DESIGNING SPACES THAT SUPPORT HEALTH FOR THE WHOLE PERSON: A SENSORY PROCESSING PERSPECTIVE OF HEALTHCARE DESIGN IN COMMUNITY-BASED SETTINGS

by

MOLLY PIERCE, OTR/L

UNIVERSITY OF OREGON

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Approved by:

Dr. Doug Blandy, Professor
Arts and Administration Program
School of Planning, Public Policy, and Management
University of Oregon

DESIGNING SPACES THAT SUPPORT HEALTH FOR THE WHOLE PERSON:
A SENSORY PROCESSING PERSPECTIVE FOR HEALTHCARE DESIGN AND ART
IN COMMUNITY-BASED SETTINGS

Molly Pierce, OTR/L, MS in Arts Management, 2019

Abstract

There are many barriers to built environments that affect health, well-being, and accessibility. Interdisciplinary models are informing healthcare design that addresses many of these barriers to support health. This research expands on the best practices using a sensory processing model to understand how the key principles of design fit into a sensory assessment to gain greater awareness for the effects on health and well-being from the built environment. There is potential to go beyond just meeting the best practices for building and ADA requirements in order to create beautiful aesthetically designed spaces that are universal, engaging and calming, and support all abilities. Understanding how a space can affect the sensory nervous system by causing anxiety, stress, or being overstimulating can inform design and is the focus of this research. The Sensory Design Assessment Tool was developed to understand how best practices of design and human context fit into a sensory processing model for vision, auditory, tactile/touch, movement/space, and oral/olfactory. By using a sensory processing theory for design, along with the concept of creative placemaking and engaging in arts and health, design for community based settings can be universal, beautiful, and supportive for all users within the community.

Keywords:
Evidence-based healthcare design, interdisciplinary models of design, sensory processing, multisensory design, psychoneuroimmunology, salutogenic design, arts and healthcare, creative placemaking, universal design, community health centers

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Mary J Pierce (Molly)

2470 Adams Street, Eugene, OR 97405 cell (541)517-1416
mollypierce06@gmail.com

Education

Master of Science, Arts Management (Arts and Healthcare Concentration)
University of Oregon, Eugene, Oregon
June, 2019

Certificate for Nonprofit Management
University of Oregon, Eugene, Oregon
June, 2019

Bachelor of Science, Occupational Therapy
University of Puget Sound, Tacoma, Washington
May, 1987

Experience

Occupational Therapy

- 30 years' experience in the field of Occupational Therapy with specialty and certifications in (SI) Sensory Integration theory and treatment and (NDT) Neurodevelopmental Therapy; Pediatric Feeding Specialist.
- Provided assessment, planning and treatment for children, adolescents, and adults.
- Trained health and education professionals, graduate students, and families.
- Fostered family service care with transdisciplinary medical professionals.
- Supervise and mentor graduate and undergraduate students.
- Provided specialty trainings through state conferences and community based programs.
- Developed therapeutic programs for children with sensory modulation challenges.
- Advocated for families and children with disabilities.
- Pediatric Occupational Therapy consultant and educator for international nonprofit programs in Nicaragua and Tanzania.
- Provided volunteer trainings, education and mentorship for Nicaraguan staff.
- Assisted in the development of play based and movement curriculum for children with disabilities for the nonprofit Cielo de Amor.

Design and Planning

- 15 years' as design consultant for Pierce Construction and Design, Inc.
- Experienced in designing and creating sensory calming spaces/rooms for children and families.
- Interest in trauma informed spaces within home, school, and community settings.
- Consult with families and contractors for design of handicap and environmental accessibility.
- Problem solved design use of space in homes and healthcare clinic settings
- Advocated for support and funding for remodels of home accessibility and equipment needs for children with disabilities

Art Education

- 6 years' experience as Lead Art Teacher for art accessible classes for children K-12 with disabilities at the Jordan Schnitzer Museum of Art, University of Oregon
- Used knowledge of developmental skills to promote success for children participating in art programs
- Relied on creative problem solving and intuitive responses to individuals and the environment to promote participation in projects and activities
- Supervised graduate students and volunteers working with children with disabilities
- Trained volunteers, students and staff on art accessibility
- Provided educational trainings for setting up environments and activities to promote children's optimal participation in class
- Created online training for accessible art adaptations for teachers and therapists

Work History

- Occupational Therapist
  - Oregon Health and Science University, Eugene, Oregon, 1995–1996, 1998 – present
  - Therapy Solutions for Kids, Eugene, Oregon, 2010 – 2013
  - Riverpark Skilled Nursing, Eugene, Oregon, 2003 – 2007
  - Developmental Therapy Services, Merrimack, New Hampshire, 1996 – 1998
  - Mary Bridge Children's Hospital, Tacoma, Washington, 1989 – 1995
  - Swedish Hospital, Seattle, Washington, 1988 – 1989

