (Department of Veterans Affairs Office of Construction and Facilities Management Design Guide: Mental Health Facilities, 2010) and Design Guide for the Built Environment of Behavioral Health Facilities (Sine & Hunt, 2012). Artwork is available on vinyl sheets to avoid the risk of frames made with glass. Additionally, safety glass is required on psychiatric units and is available in windows, which contain integral blinds so the patient may

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Behavioral health guidelines and finishing materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use acoustic ceiling tiles</td>
<td>Acoustic tiles, painted finish</td>
</tr>
<tr>
<td>Ceiling Height: 10'-8” new construction, 9'-0” minimum</td>
<td></td>
</tr>
<tr>
<td>Provide a window view of nature visible from the hospital bed</td>
<td>See window above</td>
</tr>
<tr>
<td>Provide a planter directly outside the patient’s room window</td>
<td>No planters in patient outdoor areas. Shrubbery should be non-toxic, low-growing. Avoid planting shrubbery close together as it can create visual barriers that patients or unauthorized visitors may hide behind. (Design Guide for the Built Environment of Behavioral Health Facilities, Sine and Hunt, 2012)</td>
</tr>
<tr>
<td>Provide single occupancy rooms</td>
<td>No specific behavioral health facility recommendations</td>
</tr>
<tr>
<td>Provide patient rooms not contiguous with sources of unit noise</td>
<td>No specific behavioral health facility recommendations</td>
</tr>
</tbody>
</table>

Conclusion

This section included a review of the findings from the SLR conducted. The search process and study selection were depicted and described. An analysis of the research evidence was reported in an evidence summary to describe the strength and quality of the available research on the topic of healing environments. A synthesis of the literature was detailed to illustrate the current state of the literature on OHEs. The synthesis reported findings on each of the environmental features that have the potential to positively affect patient outcomes. Based on the evidence, seven design recommendations were identified. These seven recommendations were filtered through the current Arizona statutes as well as industry standards governing mental health care facilities. Six recommendations did not represent any challenges to the current Arizona statutes, patient safety or to the industry standards governing mental health care facilities. One recommendation was altered for safety reasons. Next, the six recommendations and the one new recommendation were filtered through the available behavioral health guidelines to provide the specifications for finishing materials needed in behavioral health facilities. Next, the evidence-based design recommendations were used to create an inpatient psychiatric room design.
CHAPTER FIVE: DISCUSSION

The purpose of this systematic literature review was to: (a) analyze the research literature for evidence of architectural and design elements which will reduce stress and improve the well-being of people currently admitted to the inpatient psychiatric care setting; (b) identify design elements that are consistent with accreditation and licensing standards for inpatient psychiatric units; and (c) design a psychiatric inpatient room that is evidence-based. The findings from this systematic literature review, design implications and the seven design recommendations for an inpatient psychiatric room design will be presented, including design of an inpatient psychiatric room. A discussion of the inpatient psychiatric room design within the historical contexts of both healing environments and within the research on OHEs will follow. Lastly, the strengths and weaknesses in this body of evidence and its clinical and research implications will be discussed in this chapter. The PICO question that provided the basis for this systematic literature review was what factors in the inpatient healthcare environment support an optimal healing environment? After conducting a thorough analysis of each original research study, as well as an analysis of published systematic reviews, seven design features were identified as evidence-based based on systematically summarizing and synthesizing across the literature. To assure that in-patient, psychiatric patient care regulatory and industry standards are maintained, these design features were then evaluated for compliance with key requirements. Only one of the seven design features recommended by the literature was found to be inconsistent with industry standards (JC accreditation requirements) and was modified to meet compliance. Therefore, seven design features: (a) provide calm, naturalistic and domestic artwork or photographs; (b) provide east facing windows in the patient rooms to provide bright light; (c) provide plants in
window box or low shrubs planted outdoors; (d) use acoustic ceiling tiles; (e) provide a window view of nature visible from the hospital bed; (f) provide single occupancy rooms; and (g) provide patient rooms not contiguous with sources of unit noise. These are the evidence-based recommendations that will be discussed in Chapter 5.

Interpretation

Rashid and Zimring’s (2008) conceptual framework describing how the physical environment may set in motion a process leading to stress identifies 12 design features which may contribute to stress. There was evidence found in this systematic literature review on following design features and their effects on patients in a health care environment: artwork, room and building configuration, finish materials, interior details, light, nature and view and noise, view. This systematic literature review found no evidence to refute or support the following design features: ambient temperature, air quality, layout of rooms, functional relations or furniture layout.

Overall, studies suggest the use of artwork in the healthcare environment is beneficial. The single study on building configuration provides preliminary evidence for design of inpatient psychiatric units to provide a minimum of 100 square feet of space per patient to reduce the incidence of seclusion and restraint, and also provides evidence to suggest only single occupancy rooms be provided in psychiatric inpatient units (Brooks, Mulaik, Gilead & Daniels, 1994). Light was the only intervention to undergo investigation at the highest scientific rigor of randomized clinical trials (RCT). There is evidence to support a shorter LOS in patients with mood disorders who were assigned to rooms with an eastern window orientation (Beauchemin et al., 2001; Benedetti & Hays, 1996). There is also evidence to suggest that pain medication use and LOS are
reduced in patients with bright window exposure (Walch et al., 2005). Taken together, the evidence on light suggests east facing windows for patients in an inpatient psychiatric unit to reduce LOS. There is preliminary evidence to suggest provision of a plant in inpatient rooms to decrease analgesia use, systolic blood pressure and heart rate, decrease anxiety and tension, and decrease ratings of pain intensity and pain distress (Park & Mattson, 2008). For safety considerations in psychiatric units, this recommendation is modified to provide exterior plants both near and far from the patient window rather than an interior plant. Of the studies on noise, there is preliminary evidence to support the use of acoustic tiles, which were shown to consistently lower decibel levels (Busch-Vishniac et al., 2005). There is also preliminary evidence to suggest that patients prefer their rooms not be contiguous with noise producing areas of the unit and is an important consideration for unit design (Harris, Ross, McBride & Curtis, 2002). Of the studies on nature, the seminal study by Ulrich (1984) supports the positive effects of a window view of nature on pain medication use and LOS. This study remains the gold standard of support for the effects of window view on inpatient postoperative patients. Additionally, there is evidence to suggest that nature has restorative effects for stress recovery (Ulrich, 1981), reducing the perception of time (Schneider, Prince-Paul, Allen, Silverman & Talaba, 2004) and fulfilling informational needs of human beings (Verdeber, 1986).

**Translation to Practice**

This systematic literature review was conducted to create an evidence-based inpatient psychiatric room design based. The following design recommendations are made based on this evidence on OHE and their positive effects on patient outcomes: (a) provide calm, naturalistic and domestic artwork or photographs; (b) provide east facing windows in the patient rooms to
provide bright light; (c) provide plants in window box or low shrubs planted outdoors; (d) use acoustic ceiling tiles; (e) provide a window view of nature visible from the hospital bed; (f) provide single occupancy rooms; and (g) provide patient rooms not contiguous with sources of unit noise.

These recommendations were then evaluated for their consistency with Arizona state law for behavioral health facilities, industry standards (Joint Commission Comprehensive Accreditation Manual for Behavioral Health Care) and behavioral health guidelines (Department of Veteran’s Administration Office of Facilities Management Design Guide: Mental Health Facilities, 2010) and the Guidelines and the Design Guide for the Built Environment of Behavioral Health Facilities (Sine & Hunt, 2012). Finishing materials list were then identified based on the Department of Veteran’s Administration Office of Facilities Management Design Guide: Mental Health Facilities (2010) and the Guidelines and the Design Guide for the Built Environment of Behavioral Health Facilities (Sine & Hunt, 2012) (Appendix C). The inpatient psychiatric room design was executed using computer assisted design (CAD) software (Figure 11) incorporating all seven evidence-based design recommendations (identified by letters that correspond to the design feature list in the previous paragraph).
FIGURE 11. Inpatient Room Design
The inpatient, single occupancy psychiatric room features approximately 143 square feet of space excluding the bathroom. It has an 11-foot by 7-foot east facing window with shatterproof glass and integral blinds between the glazing. The east facing window and a view of nature is visible from the bed. The window is fitted with a bench for nature viewing and maximum sunlight exposure. The window is fitted with nearly 11 feet of window boxes filled with ornamental plants for near views of plants. If the outdoor area is a patient access area then no window boxes will be used but small planted shrubs near the window. The grounds are also landscaped to ensure distant lush nature views.

The materials list called for artwork of nature scenes, which is available in suicide proofing form of printed vinyl from Kennon Products, Inc. (www.suicideproofing.com). Artwork of nature or home life can be affixed to the walls opposite the bed. Lastly, the materials list includes acoustic, sound absorbing materials in the ceiling, walls and flooring. The bathroom is strategically placed between the unit area and the bedroom to act as a buffer for noise. This minimizes the patient room wall from being contiguous with noise producing unit areas. The bathroom is equipped with ligature resistant shower features (VA Facilities Management, 2010; Sine & Hunt, 2012). The doors are equipped with piano hinges and are sloped to prevent securing a ligature anchor point (Sine & Hunt, 2012). The shelving is open for safety (VA Facilities Management, 2010; Sine & Hunt, 2012).

**Research Implications**

Rashid and Zimring’s (2008) conceptual framework describes 16 design features (noise, lighting, ambient temperature, air quality, overall quality of the environment, building configuration, layout of the rooms, functional relations, room configuration, furniture layout,
interior details, finish materials, color, artwork, nature and view, and environmental graphics) that affect physiological, psychological, cognitive, psychosocial and social outcomes. Theor
driven research on OHEs based on this model and on these design features should be prioritized for future investigation.

The majority of the research on healing environments falls into two categories within the built environment; lighting and noise. Noise is the most studied of the eight design features in this systematic literature review; however, the majority of the research is descriptive and provides evidence that noise in the healthcare setting is at decibel levels higher than the WHO guidelines (Aitken, 1982; Balough, Kittinger & Hackl, 1993; Busch-Vishniac et al., 2005). A single study included in this review explored the effects of using acoustic tiles to diminish sound levels (Busch-Vishniac et al., 2005). Descriptive/observational studies could be utilized for further studies on noise comparing units with and without acoustic tiles, but studies with greater scientific rigor may be able to establish the effects of this finishing material on patient outcomes such as stress and sleep quality. Lighting has been studied using the designs with the most rigor, randomized clinical trials. From evidence in this systematic literature review, east facing windows that allow natural morning light seem to improve health outcomes (Beauchemin & Hays, 1996; Benedetti, Colombo, Barbini, Campori & Smeraldi, 2001; Walch, Rabin, Day, Williams, Choi & Kang, 2005). Further investigation is needed to strengthen the existing research regarding which window orientation might have the most robust effects on reducing LOS, reducing pain medication use and improving mood. Additionally, in future studies, the effects of daylight that are quantified through the use of ratings scales for mood and stress, salivary cortisol levels and serotonin blood levels, might strengthen research findings.
Initial positive study results and strong theoretical support on the restorative effects of nature warrant further investigation in this area (Hartig, Evans, Jamner, Davis & Garling, 2003; Ulrich, 2004; 2008). Since Ulrich’s study on a view of nature from the hospital bed and its effects on pain and LOS (1984), no further studies on nature views from the hospital room have been conducted. Though nature is shown to have positive benefits on stress (Ulrich, 1991; Hartig, Evans, Jamner, Davis & Garling, 2003), Ulrich’s study remains the only study of its kind conducted in the healthcare setting. Nature views are not always available in the urban setting, but Park and Mattson (2008) offered an elegant study alternative to investigate the restorative effects of nature. Park and Mattson (2008) provided a single living plant in the patient’s room. This study did show significant differences between treatment (presence of a plant) and control groups (no plant) with the treatment groups showing lower analgesia use, lower HR and BP, lower anxiety, and lower ratings in reports of pain intensity and pain distress (Park & Mattson, 2008). Building a body of evidence that may support this simple intervention to improve patient outcomes is an important research direction to consider.

New technology to investigate the built environment will soon offer far greater understanding of the patient’s response to their surroundings. The development of techniques to measure electrical activity of a person’s brain with high definition electroencephalography (HD-EEG) as they are experiencing the built environment will inform researchers and designers exactly how a person responds to different environments in real time (Edelstein & Macagno, 2012). HD-EEGs, biochemical assays of perspiration to detect neurohormonal responses to the environment and electrocardiography to measure heart rate variability as a response to the autonomic nervous system’s response to stress, combine to create powerful tools to understand
the human response to their environment and are now available (Edelstein & Macagno, 2012). Future studies of the environment will have powerful new quantitative data to assess the built environment and could shed light on patients’ responses to different artwork, building configurations, finishing materials, interior details, nature and views, noise and room configurations.

New technology should also facilitate evidence based design to address unique patient populations. There is a need for evidence with strong external validity assuring generalizability to a variety of patient populations (geriatric, pediatric, outpatient, medical-surgical, oncology, intensive care, psychiatric, rehabilitation). This would aid designers and architects to tailor facilities to meet the needs of the patient population they are serving and address specific patient outcomes in which the environment could be leveraged to facilitate recovery.

**Policy Implications**

Understanding the current and past trends that have shaped mental health treatment and mental health policy is necessary in order to make policy recommendations in the future. Two of the most important aspects of mental health treatment and services are access to care and funding mental health services. Appreciating the long term effects of earlier policies provides insight into the current issues affecting mental health delivery and patient care today.

Historical factors which are still affecting access to mental health care today are deinstitutionalization which occurred in 1974 as a result of the Wyatt v. Stickney court case in Alabama (Treatment Advocacy Center, 2011). The court’s decision was originally sought to make the case for greater mental health funding as funding was thought to be inadequate to provide appropriate treatment services in psychiatric institutions in Alabama (Treatment
Advocacy Center, 2011). The result of the Wyatt v. Stickney court case was not increased funding for services (Treatment Advocacy Center, 2011). Patients won the right to receive viable treatment from an institution in which they were kept involuntarily or be released from the hospital (Treatment Advocacy Center, 2011). The result was patients being released from institutions known as deinstitutionalization (Treatment Advocacy Center, 2011). In Alabama alone from 1970 to 1975 the state hospital discharged two thirds of their clients. The trend was replicated across the country lowering the number of psychiatric beds per 100,000 populations from 340 in 1955 to 17 in 2005 (Torrey et al., 2008). Experts indicate that 50 public psychiatric beds per 100,000 populations is the minimum threshold of recommended number of inpatient psychiatric beds; however, 42 of 50 states in the U.S. have half or fewer than half of the recommended number of public psychiatric beds per 100,000 populations (Torrey et al., 2008; Lamb & Weinberger, 2005).

Adequate numbers of inpatient psychiatric beds is the first obstacle to overcome in meeting the needs of patients with psychiatric disorders who require acute stabilization of their illness. The second issue regarding access to mental health treatment is funding for inpatient mental health services. One of the reasons psychiatric services have not kept pace with patient need is due to discrepancies in funding and reimbursement rates between mental health disorders and general medical disorders. An attempt to correct this discrepancy occurred with the passage of the Mental Health Parity and Addiction Equity Act of 2008 (MHPAWA). This act provides that group health plans for behavioral health cannot have more restrictive treatment limitations than those for medical conditions. The MHPAWA strives to increase access to mental health
care, but parity for mental health services without ensuring the availability of those services only creates a different barrier to accessing mental health care (U.S. Department of Labor, 2010).

The recent policy changes with MHPAWA regarding reimbursement may provide financial incentives for healthcare organization to increase inpatient mental health inpatient beds in the future if the potential for profit is there. Correcting decades of policy that served to erode the availability of inpatient psychiatric beds will take time. Currently, there is no proposed legislation advocating an increase in inpatient psychiatric services, however, the Excellence in Mental Health Act is currently in congress (Excellence in Mental Health, 2012, www.bazelon.org/In-Congress) and calls for federally qualified behavioral health centers (FQBHC) to provide comprehensive outpatient mental health services to all individuals regardless of a person’s ability to pay for services. The Excellence in Mental Health Act also proposes refurbishing and constructing mental health facilities, making FBHCs eligible to receive Medicaid reimbursement and allowing FBHCs eligible to apply for federal grants (Excellence in Mental Health, 2012, www.bazelon.org/In-Congress).

With increased access to outpatient mental health services, a possible outcome will be the identification of more patients who require acute inpatient treatment and stabilization. This will likely increase the need for inpatient beds and highlight the deficits in the system for the provision of acute psychiatric care. As acute care psychiatric services are already in short supply (Torrey et al., 2008; Lamb & Weinberger, 2005), identification of more mental health patients will likely worsen the current shortage of inpatient psychiatric beds. Though this is an unwelcome potential crisis, the result will likely draw needed attention to the deficits in the mental health system for those who are acutely ill.
**Doctor of Nursing Practice Role**

At this juncture, if the Excellence in Mental Health Act is approved by the Senate and Congress, then the planning and construction of FBHCs will provide Doctors of Nursing Practice (DNP) an opportunity to take a leadership role in advocating for OHEs in the outpatient mental health setting. DNPs will need to provide vision for a design project and ensure a nursing philosophy is incorporated into the organizational culture, the care delivery model, and execution of the healthcare design (Stichler, 2007). This creates the first opportunity for DNPs to advocate for OHEs in mental health settings and could be the first step in reversing mental health’s lack of progress in implementing OHEs as compared to the general medical setting. OHEs ensure that patient care is provided in a way that considers the patients’ response to the stressors of hospitalization and leverages the built environment to minimize perceptions of the environment that contribute to stress and creates an environment that facilitates the coping process. The purpose of promoting the coping process is to attain positive emotions as the outcome (Folkman, 2008).

When thinking about the future of OHEs in the psychiatric setting, it will be important for DNPs to bring the shortage of inpatient psychiatric beds to light. This will require advocacy and the introduction of a bill to construct inpatient psychiatric facilities. Currently, the American Psychiatric Nurses Association does not have a position paper on this critical shortage, and this is a necessary step to not only generate support for the issue but for psychiatric nurse leaders to assume a leadership role. A position paper is the first step towards proposing legislation for renovating and constructing inpatient facilities. The sponsors of the Excellence in Mental Health Care Act, Senator Debbie Stabenow and Representative Doris O. Matsui (Excellence in Mental
Health, 2012, www.bazelon.org/In-Congress) may be welcome to sponsoring this next important step towards true parity for mental health care along with general medical care.

When preparing for future construction and renovation of psychiatric facilities, DNPs and nurse leaders will need to create a vision for what psychiatric facilities should be. This SLR contributes to the growing evidence that suggests that the provision of the following design features have a positive effect on patient outcomes: (a) Provide calm, naturalistic and domestic artwork or photograph; (b) Provide east facing windows in the patient rooms to provide bright light; (c) Provide plants in window box or low shrubs planted outdoors; (d) Use acoustic ceiling tiles; (e) Provide a window view of nature visible from the hospital bed; (f) Provide single occupancy rooms; and (g) Provide patient rooms not contiguous with sources of unit noise. This research evidence forms the basis for how psychiatric units can be designed and constructed in the future to create OHEs. One step in bringing this evidence to light is for the American Psychiatric Nurses Association to take a leadership role and compose a position paper on how Optimal Healing Environment design can be incorporated into the inpatient psychiatric setting. This goal is a competency required of DNPs and nurse leaders to demonstrate their skill to gather the necessary knowledge about current evidence within a discipline, to evaluate the quality of research, to translate applicable research into practice, and possess the attitude to creatively apply critical thinking skills to solve healthcare design problems (Lamb et al., 2010). This essential competency is required for interdisciplinary collaboration (Lamb et al., 2010) with architects, designers, physicians, hospital administrators, state mental health officials and patient advocates to all work together to ensure the best possible patient outcomes. The key role of the DNP on the interdisciplinary team will be to provide vision for the design project to execute
evidence based optimal healing environmental design which incorporates of artwork, daylight, nature and noise reduction into inpatient psychiatric unit designs.

**Strengths and Weaknesses**

This systematic literature review does have specific weakness and strengths. One of the weaknesses of this systematic literature review is that meta-analysis was not feasible due to the heterogeneity of the interventions, study outcomes and study measures. Another weakness of this study was the PICO format which narrowed the inclusion and exclusion criteria. For example, other systematic literature reviews included a variety of settings (waiting areas, dental offices, nursing homes) and a broader population (outpatients, family members, staff). At this point when research literature on OHEs is relatively scarce, constricting the search to a narrow population and setting is a weakness. On the other hand, one of the strengths of this systematic literature review is its greater generalizability from hospitalized patients to psychiatric inpatients due to the narrowness of the PICO question.

A strength of this systematic literature review is the focus on the role of the physical environment to support healing. The only other systematic literature review to focus on the design of the physical environment to support healing was by Dijkstra (2006). One meta-analysis (Drahota et al., 2012), one systematic literature reviews (Rubin, 1998) and two integrative literature reviews (Ulrich et al., 2004, 2008) included therapeutic interventions, which do not rely on the built environment to support a healing environment, but rely upon individual staff members, staff education and training, hospital reimbursements for therapeutic interventions and hospital policy (administrative, medical, nursing, clinical support) to support a healing intervention. The key advantage of this systematic literature review is the theoretical foundation
which guides the vision of this project and asks not only what factors in the inpatient healthcare environment support an optimal healing environment, but informs and guides how the healthcare environment can support the outcome of positive emotions. The first model used in this systematic literature review was Rashid and Zimring’s (2008) Conceptual Framework Describing How the Physical Environment May Set in Motion a Process Leading to Stress, which informs which features in the built environment can support or hinder the occupants’ physical or psychological needs and physical or psychological outcomes. This model defines and describes how the core features of the environment can affect the buildings’ occupants. A weakness in this model is found in the definitions of the design features which at times lack full elaboration. The second model used is the revised stress and coping model by Folkman (2008) illustrates how a healing environment facilitates a positive perception and cognitions of the patient’s environment, which can be used to facilitate meaning, focused coping to deal with health and mental health stressors. The result, according to Lazarus and Folkman (1984) and Folkman (2008), is sustenance of the coping process and positive emotions.

Conclusion

This systematic literature review on healing environments found evidence, which suggests that the physical environment has positive effects on mental and physical health. The evidence suggests that effective, intelligent design of health care facilities may have the potential to reduce the duration of illness, reduce the amount of spent in the hospital, improve mood, reduce incidences of seclusion and restraint, reduce narcotic pain medication use, reduce the duration of labor, reduce noise and improve some physiologic responses. All of these possibilities require adequate planning and design on the part of the architects, designers,
hospital administration, clinical and nursing staff. OHEs promote holistic, integrated care of patients to ensure patients receive the best possible care not only from their healthcare providers, but also from intelligent physical design. OHEs offer the opportunity for facilitating the stress and coping process by supporting meaning focused coping, supporting the coping process and facilitating the outcome of positive emotions.
APPENDIX A:

ARIZONA DEPARTMENT OF HEALTH, ARIZONA ADMINISTRATIVE CODE: STATE
REQUIREMENTS FOR LICENSING – BEHAVIORAL HEALTH GUIDELINES AND
AMERICAN DISABILITY ACT (ADA) REQUIREMENTS
Arizona Department of Health, Arizona Administrative Code: Title 9, Chapter 20, State Requirements for Licensing – Behavioral Health
From http://www.azsos.gov/public_services/Title_09/9-20.htm

R9-20-405. Environmental Standards

A. A licensee of a residential agency or an inpatient treatment program shall ensure that the premises have:
   1. An indoor common area that is not used as a sleeping area, and that has:
      a. A working telephone that allows a client to make a private telephone call;
      b. A distortion-free mirror;
      c. A current calendar and an accurate clock;
      d. A variety of books, current magazines and newspapers, and arts and crafts supplies appropriate to the age, educational, cultural, and recreational needs of clients;
      e. A working television and access to a radio; and
      f. Space sufficient to accommodate the social and recreational needs of clients and to allow private conversations and group activities;
   2. A dining room or dining area that:
      a. Is lighted and ventilated,
      b. Contains tables and seats, and
      c. Is not used as a sleeping area;
   3. For every six clients, at least one working toilet that flushes and one sink with running water;
   4. For every eight clients, at least one working bathtub or shower, with a slip resistant surface;
   5. A separate lockable storage space for each client according to the agency's policy and procedure; and
   6. An outdoor area that:
      a. Is accessible to clients,
      b. Has sufficient space to accommodate the social and recreational needs of clients, and
      c. Has shaded and unshaded areas.

B. A licensee of a residential agency or an inpatient treatment program shall ensure that a client's sleeping area is in a bedroom that:
   1. Meets one of the following:
      a. Is a private bedroom that contains at least 60 square feet of floor space, not including the closet; or
      b. Is a shared bedroom that:
         i. Is shared by no more than four individuals;
         ii. Except as provided in subsection (C), contains at least 60 square feet of floor space, not including a closet, for each individual occupying the bedroom; and
         iii. Provides at least three feet of space between beds;
   2. For an agency licensed after the effective date of this Chapter, has walls from floor to ceiling;
   3. Contains a door that opens into a hallway, common area, or the outside;
   4. Is constructed and furnished to provide unimpeded access to the door;
   5. Is not used as a passageway to another bedroom or a bathroom unless the bathroom is for the exclusive use of an individual occupying the bedroom;
   6. Contains the following for each client:
      a. An individual storage space, such as a dresser or chest;
      b. A table or other surface;
      c. Except for a child who sleeps in a crib as permitted in R9-20-404(A)(5), a bed that:
         i. Consists of at least a mattress and frame;
         ii. Is in good repair, clean, and free of odors and stains; and
         iii. Is at least 36 inches wide and 72 inches long; and
      d. A pillow and linens that are clean, free of odors, and in good repair, including:
         i. A mattress pad;
         ii. A top sheet and a bottom sheet that is large enough to tuck under the mattress;
         iii. A pillow case;
         iv. A waterproof mattress cover, if needed; and
         v. A blanket or bedspread sufficient to ensure the client's warmth; and
7. Contains:
   a. Lighting sufficient for a client to read;
   b. Windows or doors with adjustable window or door covers that provide client privacy, if applicable; and
   c. To provide safe egress in an emergency, a working door to the outside or an openable window to the outside, unless the facility contains an automatic sprinkler system as required in R9-20-406(C)(3)(b), that is no higher than 20 feet above grade and that:
      i. Meets the fire safety requirements of the local jurisdiction;
      ii. Has no dimension less than 20 inches, has an area of at least 720 square inches, and has a window sill that is no more than 44 inches off the floor; or
      iii. Is large enough, accessible to a client, and within the capability of the client to egress in an emergency.

C. If a licensee's agency was licensed before the effective date of this Chapter with a shared bedroom containing at least 50 square feet of floor space, not including a closet, for each individual occupying the room, the licensee may operate the agency with a shared bedroom containing at least 50 square feet of floor space, not including a closet, for each individual occupying the room.

D. A licensee shall ensure that:
   1. The supply of hot water is sufficient to meet:
      a. Each client's daily personal hygiene needs; and
      b. The laundry, cleaning, and sanitation requirements in this Chapter;
   2. Clean linens and bath towels are provided to a client as needed and at least once every seven days;
   3. One of the following is available to ensure that client clothing can be cleaned:
      a. A working washing machine and dryer on the premises,
      b. An agency-provided process for cleaning clothing, or
      c. An agency-provided process for transporting a client to a building with washing machines and dryers that a client can use; and
   4. Soiled linen and clothing stored by the licensee are in covered containers or closed plastic bags away from a food preparation or food storage area or a dining area.

E. A licensee shall ensure that:
   1. Except for an agency located in a correctional facility, a client is not locked into a bedroom; and
   2. If a client's bedroom is capable of being locked from the inside, a staff member has a key that allows access to the bedroom at all times.

F. A licensee shall ensure that clients are assigned to a bedroom:
   1. As required in R9-20-404(A)(4)(a), if applicable;
   2. To ensure client health, safety, and welfare; and
   3. After considering a client's:
      a. Age;
      b. Gender;
      c. Developmental level;
      d. Behavioral health issues;
      e. Treatment needs; and
      f. Need for group support, independence, and privacy.
Section 35.151 of 28 CFR Part 35
(b) Medical care facilities. Medical care facilities that are subject to this section shall comply with the provisions of the 2010 Standards applicable to medical care facilities, including, but not limited to, sections 223 and 805 (pp. 81 and 209). In addition, medical care facilities that do not specialize in the treatment of conditions that affect mobility shall disperse the accessible patient bedrooms required by section 223.2.1 of the 2010 Standards (p. 82) in a manner that is proportionate by type of medical specialty.

223 Medical Care and Long-Term Care Facilities
223.1 General. In licensed medical care facilities and licensed long-term care facilities where the period of stay exceeds twenty-four hours, patient or resident sleeping rooms shall be provided in accordance with 223.

EXCEPTION: Toilet rooms that are part of critical or intensive care patient sleeping rooms shall not be required to comply with 603.

Advisory 222.1 General. A “cluster” is a group of rooms proximate to one another. Generally, rooms in a cluster are within sight of, or adjacent to, one another. Different styles of design provide users varying levels of privacy and convenience. Some designs include private changing facilities that are close to core areas of the facility, while other designs use space more economically and provide only group dressing facilities. Regardless of the type of facility, dressing, fitting, and locker rooms should provide people with disabilities rooms that are equally private and convenient to those provided others. For example, in a physician’s office, if people without disabilities must traverse the full length of the office suite in clothing other than their street clothes, it is acceptable for people with disabilities to be asked to do the same.

Advisory 223.1 General. Because medical facilities frequently reconfigure spaces to reflect changes in medical specialties, Section 223.1 does not include a provision for dispersion of accessible patient or resident sleeping rooms. The lack of a design requirement does not mean that covered entities are not required to provide services to people with disabilities where accessible rooms are not dispersed in specialty areas. Locate accessible rooms near core areas that are less likely to change over time. While dispersion is not required, the flexibility it provides can be a critical factor in ensuring cost effective compliance with applicable civil rights laws, including titles II and III of the ADA and Section 504 of the Rehabilitation Act of 1973, as amended.

Titles II and III - 2010 Standards - 51
[See additional requirements at 28 CFR 35.151(h), p. 13, and 28 CFR 36.406(g), p. 30.]
Department of Justice 2010 Standards: Titles II and III - 81
ADA CHAPTER 2: SCOPING REQUIREMENTS AMERICANS WITH DISABILITIES ACT: SCOPING 50

223.1.1 Alterations. Where sleeping rooms are altered or added, the requirements of 223 shall apply only to the sleeping rooms being altered or added until the number of sleeping rooms complies with the minimum number required for new construction.

223.2 Hospitals, Rehabilitation Facilities, Psychiatric Facilities and Detoxification Facilities. Hospitals, rehabilitation facilities, psychiatric facilities and detoxification facilities shall comply with 223.2.

223.2.1 Facilities Not Specializing in Treating Conditions That Affect Mobility. In facilities not specializing in treating conditions that affect mobility, at least 10 percent, but no fewer than one, of the patient sleeping rooms shall provide mobility features complying with 805.

223.2.2 Facilities Specializing in Treating Conditions That Affect Mobility. In facilities specializing in treating conditions that affect mobility, 10 percent of the patient sleeping rooms shall provide mobility features complying with 805.

223.3 Long-Term Care Facilities. In licensed long-term care facilities, at least 50 percent, but no fewer
than one, of each type of resident sleeping room shall provide mobility features complying with 805.

**805 Medical Care and Long-Term Care Facilities**

**805.1 General.** Medical care facility and long-term care facility patient or resident sleeping rooms required to provide mobility features shall comply with 805.

**805.2 Turning Space.** Turning space complying with 304 shall be provided within the room.

**Titles II and III - 2010 Standards - 180**

Department of Justice 2010 Standards: Titles II and III - 209

TECHNICAL CHAPTER 8: SPECIAL ROOMS, SPACES, AND ELEMENTS

247

**805.3 Clear Floor or Ground Space.** A clear floor space complying with 305 shall be provided on each side of the bed. The clear floor space shall be positioned for parallel approach to the side of the bed.

