Principles of Healthcare Design:

Florence Nightingale’s Legacy in Tucson’s Desert Sanatorium

by

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of the Requirements for the Degree
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ABSTRACT

Over the past century, the relationship between the built environment and people’s health and well-being has become central to the discussion and critique of healthcare design. The concept of such a relationship is not new; more than a century ago, Florence Nightingale promoted a particular vision for hospital design. Her concerns with naturalism, acoustics, ventilation, and aesthetics in the healthcare environment are as relevant today as they were in the mid-19th century.

This dissertation examines Nightingale’s contributions to the development of the nascent field of healthcare interiors by: identifying major developments of healthcare interiors through the centuries; investigating Nightingale’s life, work, and principles on the healthcare environment; and examining whether certain contemporary hospital design approaches support, expand upon, or negate her principles. The research integrates material culture analysis of extant objects and content analysis of documents within the framework of a case study of two healthcare facilities in Tucson, Arizona.

Findings show that the Nightingale era was seminal in the evolution of the healthcare environment, with key developments towards healthful interiors for the sick. Wide adoption of hospital design guidelines suggested by Nightingale—emphasizing physical elements such as ventilation, natural light, view, sanitization, and ambiance—occurred in various types of healthcare facilities, including military and tuberculosis sanatoria around the world. Additionally, analysis of the case study shows just how welcoming and supportive a 1920s healthcare facility, like the Desert Sanitarium, can be. The facility successfully adapts Florence Nightingale’s principles to the local climate and context, including indigenous pueblo architecture, traditional
Southwestern materials, Native American artifacts, desert views, and even the traditional
courtyard plan used by Spanish colonial settlers. This successful adaptation suggests that
Nightingale’s principles may be valuable to and relevant within different places and
times, even today.

Thus, Nightingale contributed to the emerging field of healthcare interiors by: 1) functionally organizing the built environment affecting patients’ healing, 2) preventing healthcare-associated infection in the physical environment, and 3) supporting psychological health with aesthetic amenities. The findings advance interior design scholarship, education, and practice; and further the documentation and explication of Arizona’s history in the healthcare environment.
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PREFACE

My combined interests in sustainability and the physical environment from my master’s degree led me to pursue doctoral work. The impetus for this particular line of research came from my experiences as a doctoral student and teaching assistant. Taking courses in History, Design and Criticism; having exposure to, by then, a new Master’s program in Healthcare Design; and working closely with the Arizona State University faculty members in these areas of expertise have all shaped my research interest the interrelationship of nursing, history, and healthcare design.

As I began reading the existing literature in healthcare design, I found myself immersed particularly in Florence Nightingale whose biography I had read in my childhood. I knew Nightingale as a pioneer of the nursing profession, yet Nightingale was not limited by the boundaries assumed by her profession. She was not an island; she explored so many other shores as a writer, statistician, reformer, and even hospital planner. This research process led me to adopt a user-centered approach to design, especially linking the historical relevance of Florence Nightingale’s model of care to a more contemporary model of care, embracing a patient-centered care/design approach.

I also had opportunities to present my work at conferences—the International Association of Societies of Design Research Conference in Seoul, South Korea in 2009 and Designing Health Conference at Washington State University in Spokane, Washington in 2010. The audience attending my presentations broadly ranged from design professionals, to nursing practitioners, hospital administrators, students, and scholars. These presentation venues allowed me to have incredible learning and networking experiences as well as to strengthen my research.
Chapter one provides a discussion of the central argument. It reviews literature to support the problem and approach by considering the general body of work on Florence Nightingale’s life and how scholars from various fields evaluate her work. It also considers the historical context of hospital design and the history of representative hospitals in Arizona. It includes reflections on current knowledge and subsequent research opportunities. Then, the study integrates material culture analysis and content analysis. The methods are structured within the historical framework of the in-depth case study. This section also describes specific procedures used in the study including selecting criteria, sources of data, data collection, and analysis methods. Lastly, it provides the purpose of the study and describes its significance as a contributor to interior design scholarship, education, and practice.

Chapter two provides a historically balanced account of Florence Nightingale’s life and work. It also identifies Nightingale’s principles regarding the healthcare environment through her *Notes on Nursing* (1859) and *Notes on Hospitals* (1860) and discusses their linkage with the contemporary healthcare environment. Her principles incorporate a number of recommendations affecting the patient’s physical environment, including the aspects such as ventilation, warmth, natural lighting, views, sanitization (cleanliness), and ambiance.

Chapter three identifies six periods in the historical evolution of the healthcare environment capturing major developments and building typologies through the centuries. These periods include the Ancient, the Medieval, the Renaissance, the Nightingale, the Megahospital, and the Healthscape. It also discusses the design characteristics of a representative healthcare facility within each period and how it relates
to current practice in the healthcare industry.

Chapter four considers the evolution of hospital design of the Desert Sanatorium and the Tucson Medical Center in Arizona from the 1920s to the 1980s in relation to Florence Nightingale’s principles regarding the healthcare environment. These primary documents tell an important story about the history of the hospital interior in Arizona, and the matrix shows a possible way to analyze such photographs, plans, sections, and visits to the extant building.

Chapter five interprets the evidence of Nightingale’s principles in the Desert Sanatorium and Tucson Medical Center. The 1920s structure of the Desert Sanatorium does exemplify Florence Nightingale’s principles while the later modern hospital, the Tucson Medical Center, does not to the same degree. It also establishes the link among current scholarship and Florence Nightingale’s principles, especially as incorporating her principles into the contemporary hospitals. It concludes with Florence Nightingale’s contributions on the nascent field of healthcare interiors, by considering Nightingale’s principles in light of all that we know of healing spaces from as far back as the ancient Greeks and as far forward as current practices at the time of this research.

My plan is to continue my scholarship aspirations from this study. I am interested in exploring the development of cultural influences in healthcare settings, the historical perspective of nurse-centered design, and evolution of nursing-stations. We desperately need fresh minds that can make such links by looking to the past to see what works and bringing the best models forward to integrate them into the future of healing environments.
CHAPTER 1: INTRODUCTION

Statement of the Problem

Health is a state of complete physical, mental, and social wellbeing and not merely the absence of disease or infirmity.¹ Healthcare facilities are physical environments where patients with health conditions seek treatment provided by healthcare professionals. In recent years, a growing body of research has proven that the physical healthcare environment has an impact on the health and wellbeing of patients. Therefore, the role of the physical environment in the holistic healing process is a growing concern among healthcare providers, environmental psychologists, medical professionals, architects, and interior designers.

Yet, discussions about effects of the physical environment for the patients’ healing process, recovery, and wellbeing, and the provisions of healthcare facilities, are not new. 145 years ago, nursing pioneer Florence Nightingale emphasized that the art of nursing is to provide an environment in which patients are in the best position for nature to act upon them. She suggested that patients would recover more quickly if they were cared for in an environment that had ventilation, natural light, cleanliness, and sanitation.

Likewise, early nursing leaders in the United States such as Annie Warburton Goodrich (1903-1973) addressed hospital environments, and the nurses’ responsibility for participating in the planning of hospitals.² Twenty-first century holistic nursing advocate


Martha Rogers (1914-1994) posited that one part in nursing is to design the environment into a place where healing conditions are optimal. Nurse theorist, Dorothy E. Johnson also placed great importance on the environment. Johnson believes that the nurse must manipulate the environment to ensure the stability of the patients, ultimately to result in achievement of health.

Florence Nightingale was one of the first nurses to write about the impact of the built environment on patients. Nightingale not only wrote about the importance of sanitation, infection rates, and ventilation but also considered the interior aspects such as color, noise, and light with the nurse’s presence. Her assertions regarding the impact of the built environment on patients were from her own bedside experiences and observations of patients, their outcomes, and their surroundings.

Mostly Nightingale had been widely recognized as an expert on nursing, hospital administration, epidemiology, statistics, and the education of healthcare providers. Her contribution to development of the nascent field of healthcare interiors has not been explored. This key perspective, often given a cursory reading but rarely considered for its full implications, remains a lost insight waiting to be rediscovered in its relevance for today’s healthcare environment.

**Literature Review**

This literature review considers four distinct topic areas: 1) general body of Florence Nightingale’s own work, and key biographies of Nightingale; 2) historical

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4 Martha Raile Alligood, ed. *Nursing theorists and their work* (Elsevier Health Sciences, 2013).
context for hospital design; and 3) representative hospital histories in Arizona. A fuller examination of contemporary element of physical environment impacting human health and performance is included in the Chapter Five. The literature review is arranged by topics since all of the materials reviewed are interpretive in nature; and as such, this review is qualitative in methodological approach. This literature review summarizes, classifies, and compares scholarship that is most relevant to this study. It also contrasts the perspectives of other disciplines to that of design history when warranted.

The following literature review identifies four types of publications. The first type consists of general surveys of the current state of the scholarship on both Florence Nightingale’s life and work. The second grouping includes the publications that survey major changes in history of hospital design by scholars in various disciplines such as architecture, medicine, and sociology. The third type includes specific in-house publications on hospital history in Arizona. The fourth type is made up of those publications that identify the elements of the physical environment in contemporary healthcare settings. Finally, this chapter concludes with reflections on current knowledge and subsequent research opportunities.

Florence Nightingale’s Life and Work

Soon after the death of Florence Nightingale, her family commissioned Sir Edward Cook to write her biography, The Life of Nightingale, published in 1913.\(^5\) Her family gave Cook access to most of her letters, manuscripts, and notes, but requested for personal reasons that he not include certain intimate details such as her romance with

Richard Monckton Miles. Cook’s biography covered the life of Florence Nightingale as a whole. He portrayed her as a determined, intelligent, masterful, soft-spoken woman who was concerned with the needs of others, even at her own expense—characteristics evident throughout her lifetime. Although he called her “the lady of the lamp” and wrote of her heroic efforts in the Crimea War, Cook also discussed her struggles and conflicts but did not emphasize them. His two-volume biography is better documented than any other. Most other biographies since have been a recapitulation of his.

Five years after Cook’s biography, Lytton Strachey included an abbreviated biography of Nightingale in his *Eminent Victorians* (1918). His portrayal of Florence was much different from Cook’s:

Everyone knows the popular conception of Florence Nightingale. The saintly, self-sacrificing woman, the delicate maiden of high degree who threw aside the pleasures of a life of ease to succor the afflicted, the Lady with the Lamp, gliding through the horrors of the hospital at Scutari, and consecrating with the radiance of her goodness the dying soldiers’ couch—the vision is familiar to all. But the truth was different. The Miss Nightingale of fact was not as facile as fancy painted her. She worked in another fashion, and towards another end; she moved under the stress of an impetus, which finds no place in the popular imagination. A Demon possessed her. Now demons, whatever else they may be, are full of interest. And so it happens that in the real Miss Nightingale, there was more that was interesting than in the legendary one; there was also less that was agreeable.\(^6\)

Most of the public was very upset with Strachey’s portrayal of Florence Nightingale, conflicting as it did with the romanticized version that they had come to believe. Reading her original papers, however, it is easy to identify many of the

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unfortunate attributes about which Strachey wrote. Although Strachey utilized Sir Edward Cook’s biography and some of the same papers that Cook used, the family had not commissioned him and therefore he was able to look at Nightingale’s life more critically than Cook.

Nearly one hundred years after the events of the Crimean War, Cecil Woodham-Smith wrote the second major Nightingale biography. He utilized the chronological events as organized by Cook, but discussed some of Nightingale’s negative relationships, especially the strained relationships Florence had with her mother and sister. Woodham-Smith had access to the Vemey-Nightingale papers, which had not been available to either Cook or Strachey. These papers comprise the domestic correspondence and private papers of Florence’s mother (Frances), her sister Parthenope (Lady Vemey), and other members of the Nightingale family. While Woodham-Smith strengthened his book with the addition of these memoirs, he did not provide the excellent documentation and referencing of Nightingale's letters, manuscripts, and notes that Cook did.

Sue Goldie, commissioned by the International Council of Nurses and supported by the Wellcome Institute for the History of Medicine, compiled, *A Calendar of the Letters of Florence Nightingale* (1983). This project undertook the monumental task of cataloguing Nightingale’s letters chronologically and by context. Goldie also enumerated the Nightingale family tree over many generations. It was a seminal work on the life and writings of Nightingale though it did not include all the existing letters.

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Other books used her letters in an attempt to look into the person called Florence Nightingale. In 1990, Vicinus and Nergaard published *Ever Yours, Florence Nightingale.* It is a collection of some of her letters used to illustrate her life story and emphasizes Nightingale’s private conflicts with her public achievements. In 1991, Baly published *As Miss Nightingale Said,* a collection of excerpts from letters and notes pertaining to the topics of war, social policy, nursing, nursing education, etc.

*Leadership and Management According to Florence Nightingale,* published in 1992 by Beth Ulrich, is a collection of excerpts from letters by Nightingale that Ulrich used to illustrate management principles. Ulrich attributed Nightingale’s success as a manager to her ability to find and enlist the right people, to recall facts and communicate them clearly with great personal force and persistence, as well as her astuteness for determining sources of power and aligning the power of others to her goal, and steadfast belief that she was practically and morally right. The book is not a study, but Ulrich’s impression of Nightingale’s letters and biographical works.

Ulrich (1992) lists some of Nightingale’s leadership strategies as having a willingness to create, desire to improve rather than stagnate, flexibility, and realizing the importance of her influence over others. Nightingale was a firm believer that success required careful observation of events, good communication skills, organization, knowing both sides of a situation before making decisions, and taking responsibility for one’s

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actions, and recognizing stakeholders and understanding their needs in given situations. She felt original data should be gathered and a statistical analysis performed to determine the effectiveness of treatments, prescriptions, and hospitals. Ulrich explains that today we would call this length-of-stay, outcome criteria, and market analysis.

Sue Goldie published *Nightingale: Letters from the Crimea* (1987) containing 100 letters in their entirety, in chronological order, with historical notations. Goldie categorized the letters as: long, detailed reports (official and unofficial) to Sidney Herbert and his successors at the War Office; letters written on nursing matters detailing conditions, asking for recruits and supplies, or describing successes; and letters to family and friends, which were often very emotional. Her book successfully illustrates details of Nightingale’s complex personality.

Hugh Small published *Florence Nightingale Avenging Angel* (1998). Small has documented his theory that Nightingale’s “breakdown” was caused by her post-war acknowledgement that her hospital, Scutari, had a higher death rate than other Crimean War hospitals and that her efforts at cleanliness, ventilation, and improving the soldiers’ diets were ineffective. Small states that it was guilt over the soldiers’ deaths in her hospitals that drove Nightingale to devote herself to reforms in the British Army. He further claims that Nightingale blamed Sidney Herbert and that they acted together to cover up information that would cast them in a bad light so that their reforms in sanitation

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and nursing might continue. This is a radically different look at the relationship between Florence Nightingale and Sidney Herbert.

Rather than full-scale biographies, other works have focused on specific aspects of the life and work of Nightingale, such as her time in Crimea, her life in Egypt and Greece, her relationship with nursing, her use of power, her management and leadership style, and her personality. Although they provide a greater in-depth view of aspects of Nightingale’s life, these works present little or no new information. The sources are Nightingale’s correspondence.

The following discussion investigates what other scholars have noted regarding Nightingale’s work. Nightingale’s theory of nursing care has become the model for today’s nursing practice and has served the profession for one and a half centuries. In the article “Florence Nightingale: Yesterday, today, and tomorrow” (1985), Dennis and Prescott utilized qualitative research data to provide support for Nightingale’s concepts

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13 Ibid.


16 Francis Smith, Florence Nightingale: Reputation and Power (Beckenham, England: Croom Helm, 1982).

17 Ibid.


which are currently utilized in modern nursing practice. These are based on the original thirteen canons found in *Notes on Nursing: What it is and is not*. Muriel Skeet in *Notes on nursing: The science and the art* (1980) made a further effort by adapting the concepts found in *Notes on Nursing* and applying them to current practice standards. This dissertation differs from her book by focusing on Nightingale’s principles on the healthcare environment and their relevancy today’s healthcare environment.

Louise Selanders (1998) in her article, "The power of environmental adaptation: Florence Nightingale’s original theory for nursing practice," terms Nightingale’s theory of nursing as environmental adaptation theory. This theory indicates that the role of the nurse is to alter the internal and external environments in order to maximize the health of patients. Nightingale’s nursing process had four sequential steps in a feedback loop: observation of patient health status, identification of the necessary environmental alteration, implementation of the alteration, and identification of the current state of patient following alteration. Today, just as Nightingale did, nurses repeat this process as frequently as necessary to achieve the goal of improved health for their patients.

In "Florence Nightingale and early origins of evidence-based nursing," Lynn McDonald (2001) analyzes the traits of Nightingale’s theory of nursing and healthcare from the perspectives of twenty-first-century evidence-based nursing. She believes that

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Florence Nightingale is now a much-ignored historical figure. She provides several examples that clearly reflect an evidence-based framework, ranging from Nightingale’s first work after her return from the Crimean War in 1856 to a late attempt to influence social policy, and describes each briefly. She argues that evidence-based nursing, a term that was not in use in Nightingale’s day, is central to her own theory of nursing and healthcare. This text is full of possible theoretical frameworks that could be applied not only to nursing but also to the design disciplines by bridging the aspects of evidence-based theory and Florence Nightingale’s theory.

Eileen Magnello in the chapter titled “The Passionate Statistician” describes Nightingale’s use of statistics to illustrate findings and establish the need for action.24 Nightingale collected and analyzed data about troop strength, sickness, and deaths in India, and collected statistics about hospital conditions in the Crimea and London. Nightingale used statistics to revolutionize nursing, hospital care, and public health conditions at home and abroad, and was the first woman elected a Fellow in the Statistical Society of London, after her return from Scutari. Magnello’s text highlights Nightingale’s role as a statistician.

I. Bernard Cohen reviews Nightingale’s interdisciplinary accomplishments, with particular attention to her development of the use of statistics.25 This article makes specific note of Nightingale’s innovative use of exploded wedge diagrams, often


referred to as pie chart diagrams, to illustrate graphically the meaning of the data she collected. Similarly, in “Florence Nightingale’s Visual Rhetoric in the Rose Diagrams,” Lee Brasseur also examines Nightingale as proponent of the use of statistics and information design. Brasseur analyzes Nightingale’s use of visual and verbal rhetoric in the design and presentation of her rose diagrams. He concludes that Nightingale was able to illustrate the whole picture of disaster from the high mortality rate to the cause of death to the reason for the disaster and its solution. Brasseur’s article further expands Nightingale’s legacy as a statistician as well as a visual rhetorician.

Irene Palmer (1996) divides her text, "Plenary Session: What Florence Nightingale would tell us today," into two distinct sections. The first is a brief biography of Florence Nightingale and a general analysis of her accomplishments on military and medical reform. She recognizes that Nightingale’s opinions in the design and construction of hospitals became a creed for many decades. According to Palmer, from the late 19th and into the 20th century, hospital design followed the Nightingale’s principles. The second (and the most significant) section contains a series of the elements required for designing hospitals. She acknowledges how Nightingale would challenge design professionals to create a healing environment. She relies heavily on case studies, which focus on the healing garden. Yet, her text is valuable for the simple fact that

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Palmer has given credit to Nightingale and made clear the relevancy of her theory as it influences contemporary landscape architecture.

Stephen Verderber’s publication *Innovation in Hospital Architecture* (2009) is perhaps the first fully developed scholarly attempt to uncover how Florence Nightingale’s work contributed to sustainable architecture for health. Verderber begins with a discussion of six aspects of the relationship between the built environment, human health, and sustainability, which he views as a pattern or healing agent for the patient. These six aspects are natural ventilation, natural daylight and view, water and sanitation, landscape, building configuration and site planning, conservation of historic resources, local building materials and self-sufficiency. Verderber discusses various major developments in the history of sustainable architecture for health. Verderber presents information regarding Nightingale’s work, her influence on hospital administration and their architects, and characteristics of a Nightingale hospital with focus on the exterior.

Scholars in various fields offer their reflection on Nightingale and an analysis of her role in their field. Nursing scholars examine the way Nightingale has provided an organizing frame on which nursing’s professional aspirations are constantly recast, the way Nightingale’s agenda for nursing reform still influences the shape of the profession and its priorities in the twenty-first century. Concurrently, the scholarship and literature attest to Nightingale’s concepts as they related to statistics, information design, landscape architecture, and sustainable architecture in the twentieth and twenty-first centuries. Important to consider, however, is that none of the literature examined Nightingale’s contributions to the design of healthcare interiors. This leaves significant areas

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unexamined and a gap in available research. This gap justifies the motivation for this study which is to fully understand Nightingale’s impact on the development of the nascent field of healthcare interiors.

History of Healthcare Environment

Scholarship and literature address the historical evolution of hospital design. Much of the discussion that follows owes its existence to two seminal books, John Thompson and Grace Golden’s *The Hospital: A Social and Architectural History* (1975), and Steven Verderber and David Fine’s *Healthcare Architecture: In an era of radical transformation* (2000). Scholarly information on the historical evolution of healthcare interiors is provided within sections of a limited number of books in architectural history. Because the hospital in the field of interior design history is a relatively new building typology, the evolution of ideas, and a nomenclature for interior architecture in hospitals can be established in the selected literature reviewed here.

The first seminal book about the history of the hospital is John Thompson and Grace Golden’s *The Hospital: A Social and Architectural History* (1975). The focus of the book is on ward design and its evolution in the ancient world, Europe, and United States from the Greek Askleppia to the modern hospitals of the 1960s. Thompson and Golden define the hospital ward as a nursing unit or inpatient unit. An inpatient unit is where patients stay overnight. A nursing unit is an area devoted directly to patient care, and thus different from other areas such as administrative offices, mechanical services, and classrooms. Their discussion about the evolution of ward design includes six periods: the Greek Askleppia to the Roman military hospital, the open monastic hospitals of the Middle Ages, the palace hospitals of Renaissance, the urban hospitals and insane asylums
of the Industrial Revolution, the Nightingale hospitals of the nineteenth and early
twentieth centuries, and finally the large-scale and complex postwar modern hospitals.

Thompson and Golden note in their introduction that their criteria for choosing
hospitals are based on reliable information about them or an opportunity to visit them.
The authors analyze the historical development of each hospital type by using a
framework, which they call “the four elements of ward design”

The design of any nursing unit is composed of four ingredients: the
healthful environment it provides for patients, the amount of privacy it
allows patients, the extent to which it exercises supervision and control
over patients, and the efficiency with which it can be operated.29

Thompson and Golden emphasize that the well-run nursing unit is composed of the four
elements including a healthful environment, privacy, supervision and control, and
efficiency. Similarly, Florence Nightingale in her book, *Notes on Nursing*, set a course
explaining the relationship between the built environment of healthcare settings and the
health and well-being of the users of these spaces. However, Thompson and Golden do
not mention any outpatient facilities built in the 1960s or early 1970s. The time for their
discussion seems to end in 1965.

The second seminal book to address the history of the hospital is Steven
Verderber and David Fine’s *Healthcare Architecture: In an era of radical transformation*
(2000). Verderber and Fine began their study in 1965 where Thompson and Golden left
off.30 The authors chose this date, which is seen as critical in the emergence of


\[30\] Steven Verderber and David J. Fine, *Healthcare Architecture: In an era of radical transformation* (New
postmodernism in architecture. They bring an international perspective to the discussion about the development of hospital design in North America, Europe, and Asia. They discuss the characteristics for each type of healthcare building typology as well as analyze conditions or events influencing healthcare architecture in the late twentieth century.

In contrast to Thompson and Golden, Verderber and Fine identify six periods in the history of the health architecture, capturing key developments over centuries. They label these periods as “six waves of health architecture in history” and identify them as “the Ancient, the Medieval, the Renaissance, the Nightingale, the Modern Megahospital, and the Virtual Healthscape.” They note a certain degree of overlap among these periods. Although Verderber and Fine focus on discussing the timeline from 1965 and expanding the scope of their discussion internationally, their identification of six periods in the history of hospital architecture matches with the timeline of Thompson and Golden’s discussion. Only their nomenclature differs. This study considered the six periods in the history of the hospital design identified by Verderber and Fine.

Of the several studies of the history of hospital architecture including the above two, the customary explanation for changes in hospital design is that their development resulted from advances in medical and scientific knowledge. Lindsay Prior (1988), in “The Architecture of the Hospital: A Study of Spatial Organization and Medical Knowledge,” argues that more attention should be paid to the social context of hospital design. Prior writes, “The acceptance of germ theory found its initial expression in the

siting and design of the operating theater and the laboratory, but from there it moved
outward and into the ward.” Here, Prior emphasizes the design as a passive receiver of
medical innovation. The author claims that all subsequent modifications to hospital
design can be seen as a product of alterations in medical discourse. Much of his argument
is presumably aimed at the two previous studies by Thompson and Golden, and
Verderber and Fine.

The most direct attempt to analyze hospital building as artifacts of medical history
is made by J. T. H. Connor (1990), in “Hospital History in Canada and the United
States.” The author suggests that the use of images of hospitals on the covers of hospital
histories implied that the texts were concerned with architecture although the texts were
not. In this essay, Connor underlines the need for synthetic studies of hospitals in
Canada and United States. This gives another justification for this proposed dissertation.
Later, Connor (1993), in “Bigger than a Bread Box: Medical Buildings as Museum
Artifacts,” illustrates how particular spaces like the operating room, or building types
such as general hospital, asylum, and physician’s office can show significant stages in the
history of medicine. Illustrations of buildings instead of written sources are a
distinguishing subject of this study.

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32 Lindsay Prior, “The Architecture of the Hospital: A Study of Spatial Organization and Medical

33 J. T. H. Connor, “Hospital History in Canada and the United States” *Canadian Bulletin of Medical
History* 7(1990): 93-104.

119-130.
On the other hand, Adrian Forty (1980), in *The modern hospital in England and France: the social and medical use of architecture*, refutes the argument put forward by historians of medicine, namely that advances in medical technology change hospital form. In an effort specifically related to the topic of changes in hospitals, Forty suggests that the eclipse of the pavilion plan resulted from a diminished confidence on the part of the medical profession in hospital buildings as instruments for curing, and towards increasing investment in medical technology. The author also disputes that patients had more influence over hospital design as wealthier patients entered these institutions. The text deals specifically with the problem of why the form of the hospital building had changed over time. The importance of this text as a whole is the number of individuals including architects, doctors, and patients it brings to light, especially underrepresented groups.

An analysis of the texts by John Thompson and Grace Golden’s *The Hospital: A Social and Architectural History* (1975), and Steven Verderber and David Fine’s *Healthcare Architecture: In an era of radical transformation* (2000), reveals that most texts rely on discussing the exterior of building as it has evolved throughout the evolution of hospital architecture. However, the texts must be recognized for their compilation and presentation of archival materials that provide researchers with material for analysis and contextualization. Verderber and Fine’s work offers nomenclatures, timelines, and critical events within the evolution of the healthcare/healing environment. These provide the researcher with a potential framework for this study. Forty’s claim that the “lack of any clear causal relationship between scientific discovery and innovation in building form suggests that more attention should given to the motives of those who controlled hospital
than to the development of science.” His assertion leads this study to include the
influence of various stakeholders such as architects, medical professionals, and patients
in hospital design. What most existing studies lack is a scholarly analysis of the interior
design aspects of healthcare facilities and contributors to or influences upon hospital
design.

*Hospital History in Arizona*

Representative of the history of hospitals in Arizona are the three works that
comprise this section of the literature review. These works show the broad-ranging
dimensions of authorship, intent, layout and format, and so on. These histories are
primarily monographs published by or on behalf of the institution. This section of the
literature review addresses specific points, such as design issues and general historical
and substantive concerns.

The content of these hospital histories displays the range of approaches for this
genre. *History of Tucson Medical Center* (1965), *Heritage: the story of St. Mary’s
Hospital, 1880-1980* (1981), and *From desert to distinction, a history of John C.
Lincoln Hospital* (1981), offer chronological narratives, and they are successful in
providing much necessary information about the origins, activities, and contributions of

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these various healthcare facilities. However, this approach has its limitations that lead to unresolved issues: it discusses neither the local context of a hospital nor architectural messages conveyed by these structures.

Leo Byrne and Alberta Cammack’s discussion of St. Mary’s Hospital prompts the reader to ponder historical narrative that is not fully articulated in the work. After giving histories of the origins of the Sisters of St. Mary’s, and the development of Tucson and its early hospitals, the authors begin their narrative proper. From a modest beginning in 1880, St. Mary’s evolved from a twelve-bed hospital into a major community health center a century later. This transformation is attributed to the hard work and dedication of the men and women in various professional and occupational categories. This one is often punctuated with lengthy lists of physicians’ names and an over-attention to dates. However, the fundamental flaw in this book is to square the underlying philosophy of a religious oriented healthcare institution with secular clinical practices and procedures. For example, the authors state that because this hospital was doing God’s work, the “doors of the hospital would be thrown open to rich and poor alike”, but the readers are informed later that St. Mary’s implemented charges for ward beds and built comfortable private patient rooms with relatively high charges.39

These statements above point up one of the problems of “in-house” publications. The authors merely present historical data and interpretations of those data in a way that can lead to inconsistencies of theme. For instance, the authors of Heritage: the story of St. Mary’s Hospital, 1880-1980 could have used the theme of religious philosophy and

39 Ibid., 78.
action as a key to explaining the essential mission of this particular hospital. *From desert to distinction, a history of John C. Lincoln Hospital* also shows similar strengths and weaknesses.

Most in-house accounts of hospital history in Arizona are usefully illustrated, but the subject matter and the relationship of photographs to general page layout are handled with varied degrees of effectiveness. Carolyn Durbin’s *History of Tucson Medical Center* has numerous photographs, but the majority consists of portraits of physicians or building scenes that are illustrative but not informative. Durbin’s book includes only one photograph of patient life in a ward. Leo Byrne and Alberta Cammack’s *Heritage: the story of St. Mary’s Hospital, 1880-1980* (1981), is illustrated to better effect with photographs showing the many facets of patient and hospital life. These illustrations complement the text of each book since they are primary sources.

However, the small size of photographs relative to the page reduces the impact of these pictorial documents. The overall point of this discussion about illustrations in all these works is that they should be considered as primary documents and they must be selected, interpreted, and presented with appropriate historical understanding. Additionally, all works examined in this literature review include only bibliographies or make no mention of research materials such as primary resources.

There are several publications, including the historical monographs of specific healthcare facilities in Arizona. For example, there is a growing body of literature on the sanatorium for the treatment of tuberculosis in United States.40 However, what is missing

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currently in the existing literature about the history of hospitals in Arizona is analysis focusing on design aspects from which we can ascertain more in-depth understanding of healthcare facilities and the real historical significance of the hospitals as artifacts. There is a tremendous need in Arizona to produce scholarship that examines design, the development of hospitals, and the relationship these healthcare facilities had with concomitant development in public health, and other broader social influences.

In conclusion, analysis of the literature show several significant gaps in scholarly literature to fully understand and interpret the Florence Nightingale’s contributions to development of healthcare interiors. (1) Scholars in various fields including nursing, statistics, information design, landscape architecture, and sustainable architecture offer their reflection on Nightingale and analysis of her role in their field. Yet, none of existing literature examines her role in providing the impact of the built environment on patients. (2) Scholarship on the history of hospital architecture is quite thorough but it does not tell how the interior design aspects of healthcare facilities have evolved. Studies on what are contributors to or influences upon interiors of healthcare environments are few. (3) Literature on possible sources for representing the history of hospitals in Arizona exists, but neither examines design aspects in depth nor the local context of a hospital and architectural/interior development. This study introduces the historical context of Florence Nightingale’s impact upon healthcare interiors. This research explores the topic to identify if there are specific interior design elements contributed by Nightingale to the healthcare environment, and how and to what extent the hospital design in Arizona reflect her recommendations on healthcare design.
Research Questions

Design professionals in the healthcare industry continue to incorporate the insights and foresight of Florence Nightingale in their practice, although her historical tie is seldom recognized or documented. There is clear lack of scholarship regarding the history of hospital interiors and their relationship to Florence Nightingale’s principles. Having identified existing gaps in the scholarship, one primary and four secondary research questions were developed for this study.

- What were Nightingale’s contributions to the development of the nascent field of healthcare interiors in her time?
  - What are the major developments of healthcare interiors through the centuries from 3000 B.C. to present, and how do Nightingale’s innovations factor into this evolution?
  - How did Nightingale’s life experiences influence her work?
  - What are the specific design elements contributed by Nightingale to the healthcare environment?
  - How and to what extent does the hospital design in Arizona reflect the application of Florence Nightingale’s principles?