- Art Educator
  - Art Accessibility, Jordan Schnitzer Museum of Art, University of Oregon, Eugene, Oregon, 2011 – 2017
- Educator
  - Lecturer at University of Oregon for Graduate Students in psychology & Early Intervention, 2000 – present

- Design Consultant
  - Pierce Construction and Design, Eugene, Oregon, 2002 – present

- Professional Development Volunteer and Educator
  - Cielo de Amor, La Concepción, Nicaragua 2015 – present (consultant)
  - Sengerema Hospital, Sengerema, Tanzania June – August 1990

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Chapter 1
Introduction and Background

The places we encounter and experience through our senses give us context of our world and play a very important role in cementing our memories and attachment to places. Places evoke moods and emotions that are stimulated through our senses by the world around us. Whether we are happy or stressed, our reactions to both place and space is strongly determined by our internal emotional regulation whether it is in our home environments, schools, or offices.

The motivation for this research, exploring the effects of our physical environments on emotional responses and health, stems from my professional expertise as an Occupational Therapist. I have spent 30 years working in the healthcare field supporting individuals with disabilities that includes physical, cognitive, emotional, and sensory challenges. There are many barriers to built environments that affect these individual's ability to access their healthcare in community-based settings. In what follows I draw on my professional experience and the research literature.

Creating built environments that support the nervous system and emotional regulation states has been an important focus in research for healthcare design.[1] Our bodies store emotional and physical memories affected by trauma and stress. This is manifested through our gut, muscle tension, headaches, pain, and anxiety. Our immune system is affected by stress and slows healing processes, learning, and social emotional engagement. In my work with children with

[1] In 2002, a workshop at Woods Hole brought together architects, neuroscientists, and psychologists whose expertise spanned the areas of stress research, visual perception and environmental psychology to further understand the effects of the physical surrounding on emotions and emotional responses to architecture affecting health. This began the exploration and research of understanding health to be taken into account in the design of buildings.

disabilities and their families, stress plays a major part in their lives related to dealing with a new diagnosis for their child, multiple surgeries, socio-economic challenges, finances, and even stress related to navigating the medical and social service world. The children often have multiple medical challenges related to an orthopedic or genic disability, but may also include issues related to trauma, chronic anxiety, sensory processing difficulties making daily life challenging. I have witnessed the impact of creating a supportive physical environment and spaces that promote health for a child's ability to calm, learn and engage in their surroundings without anxious reactions. The physical surroundings can change the way we feel, it can support our bodies, minds and spirits supporting the healing process (Sternberg, pp. 16-20). The sounds, sights, touch, feel and smells of an environment are important for design considerations of the built environment. Design can either help or hinder the process of an emotional, physical and even spiritual healing.

The fields of psychology, neuroscience, and immunology are informing architecture for understanding how to create spaces that promote healing (Sternberg, 2009). These different disciplines, combining scholars with practitioners, are evolving and shedding light onto the effects of the environment on healing. The concept of interdisciplinary models in the medical field is not new and combining with architecture design has developed the healthcare design field for nearly two decades. An initiative launched in 2000 created the Center for Health Design and the Pebble Project. The goal of this project was to create a ripple effect in the healthcare community by providing documented examples of healthcare facilities that have used an *Evidence-Based Design* (EBD) process to document outcomes (Healthcare Design Magazine, 2017). EBD is the process of basing decisions about the built environment on credible research to achieve the best possible outcomes in design for hospitals environments. There is dynamic and

ongoing research, exploration, and collaboration that contributes to the understanding of place and the effects of the built environment on its users (Cama, 2009).

The influences of *environment psychology, neuroscience, neurosensory, psychoneuroimmunology, and salutogenic methodologies* are providing a wealth of research, knowledge and understanding in creating spaces. Each discipline's focus and knowledge help to inform the design process in developing a more rich and engaging experience for the users in a physical environment, the effects on human behaviors, and on being human in these environments (Cama, 2009). Healthcare designers want to provide places for people, behavioral scientists want to understand how physical environments relate to people and a neurosensory approach wants to understand why individuals react to their environments. When combined to design a space for different populations of users, it is important to find a link in creating a common ground to share information.