**805.4 Toilet and Bathing Rooms.** Toilet and bathing rooms that are provided as part of a patient or resident sleeping room shall comply with 603. Where provided, no fewer than one water closet, one lavatory, and one bathtub or shower shall comply with the applicable requirements of 603 through 610.
APPENDIX B:

JOINT COMMISSION COMPREHENSIVE ACCREDITATION MANUAL FOR

BEHAVIORAL HEALTH CARE (CAMBHC)
Environment of Care (EC)

Overview
The goal of this chapter is to promote a safe, functional, and supportive environment within the organization so that quality and safety are preserved. The environment of care is made up of three basic elements:
- The building or space, including how it is arranged and special features that protect individuals served, visitors, and staff
- Equipment used to support care, treatment, or services or to safely operate the building or space
- People, including those who work within the organization, individuals served, and anyone else who enters the environment, all of whom have a role in minimizing risks

This chapter stresses the importance of managing risks in the environment of care, which are different from the risks associated with the provision of care, treatment, or services. Any organization, regardless of its size or location, faces risks in the environment, including those associated with safety and security, fire, hazardous materials and waste, and utility systems. When staff are educated about the elements of a safe environment, they are more likely to follow processes for identifying, reporting, and taking action on environmental risks.

The standards in this chapter apply to buildings in which care, treatment, or services are provided. The chapter does not apply to buildings in which only administrative functions are performed. In those situations where behavioral health care services are not provided in buildings, such as wilderness programs, the requirements in this chapter apply to defined areas where outdoor activities take place.

About This Chapter
The standards are organized around the concepts of planning, implementation, and evaluation of results. The chapter calls for written plans for managing risks in each of these areas. Organizations may choose to address all required components of the environment in a single management plan or in several different plans. If an

| KEY | A indicates scoring category A; C indicates scoring category C; △ indicates situational decision rules apply; ▲ indicates direct impact requirements apply; ○ indicates Measure of Success is needed; □ indicates that documentation is required |

CAMBHC Update 2, September 2011
APPENDIX C:

DESIGN GUIDE FOR THE BUILT ENVIRONMENT OF BEHAVIORAL HEALTH FACILITIES
Design Guide for the Built Environment of Behavioral Health Facilities

by James M. Hunt, AIA, NCARB and David M. Sine, ARM, CSP, CPHRM

Distributed by the National Association of Psychiatric Health Systems

www.naphs.org
APPENDIX D:

DEPARTMENT OF VETERANS AFFAIRS, OFFICE OF CONSTRUCTION AND FACILITIES MANAGEMENT – DESIGN GUIDE 2010 MENTAL HEALTH FACILITIES
APPENDIX E:

PLANETREE DESIGNATION CRITERIA
PLANETREE DESIGNATION CRITERIA

For Sites Applying for Designation as a
Patient-Centered Hospital or a Resident-Centered Community

Integrated Set, revised February 2011 (Revisions (in bold) to take effect January 1, 2012)

The Patient/Resident-Centered Designation Program was created by Planetree to recognize healthcare providers around the world that have embraced and implemented patient-resident-centered care in a comprehensive manner. This approach to care is characterized by providers partnering with patients/residents and their families to identify and satisfy the full range of their needs and preferences. In addition to improving the patient/resident experience, patient-resident-centered organizations also focus on supporting the professional and personal aspirations of their staff members, who can more effectively care for patients and residents if they are cared for themselves.

Based on the feedback of thousands of patients, residents and healthcare professionals since 1978, Planetree has identified core elements that are essential to practicing patient-resident-centered care. The Designation Program is based on these core elements, as well as additional elements related to organizational structures and measurement. For each core element, specific criteria have been identified that sites must meet in order to demonstrate that they have implemented that aspect of a patient-resident-centered approach to care. The following criteria are designed to provide a level of consistency in what it means to be a patient-resident-centered organization while continuing to promote individuality and innovation in the delivery of care and services.

The designation criteria are designed to be applicable to all healthcare providers. In some cases, however, specific criteria may apply differently in various healthcare settings (acute care, continuing care, behavioral health), and not all criteria apply to all settings. Clarifications for how individual criteria may apply differently in discrete settings (either freestanding facilities or units within a larger setting) are provided within the text. If not otherwise noted, the criteria are applied in the same way across settings.

1 It is recognized that use of the term "patient" to describe consumer of behavioral health services remains the topic of longstanding debate within the behavioral health community; however, in order to promote parity and in the absence of an all-encompassing term for which there is widespread acceptance, the term "patient" will be used throughout these criteria to refer to individuals who use medical, mental, or other services. Individual organizations are encouraged to continue using the terminology with which they are most comfortable, and use it consistent with their preferred terminology of how they work to serve.
APPENDIX F:

INDIVIDUAL ANALYSIS TABLES
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<th>Citation and Country</th>
<th>Research Design, Sample and Setting</th>
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<th>Limitations</th>
<th>Design Implications</th>
<th>Strength and Quality Score</th>
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<td>Aitken, R.J. (1982). Quantitative noise analysis in a modern hospital. Archives of Environmental Health, 37(6), 361-364. United Kingdom</td>
<td>Non-experimental descriptive study Sample and setting: one hospital in the UK built in 1973, tower block design next to a major road and under the final approach for Heathrow Airport which is 8 miles away. One unit under investigation – 4 and 6 bed general surgical wards and one isolation room on the 4th floor.</td>
<td>None. This was a descriptive study of routine hospital environment.</td>
<td>Noise levels measured in dB(A) using a Brueel and Kjaer microphone placed on the wall at the head of the bed. n = 70 acoustic measurements were taken every 10 seconds and once after the hour for 3 consecutive 24 hour periods. One night the air conditioning (AC) was shut off and noise levels were recorded for 10 (5 minute) periods with the AC on and off.</td>
<td>Equivalent continuous sound levels for the 4 &amp; 6 bed units had a noise level of 50-60 dB(A) and 55-60 dB(A) in the isolation room (IR). At night the dB(A) levels were 45 for the 4-bed unit &amp; the IR and 40 in the 6-bed unit. Quietest times were early morning and noisiest time of the day was late afternoon and early evening. No consistent differences in the levels of noise with and without AC. There were noise levels in excess of 50 and 70 dB(A) in all areas. The floor polisher increased the noise level by 4 dB(A). The nurse call chime was 77 dB(A) in the patient room and 55 dB(A) in the nursing station.</td>
<td>Single hospital and single unit under investigation. No detail provided on the unit (unit layout or configuration, location of the nursing station, entry and exit doors) under investigation. Without this detail replication of the study cannot be achieved. Did not investigate patient responses to noise.</td>
<td>This study described noise levels in an inpatient unit. Noise levels can activate vasoconstriction at 70 dB(A). Noise as low as 35 dB(A) can affect sleep. Noise levels of 40 dB(A) are advised for hospitals. This study shows dB(A) consistently above 40 dB(A). Reducing dB(A) in the hospital is suggested.</td>
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<td>Baker, C.F. (1992). Discomfort to environmental noise: heart rate responses of SICU patients. Critical Care Nursing quarterly, 15(2), 75-90. United States</td>
<td>Non-experimental – descriptive Sample: n = 28 Surgical Intensive Care Unit (SICU) patients with a mean age of 63.2 years admitted no more than 2 hours after elective surgery. Exclusion criteria: unable to hear, had acute cardiac disease, hemodynamically unstable, unable to read or speak English or were cognitively impaired. All patients had normal sinus rhythm and 86% had diagnoses of hypertension, post myocardial infarction or cardiovascular disease. After discharge the patients had hearing testing to determine if they had normal hearing. 75% of the subjects had normal hearing and 25% had mild hearing loss. All subjects were able to hear conversation at the bedside. Setting: 14-bed SICU in a 467 bed, private Southwest community hospital. Single, glass enclosed rooms equipped with acoustic tiles and doors with a central nursing station that had a view of all the rooms.</td>
<td>None. This was a descriptive study of routine hospital environment.</td>
<td>Noise pressure level measured in decibels (dBA). Noise detected by microphone placed 3 feet above head of the bed and connected to a General Radio, 1933 precision sound level meter and analyzer. To identify the sources of the sound the investigator sat at the nurses’ station recording time of day, type of activity and sound sources near the patient and this data was transcribed onto the graphed recordings of dBA. In this way the patterns of noise sources were identified from the transcribed activities. Heart rate was defined as the number of R-R intervals of the ECG per minute. The bedside monitor was connected to a monitor, which converted the R-R intervals into heart rate. The analog signal of the heart rate was printed onto the chart recorder simultaneously with the decibel level. Heart rate (HR) and sound pressure level (SPL) were measured every 12 seconds. HR and SPL were recorded continuously</td>
<td>The mean SPL for each hour ranged from 49.1 to 68.6 dBA (6 to 8 pm). Oxygen facemasks increased ambient noise levels to 59.2 dBA. The grand mean SPL across the six hours of data collection was 60.5-62.4. The loudest hour was between 3-4 pm during shift change and similar loudness occurred from 4-6 pm during assessments and procedure performances. The quietest hour was 7-8 pm after most physicians and visitors left. With 65 dBA considered loud and annoying for speech, sleep or rest, 50% subjects (n = 14) were exposed to a mean sound level of 65-69 dBA for 1-3 hours. A repeated measures ANOVA* was used to compare the minutes and the hours when noise exceeded 65 dBA. Significant differences were found in the six hours (p = 0.05) period of data collection. 22-25% of the time between 3-7 pm (change of shift) high intensity noise occurred more often. High intensity noise above 65 dBA occurred only 14-16% of the time between 7-9 pm. Differences in sound level among the four types of noise (talking in or outside the room, ambient noise and alarm and equipment noise) were compared using a repeated measures Friedman test for matched groups (a non-parametric equivalent for an ANOVA) which showed a significant difference in dBA among the 4 types of noise (p = 0.0001, n = 28). Among all subjects, talking inside the room was 64.3 dBA, alarm and equipment noise was 61.2 dBA, talking outside the room was 60.5 dBA, ambient noise was 59.2 dBA. The differences can be attributed to the high ambient level from oxygen at the patients’</td>
<td>Competing hypotheses: Increases in HR are attributed to talking inside the room, to alarms and to the hospital equipment, however, increases in HR could be attributed not to the sound of speech, but to the content of the speech. The study design overlooked this distinction. A single hospital was used for this study and the staff behaviors could influence the results. Authors report this hospital is not characteristic of most urban hospitals.</td>
<td>Study described noise levels. Oxygen administration was associated with high ambient noise. Talking inside the room and alarm and equipment noise was associated with the highest dBA. Shift change was found to be the loudest hour and could be related to unit crowding, size of the report room and nursing station as well as staff pathways to enter and exit the nursing station.</td>
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<td>for 6 hours from 245 pm to 845 pm. Sampling of data was determined according to the 4 types of noise (talking in or outside the room, ambient noise and alarm and equipment noise)</td>
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<td>heads. Humans recognize a 6 dBA increase as a doubling of sound level. During a noise episode of 3-6 dBA or greater, mean HR was categorized as a decreased, increased or unchanged. The mean number of episodes was 23 per subject during the 6-hour data collection. Of 28 subjects who experienced an increase in SPL, 89% (n = 25) had increases in HR and 46% had significantly more increases in HR (p = 0.05). HR increased 2-12 bpm with a 6-dBA increase in SPL. HR responses to noise sources: Two types of noise accounted for 86% of the highest mean HR (talking inside the room and equipment and alarm noise). A non-parametric repeated measures Friedman test for matched groups showed significant differences in the mean HR with the 4 types of noise (p = 0.0001). The highest mean HR was during talking inside the room (85 bpm) and alarm and equipment noise (83 bpm). No difference in mean HR occurred during talking outside the room and ambient noise (81.7 bpm). A significant number of subjects had an increase in HR from before impulse to during impulse noise (p = 0.006) as compared to those who had a decrease or no change in HR. Noise levels during the observation were consistently above the 35-60 dBA levels recommended for rest and sleep. The lowest mean SPL for the majority of the subjects was 59 dBA secondary to oxygen.</td>
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*the author only provided p values and no other statistics.*
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<tr>
<td>Balough, D., Kittinger, E., and Hackl, J. M. (1993). Noise in the ICU. Intensive Care Medicine, 19, 343-346. Austria</td>
<td>Non-experimental – descriptive. Sample/ Setting- ICU of 4 (6 m x 6 m x 3.5 m height) rooms with 4 patients, open ward design with all rooms opening onto a central corridor with administration desk equipped with phones and monitors. Building constructed in the 1960s. Devices in use were described and quantified. Number of staff 4 nurses in the day and 2 at night.</td>
<td>None. This was a descriptive study of routine hospital environment.</td>
<td>Noise levels were assessed in the ICU using SPL (a weighted sound pressure level) to detect noise under normal operations and noise from instrument alarms To measure overall noise a microphone was placed at one side of the room (placement was uniform among the rooms). A continuous recording was taken over two 24-hour periods. Instrument alarms were recorded as well as frequency of alarms.</td>
<td>The energy averaged level of noise is a gross overall evaluation of noise. During the daytime hours of 20-minute intervals the dB ranges from 60-65. For a few minutes the noise may climb to 70-75 dB such as an activity like dialysis. Doctor’s rounds raised dB levels to greater than 65. At night the dB remains greater than 60 and can spike to 70 dB. Levels exceeding 70 dB and sustained for more than 15-22 minutes did occur. Most alarms reach 60-80 dB with some reaching 80 dB. On average 2.1±0.8 alarms per patient per hour occurred. One unstable patient had 42 alarms an hour.</td>
<td>Limited resolution of recordings allows only semi-quantitative conclusions. Sustained high noise levels were unexplained and a notebook for staff to offer explanations would have aided understanding of incidences of high noise levels.</td>
<td>Noise levels were described. SPL of the ICU is higher than the 45 dB(A) recommended by the US Environmental Protection Agency. Routine ICU environment shows the opportunity for noise reducing architectural design features.</td>
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<td>Beauchemin, K.M. and Hays, P. (1996). Sunny hospital rooms expedite recovery from severe and refractory depressions. <em>Journal of Affective Disorders</em>, 40, 49-51. Canada.</td>
<td>Randomized clinical trial Sample: N =174 inpatients with diagnoses: Major Depression, Bipolar, depressed, and depression not otherwise specified. Patients with severe, refractory depression, often suicidal. Excluded readmission data on patients and used only data from the last admission. Excluded patients with anorexia. Excluded patients with LOS &lt; 6 days. Setting: Edmonton, Alberta Psychiatric Hospital. Sun shines all year with intense sunlight during four winter months when light is reflected by snow.</td>
<td>Patients were randomly assigned to two different wards along a north to south axes with rooms with window views, which face east (bright light) or west (daylight blocked). Patients spend the mornings (unspecified amount of time) in their rooms. Same 7 treating psychiatrists with 6 of the 7 psychiatrists all trained at same center in which the study was conducted.</td>
<td>Two year chart review of discharge data for patients assigned to rooms with east or west facing window views. Measured LOS from admission to hospital discharge in days.</td>
<td>Average LOS was 18.1 days. Patients in rooms with bright daylight stayed an average of 16.9 days whereas patients in rooms with lower levels of illumination had an average stay of 19.5 days (2.6 days greater than patients in bright daylight rooms). The difference remained across seasons. Z-score comparing sample means (Z = 1.4: 1-tail, P &lt; 0.05).</td>
<td>No quantitative measure of actual depressive symptoms to indicate that depression improved. Discharge from the setting was used as a proxy for improved depression. Discharge could have been related to something else such as lack of reimbursement from the payer source. Patients were assessed as ready for discharge (subjective clinical judgment). No quantitative amount of daylight exposure was provided rather authors report patients “spent the first part of the day in their rooms” (p. 50). No quantitative amount of light (e.g. in lumens) in the patient rooms was measured.</td>
<td>This study compared LOS of depressed patients who were exposed to light from their hospital room windows (east, bright light or west, daylight blocked). East facing (bright light) windows may reduce LOS.</td>
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<td>Benedetti, F., Colombo, C., Barbini, B., Campori, E., and Smeraldi, E. (2001). Morning sunlight reduces length of hospitalization in bipolar depression. <em>Journal of Affective Disorders</em>, 62,221-223. Canada</td>
<td>Randomized controlled trial. Sample: Non-psychotic depression, major depression or bipolar disorder, depressive episode, no co-morbid axis I, length of stay (LOS)&gt;6 days. N = 415 unipolar and 187 bipolar patients Setting: Canadian psychiatric hospital</td>
<td>Patients were randomly assigned to be in an east (morning sunlight) or west (evening sunlight) facing hospital room. Same psychiatrists for both control and treatment groups.</td>
<td>Three year chart review of discharge data for patients assigned to rooms with east or west facing window views. Measured LOS from admission to hospital discharge in days.</td>
<td>No difference in LOS for patients with unipolar depression. Significant differences in LOS for patients with bipolar who were in east facing rooms. For the whole sample t(185) = 2.35, p = 0.020. Significant differences were seen for summer and fall admissions: winter t(60) = 0.01, p = 0.996, spring t(43) = 0.53, p = 0.600, summer t(31) = 2.23, p =0.046*, fall t(45) = 2.05, p = 0.046*. Patients with bipolar in east facing rooms had an average of 3.67 fewer days in the hospital than those in west facing rooms.</td>
<td>No quantitative measure of actual depressive symptoms to indicate that depression improved. Discharge from the setting was used as a proxy for improved depression. Discharge could have been related to something else such as lack of reimbursement from the payer source. No quantitative amount of daylight exposure was provided. No quantitative measurements of light (e.g. in lumens) in the patient rooms.</td>
<td>This study compared LOS of depressed patients who were exposed to light from their hospital room windows (east, morning sunlight or west, evening daylight). East facing (morning sunlight) windows may reduce LOS.</td>
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<td>Brooks, K.L., Mulaik, J.S., Gilead, M.P., and Daniels, B.S. (1994). Patient overcrowding in psychiatric hospital units: effects on seclusion and restraint. <em>Administration and Policy in Mental Health</em>, 22(2), 133-144, United States</td>
<td>Non-experimental, retrospective study. Sample: male and female adult patients age 18-80 admitted to the hospital. Ratio of male to female is 3:2. 90% of patients are involuntary admissions. Most prevalent diagnoses: Bipolar disorder, manic type, Schizophrenia, paranoid type, psychotic disorder with depression, and adjustment disorder with depression. Excluded: primary disorder of substance abuse. Setting: large public psychiatric hospital in southeastern urban area with each of the six locked units having a capacity of 28 patients on each unit which allows 100 square feet of space per patient. All activities are on the unit at all times. Staffing patterns were the same for all the units. Policies were uniform across the units.</td>
<td>None. This was a descriptive study of routine hospital environment.</td>
<td>Data analyzed: Existing hospital reports of seclusion and/or restraint on six adult psychiatric units from January 1 to December 31, 1990. Daily census reports were obtained from the nursing supervisors. Monthly census for each unit was calculated. Mean number of seclusion and/or restraints (S &amp; R) for the hospital was calculated using one year of data (M = 21). Chi Square test was used to test if there is a significant relationship between being above or below the mean number of monthly S &amp; R (21) with the census being above or below the capacity census (28).</td>
<td>Descriptive statistics: Unit 1: Census (M = 23). S &amp; R (M = 12). Unit 2: Census (M = 26). S &amp; R (M = 15). Unit 3: Census (M = 30.4). S &amp; R (M = 27). Unit 4: Census (M = 20). S &amp; R (M = 7.6). Unit 5: Census (M = 19.7). S &amp; R (M = 18). Unit 6: Census (M = 31.4). S &amp; R (M = 49). A Chi Square test revealed there is a significant relationship between census and S &amp; R. ( \chi^2(1) = 14.4 ) (( P &lt; 0.001 )). To determine that ward variation was not the cause of variation in S &amp; R, further analysis (within groups and between groups) was done to identify sources contributing to the overall correlation between census and S &amp; R. Total correlation ( r = 0.73 ), ( P &lt; 0.001 ) indicating a strong positive relationship between the variables. Within groups correlation ( r_W = 0.67 ) indicating a strong positive relationship across units. Between groups correlation ( r_B = 0.05 ) indicating little of the total relationship was due to covariation among the wards between mean census and mean S &amp; R.</td>
<td>Unit assignments were based on catchment areas of patients' residences. Only one year of data was used to calculate the mean number of seclusion and/or restraints. One or two aggressive patients during this year could skew the data.</td>
<td>This study sought to discover if there was a relationship between the density of the population on the inpatient unit and incidences of violence. A significant relationship between density of the patient population and incidences of violence was found. Evidence supports 100 square feet of space or more per patient on psychiatric units to reduce S &amp; R. Additionally, this evidence supports single occupancy inpatient rooms on psychiatric units.</td>
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<td>Busch-Vishniac, I.J., West, J.E., Barnhill, C., Hunter, T., Orellana, D. &amp; Chivukula, R. (2005). Noise levels in Johns Hopkins Hospital. Journal of Acoustic Society of America. 118(6), 3629-3645, United States</td>
<td>Non-experimental-descriptive Johns Hopkins Hospital Sample and Setting: Five units including pediatric ICU and adult medical/surgical and oncology units – one unit built in 1999, one unit without acoustical tile and others are nearly 50 years old.</td>
<td>None. This was a descriptive study of routine hospital environment.</td>
<td>Equivalent sound pressure level measurements at the five different units with simultaneous readings of octave band sound pressure levels. 24 hour measurements at 3 different locations in the units (patient room, nurses' station/hallway and an empty room) Recording device was a Larson-Davis system 824 and measurements were taken at a height of 4.5 feet</td>
<td>Newer units were not particularly quieter than the older units and acoustical tile did show consistently lower dB levels*. No differences in the sound levels were found between straight vs. curved corridors*. Highest noise levels were found in a staff conference room*. A closed door yielded a noise reduction of only 2.2 dB(A). It was noted that hospital doors have large gaps at the bottom. Nurses' stations were noisier than other areas on the unit by 1-2 dB(A). Logarithmic averages of equivalent sound pressure levels as compared to the World Health Organization guidelines shows: 1) little variation among the 5 units studied. 2) average equivalent sound pressure levels vary from 50-60 dB(A). 3) the pediatric ICU is the noisiest unit. Observed sound levels are at least 20 dB(A) on average greater than the WHO guidelines. With all the measured logarithmic average sound levels exceeding normal speech of 45-50 dB(A), staff will need to raise their voices to be heard. Noise levels by time of day showed little (7-8 dB(A)) to no variation according to the time of day. On average hospital noise levels are at about the same sound level constantly (no means given). Use of a personal hands free telecommunicator was evaluated as compared to overhead paging on one unit. The result was a reduction in dB(A) by 5.4 after the introduction of the telecommunicator. *no other statistics were reported by the authors</td>
<td>Single hospital Limited description of units (layout and configuration, location of nursing station) prevents replication of this study. Acoustic tile was not described (quality, manufacturer, age of tile).</td>
<td>This study described noise levels in a hospital. Observed sound levels are at least 20 dB(A) on average greater than the WHO guidelines and this finding along with the finding that acoustic tiles help diminish noise, warrant the use of acoustic tiles in hospitals. Holes in standard acoustic tiles are theorized to harbor bacteria, but they are not currently contraindicated for use in hospitals. Closed hospital room doors do not diminish noise by more than 2.2 dB(A) so alterations to doors are not indicated (e.g., self-closing doors). Curved hallways do not diminish dB(A) as compared to straight hallways. The trend to change straight hallways is unnecessary as a noise reduction technique. Replacing overhead paging with hand held devices did offer a modest reduction in dB(A).</td>
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<td>Christenfeld, R., Wagner, J., Pastva, G., and Acrish, W.P. (1989). How physical settings affect chronic mental patients. Psychiatric Quarterly, 60(3), 253-264. United States</td>
<td>Mixed methods: Qualitative – descriptive, structured interview and Quasi-experimental with pretest-posttest design. Sample: long term, chronically psychotic patients on an inpatient psychiatric unit. N = 36 patients for both pretest and posttest studies for the renovated units. N = 44 patients in the control group. All staff members were invited to participate. N = 23 staff members completed both the pretest and posttest. Setting: Harlem Valley Psychiatric Center, New York State mental hospital</td>
<td>Physical changes to two wards during renovation: 1) Ceilings lowered in halls, day room and patient rooms. Shaded lights installed. Light colored flooring tiles installed. Light colored vinyl design installed on walls. Waist high room dividers added to separate dining and create 3 separate seating areas with furniture arranged for TV viewing, games and social interaction. Interior decorations including paintings, posters, and hanging baskets of flowers and plants were added. Nursing station relocated to facilitate optimal views of the dayroom, porch and retreat room. Smoking porch was ventilated and decorated with same interior decorations. Hallways were carpeted, non-institutional clocks installed, wall hangings added, archways installed and seating area added. 2) Bathrooms: ornamental tile installed, full length mirrors added, vanity style sinks added, private dressing rooms added and non-weight bearing shower heads installed.</td>
<td>Qualitative: Study authors report use of key-informant phenomenological reports from staff and patients for 8 months after moving into the renovated wards. Quantitative: Controlled study with pretest-posttest design was matched with four control wards with patients similar in age, diagnoses, chronicity, functioning and prognosis regarding discharge. Therapies and activities for all the wards were nearly the same except one less therapy aid on one model ward. Baseline data obtained from the two renovated wards and the four control wards for 4-8 months post-occupancy. Instruments: Moos’ Ward Atmosphere Scale and Lubin’s Depression Adjective Checklist (Form E). Patients from the six wards were invited to participate in a pretest and posttest structured interview conducted by a staff member on the ward. The patient interview consisted of: 1) scales developed for this study to determine satisfaction with ward patient room, dining room, shower room and day room. 2) National Institute of Mental Health’s CES-D scale. Patients from the six wards were invited to participate in a pretest and posttest structured interview conducted by a staff member on the ward. The patient interview consisted of: 1) scales developed for this study to determine satisfaction with ward patient room, dining room, shower room and day room. 2) National Institute of Mental Health’s CES-D scale.</td>
<td>Two-way ANOVA was used to test the effects of ward renovations by comparing pretest and posttest scores by patients and staff. The scale of ward satisfaction showed improvement for both control and model ward patients however it was not statistically significant*. Additionally no significant findings were found in the subscales for satisfaction with bedroom, shower and dining room*. Satisfaction for the dayroom showed a statistical significance difference between the control (pre to post difference of 0.3) and model wards (pre to post difference of 1.4), (two way interaction, F = 3.95, p &lt; 0.05). There were improvements in patient depression pre to post test, although, no statistically significant differences were found between the model and control wards according to the National Institute of Mental Health CES-D scales*. There were no statistically significant changes in factors of irritability and social isolation on the Harlem Psychosocial Scale on the control or model wards pre to posttest*. There was a statistically significant difference between control (pre to posttest difference of 1.01) and model wards pre to post test in amelioration of negative self-image (pre to posttest difference of 0.57), (two way interaction, F = 4.17, p &lt; 0.05). No significant differences were found between control (pre to posttest difference of 0.03) and model ward pre to posttest 0.07) in episodes of patient violence per month pre to post test (two-way interaction, F = 0.47, p &gt; 0.05), although there was a statistically significant reduction found in the geriatric population (no details provided)*. Authors describe study as phenomenological; however, single, structured interviews violate phenomenological study design. Study is descriptive in nature and reports were cursory. Staff members conducting patient interviews could introduce significant bias on the post-occupancy interviews.</td>
<td>Authors did not provide statistical values.</td>
<td>This study compares the original ward to the renovated ward. Significant findings for the renovated ward include: satisfaction with the remodeled day room, amelioration of negative self-image, and geriatric populations experienced a reduction in violence. The majority of the findings were non-significant and no conclusions re: potential for impact on healing environment can be drawn from this study.</td>
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<td>Daykin, N., Byrne, E., Soteriou, T. &amp; O’Connor, S. (2008). Review: The impact of art, design and environment in mental healthcare: a systematic review of the literature. The Journal of the Royal Society for the Promotion of Health, 128(2)85-94, United Kingdom</td>
<td>What is the Impact of visual art, design and environment on well-being of patients and staff in mental healthcare settings?</td>
<td>Yes Search terms identified 14 Databases identified</td>
<td>Yes Search terms did not include interior design or spatial layout Appropriate databases for subject</td>
<td>Yes Excluded art therapy</td>
<td>Ample detail of all of the studies presented in table format</td>
<td>Yes, limitations found in the review articles were discussed Qualitative studies were found to be weak due to lack of adherence to procedure Diversity of settings makes synthesis difficult Some relevant studies outside mental health settings were excluded</td>
<td>Key findings: 1) exposure to the arts may reduce anxiety and depression, clinical and behavioral outcomes. 2) positive effects on wayfinding and perception of healthcare environment. 3) natural environments are favored over urban. 4) art that is calm, naturalistic, and domestic (home scenes) is favored over abstract or challenging art content. 5) patient attitude surveys show high approval for the arts.</td>
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<td>Dijkstra, K., Pieterse, M. and Pruyn, A. (2006). Physical environmental stimuli that turn healthcare facilities into healing environments through psychologically mediated effects: systematic review. Journal of Advanced Nursing, 56(2), 166-181. Netherlands</td>
<td>What effect do physical environmental stimuli in healthcare settings have on the health and well-being of patients?</td>
<td>Yes</td>
<td>Key words for search strategy were identified. Any health care setting was included. The 8 databases searched were listed. The authors report that stimulus objects can impact the health and well-being of inpatients: 1) physiological 2) psychological. Based on this rationale, the authors have endorsed a search strategy focused on psychological processes because environmental stimuli are theorized to be activated by the senses, which then effect psychological processes. Psychological processes can be cognitive or emotional.</td>
<td>Yes Included: 1) interventions involving the health effects of environmental stimuli with or without a comparison or with no intervention 2) clinical trials with adequate control group and published in a peer reviewed journal 3) patients in a healthcare setting for any length of time 4) health related outcome Excluded: any confounding environmental intervention with a non-environmental intervention.</td>
<td>Yes Ample study detail was provided in the tables. Summary tables were also organized into the following categories: 1) effects of physical environmental stimuli A) multiple stimuli (redesign of entire wards) B) ambient features C) architectural features D) interior design features</td>
<td>Methodological characteristics of the studies were discussed in detail. The study characteristics included: 30 studies were included. 18 were controlled trials. 2 were randomized controlled trials. 10 were natural experiments. Meta-analysis could not be conducted due to the heterogeneity of the interventions (17 different environmental stimuli studied in 30 different research studies), a variety of healthcare settings and patient populations as well as varying outcome measures.</td>
<td>Overall, there is not yet enough evidence to formulate evidence-based guidelines for designing healthcare environments.</td>
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<td>Dolce, J.J. &amp; Doleys, D.M. (1985). Narcotic utilization for back pain patients housed in private and semi-private rooms. Addictive Behaviors 10, 91-95. United States</td>
<td>Quasi-experimental Sample: Orthopedic patients (n = 80) with 40 in private rooms and 40 in semi-private rooms. Hospitalized greater than 5 days. Excluded patients in hospital less than 5 days and patients with incomplete records. Setting: not described</td>
<td>None. Routine hospitalization under investigation.</td>
<td>Medical record review from 40 private room patients and 40 semi-private room patients all with pain-related disorders and treated with narcotics. Narcotic use was standardized to daily narcotic equivalents for ease of measurement. Medical and demographic variables were collected and included: back pain history, LOS, number of operative procedures during current hospitalization and past operations, previous number of back related hospitalizations, gender, age, race, marital status, occupation, distance from home. Each patient assigned to a diagnostic category (discogenic/neurological, structural or muscular).</td>
<td>t-tests for independent groups revealed no significant* differences in observed narcotic use between room type for either oral, t(78) = 1.2 or IM time contingent medications, t(78) = 0.428. The majority of narcotics were given on a request contingent basis. No statistically significant* difference was found between room types for the use of oral narcotics, t(78) = 0.675. Intramuscular medication request contingent medication use was found to be significantly greater in private use as compared to semi private rooms, t(78) = 1.736, p &lt; 0.05, one tailed. 22.5% (n = 9) of semi-private room occupants received request contingent injectable narcotics as compared to private room occupants where 47.5% (n = 19) received request contingent injectable narcotics. A general linear multiple regression analysis was used to assess if room type was predictive of narcotic utilization. R² of 0.1988 was obtained accounting for less than 20% of the total variance and was not statistically significant* F(15,64) = 1.06. No variable including room type could account for a significant amount of the variance in the use of IM request contingent narcotics when the effects of other independent variables were subtracted. These data do not support the hypothesis that room type is a predictive variable for narcotic utilization.</td>
<td>A higher incidence of injectable narcotic use in private rooms is greatly influenced by the IM injection site (e.g., gluteal) making a private room occupant more likely to use this type of narcotic administration. Sample and setting was not fully described. The incidence of substance dependence in this population is an important factor in measuring narcotic utilization and was not factored into the study.</td>
<td>This weak study evaluated the layout of rooms in the hospital setting to determine if pain medication utilization was influenced by private or semi-private room occupancy. These data do not support the hypothesis that room type is a predictive variable for narcotic utilization. This study does not demonstrate that patient outcomes are affected by private or semi-private room occupancy, and therefore does not inform hospital room design.</td>
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<td>Douglas, C.H. and Douglas, M.R. (2004). Patient-friendly hospital environments: exploring the patients' perspective. Health Expectations, 7, 61-73. United Kingdom</td>
<td>1) What are the patients’ understanding of what makes the hospital environment patient friendly? 2) What is the nature of their experience and how does it affect them? 3) What are the most important aspects of the built environment that support or impede what they want or need to accomplish? 4) What are their suggestions to create a more patient-friendly hospital environment?</td>
<td>Qualitative-exploratory study. Uses semi-structured interviews.</td>
<td>Sample selection through consultation with ward managers: A total of 50 adult inpatients ages 18-82 in surgery (n = 21), medical (n = 9), geriatrics (n = 9), and maternity (n = 12) wards with &gt; 5 days in the hospital. Inclusion criteria: able to participate in a 15-minute interview. Exclusion criteria: none. Setting: Salford Royal Hospitals NHS Trust, Salford, United Kingdom</td>
<td>Patients were given an information sheet 24 hours prior to the interview to explain the study purpose and method of data collection by interview. Two researchers were present at the interview. One researcher conducted the semi-structured interview and one researcher took detailed notes by hand.</td>
<td>Moderate rigor due to hand transcription vs. verbatim recording. Single recording researcher (not the interviewer). Lack of member checking.</td>
<td>Content from the interviews were indexed according to broad categories and placed into tables based on themes.</td>
<td>Themes identified from the four ward types: 1) sense of personal space (confidentiality and privacy): related to single rooms, use of curtains to enhance privacy and availability of separate consultation and visiting areas. 2) home atmosphere, welcoming atmosphere: interior design and color choice, noise and patient control of window coverings and electronic devices. 3) meeting visitor and family needs: parking, overnight accommodations, adequate space and furniture for guests, refreshments for guests, play area for children, adequate wayfinding, support staff for visitors with special needs. 4) physical design that was usable, controllable and accessible electronics, window coverings, lights, adequate space to move around, and adequate storage. 5) access to outdoor areas: light, visible window views, fresh air and ventilation, balconies, fountains.</td>
<td>1) Credibility is weakened by: a) poor adherence to scientific rigor b) no record of researcher opinions and biases (i.e. accounting for outliers, saturation). c) No record of triangulation or verification through multiple data sources (for example an exit survey). 2) Dependability: there was scant information (audit trail) included regarding the research process to demonstrate how the researcher reached their conclusions. There was a leap from the summary contents to the stated conclusions. 3) Transferability is strong as four different ward types presented similar themes regarding their environments, however, there was an unequal number of participants across the ward types, which could alter the findings. 4) Confirmability of findings is weak/poorly grounded in the data. Findings are not supported by data presented.</td>
<td>No recordings of the interviews due to patient reluctance, feelings of intrusion related to recordings and poor sound quality. One interviewer recorded the sessions by hand and written up in an undisclosed amount of time from note taking to written transcription. Single hospital environment limits generalizability because flawed building design features in this hospital may over-represent hospital design issues in general.</td>
<td>This flawed qualitative study explored patient views of the hospital environment and found the following themes aided patient perceptions of a friendly hospital environment: 1) personal space 2) home atmosphere, control of space 3) meeting family and visitor needs 4) accessible design features 5) accessibility to the outdoors</td>
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<td>nature in artwork and walking paths. 6) effective communication: bed position, access to media (TV, radio, internet, phone), bed layout to facilitate socialization and flexible visiting hours. 7) facilities to support recreation and leisure to occupy the mind: self-care/hygiene, physical exercise, spiritual needs, reading, hobbies, refreshments and daycare.</td>
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<td>Drahota, A., Ward, D., Mackenzie, H., Stores, R., Higgins, B. Gal, D. and Dean, T.P. (2012). Sensory environment on health-related outcomes of hospital environments. The Cochrane Collaboration, 3, 1-360. United Kingdom</td>
<td>What effects do hospital environments have on adult patient health-related outcomes?</td>
<td>Yes Key words for search strategy were identified. The 14 databases, organization websites, direct contact with researchers and reference lists were searched and documented. 78,480 records identified through searches. 102 articles in the review. 85 of the 102 articles were related to music. For each database searched, the search strategy is recorded (see appendix).</td>
<td>Yes Searches covered the fields of health, medicine, psychology and architecture. Grey literature was also searched (organizational websites and individual researchers). For each database searched, the search strategy is recorded (see appendix).</td>
<td>Yes Included 90% adult participants, both inpatients and outpatients with all diagnoses. Included any aspect of the sensory environment that altered the environment by: 1) positive distracters (aroma, artwork, performance art, audiovisual art, decoration, music, access to nature. 2) reducing environmental stressors by implementing physical changes (noise reduction, way-finding, patient control, lighting, privacy). 3) multi-faceted interventions (multiple variables manipulated).</td>
<td>Yes Ample study details were provided with tables summarizing all of the research articles.</td>
<td>Yes Details of study limitations were recorded in the tables and in the discussion.</td>
<td>Of the 102 studies reviewed, 85 were related to music and the remaining 17 articles were related to aromas, audiovisual distractions, decoration, air quality, bedroom type, flooring, furniture and furnishings, lighting, temperature or multiple design changes. Music may help patient anxiety but does not appear to effect physiological outcomes. The study authors concluded that all interventions reviewed (other than music) do not meet the threshold to make evidence-based design decisions, as there are not yet enough studies.</td>
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<td>Duncan, J. (2011). The effect of colour and design in labour and delivery: a scientific approach. Optics &amp; Laser Technology, 43, 420-424. United Kingdom</td>
<td>Quasi-experimental study Sample: 26 women in treatment group and 32 women in the control group. 58 women in labor at Chelsea and Westminster Hospital. Excluded from study: women who suffered medical conditions</td>
<td>Patients were assigned to a traditional labor and delivery room or to a birthing room that was equipped with a specially designed screen to shield emergency medical equipment from view.</td>
<td>Women beginning labor assigned to: Control room without screen to shield emergency equipment from view OR treatment room with a screen to shield emergency equipment from view. The screen with an abstract design in both cool and earth tones was chosen after anecdotal information was gathered from expectant mothers regarding their color preferences. The choice for an abstract design was not disclosed except to report it was thought to allow for open interpretation by the viewer. For 3 months midwives recorded: 1) time of entry into the room which defined the starting time of labor 2) time labor ended (delivery). 3) type of analgesia required. 4) if delivery was normal.</td>
<td>1) Independent samples t-test (unpaired t-test) to determine any difference in the length of the labor between the control and study groups. Reported to be &quot;statistically significant* shortening of the duration of the labor by 2.1 hours&quot; (pg. 423). 2)&quot;comparison of two independent proportions&quot; – To measure the frequency of requirement of epidural analgesia. Frequency of requests for epidural analgesia was 7% lower in the treatment group than the control group. Statistical significance was not achieved. *P values were not reported.</td>
<td>Author reports achieving statistical significance when comparing duration of labor between the treatment and control groups, but p values are not presented for evaluation by the research consumer. Second comparison of the frequency of requests for pain medication did not meet requirement for statistical significance. P values were not reported.</td>
<td>This study compared the effects using visual art screens to shield emergency equipment vs. no screens to shield emergency equipment in the labor and delivery room to decrease the duration of labor. This study finds support for improved patient outcomes (shorter duration of labor) by using visual art as a distraction and shield from viewing emergency equipment.</td>
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<td>Dunn, H., Anderson, M.A., and Hill, P.D. (2010). Nighttime lighting in the intensive care units. Critical care nurse 30(3), 31-37. United States, Midwest</td>
<td>Non-experimental-descriptive study Sample: surgical ICU patients (n = 21). Excluded: overflow patients, actively dying patients, and minors. Setting: Three hospital rooms in Surgical ICU. Included room with any permanent light fixture including TV (under patient control), head of bed light (under patient control), sink light, overhead light, night light. Lights excluded: equipment light, lights in possession of staff, hallway light, exterior light.</td>
<td>No intervention. Environment observed from 10 pm and 6 am and data collected on an audit sheet (Light Activity Time Evaluation = LATE sheet) for each room.</td>
<td>Seven nights Variables: time, light and its source identified activity with illumination. Environmental observations recorded on LATE sheet in five-minute increments. Total amount of light exposure from each light source was calculated for all five light sources. Total combined light exposure was calculated. Interrater reliability of audit sheet recorded between researcher and second researcher (calculation of joint probability of agreement gave correlation of 0.79%). Bedside nursing staff was not told of study intent to measure lighting. Night of week chosen was random draw of number recorded on paper from a container. Room numbers were randomly selected numbers recorded on paper drawn from a container.</td>
<td>Descriptive statistics calculated: mean, median, mode, range, standard deviation, and frequency. Light exposure calculated by the hour: longest light exposure was at 10 pm with 63.3 minutes (SD = 50.1). Shortest light exposure at 1 am with 27.3 minutes (SD = 34.5). Light source, which emitted the longest total duration of illumination, was the sink light with mean of 132.4 (SD = 105.0). Second longest was head of bed light which emitted a mean of 83.9 minutes of illumination (SD = 144.8). Shortest light emission was from night light with 28.5 minutes of illumination (SD = 106.6). Cumulative light exposure was 354.3 minutes (SD = 251.6). Activity that occurred during illumination included: assessments, bathing, medication administration, vital signs, toileting, obtaining lab samples, respiratory treatments, physician visits, family visits, staff presence, call light response, radiology, or other or none. The activity with the most associated light exposure was obtaining lab samples. The second most often recorded activity associated with light exposure was “none.”</td>
<td>Convenience sample: Small sample size of 21.</td>
<td>This descriptive study identifies light sources, which may unnecessarily cause light exposure in a surgical ICU. The sources of the longest light exposure were sink lights (not under patient control) and head of bed lights (under patient control). Further studies may be needed to determine if overhead and sink lighting are necessary for the staff to perform their roles in providing patient care and whether these lights could also be placed under patient control. The activity associated with the most illumination was lab collection. This finding offers the opportunity to explore the possible installation of task lighting or the use of mobile task lighting.</td>
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<td>Florey, L., Flynn, R. and Isles, C. (2009). Patient preferences for single rooms or shared accommodation in a district general hospital. Scottish Medical Journal, 54(2), 5-8. Scotland</td>
<td>Non-experimental - questionnaire. Sample: Total of 80 inpatients: 44 men and 36 women with median age of 64 years and median hospital stay of 4.5 days. Half of patients were from surgical units and one half from medical units. One half of these patients occupied shared rooms and one half in single rooms. Excluded patients too ill to complete the form or in hospital for &lt; 24 hours. Setting: Dumfries infirmary – a general hospital.</td>
<td>None. This was a descriptive study (questionnaire) of patients in single vs. shared hospital rooms in a routine hospital environment.</td>
<td>Questionnaire administered by a junior doctor: Queried hospitalized patients on the following topics: 1) loneliness 2) noise 3) nurse attention 4) visitors 5) confidentiality 6) privacy 7) preference for a single or shared room.</td>
<td>Fisher exact test showed statistically significant* differences between patients in single rooms and patient in shared accommodations for experiences of loneliness in patients in single rooms (p &lt; 0.001), less disturbance from noise in single rooms (p = 0.019), better for visitors in single rooms (p = 0.002) and better for confidentiality in single rooms (p &lt; 0.001). 70% of patients in shared rooms felt they could discuss personal matters in confidence and 83% felt they had sufficient privacy. Future preference for shared rooms: Of patients in a shared room, 70% preferred a shared room. Of patients in a single room, 40% would prefer a shared room. Shared rooms were preferred by older patients (median age of 68). Shared rooms preferred by those with longer hospital stays (median 5.5 days). Single rooms preferred by patients (median age 58) and shorter hospital stay (median 3.5 days).</td>
<td>Interviewer was a junior doctor and patient interviews took place during hospitalization, which may have swayed patient responses to reflect a desire to please the doctor. Spacious single rooms may have presented a bias for single rooms.</td>
<td>This study on room configuration (single or shared inpatient rooms) was subject to bias. Preference for shared rooms among patients with median age of 68 with median length of hospitalization of 5.5 days. Shared rooms did not negatively impact the overwhelming majority of patients in their perceptions of confidence or privacy.</td>
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<td>Freysteinson, W.M. and Cesario, S.K. (2008). Have we lost sight of mirrors? The therapeutic utility of mirrors in patient rooms. Holistic Nursing Practice, Nov/Dec, 317-323, United States</td>
<td>Non-experimental-descriptive Sample: 10 U.S. hospitals with 200-900 beds ranging in age from 1925-2002. Included hospitals: teaching hospitals, specialty hospitals, community-based hospitals, hospitals with magnet status.</td>
<td>None. This was a descriptive study of routine hospital environment.</td>
<td>One unit in each hospital was surveyed. Data gathered regarding mirrors: 1) Total # of mirrors 2) total mirror coverage 3) privacy 4) ability to look in mirror when bed bound 5) ability to see own chest 6) barrier free view of own chest 7) ability to view whole body in a mirror. Measurements to nearest mm taken: 1) height &amp; width of mirror 2) distance from mirror to floor 3) obstructions in front of mirror subtracted from total mirror coverage 4) barriers measured</td>
<td>Mean # of mirrors in hospital room= 2.1 (range 1 to 4). Total mirror coverage varied from 0.2m squared to 2.1 m squared. Hospital with the most mirrors (4), greatest mirror coverage (2.1 m squared), greatest degree of adequacy and privacy was of magnet status and built in 1989. Older hospitals (20%) provided no mirrors for bed-bound patients or a view of own chest or one’s entire body. Mirrors for bed-bound patients: Not available in 70% of hospitals. Mirrors for the ambulatory patient to view chest: Not available in 20% of hospitals. Barrier free view of chest in mirror: 90% of hospitals had a barrier between mirror and the person. Whole body view in mirror: 90% of hospitals did not provide a mirror for viewing the entire body. Privacy to view self in mirror: Not available in 60% of the hospitals.</td>
<td>Discussion and implications for nursing is limited to single population of mastectomy patients, however, self-image is relevant in all patient populations. This study did not examine patient preferences or response to the presence of this design detail. The only data collected/analyzed was the presence or absence and accessibility of mirrors as a design feature.</td>
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<td>Hagerman, I., Rasmanis, G., Blomkvist, V., Ulrich, R., Eriksen, C.A. &amp; Theorell, T. (2005). Influence of intensive coronary care acoustics on the quality of care and physiological state of patients. International Journal of Cardiology, 98, 267-270. Sweden</td>
<td>Quasi-experimental Sample: Patients with a stable and unstable angina pectoris and acute myocardial infarction (n= 94) with n = 31 patients in the bad acoustics group and n = 63 in the good acoustics group. Setting: Huddinge University Hospital with a catchment area of 375,000 inhabitants in an urban setting. The Coronary heart unit (CCU) has a 6-7 bed capacity.</td>
<td>During the study period, acoustics in the patient rooms and the central part of the unit were changed. The original ceiling tiles were replaced with sound reflecting ceiling tiles of plasterboard. One week before the final measurements, the sound reflecting ceiling tiles were replaced with sound absorbing tiles (40-mm Ecophon ™ ceiling tile).</td>
<td>Data was collected during weekdays. Physiological outcomes were measured including heart rate (HR), HR variability, systolic and diastolic blood pressure (BP) and HR variability. These measurements were taken in two patient populations during the periods of good and bad acoustics. Assessments of the good acoustics and the bad acoustics were for 4 weeks each.</td>
<td>In the two types of patient rooms, level of noise dropped by 5-6 dBA. There was no change in equivalent sound pressures detected in the main working area (56 dBA in the good acoustics area and 57 dBA in the bad acoustics area). After sound-reflecting plaster tiles were placed, reverberation time was reduced from 0.8 to 0.4 in main work area and in the patient rooms reverberation time reduced from 0.9 to 0.4. There were no statistically significant differences between patient groups in the bad acoustics group and the good acoustics group with regard to HR, HR variability, BP or pulse amplitude. Subdividing the patient groups according to severity of disease, there were significant differences between the good and bad acoustics groups with regard to pulse amplitude in the acute myocardial infarction (p &lt; 0.04) and unstable angina (p &lt; 0.03) groups. There was a statistically significant higher incidence of re-hospitalization at 3 months in the group with bad acoustics (p &lt; 0.01) as compared to the group with good acoustics. The significance of differences in patient ratings between the two groups (good and bad acoustics) was tested by Mann-Whitney U-tests. Patients in the good acoustics group considered staff attitude to be much better than during the bad acoustics period for the totals group (z = -2.90, p &lt; 0.004) and for the myocardial infarction group (z = -2.62, p = 0.009).</td>
<td>Hearing of the subjects was not tested and hearing impairments could greatly influence the results. The effects of hearing aid usage may amplify the poor acoustical environment and by not excluding these patients the results may have been adversely affected. Financial support for this study was provided by Ecophon ™ ceiling tiles, which were used in this study representing a risk of bias on the part of the investigators.</td>
<td>This flawed study investigated noise and its effect on physiological outcomes of cardiac patients. Poor acoustical environments during acute illness may have used physiological consequences that may negatively impact the rehabilitation period. Sound absorbing tiles (40-mm Ecophon ™ ceiling tile) in the CCU environment may reduce this risk.</td>
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<td>Harris, P.B., Ross, C., McBride, G., and Curtis, L. (2002). A place to heal: environmental sources of satisfaction among hospital patients, Journal of Applied Social Psychology, 32(6), 127-1299. United States</td>
<td>Mixed methods: Non-experimental study-descriptive and qualitative. Sample: 380 patients with an average of 3 days inpatient at six Intermountain Health Care, Inc. (IHC) hospitals. Age range 1-90 (M = 47.1). For patients &lt; age 18 (n = 17), the parents were interviewed.</td>