Methodology

The study’s argument encompassed three questions to examine Florence Nightingale’s contribution on development of the nascent field of healthcare interiors: 1) identification of the major developments of interior design within the healthcare environment through centuries from 3000 B.C. to present, 2) examination of Florence Nightingale’s life, work, and her principles on healthcare environment, and 3)
examination of the chosen Arizona hospitals to determine whether they support, expand upon, or negate Nightingale’s principles.

The first question required the author to analyze the representative furnishings, materials, and spatial organization within the physical setting for human health, and secondly to identify the complex forces that shaped the physical environment of healing facilities. It necessitated a research method that obtains evidence through direct physical analysis and that interprets iconographical evidence. It required a method for interpreting extant physical objects and written documentation in a systematic way. The second question required the researcher to analyze Florence Nightingale’s life experiences and to identify her recommendations on hospital design. It required a method for analyzing comparative content to identify major themes and issues. The last question required the investigator to analyze the interior design components within the chosen hospital, and secondly to seek evidence of its design approaches relevant to Florence Nightingale’s principles. It necessitated a research method that obtains evidence through direct physical analysis and that interprets the evidence. It required a method for interpreting extant physical objects and written documentation in a systematic way.

To address the specific research questions posed and line of argument, and to best articulate observation and elicit meanings, the study integrates material culture analysis and content analysis. The methods are structured with the historical framework of the

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in-depth case study. Material culture analysis developed a description of objects through direct analysis by recording formal qualities, sensory impressions, and emotional associations. Content analysis developed contextual themes through archival data, contributing an understanding of the period’s cultural, social, political, and economic thought. The author applied different methods that were fluid, overlapped, and often occurred simultaneously. Following is the background of the methods and a description of their broad contribution to the study. It is followed by specific procedures including selecting criteria, sources of data, data collection, and analysis methods used in this study.

Background

Material Culture Analysis

The essence of Prown’s method is that objects not only represent and but also reflect human beings’ cultural beliefs, values, attitudes, and practices at a point in time and space. The researcher can understand and interpret the cultural meanings through direct physical analysis. Early material cultural theorists rejected former art historical methods including stylistic analysis and connoisseurship. But Prown utilizes aesthetics and authenticity to obtain the belief system of a culture. He states, “the fundamental values of a society are often unexpressed because they are taken for granted. As a result


they are manifest in style rather than content."^45 Function might be easier to distinguish. Style might reflect the cultural values and attitudes across time, space, and class.

Prown’s method includes three distinct steps of object analysis: description, deduction, and speculation.^46 In the step of “description,” the researcher documents the visible symbolism of an object, describes its form, and documents its biographical evidence and condition. In the step of “deduction,” the researcher records sensory and emotional analysis. In the step of “speculation,” the researcher provides much deeper consideration by means of stylistic and iconographical analysis.\(^47\)

In this study, Prown’s method of material culture analysis helped to construct the research in terms of physical material design and cultural ideas. It also helped to articulate observed evidence derived from direct object analysis and to elicit its meaning. Further, Prown’s process of articulating descriptions assisted in achieving a less ambiguous manner of writing.

*Content Analysis*

The essence of content analysis is interpreting words as manifested symbols of cultural thought.\(^48\) It helps to analyze a phenomenon more deeply through written discourse. Content analysis deliberates words signifying consciousness, perception, and attitudes of people towards mental representation. In addition, words are considered as an

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^48 Ibid., 149.
environmental determinant.\textsuperscript{49} Words represent a people’s socially constructed and invisible semantic environment that is equally as important to their physical environment. Content analysis as a research strategy allows the investigator to analyze words from the perspective of the original author who wrote them, the text itself, and the target audience. Content analysis concerns why a phenomenon occurred and how people experienced that phenomenon emotionally and intellectually. Therefore, understanding a phenomenon might connect with theories of perception that allows the researcher to understand the worldview of designers, observers, and end-users. It also encourages the researcher to reveal one’s own feelings about the phenomenon.

In researching both key developments of healthcare environment, Florence Nightingale’s life and her principles on hospital interiors, the researcher employed content analysis in order to analyze the written discourse of the period, and to analyze subsequent scholarship about the period, and to build understanding and interpret meaning. Also, in analyzing data of the case study, written discourse included archival records of the architects and other designers (i.e. construction drawings, specifications, correspondence), and written documents describing their work in period newspapers, journals, and books. Period photographic collections and their associated dialogue were also reviewed. During the process, the researcher sought out patterns of regular occurrence in words, themes, and concepts in written contents.

The purpose of qualitative content analysis is to provide descriptive data of the phenomenon with detail. In this study, this kind of content analysis allowed the

\textsuperscript{49} Amos Rapoport, \textit{House Form and Culture} (New Jersey: Prentice-Hall, 1969).
researcher to reveal overarching key themes and underlying meanings. In addition to the analysis of written documents, utilizing content analysis also allowed the researcher to consider possible causes outside of object analysis.

**Case Study**

The case study in research uses a strategy with “an empirical inquiry that investigates a phenomenon or setting” in its real life context.\(^{50}\) It captures the complexity of a single case. Robert Stake defined the concept in *the art of case study research* (1995), stating that “as a form of research, case study is defined by interest in individual cases, not by the methods of inquiry used.”\(^{51}\) In a case study, the investigator combines different methods in order to illuminate a case from different angles. Linda Groat and David Wang in *Architectural Research Methods* (2002) explain the relations among methodologies by arguing that case studies combine other research strategies.\(^{52}\)

Triangulation provides a mean of ensuring the validity of case study research. In triangulation, the researcher combines different levels of data collection methods, data sources, strategies, and theories. Additionally, investigators even might be triangulated.\(^{53}\)

In research in practice-oriented fields such as interior design and architecture, the case study takes prominent stance since case studies contribute to the building a professional body of knowledge. It is necessary to pay close attention to the relationship

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\(^{52}\) Ibid.

between a case study and a history. Robin Collingwood pointed out the “first principle of a philosophy of history: that the past which an historian studies is not a dead past, but a past which in some sense is still living in the present.”54 An artifact often serves as primary target of attention in research in the practice-based fields. When a physical artifact becomes a case, there is tendency for gaps to occur between the case and its history. The artifact perhaps becomes a carrier of its history.

Researchers can generalize findings from a single case. Generalization from cases is not statistical but analytical. Bent Flyvbjerg in his article titled *Five misunderstandings about case-study research* (2006) explained that “knowledge that cannot be formally generalized does not mean that it cannot enter into the collective process of knowledge accumulation in a given field or in a society” by using the famous example of, ‘All swans are white.’55 A descriptive case study without generalization could be valuable in the research process.

In this dissertation, the case study methodology helped to develop the in-depth analysis of a single building type with a stronger methodological influence from historical research. It also facilitated a framework to synthesize multiple methods of analysis and diverse forms of evidence. This framework allowed the study to achieve depth through the complex details. Further it supported analyzing multiple types of documents, including reports as well as various media such as artworks, furnishings, finishes, and the building. This allowed multiple voices to be heard. It also encouraged

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reflective consideration of the researcher’s roles in design, data collection, and data selection.

Procedure

The researcher undertook different methods in three phases of discovering knowledge as illustrated in the diagram (figure 1). The first phase required the author to analyze primary and secondary sources that document the evolution of healing healthcare environments, to identify composites of traits evident through time, and dominant characteristics that have been used as interior features within healthcare environments, and to present these traits with examples chronologically. The second phase contextualized Nightingale’s life and career, and appraised her impact on the, then, development of healthcare interiors through primary and secondary sources from her life and work. The third phase required the author to identify a primary site for analysis and to collect primary and secondary sources of archived written discourse and photographs of the facility, then to analyze them by using the documentation instrument.

Phase 1

In order to determine the extent to which various major developments in the history of healthcare interior design existed, texts and images such as photographs and architectural drawings that incorporated information on the history of interior design for health were analyzed. Because the range of topics the researcher included is so wide, the data came from several sources. The researcher has drawn on a number of high quality, detailed studies of the history of medicine and of hospital buildings, and the evolution of the welfare state, to contextualize comments within the continuum of the evolution of
healthcare environments. The researcher has also referred to other substantial studies on
the development of twentieth-century design as required.

Another important source has been journalistic comments from newspapers and
many professional magazines covering nursing and medical matters, and hospital
management besides architecture and design issues. These have had the honesty of ‘short
shelf-life’ data and the quality of library and Internet searches have led to some valuable
unpublished material. The final source has been the author’s own combined personal
experiences as a professional interior designer.

The sources for the illustrations have been equally varied. The author intended not
only to use contemporary photographs but also to include some historical materials for
two reasons. First, historic pictures can include people without compromising concerns
for privacy. Also period pictures often remind us that the aesthetic qualities of healthcare
spaces are not a new phenomenon; old pictures of wards often show good quality
furniture well maintained, pictures and decorative items such as lace and cushions,
flowers and plants, pets such as dogs and birds, and large windows offering peaceful
views.

Books and journal articles were the primary target. The author excluded
unpublished material (e.g., paper presentations and theses) based on their minimal
dissemination. Texts that include a discussion of hospitals and design, but do not treat it
as the main topic, were also excluded in order to keep the scope of the research within the
focus of this researcher.

The criteria for selecting the publications were as follows. First, the study was
limited to covering the era from Ancient to the 20th century. Second, bibliographies from
the literature indicate that key information exists in the discipline of architecture, which is
the apparent root discipline for scholarship regarding healthcare environments, healing
places, and design. This study included these works in order to provide a more complete
historical development. The search expanded to include “hospital architecture” in general
because of the anticipated lack of literature on the subject of healthcare interior design.
Third, it was considered important to have a selection of publications that spanned a
significant amount of time at regular intervals in order to elucidate any changes in the
approach to the retrieval of interior features within the history of hospital architecture.

Once the researcher accumulated a large body of texts and images representing
interior spaces, the next step was to analyze them in order to identify, classify, and
characterize interior features within different healing spaces through time. The study
presented these traits of intrinsic therapeutic interior features for the patient by explaining
key examples chronologically.

Phase 2

In order to contextualize Nightingale’s life and career, and an appraisal of her
impact on the, then, development of healthcare interiors, primary and secondary sources
from Nightingale’s works, as well as secondary biographical sources were selected and
analyzed. The criteria for selecting sources were availability and the value of the
particular information source. Sources were located through the library of Arizona State
University. Inter- Library Loan at Arizona State University and author’s inquiries
supplemented available resources from remote locations including the Royal College of
Nursing, the Florence Nightingale Museum, and the Wellcome Institute. Primary sources
included Nightingale’s original volumes such as Cassandra, Notes on Nursing, and Notes
on Hospitals as well as a selection of personal letters written to and received from her family, military personnel, and government employees.

Secondary biographical sources helped to develop the details of Nightingale’s life, and further delineated the nature of the social, cultural, economic, environmental, political, and spiritual dynamics within which Nightingale lived and worked. The first was a commissioned work completed by Sir Edward Cook in 1913.\textsuperscript{56} It represents an initial effort to reconstruct the life of Nightingale from records and letters available to the author at that time, only three years following Nightingale’s death. Since it remains the earliest definitive work, it is noteworthy for its chronology and completeness, and has been the historical resource for several subsequent volumes.

The second biography has been considered more complete because of Woodham-Smith’s access to correspondence, including the Nightingale family papers that Cook did not have available to him.\textsuperscript{57} The third was Barbara Dossey’s publication which represents the most comprehensive review of Nightingale’s life and times ever attempted.\textsuperscript{58} It was developed through seven years of Dossey’s careful analysis of a wide range of Nightingale archives, letters, and publications; her own travel to key Nightingale sites, in Great Britain and in Turkey, including the Scutari Barracks in Istanbul; and through her research into supportive historical documents that developed Nightingale’s spiritual, economic, political, social, and cultural milieu. Also significant to this book are the


\textsuperscript{58} Barbara Montgomery Dossey, \textit{Florence Nightingale: mystic, visionary, healer} (FA Davis Company, 2009).
hundreds of archival pictures of Nightingale, her family, friends, colleagues, correspondents, and related illustrations and photographs that it includes.

As primary and secondary documents were read, a process evolved further in order to sort and organize data. The author first read the document for content and consistency with other known documents. Life of Florence Nightingale was partitioned into key three chronological sections as revealed from analysis of biographical sources: early life, Crimean war, and productive years.

The Nightingale works used in order to identify Nightingale’s recommendations on hospital design included her 1860 essay entitled, *Notes on Hospitals*. Additional supportive primary Nightingale sources included *Notes on Nursing: What It Is and What It Is Not* and *Notes on Nursing* has been in continuous print since its original date of publication, and is often quoted from and used as a text in current nursing education. Recently, it has been thoroughly revisited in significant volume, “Commemorative Edition” of the work that includes commentary from 13 contemporary nursing leaders.59

A comparative content analysis of the texts was conducted with the intent of identifying major themes and issues. An analysis of Nightingale’s writings resulted in linking her principles with seven aspects of the healthcare environment including ventilation, warming, natural lighting, views, sanitization (cleanliness), furnishings and amenities. Further, her principles in the healthcare environment were translated into ones in contemporary design practice. The researcher used these elements to aid in the construction of frameworks to explore whether the chosen hospital interior design

supports, expands upon, or negates Nightingale’s principles.

Phase 3

In order to examine whether the interior design within a healthcare facility supports, expands upon, or negates Nightingale’s principles required a closer look of at least one institution. The selection of the hospitals was based on the following criteria: (a) the institution represents a major typology within the nomenclature of hospital architecture, (b) the institution has been in operation for an extended time period, and (c) an ample supply of both primary and secondary sources is available for the institution. Tucson Medical Center, which has operated in Arizona from the early twentieth century to present, met these criteria and was selected as the primary case study for analysis.

Primary sources of archived written discourse and photographs for the Tucson Medical Center included construction documents, drawings, building guides, correspondence, contracts, and minutes. Secondary sources of written discourse included newspaper clippings, journal articles featuring its work, and period reference books. The sources collected for and utilized in this study emerged from on-site research at a number of archival collections. These collections are held at: Arizona State University’s Luhrs Reading Room, Arizona State University’s Architecture Library, Arizona Historical Foundation, Tempe and Tucson libraries of the Arizona Historical Society, Phoenix Public Library, and Arizona State Library.

Primary data collection strategies in this phase included the evaluation of written and printed documents related to the construction of the building, and the examination of period photographs and drawings. Secondary data collection strategies included the assessment of period newspaper and journal articles, and review of subsequent historical
structure reports and other interpretive scholarship.

The research design included developing the documentation instrument (figure 2) in order to systematically assess the interior design of the Tucson Medical Center. It looks the forms of a matrix providing a systematic and consistent means of recording pertinent information. The documentation instrument included two major sections including substantial analysis, and analysis of aspects that reflect Nightingale’s principles of healthcare environment. First, the researcher collected significant information by reading, viewing, and placing the information into a category of background (ceiling, floor, walls, door, and window), middle ground (lighting, ceiling finish, wall finish, floor finish, furnishing, equipment), or foreground (plant, artwork, human figures, decorative objects, and functional objects). The researcher revisited the information recorded on the top of the instrument by utilizing seven major elements surrounding healthcare interiors guided by Florence Nightingale encompassing ventilation, warming, light, view, sanitation, furnishings and amenities. The researcher then placed the pertinent information on the bottom half of the instrument in order to confirm the presence of these elements in the Tucson Medical Center.

**Purpose**

The purpose of this study is three-fold. The first objective is to uncover and contextualize the history of hospital interior design reflecting Florence Nightingale’s principles within the design continuum of the 21st century. The second objective is to provide knowledge of the past—reemphasizing interior versus architectural design—for healthcare designers to make informed decisions for the future. The third objective is to
contribute to the documentation and explication of Arizona’s history in the healthcare environment.

**Significance of the Study**

This study makes a significant contribution to interior design scholarship, education, and practice. The vast majority of books on hospital design deal with exterior architecture, but the interior design of hospitals has remained relatively unacknowledged in the literature. Successful hospitals must meet the challenge of integrating efforts made by both architects and interior designers. This focus upon the hospital interior provides counterpoint to many hospital histories that have addressed just the building envelope.

Nursing professionals refer to Florence Nightingale as a model for nursing practice. Nightingale ultimately succeeded in combining perspectives from the physical environment, health, and environmental psychology in her best-known work, *Notes on Nursing* (1859), but this perspective is often overlooked. Much has been written about her influence upon the history of hospital design as a structure, but there are relatively few references to her impact upon the evolution of the hospital interiors. The full range of Florence Nightingale’s influence in the area of hospital interior design should be studied to provide new guidelines applicable today for the design of the healthcare/healing environment.

Nursing has evolved from a calling to a professional career since Nightingale’s publication, *Notes on Nursing* (1859). But nurses still remain the professionals most often at the patient’s side for delivering necessary care. These findings may assist nurses or

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healthcare providers in greater understanding of the historical context of the healthcare/healing environment, and in the influence of the surrounding environment on the patient’s ability to heal.

The healthcare/healing environment is becoming a sub-specialty in interior design, architecture, and facility planning, about which designers need to make educated decisions. This has prompted academic departments across the country to integrate components related to healthcare design into their programs or offer the courses that allow the students to have experience in a growing new specialty. In order for that to happen, part of their education must be knowledge of the past to make intelligent decisions for the future. Yet most histories of healing environments in the field of interior design lack any substantive research. This study considers current issues and critical information related to design history of healthcare environment including how academicians can accurately portray the historical phenomenon in the course and how students can apply this knowledge to contemporary design challenges. Drawing on historical analysis, the inquiry provides insight into the design thinking that led to the development of Florence Nightingale’s guidelines for healthy hospital interiors, assisting to make design concepts intelligible to today’s students, and to design professionals. Thus, an assessment of the Nightingale’s principles in the context of interior design history and theory seems timely and appropriate.

A number of factors make Arizona a good place to examine the application of Nightingale’s principles to hospital design, due to its natural environment. The “five Cs” are considered the historical pillars of the Arizona economy. These include Climate, Citrus, Cotton, Cattle, and Copper. Climate is one of the oldest factors that influenced the
treatment of disease. For example, health-seekers coming to Arizona in the late 1800s and early 1900s, from all over the country, believed that the climate—including desert air, sunshine, and warm temperatures,—helped them recover from illnesses such as tuberculosis, upper respiratory diseases, and arthritis. Promotional literature about Arizona’s sanatoria boasted of location, climate, and facilities. Throughout the nineteenth and twentieth centuries leaders of the medical establishment and community in Arizona lured consumptives to the state with romantic images of Native American Indians living healthily and close to nature. The state of Arizona capitalized on the reported curative powers of hygiene, fresh air, and sunlight as well as traditional indigenous healing practices to entice health seekers to relocate to Arizona. In doing so, Arizona quickly became a mecca for health seekers. Rapid population growth in major cities such as Phoenix has created an increased demand for healthcare services. The state of Arizona holds a strong healthcare position with world-class specialties and general hospitals such as the Mayo Clinic. With exception of the health seekers’ sanatorium boom, the history of healthcare facility with focus in design in Arizona remains underexplored. Arizona is, thus, an important site in which to investigate the application of Nightingale’s principles in hospitals because it has served as a center for healthcare, going back to the days of territorial infirmaries and the sanatorium.


63 Sheila M. Rothman, Living in the shadow of death: Tuberculosis and the social experience of illness in American history (Biltmore: Johns Hopkins University Press, 1995).
This dissertation reveals a number of subjects that need further examination, particularly Florence Nightingale’s recommendations regarding the physical environment in her major publications and their influence on hospital interiors. Chapter Two concentrates on Florence Nightingale’s life and work. It also identifies Nightingale’s principles vis-a-vis the healthcare environment through her writings in *Notes on Nursing* (1859) and *Notes on Hospitals* (1860) and discusses their relevancy to the contemporary healthcare environment.
CHAPTER 2: FLORENCE NIGHTINGALE (1820-1910)

This chapter provides a historically balanced account of Florence Nightingale’s life and work. Her contribution to the then nascent field of healthcare interiors is less well known than are her contributions to the practice of nursing. Florence Nightingale is one of a great many individuals from disparate disciplines who directed their thoughts to the design of hospitals in the mid-nineteenth century. An understanding of her life experiences is crucial in providing a context for her nursing practice, which greatly influenced her innovations in regards to the modern transposition of effective medical and nursing principles into hospital design reform. Consequently, this chapter provides Nightingale’s principles on the healthcare environment through her writings in *Notes on Nursing* (1859) and *Notes on Hospitals* (1860) and discusses their linkage with the contemporary healthcare environment.

**Life of Florence Nightingale**

The opening section includes an in-depth examination of Nightingale’s life and work by highlighting three key aspects. The first, entitled “Early Life,” discusses her privileged childhood, influences and struggles against the social constraints of the Victorian era. The second, “Crimean War,” especially focuses on her pivotal work in military hospitals during the Crimean War (1854-1856). The last, “Productive Years,” addresses Nightingale’s achievements in the areas of medical statistics, nursing, hospital design, and nursing education after the Crimean war.
Early Life

Florence Nightingale (figure 3) was born in Florence, Italy, on May 12, 1820 and named for the city of her birth. The Nightingales were a wealthy family active in politics in pre- and Victorian era England. Her parents, William Edward and Frances Smith Nightingale, provided an upper class standard of living for their children including frequent travel, a classical education, and social prominence. Her father, educated at Cambridge, insisted on tutoring his two daughters himself. As a result, Florence became well-traveled, fluent in several foreign languages, including French, Italian, German, Latin, and Greek, adept at mathematics and statistics, informed in the arts, and well-read in philosophy and history.64 England during this era had a strong class structure with great differences in the expectations of the education, productivity, and social behavior between the rich and the poor. Although reform marked the character of the nineteenth century, it should be remembered that British society was clearly restricted by gender. Socially prominent women were not expected to contribute in any significant fashion to society. Although many could read, educational opportunities were severely restricted for women when compared to their male counterparts.

During Nightingale’s long lifetime, and even at the time of her death in the first decade of the twentieth century, women had not yet achieved many of the rights they enjoy now nearly a century later. Victorian ideology defined

Women’s proper social roles in narrow and restricted ways. Women’s actions had to be consistent with moral sensibility, purity, and maternal affection, and no other code of behavior was acceptable.65


Victorian ideology indicated that women exhibit specific qualities and subordinate all personal interests and activities to the maintenance of the home and family. Educational and career opportunities were restricted. Those endeavors in these areas were believed to distract woman from executing her duties as a mother or wife. During much of the nineteenth century, most women were not allowed to inherit property, go to college, retain wealth of their own, or have any significant legal standing. Women were expected to be passive, conservative, submissive, and obedient to masculine authority. Society viewed competitiveness, aggressiveness, and independence as masculine attributes. Such attributes were considered unattractive when exhibited in a woman.

Furthermore, the definitions of gender roles during the Victorian era depended on social class because of specific ideals of femininity; what was appropriate and attainable for women of the middle to upper classes was different from working class women. Governesses or private schools usually educated British women of the social class Nightingale belonged to and they were “drilled in a complex ritual of decorum.” The subject most appropriately considered within the female sphere of learning activities include dancing, music, deportment, embroidery, painting, and modern language. Little or no effort was made to instruct girls in the classics since their intellects were considered


Nightingale’s parents however, were different in their beliefs and values. Both of Nightingale’s parents came from Unitarian families. Her father was Unitarian, known for rejecting several conventional Christian doctrines, and his skepticism influenced Nightingale to question and examine doctrine. Her father was a supporter of Parliamentary reform and valued education. Through his tutoring and encouragement, Nightingale was able to obtain knowledge and a perspective far surpassing that available to most women of the era. She had a close relationship with her father until his death.

Although Nightingale maintained a close relationship with her mother, Fanny was never supportive of Nightingale’s passion for nursing. Her mother remained more accepting of conventional beliefs and conformed to the Church of England. Fanny was a dedicated hostess and accepting of her role as a woman. She was interested in maintaining social stature and seeing her daughters married well. Nightingale learned reflectiveness and scholarship from her father; the drive and ambition to work she earned from her mother.

The Smiths and Nightingales like many Unitarian families of the 1800s were large and interrelated. Out of her large number of cousins and aunts, Aunt Julie Smith and Aunt Hannah most influenced Nightingale. Julie Smith nursed various members of the family and Nightingale assisted her. Aunt Julie gave Nightingale a model for nursing as a way to channel her intense drive to help humanity. During her youth Nightingale

70 Ibid.


struggled to find a path to her career. She began to care for the family pets and later for ill servants on the family estates. These efforts inspired her early interest in caregiving.

In 1844, at the age of 24, Nightingale chose nursing as her profession. Her family resisted her decision because of nurses’ roles and reputations at that time. Households that could afford a monthly nurse during the Victorian era hired women for childcare.73 The majority of these women were young and unmarried.74 Upper middle-class ladies were unlikely to have taken any active part in the physical care of children within their households. But women employed as residential domestic servants, also called nurses or nurse maids were responsible for feeding, washing, dressing, toilet-training, putting to bed at naptime or at night and directly disciplining the infant and small child. Within the nursery domain, nurses had total power over their charges. But middle-class children treated the nurse as their servants or inferiors.75 In addition to the role of nurses as inferiors, characters such as the drunken Betsy Prig and Sairey Gamp in Charles Dickens’s (1986) *Martin Chuzzlewit* stereotyped nurses’ image in literature.76 Sairey Gamp was hired as a visiting nurse to care for sick family members, but was cruel to her patients by stealing and eating their rations. Before nursing reforms at midcentury, nurses were distrusted and disliked.

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Nightingale’s family reaction towards her decision was understandable because nursing had neither high social standing nor was it a profession organization during that era. Issues of class and status made her choice of hospital work seem particularly inappropriate and unacceptable. In the Victorian era, the indigent were cared for in their own homes; hospitals had earned reputations for filth and immorality. Constant conflict between Nightingale and her family exhausted the entire household. Her obsession led her to overwork herself. In the fall of 1847, Nightingale collapsed after months of inadequate food and sleep. In the hope that Nightingale’s obsession would be forgotten by the excitement of travel, Nightingale’s father agreed to send her to Rome for the winter.

The wealth and high social position of the Nightingale family enabled the maturing Nightingale to travel and to meet a wide variety of people. Charles and Selina Bracebridge arranged the trip to Rome in 1847 and then to Egypt in 1849. Later, Nightingale referred to this couple as “the creators of my life.” The wealthy and childless Bracebridges treated Nightingale’s ambition for hospital work as a legitimate endeavor. The Bracebridges also introduced her to Sidney and Elizabeth Herbert who later became untiring supporters of her hospital and sanitary reforms.

The Sisters of Charity were a popular topic for mid-century Britain because the Oxford movement had revived holy orders for Anglican women. Eventually even dissenting Protestant branches established such women’s institutions, which often operated schools, orphanages, and hospitals. Before Nightingale helped improve the

77 Ibid.
reputation of nursing, the covenant was the only place in Victorian society where women’s hospital training was accepted and encouraged. Nightingale held the Catholic Church in high regard for valuing women’s contributions and for providing them with meaningful work.

Nightingale visited hospitals whenever she traveled. She reported, “I have been doing a course of convents and hospitals.” She viewed facilities with a practiced and professional eye during her tours of hospitals in Rome. Her letters noted the inefficient organization of hospital wards, the dangers of overcrowding, and the lack of ventilation and exercise for patients. In particular, she noted a facility for tubercular children that had no gardens, no place for air or exercise or anything to cure them. At St. Giacomo, one of the Roman Catholic hospitals, a hospital for incurable disease, Nightingale wrote that “the stench [is] dreadful, the locale cold, airless, dark—the nuns perfectly over done, —it seemed a physical impossibility for anyone ever to get well there.” These visits confirmed her belief in the importance of proper drainage, sewage, and general sanitation.

Around the same time in 1849 Nightingale refused a marriage proposal from Richard Monckton Milnes, a popular politician and poet. This refusal of marriage shows Nightingale’s unique strength of character among nineteenth century women in Victorian

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society. She determined to remain single to serve God and humanity as a new kind of nurse, one that was greatly needed.

On her way home from Egypt in 1850, Nightingale spent two weeks at the Kaiserswerth Institution in Dusseldorf, Germany that trained Deaconesses in childcare and nursing. She was able to obtain the training she had sought since 1845 thanks to the arrangement by the Bracebridges. Her visit allowed her to inspect the nursing institution. Yet, the visit was too short to provide extensive training. She was able to fully recover from the cold caught while she worked among the nurses at Kaiserswerth. Although Nightingale’s family believed a trip to Rome would get rid of her interest in pursuing the career of nursing, Nightingale’s work continued to take shape. On her Roman trip, she also met Sidney Herbert who later served as secretary during the Crimean War and became her tireless partner in hospital and sanitation reform. Nightingale’s excursion to Rome and Egypt had distanced her from her family’s tensions and allowed her to expand the knowledge and contacts her calling required. Ironically the trip had the exact opposite effect from what her mother had intended.

Upon her return from Kaiserswerth in 1851, she drafted what she referred to as her ‘religion to the working tailors’—a philosophical discourse privately printed ten years later as the three volumes of *Suggestions for Thought* on searchers after religious truth. She reflected her classical conception of human virtue in some of her theological comments in *Suggestion for Thought*. According to Nightingale, although humans have moral choices to make, God has no such choices and thus has no free will.\(^\text{80}\) Nightingale

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states, “Surely if you were bringing up a child, you would not wish to educate it to make a free choice whether it will be a murderer or not, but to be one to whom murder is impossible.” Her notion of God suggests that good character is founded on knowledge of objective value. She also connects doing what is right with happiness.81

A chapter entitled ‘Cassandra’ included in Suggestions for Thought, which many historians presumed to be autobiographical, remains a key text in nineteenth century women’s history. In this chapter Nightingale argues that “passion, intellect, moral activity—these three have never been satisfied in woman” and describes the frustration of women who “play through life” because serious interests are not encouraged.82 In Cassandra Nightingale speaks out against the social constraints that limit the women of her day to the sphere of the household: “Why have women passion, intellect, moral activity—these three have never been satisfied in a woman.”83 Through her writings, she revealed her inner struggle throughout her adulthood with the idleness of Victorian women and what she desired to accomplish with her life. She also made an impassioned plea for a new type of education: “Women long for education to teach them the laws of the human mind and how to apply them.”84 She made the practical use of her education and consequently her writings in Cassandra continually refer to the purpose of education, and criticize the education available to women in her era. The thoughts expressed in this

81 Ibid.
83 Ibid., 37.
84 Calabria and Macrae, Suggestions for thought by Florence Nightingale: Selections and commentaries, 391.
early writing might be related to her later promotion of nurse training schemes.

Between 1851 and 1854, she visited hospitals throughout the United Kingdom and Europe, collecting information. She systematized her experiences by analyzing and reflecting on hospital reports and government publications on public health. When she visited the newly-built Lariboisière Hospital in Paris in 1853, she was favorably impressed by the wards, based on the pavilion plan. The wards were specifically designed to admit light and fresh air while allowing noxious airs or miasmas to disperse between the long, narrow ward blocks. Her research into the reduced mortality at the Lariboisière later served to confirm the validity of the ‘miasma’ theory.

The miasma theory was based on the belief that disease would occur spontaneously in dirty and enclosed spaces. Since the 1830s, this had been the basis for improvements in public health in the United Kingdom, such as the laying of sewers and the provision of clean water supplies to the cities. Few of the public health or sanitary reformers in this era were doctors or civil engineers. Edwin Chadwick, the chief sanitarian of the day, worked in insurance. Nightingale was deeply influenced by Edwin Chadwick, the main proponent of the British Public Health Act of 1849. In 1858 Louis Pasteur identified germs and proved that disease did not simply arise spontaneously. From that point, medical scientists contested the sanitary reformers’ agenda. However, although the sanitarians’ premises concerning “miasmas” were wrong, it can still be claimed that their conclusions were correct and that their reforms were valid.

In 1853, Nightingale obtained a supervisory position at the Institution of the Care of Sick Gentlewomen in London and worked there for about a year. 85 It allowed her to

begin work in her own field and for the first time she was able to display her skills in nursing and administration. While there, she upgraded the standards of nursing care, insisting that the care should be based on compassion, observation, and knowledge. Additionally, she made changes in the building design to improve efficiency, including a dumbwaiter to carry trays to and from the basement, hot and cold running water on all floors, and a system of patient call lights.