As an Occupational Therapist, I have a strong understanding of how the built environment affects individual's sensory regulatory system. A large part of environmental understanding is based on precognition process of receiving sensory information through our senses that includes visual, auditory, tactile, movement, and olfactory stimulus. This process is called sensory processing and plays a role in our memory, learning, orientation and perception of an environment and the experience we feel from our environment. Looking at space through our senses can facilitate understanding for what works or does not work in the environment and can help guide design practices. The environments designed to support these systems and the user's needs will contribute to people's quality of life, creativity, survival and well-being (Eberhard, 2005).

We spend most of our time in a built environment and when considering medical facilities and clinics, much of design has focused on family and patient centered care. It is the clinical and support staff who spend most of their time in these environments caring for the patients and their families. Gaining insight into effects on both patients and staff is important in understanding the correlation between the environment with the brain and body responses. We are all being stimulated by our surroundings and yet our responses are very different from one another depending on our own neurological reactions to life stresses at any given moment. Pulling from research in all methodologies sheds light on the brain body responses and effects for creating designs that can become universal in promoting health and well-being for people.

Neuroscience studies have shown that we experience emotions before we are consciously aware of them. Emotional states are vital to cognitive processes such as reasoning, decision-making, social behaviors, and strongly linked with sensory perception. Understanding how environments evoke emotional responses in individuals provides a basis for understanding how people engage and interact with their spaces (Daly, Mahmoudi Farahani, Hollingsbee & Ocampo, 2016). A negative emotional reaction to public spaces is important to understand in order to create environments that decrease experiences of anxiety. Negative responses such as fear are triggered by perceived threat to our well-being. Designing spaces that are beautiful and universal can elicit positive emotions of joy, calm, or peace in all users. Research in evidence-based healthcare design has informed architecture in creating these types of spaces. Understanding and incorporating the diversity and richness of a *multisensory environment*, one that isn't just engineered and designed for survival, but one that is an integrated, connected and fully celebrated place is important to consider (Erwine, 2017).

Healthcare facilities are a stressful place for people. Stress results from any situation that requires behavioral adjustments such as invasions of privacy, lack of control over noise and space, acute or chronic pain, separation from family and familiar things, feelings of helplessness, and loss of control over events and the immediate environment. Our nervous system and endocrine system are affected by stress and these two systems provide links between mind and body. Multidisciplinary research is shedding more light on the body and mind connection and how architecture design of built environments contributes to health and well-being.

This research explores the thoughtful design considerations of the healthcare built space and environments that support our nervous system, to gain clarity and understanding of what decisions can further develop feelings of calm, positive engagement and distractions from anxieties that enhance and support well-being.