<td>Group differences in environmental satisfaction: Pearson correlation coefficient showed no relationships between satisfaction and age (r = -0.08, p &gt; 0.10) or length of hospitalization stay (LOS), (r = -0.03, p &gt; 0.50), nor days since hospital discharge (r = -0.02, p &gt; 0.60). No differences found in environmental satisfaction between male (M = 4.03, SD = 0.70) and female (M = 3.94, SD = 0.77) using an independent groups t-test, t(376) = 1.23, p &gt; 0.20. One way ANOVA found no differences between the six hospitals: M1 = 3.98, SD1 = 0.71; M2 = 4.06, SD2 = 0.74; M3 = 4.06, SD3 = 0.71; M4 = 3.95, SD4 = 0.70; M5 = 3.91, SD5 = 0.86; M6 = 3.86, SD6 = 0.78, F (5, 372 = 0.77, p &gt; 0.50. Second one-way ANOVA found no differences between the following departments: medical (M = 3.98, SD = 0.72, OB-GYN (M = 4.01, SD = 0.70), orthopedics (M = 3.98, SD = 0.82) and surgical (M = 3.94, SD = 0.76) departments, F (3, 374) = 0.17, p &gt; 0.90. Using data from the two types of interviews: (A) satisfaction with room and (B) satisfaction with environment outside the hospital room was used to investigate the relationship between environmental satisfaction and overall satisfaction with the hospital experience. Multiple regression analysis: the seven quality measures (nursing, physician, clinical, admitting, discharge, facilities, and food) were simultaneously entered</td>
<td>Convenience sample from a single health care corporation limits generalizability to other health care agencies.</td>
<td>This study elicited sources of satisfaction from the overall quality of the healthcare environment. The strongest predictor of overall patient satisfaction with hospitalization included: nursing care followed by perceived quality of clinical care then environmental satisfaction. This suggests that hospital environments are not the strongest predictor of satisfaction with hospitalization but satisfaction with the hospital environment did reach statistical significance. Sources of satisfaction from the health care environment include: 1) Interior design features referenced: equipment (ex. TV), furniture (bed), finishes (wall), color and décor (artwork), layout of room (accessibility). Respondents who were satisfied with the interior could be characterized as liking the room color and artwork, having a comfortable bed, having a working telephone</td>
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<td>onto the participant ratings of the overall quality of care and services that they received while hospitalized. The 7 quality measures of hospital satisfaction accounted for 48% (adjusted R^2) of the variance in participant ratings of overall quality, F(7, 372) = 51.42, p &lt; 0.01. The strongest predictor of overall satisfaction included: nursing care (β = 0.41, p &lt; 0.01) followed by perceived quality of clinical care (β = 0.19, p &lt; 0.01), then environmental satisfaction (β = 0.12, p &lt; 0.01) and satisfaction with admitting procedures (β = 0.10, p &lt; 0.05). Overall, about 50% of the respondents commented on the interior design or architectural features of the hospital room. Overall the comments were more positive (M = 1.58, SD = 1.12) than negative (M = 0.64, SD = 0.80, t(189) = 8.64, p &lt; 0.01. Do sources of patient satisfaction relate to room satisfaction? Respondents were asked to rate the quality of their room using a 5-point scale (poor to excellent). Pearson’s correlation coefficients indicated that participants who reported greater numbers of sources of satisfaction also rated their rooms more positively (r = 0.31, p &lt; 0.01). Conversely, patients with greater numbers of sources of dissatisfactions rated their hospital rooms more negatively (r = -0.38, p &lt; 0.01). Multiple regression analysis was conducted to determine how coding on the content analysis categories related to room satisfaction ratings. The regression shows that 10 predictor variables (positive and negative of the and TV and having ease of accessibility to everything. 2) Architectural features referenced: presence of a window, size of the room, bathroom and location of the room. Satisfaction with the architecture could be characterized as having a window with a nice view, having a larger room, an accessible bathroom, being located away from sources of unit noise. 3) Housekeeping and maintenance comments referred to cleanliness. 4) Satisfaction with social features of the room could be characterized as having a private room or privacy protection (closing the door), accommodations for visitors (seating or sleeping areas). 5) ambient environment was characterized by adequate lighting, quiet surroundings and comfortable temperature.</td>
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<td>five quality measures = 10) accounted for 20% of the variance in participants’ room quality ratings, F (10, 178) = 5.56, p &lt; 0.01. Both positive (β = 0.16) and negative (β = -0.23) reports regarding maintenance relate to room satisfaction. Positive mention of social features (β = 0.21) and architectural features (β = -0.16) were significantly related to room satisfaction.</td>
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<td>Holmberg, S.K. and Coon, S. (1999).</td>
<td>Non-experimental-descriptive study.</td>
<td>None.</td>
<td>Sound levels were recorded on a data from every 5 minutes for the duration of the sampling period. Total of 36.5 hours of sound levels were sampled taken every day of the week at various time points in the day and evening (not at night). Sound samples (33 hours) were taken during times expected to have the highest levels of noise. Only 3.5 hours were sampled during times expected to have the lowest noise levels. Also recorded on the data form was the major activity occurring during the sound recordings. Three nurse research assistants used same sound analyzer (Glodi ASA 10B). Interrater reliability for the instrument of 95% was achieved.</td>
<td>The mean sound level for the adult units was 76.54 (dBA) with range from 74.85 dBA to 81.32 dBA. Authors cite study by Landstrom, Kjelberg and Bystrom (1995), which reports sound levels of 60-70 dBA reduce reaction times and cognitive performance. Authors report these findings represent greater mean sound level found in psychiatric hospitals than reported in general hospitals with average 24-hour noise levels to be above 50 dBA. This study did not include nighttime.</td>
<td>Authors report a preference for a sound instrument that would have calculated the average noise level over a given time vs. simple mean. Staff and patients were aware of the intent of the study to measure sound. This may have induced the Hawthorne effect when study participants are aware of the monitoring of behavior, which may cause participants to modify their behavior. Authors make an unequal comparison between the general hospital and psychiatric hospital. The general hospital recordings were for 24 hour periods including night and this study did not include nighttime.</td>
<td>This descriptive study on noise in a psychiatric hospital showed that mean sound levels range from 74.85 to 81.32 dBA. Noise levels at this level may reduce reaction times and cognitive performance. This is relevant to patient care practices of patients on psychiatric units.</td>
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<td>Moore, M.M. et al. (1998). Interventions to reduce decibel levels on patient care units. The American Surgeon, 64(7-12), 894-899. United States</td>
<td>Quasi – experimental pre and posttest design. Two ICU units (number of beds not provided). Single hospital – University of Virginia Health System.</td>
<td>Two interventions to reduce noise: 1) Staff education – three 1 hour sessions to encourage minimization of all noise 2) patients doors are to be kept closed at all times except for entry and exit of staff and visitors.</td>
<td>Noise measurements were taken on two units over 24 hours using a decibel meter. 3 (24 hour) recordings were made on random weekdays. Measurements were controlled for flooring and occupancy. Five-minute interval histograms were used for the analysis to determine the average noise level.</td>
<td>Baseline noise levels: 1) Highest levels of noise were measured from 8am to 6 pm. Noise level dropped substantially in the ACU from 10 pm to 5 am especially away from the nurses’ station. 2) On the ICU the noise levels were slightly more variable with noise levels only slightly different from the nurses’ station to the farthest room.</td>
<td>The interventions to reduce noise were weak. Single site was used and only 3 days of data. Staff education received in the noise reduction intervention was not fully described to facilitate replication of the study. Inadequate descriptions of the size of the ICUs prevent a full illustration of the setting and appropriateness of the interventions.</td>
<td>This study comparing levels of noise on an ICU found weak evidence showing that closing patient doors decreases the amount of perceptible noise in the patients’ rooms.</td>
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<td>Nanda, U., Eisen, S., Zadeh, R.S., and Owen, D. (2011). Effect of visual art on patient anxiety and agitation in a mental health facility and implications for the business case. Journal of Psychiatric and Mental Health Nursing, 18, 386-393, United States</td>
<td>Mixed methods: Quasi-experimental, descriptive and Qualitative – focus groups (staff only) Multipurpose lounge of acute care psychiatric unit. Seven female patients (average census is 7) age 18-65. 22 staff nurses were interviewed (term nurse was not defined).</td>
<td>Art intervention was placed on a main focus wall in multi-purpose room used for activities such as eating meals, art activities, television viewing, visiting family and friends.</td>
<td>Three different types of artwork measuring 3 feet x 4 feet (abstract by Jackson Pollack, abstract representational by Vincent Van Gogh or realistic nature photograph) were displayed for 16-19 days or control (no artwork) was displayed for 21 days. The as needed medication (most commonly Haldol and Ativan) prescribed during the different display periods was compared to the control (no artwork display). Unit nurses recorded their observations of patient behaviors during the artwork display period. Focus group: Nurses were interviewed regarding their observations of the patients’ responses to the artwork.</td>
<td>Independent t-test A 40% mean reduction in PRN prescriptions was found with nature art $M = 40$; $t (34) = 2.22$, $p = 0.032$ <em>SD not given t-test showed a significant</em> difference for the PRN/patient census ratio found to be significantly lower for the realistic nature art as compared to abstract representational art ($P = 0.039$). Additionally t-tests comparing each art condition to the control showed a single art condition significantly* different between PRN/patient census was nature art ($P = 0.032$). Descriptive statistics were used to estimate average savings over one year. The estimated average costs to the hospital due to reduction of PRN incidents when realistic nature artwork was displayed was $27,526.45 as compared to smaller estimated savings of $4167.31 and $7517.55 for abstract and abstract-representational artwork respectively. Focus groups were conducted on the staff only. *authors did not provide other statistical values for PRN/census conditions</td>
<td>Very small study for quasi-experimental study including 7 patients on average for the census. At small sample sizes t-tests become more sensitive to the assumption of normal distribution. In psychiatric units this assumption can easily be skewed because a single, acutely ill patient could skew the results. t-tests were used rather than an ANOVA because the assumptions were not met for an ANOVA. Cost estimates calculated for one year are based off of a 21-day study with an average patient census of 7 inpatients. Study results are highly dependent on artist chosen. For instance, consider difference between abstract artists Jackson Pollack and Mark Rothko or abstract representational artists Vincent Van Gogh and Thomas Hart Benton. Staff was recruited to record their observations of the patients’ behaviors during the time of the artwork display period. This may have induced the Hawthorne effect when study participants are aware of the monitoring of behavior, which may cause participants to modify their behavior. This could influence the observations the staff participants recorded.</td>
<td>This study on the effects of artwork on psychiatric inpatients shows weak support for display of realistic nature art on psychiatric inpatient units to reduce PRN incidents and costs.</td>
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<td>Nyrud, A.Q., Bysheim, K., and Bringslimark, T. (2010). Health benefits from wood interior in a hospital room. Proceedings of the International Convention of Society of Wood Science and Technology and United Nations Economic Commission for Europe – Timber Committee. Paper WS-56, 1-7. Norway</td>
<td>Non-experimental. Descriptive study-survey. Norwegian hospital Sample – 102 hospital employees returned the questionnaire and 6 patients returned the questionnaire.</td>
<td>None. Routine hospitalization under investigation.</td>
<td>10 data manipulated pictures of patient rooms with varying amounts of wood used in the interiors ranging from no wood to all wood. Pictures were displayed in random order and participants were asked to rate the pictures based on 12 adjectives from a standardized measure related to interiors and exteriors. Adjectives were: pleasant, nice, boring, pure style, airy, masculine, expensive, modern, ordinary, natural, calming, secure. A 7-point Likert scale was used to elicit if the patient liked or disliked the room.</td>
<td>Room with an intermediate amount of wood was most preferred by hospital employees as seen by the highest score on the preference item (M=4.18, SD = 1.81). Only 6 patients responded to the questionnaire and their opinions did not agree with the hospital employee responses. The only detail of the patient responses was that they did not prefer the hospital room with an intermediate amount of wood. The authors did not disclose what they did prefer.</td>
<td>This study on staff and patient preference for wood as an interior finishing material found that patient preferences for wood are not yet known. Staff prefers an intermediate amount of wood in the hospital room interior.</td>
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<td>Olsen, R.V. (1984). The effect of the hospital environment: patient reactions to traditional versus progressive care settings. Journal of Architectural and Planning Research, 1 (2), 121-136. United States</td>
<td>Quasi-experimental design Sample: any medical-surgical patient excluding cardiac patients who have been hospitalized for at least 3-4 days. Three samples of 30 patients each. Setting: Two units (31 bed progressive care unit and an 18 bed traditional unit) in a 1,000 bed hospital in large eastern city.</td>
<td>Surgical patients were assigned to available traditional or progressive units (progressive hospital bed or progressive daybed). Comparison of patient responses to traditional vs. progressive units. Patients were matched according to their diagnoses. Traditional units: 1) lounge consisted of open space along a corridor which lacked privacy and was furnished with institutional furniture. 2) no dining room or pantry. 3) corridor: T-shaped, dreary, poorly lit with dark flooring and no seating. 4) no day beds. Progressive Units: 1) separated lounge with living room like atmosphere, which included upholstered</td>
<td>Open ended and forced-choice scaled interview on passage of time, boredom, confinement, contact with peers, pleasantness and cheerfulness of unit. Patient observation every 15 minutes for 6 hours and documentation of patient location, body position and engagement in activity. Questionnaire after discharge on unit environment.</td>
<td>Patients ratings on a 10 point scale (1 best, 10 poorest) of nursing care hospital bed (M = 1.86, SD not reported), daybed (M = 2.36, SD not reported), traditional bed (M = 2.80, SD not reported), F = 2.24, p &gt; 0.05 (p value not provided). Patients ratings on negative emotional reactions to hospitalization on a 10 point scale (1 best, 10 poorest) for perceived boredom and rate of passage of time (no means or SD given) were found not to be statistically significantly different between progressive and traditional bed types. Regarding feelings of confinement as reported on a 10 point scale (1 best, 10 poorest), hospital bed (M = 3.66, SD not given), day bed (M = 4.80, SD not given), traditional bed (M = 6.40, SD not given) (F = 5.76, p = 0.01). Regarding social activity as reported on a 10 point scale (1 best, 10 poorest), hospital bed (M = 6.93, SD not given), day bed (M = 7.36, SD not given), traditional bed (M = 4.93, SD not given), (F = 7.65 , p &lt; 0.05). Mean percentages of observed social activity for hospital, bed (M = 19.79%, SD not given), day bed (M = 32.23%, SD not given), traditional bed (M = 3.75%, SD not given), (F =</td>
<td>The authors report that the progressive care unit was altered from the study design, which had excluded cardiac care patients. During the study the progressive hospital bed units were altered to include the sick and dying and this change in the patient population is thought to have adversely affected the study outcomes. Randomization was assumed. This study compares traditional vs. progressive units. The simultaneous implementation of multiple unit changes obscures which variables had the most robust or weakest effect on outcome measures. For this reason no conclusions regarding specific unit changes can be recommended at this time.</td>
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<td>furniture, curtains and carpeting. 2) dining room furnished with: table with seating for four, wallpaper, cloth curtains and window view of the city. 3) Pantry available to patients to make coffee, tea or to access snacks. 4) Racetrack corridor in beige tones with seating and artwork. 5) Daybed section with studio bedrooms with hotel like furniture, pastel colors and slipcovered beds.</td>
<td>19.84, p &lt; 0.01). Regarding the percentage of time engaged in passive behavior, hospital bed (M = 7.90%, SD not given), day bed (M = 6.15%, SD not given), traditional bed (M = 14.40%, SD not given), F = 4.08, p = 0.05. Regarding the percentage of time engaged in active and mobile behavior outside the patient room, hospital bed (M = 24.40%, SD not given), day bed (M = 24.38%, SD not given), traditional bed (M = 10.10%, SD not given), F = 5.30, p = 0.01. Regarding the perception of unit ambience based on a 10 point cheerfulness rating scale (1 least cheerful, 10 most cheerful), hospital bed (M = 9.13, SD not given), day bed (M = 8.73, SD not given), traditional bed (M = 7.70, SD not given), F = 4.46 , p = 0.05). Significantly more patients in the progressive units (hospital bed n = 14, day bed n = 17) made an association between unit appearance and non – institutional settings than the traditional setting (n = 1). (no Chi square or p values given). Significant differences were also found between traditional (n = 10) and progressive units (n = 21) regarding associations between the environment and positive mood states (no Chi</td>
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<td>Chi square or p values given). Significant differences were also found between traditional (n = 10) and progressive units (n = 21) regarding associations between the environment and positive mood states (no Chi square or p values given). Significant correlations were found between patient's perception ratings and their behaviors (no correlation coefficients or p values were provided – see p. 132). These findings showed that the more pleasant and cheerful the setting then the less boring and confining the unit seemed. Patients who rated their environments more positively were also more active in their environment (no statistical</td>
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<td>Overman Dube, J.A., et al. (2008). Environmental noise sources and interventions to minimize them: a tale of two hospitals. Journal of Nursing Care Quality, 23(3), 216-224. United States</td>
<td>Mixed method design – quasi experimental (pre and post noise assessments) and descriptive qualitative. Sample: Convenience sample of 30 patients from 57 different patient care units (PCU), (n = 1650). Actual response rates for prenoise assessments (n = 775) and postnoise assessments (n = 704). Setting: two hospitals</td>
<td>Routine hospitalization under investigation pretest. Posttest nursing leadership identified and implemented at least one noise control intervention and an Environmental Noise Education/Information Tool guided the noise control intervention for that unit.</td>
<td>Pre and post noise assessments with pen and paper format. Assessments were conducted by survey at 4 time points (am, pm, evening, night) that rated noise using a 5-point Likert type scale ranging from very quiet to very loud. Noise was measured with two types of devices (dosimeters and general field type work type II sound-level meters) operated by industrial hygienists according to Occupational and Safety Health Administration. Dosimeters were placed in a central location on 31 units and recorded readings for 24 hours. A journal entry could be made by staff to explain any unusual readings. Post intervention a sound-level meter was placed adjacent to the noise dosimeter in 4 units for comparison standards.</td>
<td>Patient and staff rating level of noise pretest: Morning: n = 1967, M = 3.44 (SD = 0.91), Posttest n = 1592, M = 3.34 (SD = 0.96), p = 0.003. Afternoon: n = 1929, M = 3.29 (SD = 0.85), Posttest n = 1567, M = 3.20 (SD = 0.84), p = 0.001. Evening: n = 1912, M = 3.06 (SD = 0.83), Posttest n = 1552, M = 2.97 (SD = 0.82), p = 0.002. Night: n = 1864, M = 2.49 (SD = 0.88), Posttest n = 1540, M = 2.44 (SD = 0.89), p = 0.155.</td>
<td>Decibel readings were inconsistent between the two measurement devices despite measurements being taken at the same time. This makes comparison of dBA levels among studies difficult. Pre and posttest interventions occurred about 6 months apart and by different patients. There was no information included about the type of flooring or the type of acoustic tiles.</td>
<td>This study on the effects of noise reduction interventions on hospital units found evidence to support the following interventions: padding chart holders, padding pneumatic tube drop stations, installing quieter paper towel dispensers, adding signage requesting quiet, closing the door to the patient room and lowering the lights.</td>
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<td>Park, S.H. and Mattson, R.H. (2008). Effects of flowering and foliage plants in hospital rooms on patients recovering from abdominal surgery. Hortotechnology, October-December, 18(4), 563-568. Korea</td>
<td>Quasi experimental (authors describe study as randomized clinical trial) 90 patients (52 male and 38 female, mean age = 37.6, ranging from age 21-60) who had undergone an appendectomy. Excluded patients &lt; age 19 and &gt; age 60, patients with chronic or acute health conditions, history of psychiatric problems or uncorrected hearing or vision impairment 250 bed suburban Korean Hospital. Ten identical rooms on same floor on same side of the hospital with window view of sky only (no trees or buildings)</td>
<td>After the patient left the room for the surgery, a plant with sterile, soilless potting mix was placed in the hospital room. Plant species were identified by the authors. Four species of plants were planted in one pot and placed in front of a large window in the patient room. Control rooms had no plants.</td>
<td>Medical data collected: length of hospitalization (LOS) in days, analgesic use and strength of analgesia (classified as weak, moderate, or strong according to analgesic medication class used to treat the pain), vital signs. Psychological data collected: Pain intensity, pain distress, anxiety, and fatigue (PPAF), State-Trait Anxiety Inventory Form Y-1 (STAI-Y1), Environmental Assessment Scale (EAS), and Patient’s Room Satisfaction Questionnaire (PRSQ).</td>
<td>Mean LOS for the patients exposed to plants was 4.64 days. Compared to the control group with mean LOS of 4.88 days there was no significant* difference in LOS found. Chi square test was used to measure analgesic use. By day 3: no strong analgesics were used by treatment or control groups. There was a significant* difference (P = 0.041) between the treatment and control group with the treatment group having less frequent use of moderate and weak analgesics. Repeated measures ANCOVA was used for systolic blood pressure (SBP) and heart rate (HR). SBP and HR data were shown to have significant* day-by-group interaction (P = 0.047, P = 0.048, respectively). The treatment group on the day of surgery and day one postoperative were show to have significant* differences in lower SBP (P = 0.04, P = 0.04) and HR (P = 0.01, P = 0.03) compared to the control group. For the PPAF significant* day-by-group interactions were found for self-ratings of pain intensity (P = 0.03), pain distress (P = 0.047) and fatigue (P = 0.04). Pain intensity (P = 0.01) and pain distress (P = 0.01) were significantly* lower in the treatment group at day 3 postoperative. STAI-Y1 and self-reported anxiety were shown to have no</td>
<td>The authors describe this study as a randomized clinical trial, however, randomization was not described.</td>
<td>This study evaluated the effect of plants in the hospital room during postoperative recovery and its effects on patient outcomes. There is supporting evidence that plants have positive effects on health outcomes and increase patient satisfaction with their hospital rooms.</td>
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<td>significant* day-by-group interactions. The treatment group had significantly* lower anxiety (P = 0.01) and lower tension (P = 0.02) post-operative. In the treatment group at the postoperative period, the EAS ratings were significant* at the P = 0.05 level for 2 items: satisfying (P = 0.34) and pleasant smelling (P = 0.36). In the treatment group at the postoperative period, the EAS ratings were significant* at the P = 0.01 level for items: relaxing, comfortable, colorful, calming, and attractive as compared to the control group. PRSQ for the treatment group (93%) showed that plants were most positive quality of their room as compared to the control group (91%) which reported that TV as the most positive quality of their room. The PRSQ results for the treatment group showed that positive qualities reported of the hospital room were temperature (77%), TV (66%) and sunshine (44%). For the control group the positive qualities reported of the hospital room were temperature (71%), sunshine (44%), and quietness (11%). The PRSQ results for the treatment group regarding the patient’s willingness to return to the hospital for treatment showed 91% were willing to return as compared to 71% of the control group reporting they were willing to return. *no other statistical values were provided by the authors.</td>
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<td>Pattison, H.M. &amp; Robertson, C.E. (1996). The effect of ward design on the well-being of post-operative patients. Journal of Advanced Nursing, 23, 820-826. United Kingdom</td>
<td>Non-experimental questionnaire Sample: 32 post-operative (5 days) female patients with a mean age of 43.6 on a bay ward and 32 postoperative patients from a Nightingale ward with a mean age of 47.1 year. No patients treated with antidepressants. All surgeries involved a similar degree of discomfort. Setting: Hospital was not described. Bay ward is not described other than to say a buzzer system is used to summon nurses and the number of beds and toilets. Nightingale ward is a long, open room with 36 beds with 3 toilets. Bay wards have 32 beds with 12 toilets.</td>
<td>No intervention. Routine hospitalization under investigation.</td>
<td>Individually interviewed patients using a questionnaire with three parts was administered on day 5 post-operative: 1) 63 questions on sleep, friendships, privacy and isolation. 2) Disturbance due to hospital noise 24 item questionnaire developed by Topf (1985) that uses a 5 point Likert scale with 1 = not at all and 5 = extremely. 3) Hospital Anxiety and Depression scale (HAD) by Zigmond and Snith (1983) that includes seven items on depression and seven items on anxiety with scores of 0-7 being normal levels and 10-21 being severe anxiety or depression.</td>
<td>Post-operative 100% of Nightingale ward patients felt they were visible whereas 84% on the bay ward felt they were visible. In the following days the perception that the patients were visible dropped for both wards with the 78% of Nightingale ward patients feeling they were visible vs. 59% of the bay ward patients feeling they were visible. The results were found to be marginally significant ($x^2 = 2.618$, $p &lt; 0.1$), however, the significance was not made clear by the authors. It could be the difference between ward design vs. the difference between the days postoperative and ward design. Bay ward patients rated their concern on a 1-5 scale about not being visible to nursing staff. The mean rating = 3.9 (SD = 1.3, n = 13). Nightingale ward patients had a mean rating = 2.6 (SD = 1.4, n = 7). Overall the bay ward patients felt less concerned about not being visible to nursing staff. There was a non-significant difference found between the groups and their reluctance to summon for help. There were 59% of patients on the bay ward who were reluctant to summon help vs. 72% of</td>
<td>Small sample size leads to lack of power for statistical tests. Stuffing levels were different for the two ward types with permanent nursing staff hours per week of 688 on the bay ward and 532 on the Nightingale ward. Ward types were not described at all or were inadequately described. No patients on antidepressants were included, but there was no exclusion of patients on anxiolytics or patients with anxiety disorders. Interviewer qualifications and training was not described.</td>
<td>This study investigated patient perceptions of the hospital environment comparing a ward design to a Nightingale ward. There is very weak evidence in support of bay ward designs; however, there were many flaws in this study.</td>
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<td>patients on the Nightingale ward ($x^2 = 1.11$, $P &gt; 0.25$). There were no statistically significant differences between bay ward patients and Nightingale ward patients regarding feeling nurses took a long time to respond to patient requests ($x^2 = 1.576$, $P &lt; 0.2$). Patients’ mean scores for noise level for the Nightingale ward = 1.82 (SD = 0.58) and the mean score on the bay ward = 1.29 (SD = 0.44). The difference was statistically significant ($F(1.62) = 6.47$, $P = 0.013$). There was a positive correlation between noise scores and anxiety levels. Statistically significant differences were found regarding patient privacy and ward relationships: 41% of Nightingale ward patients felt they could talk with a doctor without being overheard compared to 13% on the bay ward ($x^2 = 6.488$, $P &lt; 0.02$). No statistically significant differences were found between bay ward patients and Nightingale ward patients expressing feelings of isolation on admission to time post-operative. No statistically significant differences were found regarding ward design and</td>
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<td>the development of personal relationships($\chi^2 = 1.576$). Sleep habits were assessed using a Likert type scale for feeling refreshed in the morning. The at home amount of time to fall asleep, how often they awoke and got up were also assessed. The at home score was subtracted from the inpatient score. Mean scores of sleep worsened in the hospital for both wards. An ANOVA was done to compare differences ward type and no statistically significant differences were found. No statistically significant differences between the ward types on anxiety were found when measured using the HAD scale and the use of ANOVA. No statistically significant differences between the ward types on depression. There was a significant correlation between anxiety and depression ($r = 0.421$, $P &lt; 0.02$). Overall 75% of patients preferred bay ward designs vs. 22% who preferred Nightingale ward designs.</td>
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<th>Theoretical Integrity and Trust (Lincoln and Guba, 1985)</th>
<th>Limitations</th>
<th>Interpretations and Implications</th>
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<td>Rowlands, J. (2008). How does the environment impact on the quality of life of advanced cancer patients? A qualitative study with implications for ward design. Palliative Medicine, 22, 768-774, United Kingdom</td>
<td>To explore the views of patients in a regional cancer center on the impact of the ward environment on their perceived health, mood, and/or quality of life</td>
<td>Qualitative Semi-structured taped interview. Authors describe study as phenomenological</td>
<td>12 Adults at least age 18, inpatient within oncology center for at least 3 days, known malignancy</td>
<td>Interviews were taped and transcribed verbatim. Each participant provided information sheet explaining purpose of study was to assist in the redesign of the ward and opinions about the physical environment would be of interest</td>
<td>Poor adherence to phenomenological design with violations in interview type (i.e. semi-structured interview, single interview vs. multiple in-depth conversations), lack of methodologist and thematic findings. Design more consistent with descriptive studies than phenomenological studies. Second researcher independently analyzed transcripts</td>
<td>Data immersion and interpretation. Characteristics analyzed, relevant concepts and themes identified.</td>
<td>Four themes: 1) strongest theme was importance of staff to patients, 2) care environment had an effect on mood, 3) preference for multi-bedded wards, 4) importance of contact with outside world, particularly nature</td>
<td>1) Credibility is weakened by: a) poor adherence to scientific rigor b) no record of researcher opinions and biases (i.e. accounting for outliers, saturation). c) No record of triangulation or verification through multiple data sources. 2) Dependability: there was scant information (audit trail) included regarding the research process to demonstrate how the researcher reached her conclusions. 3) Transferability: minimal due to uniqueness of end of life population. Study offers minimal information regarding how the informants intellectually and emotionally interpret the inpatient setting. Broad, general statements do not demonstrate how patients interpret their environment and do not demonstrate experiences unique to the end of life experience. 4) Confirmability of findings is weak/poorly grounded in the data. Researcher interpretations are broader than the data suggest.</td>
<td>Distinct patient group with advanced cancer from single geographical region. This qualitative study investigates ward design and its impact on health, mood and quality of life. This study found that ward design is not a primary focus for inpatients. Staff interaction and patient care were of primary importance to patients. Despite current building trends of single rooms, the majority of patients prefer multi-bed units – (weak support for this assertion)</td>
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<td>Rubin H.R., Owens A.J. &amp; Golden G. (1998) Status Report (1998): An Investigation to Determine Whether the Built Environment Affects Patients’ Medical Outcomes. The Center for Health Design, Martinez, CA, United States</td>
<td>What is the relationship between health outcomes and the physical environment?</td>
<td>Yes</td>
<td>Key words for search strategy were identified. Any health care setting was included. There were three databases searched and were listed. 84 articles found and only 14 had applications for the environment.</td>
<td>The search strategy was flawed by the omission of nursing and architecture databases.</td>
<td>Yes</td>
<td>Included patient outcomes and list of outcomes were provided. Excluded the effect of the healthcare environment on staff behavior and excluded patient and clinician preferences for the healthcare environment</td>
<td>Ample</td>
<td>Yes, limitations were discussed in detail addressing topics of weak scientific rigor, methodological flaws and the lack of reproducibility or validity in the outcome measures. The authors identified a pattern of weaknesses in scientific rigor in the literature on the topic of health outcomes and the physical environment.</td>
<td>This study investigated the relationship between health outcomes and the physical environment and found that the literature offers little guidance to inform which features of the healthcare environment could improve patient outcomes.</td>
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Citation and Country | Research Design, Sample and Setting | Intervention | Method | Results | Limitations | Design Implications | Strength and Quality Score
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Southard, K. et al. (2012). Enclosed vs. open nursing stations in adult acute care psychiatric settings. *Journal of Psychosocial Nursing*, 50(5), 28-34. United States | Quasi-experimental. Repeated cross sectional study. Convenience sample: 81 hospitalized psychiatric patients with an average age of 44, an average length of stay of 5 days, diagnosed with one or more diagnoses including mood, anxiety or substance use disorders. 25 nurses and mental health technicians. Setting: 50 bed freestanding public not-for-profit acute psychiatric hospital in medium size city in the southeastern U.S. Single unit of the hospital was used for the study. The unit is T-shaped, has 25 semi-private rooms a central nursing station, 3 dayrooms, two consultation rooms, 2 medication rooms and a staff break room. Pre-test the 597 square foot nursing station plus a 242 medication room was entirely enclosed with shatterproof tempered glass with a 4 mil ballistic film. In the center of the glass enclosure was a 2-foot | Measured psychiatric ward atmosphere using the Ward Atmosphere Scale (WAS) at baseline before the nursing station enclosure was removed and 24 months later after the nursing station enclosure was removed. | No statistically significant differences were found in WAS scores from pretest to posttest in patients or staff. Multivariate tests for mean differences in any Ward Atmosphere Scale (WAS) was not found to be significant for patients, F(10,70) = 0.06761, p = 0.7428 or for staff, F (10, 14) = 0.7014, p = 0.7099) from pretest to posttest. | Pre-test sample of patients were different from the posttest sample. 22 of the 25 staff were different from the pre-test to the posttest and could account for changes in the ward atmosphere. 24 months elapsed between pretest and posttest data collection due to construction issues. Nursing and physician leadership changed between the pre and posttest times. A change in administration could also change the ward atmosphere. The milieu can change dramatically based on the patient mix at any given time. For this reason, a single pre and posttest can be attributed to the particular make-up of the milieu and the staff’s response to that milieu. For example, no aggressive or threatening patients on the unit at the time of posttest would have a different result than a posttest taken after a week with a patient who is repeatedly violent toward staff. | This flawed study provides no design implications that can be drawn regarding the effects of closed vs. open nurses’ stations on ward atmosphere in acute psychiatric hospital units. | IIC
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<td>by 4-foot operating window that could be opened or closed by the unit staff. The technicians and nurses have workstations at the back of the nurses’ station. Post-test the glass enclosing the nursing station was removed and the workstations for the technicians and nurses were moved to the front of the nurses’ station. The medication room remained enclosed. The nurses’ station also received new cabinets, countertops and paint.</td>
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<td>Suter, E. and Baylin, D. (2007). Choosing art as a complement to healing. Applied Nursing Research, 20, 32-38. Canada</td>
<td>To determine if the Art a la Carte program is beneficial to patients, their families and friends, hospital staff, and Art a la Carte program volunteers</td>
<td>Qualitative – semi-structured interview</td>
<td>Sample: 15 inpatients on a cancer unit for 5 days or more with diagnosis of cancer, family and friends of patients, hospital staff, and program volunteers</td>
<td>1:1 interview conducted by experienced interviewer. Taped and transcribed semi-structured interview of 20-30 minute duration focused on meaning of having art in the patient room and the meaning for the patient to have the ability to choose their own artwork. Additionally, questions were asked about the Art a la Carte program strengths and weaknesses, art collection, weekly rotations, volunteers, suggestions for program improvements.</td>
<td>1) Triangulation with data coding performed by 2 independent researchers. 2) Audit trail included documentation of steps of data collection and analysis. 3) Reflexivity was addressed by researchers adopting a self-critical attitude regarding their own observations and interpretations could be biased.</td>
<td>Themes across participants were identified and categorized. Saturated categories were described and relationships between the categories were explored.</td>
<td>Five themes emerged: 1) art enhances physical environment and patients’ moods. 2) art provides distraction and promotes interaction. 3) Choice of artwork is a strength of the program. 4) volunteers and staff reported benefits from the program. 5) the program provided humanity to a scientific environment.</td>
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<td>Trevisani, F. et al. (2010). Art in the hospital: its impact on the feelings and emotional state of patients admitted to an internal medicine unit. Journal of Alternative and Complementary Medicine, 16(8), 853-859. Italy</td>
<td>Non-experimental – questionnaire Sample: 239 patients ages 19-89 admitted to an internal medicine unit from August 2005 to June 2006 enrolled in the study. Patients had illnesses that included: gastroenterological (38.1%), cardiovascular (23%), hematological (10.5%), pulmonary (10%), metabolic (6.3%), nephrological (5.4%), neurological (5%) and alcohol addiction (1.7%). Excluded were blind patients, patients confined to the bed and hospital length of stay &lt; 3 days. Most patients came from northern Italy (197). Education levels: none or only primary education (96), secondary school (78), high school (48), university degree (17). Average hospital length of stay was 7.1 days with a SD of 3.9 days. Setting: Sant’Orsola-Malpighi Hospital in Bologna, internal medicine unit (5 rooms with 5 beds and 2 rooms with 2 beds).</td>
<td>25 (80 x 60 or 40 x 60 cm) panels of reproductions of black and white photographs of realistic images of people doing every day activities such as walking down a street, enjoying a day at the beach or eating at a picnic. The photographs were by two well-known regional artists were displayed in the entrance, corridor and dining room of the hospital ward.</td>
<td>On day 4 to 6 questionnaires were completed by patients. The two self-administered questionnaires were developed by a psychologist, a sociologist, a clinician and a master in communication sciences: 1) related to support by family and friends, physical and emotional well-being being shows that most patients reported some degree of weakness, half reported pain (mild to moderate) and about 60% reported sadness, anxiety and worry about their clinical condition or its prognosis. 2) assessed number of visitors, ward functioning and the photographic exhibition. Another scale was used to assess clinical status and was performed by a clinician according to the Eastern Cooperative Oncology Group (ECOG) performance status which assesses how the disease affects activities of daily living on a 5 point scale with 0 = asymptomatic and 5 = symptomatic. Distribution of answers of first questionnaire on support by family and friends, physical and emotional well-being shows that most patients reported some degree of weakness, half reported pain (mild to moderate) and about 60% reported sadness, anxiety and worry about their clinical condition or its prognosis.</td>
<td>The study results are highly dependent on the subject matter of photographs and curator of the exhibition as well as the study population. Other photographic works may not have as favorable findings and this limits the reproducibility of the study.</td>
<td>This study on the effects of artwork in the hospital environment provides support for the use of photographic artwork that included realistic images of people doing every day activities such as walking down a street, enjoying a day at the beach or eating a picnic.</td>
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<td>effects of the photographic viewing. (ECOG 0: 75.3%, ECOG 1: 61.4%, ECOG 2-3: 48.8%, P = 0.007). Self-perceived restorative effect of photographs was associated with worried about not getting over the illness (no 72.4%; yes 59%, p = 0.031). Self-perceived restorative effect of photographs was associated with feeling ill (no 71.4%; yes 58.3%, p = 0.034). Multivariate analysis showed that only ECOG performance status (odds ratio [95% confidence interval (CI) with respect to ECOG 0 was 0.47 [0.25-0.88] for ECOG 1, and 0.29 [0.13-0.63] for ECOG 2-3) and feeling anxiety (odds ratio [95% CI] with respect to no anxiety was 0.55 [0.31 – 0.97]) independently influenced this effect (outcome of restorative effect of viewing artwork).</td>
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<td>Ulrich, R.S. (1984). View through a window may influence recovery from surgery. Science, 224(4647), 420-421. United States</td>
<td>Non-experimental-retrospective record review/case control study. Sample: Records of 46 patients (23 matched pairs) ages 20-69 who had undergone uncomplicated cholecystectomy between May 1 and October 20 in the years 1972 to 1981 (times when deciduous trees have foliage) were included. Patients with a history of psychological disturbances were excluded. Setting: 200 bed suburban Pennsylvania hospital with double occupancy rooms and of approximately the same room size, the same window size and placement, furnishings.</td>
<td>Patients are afforded window views of either a small grouping of deciduous trees or a brick wall. The window view is visible when the patients are lying in the bed.</td>
<td>Patients were assigned to rooms as the rooms became vacant. Patients had the same nurses. Patients were matched for view of tree with patient with view of brick wall. Patients were also matched for age within 5 years, sex, smoker or nonsmoker, obese or normal weight, general nature of previous hospitalization, year of surgery within 6 years, floor level and color of room. Recovery data was extracted from the patients’ records by an experienced recovery/surgical experience who was blinded to which patients had which window view. Data extracted from records: 1) number of days in the hospital 2) number of and strength of analgesics each day 3) number of and strength of medications for anxiety 4) minor complications requiring medications 5) nurses’ notes related to course of recovery.</td>
<td>Patients with window views of trees had 7.96 hospital days post-operative and patients with views of a brick wall had 8.96 hospital days post-operative. Paired samples (non-parametric test) T-test: Wilcoxon matched-pairs signed-ranks analysis, T(17) = 35, z = 1.965, P = 0.025. Nurses’ notes were classified as negative or positive. There were more negative nurses’ notes for the patients with the view of the brick wall: 3.96 negative remarks for the patients with views of the brick wall as compared to 1.13 negative remarks per patient with the view of trees. Wilcoxon matched-pairs signed-ranks analysis, T(21) = 15, z = 3.49, P &lt; 0.001. Multivariate two-sample Hotelling test was used to compare the groups’ analgesic use. The mean analgesic doses per patient for each dose strength was calculated for: a) day of surgery and day 1 after the surgery b) day 2 to day 5 after the surgery c) day 6 and 7 after the surgery. Statistically significant differences were found in the mean number of analgesic doses between the patients with the tree view vs. the patients with the brick wall view on days 2 through 5 after the surgery (T2 = 13.52, F = 4.30, P &lt; 0.01. No significant differences were found between the groups in their use of anxiolytics. No significant* differences were found between the groups in their rates of minor complications. *No statistical values were provided by the author.</td>
<td>Randomization was assumed with record review and retrieval of matched pairs.</td>
<td>This non-experimental study of the effects of window views of natural environments vs. a brick wall provides evidence that a view of nature resulted in decreased hospital stays post-surgery, lower analgesic use post-surgery and fewer negative comments post-surgery.</td>
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<td>Ulrich et al. (2008). A review of the literature on evidence-based healthcare design. Retrieved from <a href="http://www.healthdesign.org">http://www.healthdesign.org</a></td>
<td>(1) What can rigorous research tell us about “good” and “bad” hospital design? (2) Can improved design make hospitals less risky and stressful and promote more healing for patients, their families, and staff? (3) Is there scientifically credible evidence that design affects clinical outcomes and staff effectiveness in delivering care?</td>
<td>Partial reproducibility. Nine databases identified and 32 search terms identified. Inclusion and exclusion criteria not given and would not be reproducible.</td>
<td>Yes.</td>
<td>No.</td>
<td>Some study details are provided in the narrative.</td>
<td>Yes, in the narrative.</td>
<td>This integrative literature review endorses provision of windows with a view and bright light, single rooms for noise reduction and use of acoustic sound absorbing flooring, ceiling and wall materials.</td>
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<td>van de Glind, I., de Roode, S., and Goossensen, A. (2007). Do patients in hospitals benefit from single rooms? A literature review. Health Policy, 84, 153-161. Netherlands</td>
<td>Do patients in hospitals benefit from single rooms?</td>
<td>Yes</td>
<td>Keywords for search strategy identified. Five Databases searched were listed and strategies for finding grey literature were included. Outcomes sought: privacy, sleep quality, noise, satisfaction, infection rates, safety and recovery rates.</td>
<td>Authors provide rationale for their inclusion of expert opinion and grey literature to provide contrast between opinion regarding single rooms and what the evidence supports. Research types including randomized controlled trials, controlled trials without randomization, quasi-experimental studies and opinion/clinical experience.</td>
<td>Yes</td>
<td>In English. Publication dates: 1970-2006. Outcome measures provided. Grey literature included expert opinion, web pages of regulatory bodies and other institutions.</td>
<td>Few study details were provided. No tables described the individual studies, however, general, summative statements about the studies were found in the narrative.</td>
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<td>Walch, J.M., Rabin, B.S., Day, R., Williams, J.N., Choi, K., and Kang, J.D. (2005). The effect of sunlight on postoperative analgesic medication use: a prospective study of patients undergoing spinal surgery. <em>Psychosomatic Medicine</em>, 67, 156-163. United States</td>
<td>Randomized controlled clinical trial Patients and nurses were blind to the study’s intervention. East and west side patient rooms in Montefiore Hospital, Bronx, NY with all same size, color and configuration. Eastside rooms were dim due to adjacent building, which blocked sunlight exposure. West side rooms were bright. 89 patients undergoing elective cervical and lumbar spinal surgery. Excluded: patients discharging from the hospital the day after the surgery. Patients with any history of major depression or the use of antidepressants.</td>
<td>Consecutive patients admitted to single occupancy rooms between 3-12-03 and 8-7-03 were assigned to rooms with windows on the east (n = 44) or west side (n = 45).</td>
<td>Twice a day three light measurements (direct, reflective, ambient) were taken using a light meter (L-508Cine Zoom Master) in same way for each patient room. The measurements were calculated to form a cumulative sunlight exposure in lux-hours. Analgesic use: analgesic was administered as needed and administered via patient-controlled analgesia (PCA) during the first 24 hours. All analgesia use was converted to an oral morphine-equivalent through a standard calculation. The amount of oral morphine-equivalent pain medication used each day was divided by 24 to calculate the amount of analgesia used per hour for each inpatient day. To calculate the amount of morphine equivalent analgesia used per hour for duration of the hospitalization, the total amount of morphine used was divided by the length of stay (LOS) in days. Cost of analgesia use</td>
<td>No differences in patients in east or west side rooms were found with regard to: demographic or clinical characteristics, clinical diagnosis or surgical procedure, baseline pain and optimism ratings, use of analgesia before hospitalization. Sunlight intensity: patients on the west side received an average of 46% (p = 0.005) more natural light than the west side patients receiving 73,537 lux-hours and the east side patients receiving 50,410 lux-hours. Analgesic Use: Mean opioid-equivalent analgesic use for the entire hospital LOS was 28.3% (P = 0.047) higher for patients on the east side (dim) rooms as compared to the west side (bright) rooms. Before admission to study rooms no statistical differences for patients were found between the patients with regards to:</td>
<td>Sample was on one type of surgical patient – spinal surgery patients. Twice daily sunlight measurement did not take into account patients who closed their blinds, utilized overhead lighting or other variables. Study lacked biological measures of serotonin concentration thought to increase after light exposure. Sunlight effects serotonin levels and is involved in mediating pain pathways.</td>
<td>This randomized clinical trial studied daylight exposure from east and west facing window orientations in hospital rooms and provides support, that rooms with western exposures (bright) decreases pain medication usage and pain medication costs.</td>
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was calculated to determine the analgesic cost per hour of inpatient stay. Four scales were used to measure psychological and pain measures. 1) McGill Pain Questionnaire (MPQ). 2) Center for Epidemiological Studies Depression Scale (CES-D). 3) Perceived Stress Scale (PSS). 4) Profile of Mood States (POMS).
Baseline tests: pain scale and Life Orientation Test Revised (LOT-R) to measure dispositional optimism.
No-interaction group: 1 of every 5 patients admitted to the study were randomized into the no interaction group. The no-interaction group did not receive psychological or pain questionnaires but did receive a pain scale upon discharge. The no-interaction group was included to measure possible effects of research staff interaction with patients.