Crimean War

In 1854 Great Britain and France joined the Crimean War on the side of Turkey. The Crimean War, fought primarily between Russia and Turkey over control of the port of Constantinople and the overland route to the Eastern trading areas, lasted for two years, from 1854-1856. During that time, the British Army was based at Scutari in Turkey, which meant that wounded and sick soldiers had to be transported by ship across the Black Sea nearly 300 miles to Scutari. The British surgeons did a good job at treating wounds by amputation and debridement.

Because the Crimean War occurred a century before the first antibiotics were created, doctors had very limited remedies to manage infectious diseases. Records from the transport ships document that 47 of 130 patients died during one 13-day transit from Balaklava to Scutari. The survival rate for the sick and wounded transported to the

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86 Lewis Charles Bernard Seaman, *From Vienna to Versailles* (Routledge, 2002).


Barrack Hospital was only 60 percent.\textsuperscript{89} Of the 21,000 men who died in the Crimean War, 16,000 died of disease rather than combat wounds.

Deaths from disease or malnutrition were not new, but the invention of the telegraph allowed the British public to read about these conditions, as well as the inadequate care and lack of medical resources for the soldiers. On October 12\textsuperscript{th}, 1854 the \textit{Times} presented the following description of Scutari, after dysentery and cholera had become epidemic among wounded soldiers:

Not only are men kept, in some cases, for a week without the hand of a medical man coming near their wounds; not only are they left to expire in agony… but now, when they are placed in the spacious building, where we were led to believe that everything was ready… it is found that the commonest appliances of a workhouse sick-ward are wanting, and that the men must die through the medical staff of the British army having forgotten that old rags are necessary for the dressing of wounds.\textsuperscript{90}

A publication in the \textit{Times} by William Howard Russell confirmed that injured soldiers were kept in brutal and revolting conditions, at greater risk of dying in Scutari Barrack Hospital than on the battlefield. He described the terrible neglect of the wounded and pointed to the differences between the facilities provided for British and French soldiers. He asked:

Are there no devoted women among us, able and willing to go forth to minister to the sick and suffering soldiers of the East in the hospitals of Scutari? Are none of the daughters of England, at this extreme hour of need, ready for such a work of mercy? Must we fall so far below the French in self-sacrifice and devotedness?\textsuperscript{91}

\textsuperscript{89} Fielding Hudson Garrison, \textit{Notes on the history of military medicine} (Washington DC: Department of the Army, 1922).

\textsuperscript{90} Rupert Furneaux, \textit{The first war correspondent: William Howard Russell of the Times...} (Cassell and Company ltd., 1944), 34.

\textsuperscript{91} William Howard Russell, \textit{Russell’s Despatches from the Crimea, 1854-1856} (Hill and Wang, 1855), 25.
After William Russell wrote about the shortage of nurses in Scutari, Nightingale offered her services to the War Office on 14 October, but her friend Sidney Herbert — the Secretary for War — already had written to her, suggesting that she should go out to Crimea. Herbert said that she would have plenary authority over all the nurses and the fullest assistance and co-operation from the medical staff. He also promised “unlimited power of drawing on the government for whatever you think requisite for the success of your mission.”

Nightingale embarked for Crimea on 21 October with thirty-eight nurses: ten Roman Catholic Sisters, eight Anglican Sisters of Mercy, six nurses from St. John’s Institute, and fourteen from various hospitals; Mr. and Mrs. Bracebridge, also went with her. They reached Scutari on 4 November. Nightingale’s official title was ‘Superintendent of the Female Nurses in the Hospitals in the East’; but she came to be known generally as ‘The Lady-in-Chief.’

To understand the significance of Florence Nightingale’s work, one needs to take a closer look at of the conditions of hospitals in the Crimean war. On arrival, Nightingale was faced with 3000-4000 wounded men in a hospital designed to accommodate 1700. There were 4 miles of beds 18 inches apart where the majority of soldiers were lying naked with no sheets or blanket. There were no kitchen or laundry facilities. A lithograph from a drawing by William Simpson, “A Ward in the Hospital at Scutari,” dated April in

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1856 (figure 4), shows the conditions at the hospital of the British Army at Scutari. The drawing illustrates how the men would eat meals on one side of the corridor with beds organized on the other side.

Additionally, hospitals in Scutari served fever patients. As Sarah Terrot, one of Nightingale’s nurses, reported,

One poor fellow neglected by the orderliness because he was dying...was very dirty, covered with wounds, and devoured by lice. I pointed this out to the orderlies, whose only excuse was, ‘It’s not worthwhile to clean him; he’s not long for this world.’ The men in bed on each side of him told me his state was such that lice swarmed from him to them.94

Her reports showed how the wards were extremely crowded. This condition in the ward was ideal for spreading typhus, typhoid, dysentery, and respiratory infection.

In search of a resolution to improve the condition of the wards, Roebuck’s Sanitary Commission composed of physicians and sanitary engineers went abroad to review army hospitals. They reported that sewage pipes drained into the sea with sewer openings above sea level. This caused wind to blow through the pipes and force sewage gases back into the hospital. Nurses even noticed a higher percentage of fatalities in patients whose beds were near toilets. Nightingale also quoted this problem of hospital sewage in her own report entitled Notes on Matters Affecting the Health, Efficiency, and Hospital Administration of the British Army (1858).

Although her interventions seem in hindsight to be acts of common sense, at that time they were considered to be revolutionary. She and her nurses washed and bathed the soldiers, laundered their linens, gave them clean beds to lie in, and fed them, while

working and lobbying to improve the overall hygiene of the wards. She helped establish a rational system for receiving and triaging the injured soldiers. As the wounded soldiers disembarked, they were stripped of their blood-soaked uniforms and their wounds were bathed. To prevent cross-contamination between soldiers, Nightingale insisted that a fresh, clean cloth be used for each soldier, rather than the same cloth for multiple patients. She set up huge boilers to destroy lice and found honest washerwomen who would not steal the linens. She shamed hospital orderlies into removing buckets of human waste, to clean up the raw sewage that polluted the wards, and to unplug latrine pipes. New windows capable of opening were installed to air out the wards. She established a separate kitchen in the Barracks Hospital, which was supported by her own finances, to prepare soups, beef teas, jellies, cereals, and other easily digestible foods to supplement the army’s poor and insufficient rations. The cleanliness of the body, clothing, bedding, water, and food were vital components in Nightingale’s fight to prevent sickness and disease in Scutari hospital.

In response to rampant petty corruption that was siphoning off medical supplies, she established a parallel supply system for critical materials and food, and she proved that the official supplies were being stolen by sending her representatives into the Turkish markets to buy back the purloined goods. When faced with the imminent arrival of hundreds of additional patients, Nightingale organized a team of 200 Turkish workers, at her expense, to replace the floor in the Barracks Hospital, which, having been destroyed by a fire, was an ideal habitat for fleas, flies, and lice. Significantly, she kept meticulous records of everything she saw or did. For these actions, she earned the deep enmity of
army bureaucrats. As a result of Nightingale’s efforts, within a year the mortality rate declined from 578 deaths for every 1000 patients into 17 deaths per 1000 patients.\(^95\)

At the beginning of Nightingale’s arrival to Scutari, she faced struggles with the head of the hospital, Dr. John Hall, who ignored Nightingale and other nurses. Her letter home described Nightingale’s great difficulty in initially convincing doctors at the military hospital:

> The real humiliation, the real hardship of this place is that we have to do with men who are neither gentlemen or men of education nor even men of business, nor men of feeling, whose only object is to keep themselves out of blame.\(^96\)

In spite of her struggles with the head of the hospital, the time that Nightingale spent in Scutari enabled her to prove her point\(^97\) and allowed build her relationship with doctors throughout her long and productive career.

Her experiences working on English fever wards and volunteering as a nurse at the Middlesex Hospital in London during the Cholera outbreak of 1854 had convinced her that the so-called heroic medicine of the day based on infusions of arsenic, mercury, opiates, and bleeding hastened the deaths of many more patients than it saved. Nightingale believed that nursing by keeping patients well-fed, warm, comfortable, and above all clean could solve many problems that nineteenth century medicine could not. She validated this nursing theory by treating soldiers in Scutari. Nightingale was given

\(^{95}\) Philip A. Kalisch and Beatrice J. Kalisch \textit{Advance of American Nursing} (Boston: Lippincott Williams & Wilkins, 1986).


the authority to put her philosophy of nursing into practice, emphasizing that it should be organized, practical, and based on scientific training. Her vision was that nurses would become not the servants of physicians and doctors, but the skilled servants of medicine, surgery and hygiene.  

98 Nightingale set the cornerstone during the Crimean war to work on a comprehensive reform later.

**Productive Years**

Nightingale returned to England in 1856 at the end of the Crimean war. Following her return, Nightingale started her most productive period. The areas she most deeply influenced include statistics, nursing, nursing education, hospital design, and public health. The following section entails her contributions to these five areas.

**Statistics**

Nightingale appreciated the practical use of quantitative methods and embraced the tools of statics that became available in the nineteenth century. With such conviction, she became the first woman to be elected as a Fellow of the Royal Statistical Society.  


In addition to her father’s influence on her training in mathematics, a couple of the leading experts of her time greatly influenced Nightingale to become skillful in the field of statistics. One was a Belgian mathematician, Adolphe Quetelet (1796-1874). He advanced intriguing hypotheses that nature and the physical environment were governed by numerical formulas, and that proper statistical analysis would unmask nature’s
mathematical master plan. Notes in her copy of Quetelet’s book, *Essaie de Physique Sociale* state the following:

All Science of Observations depend upon Statistical methods—without these, are blind empiricism. Make your facts comparable before deducing cause. Incomplete, pell-mell observations arranged so as to support theory; insufficient number of observations; this is what one sees.

Another influence was Dr. Willam Farr whom Nightingale met at a dinner party in the fall of 1856 upon her return from the Crimea. He was a physician and a highly competent government medical statistician, holding several prominent positions, such as a Fellow of the Royal Statistical Society, a member of the British Medical Association, and a member of the British Association for the Advancement of Science. While Farr worked on comparisons between military and civilian death rates, he asked Nightingale for her observations and statistics on Crimean military death rates to extend his view. Farr and Nightingale agreed to share each other’s data. He became her close associate and collaborator for the next 20 years.

Nightingale made a written contribution on the substantial government study, *Report of the Commissioners appointed to Inquire into the Regulation Affecting the Sanitary Conditions of the Army, the Organization of Military Hospital, and the Treatment of the Sick and Wounded; with Evidence and Appendix* in 1858. She wrote her observations and recommendations based on her experiences into a formal and

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confidential report. This report examines the reason for the huge death rate at medical facilities during the first winter of the war in the Crimea and discusses the solution to the problem, considering why the military failed in providing effective medical care for the soldiers. Her solution included in this report will be discussed in the section on hospital design later.

As part of her report to Parliament, Nightingale invented the Coxcomb diagram for mortality (figure 5), one that remains as a model today. These diagrams were the first pie charts. Her coxcombs are a hallmark in which she diagrammed deaths in the Army from wounds and from other disease, comparing them to the deaths that occurred in Scutari during the Crimean War. With the statistical evidence from this diagram, Nightingale was able to prove that the majority of soldiers in the Crimean War died not of war wounds, but rather of preventable conditions such as fever, cholera, and diarrhea. She had the ability to maintain detailed anecdotal notes and records, codify her observations, use statistics, and portray data graphically. Her coxcomb diagram depicts her grasp of descriptive statistics in practice. She was a pioneer in creating visual displays of quantitative information.

After completing her commission report, in Notes on Hospitals Nightingale compiled data from fifteen London hospitals in order to illustrate the mortality of nurses working at the hospital. Nightingale wrote:

Two diseases occasioned nearly 50 percent of the total mortality among the nursing staff as against 16 percent among the London female population. The single fact is quite enough to prove the very great importance of hospital hygiene. We find the total mortality among nurses

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103 Florence Nightingale, Contribution to the sanitary history of the British army during the late war with Russia (London: Harrison and Sons, 1859), 26.
to exceed the total mortality among the female population of the metropolis by about 40 percent.\textsuperscript{104}

Here Nightingale identified, through observant comparison with similar populations in different places, a theory that disease has preventive factors.

Later in \textit{Introductory Notes on Lying-In Institutions},\textsuperscript{105} she examined childbirth mortality statistics and the incidence of puerperal fever by conducting a three-year-study of postpartum women. She corresponded with physicians, nurse administrators, and sanitary engineers throughout the world to gather information in three volumes. She argued for strict separation between birthing mothers and sick patients:

The evidence further shows that, in any new plan, infirmary wards must be kept quite detached from lying-in wards. They should be in another part of the ground and should be provided with their own furniture, bedding, utensils, stores, kitchen and attendants. The same arrangement, at least in principle, should be carried out at all exiting lying-in establishments, and every case of disease should be at once be removed from the lying-in wards to the infirmary and be separately attended there.\textsuperscript{106}

She analyzed data from the Midwifery Department of King’s College Hospital concerning the mortality rate in childbearing women and recommended environmental changes and handwashing to decrease puerperal fever, then the leading cause of maternal death.\textsuperscript{107} Her findings showed that at any time puerperal sepsis was a major threat, mortality “was far lower for women


\textsuperscript{105} Florence Nightingale, \textit{Introductory notes on lying-in institutions} (London: Longmans, 1871).

\textsuperscript{106} Nightingale, \textit{Introductory notes on lying-in institutions}, 392.

\textsuperscript{107} Ibid.
delivering at home.” She utilized statistics to provide evidence that improving sanitary conditions in hospitals would improve survival rates.

Nursing Practice

Prior to Nightingale’s era, the concept of nursing—as we know it today—hardly existed. As care of the sick became separated from the church, hospitals became places that people feared due to their unacceptable conditions. Without the religious orders to engage in patient care, nurses were recruited from the poorest backgrounds and even from prison. The few examples of competent nursing from Nightingale’s time included the limited number of nuns and religious servants whose duty was still to care for the sick. Steadily there was a rise of nursing sisterhoods, particularly that of St. John’s House, which produced skilled and ethical nurses. But there also were opponents of reformed nursing within the hospital. John Flint South, surgeon at the St. Thomas’ Hospital in London in 1856 considered the qualifications of nurses comparable to those of housemaids.

Nevertheless, Nightingale developed the foundations and essentials of the nursing practice, including the need for structure and administration on a large scale, and the need for holistic care of the patient. Her great accomplishment was to establish a theoretical framework for nursing practice where none had existed. Her seminal publication, *Notes*

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on Nursing: What It Is and Is Not (figure 6), published in 1859 with discussion of the theory and practice of nursing, serves as a preface to Notes on Hospitals (figure 7). Notes on Nursing: What It Is, and What It Is Not, a highly regarded text on domestic nursing, aims to offer, “hints for thought to women who have personal charge of the health of others.”

Her intended audience for this publication was for every woman, a nurse in either professional or lay capacity. In response to the potential objections of mothers that they are not doctors and have no medical knowledge, Nightingale urges the readers:

Is all the premature suffering and death necessary? Or did Nature intend mother to always be accompanied by doctors? Or is it better to learn the piano-forte than to learn the laws? Which subserve the preservation of offspring?

Nightingale’s writings in Notes on Nursing suggest she had envisioned an autonomous role for nursing within the division of work devoted to healthcare. She began her writing by differentiating clearly between medicine and nursing. While medicine focuses primarily on the study of conditions and how to treat them, nursing focuses on people and their needs. In Notes on Nursing she prescribed “canons” or “doctrines” that shaped the content of nursing practice and education in her day. These laws did not require the direction or the orders of the doctors to execute. Furthermore, Nightingale

111 Florence Nightingale, Notes on nursing: What it is, and what it is not (Lippincott Williams & Wilkins, 1992), 55.

112 Nightingale, Notes on nursing: What it is, and what it is not, 10.


had the audacity to claim that nursing interventions are probably the most important factor in determining favorable outcomes for the sick individual.\(^{115}\)

Moreover, in making a distinction between nursing and medicine Nightingale warned against the inherent risks to the patient if nurses were not careful to understand their distinctive role as she defined it. Nightingale suggested that there might be:

A real danger of being satisfied with medical diagnosis, or with looking too much at the pathology of the case, without cultivating the resource or intelligence for the thousand and one means of mitigation even where there is no cure.\(^{116}\)

This warning spoke to the necessity of avoiding role confusion, which could happen if nurses identify the sphere of their activities as originating solely from the doctor’s domain.

Nightingale’s *Notes on Nursing* presents the essence of what she envisioned to be the core of the nursing practice. She created an independent discipline with specific functions for nurses that drew on her understanding of the state of sanitary science. Using this as the theoretical underpinning of her plan, Nightingale developed specific principles that she called “laws” to guide nurses. These principles directed nurses in order to promote health and prevent illness primarily by altering the environmental aspects of the patient.

Nursing proper (nursing of the sick) means, besides giving the medicines and stimulants prescribed, or the surgical appliances, the proper use of fresh air (ventilation), light, warmth, cleanliness, quiet, and the proper choosing and giving of diet, all at the least expense of the vital power of


the sick. And so health-at-home nursing (health nursing) means exactly
the same proper use of the same natural elements, with as much life-giving
power as possible to the healthy.117

Nightingale placed enormous emphasis on activities designed to change a
patient’s environment since she believed in the primacy of polluted air and water
as determinants of diseased states.118

Furthermore, she expanded the details for executing each of these
elements in Notes on Nursing. Her how-to-do and what-to-do include advice on
managing the sick in terms of their psychosocial needs. This includes the
following: calming anxiety, conserving energy, preventing excessive
environmental stimuli, observing for signs of mental depression, employing
appropriate communication techniques.119 Nightingale’s observations regarding
patients’ mental health align with modern theories of psychology. She argues that
the mind controls a patient’s physical health. With her own limited experience as
proof, her marginal notations insist that

These things are not fancy. People say the effect is on the mind. It is no
such thing. The effect is on the body, too, little as we know about the way
in which we are affected by form, by color, and light, we do know this,
that they have an actual physical effect.120

Nightingale offers extensive advice on how best to avoid interrupting or startling patients.

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117 Nightingale, Notes on nursing: What it is, and what it is not, 29.

118 J.J. Fitzpatrick and A. L. Whall, Conceptual models of nursing: Analysis and application (Connecticut,
Norwalk: Appleton & Lange, 1996), 324.


120 Nightingale, Notes on Nursing: What it is, and what it is Not, 90.
Nurses should carefully avoid surprising patients who are walking about: “A patient in such a state is not going to the East Indies, if you would wait ten seconds, or walk ten years further, any promenade he could make would be over.” A chapter titled with “Variety” suggests providing patients with music and flowers, bringing infants to visit, or simply positioning the sickbeds near a window.

Her publication Note on Nursing: What It Is and What It Is Not remains her most famous publication. The first printing of 15,000 copies sold out in the first two months. It also was used as a textbook in the Nightingale school where nurses acquired “specialized knowledge in addition to the laws of health for their wider scope of practice.” In 1861, Nightingale revised, expanded, and retitled this version into Notes on Nursing for the Labouring Classes. It has been serving for decades as the standard text for nursing students.

**Nursing Education**

There were no minimal educational requirements for entry into the profession. Nurses during the Victorian era were not allowed to take patient temperatures; that was considered the exclusive right of medical students or a surgeon’s assistant. Some of the physicians at that time were opposed to training nurses and doubted how much the nurses

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121 Nightingale, *Notes on Nursing: What it is, and what it is not*, 72.

122 Nightingale, *Notes on Nursing: What it is, and what it is not*, 83-89.


124 Florence Nightingale, *Notes on nursing for the labouring classes* (Harrison, 59 Pall mall, Bookseller to the Queen, 1861).

could do. John Flint South, surgeon at St. Thomas’s Hospital in London, in 1856 was opposed to reformed nursing in the hospitals and considered nurses needed no more qualification than housemaids.\footnote{Alex Attewell, “Florence Nightingale (1820–1910).” Prospects 28, no. 1 (1998): 151-166.}

Nevertheless, Nightingale was firm in her resolve, which began with her work in the Crimea, to develop nursing as an educated profession. Nightingale established formalized secular nursing education and emphasized the uniqueness of nursing in terms of the knowledge that a base nurse needs to acquire and the nature of its practice.\footnote{M. E. Rogers, “Nightingale’s notes on nursing; Prelude to the 21st century,” in Notes on nursing: What it is, and what it is not (Philadephis: Lippincott Williams & Wilkins, 1992), 59.} Impressed by Nightingale’s efforts, Queen Victoria set up the Nightingale Fund in Florence’s honor. The British public also contributed to the Nightingale Fund.

In 1869, with the help of the fund, Nightingale started the Nightingale Training School in London, which was the first modern school of nursing. She assigned St. Thomas’ Hospital in London as the place for the Nightingale School, and approximately 10 students enrolled. The objective of the Nightingale School was not only to train individual nurses but also to produce nurses capable of training others according to the following guidelines:

The Nightingale nurses were not to undertake private nursing; they were to take posts in hospitals and public institutions and establish a higher standard. One piece of indiscretion, one false step, and the hopes of reforming the nursing profession and elevating its status could be set back by years. The future of nursing depended on how these young women behaved themselves.\footnote{Cecil Woodham-Smith, Florence Nightingale (New York: Athenaeum, 1951), 234.}
Two decades later, in the article entitled ‘Nurses, training of’ for *Quain’s dictionary of medicine* Nightingale developed for the first time the requirements of an ideal nurse training school, which extracted from her experience at the Nightingale School. Nightingale as a “home sister” consolidated the learning from the wards and oversaw the probationers’ moral development. One of the requirements for an ideal nurse training school was the adopting of the home sister, the very first nurse-teacher. Another requirement was the emphasis on acquiring practical skills:

Observation tells how the patient is; reflection tells what is to be done; training tells how it is to be done. Training and experience are, of course, necessary to teach us, too, *how* to observe, *what* to observe; *how* to think, *what* to think.\(^{129}\)

Nightingale considered that the process of ‘learning to learn’ should be continued beyond one’s formal training. Her views on this subject were very up to date: “every five or ten years … really requires a second training nowadays.”\(^{130}\) She added her point about the need to keep improving the practice.

In another article entitled “Nursing the Sick” in *Quain’s dictionary of medicine*, Nightingale wrote about further skills required for the nurses. “The physician also requires the nurse to be able to ‘take’ and to record the temperature,” at every quarter of an hour in critical cases.\(^{131}\) Moreover, nurses had “to prepare the patient for and manage them after operations and anesthetics--and all this with the least call upon their small

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strength.”132 Regarding the requirements for bed-making specifies included different types of cases: fever, accidents, and various kinds of operations; and the ability to undress, handle, and put to bed accident cases.133

Henry Bonham-Carter, Nightingale’s cousin was the secretary of the Nightingale Fund from 1861 to 1914. He helped tremendously in ensuring that the Nightingale School received recognition for its achievement. In 1887, Bonham-Carter could proclaim that the Nightingale School had provided forty-two hospitals with matrons and 520 nurses had completed their training.134 Nurses trained in the Nightingale School migrated to locations all over the world including Australia, Canada, India, Finland, Germany, Sweden and the United States of America and began to establish their own nursing schools.135

Hospital Design

Upon her return, she obtained the fame that “the Barrack Hospital at Scutari was the finest in the world.”136 Nightingale’s 22 months (October 1854-July 1856) at the Barrack Hospital in Scutari became central to her ideas and research on hospital design.

Nightingale documented her experiences in the volume, *Report of the Commissioners appointed to Inquire into the Regulation Affecting the Sanity Conditions*

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133 Quain, Murray, Harold, and Bosanquet, *A Dictionary of Medicine*, 748.


of the Army, the Organization of Military Hospital, and the Treatment of the Sick and Wounded; with Evidence and Appendix not only by providing her opinions about nursing in military hospitals, but also by recommending the “best plan of hospital construction, for fulfilling the requisites of good sanitary conditions and facility of administration, with reasons for preferring any plan or plans to others.”137 Nightingale referred to the use of pavilion plans as an ideal model for military hospital construction and included the design of the hospital, building materials, accommodations for staff, and issues of sanitization and ventilation.

The pavilion plan was the ward plan with which Nightingale’s name became so firmly associated. The pavilion plan was designed as a long narrow block, of limited height, with tall windows interspersed at regular intervals along both sides to allow cross-ventilation, and with space between each window for a single bed. These long ward blocks could be laid out in a variety of ground-plans, the best being regarded as oriented east/west, and placed far enough apart to allow fresh air to circulate between the blocks, vitiated air to escape, and sunlight to shine in.

Nightingale’s involvement in the Royal Commission regarding the ideal model for military hospitals led her to publish Notes on Hospitals in 1860. It investigates civilian hospital designs including floor plans, lighting and ventilation methods, locations, rules for spatial organization and their impact on mortality based on a statistical critique of existing hospitals. Notes on Hospitals discusses various issues such as the importance of

137 Florence Nightingale and others, Report of the Commissioners Appointed to Inquire into the Regulations Affecting the Sanitary Conditions of the Army, the Organization of Military Hospitals, and the Treatment of the Sick and Wounded (London: Eyre and Spottiswood, 1858), 379.
material in the construction and the religious roles in administration. Nightingale’s central proposition in this publication was that good hospital design would save patients’ lives. She believed the pavilion plan would allow maximum efficiency, ventilation, and observation in civilian hospitals just as she insisted on adopting the pavilion plan in military hospitals.

Nightingale’s rationale in hospital design was welcomed by architects. According to the architectural historian Jeremy Taylor, “the underlying pavilion design idea was so clear and well-understood by architects and clients … in large part due to the formidable influence of … Florence Nightingale.”

Anthony King also noted Nightingale’s role in developing the pavilion hospital plan in architectural terms.

Nightingale played a critical role in the broad adoption of the pavilion model in England. The two best examples of hospitals illustrating Nightingale’s concepts were the Herbert Military Hospital, constructed in Woolwich, England between 1859 and 1864 (figure 8), and St. Thomas’s Hospital in London, completed in 1871 (figure 9). Douglas Galton, a chief architect and a sanitary engineer, designed the Herbert Hospital according to the pavilion plan. Nightingale had assisted in the design of the hospital. Nightingale considered Herbert Hospital as “the finest hospital establishment in the United Kingdom.” Similarly, St. Thomas’s Hospital built by architect Henry Currey along the Thames River in 1871 employed Nightingale’s pavilion plans. Both hospitals were

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considered a success within the hospital reform movements.\(^{141}\) Nightingale also subsequently influenced many healthcare buildings such as military and civilian hospitals in the United States by 1860.\(^{142}\)

**Public Health**

Nightingale strove to advocate for many social reforms that improved sanitary conditions for the health of the general public. She was concerned with the care of the sick poor in workhouses and workhouse infirmaries, their quality of life in the homes and in the slums, and the problems of crime that such deplorable conditions created (figure 10). In 1865, she wrote a report for the Parliament entitled “Suggestions on the Subject of Providing, Training, and Organizing Nurses for the Sick Poor in Workhouse Infirmaries” with a detailed three-part plan: to insist on separating the sick, the insane, the incurable, and the children in workhouse schools into four separate divisions separate from each other and from the usual population of paupers; to advocate a single central administration to ensure uniformity and economy in all workhouses; and to support the sick, the insane and incurable through a Medical Relief Fund to be raised through general taxes.\(^{143}\) A proposed bill integrating Nightingale’s ideas led to a formidable push toward change in the treatment of the sick poor.\(^{144}\) Nightingale’s work on health policy issues and their implementation also included the Indian subcontinent, Canada, Australia, and

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\(^{143}\) Cook, *The life of Florence Nightingale*, 133, 139, 143, and 253.

New Zealand. By 1872 she helped to establish standards of hygiene and public health in India by writing *Suggestions in Regard to Sanitary Works Required for the Improvement of India Stations.*

Nightingale submitted her essay entitled *Sick-Nursing and Health-Nursing* for presentation at the 1893 Chicago Exposition in the United States, where 400 years of the philanthropic contributions of women were discussed. It became the capstone of her own nursing and public health promotions as encompassed by her lifetime of insights. She reiterated one of her most recurring premises by making a key distinction between health and sickness. Additionally she established a clear distinction about appropriate approaches to each. Nightingale took a broader position by focusing more on policy and leadership approaches to health.

Nightingale’s health declined after she created the hospital reforms and established the Nightingale School. Yet, she continued to write and provide advice in those areas. In 1907, she received the first Order of Merit in recognition of her contributions to the British nations. She had lived 90 years and 3 months and published over 100 books and documents.

**Nightingale’s Principles in Healthcare Environment**

This section explores Nightingale’s principles regarding the inpatient healthcare environment through her writings in *Notes on Nursing* (1859) and *Notes on Hospitals*

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(1860). Consequently, it discusses the relevancy of Nightingales’ principles, as described in her writing with evidences identified within the contemporary healthcare design. She promoted her own particular vision for hospital interiors. Her principles incorporate a number of recommendations affecting the patient’s physical environment, including the aspects such as ventilation, warming, natural lighting, views, sanitization (cleanliness), and ambiance.

**Ventilation and Warming**

Nightingale’s most important environmental concerns include ventilation, clean air, and clean water. This reflects some chronic problems in Victorian England. Smoke from burning coal as the main source of heat polluted the air in the cities. Additionally, water supplies were contaminated by human waste. Due to the popular belief that night air might invite disease, houses at the time were tightly shut. Nightingale took a common sense approach to sanitation, highlighting the need for ventilation and clean water. Nightingale believed that the ability of a patient to survive and recover from disease improved when a clean environment was available.

Providing adequate ventilation was Nightingale’s top priority for patient care. In the first chapter on ventilation and warming from *Notes on Nursing*, she urges caretakers to provide pure air within and without, to open windows, and to regulate room temperature. She asserts, “The very first canon of nursing… is this: to keep the air the patient breathes as pure as the external air, without chilling him.”¹⁴⁷ She promotes fresh air through open windows and warmth. Since her readers during her era lived in the cool,

¹⁴⁷ Nightingale, *Notes on Nursing: What it is, and what it is not*, 8.
damp climate of Britain, she recognizes warmth as a main aspect for maintaining health. Nightingale also argues against the popular notion that night air was bad for a person by asking, “What air can we breathe at night but night air?”\(^{148}\) She declares that on most nights, an open window does not hurt anyone.

Natural ventilation by open windows and open fire-places, was the only efficient means for procuring—fresh air and warmth in the Victorian era. According to *Notes on Hospitals*, the ward ceiling should be at least fifteen to sixteen feet high, and the distance between the opposite windows not more than thirty feet in order to obtain fresh air.\(^{149}\) Regarding the height of wards, she proposes that a ward of thirty beds can be well ventilated with a height of about fifteen or sixteen feet, providing the windows reach to within one foot of the ceiling. “Good ventilation consists in emptying the hospital of foul air as speedily as possible.”\(^{150}\) Arranging the beds along the interior walls deprives the patients of the amount of light and air necessary to their recovery. Having more than two rows of beds between the windows makes the width of the wards, ranging from twelve to nearly twenty feet, wider than they should be between the opposite windows for thorough ventilation.

The most efficient number of beds in a ward, both in terms of surveillance and the cost of construction, is from 20 to 32.\(^{151}\) Wards housing fewer than 20 beds increase caregiver attendance in proportion to the number of patients. Ward housing of more than 32 beds, on the

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\(^{148}\) Nightingale, *Notes on Nursing: What it is, and what it is not*, 19.

\(^{149}\) Nightingale, *Notes on Hospitals*, 35.

\(^{150}\) Nightingale, *Notes on Hospitals*, 36.

\(^{151}\) Nightingale, *Notes on Hospitals*, 62.
other hand, is undesirable, because it is more difficult to ventilate, requiring a greater ceiling height, and is thus more costly in construction.

Regarding clearances around space and area to the bed, there should be space sufficient on each side of adjacent beds to ensure airflow among the beds. In addition to the space between the beds, there should be room for free movement of three or four persons allowing the use of a night-chair, without annoying the next patient, and use of a portable bath when required. The distance from foot to foot of opposite beds should be sufficient to allow space for a movable dresser or table, benches on either side, and easy passageway. The adjacent area per bed should be not less than 100 square feet.152

Every ward must have a direct connection with the external air by means of a sufficient number of windows on its opposite sides. And every ward must have its own ventilation distinct and separate from that of every other ward. Having a windowless wall on one side or covering one of the sides by a corridor caused interference with the natural ventilation of the wards, so it should be avoided.153 There must be no air except what comes directly from windows or ventilation openings from the outer atmosphere, and no other warming apparatus than the open fireplace. She argues air that is heated by metal surfaces is especially to be avoided—but does not explain why. Nightingale also expresses concern about “effluvia” or foul odors which came from excrement.154 Raw sewage found near patients and

152 Nightingale, Notes on Hospitals, 66.
153 Nightingale, Notes on Hospitals, 43.
154 Nightingale, Notes on Hospitals, 25.
ditches contaminating drinking water near the hospital were the causes of the noxious air. She urges “fumigation” to remove the offensive smell.