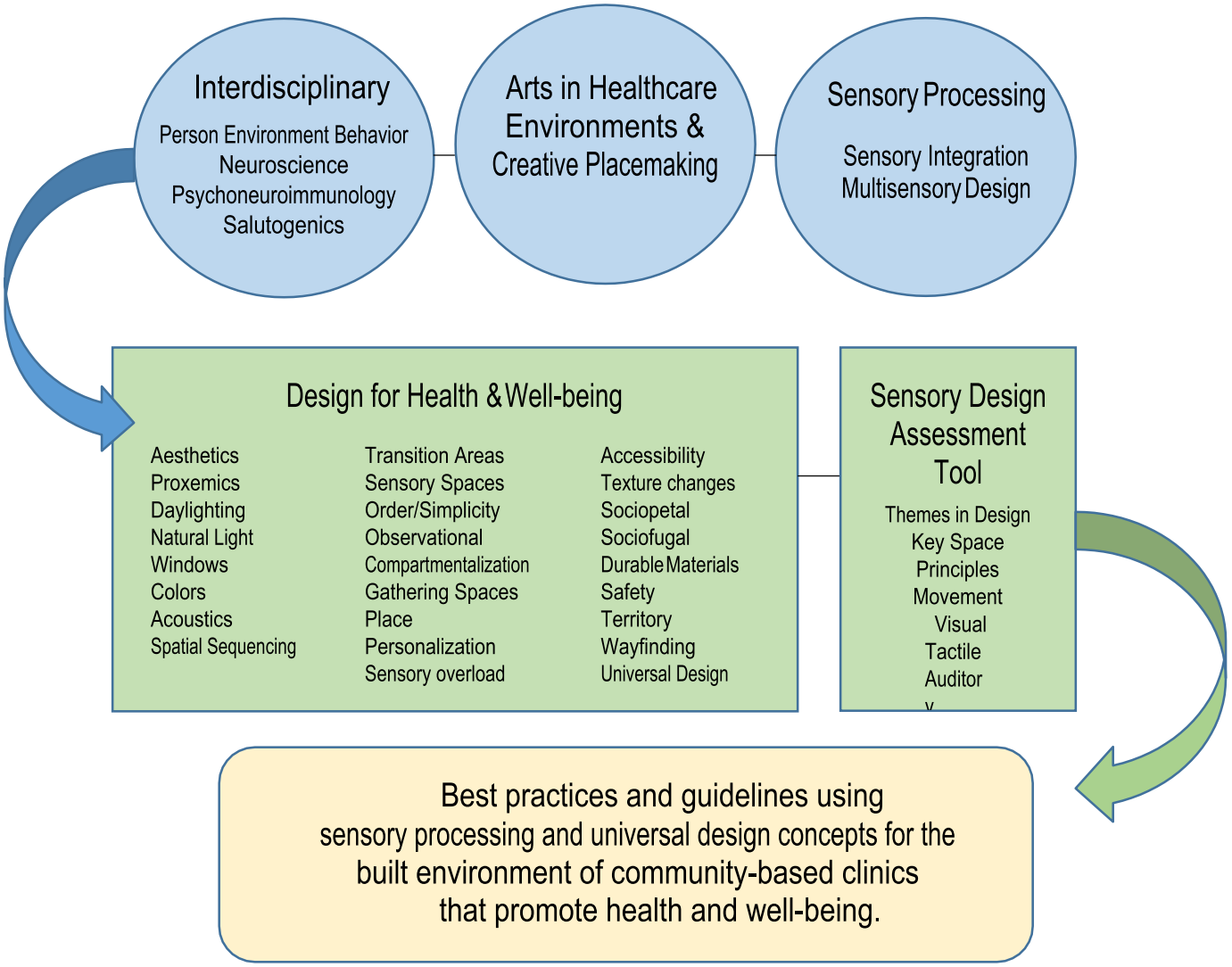
1.1 Conceptual Framework

Several interdisciplinary design approaches will be explored through literature reviews to gain understanding of the *what* and *how* each approach takes to developing designed spaces for healthcare. Methodologies explored are drawn from *Environment Behavior, Neuroscience, Psychoneuroimmunology, Salutogenic and Sensory processing*. Figure 1a outlines the three areas of literature review that informed this study.

Places evoke moods and emotions, and when we re-encounter a place, it can revive and change the brain's nerve chemicals and hormones that could help or hinder healing (Sternberg, 2009, p. 14). This is related to stress and the anxiety we may recall from a memory of a place. With the modern techniques of biochemistry, cell biology, and molecular biology, we can piece together how the elements of the world around us, which we perceive and experience through our senses, can trigger different areas of the brain in order to generate feelings of awe, fear,

peace, or comfort (Sternberg, 2009). This broader understanding and research is informing best practices for design of built environments.

Figure 1a: Conceptual Framework Schematic



1.2 Definitions: Interdisciplinary Models of Design

The *Environment Behavior (E-B) methodology* helps to give the understanding to the why people behave in certain ways when they interact with their environments (Eberhard, 2005). E-B provides better understanding of a problem and can determine clear defined opportunities needed in a built environment. Designers using this methodology have as their main objective to change physical settings to control the behavioral effects of the design decisions they make. They want their buildings, open spaces, and objects to meet the social, psychological, and developmental needs of those who use them (Zeisel, 2006). This approach provides opportunities for the EB researchers and designers to learn from the users and each other in creating these spaces.

The *Environment-Behavior-Neuroscience methodology (E/B/N)* provides a richer understanding of the effects of the built environment on the nervous system. Understanding how people's brains and minds develop and function in different situations helps the understanding of how they evolve over time to respond to physical environments (Zeisel, 2006). The environments designed to support these activities and user needs will contribute to people's quality of life, creativity and survival (Eberhard, 2005). Neuroscience is the study of how the nervous system develops, its structure, and what it does as far as focus on the brain and its impact on behavior and cognition. Wayfinding, perception, cognitive mapping, imaging, and designing are ways that people relate to their environments.

The definition for *Sensory Processing* refers to the way the nervous system receives messages from the bodies senses and turns them into appropriate motor and behavioral responses. A *Sensory Design Methodology* takes into consideration the effects of the environment through sight, sounds, touch, movement through spaces, and smells. Stress results from any situation that requires behavioral adjustments such as invasion of privacy, no control

over noise, acute or chronic pain, separation from family and familiar things, feelings of hopelessness, and loss of control over events and the immediate environment. Stress increases the reaction individuals have in spaces or environments and can either help or hinder health, well-being and healing. A sensory design method reclaims the role of the body and all the senses in creating memorable experiences of place and belonging (Erwine, 2017).