1) quantity of analgesia prescribed in the operating room.
2) quantity of analgesia prescribed in the post anesthesia care unit.
3) patient pain rating scale in the post anesthesia care unit.
General linear model was used to investigate whether stress and pain experiences mediated the effects of room assignment on medication experience. No linear relationship was found between the severity of psychological change scores and higher analgesia use.

Pain medication costs: Pain medication use for patients on the west side (bright) rooms had a mean 21% (P = 0.047) decrease in analgesic medication costs as compared to patients on the east side (dim) rooms.

Psychological and pain measures: At baseline there were no statistical differences in stress,
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<td>depression, anxiety or severity of pain between the patients. At the time of discharge the patient on the west side (bright) reported significantly less stress (PSS, ( P = 0.035 )) as compared to patients on the east side (dim) rooms. There were no significant changes in scores from baseline in depression and anxiety between the two groups. Researcher interaction did not affect the outcome of the study as evidenced by no significant difference (( P = 0.901 )) in analgesia use per hour between patients randomized into the no-interaction group and the study patients.</td>
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APPENDIX G:

EVIDENCE SYNTHESIS TABLES
## ART SYNTHESIS TABLE

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<td>Art</td>
<td>Daykin, N., Byrne, E., Soteriou, T. &amp; O'Connor, S. (2008).</td>
<td>Systematic Literature Review: Sample and setting: empirically based articles on effects of artwork in the mental healthcare setting.</td>
<td>Art and design in the mental healthcare setting.</td>
<td>Appropriate search strategy with search terms identified. 14 databases searched. Excluded art therapy.</td>
<td>Anxiety and depression: Appreciation of art.</td>
<td>Key findings: 1) exposure to the arts may reduce anxiety and depression, clinical and behavioral outcomes. 2) natural environments are favored over urban. 3) art that is calm, naturalistic, and domestic is favored over abstract or challenging art content. 4) patient attitude surveys show high approval for the arts.</td>
<td>Followed rigorous standards for conducting systematic literature review. Strong external validity for psychiatric patients.</td>
<td>Key findings: 1) exposure to the arts may reduce anxiety and depression, clinical and behavioral outcomes. 2) positive effects on wayfinding and perception of healthcare environment. 3) natural environments are favored over urban. 4) art that is calm, naturalistic, and domestic (home scenes) is favored over abstract or challenging art content. 5) patient attitude surveys show high approval for the arts.</td>
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<td>Art</td>
<td>Christenfeld, R., Wagner, J., Pastva, G., and Acrish, W.P. (1989)</td>
<td>Mixed methods: Qualitative descriptive, structured interview and Quasi-experimental with pretest-posttest design. Sample: long term, chronically psychotic patients on an inpatient psychiatric unit. Pretest and posttest (n = 36) studies for the renovated units. Control group (n = 44). Setting: Harlem Valley Psychiatric Center, New York State mental hospital.</td>
<td>Physical changes to two wards during renovation included artwork as well as: 1) Ceilings lowered in halls, day room and patient rooms. Shaded lights installed. Light colored flooring tiles installed. Light colored vinyl with design installed on walls. Waist high room dividers added to separate dining and create three separate seating areas with furniture arranged for TV viewing, games and social interaction.</td>
<td>Qualitative: Study authors report use of key informant phenomenological reports from staff and patients for eight months after moving into the renovated wards. Quantitative: Controlled study with pretest-posttest design was matched with four control wards with patients similar in age, diagnoses, chronicity, functioning and prognosis regarding discharge. Therapies and activities for all the wards</td>
<td>Satisfaction with ward facilities. Staff absences. Physician orders for staff to provide close visual monitoring of patients. Incidences of violence and property breakage.</td>
<td>Two-way ANOVA was used to test the effects of ward renovations by comparing pretest and posttest scores by patients and staff. The scale of ward satisfaction showed improvement for both control and model ward patients however it was not statistically significant*. Additionally no significant findings were found in the subscales for satisfaction with bedroom, shower and dining room*. Satisfaction for the dayroom showed a statistically significant</td>
<td>Authors describe study as phenomenological; however, single, structured interviews violate phenomenological study design. Study is descriptive in nature and reports were cursory. Staff members conducting patient interviews could introduce significant bias on the post-occupancy interviews. Sample sizes were small based on available patient census.</td>
<td>This study compares the original ward to the renovated ward. Significant findings for the renovated ward include: satisfaction with the remodeled day room, amelioration of negative self-image, and geriatric populations experienced a reduction in violence. The majority of the findings were non-significant and no conclusions re: potential for impact on healing environment can be drawn from this study.</td>
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<td>were nearly the same except one less therapy aid on one model ward. Baseline data obtained from the two renovated wards and the four control wards for 4-8 months post-occupancy. Instruments: Moos’ Ward Atmosphere Scale and Lubin’s Depression Adjective Checklist (Form E). Patients from the six wards were invited to participate in a pretest and posttest structured interview conducted by a staff member on the ward. The patient interview consisted of: 1) scales developed for this study to determine satisfaction with ward patient room, dining room, shower room and day room. 2) National Institute of Mental Health’s CES-D scale, Harlem Valley Psychosocial Scale. Staff interviews included: 1) Scales of functioning obtained from staff members were Feitel’s Checklist of Nonfunctional Methods Behaviors.</td>
<td>difference between the control (pre to post difference of 0.3) and model wards (pre to post difference of 1.4), (two way interaction, F = 3.95, p &lt; 0.05). There were improvements in patient depression pre to posttest, although no statistically significant differences were found between the model and control wards according to the National Institute of Mental Health CES-D scales*. There were no statistically significant changes in factors of irritability and social isolation on the Harlem Psychosocial Scale on the control or model wards pre to posttest*.</td>
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<td>The simultaneous manipulation of at least 14 different variables in the environment obscures which variable may be providing more robust effects and which variables are providing little or no effect.</td>
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<td>2) Bathrooms: ornamental tile installed, full length mirrors added, vanity style sinks added, private dressing rooms added and non-weight bearing shower heads.</td>
<td>2) Items from New York State Office of Mental Health’s Level of Care Survey. Other data collected from the model and control wards: 1) unscheduled staff absences. 2) physical orders for staff to provide close visual monitoring of patients. 3) Incidences of violence to self or others including: assaults, fights, suicide attempts, and property damage.</td>
<td>There was a statistically significant difference between control (pre to posttest difference of 1.01) and model wards pre to post test in amelioration of negative self-image (pre to posttest difference of 0.57), (two way interaction, $F = 4.17, p &lt; 0.05$). No significant differences were found between control (pre to posttest difference of 0.03) and model ward pre to posttest 0.07) in episodes of patient violence per month pre to posttest (two way interaction, $F = 0.47, p &gt; 0.05$), although there was a statistically significant reduction found in the geriatric population (no details provided)*</td>
<td>*Authors did not provide statistically significant details.</td>
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<td>Art</td>
<td>Duncan, J. (2011)</td>
<td>Quasi-experimental study</td>
<td>Specially designed art screen to shield emergency medical equipment from view.</td>
<td>Midwives recorded: 1) time of entry into the room which defined the starting time of labor. 2) time labor ended (delivery). 3) type of analgesia required. 4) if delivery was normal.</td>
<td>Duration of labor. Type of analgesia required. Normal or not normal delivery.</td>
<td>1) Independent samples t-test (unpaired t-test) to determine any difference in the length of the labor between the control and study groups. Reported to be &quot;statistically significant&quot; shortening of the duration of the labor by 2.1 hours&quot; (pg. 423). 2) Comparison of two independent proportions&quot; to measure the frequency of requirement of epidural analgesia. Frequency of requests for epidural analgesia was 7% lower in the treatment group than the control group. Statistical significance was not achieved. *P values were not reported.</td>
<td>p values are not presented for evaluation by the research consumer.</td>
<td>This study compared the effects using visual art screens to shield emergency equipment vs. no screens to shield emergency equipment in the labor and delivery room to decrease the duration of labor. This study finds support for improved patient outcomes (shorter duration of labor) by using visual art as a distraction and shield from viewing emergency equipment.</td>
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<td>Art</td>
<td>Harris, P.B., Ross, C., McBride, G., and Curtis, L. (2002)</td>
<td>Mixed methods: Non-experimental study-descriptive. Sample: inpatients Setting: Intermountain Health Care, Inc. (IHC) hospitals</td>
<td>None. This was a descriptive study of routine hospital environment.</td>
<td>Open and closed-ended telephone interview</td>
<td>Satisfaction</td>
<td>Group differences in environmental satisfaction; showed no relationships between satisfaction and age or length of hospitalization stay, nor days since hospital discharge. No differences found in environmental satisfaction between male and female. No statistically significant differences were found between the six hospitals. No statistically significant differences were found between medical, OB-GYN, orthopedics and surgical departments. No statistically significant differences were found in level of environmental satisfaction among the different hospital departments, hospitals, or types of patients. Using data from the two types of interviews, the strongest predictor of overall satisfaction was nursing care.</td>
<td>Convenience sample from a single health care corporation limits generalizability to other health care agencies. Replication of this study is not possible as there are no descriptions of the physical health care environment or artwork that evoked the patient’s reported satisfaction.</td>
<td>This study elicited sources of satisfaction from the overall quality of the healthcare environment. There is preliminary evidence that sources of patient satisfaction include décor (artwork).</td>
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<td>Art</td>
<td>Olsen, R.V. (1984)</td>
<td>Quasi-experimental design Sample: any medical-surgical patient. Three samples of 30 patients each. Setting: Two units (31 bed progressive care unit and an 18 bed traditional unit) in a hospital.</td>
<td>Surgical patients were assigned to available traditional or progressive units. Progressive units included addition of art in a racetrack corridor. Traditional units: 1) Lounge consisted of open space along a corridor which lacked privacy and was furnished with institutional furniture. 2) No dining room or pantry. 3) Corridor: T-shaped, dreary, poorly lit with dark flooring and no seating. 4) No day beds. Progressive Units:</td>
<td>1) Open-ended and forced-choice scaled interview performed during hospitalization on following topics: passage of time, boredom, confinement, and contact with other patients, pleasantness and cheerfulness of the unit. 2) Patient observation using a behavioral mapping technique every 15 minutes for a total of six hours recording pt. locations, body position and engagement in activity. 3) Questionnaire after discharge on topics of quality of nursing care, discharge preparation and hospital environment.</td>
<td>Passage of time, boredom, feelings of confinement, contact with other patients, unit satisfaction, patient behaviors</td>
<td>Patients ratings on a 10 point scale (1 best, 10 poorest) of nursing care: hospital bed (M = 1.86, SD not reported), daybed (M = 2.36, SD not reported), traditional bed (M = 2.80, SD not reported), F = 2.24, p &gt; 0.05. Patients ratings on negative emotional reactions to hospitalization on a 10 point scale (1 best, 10 poorest) for perceived boredom and rate of passage of time (no means or SD given) were found not to be statistically significantly different between progressive and traditional bed types.</td>
<td>During the study the progressive hospital bed units were altered to include the sick and dying and this change in the patient population could have adversely affected the study outcomes. Randomization was assumed.</td>
<td>No specific conclusions for design implications can be drawn. The effects of whole unit renovations are confounded by multiple interventions without controls to evaluate if one intervention is having a more profound effect than another. For this reason no specific design implications can be gleaned from these studies.</td>
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1) separated lounge with living room-like atmosphere which included upholstered furniture, curtains and carpeting.  
2) dining room furnished with: table with seating for four, wallpaper, cloth curtains and window view of the city.  
3) Pantry available to patients to make coffee, tea or to access snacks.  
4) Racetrack corridor in beige tones with seating.  
5) daybed section with studio bedrooms with hotel like furniture, pastel colors and slipcovered beds.

Regarding feelings of confinement as reported on a 10 point scale (1 best, 10 poorest), hospital bed (M = 3.66, SD not given), day bed (M = 4.80, SD not given), traditional bed (M = 6.40, SD not given) (F = 5.76, p = 0.01).  
Regarding social activity as reported on a 10 point scale (1 best, 10 poorest), hospital bed (M = 6.93, SD not given), day bed (M = 7.36, SD not given), traditional bed (M = 4.93, SD not given) (F = 7.65, p < 0.05).

Mean percentages of observed social activity for hospital, bed (M = 19.79%, SD not given), day bed (M = 32.23%, SD not given), traditional bed (M = 3.75%, SD not given), (F = 19.84, p < 0.01).
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<td>Regarding the percentage of time engaged in passive behavior, hospital bed (M = 7.90%, SD not given), day bed (M = 6.15%, SD not given), traditional bed (M = 14.40%, SD not given), F = 4.08, p = 0.05.</td>
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<td>Regarding the percentage of time engaged in active and mobile behavior outside the patient room, hospital bed (M = 24.40%, SD not given), day bed (M = 24.38%, SD not given), traditional bed (M = 10.10%, SD not given), F = 5.30, p = 0.01.</td>
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<td>Regarding the perception of unit ambience based on a 10 point cheerfulness rating scale (1 least cheerful, 10 most cheerful), hospital bed (M = 9.13, SD (not</td>
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<td>Given), day bed (M = 8.73, SD not given), traditional bed (M = 7.70, SD not given), F = 4.46, p = 0.05). Significantly more patients in the progressive units (hospital bed n = 14, day bed n = 17) made an association between unit appearance and non-institutional settings than the traditional setting (n = 1) (no Chi square or p values given). Significant differences were also found between traditional (n = 10) and progressive units (n = 21) regarding associations between the environment and positive mood states (no Chi square or p values given).</td>
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<td>Significant correlations were found between patient’s perception ratings and their behaviors (no correlation coefficients or p values were provided – see p. 132). These findings showed that the more pleasant and cheerful the setting then the less boring and confining the unit seemed. Patients who rated their environments more positively were also more active in their environment (no statistical values provided).</td>
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<td>Art</td>
<td>Trevisani, F. et al. (2010)</td>
<td>Non-experimental questionnaire. Sample: N = 239 internal medicine patients. Setting: Internal medicine unit.</td>
<td>Black and white photographs of realistic images of people doing everyday activities</td>
<td>The two self-administered questionnaires. Another scale was used to assess clinical status and performance status.</td>
<td>Perceived support from family friends and perceived physical and emotional well-being. Perception of ward and exhibit. Perceived clinical status and performance status.</td>
<td>Distribution of answers of first questionnaire on support by family and friends, physical and emotional well-being shows that most patients reported some degree of weakness, half reported pain (mild to moderate) and about 60% reported sadness, anxiety and worry about their clinical condition or its prognosis. Second questionnaire: patients reported they received an average of two visits a day from friends/family. 59-88% of patients appreciated the ward comfort/functioning. 72% of patients felt viewing the photos made their hospital stay more pleasant. 1.9% of patients criticized the artists. Univariate analysis: Self-perceived restorative effect of photographs was associated with younger ages (&lt;64 years 73.3%),</td>
<td>The study results are highly dependent on the subject matter of photographs, curator of the exhibition as well as the study population. Other photographic works may not have as favorable findings and this limits the reproducibility of the study.</td>
<td>This non-experimental study on the effects of artwork in the hospital environment provides support for the use of photographic artwork that included realistic images of people doing everyday activities such as walking down a street, enjoying a day at the beach or eating at a picnic.</td>
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<td>&gt; 64 years, 57.5%, p = 0.017. Self-perceived restorative effect of photographs was associated with performance status as measured by the ECOG scale (ECOG scale is 5 point scale with 0 = asymptomatic and 5 = symptomatic). As performance status decreased so did restorative effects of the photographic viewing. (ECOG 0: 75.3%, ECOG 1: 61.4%, ECOG 2-3: 48.8%, P = 0.007). Self-perceived restorative effect of photographs was associated with worried about not getting over the illness (no 72.4%; yes 59%, p = 0.031). Self-perceived restorative effect of photographs was associated with feeling ill (no 71.4%; yes 58.3%, p = 0.034). yes 59%, p = 0.031).</td>
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<td>Multivariate analysis showed that only ECOG performance status (odds ratio [95% confidence interval (CI) with respect to ECOG 0 was 0.47 [0.25-0.88] for ECOG 1, and 0.29 [0.13-0.63] for ECOG 2-3) and feeling anxiety (odds ratio [95% CI] with respect to no anxiety was 0.55 [0.31 – 0.97]) independently influenced this effect (outcome of restorative effect of viewing artwork).</td>
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<td>Art</td>
<td>Ulrich et al. (2008)</td>
<td>Integrative literature review Sample: pediatric and psychiatric inpatients Setting: hospital</td>
<td>Viewing artwork</td>
<td>Review was to answer the following research question: What influence do environmental characteristics have on patient, family or staff outcomes?</td>
<td>Artwork preference (IIB, IIC)</td>
<td>This review found n = 2 studies on art. One mixed methods study (n = 7) on psychiatric inpatient responses to different types of artwork (IIC) had insufficient sample size. One mixed methods (qualitative and quasi-experimental) study with a strength and quality rating of IIA investigated children and adolescents’ art preferences. The results show that the majority of patients prefer representational artwork of nature over reproductions by master painters. There is limited evidence that emotionally challenging art content can worsen patient outcomes.</td>
<td>Insufficient sample size (IIC). Generalizability of children’s art preferences to general population is difficult.</td>
<td>In the final conclusions and design recommendations, the authors did not endorse the use of artwork in health care settings as it is not yet linked to improved patient outcomes. This review provides preliminary evidence that representational artwork of nature is preferred by pediatric patients.</td>
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<td>Building Configuration</td>
<td>Brooks, K.L., Mulaik, J.S., Gilead, M.P., and Daniels, B.S. (1994)</td>
<td>Non-experimental, retrospective study. Sample: 6 units with 28 adult psychiatric inpatients in each unit Setting: psychiatric hospital</td>
<td>None. This was a descriptive study of routine hospital environment.</td>
<td>Data analyzed: Monthly census for each unit was calculated. Mean number of seclusion and/or restraints (S &amp; R) for the hospital was calculated</td>
<td>Correlation between unit census and S &amp; R.</td>
<td>Descriptive statistics: Unit 1: Census (M = 23). S &amp; R (M = 12). Unit 2: Census (M = 26) S &amp; R (M = 15). Unit 3: Census (M = 30.4). S &amp; R (M = 27). Unit 4: Census (M = 20). S &amp; R (M = 7.6). Unit 5: Census (M = 19.7). S &amp; R (M= 18). Unit 6: Census (M = 31.4). S &amp; R (M = 49). A Chi Square test revealed there is a significant relationship between census and S &amp; R. $\chi^2 (1) = 14.4 (P &lt; 0.001)$ To determine that ward variation was not the cause of variation in S &amp; R, further analysis (within groups and between groups) was done to identify sources contributing to the overall correlation between census and S &amp; R. Total correlation r =</td>
<td>Unit assignments were based on catchment areas of patients’ residences. Only one year of data was used to calculate the mean number of seclusion and/or restraints. One or two aggressive patients during this year could skew the data.</td>
<td>This study sought to discover if there was a relationship between the density of the population on the inpatient unit and incidences of violence. A significant relationship between density of the patient population and incidences of violence was found. Evidence supports 100 square feet of space or more per patient on psychiatric units to reduce S &amp; R. Additionally, this evidence supports single occupancy inpatient rooms on psychiatric units.</td>
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<td>0.73, P &lt; 0.001 indicating a strong positive relationship between the variables. Within groups correlation ( r_W = 0.67 ) indicating a strong positive relationship across units. Between groups correlation ( r_B = 0.05 ) indicating little of the total relationship was due to co-variation among the wards between mean census and mean S &amp; R.</td>
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<td>Building Configuration</td>
<td>Harris, P.B., Ross, C., McBride, G., and Curtis, L. (2002).</td>
<td>Mixed methods: Non-experimental study-descriptive. Sample: 380 inpatients Setting: Intermountain n Health Care, Inc. (IHC) hospitals.</td>
<td>None. This was a descriptive study of routine hospital environment.</td>
<td>Open and closed-ended telephone interview. Interview using inpatient satisfaction form.</td>
<td>Satisfaction</td>
<td>Group differences in environmental satisfaction: showed no relationships between satisfaction and age or length of hospitalization n stay, nor days since hospital discharge. No differences found in environment al satisfaction between male and female. No statistically significant differences were found between the 6 hospitals No statistically significant differences were found between medical, OB- GYN, orthopedics and surgical departments, No statistically significant differences were found in level of environmental satisfaction among the different hospital departments, hospitals, or types of patients. Using data from the 2 type’s interviews, the strongest predictor of overall satisfaction was nursing care.</td>
<td>Convenience sample from a single health care corporation limits generalizability to other health care agencies. Replication of this study is not possible as there are no descriptions of the physical health care environment that evoked the patient’s reported satisfaction.</td>
<td>This study elicited sources of satisfaction from the overall quality of the healthcare environment. Sources of satisfaction from the health care environment include: Architectural features referenced: presence of a window, size of the room, bathroom and location of the room. Satisfaction with the architecture could be characterized as having a window with a nice view, having a larger room, an accessible bathroom, being located away from sources of unit noise.</td>
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| Finish Materials   | Christenfeld, R., Wagner, J., Pastva, G., and Acrish, W.P. (1989)        | Mixed methods: Qualitative – descriptive, structured interview and Quasi-experimental with pretest-posttest design. Sample: psychiatric inpatients; (n = 36), Control group (n = 44). Setting: psychiatric hospital | Physical changes to two wards during renovation included the following finishing materials: Light colored flooring tiles installed, light colored vinyl with design installed on walls, hallways were carpeted, ornamental tile installed in bathrooms, non-weight bearing shower heads installed. Additional renovations included: 1) Ceilings lowered in halls, day room and patient rooms. Shaded lights installed. Waist high room dividers added to separate dining and create three separate seating areas with furniture arranged for TV viewing, games and social interaction. Interior decorations including paintings, posters, and hanging baskets of flowers and plants were added. | Qualitative: key-informant phenomenological reports
Quantitative: Controlled study with pretest-posttest design. Instruments: Moos’ Ward Atmosphere Scale and Lubin’s Depression Adjective Checklist (Form E). Pretest and posttest structured interview conducted by a staff member on the ward. The patient interview consisted of: 1) scales developed for this study to determine satisfaction with ward patient room, dining room, shower room and day room; 2) National Institute of Mental Health’s CES-D scale, Harlem Valley Psychosocial Scale. Staff interviews included: 1) Scales of functioning obtained from staff | Mood, Satisfaction with ward facilities. Staff absences. Physician orders for staff to provide close visual monitoring of patients. Incidences of violence and property breakage. | Two-way ANOVA was used to test the effects of ward renovations by comparing pretest and posttest scores by patients and staff. The scale of ward satisfaction showed improvement for both control and model ward patients however it was not statistically significant*. Additionally no significant findings were found in the subscales for satisfaction with bedroom, shower and dining room*. Satisfaction for the dayroom showed a statistical significance difference between the control (pre to post difference of 0.3) and model wards (pre to post difference of 1.4), (two way interaction, F = 3.95, p < 0.05). There were improvements in patient depression (pre to post test, although, no statistically significant differences were found between the model and control wards according to the National Institute of | Authors describe study as phenomenological; however, single, structured interviews violate phenomenological al study design. Study is descriptive in nature and reports were cursory. Staff members conducting patient interviews could introduce significant bias on the post-occupancy interviews. Sample sizes were small based on available patient census. The simultaneous manipulation of at least 14 different variables in the environment obscure which variable may be providing more robust effects and which variables are providing little or no effect. | This study compares the original ward to the renovated ward. Significant findings for the renovated ward include: satisfaction with the remodeled day room, amelioration of negative self-image, and geriatric populations experienced a reduction in violence. The majority of the findings were non-significant and no conclusions re: potential for impact on healing environment can be drawn from this study. | IIB and IIIC |
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| Nursing station relocated to facilitate optimal views of the dayroom, porch and retreat room. Smoking porch was ventilated and decorated with same interior decorations, non-institutional clocks installed, wall hangings added, archways installed and seating area added. 2) Bathrooms included full length mirrors added, vanity style sinks added, private dressing rooms added. | members were Feitel’s Checklist of Nonfunctional Behaviors. 2) Items from New York State Office of Mental Health’s Level of Care Survey. Other data collected from the model and control wards: 1) unscheduled staff absences. 2) physician orders for staff to provide close visual monitoring of patients. 3) Incidences of violence to self or other including: assaults, fights, suicide attempts, and property breakage. | Mental Health CES-D scales*. There were no statistically significant changes in factors of irritability and social isolation on the Harlem Psychosocial Scale on the control or model wards pre to posttest*. There was a statistically significant difference between control (pre to posttest difference of 1.01) and model wards pre to posttest in amelioration of negative self-image (pre to posttest difference of 0.57), (two way interaction, F = 4.17, p < 0.05). No significant differences were found between control (pre to posttest difference of 0.03) and model ward pre to posttest 0.07) in episodes of patient violence per month pre to post test (two way interaction, F = 0.47, p > 0.05), although there was a statistically significant reduction found in the geriatric population (no details provided)*. | *Authors did not provide statistical
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<td>Finish Materials</td>
<td>Drahota, A., Ward, D., Mackenzie, H., Stores, R., Higgins, B. Gal, D. and Dean, T.P. (2012).</td>
<td>Meta-analysis/Systematic Literature Review Sample: n = 58; n = 112. Setting: inpatient and rehabilitation ward Studies included randomized clinical trials, controlled clinical trials, controlled before and after studies and interrupted time series.</td>
<td>Flooring (carpet vs. vinyl)</td>
<td>Review to answer the following research question: What effects do hospital environments have on adult patient health-related outcomes?</td>
<td>Patient falls</td>
<td>One RCT had insufficient data for extraction. One RCT investigated carpet vs. vinyl and found more falls on carpet than vinyl but no strong effect found regarding flooring material.</td>
<td>Not enough data for meta-analysis. The diversity of settings makes generalizability of study findings more difficult. Risk of selective outcome bias in both studies.</td>
<td>This meta-analysis/systematic literature review found insufficient evidence to make evidence based design decisions regarding the safety of vinyl vs. carpeted flooring.</td>
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<td>Finish Materials</td>
<td>Harris, P.B., Ross, C., McBride, G., and Curtis, L. (2002)</td>
<td>Mixed methods: Non-experimental study-descriptive. Sample: N = 380 inpatients Setting: Intermountain Health Care, Inc. (IHC) hospitals (n = 6)</td>
<td>None. This was a descriptive study of routine hospital environment.</td>
<td>Open and close-ended telephone interview Interview using inpatient satisfaction form.</td>
<td>Satisfaction</td>
<td>Group differences in environmental satisfaction showed no relationships between satisfaction and age or length of hospitalization stay, nor days since hospital discharge. No differences found in environmental satisfaction between male and female. No statistically significant differences were found between the 6 hospitals No statistically significant differences were found between medical, OB-GYN, orthopedics and surgical departments, different hospital departments, hospitals, or types of patients. Using data from the 2 types interviews, the strongest predictor of overall satisfaction was nursing care.</td>
<td>Convenience sample from a single health care corporation limits generalizability to other health care agencies. Replication of this study is not possible as there are no descriptions of the physical health care environment that evoked the patient’s reported satisfaction</td>
<td>This study elicited sources of satisfaction from the overall quality of the healthcare environment. Sources of satisfaction from the health care environment include finishes (wall), however, there is insufficient detail about the type of wall finishes that evoked satisfaction.</td>
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<td>Finish Material</td>
<td>Nyrud, A.Q., Bysheim, K., and Bringslimark, T. (2010)</td>
<td>Non-experimental. Descriptive study-survey. Sample: hospital employees (n = 102) and patients (n = 6) Setting: hospital</td>
<td>None. Routine hospitalization under investigation</td>
<td>10 data manipulated pictures of patient rooms with varying amounts of wood used in the interiors ranging from no wood to all wood. Participants were asked to rate the pictures based on 12 adjectives from a standardized measure related to interiors and exteriors. Adjectives were: pleasant, nice, boring, pure style, airy, masculine, expensive, modern, ordinary, natural, calming, and secure. A 7-point Likert scale was used to elicit if the patient liked or disliked the room.</td>
<td>Opinion on wood as a finishing material for hospital rooms</td>
<td>Room with an intermediate amount of wood was most preferred by hospital employees as seen by the highest score on the preference item (M=4.18, SD = 1.81). On the 7-point Likert scale this room was reported by hospital employees to be: pleasant, natural, calming, and secure. The hospital room with an intermediate amount of wood was not rated as the preferred hospital room by patients.</td>
<td>Only 6 patients responded to the questionnaire and their opinions did not agree with the hospital employee responses. The only detail of the patient responses was that they did not prefer the hospital room with an intermediate amount of wood. The authors did not disclose what they did prefer.</td>
<td>This study on staff and patient preference for wood as an interior finishing material found that patient preferences for wood are not yet known due to insufficient patient response. Staff prefers an intermediate amount of wood in the hospital room interior.</td>
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<td>Finish Materials</td>
<td>Olsen, R.V. (1984)</td>
<td>Quasi-experimental design Sample: any medical-surgical patient. Three samples of 30 patients each. Setting: Two units (31 bed progressive care unit and an 18 bed traditional unit) in a hospital</td>
<td>Surgical patients were assigned to available traditional or progressive units. Progressive units included changes to finish materials and included the addition of: curtains, carpeting and wallpaper. Traditional units: 1) lounge consisted of open space along a corridor which lacked privacy and was furnished with institutional furniture. 2) no dining room or pantry. 3) corridor: T-shaped, dreary, poorly lit with dark flooring and no seating. 4) no day beds. Progressive Units: 1) separated lounge with living room-like atmosphere which included</td>
<td>1) Open-ended and forced-choice scaled interview performed during hospitalization on following topics: passage of time, boredom, confinement, contact with other patients, unit satisfaction, patient behaviors</td>
<td>Patients ratings on a 10 point scale (1 best, 10 poorest) of nursing care: hospital bed (M = 1.86, SD not reported), daybed (M = 2.36, SD not reported), traditional bed (M = 2.80, SD not reported), F = 2.24, p &gt; 0.05 (p value not provided). Patients ratings on negative emotional reactions to hospitalization on a 10 point scale (1 best, 10 poorest) for perceived boredom and rate of passage of time (no means or SD given) were found not to be statistically significantly different between progressive and traditional bed types. Regarding feelings of confinement as reported on a 10 point scale (1 best, 10 poorest), hospital bed (M = 3.66, SD not given), daybed (M = 4.80, SD not given), traditional bed (M = 6.40, SD not given) (F = 5.76, p = 0.01). Regarding social activity as reported on a 10 point scale (1 best, 10 poorest), hospital bed (M = 6.93, SD not given), day bed (M = 7.36, SD not given),</td>
<td>During the study the progressive hospital bed units were altered to include the sick and dying and this change in the patient population may have adversely affected the study outcomes. Randomization was assumed.</td>
<td>No specific conclusions for design implications can be drawn. The effects of whole unit renovations are confounded by multiple interventions without controls to evaluate if one intervention is having a more profound effect than another. For this reason no specific design implications can be gleaned from these studies.</td>
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upholstered furniture.
2) dining room furnished with: table with seating for four, wallpaper, cloth curtains and window view of the city. 3) Pantry available to patients to make coffee, tea or to access snacks.
4) Racetrack corridor in beige tones with seating and artwork.
5) day bed section with studio bedrooms with hotel like furniture, pastel colors and slipcovered beds.