Moreover, Nightingale emphasizes the importance of the room temperature. Patients should not be too cold or warm in the ward. Taking an appropriate balance between burning fires and ventilation via windows is a way to control the temperature of the ward.

**Light**

In the chapter on light from *Notes on Nursing*, Nightingale claims that providing a room with light and windows is essential to both the health and recovery of patients. Nightingale insists windows must not be tightly sealed, and she does not approve of any window coverings except light, thin, washable curtains so sunlight can enter a room. Later, in *Notes on Hospitals*, Nightingale again asserts the importance of natural light for patient’s recovery in the wards:

Second only to fresh air, however, I should be inclined to rank light in importance for the sick. Direct Sunlight, not only daylight, is necessary for speedy recovery, except, perhaps, in certain ophthalmic and a small number of other cases. Instances could be given, almost endless, where, in dark wards or in wards with a northern aspect, even when thoroughly warmed, or in wards with borrowed light even when thoroughly ventilated, the sick could not by any means be made speedily to recover.\(^\text{155}\)

Although acknowledging a lack of scientific information, Nightingale explains the positive effects of light on promoting recovery by referring to the writings of the medical professionals such as Sir Andrew Wylie, Dr. Milne-Edwards, and Mr. Ward. She notes that people need natural light whether they are in a bedroom at home or in a patient room at the hospital. However, the importance of light had been lost sight of in English architecture during the early

\(^{155}\) Nightingale, *Notes on Nursing: What it is, and what it is not*, 19.
Victorian era due to a window-tax that resulted in a far smaller proportion of light via windows than in French houses.\textsuperscript{156} For the same purpose of ensuring a sufficiency of light, the wall should always be a light color, except perhaps for some few cases of ophthalmia (eye disorders).

Additionally, Nightingale specified that at least one window should be allotted for every two beds; the window should not be less than 4 feet 8 inches wide, the sill should be within 2 or 3 feet of the floor (so that the patient can see out), and the window should extend up to within a foot of the ceiling.\textsuperscript{157} The pair of beds should have the width of the window between them on one side and in the wall space between the windows the beds should be not less than 3 feet apart. Windows are to be placed opposite each other, and to be either double hung or filled with plate glass; the former would be preferable, because of affording the opportunity of indirect ventilation in all weather.

For the window-treatments, Nightingale recommends window-blinds to moderate the light in the ward.\textsuperscript{158} The axis of a ward should be north and south if possible; the windows should be on both sides, so that the sun might shine in at one side or the other. The window-space should be one-third of the wall-space. Nightingale explained that “while we can generate warmth, we cannot generate daylight, or the purifying and curative effect of the sun’s rays.”\textsuperscript{159} Heat loss might be reduced by plate or double glass.

\textsuperscript{156} Nightingale, \textit{Notes on Nursing: What it is, and what it is not}, 68.

\textsuperscript{157} Nightingale, \textit{Notes on Hospitals}, 19.

\textsuperscript{158} Ibid.

\textsuperscript{159} Nightingale, \textit{Notes on Hospitals}, 20.
In the chapter on light from *Notes on Nursing*, Nightingale claims that providing a room with a view is essential to both the health and recovery of patients. She writes:

I have seen, in fevers the most acute suffering produced from the patient (in a hut) not being able to see out of a window, and the knots in the wood being the only view. I shall never forget the rapture of fever patients experienced over a bunch of bright colored flowers. I remember (in my own case) a nosegay of wild flowers being sent me, and from the moment recovery becoming more rapid.160

She emphasizes, via her own experience, the importance of visual stimulus, such as flowers. For optimal visual interest, patients should be able to see out of a window from their beds.

Moreover, Nightingale states in *Notes on Hospitals*:

Among kindred effects of light I may mention, from experience, as quite perceptible in promoting recovery, the being able to see out of a window, instead of looking against dead wall; the bright colors of flowers; the being able to read in bed by the light of a window close to the bed-head. It is generally said that the effect is upon the mind.161

Although she does not specify the content of these views, her mention of ‘bright colors of flowers’ implies the natural landscape or vegetation for views through the window, or flowers in nearby vase.

Sanitation

In the chapter on cleanliness of rooms and walls from *Notes on Nursing*, Nightingale suggests maintaining a clean room with walls, carpets, and furniture that are dust-free, and using correct dusting techniques with usage of a damp-cloth, not a feather

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160 Nightingale, *Notes on Nursing: What it is, and what it is not*, 84.

duster. She points out the even the best ventilation cannot refresh the ward without cleaning first. She also advises eliminating odors from painted and papered rooms. For the floor finish, a carpet is the worst expedient due to the possibility of infection from the dirty carpet.

Nightingale also ranks wall materials such as papered, plastered, and oil-painted walls. According to Nightingale’s rankings, the worst option is the papered wall; the next worst is plaster. Plastered walls can be improved with frequent lime-washing. A glazed paper gets rid of a good deal of the danger because it can be cleaned more easily.

Nightingale further discusses the defects in the use of materials for floors, walls, and ceiling in Notes on Hospitals. Regarding using absorbent materials for floors, walls, and ceilings, she explains the following:

The amount of organic matter given off by respiration and in other ways from the sick is such that the floors, walls, and ceilings of hospital wards—if not of impervious materials—become dangerous absorbents.

Nightingale advises against absorbent materials for floors, walls, and ceilings in hospitals because they could become saturated with organic pollutants over time. These pollutants, in addition to other, accidental spills, especially in combination with improper cleaning, can lead to noxious odors.

Common plaster was the material most usually employed for ward walls and ceilings during the Victorian Era. When the surface is recently finished, plaster actually tends to purify

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162 Nightingale, Notes on Nursing: What it is, and what it is not, 125.

163 Nightingale, Notes on Nursing: What it is, and what it is not, 126.

164 Nightingale, Notes on Hospitals, 44.
the air of a sick ward. But after a time it can become contaminated. When ward walls and ceilings are dirtied in this way, hospital diseases are more apt to spread in wards. To prevent the invasion of disease in the wards, Nightingale suggests the remedy of frequent lime-washing with periodical scraping, and advises that the wards should be evacuated during the cleaning and drying.165

In *Notes on Hospitals* Nightingale addresses the fact that one of the most difficult points in ward construction is to find good materials for walls and ceilings. Nightingale recommends that an impervious material capable of a white or tinted polished surface would make the best wall finish for a hospital ward. Parisian cement was the nearest approach to a good material for this purpose at the time. Yet, the polish was rather costly and the manufacture had not reached a point of perfection for retaining a uniform texture, color, and polish. According to Nightingale, all the woodwork should be painted and varnished. The best material to be polished or varnished, she suggests, is wainscot oak because it is the cleanest, most durable, and most “satisfactory” in use.

Nightingale recommends oak wood, pine wood, or tiles as the material for floors in the ward.166 Out of these, the best is oak wood because of its resistance to water absorption. Additionally, its water resistance could be increased by sealing the floor with beeswax and turpentine. The joints of the flooring, Nightingale continued, should be tightly fitted and sealed with any non-absorptive material.167 While Nightingale states that waterproof, non-

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166 Nightingale, *Notes on Hospitals*, 69.

167 Nightingale, *Notes on Hospitals*, 70.
absorbent cement or similar materials should be used, she also recommends providing each patient with a pair of slippers and a small bedside rug for comfort. Tile or cement flooring is better suited for a warm climate than for a cold one. The stairs and landings should ideally be made of stone. The corridors should be floored with diamond-shaped flags or tiles, which hold up to wear better than the more common varieties. The outside terrace might be either covered with asphalt or glazed tile so that recovering patients can walk or be wheeled out in the corridors and stay dry.

Ambiance

Nightingale believes that variety in the physical environment is a critical aspect affecting the recovery of the patient. In the chapter on variety, she writes:

To any but an old nurse, or an old patient, the degree would be quite inconceivable to which the nerves of the sick suffer from seeing the same walls, the same ceiling, the same surroundings during a long confinement to one or two rooms.169

In this quote, she illustrates the boredom of the sick during their stay in the hospital. She emphasizes the need for variety of form and color, such as bringing brightly colored flowers or growing plants into the ward. She suggests the rotation of ten or twelve paintings and engravings each day, week, or month to provide greater visual variety to the patient.170

Nightingale states:

People say the effect is only to the mind. It is no such thing. The effect is on the body, too. Little as we know about the way in which we are affected by form, by color, and light, we do know this, that they have an actual physical effect.171

168 Nightingale, Notes on Hospitals, 71.

169 Nightingale, Notes on Nursing: What it is, and what it is not, 83.

170 Nightingale, Notes on Nursing: What it is, and what it is not, 84.

171 Nightingale, Notes on Nursing: What it is, and what it is not, 59.
Her observations led her to believe in the interaction between mind and body.

In the chapter on beds and bedding from *Notes on Nursing*, Nightingale recommends an iron bedstead with a thin three and a half foot wide mattress made of animal hair\textsuperscript{172} as opposed to a wooden trough shaped bedstead containing loose straw of the Medieval and Renaissance eras. She asserts that the patient bed should be located at the lightest spot in the ward. She also argues against the traditional four-post bed with curtains.

Additionally, in *Notes on Hospitals*, Nightingale explains how interiors in the ward help create user comfort: “Just in proportion to the discrepancy between the spacious, cheerful ward and its shabby dirty looking furnishing, is the air of general discomfort.”\textsuperscript{173} To provide a patient privacy, a low, moveable screen that reaches the height of the patient’s head when the patient sits up in bed is recommended. Again, curtains at the beds are not necessary because they interrupt ventilation and entail additional costs in washing.

Hospital bedsteads should always be made of iron, Nightingale suggested, and painted a light, cheerful color because this small detail costs little and has a more significant impact on the general appearance and comfort of a hospital ward than most people are aware of.\textsuperscript{174} A head shelf near the bed is also useful. Although straw has the advantage of being easily renewed, it is not desirable for mattress materials. Animal hair was then the only material yet discovered that she regarded as fit for mattresses.

\textsuperscript{172} Nightingale, *Notes on Nursing: What it is, and what it is not*, 115.

\textsuperscript{173} Nightingale, *Notes on Hospitals*, 81.
For the rest of the furniture in the ward, Nightingale recommends oak. Additionally, she suggests several pieces of furniture around the patient bed: there should be a light chair for each bed, two or three spare arm chairs for patients who get up for the first time to sit at the ward fire; there should be a small open bedside-table for each bed; and two or more tables or moveable dressers down the center of the ward.

**Conclusion**

Nightingale is one of the best well-known Victorian figures. She was well known in her era, and her reputation has continued in subsequent generations. This chapter has summarized the landmark events in Nightingale’s career. When she entered public life during the mid-nineteenth century, few women were public figures. Nightingale was highly educated and went on an extensive trip abroad because of her privileged background. She wanted to pursue a different pathway than becoming the wife of an aristocrat.

Florence Nightingale’s significance goes beyond the field of nursing. In her mission of organizing care for the sick at the military hospital in Scutari, Turkey, Nightingale confronted major issues rooted in Victorian society. First, she worked with secular female nurses from the working class who did not have much experience in caring for the sick. Within the two-year-period of the Crimean War, Nightingale shaped efficient nursing practices by directing the training of other nurses. Nightingale initially had another great struggle in convincing military leadership and the government due to the Victorian convention in prohibiting women’s authority in the public sphere. Her success with hospital reform and establishment of the nursing service led physicians to accept her contributions after the Crimean War had

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175 Nightingale, *Notes on Hospitals*, 79.
concluded. Her writing style reiterating certain points each time, perhaps was an effective strategy in meeting the accusations against her and succeeding in furthering reform. Additionally, Nightingale was able to manage political straits well and had many productive years as a nurse, in part because of receiving assistance from her life-long-collaborators such as Sydney Herbert.

Findings reveal that many of the changes Nightingale made at the hospital during the Crimean War became the foundation for what she documented in her seminal publications. In fact, Nightingale’s 145-year-old dictum still stands: “The very first requirement in a hospital is that it should do the sick no harm.” Florence Nightingale was one of the very first nurse scholars who documented the impact of the built environment on patients. All of her assertions in Notes on Nursing and Notes on Hospitals were based on her bedside observations of patients and their surroundings.

Nightingale’s principles place the patient in the center of the healthcare environment. She discusses key aspects of the physical setting, including ventilation, warmth, natural lighting, views, sanitization (cleanliness), and ambiance. The table shown in figure 11 lists Nightingale’s canons as outlined in her seminal publications, her key principles for creating a beneficial patient environment, and how those principles translate into contemporary design practice. This table shows clearly how Nightingale’s principles continued to be useful in the design of today’s healthcare facilities. Nevertheless, there is still room for scholars to expand upon this research.

Chapter Three identifies six periods in the historical evolution of the healthcare

176 Nightingale, Notes on Hospitals, iii.
environment capturing major developments through centuries. These periods include the Ancient, the Medieval, the Renaissance, the Nightingale, the Megahospital, and the Healthscape. It also discusses the design characteristics of a representative healthcare facility within each period and their linkage to current practice in the healthcare industry.
CHAPTER 3: HISTORICAL EVOLUTION OF HEALTHCARE ENVIRONMENT

This chapter examines the various dimensions of the physical environment that contributed to patients’ healing as these dimensions evolved through the centuries. The organization of this chapter reflects a chronological emphasis. It identifies six periods in the history of the healthcare environment that capture major developments. These periods include the Ancient, the Medieval, the Renaissance, the Nightingale, the Megahospital, and the Healthscape. Within each period, there is a discussion of the design characteristics of prototypical hospitals. It also discusses how each period relates to current practices in today’s healthcare industry.

Ancient

At the beginning of this era, gods were thought to be responsible for many illnesses. The treatments often involved a mystical element. Therefore, the medical facilities in the Ancient era were largely grounded in temples. The first evidence of something resembling a hospital may be found as early as 1200 B.C., when patients were cared for in Greek temples. By 400 B.C., the time of Hippocrates, the temples of Asclepius appeared. Patients came to the temples of the god to sleep overnight and receive a visitation from Asclepius in a dream. Sometimes immediately, sometime after the dream had been interpreted by a religious official, the patient might be cured of paralysis, blindness, suppurations, and the like.177

The major shrines of Asclepius in Epidaurus and Cos displayed magnificent temple complexes (figure 12). The sick, after purification in the spring and a visit to the

temple, would retire to the small incubation rooms. The shrine had a library, a theater, and long portico where visitors could walk and talk. It was connected to Pergamum itself by a mile-long colonnaded street. The treatment building had a circular terrace and circular interior hallways with windows allowing southern exposure. There were six round bath basins upstairs and a combination of large tubs with arrangements to draw up water downstairs.\textsuperscript{178}

The dimension of the rooms for patients in the temples of Asclepius were 24 feet deep by 108 and 96 feet long and completely enclosed on three sides and opened to the south with a row of pillars—the typical form of a Greek stoa (portico)—oriented to the Sun (figure 13). A row of columns, the portico permitted patients to see the temple and the surroundings from their beds. The portico also afforded patients experience with natural ventilation and daylight. This southern orientation of the long open hall allowed maximum daylight to transmit into the interior of the rooms. In this sense, the hall of the Asclepius’s significance rests on locating elements of the physical environment, including view, ventilation and natural light as central components of the care setting.

Another exemplary healthcare facility in the Ancient era was the valetudinarium, the first military hospital (figure 14). Following the fall of Greece, the Romans made significant contributions to medicine by focusing on public health advancements such as advanced sanitary systems, the construction of a network of massive aqueducts, the invention of indoor plumbing, and the invention of the valetudinarium. Valetudinariums were designed to restore and return soldiers to battle. The earliest valetudinariums were

\textsuperscript{178} Ekrem Akurgal, \textit{Ancient Civilizations and Ruins of Turkey}, (Istanbul: Kegan Paul, 2002), 108-09.
constructed of wood but these were later replaced by durable stone structures in order to afford more fire-resistance and better protection against the cold winter as the valetudinaria was adopted throughout central Europe.  

The most characteristic feature of the Roman military hospital was a symmetrical and quadrangular plan (figure 14). The wards were arranged on either side of a main circulation corridor which extended continuously through all four sides of the building. The four corridors yielded an open-air courtyard at the center. The patient rooms were deployed along double-loaded corridors with clerestories that ran down the center of the corridor.  

These clerestories on the raised section of roof allowed the warm air to pass upward and out through the window openings placed at specific intervals along the interconnected hallways (figure 15). These openings could draw musty air out from the inpatient rooms, thus improving ventilation and air quality.

The valetudinaria provided 60 inpatient rooms with the dimension of 11 by 15 feet, in which no more than 3 beds could fit. Another noticeable feature of the valetudinaria was the arrangement of pairing the small ward with a vestibule (figure 14). The patient rooms were accessible directly, not from the corridor, but rather from a vestibule between every two patient rooms. The vestibule had doors on all four walls: to the corridor, to the rooms on either side, and to a little room behind. Entering the patient room through the vestibule led to a decrease in the amount of dust and noise from the corridor. It also provided privacy for the patients. The function of the vestibule has been

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the subject of conjecture. According to Dieter Jetter, it was used as a nursing station by personnel.\textsuperscript{181} Webster identified it either as a latrine or a storeroom for personal belongings.\textsuperscript{182} Each patient room provided a small square window of its own as a source of some light and natural ventilation.

Ancient Greek temples had more in common with a spa or wellness center than an inpatient care unit by contemporary standards. Wellness centers are facilities combining medical and fitness elements into a comprehensive healthcare center.\textsuperscript{183} Asclepia provided patients with both nursing and wellness care, consisting of bed rest, medication, bathing, and exercises. The Greeks recognized the importance of healing therapies in harnessing the powers of medicinal springs. Although medical theories behind such treatment were based on the belief in supernatural gods, using elements of the physical environment—including views, ventilation and natural light—as a central element of inpatient nursing was not different from how a contemporary wellness center would make accommodations.

Inpatient rooms in the Roman valetudinarium also merit some attention in this regard. The arrangements, including clerestories in the corridor for natural ventilation, windows in each room for lighting, and a vestibule at the entry to each room for noise control and privacy, helped provide patients with their healing. In some ways, the inpatient room from the Roman military hospital can be seen as a very loose model for

\textsuperscript{181} Dieter Jetter, \textit{Geschichte Des Hospital I} (Wiesbaden: Franz Steiner Verlag, 1996), 45.

\textsuperscript{182} Graham Webster, \textit{The Roman Imperial Army of the First and Second Centuries A.D.} (London: Adam and Chas. Black, 1969), 73.

\textsuperscript{183} Joan Whaley Gallup, \textit{Wellness centers: a guide for the design professional.} Vol. 7. (John Wiley & Sons, 1999), 68.
today’s inpatient room, in terms of organization, architectural plan and the physical environment as a way to meet patient needs.

**Medieval (A.D. 500-1500)**

In the second major era, the Medieval, hospitals were sacred places; they were not secular institutions in the modern sense. Hospital statutes from throughout medieval Europe gave priority to the spiritual, rather than secular, well-being of the sick and to sacramental care over medical treatment. Thus, local communities of religious men or women served hospitals as a staff.\(^{184}\) Concerns in these hospitals were not medicinal regiment but a commemorative Mass and proper burial for patients. Most hospitals were considered as a place to die rather than as a source for a cure. These ecclesiastic institutions emerged adjacent to towns and along primary routes of travel as housing to shelter pilgrims, to care for the sick and the poor, and to segregate the lepers from communities. Often they were erected beside churches to shelter the sick.

Throughout Europe the open ward remained the prevalent type of design from the middle ages until the eighteenth century. The large open wards featured an altar and a chapel at the end or in the middle. Patrons were housed in open cross-shaped wards that enabled them to observe daily religious rituals from their beds. The plan (figure 16) indicates how an open ward could be designed. Johannes Beerblock’s painting “View of the Sick Ward of St. John’s Hospital,” 1778 illustrates how large an open ward with chapel could be.

All other wards at Florence, Italy’s hospitals during this period conformed to the traditional open-ward design. A typical example was shown in the interior view of Corsia Sistina, the main ward of Rome’s largest hospital, S. Spirito in Sassia (figure 23). This view illustrates the combined functions of cures for both the body and the soul. Individual beds lined the walls of the ward, each enclosed by curtains to maintain heat and privacy. This image shows it more crowded than normal; the four extra rows of temporary beds would have been added as a response to the demands of an epidemic. The view is taken from the crossing, and shows an impressive neo-classical altar where the daily celebration of Mass could have been visible by patients in all wings of the ward. The organ just behind the altar indicates that Mass would have had a musical accompaniment, while the group of nursing staff in the foreground includes one kneeling in prayer. Hospital chapels and wards, just like their churches, were visited on feast days by potential patrons who would have been encouraged to leave money for the facility’s expansion and decoration.

As shown in the photo of the interior of the hospital from west to east (figure 17), the open single-nave plan of the ward terminated in the polygonal apse of the chapel. Since there were no transepts or internal supports, the focal point of the interior was the flood of light from the windows of the chapel which were framed by the center arch rising to the full height of the timber vault. The tall chancel arch, the enormous timber barrel vault of the hall, and the intense light from the chapel windows enhanced the austerity of this space. The east end was vaulted entirely in stone and comprised a wide chapel containing the high altar. The openings of the triumphal arch are large to highlight
the chapel as a visual effect. Both current opinion and antiquarian material support that a low screen separated the ward from the chapel.185

It was believed that disease could be created in the air through the escape of noxious fumes into the atmosphere. Sick patients were believed to have an innate ability to create disease within themselves. Therefore the hospital was designed to ensure the circulation of air and to encourage it to rise from the level of the beds toward the roof. Windows could have been another way to promote circulation of air but in many cases windows were glazed and fixed shut; they were designed as a source of light rather than fresh air. Examples include the tall mullioned window of S. Maria Nuova’s male ward as shown in the Bicci di Lorenzo fresco (figure 24). These windows were probably made of glass. While earlier medieval hospitals in northern Europe such as leper houses used stretched polished skins, the windows of the larger institutions for the sick in England and France were glazed with clear glass.

However, most monastic hospitals during this era placed minimal importance on delivering natural daylight and ventilation. For example, the windows at Notre Dame des Forntenilles were placed as high as possible along the north and south walls (figure 18). A contrast in fenestration differentiated the chapel from the infirmary. On the exterior, the traceried windows of the chapel expressed the hierarchical division of the building. Similar to the infirmary, the chapel windows were placed high on the walls, but they were different in proportion from those of the ward. Both ward and chapel had double lancets and quatrefoils in contrast to the wider and simpler round-headed windows of the

infirmary (figure 17 and 19). The windows, and the light they admitted, dominated the mural surfaces of ward and chapel. Using surviving fragments and comparative material from the church, Meredith Lillich reconstructed the widow glazing at Tonnerre. Her findings affirm that monochromatic patterned glass typical of Cistercian glazing and colored glass with principal colors, such as deep red, royal blue, green, white, and yellow gold, were combined in the windows of both the infirmary and chapel.\textsuperscript{186}

Likewise, the infirmary of the Abbey of Ourscamp in France (figure 20) shows an open-ward plan with a possible arrangement of 84 beds.\textsuperscript{187} It also had both sacred and secular windows (figure 21 and figure 22). The rose window and two tall windows below it with detailed tracery were not operable and were considered only as a source of light. Three small windows near the ground were minimally operable and could be used for ventilation. Yet, patients were not able to see out from the bottom row of windows.

The simplest kind of bed was the litter, visible on the left-hand side of Domenico di Bartolo’s well-known fresco, the Care of the Sick (figure 25). It was used to place a patient on when he or she arrived at the hospital for admission. Larger numbers of litters might have been brought in during emergencies. The view of the Corsia Sistina (figure 23) shows those four rows of temporary beds.

The most common type of bed in the hospital during this era was the lettiera.\textsuperscript{188} It consisted of a series of planks joined together by a frame. This was distinguished from


\textsuperscript{187} Thompson and Goldin, \textit{The Hospital: A Social and Architectural History}, 22.

the most basic litter form of bed by its headboard to which a shelf or cornice was attached. The right-hand side of Domenico di Bartolo’s Care of the Sick (figure 25) shows a dying man in a bed. A shelf behind this bed displays a number of receptacles for medicines; the two flasks may have contained liquid such as water and wine.

Patient beds had benches or chests around them. In a chest at the foot of the bed the patient’s clothes were stored. Domenico di Bartolo’s fresco shows this kind of chest where the friar is resting one of his feet. Likewise, the architect Filarete in his *Tractate on Architecture* described his plan for the Ospedale Maggiore in Milan:

> The beds were fine and good. The bedstead were 2 ½ braccia wide and 3 ½ braccia long (4.9 x 6.8 feet). At the end of each bed was a cupboard or a little window. When it was opened, the door made a little table where the sick could eat…At the foot of each bedstead there was a small chest where things could be kept in case of need.189

Patients shared beds with other patients. Allowing two patients per bed was customary at that time, and each bed contained two or three patients by 1595 as Hennry Piers recorded during his visit in Florence. When Grand Duke Cosimo II visited the hospital twenty three years later, four or six women were forced to share the same bed. This practice helps the researcher to speculate that cross-infection could have occurred in the wards and it may help to explain S. Maria Nuova’s higher female mortality.

The beds could be enclosed by curtains to maintain privacy and heat as shown in the interior of Corsia Sistina, the main ward of Rome’s largest hospital, S. Spirito in Sassia (figure 23). Blankets, bed linens and woolen covers also provided heat. Since there was no hearth or fireplace in the infirmary, the only heating available was supplied by

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portable braziers. It was too cold in the great stone interior to lie in an open bed. With insufficient heating, patients in the bed were safer from drafts behind curtains where the patient could warm up the air in his or her cubicle with his own breath or body heat since nothing better was offered.

Another common feature was the painting of images on headrests or footboards. A similar practice was also found in the domestic context. A hospital bed from the Ospedale del Ceppo in Pistoia from fourteenth century (figure 26) shows the Virgin and Child. The head and footboards contained images of the kneeling figures of the patron who was identified by the coat of arms painted at the foot of the bed. The painting of beds might have served a patient as a reminder of a particular saintly patron.

Caregivers in medieval times were an inverse of today’s caregivers in that they relied predominantly on spiritual healing. The main elements of hospital design in the medieval era grew out of and adapted existing models. The ground plan of the majority was based on the monastic infirmary and with the advantage that it could be easily extended in modular form as a Greek cross through the development of a cruciform plan. This open plan enabled all patients to participate in the celebration of Mass in the ward chapel. It also was suitable for staff easily to keep an eye on their charges. Yet, the medieval era was a dark age, in regards to hospital interiors, as compared to contemporary practices, since designs placed minimal importance in delivering natural daylight, ventilation, and proper amenities such as furnishings.

Examining the structure and appearance of beds during this period added to researcher’s understanding of patients’ day-to-day experience of their immediate

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environment. Exploring various views of hospital interiors provide the researcher with a
guide to the main activities in a ward and general idea of the roles of the personnel.
Moreover, many of these scenes demonstrate the interdependence of the physical and
spiritual care of patients. Supporting spiritual care in the healing process has still been
emphasized in contemporary healthcare settings by offering spaces such as meditation
rooms or chapels. Their purpose is to provide an opportunity for meditation and
relaxation for patients awaiting a visit with the doctor or surgery, as well as recovering
from their disease. On-site chapels for spiritual care are perhaps the early monastic
hospital’s enduring contribution to any contemporary interpretation of design principles
for healthcare facilities. The curtains around the bed for privacy are another contribution
of the medieval hospital interiors to contemporary practices. We still use those curtains,
especially in the Emergency Department where there can be multiple numbers of beds
within an open space. Also, we use them in rooms housing up to 2 or 3 patients for their
privacy.

**Renaissance (1500-1800)**

The word, hospital, is derived from the Latin *hospes*, meaning “host” or “guest”
and first came into being during the early Renaissance. The hospital during this era
covered a wide variety of institutions, and only some of these were intended to cater
exclusively for the sick. In the early Renaissance period, shelter was still the traditional
function of a hospital and many of these early foundations provided temporary
accommodations for travelers and pilgrims. To serve those populations, the location of
many hospitals was along the main roads leading to the city such as Valencia, Arles, Lyon, and Paris.\textsuperscript{191}

From the fourteenth century to the end of the sixteenth century there was a rebirth of European social and cultural life achieved by emulating the ancients and by discarding the medieval past. It began from the rich commercial cities of northern Italy and later in Northern Europe. This humanist enterprise in the Renaissance led to the belief, before the middle of the seventeenth century, that human bodies deserved to be physically investigated. Physicians understood this need to advance medical knowledge by probing deeply into the body. One of the greatest achievements in Renaissance medicine was the discovery of the circulation of the blood by William Harvey. Harvey explained that “The heart of animals is the foundation of their life, the sovereign of everything within them and responsible for blood circulation.”\textsuperscript{192} Doctors and the sick needed buildings to conduct such serious work, so splintering the concept of shelter into its own freestanding hospital was established. Concurrently, as the modern state sought to protect the working members, public hospitals were constructed by philanthropists. After 1500, these hospitals might have overlapping functions, somewhat similar to asylums and prisons.

The Protestant Reformation closed many of the Catholic hospitals in Protestant countries such as France and England. These were replaced by privately financed and conducted institutions. Secularization of the hospitals in France proceeded rapidly

\textsuperscript{191} Lindsay Granshaw and Roy Porter, \textit{The hospital in history} (New York: Routledge, 1989), 68.

\textsuperscript{192} Helen Rapson, \textit{The Circulation of the Blood} (London: Frederick Muller, 1982), 67.
following the French Revolution. Despite secularization, many hospitals retained the look of religious structures, indicating the institutions’ former affiliation with the church.

With rise of the Renaissance, hospitals began to exist separately from churches. As the wards became larger than in the medieval era, the condition of wards became more dangerous. The oldest hospital in Western Europe is the Hotel Dieu in Paris built in A. D. 550 and rebuilt during the seventeenth century. By the mid seventeenth century the Hotel Dieu had deteriorated to a horrific condition, as can be seen in the figure 19. In the interior of the Hotel Dieu (figure 27), patients on the right are being fed by nuns; on the left a priest offers the Eucharist to a patient; in the left foreground two nuns prepare corpses for burial; the center houses the other patients; religious iconography is shown in the center of the ward. Some wards had 100 beds with multiple patients per bed even up to four. Feather and flock mattresses were not common until the middle fifteenth century. The wards were dark, since windows were set high in the wall. The wards were located adjacent to other wards with infectious patients.

Hospitals during the Renaissance looked like palaces; however, they were far from luxurious. Bethlehem Hospital in London (1676) was characterized by the style of classical architecture (figure 28). Centered on a courtyard with a chapel in the middle, it had cells for patients, a kitchen, staff accommodation, and an exercise yard. The private room was essentially for the benefit of the upper classes. Meanwhile, the lower classes continued to be relegated to deplorable wards with negligible amenities.

St. Luke’s Hospital for the insane in London (1751) also was designed to emulate palaces of the period conveying a noble façade (figure 29). However, the interior conditions for the patients were unacceptable. A plate by Rowlandson and Pugin (figure
30) shows the interior of the women’s ward at St. Luke’s Hospital. The cell with
dimension of 10’4” × 8’ × 13’3” high has its long thin windows, high cell doors, and iron
grilles. The semicircular grille above the door for the cell does not draw cross
ventilation from its window. In the 15-foot long corridor, inmates are helping out with
washing and restoring beds, mattresses, and quilts. The medical superintendent of St.
Luke’s Hospital noted the aspects of the hospital as it must have been in 1803:

The wards are shut off from the central portion by thick upright iron bars
and heavy iron gates which accord a complete view of their whole length
on each side. The wards open directly into the wings, so that a
classification of patients was not possible on any floor. There is no
furniture beyond bare tables and wooden forms. The walls are not even
white-washed. There are no fire-places nor any means whatever of heating
the wards. There are no infirmaries or places where sick patient can be
treated apart from the others. Each patient has a wooden trough shaped
bedstead fixed into the wall, and containing loose straw, which covered
with rough sacking in the case of convalescing patients only. There are
nearly three hundred patients in residence, two thirds being acute cases.

Similarly, the pass-room at Bridewell Hospital in London had wooden trough shaped
bedsteads fixed into the wall (figure 31). It shows women and children, some lying on
paillasses, a thin mattress stuffed with straw. The women were possibly homeless, petty
criminals or prostitutes in the part of the building used as a house of correction.