Research that uses a *psychoneuroimmunology (PNI) framework* seeks to determine whether valid associations exist among stress, immune function, and health. It encompasses a broad scientific research from the molecular to the interpersonal and has potential to lead to the development of a more comprehensive model of health (Daruna, 2012). Difficulties arise in understanding effects due to the multifaceted and complex nature of the neuro-endocrine-immune systems. The usefulness of this framework provides knowledge of how space affects individuals but also how individuals may react to spaces depending on their stress levels. Designing to engage our senses has the capability to create more soothing solutions that demonstrate connections to this complex nervous system interaction.

Salutogenic design focuses on the positive impact of design on human health. It's a measurable aspect of design that can help a building's inhabitants operate at their peak performance and can help them maintain physical and mental well-being. It is the ultimate investment in people, in an architectural sense (Rickard-Brideau, 2017). Simple concepts like comfort, coziness, joy, aesthetics are the psychological bricks and mortar of all healthy buildings (Golembiewski, 2012). Salutogenic design aims to build structures that make people healthier and happier.

1.3 Design for Health and Well-Being: Key Principles for Healthcare Design

The second part of the Conceptual Framework outlines key principles for healthcare design. Interdisciplinary research has determined specific factors in design for understanding engagement and participation in spaces that can either help or hinder stress responses.

Architecture key principles: There are seven principles within architecture when considering the human context for design. These include *proxemics*, *privacy*, *propinquity*, *personalization*, *territoriality*, *wayfinding*, *and locationality* (Gilliam & Young, 2018).

- *Proxemics* includes use of space and how to create spaces for engagement. Terms used include *sociopetal* (arranged for communication) or *sociofugal* (arranged to avoid communication). This gives choices of how to use a space.
- Spaces can be built to allow for *privacy* or *propinquity* allowing for choices in interactions but can be determined by culture.
- Personal space can be determined through *territory* or establishing spatial ownership and *personalization* in which users can tailor a space to fit their needs.
- *Wayfinding* is the ability to find one's way in the physical environment. Consideration for paths, pathways, nodes, districts, and landmarks can be assessed through perceptual access, configuration and signage.
- The last of the seven principles is *locationality* which is the state of residing in a place where the space can be both private and public, this is often referred to as front stage and backstage. These become the foundations in design that the use of interdisciplinary models can help inform best practices when designing healthcare spaces.

Specific healthcare design looks at elimination of environmental stressors such as air quality, glare from direct light and noise. Themes noted in several studies includes connection to nature, positive distractions, control in space, safety and security, social support when considering proximity and personalization of the spaces with healthcare facilities (Eberhard, 2009, Erwine, 2016, Cama, 2009, Zeisel, 2006, Sternberg, 2009, Share & Mullick, 2009, Golembiewski, 2012, Humphreys, 2008). Creating a healing environment using best practices of design in the physical environment has included consideration for daylighting, noise control and acoustics, air quality, privacy, social support, and positive distractions. Also being considered are creating safe havens, engagement spaces for all levels of users, and providing low stimulation environments, outdoor healing environments such as healing gardens create opportunities for improved indoor/outdoor connections that minimize stress for children and families.

Collective key principles: Key principles drawn from research with special populations has led to recommendations for all users of a space using sensory methodologies supported in neuroscience awareness for effects of brain and body responses. There has been groundbreaking research assessing the built environment for challenging population and many of the concepts discovered can be used for all designs that creates universal accessibility (Mostafa, 2008, Humphrey, 2018). Key principles from a sensory design model with consideration for control of sensory stimulation includes:

- Visual input - natural light and use of light with dimmers, minimizing visual distractions, art, colors
- Tactile input - fabrics, materials used in the built environment
- Movement - Creating smaller spaces with low stimulus, consider barriers in the environment for all users
- Oral - Use materials that are durable, bite proof materials

- Auditory - Consideration for the acoustic properties of materials, acoustics of rooms, sound barriers

Principles for neurosensory support in creating a calmer environment includes: Spaces that can be supportive using visual, auditory, tactile, and movement spaces are to have clear arrangement, direct routes, neat zoning, use of simple forms, and uncluttered interiors. Common themes relate to visual structure, spatial standards and movement opportunities within spaces, "withdrawal spaces" or quiet spaces for retreating and physical accessibility. Through experience and observed need, bathroom design with considerations for older individuals with physical disabilities who need assistance would include providing more room and a larger platform at wheelchair height for transfers to aide in changing these individuals with disabilities. Considering acoustics in bathrooms is important as the sound of public flushing toilets can be overstimulating. Colors can be used to facilitate and support calming for individuals who become highly stressed in these environments. Another consideration includes durable materials for equipment, furnishing, fixtures, and fittings to last and for sustainability. Key principles for facilitating sensory integration environments in Pediatric spaces includes thoughtful design for multisensory stimuli within the environment such as providing opportunities for movement, touch exploration, quiet spaces, use of music and or creating visual experiences that are calming and pleasing, areas for movement. It is also important for consideration of creating spaces with less distractions but visually pleasing and calming (Khare & Mullick, 2008). All terms and concepts introduced above will be explored in detail through a comprehensive literature review.