traditional bed (M = 4.93, SD not given), (F = 7.65, p < 0.05).
Mean percentages of observed social activity for hospital, bed (M = 19.79%, SD not given),
day bed (M = 32.23%, SD not given), traditional bed (M = 3.75%, SD not given), (F = 19.84, p < 0.01).
Regarding the percentage of time engaged in passive behavior, hospital bed (M = 7.90%, SD not given),
day bed (M = 6.15%, SD not given), traditional bed (M = 14.40%, SD not given), F = 4.08, p = 0.05.
Regarding the percentage of time engaged in active and mobile behavior outside the patient room, hospital bed (M = 24.40%, SD not given),
day bed (M = 24.38%, SD not given), traditional bed (M = 10.10%, SD not given), F = 5.30, p = 0.01.
Regarding the perception of unit ambience based on a 10 point cheerfulness rating scale (1 least cheerful, 10 most cheerful), hospital bed (M = 9.13, SD not given),
day bed (M = 8.73, SD not given), traditional bed (M = 7.70, SD not given),
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<td>F = 4.46, p = 0.05. Significantly more patients in the progressive units (hospital bed n = 14, day bed n = 17) made an association between unit appearance and non-institutional settings than the traditional setting (n = 1). (no Chi square or p values given). Significant differences were also found between traditional (n = 10) and progressive units (n = 21) regarding associations between the environment and positive mood states (no Chi square or p values given). Significant correlations were found between patient’s perception ratings and their behaviors (no correlation coefficients or p values were provided – see p. 132). These findings showed that the more pleasant and cheerful the setting then the less boring and confining the unit seemed. Patients who rated their environments more positively were also more active in their environment (no statistical values provided).</td>
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<td>Finish Materials</td>
<td>Ulrich et al. (2004)</td>
<td>Integrative Literature Review Sample: N = 94 inpatients Setting: Coronary Care Unit</td>
<td>Acoustic tile</td>
<td>Review was to answer the research question: What is the role of the physical environment in the hospital of the 21st century?</td>
<td>Noise level, heart rate (HR), HR variability, blood pressure</td>
<td>This integrative literature review found one quasi-experimental study (IIC) which investigated the use of acoustic building materials to reduce noise and study the effects patient’s physiological outcomes. No change in equivalent sound pressures were detected between the good (56 dBA) and bad (57 dBA) acoustics areas. Reverberation time was reduced from 0.8 to 0.4 after the sound absorbing acoustic tiles replaced sound reflecting plaster tiles.</td>
<td>Sample included patients with hearing impairments which could affect results. Study was funded by acoustic tile manufacturer which could bias the study results.</td>
<td>This single, study on the effects of acoustic sound absorbing flooring, ceiling and wall materials provides insufficient evidence to inform healthcare design at this time.</td>
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<td>Finish Materials</td>
<td>Ulrich et al. (2008)</td>
<td>Integrative literature review Sample: one neonatal unit; n = 288 sleep episodes in 12 healthy volunteers Setting: neonatal unit; surgical ward Includes both inpatient and outpatient settings</td>
<td>Acoustic tile, staff behavior to reduce noise (soft speech, lower lights)</td>
<td>Review was to answer the following research question: What influence do environmental characteristics have on patient, family or staff outcomes?</td>
<td>Sleep recordings; noise levels</td>
<td>Two quasi-experimental studies were new to the Ulrich et al. (2008) review. The first quasi-experimental study (IIA) was conducted on healthy volunteers and found the mean number of arousals was significantly lower in rooms with acoustic tiles. The second quasi-experimental study (IIA) was conducted on a neonatal ICU showed significant reductions in noise levels through a combination of staff behavior changes to reduce noise combined with environmental changes. One of the environmental changes included the use of acoustic tiles.</td>
<td>Generalizability of the study findings is limited due to the use of healthy volunteers and neonates as the study samples.</td>
<td>This integrative review found preliminary evidence to suggest that acoustic building materials may reduce patient arousals from sleep in healthy volunteers and infants.</td>
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<td>Interior Detail</td>
<td>Christenfeld, R., Wagner, J., Pastva, G., and Acrish, W.P. (1989)</td>
<td>Mixed methods: Qualitative – descriptive, structured interview and Quasi-experimental with pretest-posttest design. Sample: psychiatric inpatients; (n = 36), Control group (n = 44). Setting: psychiatric hospital</td>
<td>Physical changes to two wards during renovation included the following interior details: seating areas with furniture arranged for TV viewing, games and social interaction, non-institutional clocks installed, full length mirrors added. Additional changes to the ward included: 1) Ceilings lowered in halls, day room and patient rooms. Shaded lights installed. Light colored flooring tiles installed. Light colored vinyl with design installed on walls. Waist high room dividers added to separate dining area. Interior decorations including paintings, posters, and hanging baskets.</td>
<td>Qualitative: Study authors report use of key-informant phenomenological reports from staff and patients for 8 months after moving into the renovated wards. Quantitative: Controlled study with pretest-posttest design was matched with four control wards with patients similar in age, diagnoses, chronicity, functioning and prognosis regarding discharge. Therapies and activities for all the wards were nearly the same except one less therapy aid on one model ward. Baseline data obtained from the two renovated wards and the four control wards for 4-8 months post-occupancy. Instruments: Moos’ Ward Atmosphere Scale</td>
<td>Satisfaction with ward facilities. Staff absences. Physician orders for staff to provide close visual monitoring of patients. Incidences of violence and property breakage.</td>
<td>Two-way ANOVA was used to test the effects of ward renovations by comparing pretest and posttest scores by patients and staff. The scale of ward satisfaction showed improvement for both control and model ward patients however it was not statistically significant*. Additionally no significant findings were found in the subscales for satisfaction with bedroom, shower and dining room*. Satisfaction for the dayroom showed a statistical significance difference between the control (pre to post difference of 0.3) and model wards (pre to post difference of 1.4). (two way interaction, F = 3.95, p &lt; 0.05). There were improvements in patient depression pre to post test, although, no statistically significant differences were found between the model and control wards according to the National Institute of</td>
<td>Authors describe study as phenomenological; however, single, structured interviews violate phenomenological al study design. Study is descriptive in nature and reports were cursory. Staff members conducting patient interviews could introduce significant bias on the post-occupancy interviews. Sample sizes were small based on available patient census. The simultaneous manipulation of at least 14</td>
<td>This study compares the original ward to the renovated ward. Significant findings for the renovated ward include: satisfaction with the remodeled day room, amelioration of negative self-image, and geriatric populations experienced a reduction in violence. The majority of the findings were non-significant and no conclusions re: potential for impact on healing environment can be drawn from this study.</td>
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<td>of flowers and plants were added. Nursing station relocated to facilitate optimal views of the dayroom, porch and retreat room. Smoking porch was ventilated and decorated with same interior decorations. Hallways were carpeted, wall hangings added, archways installed. 2) Bathrooms: ornamental tile installed, vanity style sinks added, private dressing rooms added and non-weight bearing shower heads installed</td>
<td>and Lubin’s Depression Adjective Checklist (Form E). Patients from the six wards were invited to participate in a pretest and posttest structured interview conducted by a staff member on the ward. The patient interview consisted of: 1) scales developed for this study to determine satisfaction with ward patient room, dining room, shower room and day room. 2) National Institute of Mental Health’s CES-D scale, Harlem Valley Psychosocial Scale. Staff interviews included: 1) Scales of functioning obtained from staff members were Feitel’s</td>
<td>Mental Health CES-D scales*. There were no statistically significant changes in factors of irritability and social isolation on the Harlem Psychosocial Scale on the control or model wards pre to posttest*. There was a statistically significant difference between control (pre to posttest difference of 1.01) and model wards pre to post test in amelioration of negative self-image (pre to posttest difference of 0.57), (two way interaction, F = 4.17, p &lt; 0.05). No significant differences were found between control (pre to posttest difference of 0.03) and model ward pre to posttest 0.07) in episodes of patient violence per month pre to post test (two way interaction, F = 0.47, p &gt; 0.05), although there was a statistically significant reduction found in the geriatric population (no details provided)*.</td>
<td>different variables in the environment obscures which variable may be providing more robust effects and which variables are providing little or no effect.</td>
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<td>New York State Office of Mental Health’s Level of Care Survey.</td>
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<td>Checklist of Nonfunctional Behaviors. 2) Items from New York State Office of Mental Health’s Level of Care Survey. Other data collected from the model and control wards: 1) unscheduled staff absences. 2) physician orders for staff to provide close visual monitoring of patients. 3) Incidences of violence to self or other including: assaults, fights, suicide attempts, and property breakage.</td>
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<td>Interior Detail</td>
<td>Dijkstra, K., Pieterse, M. and Pruyn, A. (2006)</td>
<td>Systematic Literature Review Sample: N = 337 Setting: waiting rooms in 3 hospitals</td>
<td>Television or no television (TV)</td>
<td>Review to answer the following research question: What effect do physical environmental stimuli in healthcare settings have on the health and well-being of patients?</td>
<td>Satisfaction, perceived wait time, affective and cognitive appraisal of the wait</td>
<td>This systematic literature review found one controlled clinical trial on interior detail and found that the presence of a TV did not serve as a distractor in a waiting room and did not alter perception of the waiting experience compared to no TV.</td>
<td>Generalizability to other populations is limited as this study sampled any waiting room occupant.</td>
<td>This systematic literature review did not find any evidence at this time to support the use of TV in waiting rooms to serve as a distractor and alter the perception of the waiting experience.</td>
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<td>Interior Detail</td>
<td>Freysteinson, W.M. and Cesario, S.K. (2008)</td>
<td>Non-experimental-descriptive Sample: 10 U.S. hospitals with 200-900 beds Setting: hospitals</td>
<td>None. Routine hospitalization under investigation</td>
<td>Data gathered regarding mirrors: 1) Total # of mirrors 2) total mirror coverage 3) privacy 4) ability to look in mirror when bed bound 5) ability to see own chest 6) barrier free view of own chest 7) ability to view whole body in a mirror. Measurements to nearest mm taken: 1) height &amp; width of mirror 2) distance from mirror to floor 3) obstructions in front of mirror subtracted from total mirror coverage 4) barriers measured</td>
<td>Access to mirrors</td>
<td>Mean # of mirrors in hospital room= 2.1 (range 1 to 4). Total mirror coverage varied from 0.2m squared to 2.1 m squared. Mirrors for bed-bound patients: Not available in 70% of hospitals. Mirrors for the ambulatory patient to view chest: Not available in 20% of hospitals. Barrier free view of chest in mirror: 90% of hospitals had a barrier between mirror and the person. Whole body view in mirror: 90% of hospitals did not provide a mirror for viewing the entire body. Privacy to view self in mirror: Not available in 60% of the hospitals.</td>
<td>Discussion and implications for nursing is limited to single population of mastectomy patients, however, self-image is relevant in all patient populations.</td>
<td>This descriptive study of access to mirrors in the inpatient setting provides insufficient evidence to inform evidence based design.</td>
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<td>Interior Detail</td>
<td>Harris, P.B., Ross, C., McBride, G., and Curtis, L. (2002)</td>
<td>Mixed methods: Non-experimental study-descriptive. Sample: N = 380 inpatients Setting: N = 6 Intermountain n Health Care, Inc. (IHC) hospitals.</td>
<td>None. Routine hospitalization experience under investigation.</td>
<td>Telephone interview</td>
<td>Patient satisfaction</td>
<td>Group differences in environmental satisfaction: showed no relationships between satisfaction and age or length of hospitalization stay, nor days since hospital discharge. No differences found in environmental satisfaction between male and female. No statistically significant differences were found between the six hospitals No statistically significant differences were found between medical, OB-GYN, orthopedics and surgical departments, No statistically significant differences were found in level of environmental satisfaction among the different hospital departments, hospitals, or types of patients.</td>
<td>Non-experimental study. Convenience sample from a single health care agency limits generalizability to other hospitals. The study lacked sufficient detail regarding the interior detail that evoked patient satisfaction limiting replication of the study findings.</td>
<td>This mixed methods study elicited sources of satisfaction from patients, however, the study lacked sufficient detail about the interior that could be used to inform evidence based design.</td>
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<td>Interior Detail</td>
<td>Olsen, R.V. (1984)</td>
<td>Quasi-experimental design Sample: any medical-surgical patients. Three samples of 30 patients each. Setting: Two units (31 bed progressive care unit and an 18 bed traditional unit) in a hospital</td>
<td>Surgical patients were assigned to available traditional or progressive units. Progressive units included the following interior details: which included upholstered furniture, dining room furnished with table with seating for four, daybed with hotel like furniture. Traditional units: 1) lounge consisted of open space along a corridor which lacked privacy and was furnished with institutional furniture. 2) no dining room or pantry. 3) corridor: T-shaped, dreary, poorly lit with dark flooring and no seating. 4) no day beds. Progressive Units: 1) separated lounge with</td>
<td>1) Open-ended and forced-choice scaled interview 2) patient observation using a behavioral mapping technique every 15 minutes for a total of 6 hours recording pt. locations, body position and engagement in activity. 3) questionnaire after discharge on topics of quality of nursing care, discharge preparation and hospital environment.</td>
<td>Passage of time, boredom, feelings of confinement, contact with other patients, unit satisfaction, patient behaviors</td>
<td>Patients ratings on a 10 point scale (1 best, 10 poorest) of nursing care hospital bed (M = 1.86, SD not reported), daybed (M = 2.36, SD not reported), traditional bed (M = 2.80, SD not reported). F = 2.24, p &gt; 0.05 (p value not provided). Patients ratings on negative emotional reactions to hospitalization on a 10 point scale (1 best, 10 poorest) for perceived boredom and rate of passage of time (no means or SD given) were found not to be statistically significantly different between progressive and traditional bed types. Regarding feelings of confinement as reported on a 10 point scale (1 best, 10 poorest), hospital bed (M = 3.66, SD not given), day bed (M = 4.80, SD not given), traditional bed (M = 6.40, SD not given) (F = 5.76, p = 0.01).</td>
<td>During the study the progressive hospital bed units were altered to include the sick and dying and this change in the patient population may have adversely affected the study outcomes. Randomization was assumed.</td>
<td>No specific conclusions for design implications can be drawn. The effects of whole unit renovations are confounded by multiple interventions without controls to evaluate if one intervention is having a more profound effect than another. For this reason no specific design implications can be gleaned from these studies.</td>
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<td>living room-like atmosphere, curtains and carpeting. 2) dining room, wallpaper, cloth curtains and window view of the city. 3) Pantry available to patients to make coffee, tea or to access snacks. 4) Racetrack corridor in beige tones with seating and artwork. 5) daybed section with studio bedrooms</td>
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<td>Regarding social activity as reported on a 10 point scale (1 best, 10 poorest), hospital bed (M = 6.93, SD not given), day bed (M = 7.36, SD not given), traditional bed (M = 4.93, SD not given), (F = 7.65 , p &lt; 0.05). Mean percentages of observed social activity for hospital, bed (M = 19.79%, SD not given), day bed (M = 32.23%, SD not given), traditional bed (M = 3.75%, SD not given), (F = 19.84 , p &lt; 0.01). Regarding the percentage of time engaged in passive behavior, hospital bed (M = 7.90%, SD not given), day bed (M = 6.15%, SD not given), traditional bed (M = 14.40%, SD not given), F = 4.08, p = 0.05. Regarding the percentage of time engaged in active and mobile behavior outside the patient</td>
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<td>room, hospital bed (M = 24.40%, SD not given), day bed (M = 24.38%, SD not given), traditional bed (M = 10.10%, SD not given), F = 5.30, p = 0.01. Regarding the perception of unit ambience based on a 10 point cheerfulness rating scale (1 least cheerful, 10 most cheerful), hospital bed (M = 9.13, SD not given), day bed (M = 8.73, SD not given), traditional bed (M = 7.70, SD not given), F = 4.46, p = 0.05). Significantly more patients in the progressive units (hospital bed n = 14, day bed n = 17) made an association between unit appearance and non–institutional settings than the traditional setting (n = 1) (no Chi square or p values given). Significant differences were also found between traditional (n = 10)</td>
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and progressive units (n = 21) regarding associations between the environment and positive mood states (no Chi square or p values given). Significant correlations were found between patient’s perception ratings and their behaviors (no correlation coefficients or p values were provided – see p. 132). These findings showed that the more pleasant and cheerful the setting then the less boring and confining the unit seemed. Patients who rated their environments more positively were also more active in their environment (no statistical values provided).
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<td>Lighting</td>
<td>Beauchemin, K.M. and Hays, P. (1996).</td>
<td>Randomized clinical trial Sample: N =174 psychiatric inpatients Setting: psychiatric hospital</td>
<td>East (bright light) or west (daylight blocked) window views.</td>
<td>chart review</td>
<td>LOS</td>
<td>Average LOS was 18.1 days. Patients in rooms with bright daylight stayed an average of 16.9 days whereas patients in rooms with lower levels of illumination had an average stay of 19.5 days (2.6 days greater than patients in bright daylight rooms). The difference remained across seasons. Z-score comparing sample means (Z = 1.4: 1-tail, P &lt; 0.05).</td>
<td>No quantitative measure of actual depressive symptoms to indicate that depression improved. Discharge from the setting was used as a proxy for improved depression. Discharge could have been related to something else such as lack of reimbursement from the payer source. Patients were assessed as ready for discharge (subjective clinical judgment). No quantitative amount of daylight exposure was provided rather authors report patients “spent the first part of the day in their rooms” (p. 50). No quantitative amount of light (e.g., in lumens) in the patient rooms was measured.</td>
<td>This study compared LOS of depressed patients who were exposed to light from their hospital room windows (east, bright light or west, daylight blocked). East facing (bright light) windows may reduce LOS.</td>
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<td>Lighting</td>
<td>Benedetti, F., Colombo, C., Barbini, B., Campori, E., and Smeraldi, E. (2001)</td>
<td>Randomized controlled trial. Sample: 415 unipolar and 187 bipolar patients Setting: psychiatric hospital</td>
<td>East (morning sunlight) or west (evening sunlight)</td>
<td>Chart review</td>
<td>LOS</td>
<td>No difference in LOS for patients with unipolar depression. LOS for patients with bipolar who were in east facing rooms. For the whole sample t(185) = 2.35, p = 0.020. Summer and fall admissions: winter t(60) = 0.01, p = 0.996, spring t(43) = 0.53, p = 0.600, summer t(31) = 2.23, p = 0.033*, fall t(45) = 2.05, p = 0.046* Patients with bipolar in east facing rooms had an average of 3.67 fewer days in the hospital than those in west facing rooms.</td>
<td>No quantitative measure of actual depressive symptoms to indicate that depression improved. Discharge from the setting was used as a proxy for improved depression. Discharge could have been related to something else such as lack of reimbursement from the payer source. No quantitative amount of daylight exposure was provided. No quantitative measurements of light (e.g., in lumens) in the patient rooms.</td>
<td>This study compared LOS of depressed patients who were exposed to light from their hospital room windows (east, morning sunlight or west, evening daylight). East facing (morning sunlight) windows may reduce LOS.</td>
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<td>Lighting</td>
<td>Choi, J.H., Beltran, L.O., Hway-Suh, K. (2012)</td>
<td>Quasi experimental study Sample: N = 1167 inpatients Setting: internal medicine, otolaryngology, surgery and gynecology wards</td>
<td>SE or NW window orientation</td>
<td>Average LOS measured in days. Position of the head of the bed in relation to the window was measured. Light (daylight illuminance, seasons, availability of daylight) exposure from a SE or NW window orientation in the inpatient room was measured.</td>
<td>LOS</td>
<td>SE facing rooms had a wider range of illuminance (mean value of indoor daylight) ranged from 414 to 218 in the fall). SE window orientations had higher illuminance than NW in all seasons. In comparisons of patient ALOS between room type A (view of exterior of hospital) and type B (view of sky and building in far distance) both with NW and SE window orientations on four different floors during the spring, fall and winter months: (Case 1) 8th floor, room type A, ALOS spring (SE window orientation, M = 5.33, NW window orientation, M = 5.25, p = 0.888), fall (SE window orientation M =4.79, NW window orientation, M = 4.83, p = 0.915), winter (SE window orientation M = 5.58, NW window orientation M = 4.75, p = 0.183). (Case 2) 8th floor, room type B, ALOS spring (SE window orientation, M = 4.53, NW window orientation, M = 7.7, p = 0.015*), fall (SE window orientation M =5.12, NW window orientation, M = 5.51, p = 0.377), winter (SE window orientation M = 5.12, NW window orientation M = 5.23, p = 0.779).</td>
<td>To report nearly 25% (6 of 24 cases of SE facing rooms) of cases as significant, authors had to include marginally significant results. No effect size was included. Randomization was assumed.</td>
<td>This quasi-experimental study investigated the effect of daylight exposure from an inpatient window facing SE or NW to determine its effects on hospital LOS. There is some preliminary evidence to suggest that SE window orientations reduce LOS. SE window orientations had higher illuminance than NW in all seasons.</td>
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<td>(Case 3) 11th floor, room type A, ALOS spring (SE window orientation, M = 7.19, NW window orientation, M = 6.96, p = 0.868), fall (SE window orientation M = 5.22, NW window orientation, M = 7.09, p = 0.048*), winter (SE window orientation M = 6.32, NW window orientation M = 9.65, p = 0.074).</td>
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<td>(Case 4) 11th floor, room type B, ALOS spring (SE window orientation, M = 6.13, NW window orientation, M = 6.44, p = 0.768), fall (SE window orientation M = 6.96, NW window orientation, M = 8.03, p = 0.484), winter (SE window orientation M = 7.33, NW window orientation M = 10.56, p = 0.088).</td>
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<td>(Case 5) 12th floor, room type A, ALOS spring (SE window orientation, M = 5.91, NW window orientation, M = 6.12, p = 0.864), fall (SE window orientation M = 5.04, NW window orientation, M = 6.58, p = 0.098), winter (SE window orientation M = 4.83, NW window orientation M = 8.63, p = 0.251).</td>
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<td>(Case 6) 12th floor, room type B, ALOS spring (SE window orientation, M = 5.45, NW window</td>
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<td>orientation, M = 5.76, p = 0.754, fall (SE window orientation M = 6.77, NW window orientation, M = 7.41, p = 0.771), winter (SE window orientation M = 7.75, NW window orientation M = 9.64, p = 0.538). (Case 7) 16th floor, room type A, ALOS spring (SE window orientation, M = 8.2, NW window orientation, M = 7.11, p = 0.474), fall (SE window orientation M = 7.6, NW window orientation, M = 5.77, p = 0.201), winter (SE window orientation M = 5.66, NW window orientation M = 6.77, p = 0.073). (Case 8) 16th floor, room type B, ALOS spring (SE window orientation, M = 6.33, NW window orientation, M = 6.07, p = 0.763), fall (SE window orientation M = 4.86, NW window orientation, M = 5.37, p = 0.521), winter (SE window orientation M = 6.2, NW window orientation M = 5.74, p = 0.582). (*) indicates statistically significant value</td>
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<td>Lighting</td>
<td>Christenfeld, R.,</td>
<td>Mixed methods: Qualitative – descriptive, structured interview and Quasi-experimental with pretest- posttest design.</td>
<td>Physical changes to two wards during renovation included the following changes to lighting conditions: Shaded lights installed. Additional unit changes included: 1) Ceilings lowered in halls, day rooms and patient rooms. Light colored flooring tiles installed. Light colored vinyl with design installed on walls. Waist high room dividers added to separate dining and create 3 separate seating areas with furniture arranged for TV viewing, games and social interaction. Interior decorations including paintings, posters, and</td>
<td>Qualitative: Study authors report use of key-informant phenomenological reports. Quantitative: Controlled study with pretest-posttest design was matched with four control wards with patients similar in age, diagnoses, chronicity, functioning and prognosis regarding discharge. Therapies and activities for all the wards were nearly the same except one less therapy aid on one model ward. Baseline data obtained from the two renovated wards and the four control wards for 4-8 months post-occupancy. Instruments: Moos’ Ward Atmosphere Scale and Lubin’s Depression Adjective Checklist (Form E). Patients from the six wards were invited to participate in a pretest and posttest structured interview conducted by a staff member on the ward. The patient interview consisted of: 1) scales developed for this study to determine</td>
<td>Satisfaction with ward facilities. Staff absences. Physician orders for staff to provide close visual monitoring of patients. Incidences of violence and property breakage.</td>
<td>Two-way ANOVA was used to test the effects of ward renovations by comparing pretest and posttest scores by patients and staff. The scale of ward satisfaction showed improvement for both control and model ward patients however it was not statistically significant*. Additionally no significant findings were found in the subscales for satisfaction with bedroom, shower and dining room*. Satisfaction for the dayroom showed a statistical significance difference between the control (pre to post difference of 0.3) and model wards (pre to post difference of 1.4). (two way interaction, F = 3.95, p &lt; 0.05). There were improvements in patient depression pre to post test, although, no statistically significant differences were found between the model and control wards according to the National Institute of Mental Health CES-D scales*.</td>
<td>Authors describe study as phenomenological; however, single, structured interviews violate phenomenological study design. Study is descriptive in nature and reports were cursory. Staff members conducting patient interviews could introduce significant bias on the post-occupancy interviews. Sample sizes were small based on available patient census. The simultaneous manipulation of at least 14 different variables in the environment obscures which variable may be providing more robust effects and which variables are providing little or no effect.</td>
<td>This study compares the original ward to the renovated ward. Significant findings for the renovated ward include: satisfaction with the remodeled day room, amelioration of negative self-image, and geriatric populations experienced a reduction in violence. The majority of the findings were non-significant and no conclusions re: potential for impact on healing environment can be drawn from this study.</td>
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<td>hanging baskets of flowers and plants were added. Nursing station relocated</td>
<td>satisfaction with ward patient room, dining room, shower room and day</td>
<td>There were no statistically significant changes in factors of irritability and social isolation on the Harlem Psychosocial Scale on the control or model wards pre to posttest*.</td>
<td>*Authors did not provide statistical</td>
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<td>to facilitate optimal views of the dayroom, porch and retreat room. Smoking</td>
<td>room. 2) National Institute of Mental Health’s CES-D scale, Harlem</td>
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<td>porch was ventilated and decorated with same interior decorations. Hallways</td>
<td>Valley Psychosocial Scale. Staff interviews included: 1) Scales of</td>
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<td>were carpeted, non-institutional clocks installed, wall hangings added,</td>
<td>functioning obtained from staff members were Feitel’s Checklist of</td>
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<td>archways installed and seating area added 2) Bathrooms: ornamental tile</td>
<td>Nonfunctional Behaviors. 2) Items from New York State Office of Mental</td>
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<td>installed, full length mirrors added, vanity style sinks added, private</td>
<td>Health’s Level of Care Survey. Other data collected from the model and</td>
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<td>dressing rooms added and non-weight bearing shower heads installed.</td>
<td>control wards: 1) unscheduled staff absences. 2) physician orders for</td>
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<td>staff to provide close visual monitoring of patients. 3) Incidences</td>
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<td>of violence to self or other including: assaults, fights, suicide</td>
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<td>attempts, and property breakage.</td>
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*No significant differences were found between control (pre to posttest difference of 0.03) and model ward pre to posttest 0.07) in episodes of patient violence per month pre to post test (two way interaction, $F = 0.47, p > 0.05$), although there was a statistically significant reduction found in the geriatric population (no details provided).*
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Lighting</td>
<td>Dijkstra, K., Pieterse, M. and Pruyn, A. (2006). Sample: (IA, n = 89); (IB, n = 174); (IB, n = 628); (IB, n = 602). Setting: psychiatric hospital (IB, IB); cardiac intensive care unit (IB); Post-operative unit (IA).</td>
<td>Systematic Literature Review</td>
<td>daylight</td>
<td>Review to answer the following research question: What effect do physical environmental stimuli in healthcare settings have on the health and well-being of patients?</td>
<td>LOS and reduction of pain medication use and costs, mood</td>
<td>This systematic literature review found four studies on the effects of daylight on LOS (three RCTs at the strength and quality rating of 1B) showing positive benefits of daylight on LOS and one (1A) showing positive benefits of daylight on reduction of pain medication use and costs.</td>
<td>No quantitative amount of daylight exposure was provided. No quantitative measure of mood such as a rating scale was used. No quantitative measures of light (e.g., in lumens) in the patient rooms.</td>
<td>This systematic literature review finds evidence to suggest that daylight has significant positive effects on patient outcomes of LOS and reduction of pain medication use and costs.</td>
<td>IVA</td>
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<td>Lighting</td>
<td>Drahota, A., Ward, D., Mackenzie, H., Stores, R., Higgins, B. Gal, D. and Dean, T.P. (2012)</td>
<td>Meta-analysis/Systematic Literature Review Sample: n = 89 Settings: Post-operative unit.</td>
<td>daylight</td>
<td>Review to answer the following research question: What effects do hospital environments have on adult patient health-related outcomes?</td>
<td>pain</td>
<td>One CCT found no strong evidence for an effect of daylight on outcome of pain.</td>
<td>There were an insufficient number of studies on lighting to conduct a meta-analysis. Use of window blinds can alter daylight exposure and this variability was not measured by the researchers.</td>
<td>There is currently insufficient evidence from this SLR to make evidence-based design decisions regarding daylight and improved patient outcomes.</td>
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<td>Lighting</td>
<td>Harris, P.B., Ross, C., McBride, G., and Curtis, L. (2002)</td>
<td>Mixed methods: Non-experimental study-descriptive. Sample: 380 inpatients Setting: Intermountain n Health Care, Inc. (IHC) hospitals.</td>
<td>None. This was a descriptive study of routine hospital environment.</td>
<td>Open-ended telephone interview in 1997-1998. Two forms interview: A) open-ended questions about satisfaction with the hospital room. B) Open-ended questions about satisfaction with the hospital environment outside the patient room. Closed ended question: 5-point rating scale 1 (poor) to 5 (excellent) ratings of the hospital room and the environment outside the hospital room. Interview using inpatient satisfaction form.</td>
<td>Satisfaction</td>
<td>Respondents who were satisfied referenced: presence of a window with a nice view and having adequate lighting.</td>
<td>Convenience sample from a single health care corporation limits generalizability to other health care agencies. Replication of this study is not possible as there are no descriptions of the physical health care environment that evoked the patient’s reported satisfaction or the amount of daylight exposure in the patient rooms.</td>
<td>This study elicited sources of satisfaction from the overall quality of the healthcare environment. Satisfaction with the hospital environment did reach statistical significance. Respondents who were satisfied referenced: presence of a window with a nice view and having adequate lighting.</td>
<td>IIB</td>
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<td>Lighting</td>
<td>Rubin H.R., Owens A.J. &amp; Golden G. (1998)</td>
<td>Systematic Literature Review Sample: N = 724 neonates; n = 72 geriatric patients; n = 174 psychiatric patients. Setting: Neonatal, geriatric unit, psychiatric unit</td>
<td>daylight</td>
<td>This review sought to answer the following question: What is the relationship between health outcomes and the physical environment?</td>
<td>Vitamin D, jaundice, LOS</td>
<td>Three studies on lighting: One observational study shows daylight window exposure may reduce neonatal jaundice. One observational study shows vitamin D levels may be observed in geriatric persons with inadequate exposure to outdoor light. One RCT shows sunny hospital rooms with an eastern window orientation may reduce LOS in psychiatric inpatients.</td>
<td>Based on a single study the authors recommend hospital rooms with a southern exposure. However, the study referenced provides evidence supporting the use of windows with an eastern exposure.</td>
<td>This SLR found that daylight may affect specific medical outcomes and suggest maximizing natural light by not obstructing windows with awnings and use ample window openings.</td>
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<td>Lighting</td>
<td>Ulrich et al. (2004)</td>
<td>Integrative Literature Review Sample: (IA, n = 89 postoperative patients); (IB, n = 174 psychiatric patients); (IB, n = 628); (IB, n = 602 psychiatric patients); (IIC, n = 6 dementia patients); (IIA, n = 154 healthy volunteers); (IIA, n = 22 dementia patients) Setting: psychiatric units, post-operative units,</td>
<td>Daylight, artificial light</td>
<td>Review was to answer the research question: What is the role of the physical environment in the hospital of the 21st century?</td>
<td>Pain medication use and costs, mood, sleep</td>
<td>This review found seven research studies on the topic of lighting. Studies on daylight: Two RCTs with a strength and quality rating of IB found support for the positive effects of daylight on LOS of depressed psychiatric inpatients. One RCT with a strength and quality rating of IA found support for the positive effects of daylight on pain medication use and costs. Studies on the effects of exposure to artificial lighting at specified lux levels: Two quasi-experimental studies on dementia patients (at the strength and quality ratings of IIA and IIC) found positive effects of artificial lighting on patient outcomes. One study with n = 6 (IIC). Insufficient sample size affects statistical power. One CCT at the strength and quality rating of IIA found positive effects of artificial lighting on seasonal affective patients. One descriptive study at the strength and quality rating of IIA investigated illumination exposure and sleep patterns to infer effects of artificial lighting on sleep.</td>
<td>The authors of this review report on the efficacy of bright light or artificial light’s effects on depression without specifying the studies administered bright light therapy for specific durations of time and at specific lux levels. Insufficient sample size affects statistical power.</td>
<td>This integrative literature review found evidence to suggest daylight through hospital windows has a positive effect on patient outcomes of LOS and reduced pain medication use and costs. Additionally, this review found preliminary evidence to suggest that artificial lighting for specific duration of time and at specific lux levels, may improve patient outcomes in patients with dementia and seasonal affective disorder.</td>
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<td>Lighting</td>
<td>Ulrich et al. (2008)</td>
<td>Integrative literature review Sample: (IA, N = 20 studies in meta-analysis); (IA, N = 102 psychiatric patients); (IIC, N = 7 geriatric patients); IC, n = 18 ICU patients). Settings: geriatric psychiatric and intensive care units</td>
<td>Artificial and natural daylight</td>
<td>Review was to answer the following research question: What influence do environ-mental characteristics have on patient, family or staff outcomes?</td>
<td>Integrative literature review for evidence-based design for better and safer hospitals</td>
<td>There are four new studies to this 2008 review since the 2004 review. One meta-analysis at the strength and quality rating of IA found evidence to suggest that bright light treatment at specific quantities and lux levels and dawn simulation are effective for seasonal affective disorder while bright light alone is effective for non-seasonal depression. One RCT with a strength and quality rating of IA found evidence to support the use of bright light at specific quantities and lux levels as adjunctive treatment to antidepressants in non-seasonal depression. One quasi-experimental study (n = 7) with a strength and quality rating of IIC found positive effects of artificial lighting exposure at specific quantities and lux levels to increase melatonin levels, increase immobile minutes at night, prolong time in bed and delay arising from bed in geriatric patients. Insufficient sample size decreases statistical power. One quasi-experimental study (n = 18) with a strength and quality rating of IIC measuring ambient light variation on an ICU found that the patients’ duration of sleep was reduced with greater variation in light based on nurses’ estimation of patients’ sleep duration. Insufficient sample size decreases statistical power.</td>
<td>Studies on lighting included a patient population with specific types of depression and ongoing pharmacological treatments making generalizability more difficult. Nurses’ estimation of a patient’s sleep is an unreliable measure of patient’s sleep and also creates a risk of bias on the part of the nurses estimating the sleep while aware of the intent of the study. Additionally, the patients were receiving different medications which could affect cognition and sleep. Insufficient sample size decreases statistical power.</td>
<td>This integrative review provides evidence to suggest that the provision of bright light treatment at specific quantities and lux levels is effective in the treatment of non-seasonal depression while other limited evidence suggests that bright light treatment at specific quantities and lux levels may be effective as adjunctive treatment to the patient’s ongoing antidepressant therapy.</td>
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<td>Lighting</td>
<td>Walch, J.M., Rabin, B.S., Day, R., Williams, J.N., Choi, K., and Kang, J.D. (2005)</td>
<td>Randomized controlled clinical trial Patients randomly assigned to dim eastside rooms where an adjacent building blocked sunlight or to bright west side rooms. Sample: 89 patients undergoing elective surgery. Setting: hospital</td>
<td>Rooms with windows on the east (n = 44) or west side (n = 45).</td>
<td>Twice a day three light measurements (direct, reflective, ambient) were taken using a light meter (L-508Cine Zoom Master) in same way for each patient room. The measurements were calculated to form a cumulative sunlight exposure in lux-hours. Analgesic use: analgesic was administered as needed and administered via patient-controlled analgesia (PCA) during the first 24 hours. All analgesia use was converted to an oral morphine-equivalent through a standard calculation. The amount of oral morphine-equivalent pain medication used each day was divided by 24 to calculate the amount of analgesia used per hour for each inpatient day. To calculate the amount of morphine equivalent analgesia used per hour for duration of the hospitalization, the total amount of morphine used was divided by the length of stay (LOS) in days. Cost of analgesia use was calculated to determine the analgesic cost per</td>
<td>Amount of analgesia used. Cost of analgesia used. Depression Perceived Stress Mood States Pain perception</td>
<td>No differences in patients in east or west side rooms were found with regard to: demographic or clinical characteristics, clinical diagnosis or surgical procedure, baseline pain and optimism ratings, use of analgesia before hospitalization. Sunlight intensity: patients on the bright west side received an average of 46% (p = 0.005) more natural light than the dim east side patients receiving 73,537 lux-hours and the east side patients receiving 50,410 lux-hours. Analgesic Use: Mean opioid-equivalent analgesic use for the entire hospital LOS was 28.3% (P = 0.047) higher for patients on the east side (dim) rooms as compared to the west side (bright) rooms. Before admission to study rooms no statistical differences for patients were found between the patients with regards to: 1) quantity of analgesia prescribed in the operating room. 2) quantity of analgesia prescribed in the post anesthesia care unit.</td>
<td>Sample was on one type of surgical patient – spinal surgery patients. Twice daily sunlight measurement did not take into account patients who closed their blinds, utilized overhead lighting or other variables. Study lacked biological measures of serotonin concentration thought to increase after light exposure. Sunlight effects serotonin levels and is involved in mediating pain pathways</td>
<td>This randomized clinical trial studied daylight exposure from east and west facing window orientations in hospital rooms and provides support those rooms with western exposures (bright) decreases pain medication usage and pain medication costs.</td>
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hour of inpatient stay. Four scales were used to measure psychological and pain measures. 1) McGill Pain Questionnaire (MPQ). 2) Center for Epidemiological Studies Depression Scale (CES-D). 3) Perceived Stress Scale (PSS). 4) Profile of Mood States (POMS). Baseline tests: pain scale and Life Orientation Test Revised (LOT-R) to measure dispositional optimism.