194 John Summerson, Thomas Rowlandson, and Augustus Pugin. *The microcosm of London by T.


196 The Pass room is a kind of institutional space where, for example dislocated poor were held before
being expelled from the city.

Guy’s Hospital for Incurables in London (1725) had built-in wooden bunks in its six large wards. The wards were “much offensive by unwholesome smells occasioned as is conceived by the settles fixed to the bedsteads there-in, wherein under the beds cannot be swept.”\textsuperscript{198} Additionally all able patients helped staff to clean beds, floors, corridors, stairs, and dirty linens. Despite such efforts by staff and patients, forty years after the reconstruction of Guy’s Hospital, “bugs were said to be a greater evil to the patient than the malady for which he seeks a hospital.”\textsuperscript{199} The ample wooden bunks accommodated more than one patient as a typical bed (figure 32). A few long windows were irregularly placed with no relationship to the row of wooden bunks. Window apertures were small. The building footprints were usually narrow to allow fresh air and some daylight into the hospital. Note the presence of a fireplace.

Humanism, placing the human at the center, with attendant interest in the working of the body, during the Renaissance made a critical impact on advancing hospital design, medical education, practice, and administration. The Renaissance hospital functioned in a manner somewhat similar to that of a contemporary hospital in existing separately from the church. Despite secularization, however, many hospitals from the early Renaissance era retained the look of religious structures. As a result of rapid secularization following the French Revolution, hospitals started to resemble a palace. Although its appearance from the exterior conveyed a noble facade, interiors of the public wards were overcrowded and lacked natural light, fresh air and comfortable amenities.

\textsuperscript{198} Hujohn A. Ripman, ed. \textit{Guy’s Hospital, 1725-1948} (London: Guy’s Hospital Gazette Committee, 1951), 114.

\textsuperscript{199} Ibid., 115.
Nightingale (1800-1945)

Over the last three periods, hospitals served only a minority of the population but had steadily evolved into institutions that are similar to contemporary healthcare facilities. At the beginning of Nightingale era, the sick still chose to stay at home. There were the cottage hospitals, public hospitals, and almshouses, wretchedly maintained by poor staff. All these had few technical or clinical requirements to meet compared to later standards. The physicians relied on mercury and arsenic to cure a variety of diseases due to little knowledge of sterilization during this age. Postoperative infections, passed from patient to patient by the physicians, resulted in high mortality rates. According to W. Gill Wylie’s study on the mortality at Bellevue Hospital in New York City, more than one thousand patients died between 1860 and 1873, at least sixty of which deaths were caused from pyemia and puerperal fever spread within the institution by staff. His conclusion was: “The truth is the majority of our hospitals are liable to do more harm than good.”

Since home was a more sanitary place for care and surgery, the wealthy and middle-class preferred to receive their care at home.

During the era when Nightingale practiced nursing, the pavilion-plan dominantly replaced the open ward or cross-shaped hospital, the usual form of hospitals in Europe and North America. In the mid-eighteenth century, the prevailing theory of the causality of disease was the miasmatic or zymotic theory. This theory became popular by the

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1880s and dictum by the 1890s. It postulated that illness was the result of miasma or bad air and an effective deterrent to miasma was the circulation of plenty of fresh air. This theory provided the rationale for the construction of the pavilion, separate buildings joined by a single arcade and corridor, in order to increase natural ventilation and reduce contagion in the hospital. The pavilion plan made the issues of day lighting, ample ventilation, and sanitization central to discussions of the design of hospitals.

Physicians were concerned about the cross-infection that resulted from massing patients in large and undifferentiated wards. The answer was the pavilion plan. The construction of the pavilion-plan began to segregate surgical from nonsurgical cases and even attempted to divide and isolate patients according to symptoms. To provide ambient fresh air and space for recovery of patients, the range of 12 to 32 patients per a ward was suggested as ideal by hospital planners such as W. Gill Whylie and Florence Nightingale.

The earliest pavilion-plan hospital was the remodeled Hotel Dieu in Paris. Tenon, a physician of the Hotel Dieu, redesigned the open ward and ward for smallpox patients with two-bed cubicles (figure 33). The open ward was for noncontagious patients. There were a stove for patients, and a room for staff functioned as a nursing station in the center.

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of the open ward. With Tenon’s redesign, the number of beds in one room at the hotel Dieu was reduced from 100 to 24. Tenon stated he would limit the number of patients in the ward in order to keep their number proportionate to the reasonable usage of the nurse’s time and strength. In the ward for smallpox patients, there was a hooded fireplace and sink instead of a room for staff. Partitions that were 6 feet high and open on top helped separating the smallpox patients into two-bed cubicles in order to prevent them from spreading diseases and harming themselves in the state of delirium. The entry vestibule in the ward for smallpox patients kept the ward warm, functioned as distribution point for supplies, and prevented contact between the patients and staff from outside of the hospital.

Florence Nightingale’s reform of a British military hospital in Istanbul in 1854 was a significant step in recognizing the merits of the pavilion hospital. It also led to many military hospitals developing along the same lines during the American Civil War. Nightingale’s experiences at the British military barracks during the Crimean War demonstrated the curative potential of this hospital design and revealed the positive impact of fresh air, natural daylight, and sanitization on disease prevention and patient recovery. The physical settings she refined led to a considerable success in increased patient survival rate. Upon her return to Britain after the war, she wrote the influential book, Notes on Hospitals in 1858, in which she further explained the importance that the physical setting of a hospital played in preventing death. Also she provided in great detail

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206 Dankwart Leistikow, Ten centuries of European hospital architecture (Germany: C.H. Boehringer Sohn, 1967), 75.
her guidelines for general hospital construction (Chapter Two includes a discussion of Nightingale’s reforms within the healthcare/healing environment and her principles on ward interiors as articulated in her two publications, Notes on Nursing and Notes on Hospitals).

Nightingale’s design for the ideal ward—a long rectangular space (30 feet by 128 feet) with 15 beds arranged along walls, a single entrance adjacent to the nurse’s station, and with fresh air circulation via windows—came to be called a Nightingale ward (figure 34). The sister’s room, or nursing station, had a window overlooking the ward. The window feature of the sister’s room allowed staff continuously to observe patients. While clearly emphasizing the importance of air circulation, daylighting, and sanitation, Florence Nightingale described the design element, visibility, as essential to nursing effectiveness, stressing the importance of positioning a nursing station within the ward in order to ensure a view of the entire room both during daytime and at night.\(^\text{207}\) The phrase, ‘hospital ward’ used in the British English language is similarly used to describe a division of a hospital shared by patients who need a similar kind of care. The phrase ‘hospital ward’ can be a precursor to the term ‘nursing unit’ in contemporary hospital design. The fundamental design of the nineteenth century nursing unit layout in the Nightingale ward became a linchpin of the pavilion-plan hospital design.

The constructions of the Hebert Military Hospital in Woolwich in 1865 (figure 35) and St. Thomas’s Hospital in London in 1871 (figure 38) exemplified Nightingale’s ideal ward. According to John D. Thompson and Grace Goldin, architectural historians,

\(^{207}\) Nightingale, Notes on hospitals, 153.
the Hebert Hospital was “the first hospital to be built entirely under her supervision.”

Each pavilion had two floors of wards with high ceilings, whitewashed walls, polished floors and water-closets, and windows admitting light and air (figure 37). Each ward was connected to a central corridor to maximize daylight and fresh air (figure 36). Herbert Hospital implemented Nightingale’s guidelines for hospital design.

Likewise, St. Thomas Hospital followed Nightingale’s principles in ward design and the pavilion plan. It was recognized as a huge success within the hospital reform movement during this era. The inpatient pavilions were very similar to what Florence Nightingale advocated at the time (figure 39). Each ward approximately was 28 feet wide and 120 feet in length (as determined by the number of beds, 28, and the space between beds). A photograph showing the Nightingale ward at St Thomas’s Hospital (figure 40 and 41) illustrates the interior of the ward well: the beds are well apart interspersed by windows; there is a nurse’s desk in the center and the specialist heaters mid-ward. These created up-currents of hot air to aid in the removal of vitiated air and in the circulation of fresh air. There was a porch located at the end of each ward overlooking the Thames River. A steam pipe system was used as heating, and rooftop cupolas allowed foul air to pass upward and out through the roof vents. Patients convalesced outdoors on the open veranda overlooking the Thames River (figure 42).

Between the 1860s and the 1870s the pavilion plan provided a pattern for hospital construction all over the world for the next hundred years. Hospitals in North America


also successfully adopted the pavilion plan during this era. Medical historian Charles Rosenberg included a complete list of pavilion-plan hospitals constructed in New York, Boston, Cincinnati, and Philadelphia.\textsuperscript{210} John Shaw Billings designed Johns Hopkins Hospital in Baltimore on this model. Interiors of the ward shown both in Johns Hopkins Hospital in Baltimore (figure 43) and Bellevue Hospital in New York (figure 44) could be almost identically matched with design features in the Nightingale ward. In both wards, there was a designated multi-purpose space in the center of the ward for heaters, armchairs, tables for displaying books, a vase, a basket, and even flowers; this space functioned as a recreation or amenities center for patients. The practice of hanging artwork and clipping case notes to the wall above the bed is recognizable from the children’s ward in Bellevue Hospital. There are also prints or photos on the wall.

Throughout this period, technological and procedural changes in medicine made hospitals safer for patients. The demonstrations of anesthesia in the 1840s and asepsis in the 1880s greatly improved the patient’s chances of survival from surgery, childbirth, or other procedures. Surgery became more prevalent during the latter part of the nineteenth century. Wilhelm Roentgen’s discovery of X-rays in 1895 greatly expanded medicine’s diagnostic capabilities. By World War I, all urban hospitals had installed X-ray facilities. These advances such as anesthesia, asepsis, and X-ray not only provided a much clearer image of the injury and diseases but also became the clinical foundation of the emerging modern hospital.

\textsuperscript{210} Charles E. Rosenberg, \textit{The care of strangers: The rise of America's hospital system} (Baltimore: Johns Hopkins University Press, 1995), 137.
Technological advances and procedural changes in medicine had a tremendous impact upon the design and construction of institutions. Many procedures moved from the patient’s home or kitchen table into a specifically designed operating room environment. Surgical suites were added to older hospitals and were mandatory in new hospital construction in the 1890s. The interior view of the operating theater in Massachusetts General Hospital (figure 45) illustrates doctors performing an aseptic surgery while students observe the procedure. The operating room was not constructed initially but appeared in 1917 in response to Joseph Lister’s work on post-operative sepsis. It (figure 46) had large expanse of skylight windows. Typically all surfaces in the operating room had to be smooth and impervious for easy maintenance or sterilization; the overall area had to be well-lit for surgery performance.

Moreover, new diagnostic abilities and improved surgical interventions attracted new populations, the wealthy, into the hospital. The wealthy expected a different level of care than hospitals traditionally provided the poor. Institutions began to offer two divergent kinds of experience to the patients. The poor were admitted to general wards with sparse furnishings where 20 to 40 beds lined the walls. Here, the nursing staffs were short-handed. The patient might be awakened by neighbors moaning or disturbed by another’s death. Patients’ experience from this communal ward was similar to that in early monastic hospitals from the medieval era.

On the contrary, private rooms for wealthier-paying patients offered accommodations with luxurious fittings and even amenities such as rooftop garden sitting areas. Henry Charles Burdett described the single room after his visit to Massachusetts General Hospital in Boston in 1898.
The room for the private [patient] has been fitted up with Eastlake furniture, Turkey rugs, and plate-glass mirrors. The halls have tesselated flooring, brass fixtures, and small Axminster rugs by each of the beds and electric signals to all parts of the building. A feature of this modern pay hospital is the recreation room, in which the attractions of a conservatory are combined with those of an aquarium. A platform for a band has been placed at one end of this room.211

Likewise, a print of a view of a private patient room in New York Hospital included in Harper’s New Monthly Magazine illustrates how the hospital could be sumptuously furnished and decorated for paying patients (figure 47). Private rooms with domestic settings had amenities such as dressers, tables and chairs intended to make patients feel at home. In such a way, patients were able to maintain their privacy while benefiting from those amenities.

The disparities between care in the private rooms and in the common ward also were shown at Johns Hopkins Hospital. The public ward for charity patients included the design features suggested by Florence Nightingale based on pavilion plan. In contrast to public ward patients, these paying patients were provided with amenities that lessened the burden of leaving their home environment. The pay ward, including thirteen rooms on each of the two pay floors, was located in a separate building from large public wards (figure 48). The private patient room of the pay ward (figure 49) was finished in ash wood and had freestanding furnishings in addition to the brass bed, such as a dresser with mirror attached, side-tables, chairs, and an electric bell for each room, resembling domestic interiors.212

211 Henry Charles Burdett, Pay hospitals and paying wards throughout the world (Philadelphia: P. Blackiston, 1879), 79.

212 John Shaw Billings, Description of the Johns Hopkins Hospital (Baltimore: Press of J. Friedenwald, 1890), 85.
Similarly, there were seven private rooms of different sizes and grades situated in different parts of the Massachusetts General Hospital around 1864. Some of these rooms were fitted up quite luxuriously, and very little about them suggests a room for the sick. The heavy damask lambrequins, surrounded by gilt cornices, and the lace draperies and soft carpet dispelled all thoughts of a patient’s room in a hospital.213 Later, Phillips House was established in 1916 as Massachusetts General Hospital’s ward for private patients. It was a 59-bed facility for patients who wanted the comforts of home while enjoying the benefits of first-rate medical care at the institution. It provided several amenities to patients. The roof of Phillips House afforded sunlight, fresh air, and an excellent view of the Charles River and the Boston area (figure 50). The balconies adjacent to the wards at Phillips House afforded panoramic views and fresh air for private patients (figure 51). A kitchen was constructed in 1917, a year after it opened as a private ward (figure 52). The well-to-do patients expected and paid for first-rate accommodations including views and cuisines.

Bed curtains, long regarded as a necessity in the drafty interiors of the days before central heating, were dispensed with during the Nightingale era with in an effort to promote ventilation. In the Ward 29 (figure 53) located in the Bulfinch Building, there were the portable wood panel with curtains to provide privacy, and on rollers in order to facilitate transfer from one bed to another as well as the early incandescent light bulbs and wires on the chimney walls at right, made possible by the establishment of the Edison

213 Grace Whiting Myers, History of the Massachusetts General Hospital, June 1872 to December 1900 (Boston: Griffith-Stillings Press, 1929), 23.
Electric Illuminating Company of Boston in 1886. Both Ward 29 (figure 53) and the Warren Ward (figure 54) showed blacksmith beds brought from England. The framework of blacksmith beds had iron rods that stretched from one side to the other and held the mattress up. The bed was made out of iron, “more elastic than wood, and cleaner than the common sacking.”214 At the center of both wards, there were wooden tables used by nurses and a couple of chairs for patients. These wards with their windows opened illustrate contemporary preoccupations with fresh air. The shutters to protect from sun still allowed air into the ward.

From the later Nightingale era, specialist institutions were established to control and combat lunacy or tuberculosis. In these, patients were isolated from the community and provided with medical treatments. The Kirkbride System, reflected in the Asylum for the Insane of Alabama at Tuscaloosa, was the representative of the American asylum. Dr. Thomas S. Kirkbride, the superintendent of the private Pennsylvania Hospital for the Insane and his principal architect, introduced the 250-bed linear plan (figure 55) with a narrow, stepped, linear building footprint. Between 1841 and 1887 thirty-two state asylums utilizing the Kirkbride template had been constructed in the United States. Single rooms were 8 by 10. The wings offset to the rear allowed for a central corridor open to sun and breezes at both ends. The narrow width of the patient room provided abundant light and ventilation with use of large operable windows and operable transoms above doors. The height of the windowsill was no higher than 3 feet above the floor,

which allowed patients to overlook views.\textsuperscript{215} On the topic of the surroundings in hospital construction, Kirkbride wrote that “the surrounding scenery should be varied and attractive, and the neighborhood should possess numerous objects of an agreeable and interesting character.”\textsuperscript{216} He promoted the incorporation of nature by providing views in the patient unit.

Meanwhile, the rapid spread of tuberculosis resulted in many hospitals in Europe and in North America providing spaces for heliotherapy. At the start of this period, there was no medication for tuberculosis. It was a disease closely associated with the rapid growth of industrialization and a poorly nourished urban working class, young men and women who lived in insalubrious, overcrowded conditions. Tuberculosis is mostly transmitted through the inhalation of airborne droplets of tubercle bacilli that can remain suspended in the air for many hours.\textsuperscript{217} At that time, medical professionals encouraged patients to have deliberate exposure to the sun in fresh, dry air and to rest for prolonged periods with a rich nourishing diet. Doctors prescribed methods to kill germs and sterilize facilities as a treatment for the illness. Providing easy access to generous sun light and fresh air became the focus of certain design features in sanatorium design. Major features in early sanatorium design included deep verandas, balconies, covered corridors, and garden shelters furnished with reclining couches or chairs. These institutions were usually

\textsuperscript{215} Nancy Tomes, \textit{A generous confidence: Thomas Story Kirkbride and the art of asylum-keeping, 1840-1883} (Cambridge: Cambridge University Press, 1984), 95-114.

\textsuperscript{216} Tomes, \textit{A generous confidence: Thomas Story Kirkbride and the art of asylum-keeping, 1840-1883}, 38.

set in a tranquil, wooded environment where good food, rest, and gentle exercise were prescribed to patients.

One key example from this period is the tuberculosis sanatorium at Paimio in Finland designed by Alvar Aalto. The Paimio sanatorium exemplified how several design features maximized the curative effects of dry, fresh air, sunlight, and hygiene to combat this particular disease. The floor plan was composed of a series of pavilions connected to a main administration building. There were two types of terraces. At the eastern end of the patients’ wing each ward had access to sun balconies, which were adjacent to each patient room for 24 patients (figure 56). Another was the sun deck located on roof for 120 patients for the use of all wards (figure 57). An open-air roof garden in the sun deck provided extensive views of the surrounding natural landscape.

Aalto considered the patient room (figure 58) as a minimal apartment allowing for one to rest, dress, wash hands, cough up sputum and work at a table within 883 cubic feet of a strictly dimensioned space. His solution included specifying hygienic materials, using window frames, light resources, soothing color schemes, and suitable furniture, both movable and fixed, allowing easy movement within a small space. The floor finish was linoleum for easy maintenance and the walls could be washed when necessary. The color scheme of the patient room was in shades of green, brown and white.

Aalto provided great care in window design. The windows of the pavilion for patients faced south-east towards the morning sun. Fixed wooden venetian blinds outside of windows regulated day lighting entering the patient room. The windows were also furnished with canvas sun awnings. Aalto provided both sunlight and shades to patient with careful consideration in window design. The double glazed window in the patient
room (figure 59) had three parts in its steel frame. The left-handed one reached down to the floor. In the upper part of the window was a specially-hinged hopper windows providing ventilation. A cast-iron panel radiator was located under the window.

Aalto designed each piece of furniture in the patient room. He integrated custom furnishings into the interior space of the inpatient unit. Using furniture that could be wiped clean, glass lamp shades, panel radiators fixed to the walls and encased radiant heaters on the ceilings prevented dust accumulation. The wardrobes in the patients’ rooms were for storing indoor clothing. Aalto’s design for a standard wardrobe in the patient room was made of molded plywood. There was no toilet in the patient room. But each patient room had its own wash basin. At that time, equipping each a patient room with an individual wash basin probably was considered both a hygienic and luxurious solution in the hospital setting (figure 60). There were four types of lighting provided in each patient room—an indirect globe lamp, overall general lighting from the ceiling, reading lamps attached either to the head of the bed or on the bedside table, and a conical incandescent lamp without a shade attached to the wall by a metal bracket above the wash basin (figure 58).

With increasing numbers of private and public sanatoria constructed throughout Europe and the United States of America, there was definite demand upon furniture that would allow a patient with this disease to rest for long periods of time in the open air and in all weather. Leonard T. Davidson described his daily life at the Sanatorium in Saranac Lake, New York. As a general rule, the patients who came to the Sanatorium were required to rest between two and four o’clock and spent practically all their time in the

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“cure chair” as the long reclining chair was called.\textsuperscript{219} Medical professionals believed that tubercle bacillus could live only for a very short time in daylight. Therefore, requirements of furniture for tuberculosis patients included materials to withstand climatic extremes such as hardwood, cane, or metal, easy maintenance for cleaning and disinfection, and a shape reflecting the anthropometric measurement of the patient.\textsuperscript{220}

The most famous recliner in the United States was a wooden framed reclining chair at the Saranac Sanitarium (figure 61). The Adirondack Hardware company manufactured this chair designed by George Starks, the owner, and called it the Adirondack Recliner. It had mattress cushions constructed in two pieces and supported by steel springs and straps, a back-rest adjustable by side levers, and a foot board, an extension for a magazine rack and a cup holder on the right arm side. It was wide enough for comfort and also narrow enough for travel through a standard doorway. The metal castors also helped with the portability of the chair.

Many architects such as Marcel Breuer and Alvar Aalto in Europe designed similar chairs. The most successful ones were Alvar Aalto’s furnishings used in the communal rest hall and the roof terrace for the Paimio Sanatorium. First, there was ‘chair 41’ known as the ‘Paimio chair’ or ‘scroll chair (figure 62).’ Due to the climate in Finland, this chair was used indoors. The 110 degree angle at the back of this armchair helped patients ease their breathing. The front parts of the curve functioning as armrest might assist patients for getting up. Its framework consisted of two closed loops of

\textsuperscript{220} Margaret Campbell, “From cure chair to chaise longue: medical treatment and the form of the modern recliner.” \textit{Journal of design history} 12, no. 4 (1999): 329.
laminated wood forming the top and bottom into twisted scrolls made from lacquered natural birch plywood. The Paimio chair was the result of numerous bending trials using birch wood that was in part naturally damp. Aalto intentionally used wood to provide a warmer look and more flexible furnishings to patients in order to negate the institutional coldness. This material also allowed easy maintenance and prevented infection. Second, there was a recliner, ‘chaise longue’ for patients resting on the roof terrace made of a metal frame with stove-enamedled white finish (figure 63). Compared to the scroll chair, it was a bit closer to a true recliner. Aalto provided a comfortable foot rail for the patient’s legs. He incorporated a ratchet into the semi-circle of the armrests so that patient could make various adjustments of the backrest on their own. Later, these chairs became popular for use not only in sanatoria but also in domestic interiors.

Significant innovations in interiors of the patient care unit occurred in hospitals built during the eighteenth and nineteenth centuries. It began with the work of Florence Nightingale based upon her bedside experiences during the Crimean War, and her books documenting the impact of the built environment on patients. She not only wrote about sanitation, infection rates, and ventilation, but she also emphasized environmental aspects including color, noise, light, as well as the nurse’s presence. Much of what is taken for granted today in healthcare interiors—sanitation, ventilation, light, view, and ambiance—is assumed to be the current standard. Nightingale’s writings set the standards for the nursing unit and provided a pattern for hospital construction all over the world until the outbreak of World War II. In addition to Nightingale’s contributions on hospital design,

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technological and procedural advances in medicine required the institutions to construct diagnostic department and surgical suites. They led the institutions to provide specialized private rooms for the wealthy. These might be considered as the origin of VIP suites, an emerging market-driven model in the contemporary healthcare industry. In the late nineteenth century, the Kirkbride asylum system for the insane had varied degrees of Nightingale’s key precepts on physical settings for healing: fresh air, pure water, cleanliness, daylight and view. Similarly, tuberculosis sanatoria constructed in the United States and Europe during early twentieth century included several design features such as terraces, balconies, windows, and amenities such as handwashing basins, lighting, and recliners in order to maximize curative effects of dry, fresh air, hygiene and sunlight.

Megahospital (1945-1975)

Hospitals solidified their roles as a core of civilization after World War II. By 1960, Americans had embraced the hospital as the preferred location for their serious medical problems. Between 1873 and 1960, the number of hospitals rose from 178 to 5237.222 Concurrently the roles of general practitioners became narrowly defined and new medical specialists were established. In 1950, the American Medical Association declared that pathology, radiology, and anesthesiology were specialties equal to surgery, internal medicine, and other practices that had not previously been particularly hospital-based.223 There was also a predominance of nurses who specialized along with physicians. As a result, several specialty nurses such as pediatric, emergency and

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intensive care replaced general ward nurses. Ambulatory care with the increase in same-day surgery started to take place not at doctor’s offices but in hospitals.

The hospitals built during this period following the end of World War II were efficient and mega-size. Healthcare providers began to apply the management practices of industry in an attempt to improve the operations and efficiency of turnover of the facilities. With the increased need for efficacy in management and performance came the needed improvement of the hospital design to function efficiently and to allow for greater patient turnover, thus producing a hospital as factory or machine. Advances in artificial lighting, the development of long-span structural systems, and heating, ventilation, and air-conditioning systems (HVAC) made it possible to minimize the number of interior columns and to expand the typical structural bay as a basic unit of planning. These advances allowed hospitals to adopt multiple blocks containing newly formed departments such as diagnosis, treatment, surgery, and other support functions.

World War II led to significant advances in surgical and medical practices in response to the large numbers of injuries sustained by soldiers in combat. Many of the injuries, such as deep bullet wounds and injuries leading to amputations, required surgical treatment employing anesthesia. With the increase of injured and disabled soldiers, along with a large number of combat surgeons returning from war, many countries faced great pressure to increase their healthcare system. After World War II, the vast funds allocated to postwar federal and state programs resulted in construction of new hospitals and clinics. They also had profound impact on hospital size, outward appearance, and configuration.
In the United States, the Hill-Burton Act (1946) from the New Deal programs of the 1930s, set the stage to create large numbers of community hospitals throughout the country. There was the increasing need to accommodate the returned veterans and the new households created from exponential growth of the suburbs. The Hill-Burton Act resulted in locating an urban teaching institution in the center and arraying a network of supporting specialty centers such as psychiatry, tuberculosis, chronic diseases, and community health in outlying zones. The Hill-Burton program resulted in buildings to house as many beds as possible per floor, with the diagnostic and treatment functions located on lower floors. To ensure minimum quality and content, the Hill-Burton Act had its own standards including preset floor plans, room arrangements, bed capacities, and minimum requirements for diagnostic and treatment departments.

Correspondingly, interior configurations for nursing units throughout the 1950s followed the Hill-Burton guidelines. The term, nursing unit, originated with the construction of the modern hospital during the era of the Megahospital. It refers to an area in a healthcare setting where patients with similar needs are grouped to facilitate their care delivery provided by medically trained professionals. Typically a nurse manager is in charge of the nursing unit. There are various types of nursing units such as inpatient, outpatient, intensive care, and other specialized care units. Around the 1920s, smaller rooms off a double loaded central corridor gradually replaced the large open wards from the Nightingale era. The large open wards came into disfavor due to their
inherent limitations in terms of high noise levels, lack of privacy, and the difficulty in isolating infected patients.\textsuperscript{224}

The linear corridor unit design, also called racetrack design, marked the epitome of the nursing unit in this era. The racetrack unit design occurs as a single corridor or double corridor layout. The Memorial Unit at the Yale-New Haven Hospital in New Haven in Connecticut in 1953 illustrates typical racetrack design (figure 64). In the floor plan of most racetrack unit designs, there is one central nursing station with charts, orders, medications and supplies functioning as the heart of patient care activities. The racetrack unit design allows staff to have responsive access to all patient room and good visibility to the patient rooms located closer to the nursing station. The downsides of racetrack unit design include long travel distances for staff and restricted visibility to the patient rooms located farther from the nursing station.\textsuperscript{225} Nearly all veterans’ administration hospitals, urban teaching hospitals, and community hospitals of this period followed this plan.

Nursing units built during the era of the megahospital were designed with one centralized nursing station. A nursing station is a room or area used by nurses or other patient care staff that supervise or administer health care services. It is the primary workstation that typically is assigned to a specific unit of the facility. The nursing station


usually includes a unit reception, admissions desk, and records or charting work areas. The centralized nursing station design provided space for social interaction and for informal teaching and learning opportunities among staff. It also became a symbolic barrier separating the public and private spaces. For example, rather than placing the nursing station at the ends of long hallways lined with patient rooms, the centralized nursing station at the Dartmouth Hitchcock Medical Center in 1953 was located in the center of a ring of patient rooms (figure 65).

However, the design of the corridor nursing unit with four to six beds in each room and one central nursing station increased travel distance by staff. The increased nurses’ travel distance raised a critical design issue, a balance between the need for patient’s privacy and nurse’s easy access to patients. In the 1970s, Gordon Frissen suggested two components to address this balance. The first component was nurervers, closets located outside each patient’s room that contained a phone, entry to a pneumatic tube system, space for clean and dirty supplies, a chart holder with a pull out writing shelf and a locked drawer for storage of non-controlled medications (figure 66). The second component was the decentralized nursing stations instead of the centralized station. His approach brought nurses closer to patients compared to centralized nursing stations.

Keeping the nurse at the bedside by having each patient’s medications, treatment

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equipment, linen supplies and chart located right in the room, rather than being held at various other centralized locations helped staff to decrease their travel distance and increase time spent with patients. Although Frissen’s approach pioneered the concept of decentralized nursing stations, his priority was not communication or socialization of staff but operational efficiency in terms of supply management and effective staff utilization.

There was a dramatic shift away from the open ward: the early 1900s, Nightingale era ward shrank to semi-private, later, all-private-room arrangements in the late twentieth-century hospital. The shift in abandoning the ward concept began after 1945 in the United States for the first time and was completed by 1972. The evolution of the modern nursing unit emulated the monumental debate during the 1950s and 1960s over the merits of the open ward versus the private or semi-private patient room. There was apparent dominance of semi-private rooms containing two beds to a room during this era. By 1970, the modern hospital offered several variants on the typical nursing units, including private rooms, double-occupancy rooms, and small wards of up to six beds.

This shift was a response to privacy acclaimed by hospital administrators and desired by patients. Raymond Duff and August Hollingshead describe how hospitals provided all three types of patient room accommodations:

> The (private) rooms are bright and tastefully decorated, furnished with a single bed, a lounge chair, and a reading table; there are outlets for lamps, television and telephone. The general impression is one of light, airiness and quiet… The semi-private accommodations have 60 percent more beds in the same floor space…The ward accommodations are crowded with equipment and people, sick and well.\(^{229}\)

This description reflects how many in the hospital field viewed the private room considered exclusively for the wealthy class, as a reasonable request for patients. To correspond to this request, 29 private patient rooms at the Dartmouth Hitchcock Medical Center in 1953 were constructed through its renovation (figure 67). Each private room was “beautifully furnished with telephone.”

By the mid-1960s, healthcare providers in the United States believed that all private rooms in hospitals would be beneficial to the patients. Most hospitals stayed in a semi-private room system because of the high cost of construction and required staff attentions.

However, patient rooms housing up to six patients continued in many European countries because this allowed great flexibility to accommodate the number of men, women, and children admitted from time to time with very little adjustments. The ward at the Montague Hospital in Mexborough, South Yorkshire had partitions to provide privacy (figure 68). Women’s surgical at the Montague Hospital in 1968 was reminiscent of the Nightingale Ward with beds arranged along walls and a central nursing station (figure 69).

The Princess Margaret Hospital at Swindon between 1960 and 1965 shows a typical configuration with double loaded unit design in European countries during the era of the Megahospital. It had 388 beds in a linear block configuration. Each floor comprised two, twenty-bed nursing units sharing a central day space, kitchen and treatment suite. Each patient room (figure 70) accommodated up to six patients.

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231 M. J. Grayson, J. P. Hughes, and J. W. Paulley, “The Princess Margaret Hospital, Swindon.... 546.”
provided hand wash basins with paper towels and plugs for electric razors and floor-to-ceiling windows. Although patients from each bed were able to look out over the surrounding countryside from large glass windows, patients complained about glare caused by the window wall. Each bed had an angle-poise lamp, a plastic curtain, a locker with compartment in the back for hanging clothing, a drawer, and a shelf. Radiant heating was provided in the floor covered with compressed cork tiles. All doors of the patient room were finished with Formica, laminated plastic sheet. The ceiling was not finished with noise-absorbing tiles.

At the same time, hospitals in Europe continued to develop the latest amenities built within a mix of open wards and private rooms. Patient rooms at Porte De Choissy Medical and Surgical Center (1962-64) in Paris exemplified the level of design attention accorded in the private rooms (figure 71). Amenities provided in the private rooms were swivel chairs, a bedside desk, and a wood-veneer headboard for the bed, with an incandescent light mounted on the wall above the bed.