1.4 Purpose Statement

The purpose of this study is to explore and gain understanding for best practices in healthcare design in order to create guidelines that can be followed by any health or human service organization interested in improving their staff and patient environments to create spaces of well-being. The field research for this study will be completed in two stages. Stage one, to be completed during the summer of 2018, will be to complete five site visits to Children's hospitals that have been identified as using best practices in design. Stage two, fall 2018 - winter 2019, will be an in-depth case study that will be analyzed through qualitative methods. Data collection will include face-to-face interviews, site visit, and development and use of a Sensory Design Assessment Tool to be used for evaluating six Community Health Centers. Phone interviews will also be conducted with key informants in the field of healthcare design. Ultimately, this study will lead to a set of "best practices" guidelines that promote health and well-being for all users.

1.5 Methodological paradigm

As a researcher, I am aligned with the interpretivist methodological paradigm. Significant contributions of this study will be to provide an interdisciplinary research approach in design for well-being drawn from methodologies of Environment Behavior, Neuroscience, Salutogenics, Sensory Design, and Psychoneuroimmunology. The goal of this master's research project is to gain understanding of best practice design for health facilities. The focus will be on identifying and assessing specific key principles that promote well-being in healthcare design of urban hospitals but that can be used universally in design for community, rural and public health facilities. Using an interpretivist methodology will help generate knowledge of the meaning for best practices that may be influenced by culture and values of these populations.

The subject/researcher relationship will be one that is interactive and participative through qualitative research methods including interviews, site visits, and professional observations using a design assessment tool. These are felt to be the best way to understand design for wellness through key informant interviews and site visit observations with community health programs by observing those individuals who engage in these healthcare environments. Desired information from this study will be greater understanding for what some people think and do in the spaces, what kind of problems they are confronted with from the design or built environment, and how they deal with problems that arise as well as understanding what is working in the environment and supports positive responses.

1.6 Role of the Researcher

As a qualitative researcher, I am strongly interested in exploring best practices in the healthcare design field. Biases that I bring to this study are related to my experience in working in the healthcare field and growing frustration for the lack of support that is strongly needed in creating spaces for health and well-being outside of hospitals.

1.7 Research Questions

What are best practices in healthcare design that promotes health and well-being?

1. What are interdisciplinary models in design for healthcare environments?
    a. What are the theories and concepts of design from different methodologies?
    b. How do interdisciplinary methodologies inform best practices?
    c. What concepts, ideas, and terms are used to discuss key principles of design?
2. What are key principles in design for healthcare environments?
3. How does the role of community engagement, placemaking, and art play a role in healthcare built environments that support health?

4. How do these principles fit into a Sensory Design Model for creating spaces that promote health (calm, engagement, and relieve stress)?
    i. What are the *Visual* components in the public space that work? That don't work.
    ii. What are the *Auditory* components that work? Don't work?
    iii. How does the space support *Movement*? Is it direct? Are there barriers?
    iv. How does the space provide opportunities for *Tactile/touch*?

1.8 Delimitations and Limitations

The delimitations for this study consist of site visits of Children's hospitals within the Pacific Northwest that have been recognized as using evidence-based design and best practices in building their facilities. Prospective sites will be determined through preliminary conversations with key informants, web research, and publications. Stage one of this study will assess public spaces of the interior and exterior healthcare and staff areas; waiting rooms, entry, hallways, cafeteria, nooks within spaces, interior and exterior design/furniture, healing gardens, and public restrooms to assess for ADA and aesthetics in the design. The research design for an in-depth case study in Stage two will be articulated in early Fall 2018.

The limitations for this study consist of time limitations and ability to get enough feedback in surveys in order for creating themes from data that can be then used in creating guidelines for best practices. There will be a need to interview several professionals and disciplines in order to gain insight to best practices in design. There are recommendations for design of space but aesthetics for interiors can be very subjective. To gain a body of knowledge for the healthcare space, observations will need to occur at various times during the day and various locations of healthcare facilities that have engaged best practices in their design.

Generalization of this information may be a limitation, but the goal is to create guidelines that can be flexible and can be used in cost effective ways. Limitations also occur with this researcher's own bias due to experience in the healthcare field and having understanding of how space affects individuals with disability. It is not possible to generalize findings to all healthcare environments, but valuable lessons and guidelines can be drawn from disciplines of architecture, neuroscience, sensory design, and salutogenesis.