No-interaction group: one of every 5 patients admitted to the study were randomized into the no interaction group. The no-interaction group did not receive psychological or pain questionnaires but did receive a pain scale upon discharge. The no-interaction group was included to measure possible effects of research staff interaction with patients.

3) patient pain rating scale in the post anesthesia care unit. General linear model was used to investigate whether stress and pain experiences mediated the effects of room assignment on medication experience. No linear relationship was found between the severity of psychological change scores and higher analgesia use.

Pain medication costs: Pain medication use for patients on the west side (bright) rooms had a mean 21% (P = 0.047) decrease in analgesic medication costs as compared to patients on the east side (dim) rooms. Psychological and pain measures:

At baseline there were no statistical differences in stress, depression, anxiety or severity of pain between the patients. At the time of discharge the patient on the west side (bright) reported significantly less stress (PSS, P = 0.035) as compared to patients on the east side (dim) rooms. There were no
significant changes in scores from baseline in depression and anxiety between the two groups. Researcher interaction did not affect the outcome of the study as evidenced by no significant difference ($P = 0.901$) in analgesia use per hour between patients randomized into the no-interaction group and the study patients.
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<td>Nature and View</td>
<td>Dijkstra, K., Pieterse, M. and Pruyn, A. (2006)</td>
<td>Systematic Literature Review</td>
<td>Daylight</td>
<td>Review to answer the following research question: What effect do physical environmental stimuli in healthcare settings have on the health and well-being of patients?</td>
<td>Mental status, LOS</td>
<td>Three CCTs found on the effects of windows on patient outcomes. One CCT explored the effects of windows vs. no windows in the ICU and found patients in the rooms with windows reported improvement in orientation for day of the week and time of day, less sleep disturbance and fewer hallucinations and delusions. In contrast the second CCT showed that patients in rooms with no windows had statistically significant less delirium after surgery. The third CCT was on post-operative patients with a view of nature from their hospital bed vs. a view of a brick wall. Patients in the room with a view had shorter LOS, fewer negative comments and took fewer analgesics.</td>
<td>Strict inclusion criteria for only CCTs greatly reduce the number of research articles included in this review. There are few CCTs conducted on physical environmental stimuli in the healthcare setting.</td>
<td>This Systematic literature review showed conflicting evidence regarding the effects of windows vs. no windows in the ICU to affect patient outcomes so there are no design implications from these studies. A single CCT found evidence to suggest that a window view of nature from the hospital bed in post-operative units may generate fewer negative comments, reduce LOS and reduce analgesic use.</td>
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<td>Nature and View</td>
<td>Christenfeld, R., Wagner, J., Pastva, G., and Acrish, W.P. (1989)</td>
<td>Mixed methods: Qualitative – descriptive, structured interview and Quasi-experimental with pretest-posttest design. Sample: psychiatric inpatients; (n = 36), Control group (n = 44). Setting: psychiatric hospital</td>
<td>Physical changes to two wards during renovation included the addition of nature elements: hanging baskets of flowers and plants were added. Additional changes to the ward included: 1) Ceilings lowered in halls, day room and patient rooms. Shaded lights installed. Light colored flooring tiles installed. Light colored vinyl with design installed on walls. Waist high room dividers added to separate dining and create three separate seating areas with furniture arranged for TV viewing, games and social interaction. Interior decorations including paintings, posters. Nursing station relocated to facilitate optimal views of the earth.</td>
<td>Qualitative: Study authors report use of key-informant phenomenological reports. Quantitative: Controlled study with pretest-posttest design matched with four control wards. Instruments: Moos’ Ward Atmosphere Scale and Lubin’s Depression Adjective Checklist (Form E). Pretest and posttest structured interview conducted by a staff member on the ward. The patient interview consisted of: 1) scales developed for this study to determine satisfaction with ward patient room, dining room, shower room and day room. 2) National Institute of Mental Health’s CES-D scale, Harlem Valley Psychosocial Scale. Staff interviews included: 1) Scales of functioning</td>
<td>Satisfaction with ward facilities. Staff absences. Physician orders for staff to provide close visual monitoring of patients. Incidences of violence and property breakage.</td>
<td>Two-way ANOVA was used to test the effects of ward renovations by comparing pretest and posttest scores by patients and staff. The scale of ward satisfaction showed improvement for both control and model ward patients however it was not statistically significant*. Additionally no significant findings were found in the subscales for satisfaction with bedroom, shower and dining room*. Satisfaction for the dayroom showed a statistical significance difference between the control (pre to post difference of 0.3) and model wards (pre to post difference of 1.4), (two way interaction, (F = 3.95, p &lt; 0.05)). There were improvements in patient depression</td>
<td>Authors describe study as phenomenological; however, single, structured interviews violate phenomenological study design. Study is descriptive in nature and reports were cursory. Staff members conducting patient interviews could introduce significant bias on the post-occupancy interviews. Sample sizes were small based on available patient census. The simultaneous manipulation of at least 14 different variables in the environment obscures which variable may be providing more robust effects and which variables are providing little or no effect.</td>
<td>This study compares the original ward to the renovated ward. Significant findings for the renovated ward include: satisfaction with the remodeled day room, amelioration of negative self-image, and geriatric populations experienced a reduction in violence. The majority of the findings were non-significant and no conclusions re: potential for impact on healing environment can be drawn from this study.</td>
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<td>dayroom, porch and retreat room. Smoking porch was ventilated and decorated with same interior decorations. Hallways were carpeted, non-institutional clocks installed, wall hangings added, archways installed and seating area added. 2) Bathrooms: ornamental tile installed, full length mirrors added, vanity style sinks added, private dressing rooms added and non-weight bearing shower heads installed.</td>
<td>obtained from staff members were Feitel’s Checklist of Nonfunctional Behaviors. 2) Items from New York State Office of Mental Health’s Level of Care Survey. Other data collected from the model and control wards: 1) unscheduled staff absences. 2) physician orders for staff to provide close visual monitoring of patients. 3) Incidences of violence to self or other including: assaults, fights, suicide attempts, and property breakage.</td>
<td>pre to post test, although, no statistically significant differences were found between the model and control wards according to the National Institute of Mental Health CES-D scales*. There were no statistically significant changes in factors of irritability and social isolation on the Harlem Psychosocial Scale on the control or model wards pre to posttest*. There was a statistically significant difference between control (pre to posttest difference of 1.01) and model wards pre to post test in amelioration of negative self-image (pre to posttest difference of 0.57), (two way interaction, F = 4.17, p &lt; 0.05). No significant differences were found between</td>
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<td>control (pre to posttest difference of 0.03) and model ward pre to posttest 0.07) in episodes of patient violence per month pre to post test (two way interaction, $F = 0.47, p &gt; 0.05$), although there was a statistically significant reduction found in the geriatric population (no details provided)*. *Authors did not provide statistical</td>
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<td>Nature and View</td>
<td>Harris, P.B., Ross, C., McBride, G., and Curtis, L. (2002)</td>
<td>Mixed methods: Non-experimental study- descriptive. Sample: 380 inpatients Setting: six Idaho Health Care, Inc. (IHC) hospitals</td>
<td>None. Routine hospitalization under investigation.</td>
<td>Telephone interview</td>
<td>Satisfaction</td>
<td>Group differences in environmental satisfaction: showed no relationships between satisfaction and age or length of hospitalization and stay, nor days since hospital discharge. No statistically significant differences were found in environmental satisfaction between male and female. No statistically significant differences were found between medical, OB-GYN, orthopedics and surgical departments. No statistically significant differences were found in level of environmental satisfaction among the different hospital departments, hospitals, or types of patients. Using data from the two types of interviews, the strongest predictor of overall satisfaction was nursing care.</td>
<td>Convenience sample from a single health care corporation limits generalizability to other health care agencies. Replication of this study is not possible as there are no descriptions of the physical health care environment that evoked the patient’s reported satisfaction.</td>
<td>This mixed methods, non-experimental descriptive study on patient satisfaction found that having a window with a nice view was a source of satisfaction with the health care environment.</td>
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Sample: any medical-surgical patient. Three samples of 30 patients each.  
Setting: Two units (31 bed progressive care unit and an 18 bed traditional unit) in a hospital | Assigned to available traditional or progressive units. Progressive units included a dining room with a window view of the city. Traditional units:  
1) lounge consisted of open space along a corridor which lacked privacy and was furnished with institutional furniture.  
2) no dining room or pantry.  
3) corridor : T-shaped, dreary, poorly lit with dark flooring and no seating.  
4) no day beds.  
Progressive Units:  
1) separated lounge with living room-like atmosphere which included upholstered furniture, curtains and carpeting.  
2) dining room furnished with: table with seating for four, wallpaper, cloth curtains.  
3) Pantry available to patients to make coffee, tea or to access snacks.  
4) Racetrack corridor in beige tones with seating and artwork. | 1) Open-ended and forced-choice scaled interview  
2) Patient observation using a behavioral mapping technique every 15 minutes for a total of 6 hours recording pt. locations, body position and engagement in activity.  
3) questionnaire after discharge | Passage of time, boredom, feelings of confinement, contact with other patients, unit satisfaction, patient behaviors | Patients ratings on a 10 point scale (1 best, 10 poorest) of nursing care hospital bed (M = 1.86, SD not reported), daybed (M = 2.36, SD not reported), traditional bed (M = 2.80, SD not reported), F = 2.24, p > 0.05 (p value not provided).  
Patients ratings on negative emotional reactions to hospitalization on a 10 point scale (1 best, 10 poorest) for perceived boredom and rate of passage of time (no means or SD given) were found not to be statistically different between progressive and traditional bed types.  
Regarding feelings of confinement as reported on a 10 point scale (1 best, 10 poorest), hospital bed (M = 3.66, SD not given), day bed (M = 4.80, SD not given), traditional bed (M = 6.40, SD not given) (F = 5.76, p = 0.01).  
Regarding social activity as reported on a 10 point scale (1 best, 10 poorest), hospital bed (M = 6.93, SD not given), day bed (M = 7.36, SD not given), traditional bed (M = 4.93, SD not given), (F = 7.65, p < 0.05).  
Mean percentages of observed social activity for hospital, bed (M = 19.79), | The authors report that the progressive care unit was altered from the study design which had excluded cardiac care patients.  
During the study the progressive hospital bed units were altered to include the sick and dying and this change in the patient population is thought to have adversely affected the study outcomes. Randomization was assumed. | No specific conclusions for design implications can be drawn. The effects of whole unit renovations are confounded by multiple interventions without controls to evaluate if one intervention is having a more profound effect than another. For this reason no specific design implications can be gleaned from these studies. | IIB |
5) day bed section with studio bedrooms with hotel like furniture, pastel colors and slipcovered beds.

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SD not given, day bed (M = 32.23%, SD not given), traditional bed (M = 3.75%, SD not given), (F = 19.84, p < 0.01).

Regarding the percentage of time engaged in passive behavior, hospital bed (M = 7.90%, SD not given), day bed (M = 6.15%, SD not given), traditional bed (M = 14.40%, SD not given), F = 4.08, p = 0.05.

Regarding the percentage of time engaged in active and mobile behavior outside the patient room, hospital bed (M = 24.40%, SD not given), day bed (M = 24.38%, SD not given), traditional bed (M = 10.10%, SD not given), F = 5.30, p=0.01.

Regarding the perception of unit ambience based on a 10-point cheerfulness rating scale. (1 = least cheerful, 10 = most cheerful), hospital bed (M = 9.13, SD not given), day bed (M = 8.73, SD not given), traditional bed (M = 7.70, SD not given), F = 4.46, p = 0.05).

Significantly more patients in the progressive units (hospital bed n = 14, day bed n = 17) made an association between unit appearance and non – institutional settings than the traditional setting (n = 1). (no Chi square or p values given.)
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<td>Significant differences were also found between traditional (n = 10) and progressive units (n = 21) regarding associations between the environment and positive mood states (no Chi square or p values given). Significant correlations were found between patient’s perception ratings and their behaviors (no correlation coefficients or p values were provided – see p. 132). These findings showed that the more pleasant and cheerful the setting then the less boring and confining the unit seemed. Patients who rated their environments more positively were also more active in their environment (no statistical values provided).</td>
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<td>Nature and View</td>
<td>Park, S.H. and Mattson, R.H. (2008)</td>
<td>Quasi experimental Sample: inpatients (n = 90) Setting: 250 bed hospital</td>
<td>Plant with was placed in the hospital room.</td>
<td>Medical data collected: length of hospitalization (LOS) in days, analgesic use and strength of analgesia (classified as weak, moderate, or strong according to analgesic medication class used to treat the pain), vital signs (VS). Psychological data collected: Pain intensity, pain distress, anxiety, and fatigue (PPAF), State-Trait Anxiety Inventory Form Y-1 (STAI-Y1), Environmental Assessment Scale (EAS), and Patient’s Room Satisfaction Questionnaire (PRSQ).</td>
<td>LOS Analgesia use VS Pain intensity Pain distress Anxiety Fatigue Room Satisfaction</td>
<td>Mean LOS for the patients exposed to plants was 4.64 days. Compared to the control group (no plant) with mean LOS of 4.88 days there was no significant* difference in LOS found. Chi square test was used to measure analgesic use. By day 3: no strong analgesics were used by treatment or control groups. There was a significant* difference (P = 0.041) between the treatment and control group with the treatment group having less frequent use of moderate and weak analgesics. Repeated measures ANCOVA was used for systolic blood pressure (SBP) and heart rate (HR). SBP and HR data were shown to have significant* day-by-group interaction (P = 0.047, P = 0.048, respectively). The treatment group on the day of surgery and day one post-operative were show to have significant* differences in lower SBP (P = 0.04, P = 0.04) and HR (P = 0.01, P = 0.03) compared to the control group. For the PPAF significant* day-by-group interactions were found for self-ratings of pain intensity (P = 0.03), pain distress (P = 0.047) and fatigue (P = 0.04).</td>
<td>The authors describe this study as a randomized clinical trial, however, randomization was not described.</td>
<td>This study evaluated the effect of plants in the hospital room during postoperative recovery and its effects on patient outcomes. There is supporting evidence that plants have positive effects on health outcomes and increase patient satisfaction with their hospital rooms.</td>
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<td>Pain intensity (P = 0.01) and pain distress (P = 0.01) were significantly lower in the treatment group at day 3 post-operative. STAI-Y1 and self-reported anxiety were shown to have no significant day-by-group interactions. The treatment group had significantly lower anxiety (P = 0.01) and lower tension (P = 0.02) post-operative. In the treatment group at the postoperative period, the EAS ratings were significant at the P = 0.05 level for 2 items: satisfying (P = 0.34) and pleasant smelling (P = 0.36). In the treatment group at the postoperative period, the EAS ratings were significant at the P = 0.01 level for items: relaxing, comfortable, colorful, calming, and attractive as compared to the control group. PRSQ for the treatment group (93%) showed that plants were most positive quality of their room as compared to the control group (91%) which reported that TV as the most positive quality of their room. The PRSQ results for the treatment group showed that positive qualities reported of the hospital room were...</td>
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<td>temperature (77%), TV (66%) and sunshine (44%). For the control group the positive qualities reported of the hospital room were temperature (71%), sunshine (44%), and quietness (11%). The PRSQ results for the treatment group regarding the patients willingness to return to the hospital for treatment showed 91% were willing to return as compared to 71% of the control group reporting they were willing to return. *No other statistical values were provided by the authors</td>
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<td>Nature and View</td>
<td>Ulrich, R.S. (1984)</td>
<td>Non-experimental-retrospective record review Sample: Records of 46 inpatients (23 matched pairs) Setting: 200 bed hospital</td>
<td>Hospital room with window views of either a small grouping of deciduous trees or a brick wall</td>
<td>Retrospective chart review/case control study</td>
<td>LOS Number of and strength of analgesics each day. Number of and strength of medications for anxiety. Minor complications requiring medications. Nurses’ notes related to course of recovery classified as positive or negative.</td>
<td>Patients with window views of trees had 7.96 hospital days post-operative and patients with views of a brick wall had 8.96 hospital days post-operative. Paired samples (non-parametric test) T-test: Wilcoxon matched-pairs signed-ranks analysis, T(17) = 35, z = 1.965, P = 0.025. Nurses’ notes were classified as negative or positive. There were more negative nurses’ notes for the patients with the view of the brick wall: 3.96 negative remarks for the patients with views of the brick wall as compared to 1.13 negative remarks per patient with the view of trees. Wilcoxon matched-pairs signed-ranks analysis, T(21) = 15, z = 3.49, P &lt; 0.001. Multivariate two-sample Hotelling test was used to compare the groups’ analgesic use. The mean analgesic doses per patient for each dose strength was calculated for: a) day of surgery and day 1 after the surgery b) day 2 to day 5 after the surgery c) day 6 and 7 after the surgery. Statistically significant differences were found in the mean number of analgesic doses between the patients</td>
<td>Randomization was assumed with record review and retrieval of matched pairs</td>
<td>This non-experimental study of the effects of window views of natural environments vs. a brick wall provides evidence that a view of nature resulted in decreased hospital stays post-surgery, lower analgesic use post-surgery and fewer negative comments post-surgery.</td>
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<td>with the tree view vs. the patients with the brick wall view on days 2 through 5 after the surgery (T2 = 13.52, F = 4.30, P &lt; 0.01. No significant differences were found between the groups in their use of anxiolytics. No significant* differences were found between the groups in their rates of minor complications.</td>
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<td>Nature and View</td>
<td>Ulrich et al. (2004)</td>
<td>Integrative Literature Review</td>
<td>Audio visual distractions</td>
<td>Review was to answer the research question: What is the role of the physical environment in the hospital of the 21st century?</td>
<td>Pain, LOS</td>
<td>There were four studies on window view and nature that met the inclusion criteria for this review: One RCT with a strength and quality rating of IA investigated the effects of audio-visual distractions on pain levels of outpatients and found audio-visual distractions may improve tolerance to invasive outpatient procedures. One non-experimental study (IIIA) found positive effects of a window view of nature on patient LOS, pain medication use and negative nursing comments. There were two non-experimental studies that utilized questionnaires to elicit patient and staff views of window exposure to daylight. One was a photo questionnaire and one was a written questionnaire. The study found that informative window views were desired by patients. One study was at the strength and quality level of IIB and the other was at the level of IIIC due to sample included brain injured clients. Researchers did not make an assessment of competency of these patients.</td>
<td>The quasi experimental studies included brain injured and clients who were not considered to be fully alert and oriented. This patient population renders the results difficult to generalize to other populations.</td>
<td>Two studies provide some evidence to suggest that windows with a view and bright light may reduce LOS, pain medication use and reduce negative nursing comments. Audio-visual nature distractions may improve tolerance to invasive outpatient procedures. Patients were found to desire informative window views.</td>
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<td>Nature and View</td>
<td>Ulrich et al. (2008)</td>
<td>Integrative literature review Sample: Theoretical and empirically based articles. Setting: Academic setting, natural setting and outpatient</td>
<td>Audio visual distraction of nature images and sounds (IB), video of natural and urban scenes (IA, IA). Viewing photographs of natural and urban environments (IIB), walking in natural and urban environments (IIA), viewing a video of driving commutes through natural and urban environments (IIB), virtual reality of natural environments (IIB), viewed slide show of nature scenes (IIB, IIB), shown frightening video followed by natural and urban environments (IIB), viewing audio-visual of nature scenes and food (IIC), viewed travelogue (IIIC).</td>
<td>Review was to answer the following research question: What influence do environmental characteristics have on patient, family or staff outcomes?</td>
<td>Attention, heart rate, sedative medication use and pain tolerance (IA, IA, IB). Emotion, stress recovery, immunization to stress and performance (IIB, n = 5). Stress recovery (IIA, n = 1). Perception of time (IIB, n = 1). Agitation during shower time (IIB, n = 1). Patient comfort (IIIC, n = 1)</td>
<td>There were no articles new to the 2008 review on window views. There were 12 research articles on nature that were new to the 2008 review: 3 studies were RCTs at strength and quality levels of IA, IB and IA provide support for the use of audio and/or visual nature distraction on outcomes such as attention, heart rate, sedative medication use and pain tolerance. Two of these studies were conducted on healthy volunteers and one on outpatients. There were eight quasi-experimental studies on the effects of nature: Five of these quasi experimental studies utilized photographic slides or video to compare the effects of natural vs. urban scenes on healthy student volunteers and found positive effects of nature on outcomes such as emotion, stress recovery, immunization to stress and performance. These studies achieved</td>
<td>Of the 12 studies on nature, 8 were conducted on healthy volunteers. This limits generalizability to the inpatient health care setting. Of the 12 studies on nature, 8 studies were not conducted in a healthcare setting. 2 of the 12 studies were conducted in the outpatient setting. This limits generalizability to the inpatient health care setting. The single study on residential clients with dementia is of weak quality.</td>
<td>This integrative review provides some evidence to suggest that audiovisual distraction of nature may improve attention, heart rate, sedative medication use and pain tolerance in outpatients and healthy student volunteers. There is also evidence to suggest that natural environments as compared to urban environments may have positive effects on emotion, stress recovery, immunization to stress and performance in healthy student volunteers. There is some preliminary evidence to suggest that virtual reality of nature during administration of chemotherapy</td>
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<td>strength and quality levels of IIB (n = 5)</td>
<td>One study achieved a strength and quality rating of IIA (n = 1) and found positive effects of nature (real nature, not simulated) over urban environments on stress recovery. One quasi-experimental study with a strength and quality rating of IIB used virtual reality of nature during administration of chemotherapy to outpatients and found the perception of time was altered (shortened) with virtual reality of nature. One quasi-experimental (IIB) found decreased agitation in patients with dementia during shower time when they were exposed to both pictures of nature and of food and were offered food as well. There was a single non-experimental study which investigated the use of audio visual distraction (travelogue of Washington) during</td>
<td>to outpatients may alter the perception of time by shortening the perception of time.</td>
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<td>an outpatient procedure to investigate patient comfort with the procedure. This study achieved a strength and quality rating of IIIC due to insufficient study detail for replication.</td>
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<td>Noise</td>
<td>Aitken, R.J. (1982)</td>
<td>Non-experimental descriptive study. Sample and setting: one hospital, one unit general surgical wards and one isolation room (IR).</td>
<td>None. This was a descriptive study of routine hospital environment.</td>
<td>Noise levels measured in dB(A) using microphone. Acoustic measurements (n=70) were taken every 10 seconds and once after the hour for 3 consecutive 24-hour periods. One night the air conditioning was shut off and noise levels were recorded for 10 (5 minute) periods with the AC on and off.</td>
<td>Noise</td>
<td>Equivalent continuous sound levels for the 4 and 6 bed units and IR were 50-60 dB(A). At night dB(A) levels were 40-45 (4-6 bed unit and IR). Quietest time: early morning. Noisiest time: late afternoon and early evening. No consistent differences in the levels of noise with and without AC. The nurse call chime was 77 dB(A) in the patient room and 55 dB(A) in the nursing station.</td>
<td>Single hospital and single unit under investigation. No detail provided on the unit (unit layout or configuration, location of the nursing station, entry and exit doors) under investigation. Without this detail replication of the study cannot be achieved. Did not investigate patient responses to noise.</td>
<td>This study described noise levels in an inpatient unit. Noise levels can activate vasoconstriction at 70 dB(A). Noise as low as 35 dB(A) can affect sleep. Noise levels of 40 dB(A) are advised for hospitals. This study shows dB(A) consistently above 40 dB(A). Reducing dB(A) in the hospital is suggested.</td>
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<td>Noise</td>
<td>Balough, D., Kittinger, E., and Hackl, J.M. (1993)</td>
<td>Non-experimental descriptive study. Sample Setting: ICU with open ward design</td>
<td>None. This was a descriptive study of routine hospital environment.</td>
<td>Noise levels were assessed in the ICU using SPL (a weighted sound pressure level) to detect noise under normal operations and noise from instrument alarms. To measure overall noise a microphone was placed at one side of the room (placement was uniform among the rooms). A continuous recording was taken over two 24-hour periods. Instrument alarms were recorded as well as frequency of alarms.</td>
<td>Noise</td>
<td>The energy averaged level of noise is a gross overall evaluation of noise. During the daytime hours of 20-minute intervals the dB ranges from 60-65. For a few minutes the noise may climb to 70-75 dB such as an activity like dialysis. Doctor’s rounds raised dB levels to greater than 65.</td>
<td>Sustained high noise levels were unexplained and a notebook for staff to offer explanations would have aided understanding of incidences of high noise levels.</td>
<td>Noise levels were described. SPL of the ICU is higher than the 45 dB(A) recommended by the US Environmental Protection Agency. Routine ICU environment shows the opportunity for noise reducing architectural design features.</td>
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<td>Noise</td>
<td>Busch-Vishniac, I.J., West, J.E., Barhill, C., Hunter, T., Orellana, D. &amp; Chivukula, R. (2005)</td>
<td>Non-experimental descriptive study. Sample &amp; Setting: pediatric ICU, adult medical/surgical and oncology units (n = 5 units). One unit without acoustical tile.</td>
<td>None. This was a descriptive study of routine hospital environment.</td>
<td>Equivalent sound pressure level measurements at the five different units with simultaneous readings of octave band sound pressure levels. 24 hour measurements at 3 different locations in the units (patient room, nurses' station/hallway and an empty room). Recording device was a Larson-Davis system 824 and measurements were taken at a height of 4.5 feet</td>
<td>Noise</td>
<td>Newer units were not particularly quieter than the older units and acoustical tile did show consistently lower dB levels*. No differences in the sound levels were found between straight vs. curved corridors*. Highest noise levels were found in a staff conference room*. A closed door yielded a noise reduction of only 2.2 dB(A). It was noted that hospital doors have large gaps at the bottom. Nurses' stations were noisier than other areas on the unit by 1-2 dB(A). Logarithmic averages of equivalent sound pressure levels as compared to the World Health Organization guidelines shows: 1) little variation among the five units studied. 2) average equivalent sound pressure levels vary from 50-60 dB(A). 3) the pediatric ICU is the noisiest unit. Observed sound levels are at least 20 dB(A) on average greater than the WHO guidelines. With all the measured logarithmic average sound levels exceeding normal speech of 45-50 dB(A), staff will need to raise their voices to be heard.</td>
<td>Single hospital Limited description of units (layout and configuration, location of nursing station) prevents replication of this study. Acoustic tile was not described (quality, manufacturer, age of tile).</td>
<td>This study described noise levels in a hospital. Observed sound levels are at least 20 dB(A) on average greater than the WHO guidelines and this finding along with the finding that acoustic tiles help diminish noise, warrant the use of acoustic tiles in hospitals. Holes in standard acoustic tiles are theorized to harbor bacteria, but they are not currently contraindicated for use in hospitals. Closed hospital room doors do not diminish noise by more than 2.2 dB(A) so alterations to doors are not indicated (e.g., self-closing doors). Curved hallways do not diminish dB(A) as compared to straight hallways. The trend to change straight hallways is unnecessary as a noise reduction technique. Replacing overhead paging with hand</td>
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<td>Noise levels by time of day showed little (7-8 dB(A)) to no variation according to the time of day. On average hospital noise levels are at about the same sound level constantly (no means given). Use of a personal hands free telecommunicator was evaluated as compared to overhead paging on one unit. The result was a reduction in dB(A) by 5.4 after the introduction of the telecommunicator. *no other statistics were reported by the authors</td>
<td>held devices did offer a modest reduction in dB(A).</td>
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<td>Noise</td>
<td>Dijkstra, K., Pieterse, M. and Pruyn, A. (2006)</td>
<td>Systematic Literature Review Sample and setting: ICU (n = 1) Studies included only controlled clinical trials.</td>
<td>Sound absorbing tiles</td>
<td>Review to answer the following research question: What effect do physical environmental stimuli in healthcare settings have on the health and well-being of patients?</td>
<td>Rehospitalization rate, pulse amplitude, necessity for treatment with IV beta blocker, perceived quality of care.</td>
<td>One controlled clinical trial was found on sound: The use of acoustic tile in ICU resulted in statistically significant higher rates of rehospitalization in the group with poor acoustics.</td>
<td>Single cardiac ICU was studied making generalization to other types of units more difficult.</td>
<td>A single controlled clinical trial provided preliminary support for the use of acoustic tiles to decrease rehospitalization rates in the ICU.</td>
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<td>Noise</td>
<td>Harris, P.B., Ross, C., McBride, G., and Curtis, L. (2002)</td>
<td>Mixed methods: Non-experimental study-descriptive, qualitative. Sample and setting: 380 inpatients in Inter-mountain Health Care, Inc. (IHC) hospitals (n = 6).</td>
<td>None. This was a descriptive study of routine hospital environment.</td>
<td>Telephone and written interview</td>
<td>Satisfaction</td>
<td>Interrater reliability for scales averaged 0.87. Sources of satisfaction and dissatisfaction with the hospital room included noise. Respondents who were satisfied with the interior referenced being located away from sources of unit noise and having quiet surroundings.</td>
<td>Convenience sample from a single health care corporation limits generalizability to other health care agencies. Replication of this study is not possible as there are no descriptions of the physical health care environment that evoked the patient’s reported satisfaction.</td>
<td>This mixed methods study utilized interviews to elicit sources of satisfaction from the health care architecture and included having a room located away from sources of unit noise.</td>
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<td>Noise</td>
<td>Holmberg S.K. and Coon, S. (1999)</td>
<td>Non-experimental-descriptive study. Sample and Setting: psychiatric hospital</td>
<td>None. This was a descriptive study of routine hospital environment.</td>
<td>Sound levels</td>
<td>Noise</td>
<td>The mean sound level for the adult units was 76.54 (dBA) with range from 74.85 dBA to 81.32 dBA.</td>
<td>Staff and patients were aware of the intent of the study to measure sound. This may have induced the Hawthorne effect when study participants are aware of the monitoring of behavior, which may cause participants to modify their behavior.</td>
<td>This descriptive study on noise in a psychiatric hospital showed that mean sound levels range from 74.85 to 81.32 dBA. Noise levels at this level may reduce reaction times and cognitive performance. This is relevant to patient care practices of patients on psychiatric units.</td>
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<td>Noise</td>
<td>Dube, J.A, et al. (2008)</td>
<td>Mixed method design—quasi experimental, descriptive, qualitative. Sample: inpatients (n =3129) Setting: hospitals (n = 2)</td>
<td>Pretest: None. Routine hospitalization under investigation. Posttest after noise control intervention implemented to reduce noise were: close patient door, dim lights, limit overhead pages, lower speaking voice, lower alarms, lower ringers on phones, post quiet signs other, quiet carts and add white noise.</td>
<td>Pre and post noise assessments surveys. Noise was measured.</td>
<td>Noise</td>
<td>Patient and staff rating level of noise pretest: Morning n = 1967, M = 3.44 (SD = 0.91). Posttest n = 1592, M = 3.34 (SD = 0.96), p = 0.003. Afternoon n = 1929, M = 3.29 (SD = 0.85). Posttest n = 1567, M = 3.20 (SD = 0.84), p = 0.001. Evening n = 1912, M = 3.06 (SD = 0.83). Posttest n = 1552, M = 2.97 (SD = 0.82), p = 0.002. Night n = 1864, M = 2.49 (SD = 0.88). Posttest n = 1540, M = 2.44 (SD = 0.89), p = 0.155.</td>
<td>There was no information included about the type of flooring or the type of acoustic tiles.</td>
<td>This study on the effects of noise reduction interventions on hospital units found evidence to support the following interventions: padding chart holders, padding pneumatic tube drop stations, installing quieter paper towel dispensers, adding signage requesting quiet, closing the door to the patient room and lowering the lights.</td>
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<td>Noise</td>
<td>Rubin H.R., Owens A.J. &amp; Golden G. (1998)</td>
<td>Systematic Literature Review Sample: volunteer study participants n = 70. Setting: CCU</td>
<td>None. Routine CCU environment under investigation.</td>
<td>This review sought to answer the following question: What is the relationship between health outcomes and the physical environment?</td>
<td>REM sleep</td>
<td>This systematic literature review found one quasi experimental study found healthy volunteers exposed to CCU noise had less REM, shorter duration REM and longer duration between REM cycles than those in the control group.</td>
<td>Use of healthy volunteers limits generalizability to the inpatient population.</td>
<td>This systematic literature review identified one quasi experimental study which found significant differences in REM intervals between the control group (no noise) and the study group exposed to CCU noise. This suggests opportunities for sound reducing architectural features.</td>
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<td>Noise</td>
<td>Ulrich et al. (2004)</td>
<td>Integrative Literature Review Sample and setting: theoretically and empirically based articles. Setting: Includes both inpatient and outpatient settings</td>
<td>Acoustic tile (IIB, n = 1; IIC, n = 1), acoustic foam in neonatal incubator (IIB, n = 1), noise and light reduction (IIC, n = 1), coping with noise (IIA, n = 1), headphones of ICU noise recordings (IIA, n = 1).</td>
<td>Review was to answer the research question: What is the role of the physical environment in the hospital of the 21st century?</td>
<td>Stress (IIA, IIIA, IIC), sleep (IIA; IIB, IIC, IIC, n = 2), median diastolic BP, mean arterial pressure and decreased infant movements (IIC), staff stress (IIB, IIIIC)</td>
<td>21 research articles were found on the topic on noise: quasi experimental studies (n = 8; IIA, n = 2; IIB, n = 2; IIC, n = 4) and non-experimental studies (n = 13; IIIA, n = 1; IIB, n = 5; IIC, n = 7). Studies on noise and sleep disruption (n = 5): One study (IIA) found healthy subjects who were exposed to ICU noise recordings had decreased duration of REM and decreased REM activity. One study (IIC) found a significant correlation between noise and EEG arousal from sleep in ICU (n = 6). Small sample size leads to lack of power for statistical tests. Another study (n = 13) (IIC) studied the effects of noise and patient care activities on sleep in ICU patients and found these factors account for less than 30% of sleep arousals and awakenings. Small sample size leads to lack of power for statistical tests. Another study (IIIC) found noise and incontinence care were responsible for 50% of 4 minute or longer waking episodes in nursing home patients. No data were provided for the research consumer. One study (IIIB)</td>
<td>10 of the 21 research studies on noise were of C quality due to insufficient sample size (n &lt; 20), competing hypotheses or insufficient information (including statistical data) for the research consumer. Sample population other than adult inpatients (neonates, nursing home patients, healthy volunteers) makes generalizability more difficult. Unique treatment settings such as operating theatres makes generalizability more difficult.</td>
<td>This integrative literature review found preliminary evidence to suggest that ICU noise disrupts sleep in healthy volunteers. This integrative review also found evidence to suggest that noise is greater during times of increased visitor traffic in open bay pediatric wards. This integrative review also found evidence to suggest nursing staff perceived significantly lower work demands, pressure and strain in units with sound reflecting tiles.</td>
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<td>found that 22% of inpatients who slept well at home had trouble sleeping in the hospital. Studies on noise and open bay wards (n =1): One study (IIIB) described noise levels found higher levels of noise during visiting times on an open bay pediatric unit. Studies on noise and effects on nursing staff (n = 2): One study (IIB) found nursing staff perceived significantly lower work demands, pressure and strain in units with sound reflecting tiles. One study (IIIC), (n = 11) found noise was shown to correlate with stress in ICU nurses. Competing hypothesis of elevated unit noise may indicate patient acuity which affects nurse stress. Insufficient sample size. Studies of staff interventions to reduce noise (n = 5): One study (IIC) found closing doors, lowering lights and decreasing TV volume found pre-intervention dBA levels = 42 and post-intervention dBA levels = 45. No statistical tests were performed to determine significance of the change in dBA level pre to post-intervention. One</td>
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<td>Design Feature</td>
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<td>study (IIB) investigated the use of acoustical foam in incubators in a neonatal unit and found a statistically significant correlation between higher noise levels and oxygen support therapy. One study (IIC) found the staff intervention of closing patient doors reduced noise levels by 6 dBA. The study provided insufficient detail of staff education and interventions to replicate the study. One study (IIC) investigated staff intervention of quiet hour on noise levels in a neonatal ICU (n = 10) and found reduced median diastolic BP, mean arterial pressure and decreased infant movements. Insufficient sample size. One study (IIC) investigated the effects of guidelines to reduce noise and light in an ICU (n = 17) and found noise levels were reduced but background noise levels remained unchanged. Insufficient sample size. Studies on anxiety and noise (n = 1): One study (IIIB) found that mean annoyance levels were higher during quiet hour. Descriptive studies of noise (n = 4):</td>
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<td>One study (IIIB) found sound levels in an ICU ranged from 48.5 to 68.5 dBA. One study (IIIB) found sound levels in a neonatal ICU were greater than 90 dBA during peak noise times. One study (IIIC) recorded noise levels for 5 minutes in an operating theatre and found noise levels up to 108 dBA. One study (IIIC), (n = 5 surgeries) recorded noise levels in an operating theatre and found noise levels did not exceed the recommended 110 dBA. Studies on noise and stress (n = 3): One study (IIIC) found noise was not a top five stressor in the ICU. Study did not include literature review, theoretical framework or tables of statistical findings. One study (IIA) found statistically significant correlation between the greater person’s sensitivity to noise the greater was their ability to cope with noise. One study (IIIA) investigated the effects of stress and sleep and found environmental stress accounted for a significant amount of sleep variance.</td>
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<th>Design Feature</th>
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<tr>
<td>Noise</td>
<td>Ulrich et al. (2008)</td>
<td>Integrative literature review Sample: theoretical and empirically based articles. Setting: inpatient and outpatient</td>
<td>Sleeping with headphones playing ICU sounds (IIA), earmuffs on neonates (IIB)</td>
<td>Review was to answer the following research question: What influence do environmental characteristics have on patient, family or staff outcomes?</td>
<td>Sleep quality (IIA), oxygen saturation and behavioral state changes, time in quiet sleep (IIB)</td>
<td>There are five research studies new to the 2008 review (two non-experimental studies in French not included): quasi experimental studies (n = 2; IIA, n = 1; IIB, n = 1) and non-experimental studies (n = 3; IIIB, n = 3). One study (IIA) found time to fall asleep increased, time spent asleep decreased, awakenings increased and sleep quality decreased in healthy volunteers who slept with headphones playing ICU sounds. One study (IIB), (n = 30) found significantly higher oxygen saturation, fewer behavior state changes and more time in quiet sleep in infants who wore earmuffs. Non-experimental descriptive studies of noise levels in ICUs (n = 2, IIIB) both found noise levels range from 60-65 dBA. One study (IIIB) found mean noise levels in a psychiatric hospital to range from 74.85 to 81.32 dBA.</td>
<td>Use of healthy volunteers limits generalizability of findings to inpatients. Studies in neonates are difficult to generalize to adults.</td>
<td>This integrative review found some preliminary evidence that sleep is disrupted in healthy volunteers who are subjected to ICU sounds. Additionally, this integrative review found some consistency among the qualitative descriptions of noise levels in hospitals to be between 60-65 dBA and between 74-82 dBA in a psychiatric hospital demonstrating the opportunity for noise reducing architectural features.</td>
<td>IVB</td>
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## ROOM CONFIGURATION SYNTHESIS TABLE