An inflexible metal bed, machine-like in appearance typically was the central piece in the patient room during this era. But the introduction of an adjustable crank double-pedestal over-bed table by Hill-Rom in 1933 was a pivotal step in revolutionizing the furnishings of the patient room. In the 1960s, Hill-Rom developed the electric bedside cabinet, integrating a nurse call system as well as switches for lights, radio and TV. It was the beginning of the concept of customized headwalls, later to become integrated in the postmodern hospital during the era of the healthscape, the final period in the historical evolution of healthcare environment, from 1955 to present. Another innovation, the infant bed (1962), provided taller height for increased safety (figure 72). Promotion
for the Retractable Patient Bed developed in 1964 conveyed the idea of flexibility to support various postures of the patient at the bed (figure 73). Overall, Hill-Rom created several “firsts” in the healthcare industry to help increase efficiency, safety, and comfort of the products used by caregivers and patients from 1933 to 1965: the first bedside patient-room lamp (1936), the first swinging-arm bedside table (1945), a fracture bed (1946), the first low-back bed with adjustable back height (1947), the first Hi-Lo bed (1948), the Trendelenburg Spring, and the first bed with partial side-rails (1949), the first mattress guard and the recovery bed (1955), the first labor bed (1955), and the patient-centered bedside cabinet (1965).

At the end of the megahospital period, the culture of medicine that had led to hospitals that were “more formal and bureaucratic, unified in authority, consistently reflecting medical needs and perceptions,” led to a rising chorus of criticism.232 Charles Rosenberg wrote,

Suddenly, it seemed in the late 1960s, the American hospital became a problem. The hospital appeared a source of uncontrolled inflationary pressure, and instrument of class and sexual oppression, or an impersonal monolith, managing in its several way to dehumanize rich and poor at one, if not alike.233

The hospital came under attack both as too costly and as unfeeling, uncaring and impersonal. Although the health care field had raised expectations and success rates, patients complained about staff listening more closely to machines than to people. By the 1970s, communities and individuals complained about the impersonality of the hospital.

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233 Ibid., 6.
Visits to the hospital had to be carefully arranged during short visiting hours. Children were often forbidden entrance at any time.

In postwar years, hospital administrators paid attention to obtaining the latest machines and equipment and housing these necessities within the building. New construction, creating specialty-departments and locating corresponding medical machines, occurred rapidly. However, little attention was paid during this era to advancing the interior design of nursing units, such as patient rooms and nursing stations. To find a patient’s room, visitors wandered through mazelike, long, drab, and sterile looking endless corridors that were interrupted only with nursing stations. Harsh, fluorescent lighting fixtures were paired with white color schemes and the most perfunctory accommodations for equipment, supplies, and people. Spare furnishings and machines loomed over the patient’s bedside. The patient room was like a dormitory room, so patients had to be moved for most procedures. Moreover, furnishings within the patient room continued to evolve without major impact on the size, amenities, or ambiance of the room itself. Layout, furnishings, orientation, and even the aesthetic experience of the patient room tended to be chronically overlooked. Hospital design in the era of the megahospital was based on provider-focused systems maximizing the efficiency of feasible services and subspecialties, such as the highest total bed count and highly specialized diagnostic and treatment units which were expanded to zones remote from the nursing unit. Therefore, the interior of the patient room was neglected.

**Heathscape (1975-current)**

The era of the healthscape is still emerging. Postmodern institutions in the 1980s and 1990s focused on patient-centered design. Consumers rapidly rose as an integral
factor influencing hospital design in the twentieth century. As there has been a steady increase in healthcare costs, consumers are expected to pay out of their own pockets.

The rapid increase in information available to society as a whole has grown exponentially over the past 20 years. The information age is a term that has been used to refer to the present era, generally beginning around 1990. Individual consumers have started to increase their knowledge and demand new levels of service. At the same time, easier access to health-related information via the Internet has created well-informed consumers. Therefore, consumers in healthcare have begun to shape the delivery system. In the realm of consumer responsive care, healthcare providers have adopted strategies from wholesale bargaining with managed-care plans to target marketing directly toward consumers in order to attract their business.\textsuperscript{234}

Healthcare providers have begun to redefine their image and relationship with their customers by catering more to patients. Many organizations such as the Institute of Medicine\textsuperscript{235} and the Institute for Healthcare Improvement have made great strides in this direction. The first attempt to change the status quo, provider-focused system in healthcare delivery, was the development of the Planetree patient-centered model in the early 1980s. Planetree is an international nonprofit, consumer-oriented healthcare organization established in San Francisco in 1978. Its goal was to improve medical care from the patient’s perspective.


Patient-centered care in the Planetree model is based on evaluating everything in the hospital from the perspective of the patient. The nine elements of Planetree patient-centered care include the following: the importance of human interaction, informing and empowering diverse populations through the creation of consumer health libraries and patient education, healing partnerships centered around family and friends, nutrition and the nurturing aspects of food, spirituality and drawing upon inner resources in healing, human touch as an essential medium for interpersonal communication, the therapeutic value of the healing arts, the integration of complementary and alternative medicine into conventional care theory and practice, and the restorative role of architecture and interior environments in the healing process. Particularly, Planetree has had an epic influence on the physical environment of healthcare facilities, culminating in the patient-care-centered approach to design. By the late 1990s, dozens of Planetree units were in operation in the United States.

The Pacific Presbyterian Medical Center in San Francisco opened the very first medical-surgical unit with thirteen beds based on the Planetree model in 1985. Nora Greer in *Architecture* wrote about the first Planetree Unit:

The typical sanitized hospital décor—cold aluminum and stainless steel, and linoleum, fluorescent lights, and hard, painted surfaces is gone. Instead, the design esthetic is comfort and hominess: wood, carpet, and incandescent lights. Care that often can be characterized as dehumanizing, depersonalizing, frightening is gone. It has been a resounding success one in which the physical environment and the patient care works in tandem to create a non-institutional ambiance.

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237 Ibid.

The designs placed the patient and the patient’s family at the center of all healthcare rather than the traditional model which placed the operation of hospital and staff needs at the center of the equation.

The basic layout of the nursing unit at the Pacific Presbyterian Medical Center was a racetrack due to the restriction by the template of the existing facility. The central space of the nursing unit, formerly for housing staff, had been transformed only with different functions and ambiances. Instead of a traditional centralized nursing station set apart from patients by half-walls or glass partitions, the nursing station was transformed into an open work area for doctors, nurses, and patients (figure 74) finished in warm wood tones. This concept of an open nursing station in the Planetree model creates a more welcoming environment where patients and family members feel more comfortable to approach to nurses. Most Planetree prototypes reject the wall-defined, enclosed nursing station and favor complete removal of the barriers. Materials like oak, used in the nursing station, minimize the patient’s experience of an institution-like environment. The open nurse’s station also has windows looking out into the lounge and kitchenette adjacentally located. A lounge and kitchenette is available for the patient’s family to prepare special meals and snacks for patients. The Planetree model calls attention to an empowered patient and to increased family involvement by providing this kind of gathering space.

Each patient room at the Pacific Presbyterian Medical Center has several interior features in order to create an environment more like a home than a hospital: use of a pastel rainbow color palette, thirteen different bedspreads with soft floral sheets, plants,
and nature-themed artwork. In the Planetree model, “the arts [have] been described as inspiration for the mind, language for the emotions and balm for the soul.”\textsuperscript{239} The first Planetree unit incorporated a wide variety of arts, including painting, music, and movies in its healing environment at no charge to patients. Bookshelves, bulletin boards, and niches enable the patients to display or store personal items such as flowers, cards, and gifts and also offer a way to glance at these from their bed.

Another example epitomizing the Planetree patient-care unit was the pediatric nursing unit at Mercy Memorial Hospital in St. Joseph, Michigan constructed in 1986 (figure 75). The layout of the core area for staff members was not so much different from the traditional nurse’s station, yet, there were remarkable interior design components integrated in the corridor of the nursing unit. Front doorways to the patient rooms differentiate private spaces from public spaces. Use of vivid colors also eliminates a clinical appearance in accordance with the Planetree philosophy.\textsuperscript{240} Pastel-color-coded doors to patient room with gabled soffits, incandescent lighting, side rails and a window evoke a street view in a residential community. These also function as landmarks to make unique and memorable corridor intersections, allowing patients or visitors to find their way throughout a facility.

A growing attention was paid to patient needs in hospital design in the 1950s. For example, maternity rooms began to include private phones, silent nurse-call systems, attractive window treatments, and adjustable beds in order. The area for waiting or

\textsuperscript{239} Frampton and Charmel, \textit{Putting patients first: best practices in patient-centered care}, 143.

\textsuperscript{240} Jain Malkin, \textit{Hospital interior architecture: Creating healing environments for special patient populations} (Van Nostrand Reinhold Company, 1992).
sleeping for fathers was often further away from the maternity room. A lack of space led hospitals to accommodate mothers in a group-labor room setting that resulted in patients having terrifying experiences.\textsuperscript{241} The spaces in the maternity unit continued to be organized according to prioritizing the needs of staff rather than patients and family. Much of this had changed by the 1980s.

In the 1980s, by contrast, there was a dramatic shift in attitudes towards the birthing experience. Several factors created a favorable climate for developing a new approach in birthing experiences: a birthing movement with emphasis on patient empowerment, patient-family involvement, and the use of appropriate technology; the women’s movement with its attending focus on women obtaining decision-making confidence through and control; better-informed consumers; and competition with other hospitals for the declining number of births. Medical professionals introduced hospital-based alternative birth centers or hospitals with labor-delivery-recovery rooms and, later, labor-delivery-recovery-and-postpartum rooms.\textsuperscript{242} These rooms integrated more homelike interior features, with patterned wallpaper, wooden furniture, private baths, rocking chairs and double beds. Double beds providing various positions allowed patients to stay in the same room throughout most procedures instead of being moved from labor room to a delivery room to a recovery room.\textsuperscript{243} The all-in-one, LDRP room, had a wide


\textsuperscript{242} Amanda Carson Banks, \textit{Birth chairs, midwives, and medicine} (University Press of Mississippi, 1999), 101.

appeal because of the level of comfort patients could obtain in a self-contained entity room.

Interior features reinvented in the birthing unit bloomed in the 1980s, epitomizing how healthcare facilities placed patient rooms at center of stage. For example, the LDRP room at the center for Women’s Health at Cottonwood Hospital in Murray, Utah (figure 76) shows changes in hospital birth practices. Furnishings such as natural wood floors, side tables, a mirror, desk, chair, and a sleeper sofa for family and their overnight stays, set this room’s atmosphere as a residence rather than a hospital. This room is distinguished from a traditional patient room because of its adaptability. The LDRP room transforms into a labor, delivery and recovery suite with all the necessary medical equipment brought from various compartments and concealments along the perimeter of the room (figure 77). User-friendly interior features of these rooms allow different approaches to labor, such as an increase in the woman’s freedom of movement and posture during labor, and the possibility of attendance for the father or a family member.

Additionally, newly developed products for the birthing room further illustrate the trend toward integrating patient empowerment and family involvement with the technology. Starting in the mid-1970s, advertisements began to appear in mainstream obstetrical journals for furnishings such as birth chairs and labor-delivery-recovery beds, often referred to as chair-beds. By 1979 several medical manufacturing companies including Century Manufacturing, the Borning Corporation, and Stryker Medical advertised birth chairs and chair-beds for use in hospital settings in medical publications.

The promotional materials for these products convey the idea of providing more user-centered care via furnishings. The Borning Corporation described its beds as following:

Once, care could be responsive to the family’s emotional need during the most significant event of their lives…Or it could have the safety of uncompromised standard medical care. Now it can be both.  

Chair-beds are similar to standard hospital beds and include a group of movable sections accommodating any position from a semi-upright birth to complete horizontal delivery with stirrups and restraints. This bed supports versatile positions of the mother through the birthing process: it can be lowered for operative deliveries, be positioned for lithotomy birth, and serve as a postpartum recovery bed. Examples include the ‘Birthing bed’ by the Borning Corporation (figure 78) and ‘First Care Ultra’ by Stryker Medicals (figure 79). These beds reflect increased innovations by manufacturers, and are still evolving with newer features.

More recently, technological advances within society have influenced not only many factors of our everyday lives but also the way that healthcare is being delivered. Mobile technologies have been improving the manner and changing the locations for delivery care within the modern healthcare setting. Patients have been receiving more procedures with mobile equipment in their room. This capability significantly decreases the risk posed to the patient during transport. Technological advances such as WiFi, Bluetooth, and Cellular broadband transmission have provided greater opportunities for virtual functional relationships, decentralizing the diagnostic and treatment procedures

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245 ———. Advertisement in American journal of obstetrics and gynecology 143, no. 8 (1980).

246 Banks, Birth chairs, midwives, and medicine, 107.
and moving more of them into patient nursing units. Mobility and the smaller size of medical equipment make it possible for the patient to receive care services in their bed.

Correspondingly, the design of nursing units, including patient rooms and nursing stations has continued to evolve along with the products, materials, and technologies in order to make suitable accommodations for several end-users such as patients, family, and staff members. During the 1980s the first bedside stand-alone computerization systems, such as the MedTake system, enabled nurses to enter patient-care data into a terminal at the patient’s bedside. This kind of ‘point of care’ system made the degree to which information was transported and organized less dependent on human face-to-face interaction. Data from the point of care system became increasingly easier and faster to access at multiple locations simultaneously.

In an effort to adopt technology and equipment in patient room, computerized systems in the 1990s allowed patients to control the comfort of their personal space, including screens, lighting, bed positions, and audio visual devices like the television and stereo. A variety of high-tech products in the patient room included integrated head walls (the wall unit at the head of the bed consisting of electronic control panels and utilities) and freestanding power columns, remote nurse-patient communication systems, patient-controlled telephones and intercoms mounted on the bed side rail, ergonomic beds for patients with special needs, such as the obese and those with severe physical disabilities. Over time, the advent of such high-tech equipment and furnishings in the patient room led to reconsideration of many aspects of room design, such as bed positioning, ceiling height, room lighting, floor and wall surfaces, vanities, closets, window positioning and
the overall size of the room. At the same time, designers constantly tried to manage the visual clutter caused by adopting high tech equipment.

For example, the inpatient room at Clemson University in 2006 typifies how technology played a critical role in transforming interior design features in order to make accommodation for various users of the patient room. The headwall (figure 80) with a four-feet-wide light and utility box consists of several equipment-intensive features such as a composite face panel and side utility surfaces, including electrical devices, medical gas outlets, and devices.247 The face panels conceal the clutter of medical hardware and accessories from the family area. Its task is to serve as a focal point connecting technology and equipment to the patient. Patients can control room temperature and lighting, in the recessed ceiling above the bed and the translucent backlit headwall panels with the twelve color options. The footwall (figure 81) includes the flat screen video technology and a full wall digital display. Video screens provide access to entertainment, video conferencing with family members at home, speaking to medical specialists, communicating with staff, and connecting to medical information.

The increased mobility of nursing care has required more distributed, mobile, and flexible nursing stations. Designers have started to consider the issues of privacy, social needs, noise levels, communication modes and technology on the nursing station design. There has been a strong shift from centralized towards decentralized nursing stations. The decentralized nursing station with an information station located outside each patient room offers several benefits: improving accessibility and visibility, ease of supervision

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and shortened walking distance. But nurses report their sense of isolation from their colleagues.248

In response to this concern, a hybrid nursing station model with bedside nursing stations and a collaborative centralized nursing station was introduced. Hybrid nursing stations include placing a charting alcove between two rooms with a countertop large enough for a computer, and with visual access into the rooms serving as a nursing substation. These charting substations in the hybrid model have now evolved into docking stations for portable computers or for computers on wheels, enabling nurses to roll their substations from room to room. Some decentralized charting substations are transforming into charting islands, using partial walls to protect furniture systems and distinguish spaces between patient rooms as the nurses’ area.

Additionally, furniture design has been playing a critical role in the development of the nursing station. In response to the rapid changes in nursing stations, there has been a growing need to develop flexible and comfortable furnishings in the nursing stations. Several aspects most frequently considered about furniture in the nursing station include: providing ergonomically appropriate access to computer charting, patient information, communication devices and group consultations to arrange the capacity for quick work activity changes. The recent increase in the aging population among nurses in particular has led to a greater focus on ergonomics in nursing station design to prevent back stress, fatigue, and injuries among staff.249

248 Ibid.

In the beginning of the twenty-first century, patient care units that employ user-centered design, also known as human-centered design, have begun to proliferate in the United States. User-centered design is a design philosophy that places the end user in the center of developing items intended for human use. While the use of this term in healthcare design might be fairly new, human factor engineers have used principles and methodologies based on user-centered design, integrating user input at all stages of design and evaluation, for decades.

During the latter period of the twentieth century, the focus of the healthcare facility was mainly patients and also partially family members. However, in the twenty-first century, healthcare providers and designers have brought strategies to meet the fundamental needs and interests of all end-users, such as patients, their families, and their caregivers (staff). The year of 2006 was a particularly seminal year for the history of interiors in patient rooms. The American Institute of Architects (AIA) in its “Guidelines for Design and Construction of Healthcare Facilities” set one bed per room as a standard unless the functional program demonstrates the necessity of a two-bed arrangement. This protocol requiring the private patient room led to constant discourse about the key interior elements of the inpatient room. The most significant change in hospital design has been in redefining the elements of the standard patient room. As a result, the hospitality industry influenced models for this change and many of these amenity-based concepts have been applied to hospitals.


The prototype patient room for the long-term child patient built at the University of Minnesota Children’s Hospital in Fairview in 2006 exemplifies how detailed interior design features such as furniture, finishes, fixtures, and equipment have been critical in transforming a facility into a user-centered environment for health. Perkins+Will collaborated with the Adopt a Room Foundation, a nonprofit organization, founded in 2004 by two families whose terminally ill children had been hospitalized over an extended period of time. Team members from various fields included medical, educational, business, architectural, and construction professionals, as well as children themselves. This project focused on four fundamental needs addressed by end-users through a design development for alternative environments: sense of control, comfort, connectedness with life outside the hospital, and family involvement. It illustrated the concept of Adopt-A-Room that any changes should be dependent upon needs.

Many hospitals in the era of the healthscape have zoned the patient room into three distinctive spaces for patient, family, and caregivers. Patient rooms at the University of Minnesota Children’s Hospital exemplify these three distinctive zones with various amenities. An LCD panel screen at the front door to the patient room displays artwork, photos, and messages (figure 82). It functions as a distraction for visitors in the hallway and prohibits them from seeing inside of the patient room. There is a separate sink near the room entry for the use of nursing and medical staff (figure 83). This wet work zone with the aforementioned sink at the entry to the room promotes hand washing

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by staff upon both entering and exiting the room. An acoustical barrier between walls used in the construction of home theater settings keeps sound within the patient room. Absorptive ceiling panels soften sounds or noise created in the patient room.

The patient space stands below a recessed circular ceiling with a virtual skylight consisting of more than twenty LED lights whose colors could be varied (figure 84). This ceiling feature helps create a sense of day and night for patients. The curved headwall finished with wood panels (figure 85) not only conceals visual clutter from medical equipment and monitors but also provides some level of privacy in the patient’s bed area. A universal LCD screen at the bedside with touchpad provided patients with independent control of their environmental settings, such as lighting, window shades, temperature, and other media technology. The footwall has a large flat screen television and monitor with two side-wall-mount monitors for DVD and Internet use allowing patients to make connection to siblings and friends (figure 86). Various entertainment features in the footwall function as a positive distraction for patients. Features in the bathroom (figure 87) include an ergonomically designed European style sink, a let-it-rain deluge style shower fixture, grab bars, heated floors finished with ceramic tile and accentuated walls in order to provide accessibility and comfort to patients.

For family member’s work, there is a designated workstation with a glass sliding door allowing a measure of privacy (figure 83). There is also a sleeper sofa bed that can be positioned alongside and at the same height of with child’s bed for family members’ overnight stays. The introduction of a second bed contributes to patients’ normalizing their experience and relieving the nursing staff of many simple supporting activities. Providing their own space for patients and family members makes for a less stressful
environment during hospitalization.

Another important element of this patient room is a retreat space focusing on facilitating the interaction of children and family members. A retreat area reminiscent of a home setting within the patient room features several amenities (figure 86). It offers a height adjustable table and chairs for comfortable seating that can be rearranged based upon their needs. A refrigerator, a microwave, and a coffeemaker (figure 88) allow for patient and family members to prepare food and beverages in the room. These food prep amenities also spare family members trips away from the room in search for such items. A substantial amount of storage space makes it possible for family members to bring their personal items necessary for their children’s hospital stay (figure 89).

One of the chief improvements in the design of interior spaces during the era of the healthscape has been incorporating sustainable design practices. With society focusing on a more sustainable and healthier environment, there is increasing interest in healthier building practices and materials. The Leadership in Energy and Environmental Design (LEED) green building certification system for healthcare provides a framework for identifying and implementing green building design, construction, operating, and maintenance solutions.

Concurrently, designers have been considering the impact of their interiors in healthcare facilities on providing non-toxic and sustainable finishes, furnishings, and materials, optimizing maintenance practices as well as indoor air quality. Examples of employing such finishes in interiors include cork flooring, recycled fiber carpet, maple panels, low-e glass, and biodegradable EcoResin headwall panels. Materials and finishes that easily stain and must be replaced frequently have given way to more permanent
materials with surfaces that are easily cleaned. In order to provide healthier indoor environments for patients, families, and staff, providing access to daylight and views into the hospital, became one of the customary amenities, especially in patient rooms. Where natural light via windows is not available, a variety of contemporary fixtures mimicking daylight or incandescent light have created a far warmer than that created by standard cool fluorescent tubes.

The words of the Greek philosopher Heraclitus—“Nothing endures but changes”—could certainly refer to the nature of the healthcare design industry with its dramatic and constant shifts in the twenty-first century. One of recent shifts by healthcare providers is to offer more care in the outpatient environment with an effort to reduce inpatient admission and cost.254 Yet, this shift does not stop reinventing the inpatient care units. Rather, hospitals are investing in improving the inpatient experience and environment. In the center of reconsidering the approaches of the past, there still are patients, family members, and staff to take into account. Thus, patient-centered care is no longer a buzzword by particular organizations in the healthcare design industry. Rather, design currently reflects strategic plans and models of nursing care. While the era of healthcare is still emerging, it has been celebrating user-centered, appealing, and accessible design for several decades. With the celebration of user-centered design, interiors of healthcare facilities have bloomed with the reinvention of users’ experiences via ubiquitous hospitality touches. Such touches include greater environmental control and comfort

through artwork, lighting, and audio-visual devices; family zones, including a pull-out sofa, food prep area, and entertainment; and a caregiver’s space for handwashing and charts. The environment also has continued to evolve along with the products, materials, and technologies to help keep the patient care unit clean and patient safe.

Conclusion

This chapter reviewed the historical evolution of the healthcare environment in a series of major developments arranged in chronological order but also strategically categorized by paramount developments in the history of medicine and pivotal changes or movements in the history of society. In each era, hospitals functioned as various symbols of community with engagements in delivering its healthcare system for fighting illness. As societies and cultures have changed over time, the roles of hospitals have also changed. Thus, the physical settings for patients’ healing have evolved to reflect those changes with them.

At the beginning, the Greek Ascelepia was a place for physical protection or spiritual comfort. The institution provided rest, baths, exercise, and a reasonable diet in use of natural surroundings resembling the spa in contemporary standards. The Roman military hospital was a place for separation. It became a tool for isolation designed to control the inmates and provide proper care within rudimentary settings addressing privacy, fresh air, and natural light. The hospitals that functioned during medieval era provided great spiritual solace but minimal physical comforts with their physical settings. The accent was on mending souls of the inmates and communal life at the expense of patients’ privacy and comforts. During the Renaissance, the modern state provided hospitals separated from the church with a monumental façade mimicking the palace
style. But interiors of the hospital did not successfully provide features to support the physical comforts of the patients.

By the time of the Nightingale era, the hospital became a place for cures, serving injured soldiers in the armed forces who needed to recover and be returned to duty. To serve their needs, the hospital became the instrument for both physical and mental recovery. Ward interiors providing fresh air, cleanliness, view, light, and amenities by Florence Nightingale set the standard for hospital construction. By contrast modern hospitals in the megahospital period reversed the emphasis on spiritual and emotional needs and focused primarily on patients’ physical recovery in more mechanized and depersonalized environments. Patients and visitors complained about their traumatic and intimidating experiences during their hospitalization or visit. But little attention was paid to the spatial qualities that were an essential component of end-users such as patients, family members, and visitors.

In the twenty-first century, healthcare providers have been devising new ways of making their care more humane through various approaches in interior design in order to respond to the needs, fears, and hopes of their customers, end-users such as patients and family members. Designers are making vigorous attempts to recover patients’ health by reintegrating them into their families’ involvement and adapting the comforts of hospitality environments so the hospital is more like the hotel. These changes allow patients to understand and control their surroundings, find their way to around, and relax. The chief improvements in the design of interior spaces include controlling infection through use of sustainable materials, expanding areas that incorporate natural light, exploring hybrid nursing station designs, and redefining the elements of the standard
patient room such as a second bed for family members’ overnight stay, personalized spaces, and caregiver space with amenities.

In conclusion, the Nightingale era was a seminal period in the evolution of healthcare environment since there were key developments and a real change in attitudes towards healthful interiors for the sick. Wide adoption of the guidelines on ward and hospital design suggested by Florence Nightingale emphasized the physical elements such as ventilation, natural light, view, sanitation, and ambiance. This occurred in various types of healthcare facilities including military, psychiatric, and tuberculosis sanatoria all over the world. For a very long time these wards became ubiquitous in any new hospital design. Technology and advanced medicine supplanted the modernist ideals neglecting aspects of the environment including natural ventilation, light, and views. Hospitals during the megahospital era were stripped of interior design features and amenities due to focusing more on the architectural design of the building exterior or an impressive lobby. To solve end-users’ intimidating experiences in a depersonalized environment, design professionals have been employing a number of environmental features, such as a view of nature or, natural light that are well established in research literature. Many of our current healthcare interior practices such as human centered design and infection prevented might trace their origins to practices enacted by Nightingale.
CHAPTER 4: CASE STUDY—THE DESERT SANATORIUM (TUCSON, AZ)

This chapter interprets Nightingale’s contributions to the nascent field of healthcare interior design and the implications for those contributions within contemporary healthcare environments. It provides an analysis of the interior design of the Desert Sanatorium and Tucson Medical Center. This case study begins with a discussion of the “Desert Sanatorium”, between the years 1925 and 1940. It considers the various historical and social aspects of the time and their impact on this tuberculosis sanatorium. The section of “Evidence of Nightingale’s principles in the Desert Sanatorium” deals with the relevancy of Nightingale’s guidelines to the inpatient care environment in the Desert Sanatorium.

**Desert Sanatorium**

Arizona is a land of high mountains, fertile valleys, ample forests, mineral wealth, but one of its greatest assets is its dry desert climate. The coming of the railroad in 1880 opened the West and helped to settle the Arizona Territory. Articles were published in Eastern papers, advertising the territory of Arizona as a health resort. Arizona speculators promised “vigor, long life, strength, and happiness under glorious skies” and told of the remarkable healing prosperities of Arizona’s sunlight and pure aseptic air. Patrick Hamilton’s *Resources of Arizona* claimed that the “purity dryness, and elasticity of the air made it unequaled in the entire continent for the cure of consumption, kidney diseases, and rheumatism.”

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255 Patrick Hamilton, *The resources of Arizona: Its mineral, farming, grazing and timber lands; its history, climate, productions, civil and military government, pre-historic ruins, early missionaries, Indian tribes, pioneer days, etc., etc.* (AL Bancroft & Company, Printers, 1884), 134.
articles in leading medical journals. Dr. Mark A. Rodgers of Tucson wrote in the Medical
and Surgical Reporter, May 16, 1896:

The climate of Arizona is peculiarly adapted to the requirements of people
suffering from pulmonary disease. They need a climate wherein they can
live out of doors. No one will dispute the statement that outdoor life is the
one for the consumptive.256

As a result, the territory of Arizona became increasingly popular as a place to recover
from respiratory diseases. This popularity, coupled with a lack of luxury hotels and
hospitals for the affluent sick, led to the founding of a number of sanatoria and clinics. In
the late 1800s the dreaded white plague (tuberculosis) brought hundreds of sufferers from
all parts of the country to Arizona to seek health in the dry, sunny desert. Few
accommodations existed for the large numbers of people who came to the curative
climate in desperation and with little means of support.

Between the 1920s and the 1930s, the sanatoria development boomed in Tucson.
More clinics, hospitals, sanatoria, and boarding houses opened to accommodate the
masses of consumptives residing in Tucson. Dr. Bernard L. Wyatt established the Tucson
Desert Sanatorium with primary focus on treating tuberculosis patients on November 18,
1925. It also admitted those with other types of diseases and conditions as well as those
who just wanted a rest. Thus, the institution was appropriately named a sanatorium.257

256 Lane W. Rogers, Sanitarium of the Southwest Seeking a Cure in the Arizona Sunshine (Tucson: The
Desert Leaf, 1992), 8.

257 The two words, sanatorium and sanitarium are often used interchangeably. Sanatorium (from the Latin
Sanatus meaning “healed”) stresses curative and healing measures, usually meaning a health resort for
persons needing mainly rest and recuperation in pleasant surroundings. Sanitarium (from the Latin Sanitas
meaning “health”) stresses hygienic conditions and usually has patients needing special treatment.
The Desert Sanatorium, with accommodations for 120 patients, was based on the cottage plan. The cottage plan layout includes a central administration building—housing those facilities shared by patients—surrounded by smaller, separate cottages that accommodate patient rooms. In terms of its overall site configuration, the cottage plan differed little from the larger-scale pavilion plan, whereby attached and detached rectangular wards surrounded a central hospital administration building. The seclusion offered by the cottage design of the Desert Sanatorium appeared to be a deterrent to cross infection and tuberculosis patients were assigned to a designated court. Each court contained a nursing station, a kitchen, a private room, suite, screened porch, and either private or connecting bath. A series of eight cottages, “courts” built of brick and in the Hopi style of architecture were named after Indian tribes in Arizona—Pima, Navajo, Maricopa, Apache, Papago, Hopi, Moqui, and Yavapai (figures 90-97).

Original drawings of the main building at the Desert Sanatorium showed a two-story building with a roof solarium as a third story. An elevator carried the patients from the two lower levels to the roof. The east side of the first floor of the main building had ten single rooms and two private suites (figure 98). The suites consisted of a bedroom, dressing room, and bath, all opening onto a long porch. The entrance to the main building was on the southwest side. On north of the entrance were the main office, waiting room, corridor, and president’s office with a large vault adjacent to this office.

The next wing housed the X-ray (figure 99), dark room, and a medical treatment room. The office of the superintendent of nurses was south of the main entrance. Next to it was the electromagnetic laboratory with equipment for recording radiometric measurements. The roof of the laboratory was reinforced with a heavy frame and special

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steel beams in order to support the large copper-clad dome that housed the ultraviolet solar radiometer. In the west wing there were a staff dining room finished with an oak floor, the servant’s dining room, kitchen and salad tray room, bakery, refrigerating room, service porch and platform. A long corridor north to south divided the rooms and porch from the offices and waiting room.

The second floor of the main building included ten rooms and two suites directly above those on the first floor. A long corridor separated staff space such as a surgery room, a sterilizing room, nurses’ work room, linen closet, utility room, diet kitchen, and staff room from the patient rooms. There were eight bedrooms and two baths serving employee in the west wing.

In spite of the Great Depression, the Desert Sanatorium was still well advertised and continued to gain attention for its research, first regarding tuberculosis and later arthritis. A large number of arthritis suffers came to Tucson. Some came only to spend the winter, but many brought their families and tried to find work so that they could make their permanent home in the warm climate. One court still housed tuberculosis patient and tuberculosis research continued. After much research and observation, heliotherapy treatments did not prove to be beneficial to patients suffering from pulmonary tuberculosis. By January 1929, the Desert Sanatorium was no longer accepting patients with this disease for treatment. But the increased number in arthritis patients changed the priority of the Sanatorium from tuberculosis to arthritis.

A few maternity care beds had been provided at the Desert Sanatorium for some time, but the demand began to far exceed the supply. In the fall of 1939, two rooms in the medical building of the Desert Sanatorium were used to accommodate a few maternity
patients. Since the Desert Sanatorium did not have a dedicated delivery room, the operating room in the building annex was used for this purpose. By 1941, the need for maternity beds in Tucson had become so critical that a section of the medical building was remodeled to add 18 more beds.