1.9 Benefits of the Study

The effects of our physical environment on the healing process and well-being has been well researched over the past decade. During this time, there has been a movement for Evidence-based Healthcare Design for patient centered care and positive impact studies on patient's recovery with implementation of these models. Interdisciplinary models explore the human context of design and effects on the central nervous system that will influence health and well-being. There is a rich body of research supporting best practices for design.

This research study explores several interdisciplinary models to develop a checklist integrating concepts of best practices through the lens of a sensory processing methodology to assess spaces of rural, community and public health built environments. There is a gap in the research and practice for the impact of the built environments on community based clinics for rural and public health facilities.

By exploring the issues that surround health of our communities in rural and public health domains, this study aspires to open a dialogue between the use of best practices for healthcare design for community health facilities. Understanding the effects of the built environment on our central nervous system and how the use of arts in design for developing aesthetic spaces for health and well-being in smaller community and public health sectors are important to the

discussion of health. This study will collect data from hospital designs to develop guidelines and recommendations for future design, remodel, and construction of community, rural, and public health clinics.

Chapter 2
Research Design Introduction

The research for this study was conducted in two stages. The first stage consisted of exploratory research and occurred over the summer of 2018. Site visits of two children's hospitals in Washington and Oregon were conducted to using the Sensory Design Profile. This checklist was developed from literature review and best practice recommendations to inform creating a sensory design that supports the nervous system within the interior built environment. Observational data was collected on the design and aesthetics of public spaces to include the entryways, waiting rooms, hallways, exterior landscape, use of sculptures and artwork throughout the public spaces, wayfinding, cafeteria, and healing gardens.

The preliminary data was used to develop research methods for stage two completed in the fall of 2018 and winter 2019. The in-depth case study will dive deeper into engagement with users using an evaluation process to gain better insight and understanding of the key design principles that were used and the effects on current health and well-being of the users. A qualitative methods approach was used and instruments developed in the early fall for submission for IRB approval.

The importance to understanding universal design in the use of spaces that works for all users to promote engagement, health and well-being was also explored more thoroughly in fall 2018. Informational interviews and site visits were conducted with public health and rural community clinics. Data was collected and analyzed to gain further insight into what truly works and does not work for this population. The data will be gathered to find themes for

understanding key principles that can be synthesized into a sensory based guide in creating universal spaces that are inspiring and thoughtful in promoting health and well-being for all.

2.1 Ethics and Human Subject Issues

Anticipated risks associated with this research study were minimal. All interviewees were properly recruited per Human Subjects guidelines and formal, written consent was obtained. Only participants who were willing to be identified in any written documents associated with this study were recruited. Since this study was exploratory in nature, the researcher's primary goal was not to answer or challenge existing practices, but to bring forth and provoke new questions and research in yet to be investigated areas.

2.2 Time Frames

The study was conducted in two stages. The first stage was over the summer of 2018 to complete site visits of two Children's hospitals. Stage two began in early fall, 2018 with the development of instruments for a more in-depth case study of rural and community health clinics that were completed during the winter term of 2019.

2.3 Data Collection, Analysis, and Disposition Procedures

Stage One: Stage one of this study consisted of site visits to two children's hospitals, one in Oregon and one in Washington, to gain insight and understanding for key principles of healthcare design and the impact on health and healing environments. To narrow the focus of this study, design of the public spaces included entry ways, waiting spaces, hallways, wayfinding, outdoor environments/gardens, restrooms, elevators, stairways, and cafeterias.

Stage Two: Stage two of this study consisted of key informant interviews with professions in the field of healthcare design to include architecture, interior design, arts and healthcare program managers. Interviews also conducted with key administrative informants for

several community and public health facilities in Western Oregon. Site visits were conducted at six community and rural health clinics.

Sources of Data: Observations and a checklist was developed prior to the site visits and used to assess key design principles during Stage One. This checklist consisted of the key principles for healthcare design derived from the literature reviews of interdisciplinary disciplines on best practices. The checklist was used during the site visits for first impression by this researcher. Stage Two data was collected at each site through key informant interviews with administration/staff, site visit observations of public space, and completion of the Sensory Design Profile using descriptive notes and photographs.

Collection of Data: Field notes, photos of spaces, sketches/drawings, and annotated maps will be used to collect data during Stage one of the research study. The Sensory Design Profile checklist was developed to assess the following design of spaces (See Appendix 6).