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<tr>
<td>Room Configuration</td>
<td>Christenfeld, R., Wagner, J., Pastva, G., and Acrish, W.P. (1989)</td>
<td>Mixed methods: Qualitative – descriptive, structured interview and Quasi-experimental with pretest-posttest design. Sample: psychiatric inpatients; (n = 36), Control group (n = 44). Setting: psychiatric hospital</td>
<td>Physical changes to two wards during renovation included the following changes to room configuration: Waist high room dividers added to separate dining and create 3 separate seating areas, nursing station relocated to facilitate optimal views of the dayroom, porch and retreat room, private dressing rooms added to the bathrooms. Additional changes to the ward included: 1) Ceilings lowered in halls, day room and patient rooms. Shaded lights installed. Light colored flooring tiles installed. Light colored vinyl with design installed on walls, separate seating areas with furniture</td>
<td>Qualitative: Study authors report use of key-informant phenomenological reports from staff and patients for 8 months after moving into the renovated wards. Quantitative: Controlled study with pretest-posttest design was matched with four control wards with patients similar in age, diagnoses, chronicity, functioning and prognosis regarding discharge. Therapies and activities for all the wards were nearly the same except one less therapy aid on one model ward. Baseline data obtained from the two renovated wards and the four control wards for 4-8 months post-occupancy. Instruments: Moos’ Ward Atmosphere Scale and Lubin’s Depression Adjective Checklist (Form E). Patients from the six wards were invited to participate in a pretest and posttest structured interview conducted by</td>
<td>Satisfaction with ward facilities. Staff absences. Physician orders for staff to provide close visual monitoring of patients. Incidences of violence and property breakage.</td>
<td>Two-way ANOVA was used to test the effects of ward renovations by comparing pretest and posttest scores by patients and staff. The scale of ward satisfaction showed improvement for both control and model ward patients however it was not statistically significant*. Additionally no significant findings were found in the subscales for satisfaction with bedroom, shower and dining room*. Satisfaction for the dayroom showed a statistical significance difference between the control (pre to post difference of 0.3) and model wards (pre to post difference of 1.4), (two way interaction, F = 3.95, p &lt; 0.05). There were improvements in patient depression</td>
<td>Authors describe study as phenomenological; however, single, structured interviews violate phenomenological al study design. Study is descriptive in nature and reports were cursory. Staff members conducting patient interviews could introduce significant bias on the post-occupancy interviews. Sample sizes were small based on available patient censuses. The simultaneous manipulation of at least 14 different variables in the environment obscures which variable may be providing more robust effects and which variables are providing little or no effect.</td>
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<td>arranged for TV viewing, games and social interaction. Interior decorations including paintings, posters, and hanging baskets of flowers and plants were added. Smoking porch was ventilated and decorated with same interior decorations. Hallways were carpeted, non-institutional clocks installed, wall hangings added, archways installed and seating area added. 2) Bathrooms: ornamental tile installed, full length mirrors added, vanity style sinks added, and non-weight bearing shower heads installed.</td>
<td>a staff member on the ward. The patient interview consisted of: 1) scales developed for this study to determine satisfaction with ward patient room, dining room, shower room and day room. 2) National Institute of Mental Health’s CES-D scale, Harlem Valley Psychosocial Scale. Staff interviews included: 1) Scales of functioning obtained from staff members were Feitel’s Checklist of Nonfunctional Behaviors. 2) Items from New York State Office of Mental Health’s Level of Care Survey. Other data collected from the model and control wards: 1) unscheduled staff absences. 2) physician orders for staff to provide close visual monitoring of patients. 3) Incidences of violence to self or other including: assaults, fights, suicide attempts, and property breakage.</td>
<td>pre to post test, although, no statistically significant differences were found between the model and control wards according to the National Institute of Mental Health CES-D scales*. There were no statistically significant changes in factors of irritability and social isolation on the Harlem Psychosocial Scale on the control or model wards pre to posttest*. There was a statistically significant difference between control (pre to posttest difference of 1.01) and model wards pre to posttest in amelioration of negative self-image (pre to posttest difference of 0.57), (two way interaction, F = 4.17, p &lt; 0.05). No significant differences were found between control (pre to...</td>
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<td>Room Configuration</td>
<td>Dijkstra, K., Pieterse, M. and Pruyn, A. (2006)</td>
<td>Systematic Literature Review Sample and setting: orthopedic unit Studies included only controlled clinical trials.</td>
<td>Room type – private or semi-private room</td>
<td>Review to answer the following research question: What effect do physical environmental stimuli in healthcare settings have on the health and well-being of patients?</td>
<td>Frequency, route and amount of pain medication use</td>
<td>This systematic literature review found one quasi-experimental study on room configuration: No variable including room type could account for a significant amount of variance in the use of pain medication use.</td>
<td>Results of the study are highly dependent on the patient population that the hospital treats.</td>
<td>This systematic literature review found a single study on the topic of single occupancy rooms and found it did not have a significant effect on pain medication use. No design implications can be drawn from this single study</td>
<td>IVA</td>
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APPENDIX H:

ARIZONA STATE LAW, INDUSTRY STANDARDS (JOINT COMMISSION) AND RECOMMENDATION TABLES
### Arizona State Law, Industry Standards (Joint Commission), and Recommendation Table

(Rating scale: 1 = is within the guidelines, 2 = challenges the guidelines with potential or critical risk of harm to patient or staff.)

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Private Bedroom at least 60 sq. ft. not including closet</th>
<th>OR shared room with 60 sq. ft. for each person and no more than 4 to a room and 3 ft. between beds</th>
<th>Floor to ceiling walls</th>
<th>Bedroom door opens to hall, common area or outside</th>
<th>Bedroom is constructed and furnished without impediments to access to door</th>
<th>Bedroom is not used as a passage to another room</th>
<th>Bedroom contains storage space such as dresser or chest. Has a table or other surface</th>
<th>Has a clean pillow, linens, in good repair. Also sheets are large enough to tuck under the mattress. There is a waterproof mattress cover if needed, blanket or bedspread sufficient to ensure patient’s warmth</th>
<th>Sufficient lighting to read</th>
<th>Windows or doors with adjustable window or door covers to provide privacy. Working door or window for safe egress unless there is automatic sprinkler system. Doors meet fire safety requirement and doors no less than 20 inches, has area of at least 720 inches. Window sill no more than 44 inches off the floor</th>
<th>Client is not locked into a bedroom. If the door locks, a staff member has the key allowing access at all times</th>
<th>Facilities not specializing in treating conditions that affect mobility, at least 10% of patient sleeping rooms shall provide mobility features</th>
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<td>Recommendations</td>
<td>Leadership identifies risks. Organizations manage safety, security risks. Organizations manage hazardous materials risks</td>
<td>Organization manages fire risks, minimizes risk of fire. Maintains free and unobstructed access to all exits. Conducts fire drills, maintains fire safety equipment and fire safety building features</td>
<td>Organization manages risks associated with utility systems, has reliable electric power source, and provides emergency power. Inspects, tests, and maintains utility and emergency power systems</td>
<td>Organization establishes and maintains a safe, functional environment</td>
<td>Organization provides storage space to meet the needs of the individuals served for safety and suitability for the care, treatment, or services provided</td>
<td>Restrooms are adequate in size and number for people using the facility</td>
<td>Lighting is suitable for care, treatment or services. Lighting is controlled by individuals served consistent with care, treatment or services provided</td>
<td>Organizations maintain ventilation, temperature, and humidity levels suitable for the care, treatment, or services provided</td>
<td>Areas used by individuals served are safe, clean, and comfortable</td>
<td>Furnishings and equipment should reflect the ability and needs of the individual served</td>
<td>Door locks and other structural restraints such as fences are consistent with the organization’s mission, program goals, program policy, and law and regulation, provide the least restrictive environment &amp; meet the needs of the individual served.</td>
<td>Organization keeps furnishings &amp; equipment safe and in good repair</td>
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(Adapted from Joint Commission, 2012)
APPENDIX I:

INITIAL SEARCH STRATEGY
SEARCH STRATEGIES 10-5-12

1. **Database: PubMed**
   
   
   
   
   (**Hospitals**[Mesh])
   
   AND
   
   ("Environment Design"[Mesh] OR "Art"[Mesh] OR "healing environment" OR "hospital design" OR "healthcare design" OR "built environment" OR nature OR plants OR daylight OR garden OR "nature view" OR landscape OR window* OR sunlight OR color)
   
   Results: 5047
   
   Limits applied: English language, adults age 19+ (age 18 unavailable in PubMed), human subjects, publication dates 1980 to 2012
   
   Results: 890

2. **Database: CINAHL**
   
   (MH "Facility Design and Construction") OR (MH "Hospital Design and Construction") OR (MH "Interior Design and Furnishings") OR (MH "Environment") OR (MH "Health Facility Environment") OR (MH "Natural Environment") OR (MH "Home Environment") OR (MH "Plants") OR (MH "Flowers") OR (MH "Horticulture") OR (MH "Sunlight") OR (MH "Color") OR (MH "Color Therapy") OR (MH "Art") OR "healing environment" OR "biophilia" OR "daylight" OR "garden" OR "nature views" OR "landscape" OR "windows"
   
   AND
   
   ("MH Hospitals")
   
   Results: 798
   
   Limits applied: English language, adults age 19+ (age 18 unavailable in CINAHL), human subjects, publication dates 1980 to 2012, peer reviewed journals, inpatients.
   
   Results: 24

3. **Database: PsycINFO**
   
   Search terms: (DE "Hospitals") AND ((DE "Hospital Environment") OR (DE "Environment") OR (DE "Nature (Environment)") OR (DE "Plants (Botanical)") OR (DE "Horticulture Therapy") OR (DE "Art") OR "healthcare design" OR "hospital design" OR "healing environments" OR biophilia OR daylight OR garden OR nature views OR landscape OR windows OR color)
   
   Results: 254
   
   Limits applied: English language, adults age 18+, human subjects, publication dates 1980 to 2012, peer-reviewed journals.
   
   Results: 99

**Total from databases x3 (PubMed, CINAHL, PsycINFO) = 1013 (-1 duplicate) = 1012**

4. **Database Web of Science**
   
   Search terms: (DE "Hospitals") AND (DE "Hospital Environment") OR (DE "Environment") OR (DE "Nature (Environment)") OR (DE "Plants (Botanical)") OR (DE "Horticulture Therapy")
OR (DE "Art") OR "healthcare design" OR "hospital design" OR "healing environments" OR biophilia OR daylight OR garden OR nature views OR landscape OR windows OR color

Results: 1826

Total from the four databases (PubMed, CINAHL, PsycInfo, Web of Science) = 2838

Further screening with application of inclusion criteria (outcomes of stress, anxiety and mood) yields total of four articles:


APPENDIX J:

SEARCH STRATEGY
Search Strategy
Database: PubMed

Search 1
Search terms (mesh headings adopted from Cochrane Review by Drahota et al., 2012):
("Facility Design and Construction"[Mesh]) AND "Health Facility Environment"[Mesh]
Results = 1436
Limits applied: dates 1980 to 2012, adult 19+, humans, English
Results = 219

Search 2
Search terms: "therapeutic design" OR "healing design" OR "restorative design" OR "therapeutic environment" OR "healing environment" OR "restorative environment"
Results = 119 (-3 duplicates) = 116

Search 3
nature OR biophilia OR horticulture OR plant* OR daylight OR garden OR "nature view*" OR landscape OR window* OR "natural light" OR sunlight OR color OR artwork OR painting OR sculpture OR "spatial layout" OR furniture OR "room size"
AND
inpatient* OR "hospitalized patient*" OR "acute care" OR "intensive care unit" OR "psychiatric inpatient*" (note: with search term hospital the yield was 11,388 so this term was removed and the yield dropped to 942)
AND
Search terms: "holistic health" OR "mental health" OR "mental healing" OR stress OR depression OR emotion OR anxiety OR mood OR satisfaction OR therapeutic OR healing OR restorative
Results: 942 (-14 duplicates) = 928

Database: CINAHL
Search terms: (MH "Hospital Design and Construction") OR (MH "Health Facility Environment")
Limits applied: 1980-2012, English, Human, Inpatient, all adult
Results =160 (no duplicates with PubMed search)

nature OR biophilia OR horticulture OR plant* OR daylight OR garden OR "nature view*" OR landscape OR window* OR "natural light" OR sunlight OR color OR artwork OR painting OR sculpture OR "spatial layout" OR furniture OR "room size"
AND
inpatient* OR "hospitalized patient*" OR "acute care" OR "intensive care unit" OR "psychiatric inpatient*"
AND
Search terms: "holistic health" OR "mental health" OR "mental healing" OR stress OR depression OR emotion OR anxiety OR mood OR satisfaction OR therapeutic OR healing OR restorative

Results = 477

Database: PsycInfo
Thesaurus controlled vocabulary – hospital environment (does not have controlled vocabulary term for facility design)
Limits applied: 1980-2012, English, Human, adulthood

Search 1
DE "Hospital Environment"
Results = 773 (no duplicates)

Search 2
nature OR biophilia OR horticulture OR plant* OR daylight OR garden OR "nature view*" OR landscape OR window* OR "natural light" OR sunlight OR color OR artwork OR painting OR sculpture OR "spatial layout" OR furniture OR "room size"
AND
inpatient* OR "hospitalized patient*" OR "acute care" OR "intensive care unit" OR "psychiatric inpatient*"
AND
"holistic health" OR "mental health" OR "mental healing" OR stress OR depression OR emotion OR anxiety OR mood OR satisfaction OR therapeutic OR healing OR restorative

Results = 572

Database: Web of Science
Limits applied: English, 1980 to present, (human not available)

Search 1
"therapeutic design" OR "healing design" OR "restorative design" OR "therapeutic environment" OR "healing environment" OR "restorative environment"
Results = 415

Search 2
nature OR biophilia OR horticulture OR plant* OR daylight OR garden OR "nature view*" OR landscape OR window* OR "natural light" OR sunlight OR color OR artwork OR painting OR sculpture OR "spatial layout" OR furniture OR "room size"
AND
inpatient* OR "hospitalized patient*" OR "acute care" OR "intensive care unit" OR "psychiatric inpatient*"
AND
"holistic health" OR "mental health" OR "mental healing" OR stress OR depression OR emotion OR anxiety OR mood OR satisfaction OR therapeutic OR healing OR restorative
Limits applied: English, 1980 to present (human not available)
Results = 587

New Search 11-12-12
Database: Avery Index to Architectural Periodicals

Search 1
nature OR biophilia OR horticulture OR plant* OR daylight OR garden OR "nature view*" OR landscape OR window* OR "natural light" OR sunlight OR color OR artwork OR painting OR sculpture OR "spatial layout" OR furniture OR "room size"
AND
inpatient* OR "hospitalized patient*" OR "acute care" OR "intensive care unit" OR "psychiatric inpatient*"
AND
"holistic health" OR "mental health" OR "mental healing" OR stress OR depression OR emotion OR anxiety OR mood OR satisfaction OR therapeutic OR healing OR restorative
Limits applied: Jan 1980-Nov 2012, English
Results = none found

Search 2
"therapeutic design" OR "healing design" OR "restorative design" OR "therapeutic environment" OR "healing environment" OR "restorative environment"
Limits applied: Jan 1980-Nov 2012, English
Results = 7

Database: Google Scholar
Search
“healing environment” AND hospital*
Limits applied: articles, dates 1980-2012
Results = 1290 (-2 duplicates) = 1288

Total number of articles identified from a search of the 6 databases = 5,542
APPENDIX K:
FINISHING MATERIALS LIST
Design Guide: Mental Health Facilities, 2010

**Function:**
Single bed patient rooms comprise 50% of the total bed space of a typical inpatient unit. 20% of the total bed space must be accessible and all of the accessible bed space must be in single occupancy rooms as illustrated in this guide plate. The accessible patient rooms are the same size as the standard patient rooms but the bathrooms are larger.

*Note: Where VA standard items are shown, non-institutional & sustainable options should be considered if feasible.*

**Space Requirement:**
- Patient Room, One Bed, Standard Inboard Toilet Option: 135 NSF [12.6 NSM]
- Bathroom, Patient, Accessible: 65 NSF [6.0 NSM]

**Patient Room Architectural:**
- Floor Finish: Sheet vinyl, linoleum or rubber flooring
- Base: Rubber Base (Upgraded rubber base with molding profile recommended)
- Wall Finish: Impact Resistant Gypsum Board, painted finish
- Ceiling: Acoustic tiles, painted finish
- Ceiling Height: 10’-8” new construction, 9’-0” minimum
- Noise (STC Rating): 40 STC
- Hardware: Refer to Sections 3 and 4 in the Guide.
- Doors: 3’-6” x 7’-0” wood with view panel.
- Windows: Required by code, see PG-18-3, Topic 1, Codes and Standards. Window unit shall have integral blinds for sun control located between layers of glazing. Inside layer shall be laminated glass. If operable, window unit must not open more than 4 inches.
- Vinyl Printed Artwork: Naturalistic or domestic setting
  - Kennon Products, Inc.
  - Sheridan, WY
  - 307-674-6498
  - www.suicideproofing.com

**Electrical:**
- Lighting Levels:
  - Gen. Illumination: Full spectrum lighting
  - Task Illumination: 75 fc at bed
Emerg. Illumination: Provide one emergency light

Night Illumination: Low level lighting for wayfinding to the bathroom. Ceiling mounted night light at entrance of patient bed room, controlled at exterior entrance
Telecommunications: Yes
Medical Gases: Not Applicable
Receptacles: 4 duplex per room and shall be tamper resistant or equipped with ground-fault circuit interrupters (GFCI’s)

**Bathroom**

**Architectural:**
- Floor Finish: 2 x 2 ceramic tile. Shower pan may be ceramic tile or pre-manufactured solid surface basin.
- Base: Rubber Base
- Wall Finish: Epoxy Painted Gypsum Board. Solid Surface panels securely applied in shower areas
- Ceiling: Gypsum Board with Epoxy Paint
- Ceiling Height: 10’-8” (New Construction) 9’-0” minimum
- Noise (STC Rating): 40 STC
- Slab Depression: 3” depression for sloping ceramic tile floor
- Hardware: Based on door option selected
- Doors: Wood door with sloped top set in 3’-0” x 7’-0” frame or other options - See Section 3.
- Windows: None

**Electrical:**
- Lighting Levels:
  - Gen. Illumination: Full spectrum lighting
  - Task Illumination: N/A
  - Night Illumination: Low level lighting for wayfinding. Ceiling mounted night light at entrance of bathroom, controlled at exterior entrance
  - Emerg. Illumination: Provide one source

  Receptacles: 1 GFCI
SYMBOL QUANTITY AI DESCRIPTION
Note: Where VA standard items are shown, noninstitutional & sustainable options should be considered if feasible.
JSN M7012 1 VV
BED, PLATFORM WITH MATTRESS, 1015mm x 2106mm x 457mm (40"w x 83"l x 18"h)
JSN F0210 1 VV
CHAIR, SIDE- NON-TILTING, NO ARMS UPHOLSTERED 812 mm X 482mm X 584mm (32"h x 19"w x 23"d)
NO JSN 1 CC
BUILT IN PATIENT DESK- SOLID SURFACE COUNTER 913mm x609mm x 761mm (36"x 24"d x 30"h)
NO JSN 1 CC
OPEN SHELVING FOR PATIENT CLOTHING STORAGE – SOLID SURFACE COUNTER 1218mm x 457mm x 761mm
JSN F2000 1 W
WASTE CONTAINER - PLASTIC 457 mm x 406mm dia. (18"h x 16" dia.)
JSN F3050 1 CC
WHITE PORCELAIN MARKER BOARD MOUNTED TO WALL WITH SECURE FASTENERS
1 VINYL PRINTED ART WORK

BATHROOM, PATIENT (TLTS2):
JSN P9400 1 CC
TOILET, BACK SPUD PUSH BUTTON FLUSH VALVE, SEAT WITH OPEN FRONT AND CHECK HINGE
JSN A5109 AR CC
GRAB BAR 1-1/4” DIA., SS, WALL, WITH PLATE BETWEEN WALL AND BAR FOR WATER CLOSET
JSN A5200 1 CC SAFETY TOILET TISSUE DISPENSER WITH SOFT SPINDLE
NO JSN 1 CC
VANITY, SOLID SURFACE COUNTER TOP, MOLDED SELF EDGE AND BACKSPLASH; INTEGRAL LAVATORY
JSN A5075 1 W DISPENSER, SOAP, DISPOSABLE
JSN A1085 1 CC
MIRROR, STAINLESS STEEL FRAME WITH PLEXIGLASS, 457mm x 914mm (18”w x36”h)
JSN U5080 1 CC
PAPER TOWEL DISPENSER, SATIN FINISH STAINLESS STEEL, SINGLE-FOLD, RECESSED
JSN U5145 3 CC HOOKS, COLLAPSIBLE STAINLESS STEEL
1 CC PSYCHIATRIC PATIENT SHOWER CONTROLS
1 CC SHOWER: SOAP DISH, RECESSED
JSN A5110 AR CC
GRAB BAR 1-1/4” DIA., SS, WALL, WITH PLATE BETWEEN WALL AND BAR FOR WATER CLOSET
1 CC CURTAIN TRACK, RECESSED
1 CC CURTAIN – SHOWER (BREATHABLE) WITH COLLAPSIBLE HOOKS
JSN F2000 1 W
WASTE CONTAINER, PLASTIC 457mm x 406mm (18” high X 16” dia.)
REFERENCES


Long, D., Hunter, C. L. & van der Geest, S. (2008). When the field is a ward or a clinic: hospital ethnography. *Anthropology and Medicine, 15*(2), 71-78.


Table of all screening tools and rating scales (2010). Retrieved from http://www2.massgeneral.org/schoolpsychiatry/screeningtools_table.asp