Desert Sanatorium reinforced the idea that design and the environment could treat disease and support the well-being of patients. It exhibited modernist design features such as windows and balconies with a focus on sunlight and cross-ventilation. This was typical of the design of sanatoria for the treating of tuberculosis patients through the 1920s and 1930s (see Chapter 3: Historical Evolution of Healthcare Environment). Each court or building in the Desert Sanatorium was built at ground level, and French doors through which beds could easily be rolled into large verandas connected with the rooms. Patient used such porches in Arizona’s pleasant weather.

Another essential point in planning buildings at the Desert Sanatorium was that tuberculosis patients were housed in separate rooms instead of in wards. Coughing was not only bad for the individual patient but also disturbing other patients when they were housed together in a ward. Adoption of a private room perhaps made patients psychologically more contented and also increased their sense of self-respect. Additionally, it was effective since the construction of the Desert Sanatorium was both in order to care for the patient and to prevent the spread of pulmonary tuberculosis.

When Pearl Harbor was attacked on December 7, 1941, the United States entered the World War II. The effect of the war on the Desert Sanatorium was dramatic in reducing the number of the patients from abroad. Since the war restrained overseas travel, fewer patients from abroad were treated at the Sanatorium. On the other hand, critical
shortages of local hospital facilities occurred due to the increased number of patients that paralleled the arrival of servicemen and their families at Tucson’s Davis-Monthan Airbase. Most of beds at the Desert Sanatorium were devoted to local patients. Hospital personnel left to accept better paying defense jobs or to join the military service. Catering to the need of the wealthy was becoming a thing of the past. Often beds had to be placed in the corridors and those wishing to come for a rest could no longer be accommodated. As the warescalated the shortages of personnel and restriction on equipment and supplies made it difficult to maintain high standards of patient care.

Further, the economic picture of Tucson improved at the start of and following World War II since the establishment of military aviation facilities brought increased revenue to the state. However, this increasing economic prosperity did not revive the Desert Sanatorium of the previous decade. The discovery of the antibiotic streptomycin by microbiologist Selman Waksman made the previous tuberculosis treatment comparatively ineffective. By the 1940s, Tucson was no longer a place providing the same sense of refuge to ailing health-seekers, especially “lungers”; converting the facilities to a community hospital reflected this change.

Evidence of Nightingale’s Principles in the Desert Sanatorium

Ventilation and Warming

Nightingale’s first principle is providing pure air within and without, opening windows, and regulating the room temperature for patients’ comfort. For the thermal

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comfort of the patients and indoor air quality, all buildings at the Desert Sanatorium had been insulated against the heat and equipped with cooling and ventilating systems. In order to reduce the temperature of the patient rooms, there was a layer of insulation placed between the ceiling joists and the attic containing a dead air space in the second floor of the main building. Thermostatically controlled oil-burning hot air furnaces in the main building provided heat in the winter. In the summer, heating system ducts conveyed air that had been cooled by the swamp cooling system, were the device to cool the Sanatorium. After World War II, the widespread adoption of the air conditioner spelled the demise of front porches, wide eaves, and high ceilings.

**Light**

Nightingale emphasized providing natural day lighting in the ward as essential to health and recovery of patients. At the Desert Sanatorium, each patient room has a window as well as a screened private porch. A photograph of a patient suite from 1927 illustrates the ways in which the window was incorporated (figure 108). A pair of double-hung windows is opened. The height of the sill is low enough so that the patient can see out. Double layers of curtains provide the patient a means for controlling light and privacy. The glazed door to the screened porch, is opened, admitting fresh air and light from multiple directions.

Moreover, the Desert Sanatorium was the first institution in the United States to make the attempts to cure tuberculosis by direct solar radiation.\(^{260}\) The intensity of the Arizona sunlight made protecting against an overdosage imperative. Exposures of a total

of two to two-and-a-half hours during the morning time and in the middle of day, were considered ideal for patients with tuberculosis of the bones and joints. Patients protected their heads with a white linen hat and all patients were encouraged to wear sun glasses to receive general heliotherapy (figure 109).

Patients could sunbathe either out on the desert patio or in a private solarium connected to each room (figure 108). A long veranda also provided patients a place for sun treatment. It occupied the entire eastern exposure of the main building (figure 98). In the structure of this main solarium, hand-carved posts with Indian-Spanish bolsters supported rough beams (figure 111).

View

Nightingale asserts that views through a window have a positive effect on patient’s recovery. Windows in the patient rooms at the Desert Sanatorium afforded full views of surrounding desert landscape. In the eight courts, each patient room also opened onto a private-screened porch (figure 108). Deborah L. McBride writes that “views of distant mountains and forests were believed to emotionally stir and physically heal patients as they rested on their porches.” Furthermore, patios played a critical role in the Desert Sanatorium since many of the patients came to the southwest from colder


262 There were two types of glass mounted on a two and one-half wall of brick and extended for seven feet upward: the lower half with stained glass and the upper half with 800 square feet of clear Vita glass. Vita was the glass of high quartz content to which certain rare elements were added in order to give it the faculty of reducing the amount of heat transfer through the glass without reducing the ultraviolet rays.

climates to escape the coldness where they resided, as well as to secure the benefits of a stay in dry, sunny climate. Marie Booth in her editorial “Patios for a Purpose” published in the August of 1973 issue of the Spokesman states:

TMC, in its unique history and setting, has always used the benefits of the Arizona sun and air to supplement patient care. Believing in the aid to recuperation of relaxation, our patios have been designed for our patients’ comfort…a place where they and their families can enjoy their togetherness much the same as home.264

This quote sums up the value of patios. Each court was built around its own patio with a fish pond (figure 114 and 115). The patios provided patients with access to the outdoors. Even non-ambulatory patients could be moved to the court patio via their wheelchair or their own beds (figure 116). Thus, patients could relax either on the porches or patios, enjoying the view of the surrounding desert and mountains.

Windows, private-screened porches, and patios at the Desert Sanatorium helped patients to ameliorate stress and were the sources of positive distractions. The Desert Sanatorium called attention to the surrounding desert landscape’s most striking elements. It aptly captured elements of its vernacular context and local traditions in every aspect of its design, from its pueblo architectural style, to overhead beams, courtyards, and woven Navajo textiles.

Cleanliness

Nightingale offers guidance in selecting materials for floors, walls, and ceiling, with a major focus on infection prevention and ensuring healthy outcomes for patients, workers, and the environment. She mandated stringent requirements for durability and

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maintenance of interior finishes. Her criteria for ideal surfaces include cleanability, resistance to moisture, and reducing the risk of fungal contamination.

Seclusion of patients by the cottage design of the Desert Sanatorium appears to have been a major deterrent to cross infection. Some of the floor finishes followed Nightingale’s guidelines. The patient rooms use hard surface finishes (figure 108). The curtains, rugs, and other textiles could be laundered. Surgery room, a sterilizing room, utility room, diet kitchen, and staff room in the second floor of the main building at the Desert Sanatorium were finished with a rubber tiled floor. The dining room located in the west wing was finished with an oak floor, with water-resistant finish (figure 119 and 118). Terrazzo was used throughout the Desert Sanatorium due to its cheapness and durability, while marble was often reserved for use in the lobby.

Amenities

Nightingale advocated including amenities such as artwork, natural elements, décor, equipment, as well as the necessary equipment and furnishings in patients’ room. Nightingale advised that each patient bed area should have ample clearances around the bed. She suggested the following furnishings: a head shelf to the bed; a light chair for each bed, two or three spare arm chairs for patients or visitors; a small open bed-table for each bed; two or more tables or moveable dressers down the center of the ward.

Similarly, the Desert Sanatorium provided various amenities including furnishings, artwork, and décor within its spaces. Pima Mercantile Company built special cots for use on the solarium of the main building at the Desert Sanatorium (figure 111). An extension above the edge of the cot allowed ventilation and provided the patient
privacy and protection. The cots facilitated the fresh air cure of pulmonary tuberculosis with a combination of bed and chair.

Furnishings in the Desert Sanatorium were as authentic and natural to the area as possible. All rooms in the eight courts were attractively furnished with Navajo rugs and wicker furniture. An archival photograph shows a typical patient suite at the cottage of the Desert Sanatorium, with a metal bed with an overhead light in the room’s corner, a regular chair, a bedside table, and a desk (figure 108). This photograph also shows books, a tray, and a bouquet at the bedside table, a birdcage with bird, family photos, a book, and a corner table with a potted plant, as well as a Navajo rug. A door opened toward the porch where patients and their guests could relax on a wicker armchair with footrest. Here, the arrangement of furniture suggests a multitude of functions, a space in which to sleep, to relax, to read, write, or even work. Through the arrangement of furniture, patients were afforded individual choices in their private space. Perhaps the patient would have found this comforting or felt a sense of security through the familiar atmosphere of domesticity.

Patients and guests had one meal daily in the Zuni dining rooms. The rooms were divided by a small hallway that could be entered from outside (figure 117 and 118). The dining rooms incorporated the scheme of Indian decorations, ornamental ceilings and walls, and fountains play with the space. The murals used in the decorations were the authentic reproductions of altar and ceremonial paintings of the Zuni Indians and contained traditional Pueblo symbols representative of life, breath, and healing powers (figure 119). The Navajo sand paintings were replicas of similar paintings used in traditional Navajo healing ceremonies. Large panels of these symbols, drawn by Hopi
Indian artists, and the Sewell Brothers, Hope and Charlie of the Sewell Painting Company, were placed between each of the hand-hewn ceiling beams in the two rooms (figure 120).

A recreation room in the medical building at the Desert Sanatorium from 1927 was furnished with comfortable chairs and tables. These include wickerwork seating and wooden table of a Spanish Colonial Style (figure 121). Rugs and wall decorations such as woven baskets influenced by Hopi and Navajo Indians were evident. The furniture was arranged causally, loosely grouped around a piano, probably intended to stimulate intimate, homely gatherings. It seems that the interior design of Zuni dining and recreation rooms suggest a casual resort instead of a sanatorium. The interiors might distract the patient from worrying about their ailments and healing processes.

The Desert Sanatorium had adopted the modern equipment in the early 1940s. Call lights from all courts were connected to the main nursing station. When a light came on in the nurse’s station, nurses had to leave the building and go to that particular court. At night they would carry flashlights to light their way.

Findings from the case study indicate that the Desert Sanatorium in Arizona and its campus was made up of a number of buildings in order to house patients according to their stages of recovery. Patient wards varied to some degree but by-and-large, non-ambulatory patients were housed adjacent to the surgery or infirmary, while ambulatory patients were housed in separate auxiliary quarters, such as cottages or courts. Further, ventilation, warming, cleanliness and amenities were considered key features of the healing process, and so it was paramount that the Desert Sanatorium provide all of these features with variation to some degrees. In considering the design approaches of Desert
Sanatorium, one can draw the convincing conclusion that the overall designs exemplified Florence Nightingale’s principles in healthcare environment.
CHAPTER 5: EVIDENCE OF NIGHTINGALE’S PRINCIPLES SINCE THE MID-TWENTIETH CENTURY

Evidence of Nightingale’s Principles in the Tucson Medical Center

Developments after World War II through the 1980s during the conversion process from sanatorium to the modern general hospital are included in the section, titled “Tucson Medical Center.” The section of “Facets of Nightingale’s Principles in the Tucson Medical Center” deals with the linkage of Nightingale’s guidelines to healthcare environment in the Tucson Medical Center.

Tucson Medical Center

Mrs. Alfred Erickson donated the land and buildings of the Desert Sanatorium to create Tucson Medical Center in 1943. During the summer of 1943, Lewis Abbot of the Boston-based Hospital Architectural Engineers firm of Coolidge, Shepley, Bullfinch and Abbot, surveyed the Desert Sanatorium to see whether it was feasible to convert the Sanatorium into a community hospital, an acute general hospital. Tucson Medical Center’s first conversion phase in 1944 included installing an ice storage room and venetian blinds for 73 windows, converting the medical building into a 30 bed obstetrical unit, remodeling of Papago court (figure 100). In 1945, a cancer clinic was organized in Tucson for the first time. Construction in 1946 included the main building’s extension to incorporate the small Apache Court to the north and Maricopa Court to the south (figure 99). The construction in 1946 included a diagnostic and therapeutic X-ray department, surgical unit (figure 102), laboratory, central service with a large sterilizing unit, medical record room, medical library, admitting business office, offices for department
administration, pharmacy and soda fountain as well as 13 bed pediatric department and a 65 bed adult unit.

The worst polio epidemic occurred in 1944, but it was only one of many years in which polio was a major concern. Most polio cases were cared for in Moqui Court from 1944 to March 1948, at which time the Tucson Medical Center was designated as a diagnostic and treatment center for polio patients of southern Arizona. The south side of the Patio building was remodeled to accommodate 17 beds for polio patients (figure 103). Specialized procedures were necessary in treating polio cases including the physical therapy whirlpool and immersion tanks to exercise weak muscles (figure 104).

After World War II, the hospital changed due to a slump in the economy. Beginning early in 1950, with the arrival of a Photo-Roentgen unit and in the hope of increasing the protection of both patients and staff, all patients and new employees were routinely chest X-rayed. In the year 1951, Hopi Court, once reserved for tuberculosis patients, was closed for eight months because tuberculosis was being treated more effectively by surgery and drugs than long-term hospital rest. Prior to 1947, other than the nursery for newborn babies, no pediatric ward existed at Tucson Medical Center and children were admitted to adult wards or private adult rooms. By 1954, Tucson’s population was growing at the rate of 1000 new families a month and there were fewer than 80 pediatric beds available at Tucson Medical Center and St. Mary’s Hospital for children of the community. Tuscan Medical Center applied for Hill-Burton funds, authorized by the federal government for hospital construction in order to add an 18-20 bed psychiatric unit.
Building Program Plans initiated in 1957 indicated that the new hospital wing must be designed in keeping with the original Tucson Medical Center plan. The growth of the Tucson Medical Center between 1957 and 1962, was greater than in any earlier period. In June 1962 the first pediatric wing patients were admitted to the new wing. The new building was to be modern yet blend with the existing building and retain the one-story concept in an H design for future extension. It included the new ancillary and surgical wings. The pediatric wing consisted of an admitting office, two examining rooms, a dedicated lobby, waiting room, two wards for isolation, a fog room, a ward for infants, and three other wards used flexibly for preschool, school age, and teenage patients. The fog room, the latest in the treatment of respiratory problems, was a special room for young patients requiring very moist air (figure 105). The maternity wing consisted of 58 beds, a waiting room, two nursing stations and a serving kitchen. The nursery and labor and delivery wing had a father’s waiting room, 16 labor rooms, a nursing station and doctor’s call room, six delivery rooms, a recovery room with eight beds and a nursery of 104 bassinets.

A long range plan from 1963 included the building of two-eight story towers in three phases over a period of ten years (figure 106). It was a plan which mixed horizontal construction with vertical tower facilities. The first phase included the construction of a new kitchen to serve an 800-bed hospital and the ground floor for the north tower. The second phase was the construction of the south tower including space on the ground floor for a new main lobby, X-ray department, pharmacy, admitting, auxiliary gift shop, and auxiliary offices. The second phase included the construction of the next three stories for surgical patient areas with 24 beds per each floor as well as the second floor of the north
tower providing space for 24 psychiatric beds. The third phase was to add four more stories to each tower. The period of the third phase began in 1970 and ended in 1975. With completion of the third phase, Tucson Medical Center has a total of 804 beds.

Another long range plan was initiated in 1975 to reflect the challenges that the healthcare industry faced. It was completed in 1981. Outpatient services continued to grow and the length of stay for patients was reduced. It included expansions into an integrated whole including the construction of the emergency facility equipped with special care rooms for treatment of trauma victims and cardiac patients (figure 107), grouping all diagnostic and treatment services in the outpatient center, and remodeling the maternity and nursery areas.

The changes that occurred in the Tucson Medical Center from 1946 to 1965 resulted from the Hill-Burton Act, known as the Hospital Construction Act of 1946. The Hill-Burton Act led to having a series of overlapping rings laid across the nation, with a large, typically urban teaching institution at the center of each ring and a network of support clinics and specialty hospitals such as psychiatry, tuberculosis, and chronic diseases arrayed in outlying zones. During this period, Tucson Medical Center received a massive infusion of funds for construction. The intent of the Hill-Burton Standards ensured minimum quality of care, so Tucson Medical Center assisted communities around Tucson by virtue of preset floor plans, room arrangements, bed capacities, and minimum standards for diagnostic and treatment department.

For example, the dominant internal configuration for the nursing unit at Tucson Medical Center throughout the 1960s was the double-loaded corridor. A central corridor was flanked by rooms that opened onto it. As identified in Chapter Three, Tucson
Medical Center was a community hospital from the Megahospital era. Its expansion reflected the typical approach of that era. The service core contained nurses’ stations, closets for clean and soiled linen, mechanical shafts, general storage, staff offices, and treatment rooms (figure 102). The patient floors in the surgery unit housed a mix of private and semi-private accommodations; two rooms each containing three beds plus three rooms each containing 6 beds. The modest scale of the main lobby was typical of 1960s community hospitals.

Tucson Medical Center in the mid-1960s adopted the high-rise block configuration with the construction of two towers (figure 106). It was a response to the administration’s concern that a horizontally existing complex led to inefficient traffic pattern between departments and buildings. Adopting the high-rise block was possible since there were advances in artificial lighting, heating, ventilation, and air-conditioning system (HVAC), as well as the development of a long-span structural system (see Chapter 3: Historical Evolution of Healthcare Environment). This block hospital was the cornerstone of a massive construction program at Tucson Medical Center from the 1960s through the 1970s. While the two-tower hospital was focused on providing its capacity for people, services, and high technology, only the exterior perimeter of wall of the towers contained windows; all other rooms were windowless. Thus, there was little consideration given to providing natural daylight and making connection to the natural environment at the nursing unit.

**Facets of Nightingale’s Principles in the Tucson Medical Center**

*Ventilation and Warming*
Tuscan Medical Center was converted from the Desert Sanatorium with modernized building technology such as HVAC (heating, ventilation, air conditioning). The advent of central air conditioning reshaped hospital design.

*Light*

Tuscan Medical Center continued to provide natural lighting to certain spaces, such as the operating room. A photograph of the operating room from 1929 shows the table illuminated by both daylight through the windows and artificial lights (figure 112). Most surgeons during the interwar period preferred artificial lighting in the operating room; they pointed to the variability of daylight in terms of both quality and color and complained that they could not control the direction of natural light. Proponents of artificial light also emphasized the power saving to be gleaned from designing a system of illumination that could be tailored to the precise need of each surgical procedure. Artificial lighting was considered more scientific than natural illumination. Yet, Dr. Darwin Neubauer reminisced about the first Tucson Medical Center Surgery unit performed in December 1946:

> The unit consisted of two major operating rooms and one minor room, a cast room, and cystoscopic room. It was unusually attractive as the high windows permitted, during moments of relaxation, a beautiful view of the Catalina Mountains. This was quite a contrast to the fully walled operating rooms of today.265

Despite disagreements over which type of light was best, transmission of natural daylight into the interior was integral at the Tucson Medical Center. This translated into operable windows, multiple lighting options for the patient and family including a mix of both incandescent and florescent light sources in patient rooms and in adjacent spaces.

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larger window apertures, the use of low-e glazing types, and new full-spectrum light fixture (figure 113). These means mentioned above to bring light into the interior realm helped the patient to engage the natural environment as part of the healing experience.

_Cleanliness_

Tucson Medical Center was planned in functional zones very much like the typical interwar hospital, and the hospital’s flooring materials were carefully matched to the various functions of spaces, reflecting then current notions in acoustics, cleaning, and resistance to moisture. The nursing units, including patients’ rooms, typically had sound-absorbing floor coverings such as linoleum, cork, or rubber.266 The floors of balconies, waiting rooms, and kitchens were covered in quarry tile; vitreous tile was found on the floors of operating room.267 All surfaces were tiled and corners were rounded in order not to harbor dust and germs. A spacious corridor leading into the surgery suites was laid with nonconductive tile to prevent the safety hazard of static electricity in the operating rooms, since potentially explosive anesthetics were employed at that time.

_Amenities_

Tucson Medical Center continued to provide more amenities in public and private spaces. For example, there were chairs and small tables with several artworks displayed on the wall in waiting area at the surgery unit (figure 122). To support spiritual considerations in the care of terminally ill patients, Tucson Medical Center constructed the meditation room in 1965. The meditation room was small but could accommodate up

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266 Reba D. Grubb, _Portrait of Progress: A Story of Tucson Medical Center_. (Tucson, AZ: Tucson Medical Center, 1984), 189.

267 Grubb, _Portrait of Progress: A Story of Tucson Medical Center_, 182.
to six people with comfortable seating (figure 123). Patients and visitors could enter through a carved redwood door that opened from the corridor to the surgery wing.

Private rooms at the Intensive Care Unit built in 1980 offered features such as a TV set, carpeted floors, walls painted in earth tones, a monitoring system, and a picture window overlooking a courtyard. The monitoring system could track a patient’s vital signs, display heart rhythms, and blood pressure readings directly on the screen. It also noticed an abnormal change in a patient’s vital signs and sounded a warning to nearby nurses.

Especially, the rooms in the maternity unit emphasized the significance of portraying a homelike atmosphere. The residential image of the interwar maternity unit at the Tucson Medical Center countered or at least offset the tensions between understanding birth as natural or a pathological event. The inclusion of brightly colored bedspread, chairs, rocking chair, dresser, carefully designed cabinetry masking medical equipment in the maternity unit shows how interiors served as a tool in the modern concept of recuperation from birth. Just as the procedures surrounding birth borrowed from the techniques of modern surgery, delivery rooms resembled operating rooms; the bed was metal, wheeled, and easily cleaned.

In addition to providing more space, the renovation in 1978 strengthened the home like décor to create an atmosphere more conducive to family-centered maternity care. Three out of ten delivery rooms were redesigned for labor and delivery in one, to provide a home-like atmosphere during the birth process. Each was equipped with new Adel beds that could be used throughout the birth process (figure 124). As the husband and family became key players in the labor and delivery process Tucson Medical Center
provided space for overnight accommodations for family members in order to foster social support.

Patient rooms included the latest technology: an elaborate call system, locating signal, telephones, and special night-lights. Similarly, a new and radically different kind of hospital bed, the CircOlectric bed, allowed the very ill patients to do many things self-sufficiently. It was adopted at the orthopedics department in 1959 (figure 125). At the touch of a button, the motorized bed allowed a patient to be turned to any needed position. Various accessories for the bed included traction bars, suspension and exercise apparatus attached to the hoop-like frame that supported the bed, restraining straps, and intravenous bottle holder.

Interior features in the pediatric department such as a playroom, dayroom, and overnight space are intended to make the hospital experience for the children as homelike as possible and to minimize the fear and anxiety that often accompany a hospital stay. A private room in the general pediatric area accommodates younger children who usually have a member of their families stay throughout their hospitalization. A chair-bed is available at each child’s bedside for overnight stays by parents. An interior photograph of the waiting room in the pediatric department from 1962 shows the amenities provided (figure 126). The clock, plants, and chairs are identical to those found in the other departments for adults. What differentiates this waiting room from others within the hospital is the inclusion of the train set. A playroom in the pediatric department at Tucson Medical Center provides children with a place to get away and simply left off steam and excess energy (figure 127). It is equipped with toys, games and other items of interest to
younger patients. Also adolescents have their own dayroom with games, magazines, a television set and a private exit onto a patio (figure 128).

Findings from the case study indicate that through conversion into the modern general hospital, Tucson Medical Center housed patients according to specialty areas. Once such major innovations as the electric light bulb, the elevator, and central air conditioning systems were introduced in hospitals in the early twentieth century, the concepts in Nightingale’s principles were compromised. Thereby, Nightingale’s requirement on the maximum allowable width and length of a ward, the size of windows, and their placement in relation to the bed were disregarded in the Tucson Medical Center.

However, it is evident that Nightingale’s guidelines in providing patients with access to fresh air, warmth, a sanitary environment, as well as amenities were adapted and implemented in the Tucson Medical Center. Modernized building technologies such as HVAC adopted in Tucson Medical Center contributed to providing thermal comfort of the patients and indoor air quality. Also, its flooring materials reflected current notions in acoustics, cleaning and resistance to moisture. Tucson Medical Center continued to provide more amenities in public and private spaces including various furnishings, equipment, plants and artwork. It provided natural day lighting to certain spaces such as the operating room.

Nevertheless, changes occurred through the 1960s to the 1980s that did not reflect Nightingale’s principles. The adoption of two-towers allowed only the exterior perimeter walls. To contain windows; all other rooms were without windows. Therefore, there was little consideration given about providing natural daylight and making a connection to the natural environment at the patient care units in Tucson Medical Center. The Desert
Sanatorium was more successful in this regard. Finally, this case study sheds light on the important but overlooked, application of Nightingale’s principles in healthcare environment, specifically the Tucson Medical Center.

**Evidence of Nightingale’s Principles Today: A Brief Literature Review**

The following section discusses existing knowledge about the relationship between the design of healthcare environments and end-users. One characteristic of a healing attribute is its physical, psychological, and social psychological influence on patient well-being. A growing body of research indicates a relation to the health outcomes of end-users such as patients, family members, and staff by measuring among those attributes within healthcare facility. Various elements in the healthcare environment are composed to create either a specific or general appearance. Interior parameters in this section include lighting, view, noise, finish materials, artwork, and amenities. These were all topics that Florence Nightingale addressed in *Notes on Nursing*. Therefore, each topic is important for my dissertation.

*Ventilation and Warmth*

A strong and large body of evidence exists regarding the impact of the air quality on patient and staff outcomes in hospitals. Poor air quality and ventilation allow transmission of bacteria and put patients and staff at risk of hospital-acquired infections. The type of air filter, direction of airflow, air pressure, air changes per hour, humidity, and ventilation system

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maintenance all have been linked to infection rates. Today, careful design and maintenance of hospital HVAC system and use of HEPA filtration reduce the risk of infection.

Nightingale’s advocacy of fresh air and ventilation is indoctrinated into contemporary practice. Windows are no longer routinely opened in clinical areas of the hospital. Yet, advocates of energy efficiency and sustainable design state that natural ventilation can increase energy efficiency of buildings as well as improving indoor environmental conditions. According to the Green Guidelines for Healthcare Construction, a strategy for good indoor air quality is to “develop ventilation strategies that support operable windows, where appropriate.” Operable windows make the sensory stimuli such as smells and breezes available to occupants. The Leadership in Energy and Environmental Design (LEED) for Healthcare includes the “indoor environmental quality” category, which affects both staff and patients within a space. In this category, creating a space with high indoor air quality and specifying materials and adhesives that meet certain LEED standards of VOC emissions are key to obtaining points for certification.

Additionally, there are studies supporting the value of Nightingale’s emphasis on thermal comfort in the patient room. These studies show the relationship of temperature to health outcomes with inpatient surveys that identify uncomfortable temperatures—either too hot or too cold—as a cause of sleep disruption. Temperature and humidity are noted to affect particular processes such as wound


Vulnerable populations such as patients under anesthesia, patients with spinal cord injuries, infants with low birth weight, and the elderly have more extreme reactions to the adverse effects of temperature.

Today buildings are constructed to be climate-controlled in such a manner that the patient or nurse cannot control the temperature of the room. The increasing research being done on availability of local temperature or climate control for the patients and patients’ satisfaction has supported Nightingale’s concern about maintaining an appropriate temperature. Similarly, LEED for Healthcare in current practice recognizes Nightingale’s notion of maintaining appropriate temperatures. It includes the requirement for both thermal comfort design and thermal comfort:

- Provide individual thermal comfort controls for every patient room:
  Thermal comfort controls allow occupants to adjust at least one of the following in their local environment: air temperature, radiant temperature, air speed, and humidity.\(^{273}\)

**Lighting**

A large body of literature exists on the importance of natural sunlight on healing. Peter Barss and Kathy Comfort’s study shows that newborns in the obstetric ward at tropical hospitals critically exhibited an increased rate of neonatal jaundice from 0.5 % to 17 % because of the decreased amount of sunlight entering the ward after the installation of an exterior awning.\(^{274}\) N. P. Manns and others found that infants exposed to diurnally

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cycled lighting in intensive care had both physical and behavioral developmental benefits. They mimicking the circadian rhythms of light and noise in a newborn nursery increased the time preterm infants spend sleeping and improves their weight gain.

Kathleen Beauchemin and Peter Hayes conducted a study on the effects of sunlight in psychiatric inpatient rooms over a two-year-period. They randomly assigned psychiatric inpatients to rooms with an east or west orientation in a room with the daylight blocked. They found that patients in a room with bright light had an average of 2.6 fewer days in their hospital stay compared to patients in a room with the daylight blocked. Their findings also showed that patients in rooms that received more sunlight were less depressed.

Francesco Benedetti and others conducted a study for a three-year period by reviewing randomly assigned unipolar and bipolar patients to east or west facing rooms. They found there were significant differences in length of their stay for patients with bipolar disorder in the east facing rooms during fall and summer admission. Patients with bipolar disorder in east facing rooms had 3.67 days shorter length of their stay compared to patients in west facing room.

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A systematic literature review by Karin Dijkstra and others\textsuperscript{278} included four randomized clinical trials showing the effects of lighting on patient outcomes such as reduced use and cost of pain medication. Another meta-systematic literature review by Amy Drahota and others included one controlled clinical trial but did not find strong evidence for the effect of daylight on patients’ outcomes.\textsuperscript{279}

Joon-Ho Choi and others conducted a study on the effect of indoor daylight on patients’ length of stay. They used a quasi-experimental method with 1167 patients in four medical units.\textsuperscript{280} They conducted multiple independent t-tests in order to compare the southeast and northwest room orientations. Their findings indicated that the average length of stay in only two out of the 24 in the southeast room orientation was shorter than in the northeast room orientation. Although this study showed a relationship appeared to exist between indoor daylight and the average length of stay, their study provided scant evidence on the effect of a southeast orientation on patients’ length of stay.

In summary, the evidence for the positive impact of light on health and well-being of humans is the best established in the physical healthcare setting. There is evidence supporting the assertion that patients with natural lighting in their hospital rooms stayed fewer days and were less depressed. One systematic literature review found that effects of

\footnotesize\textsuperscript{278} Karin Dijkstra, Marcel Pieterse, and Ad Pruyn, “Physical environmental stimuli that turn healthcare facilities into healing environments through psychologically mediated effects: systematic review.” \textit{Journal of advanced nursing} 56, no. 2 (2006): 166-181.


lighting included reduced use and cost of pain medication. The quasi-experimental study on southeast facing rooms provided weak evidence to support that southeast facing rooms reduce the length of stay.

A number of strong empirical studies exploring the importance of natural light to healing support Nightingale’s notions regarding natural light. Bright light in the patient room contributes to faster recovery of the depressed patients in a psychiatric unit. Daylighting was found to have statically significant effects on shorter stays, lower stress, less pain, lower intake of pain medications and even lower mortality. The increase in natural light influences the quality of the staff’s work life in the hospital as well.

Nightingale’s notion of providing natural lighting in the ward still remains a key physical element for contemporary healthcare settings. The 2014 Guidelines for Design and Construction of Hospitals and Outpatient Facilities states that “each patient room shall be provided with natural light by means of a window to the outside.” Designers consider that lighting can play a critical role in the perception of the hospital environment. Nightingale recommended a thin-fabric curtain as window treatment, and today blinds, shades, and curtains are useful in contemporary patient rooms to allow patients to avoid direct sunlight. It is desirable that bedridden patients can control those window treatments from their beds.

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A large body of research is consistent with the proposition that patients benefit from exposure to nature, even a brief view of a garden or interaction with a natural element. Larkin Wilson found patients in intensive care units without windows had significantly higher incidences of organic delirium than did patients in rooms with windows.285 His conclusion indicated that the presence of windows is highly recommended in the intensive care unit in order to prevent sensory deprivation. Roger Ulrich’s landmark study examined the effect of views out of windows on patients recovering from gallbladder surgery.286 He found that patients recovering from surgery in rooms with a view of nature “had shorter postoperative hospital stays, had fewer negative evaluative comments from nurses, took fewer moderate and strong analgesics doses, and had slightly lower scores for minor postsurgical complications” compared to patient rooms with a view of a brick wall.287

In related research by Stephen Verderber, 125 staff and 125 inpatients in the physical medicine and rehabilitation units viewed 64 color photographs depicting illustrated conditions in eleven hospitals and answered questionnaires regarding desirable window views. Rooms in the patient living area, treatment areas, and staff areas ranged from windowed to windowless. Respondents preferred the photographs with tree and


287 Ibid., 421.
lawns, neighborhoods surrounding the hospital, people outside the unit, and vistas. As part of his conclusion, he defined an informative window view as one that satisfied the human predilection for visual information about their environment to aid comprehension of their environment and to facilitate coping with the environment. Stephen Verderber and David Reuman’s non-experimental study also prompted a preference on the part of patients and staff by using a photo questionnaire on desirable window views. But this study has weakness since it included brain-injured patients whose mental status was not evaluated.

Seong-Hyun Park and Richard Mattson conducted a quasi-experimental study to investigate whether plants influence the recovery of patients who underwent an appendectomy. This study designed treatment rooms with a plant and compared the data for each patient between treatment room with a plant and ones without plants. Their findings showed that patients in rooms with plants and flowers had significantly more positive health outcomes such as lower systolic blood pressure, lower ratings of pain, anxiety, and fatigue than patients in rooms without plants. They also found that patients with plants evaluated their room as more satisfying. This study indicates that plants in the healthcare environment have therapeutic value to surgical patients.

In summary, there is evidence supporting the theory that windows and views of nature impact patients’ length of stay, medication consumption, and postsurgical


complications in a healthcare setting. Researchers suggest that end-users prefer nature scenes over urban ones with benefits such as aiding comprehension of their environment and coping with the environment, but this study had a methodological flaw due to improper sampling. There was a single study showing that plants in the healthcare environment had resulted in positive outcomes for patients. While findings from several studies provide strong evidence that there is a critical relationship between the design variables of nature and views and the outcome of end-users, it remains vague whether the positive outcomes resulted from the effects of window, light, and view or a specific combination of those variables.

Several studies support Nightingale’s notion on views and their effect on patient recovery. A view of nature through a window at inpatient units has been correlated with shorter postoperative hospital stays, and higher satisfaction with nursing care.290 Views of nature can reduce anxiety and pain and have a restorative effect on patients and even staff. 291 Surgical patients in postoperative units without windows to the outside developed twice as many cases of postoperative delirium during a 72-hour period as those with windows.292


Current standards for healthcare facility design echo Nightingale’s principle on providing views. The 2014 Guidelines for Design and Construction of Hospitals and Outpatient Facilities states:

the design for a healthcare facility would include direct physical access to the outdoors as well as views of nature and indoor garden/atria. When direct access is not possible, suitable alternatives could include gardens with natural light (atria) and visual access to nature.293

The LEED for Healthcare also includes the requirement of making a connection to the natural outdoor environment by providing quality views.

**Noise**

Hospitals are noisy places. Noise is one of the deleterious environmental stressors to patients. It interrupts sleep. Margaret Topf and Jean Davis conducted a quasi-experimental study on healthy volunteers to assess sleep in those exposed to the critical care unit (CCU) noise.294 Seventy healthy women were randomly assigned to sleep in a lab under quiet conditions or listening to an audiotape recording of CCU sounds. They found there were statistically significant decreases in rapid eye movement (REM) sleep, duration of REM sleep and increased duration of time between REM cycles in patients exposed to CCU noises. Although this study has limitations that result from the use of volunteers in a lab and might not apply to patients in the CCU, it provided preliminary evidence that CCU noise affects REM sleep.

293 Ibid., 24.

Another study showing the relationship between sleep and noise was conducted by Southwell and Wistow. They identified the sources of disturbance on patient’s sleep in the hospital at night by method of using a questionnaire. Their findings indicated that one-third of patients were disturbed by other patients making a noise, a quarter by nurses attending to other patients, and a fifth by telephones ringing. They found that 22% of inpatients who slept well at home had trouble sleeping in the hospital.

Aaron and colleagues found there was a significant correlation between noise and EEG arousal from sleep in the ICU. Gabor and others studied the effects of noise and patient care activities on sleep in ICU patients. Their finding indicated that these factors account for less than 30% of sleep arousals and awakenings. Two studies on noise and sleep disruption by Aaron and Gabor have limitations in their statistical test due to insufficient sample sizes.

Noise also creates a stressful environment for the hospital staff. There were two studies on noise and its effects on nursing staff. Morrison and colleagues conducted a study on the relationship between hospital noise and nursing stress employing a cohort observation-method. Their finding indicated noise was shown to correlate with stress in

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ICU nurses. This study has limitations on inclusion of insufficient sample size. Additionally, it has a competing hypothesis of elevated unit noise indicating patient acuity which affects nurse stress. Blomkvist and others conducted a study on the influence of different acoustic conditions on the work environment and the staff in a coronary critical care unit. They found that the nursing staff perceived significantly lower work demands, pressure and strain in units with sound reflecting tiles. Their study shows that improving room acoustics via sound absorbing tiles improves staff outcomes.

Additionally, there was study on noise reduction intervention. Overman Dube and her colleagues conducted a quasi-experimental study with pre and post-test noise assessments. Interventions to reduce noise in their study were padding chart holders, padding pneumatic drop stations, installing quieter paper towel dispensers, adding signs requesting quiet and closing the patient room doors. Their findings showed that noise reduction interventions resulted in significantly reduced noise in all shifts but the night shift.

In summary, there is evidence supporting the notion that noise in the critical care unit affected the rapid eye movement of patients during their sleep and was listed as one of the top disturbing resources for patients’ sleep. Additionally, researchers suggest that

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noise creates a stressful environment for staff. Lastly, there was a study that various interventions such as padding chart holders and adding signs requesting quiet helped significantly reducing noise. Some of the significant findings in sound and noise aligned with Nightingale’s nursing canons in *Notes in Nursing* (1859). Nightingale listed noise as one of the particular aspects of interest for the healthcare environment: “Unnecessary noise is the most cruel absence of care which can be inflicted either on sick or well.”

*Finish Materials*

Ulrich and others’ integrative literature review included one quasi-experimental study by Hagerman and others. Hagerman and colleagues investigated use of acoustic tiles and its effect on heart rate, heart rate variability and blood pressure in the intensive coronary heart unit at Huddinge University Hospital. The methodological flaw—that they did not assess the hearing of their study sample— influenced the conclusion of the study. Another integrative literature review by Ulrich and others found two quasi-experimental studies on the effect of finishing materials in healthcare environment. Soren Berg found the mean number of arousals from sleep was significantly lower in a room

301 Nightingale, *Notes on Nursing: What it is, and what it is not*, 27.


with acoustic tiles. Kathleen Philbin and Lincoln Gray found that finishing with acoustic tiles decreased the level of noise in an intensive care nursery. Ulrich and others’ second integrative literature review provided evidence that acoustic tiles have positive effects such as assisting patients’ sleep and decreasing noise levels.

Mary Lankford and her colleagues evaluated fourteen specific types of flooring, wall finishes, and upholstery fabric after contaminating them with Pseudomonas aeruginosa (PSAE) and vancomycin-resistant enterococci (VRE). Samples were cleaned according to manufacturers’ recommendations. To assess the transmission of the surfaces, healthy volunteers touched inoculated samples with their hands. They found that all surfaces contaminated with VRE remained contaminated for a week; but contamination levels dropped for 11 of the materials except for VCT, microvented perforated vinyl wallcovering, and continuous monofilament polyethylene textile paper-backed wallcovering. Their findings alert designers to consider both product application and complexity of manufacturer’s recommendation for surface disinfection in selecting materials for any healthcare setting. This study also calls attention to the importance in cleaning environmental surfaces with proper products.

Anders Nyrud and others conducted a non-experimental study with surveys of patients and staff on their preference for natural materials like wood as a finish in a


hospital room. The amount of wood used in the interior of a hospital room was
differentiated in three photographs: all wood with wood paneling on all four walls and
ceiling, intermediate amount of wood with wood paneling on a single wall opposite the
head of the bed, no wood paneling. Their findings indicated that most staff preferred the
room with the intermediate level of wood, but only six patients participated in the survey
and did not agree with the staff. This study provided some guidelines for which amount
of wood should be used in interiors of hospital room, but there was no further information
provided by these patients regarding their preferred amount of wood in room.

A study by Paul Harris and others showed that patients referenced finishing
materials used in room as a source of the satisfaction in their hospital stay. But, this
study did not indicate which finishing material in a hospital patients preferred. In another
study, Amy Drahota and others used a meta-systematic literature review to conduct a
single study on patient falls and their relationship to flooring materials of carpet and
vinyl. Their finding indicated there was no critical effect between patient falls and
flooring materials due to insufficient evidence.

In summary, one systematic literature review found one the study on use of
acoustics tiles and its effects upon patients’ outcomes, but this study had methodological
flaw due to its sample size. But another systematic literature review found two studies

308 Anders Q. Nyrud, Kristian Bysheim, and Tina Bringslimark, “Health Benefits from Wood Interior in a
Hospital Room.” In Proceedings of the International Convention of Society of Wood Science and

309 Paul B. Harris, Glen McBride, Chet Ross, and Linnea Curtis, “A Place to Heal: Environmental Sources
of Satisfaction Among Hospital Patients.” Journal of Applied Social Psychology 32, no. 6 (2002): 1276-
1299.

310 Ibid.
providing evidence that use of acoustic tiles had influenced assisting patients’ sleep and decreasing noise level. Additionally, the study about specific types of flooring, wall finishes, and upholstery fabric after contaminations with PSAE and VRE found that designer should consider not only product application and complexity of manufacturer’s recommendation but also cleaning protocols for the environmental surfaces. The research investigating wood as a finishing material provided insufficient data as to whether patients would prefer wood as an interior finishing material, or the amount of wood preferred. Further, there is evidence supporting that finishing materials used in patient room was one of the sources of their satisfaction. The researcher suggests that there was no critical relationship between patient falls and floor materials such as carpet versus vinyl. Some of the findings in finish materials aligned with Nightingale’s recommendation for materials and finishes and for maintaining clean rooms. Nightingale recommends oak wood, pine wood, or tiles as the ideal floor material in the ward.311

Sanitation

There is evidence to support Nightingale’s principles on maintaining clean rooms for controlling infection. In one study, conducted by Harris and others, patients provided comments referring to cleanliness as a source of satisfaction with the healthcare environment.312 McFarland’s study also validates that environmental contamination

311 Ibid., 69.

directly contributes to outbreaks of infection. It shows that a toilet chair was the main cause of the secondary spread of Clostridium difficile to eight patients in a single ward environment within one week. He concluded that thorough cleaning of the environment and of equipment could have prevented this costly outbreak.

Additionally, there is evidence to support Nightingale’s recommendations for materials and finishes. Patients identified finishing materials used in hospital rooms as a source of satisfaction with the healthcare environment. The British Department of Health published a report entitled with “Winning Ways: working together to reduce healthcare associated infection in England.” This report recognizes that environment is a potential reservoir of infection and suggests that surfaces and furniture should be durable and easily cleaned.

Some of Nightingale’s restrictions against carpet, fabrics, and wall paper can be offset to some degree because of current advanced cleaning mechanisms like vacuum cleaners. But many of Nightingale’s principles on sanitization are still incorporated into infection control in healthcare design practice. The 2014 Guidelines for Design and Construction of Hospitals and Outpatient Facilities states that the selected surfaces for flooring and walls should be cleanable and water-resistant.


314 Ibid.


316 Ibid., 88-92.
Jain Malkin, a leader in the field of healthcare interior design, provides three criteria in selecting interior material and finishes in order to secure sanitation:

- Cleanibility of wallcovering, flooring and other interior finishes,
- Asepsis (inability to support bacteria) of interior finish materials, and
- Homogenous character of materials to eliminate pores or cracks that may support bacterial growth.317

Malkin’s suggested criteria for selecting interior and finishes could almost have been taken word for word from Nightingale’s.

**Art**

Paul Harris and others conducted a study on patient satisfaction among hospital patients with a qualitative analysis of open-ended questions regarding the sources of satisfaction with the hospital room. 318 They defined interior design features as less permanent aspects of the hospital environment such as furnishings, nonmedical equipment, colors, finishes, and artwork. They found that art was a source of satisfaction with the patient. But they did not describe what type of art led to patients’ satisfaction.

Sarajane Eisen and others defined nature arts as the images dominantly containing natural vegetation, flowers or water.319 They used a three-phase, multi-method approach with children aged 5-17 years including a focus group study, a randomized study, and a quasi-experimental study design. They found that children and adolescents responded

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318 Ibid.

positively to representational nature artwork in the healthcare setting. But the study findings indicated that hospitalized pediatric patients responded more to social support.

Norma Daykin and others investigated the effects of visual art on the well-being of patients and staff in mental health settings with a systematic review of papers.  

Although their study did not provide the definition of art, the inclusion criteria shed light on the breadth of art. Daykin and others found that exposure to the art might not only reduce anxiety and depression in specific groups of patients but also positively affected clinical and behavioral outcomes. Their findings also indicated that there is evidence that those patients preferred calming artwork with naturalistic and domestic imagery to abstract or challenging art. They did not define ‘challenging art’, but raised the question in their conclusion of whether there is a role for other models of art that might be perceived as challenging.

Jane Duncan conducted a quasi-experimental study with expectant mothers in a labor and delivery room. A specially made art-screen was installed in order to conceal emergency equipment as well as to provide a focal point of attention so that women could reduce the level of their anxiety. After anecdotal information gathered from expectant mothers in regards to their color preferences, there was the execution of two color palette on the abstract art-screen including earthy warm and aquatic cool tones. The researcher included her reasoning for her choice of an abstract design to provide an open


interpretation by the viewer, but it was not fully detailed. She found there were significant differences between treatment and control groups in shortening their labor-duration by 2.1 hours. The control group was formed by women giving birth in the unchanged room. Duncan did include the photos of screen options with different color palettes that the study group saw during their delivery, but did not include in her conclusion the difference in those seeing a warm vs. cool color palette.

Franco Trevisani and others conducted a non-experimental study by using patient questionnaires in regards to physical, psychological, and social well-being, and ward functioning. They installed a 25-panel black and white photographic exhibit in the internal medicine unit. This depicted realistic images of people doing everyday activities such as enjoying a summer day at the beach and eating watermelon. The exhibition area included the entrance, corridor, and dining room of the ward. Their findings showed 72 percent of patients felt browsing an exhibition of photographic panels helped to make their hospital stay more pleasant. Further, embellishing the clinical spaces with artistic photographs helped patients to cope with their stress during their hospitalization.

Pati conducted a study to investigate the influence of positive distractions in the dental and cardiac clinic waiting areas at the Children’s Medical Center of Dallas. He defined a positive distraction as “an environmental feature that elicits positive feelings and holds attention without taxing or stressing the individual, thereby blocking


323 Debajyoti Pati, “Positive distractions in waiting areas could be an advantage for hospitals.” Healthcare Design Magazine, March 2010:28-34.
worrisome thoughts.”

Five distractions using ambient art were installed: a nature slide show without audio, an aquarium with audio, an aquarium without audio, ambient art with audio, ambient art without audio. Ambient art, using modern technology to create a number of visual and audio teasers within a common art theme, was displayed on a 23-inch flat screen television. His findings indicated that there were benefits from positive distractions using nature-themes for both adults and children. These included the reduction of pain and anxiety, improved energy, and other desirable physiological and psychological outcomes.

In summary, the research suggests that the use of artwork improved patient satisfaction, reduced anxiety and depression, and helped the patients or visitors to cope with their stress. Additionally, there is evidence supporting that the use of artwork with natural and domestic imagery or illustration reduced labor by 2.1 hours. The research also suggests that using ambient art could function as a positive distraction and patients and visitors have benefits such as reduction of anxiety and improvement of energy from those positive distractions. Findings from these studies support the inclusion of naturalistic art work that Nightingale advocated. Nightingale suggests rotating ten or twelve paintings and prints regularly in order to provide greater visual variety to the patients.

Amenities

Roger Christenfeld and others conducted a study on the effects of a remodeled ward in a psychiatric hospital. They employed mixed methods including a qualitative

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324 Ibid., 30.
325 Ibid., 84.
descriptive structured interview and a quasi experimental study with pretest posttest
design. Renovation of the ward in a psychiatric and a medical surgical unit included
seating areas with furniture arranged for television viewing, games, social interaction,
non-institutional clocks, full length mirrors, upholstered furniture, dining room furniture,
daybeds and hotel-like furniture. Multiple simultaneous interventions confounded the
effects of the renovation in the unit versus questioning if just one intervention had a more
critical effect than another. The results were difficult to interpret; therefore there was no
conclusion in regard to design suggestions drawn from this study for renovation of ward.

Paul Harris and others’ study provided information on the amenities that satisfied
patients with their hospital room. They conducted a phone interview with the
discharged inpatient by asking open-ended questions about their hospital room. Their
findings showed respondents were satisfied with having a comfortable bed, working
telephone and television, and appealing room color. But their study does not provide
further detailed specification regarding which amenities satisfied patients.

Wyona Freysteinson and Sandra Cesario conducted a non-experimental and
descriptive study on the quantified availability and accessibility of mirrors in patient
rooms at ten hospitals in the United States. Their findings indicated that mirrors for
bed bound patients were not available in 70% of hospitals. They also found that 90 % of
hospitals did not provide mirrors allowing patients to view their entire body. Yet, their

326 Roger Christenfeld, James Wagner, Mr Wagner Gary Pastva, and Ms Wendy P. Acrish, “How physical
settings affect chronic mental patients.” *Psychiatric Quarterly* 60, no. 3 (1989): 253-264.

327 Ibid.

328 Wyona M. Freysteinson, and Sandra K. Cesario, “Have we lost sight of the mirrors?: the therapeutic
evidence was insufficient to make recommendation for using mirrors in patient rooms. They did not include the impact of mirrors and their effect on physical settings for patients’ recovery.

Dana Goldman and John Romley studied patients’ preferences on the amenities in their hospital stay by using a marketing survey in Los Angeles. They argued that patients value the amenities such as good food, attentive staff, and pleasant surroundings, all basic requirements in the hospitality industry. They found these amenities played an important role in generating hospital demand. Their finding indicated that patients value the amenities twice as much as they value the clinical reputation in making their hospital choices. They mentioned a couple of possible amenities such as daybeds for family members, wireless Internet access for patient and guests for consideration to be included in patient rooms. But they did not provide the details of the amenities the patients valued most.

Another study on providing hotel-like amenities in hospitals provides further information on the details of features. Ziqi Wu, Stephani Robson, and Brooke Hollis in their study, “the Application of Hospitality Elements in Hospitals,” identified physical hotel design elements and associated operational features used in the healthcare arena by interviewing hospital and hotel design experts. Hospitality elements applied in existing hospitals in this article included hotel-like rooms and décor; actual hotels incorporated


into medical centers; hotel quality food, room service, and dining facilities for families; welcoming lobbies and common spaces; hospitality-oriented customer service training; enhanced service offerings, including concierges, spas or therapy centers; hotel-style signage and way-finding tools; and entertainment features. They conclude that hotels and hospitals have common criteria in designing their facilities such as function, cost-effectiveness, and meeting the missions of their organization. Yet, the primary goal of the hospital remains providing quality clinic care.

In summary, one mixed methods study and one quasi-experimental study investigating the effects of remolded patient rooms did not provide sufficient evidence to inform evidence based design conclusions. The single non-experimental and descriptive study on the availability and accessibility of mirrors in patient rooms provided insufficient evidence for the impact of mirrors and their effect on recovery of patients. But there is evidence supporting that patients chose the amenities such as a bed, television and telephone as one of their sources for satisfaction. Further, the researchers suggest that patients value hotel-like amenities including daybeds and wireless Internet access in making their hospital choices. Findings from the research on the amenities are in line with Nightingale’s recommendation on the use of artwork, flower, trees, and furnishings with which patients might interact for their comfort.

In spite of the increasing body of empirical studies suggesting a relationship between the hospital environment and the patient or staff’s perception or outcomes, this section of literature review shows that it still remains challenging to investigate the relationship between various design parameters and end-users’ perceptions. The large
number of variables involved might cause methodological challenges to measure perceptual responses from the end-users.

Overall, the existing literature confirms that characteristics of the physical settings in which patient receive care affect the health outcomes or well-being of the end-users. The thrust of the research findings reviewed in this section support the importance of sunlight, a natural view through windows, noise-free environment, finish materials, artwork, and amenities in healthcare facility. Many of the studies have some limitations with respect to conceptual or methodological issues, but the overall weight and consistency of the literature supports Florence Nightingale’s theories. Design interventions made by these individual variables play a significant role in influencing the health and well-being of end-users such as patients, visitors, and staff.

Moreover, the thrust of the literature resonates with aspects of Nightingale’s recommendations on hospital design including sanitization, color, noise, light, view and variety. The current literature makes a convincing argument for understanding Florence Nightingale’s recognition of the impact of the built environment on the patient. Researchers are still challenged to reveal the profound impact of the physical environment on a wide range of areas from patient outcome and length of hospital stay to medical errors.

**Conclusion**

The literature review shows that today’s scholars and healthcare providers still turn to Florence Nightingale’s principles for inspiration. They still see her work as relevant. Some of the significant findings are in line with Nightingale’s recommendations
on hospital design. Also, the literature review shows that, for too long, scholars have
analyzed hospital architecture without considering the importance of hospital interiors.

Current research studies on the impact of the designed environment on the end-
users demonstrate that patients are aware of and respond to interior design features in
their rooms. Also, many patients seem to be aware of the same interior elements that
Florence Nightingale addressed in her influential books of the 1850s and 1860s, even
though they have not read her books, or may not know anything about her.

The case study shows that primary documents are available to tell an important
story about the history of the hospital interior. The matrix (Figure 2) shows a possible
way to analyze such photographs, plans, sections, and visits to the extant building.

Because of its climate, the Arizona Territory and early state of Arizona (after 1912) was a
healthcare mecca, especially for those with tuberculosis. Today, it remains a center for
innovative healthcare design.

A structure like the Desert Sanitarium shows just how welcoming and supportive
a 1920s healthcare facility could be. It epitomizes Florence Nightingale’s principles,
while still reflecting the local climate and context, including indigenous pueblo
architecture, traditional Southwestern materials, Native American artifacts, desert views,
and even the traditional courtyard plan used by Spanish colonial settlers. This suggests
that Nightingale’s principles are adaptable to different places and times, because they
are so fundamental and universal.

It is humbling to consider that the current design and medical professionals still
are challenged by the similar environmental attributes that beset Florence Nightingale
more than 150 years ago. In this context, Florence Nightingale’s principles honor and
acknowledge age-old approaches to healing that date all the way back to the ancient
Greeks; yet, they are still relevant today. Nightingale is not of the past; her message
resonates as forcefully today as in her lifetime.

Research Implication

This study validates the use of an interdisciplinary postmodern approach
combining observations in practice with scholarly research. The integration of material
culture analysis and content analysis led to the identification of concepts underlying
interior design in the healthcare environment. This study verifies Nightingale’s nursing
theory and expands on it by testing it materially within a hospital building in Arizona. In
this regard, findings validate Victor Margolin’s argument regarding historical design
scholarship, and give credibility to his prior theory by verifying it using an historical
process.331 This study integrates material culture analysis to reveal the relevancy of
Nightingale’s principles in the design approaches at the Tucson Medical Center,
therefore, findings validate Jules Prown’s argument that physical analysis gives credibly
to textual theory, and affirms the usefulness of his methodology.332

In addition, this dissertation argues in favor of the importance of interior design
amenities in patient care areas. These areas should not be after thoughts; they should
receive thoroughly researched, creative design analysis even at the expense of more
public areas.


Above all, understanding Florence Nightingale’s nursing theory—from the perspective of interior design—expands the existing scholarship and contributes essential information to the practice. The findings have important implications for professional practitioners who specialize in healthcare environments and students in design programs. Critical design thinking and a more nuanced understanding of issues is possible by understanding the historical context of the healthcare environment and the development of its important design issues.

*Additional Areas of Research*

This study sought to identify Florence Nightingale’s guidelines regarding hospital design. The Planetree and Samueli Institutes are two representative organizations focusing on defining and promoting optimal healing environments today. Both organizations set the standard for the physical design of the healing environment. Conducting a study to compare Nightingale’s nursing principles with the contemporary standards proposed by these two organizations might offer additional information to inspire further research.

One possible source of the future research would be to replicate the current study’s content analysis, focusing only on Nightingale’s writings such as Notes on Hospitals. Another source from which content analysis could be performed includes non-design professional journals in medicine, nursing and environmental design that are focused on the impact of healthcare environments and that have resonance with the aspects of Nightingale’s guidelines on hospital design.

Other areas for future research include case studies and specialized applications. The case study on the Tucson Medical Center could be replicated with other similar case
studies in other states or countries. Future researchers might consider whether Nightingale’s principles apply to other facilities such as the school infirmary. Future studies could also apply Nightingale’s principles to other sorts of healthcare interiors, such as the lobby, the meditation room, or a staff break room. These areas for future research would expand upon the existing study and could further validate the relevancy of these findings to a broader audience.
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FIGURES

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| Middle-ground Visual: |
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| Equipment            |
| Wall finish          |
| Floor finish         |
| Other                |

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Hospital construction defect that prevented health

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- Defective ward furniture
- Defective accommodation for nursing
- Defective hospital kitchen
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- Selection of bad sites and bad local climates for hospitals.
- Erecting of hospitals in towns
- Defects of sewage
- Construction of hospitals without free circulation of external air

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<tr>
<td><strong>Ventilation and Warming</strong></td>
<td>Provide pure air within and without, to open windows, and to regulate room temperature</td>
<td>Organizations maintain ventilation and temperature levels suitable for the care, treatment, or services provided</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Develop ventilation strategies that support operable windows, where appropriate</td>
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<tr>
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<td></td>
<td>Provide individual thermal comfort for every patient room</td>
</tr>
<tr>
<td><strong>Ventilation</strong></td>
<td><strong>The best number of the beds in a ward ranges from 20 to 32 sick</strong></td>
<td>Provide single occupancy rooms: private patient room at least 60 sq. ft. not including closet;</td>
</tr>
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<td></td>
<td></td>
<td>Or provide shared room with 60 sq. ft. for each person and no more than 4 to a room and 3ft. between beds</td>
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<td></td>
<td><strong>A ward should be at least fifteen to sixteen feet high; the distance between the opposite windows not more than thirty feet; providing the windows reach to within one foot of the ceiling</strong></td>
<td>The interior feels light and airy</td>
</tr>
<tr>
<td></td>
<td><strong>Regarding space and area to the bed, there should be space sufficient between each side of adjacent beds.</strong></td>
<td>Carefully design and maintain hospital HVAC system</td>
</tr>
<tr>
<td></td>
<td><strong>Every ward must have its own ventilation distinct and separate from that of every other ward</strong></td>
<td>Use HEPA filtration</td>
</tr>
<tr>
<td></td>
<td><strong>Fumigation, the offensive smell should be removed.</strong></td>
<td><strong>Light</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The axis of a ward should be as possible north and south; the windows on both sides, so that the sun shall shine in at one side or the other</td>
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<tr>
<td></td>
<td><strong>Provide a room with natural light and windows is essential to both the health and recovery of patients;</strong></td>
<td>Provide east facing windows</td>
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<td><strong>Windows must not be tightly sealed;</strong></td>
<td>Spaces where staff and patient spend time have windows;</td>
</tr>
<tr>
<td></td>
<td><strong>Provide window coverings only with light, thin, washable curtains</strong></td>
<td>Each patient room shall be provided with natural light by mean of a window to the outside</td>
</tr>
<tr>
<td></td>
<td><strong>Provide a window at least should be allotted for every two beds; the window to be not less than 4 feet 8 inches wide, the sill within 2 or 3 feet of the floor; The windows should reach from two or three feet of the floor to one foot of the ceiling.</strong></td>
<td>Patient can easily open the windows</td>
</tr>
<tr>
<td></td>
<td><strong>Provide a room with view; Patients should be able to see out of a window from their beds; Provide view instead of looking against dread wall</strong></td>
<td>Patient and staff easily exclude sun light and daylight;</td>
</tr>
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<td></td>
<td>Provide window treatment such as blinds, shade, and curtains</td>
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<tr>
<td></td>
<td><strong>Window sill no more than 44 inches off the floor</strong></td>
<td><strong>View</strong></td>
</tr>
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<td>Provide direct physical success to the outdoors as well as views of nature and indoor garden/atria. When direct access is not possible, suitable alternatives could include gardens with natural light (atria) and visual access to nature;</td>
</tr>
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<td>Provide a window view of nature visible from the hospital bed</td>
</tr>
<tr>
<td>Cleanliness of Rooms and Walls</td>
<td>Maintain a clean room with walls, carpets, and furniture that are dust-free, using correct dusting techniques with usage of a damp-cloth, not a feather duster</td>
<td>Areas used by individuals served are clean; Organization keeps furnishing &amp; equipment safe and in good repair; The interior looks clean, tidy and cared for</td>
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<tr>
<td>Do not specify absorbent materials for floors, walls, and ceilings; Use impervious materials capable of receiving a polish on a white or tinted surface would make the best lining for a hospital ward; All the woodwork should be painted and varnished; The joints of the flooring must be fitted well together and cemented with any impervious substance; The corridors should be floored with diamond-shaped flags or tiles which stand better than those laid in the usual manner; The terrace over the corridors might be either covered with asphalt or glazed tile so that convalescents can walk on them and patients wheel out on them.</td>
<td>The selected surfaces for flooring and wall should be cleanable and water-resistant; Select cleanable wallcovering, flooring and other interior finishes; Select interior finish materials with Asepsis (ability to support bacteria); Select homogenous character of materials to eliminate pores or cracks that may support bacterial growth</td>
<td></td>
</tr>
<tr>
<td>Variety</td>
<td>Provide changes in form and color such as bringing a brightly colored flowers or growing plants in the ward. Provide plants</td>
<td>The interior has provision for art, plants and flower</td>
</tr>
<tr>
<td>Variety</td>
<td>Rotate ten or twelve paintings and engravings each day, week, or month to provide variety to the patient</td>
<td>Provide calm, naturalistic and domestic artwork or photography</td>
</tr>
<tr>
<td>Furnishings</td>
<td>The adjacent area per bed should be not less than 100 square feet (in order to provide room for free movement of three or four persons allowing the use of a night-chair, without annoying the next patient, and use of a portable bath when required)</td>
<td>Patient has table or other surface</td>
</tr>
<tr>
<td>Furnishings</td>
<td>The distance from foot to foot of opposite beds should be provided (in order to allow space for a movable dresser or table, benches on either side, and easy passage way)</td>
<td>Patient room contains storage space such as dresser or chest</td>
</tr>
<tr>
<td>Furnishings</td>
<td>Include several furnishings around the patient bed: a light chair for each bed, two or three spare arm chairs for patients who get up for the first time to sit at the ward fire; a small open bed-table for each bed; two or more tables or moveable dressers down the center of the ward</td>
<td>There are easy chairs, tables, and desks in the patients’ spaces; Where possible seating should be capable of being arranged to enable family and visitor to be comfortable and sociable.</td>
</tr>
<tr>
<td>Furnishings</td>
<td>Use an iron bedstead with not above three and half foot wide mattress made of a thin hair; Paint bedstead with a light cheerful color; Provide a head shelf to the bed; Get rid of the old four-post with curtains from the bed</td>
<td>Furnishings and equipment should reflect the ability and need of the individual served</td>
</tr>
</tbody>
</table>

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... The Courts

Moqui, Yavapai, Hopi and Papago Courts

| No. | Room Type     | 1951
|-----|---------------|--------
| 6   | Bed Room     | 208    | 2,500  |
| 7   | Porch        |         | 75     | 900    |
| 8   | Bed Room     | 208    | 2,500  |
| 9   | Porch        |         | 75     | 900    |
| 10  | Bed Room     | 208    | 2,500  |
| 11  | Porch        |         | 75     | 900    |
| 12  | Nurses Office| 100    | 1,200  |
| 13  | Kitchen      | 83     | 1,000  |
| 14  | Utility Room | 25     | 300    |
| 15  | Porch        |         | 75     | 900    |
| 16  | Bed Room     | 208    | 2,500  |
| 17  | Porch        |         | 75     | 900    |
| 18  | Bed Room     | 208    | 2,500  |
| 19  | Porch        |         | 75     | 900    |
| 20  | Porch        |         | 75     | 900    |
| 21  | Bed Room     | 208    | 2,500  |
| 22  | Bed Room     | 208    | 2,500  |
| 23  | Porch        |         | 75     | 900    |
| 24  | Bed Room     | 208    | 2,500  |
| 25  | Bed Room     | 208    | 2,500  |
| 26  | Porch        |         | 75     | 900    |

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