1. Visual: Intensity of artificial lighting, windows/natural lighting, room exposure to sunlight, colors of spaces, artwork
2. Auditory: sound barriers, use of music, noise within spaces, privacy
3. Movement/Spatial: Exposure to environment/outdoor spaces, layout/decor of spaces for social interactions, staff use, those with disabilities or wheelchairs, outdoor spaces, furniture placement, use of design to promote or hinder movement
4. Tactile/Touch: fabrics, activities for children/adults in waiting spaces, signage (braille), floor changes to allow for visual impairments
5. Materials: Flooring
6. Privacy/openness of room, creation for privacy space
7. Wayfinding: how used, what, where within the hospital, culturally relevant

8. Accessibility: Restrooms, hallways, entry, waiting areas, safety and security

Data was collected through field notes, drawings/sketches of space, photographs of spaces, and site plans as appropriate. Results were compared with Second Stage interviews and site visits to determine design principles and assessment for positive or negative attributes in the design. During phone and in-person interviews, the researcher took handwritten notes and made audio recordings. The resulting audiotapes were selectively transcribed and referred to for exact quotes during the writing process.

Photographs were taken by the researcher and obtained from websites outlining best practices of healthcare design. Photographs were only taken of the built environments of public spaces at each clinic site. Permission was obtained to refer to interviewees by name if used in any resulting written documents. Data collected will be securely maintained and not shared with other researchers without written consent of participants. All notes, audiotapes and photographs will be kept for possible future studies.

2.4 Coding Schemes and Analysis Procedures

Themes were developed through the *Sensory Design Assessment Tool (SDAT)* corresponding to the conceptual framework. These themes will be used for coding and analysis of data collected from each site visit and information from interviews. Below are the main topical areas and sub-topical areas outlines.

- Visual: daylight, windows, wayfinding, colors, themes
- Auditory: acoustics, barriers to sound/noise, privacy, auditory features
- Tactile/Touch: attributes for visual impairment (braille, changes in floor material), accessibility, fabrics used in furniture, age appropriate activities in waiting spaces
- Movement/Spatial/Perceptual: privacy, nooks, seating arrangements, barriers

- Art/Aesthetics: colors, artwork, furniture, interior/exterior design, landscapes/gardens

2.5 Strategies for Validating

Validating findings is a key component to conducting research. Particularly with qualitative research, validity techniques help to establish trustworthiness of the study (Lincoln & Guba, 1985). The use of several methods helped to shed light on best practices to produce greater understanding. Triangulation was used in this study to include site visits, literature review and participatory engagement through interviews and surveys of key informants in community healthcare facilities and professionals in the field of Art and Healthcare Design. The three strategies of looking, participating, and listening will be key to validating this study. The use of multiple methods helps facilitate a deeper understanding for key principles in the built environment that promotes health and well-being.

In order to establish transferability, descriptive notes, drawings and photographs were used when collecting data from each site visit. This included comprehensive observation notes of public spaces and careful transcription of audio tapes from key informant interviews. Photographs supplemented the Sensory Design Profile checklist and notes from the site visit observations.

The final strategy for validating data included the researcher's expansive journal kept during the entire research study outlining notes, drawings and descriptions of spaces related to concepts of sensory design.

Chapter 3

Literature Review: Interdisciplinary Methodologies for Design

3.1 Introduction

Places have strong influence on our emotions and memories. The Merriam-Webster Dictionary defines *place* as a physical environment, a way for admission or transit, our physical surroundings, a building or locality used for a special purpose (Merriam-Webster Dictionary, 2014). Place can evoke emotions of joy, fear, excitement, anxiety, stress, and calm. Consider our homes, our offices, schools, libraries and healthcare clinics or hospitals. These places evoke different emotions depending on our own emotional state. We encounter different places throughout our lives and hold memories of the spaces we have experienced. The built environment plays an integral part in our lives whether it be in our homes, offices, schools, and healthcare facilities. All aspects in daily life integrate our experiences within a built environment, indoor and outdoor spaces, and even transitional spaces we encounter. It follows that a positive influence on health of our communities can result from thoughtful design of these spaces.

In order to explore and gain understanding for design of built environments and creating thoughtful spaces for well-being, it is necessary to complete a literature review on design for health outcomes and effects on the body. The sensory nervous system is critically important in our daily lives and responses to our environments. It contributes to our personal well-being and safety and supports communication with others.

The places we encounter as experienced through our senses give us context of our world. Our responses and reactions to places that may include a built environment play a very important

role in cementing memories. Places evoke moods and emotions and can trigger an autonomic nervous system response of fight or flight or elation and excitement. When we re-encounter the place, it can revive and change the brain's nerve chemicals and hormones that help or hinder healing. With the modern techniques of biochemistry, cell biology, and molecular biology, we can piece together how the elements of the world around us, which we perceive and experience through our senses, can trigger different areas of the brain in order to generate feelings of awe, fear, peace, or comfort (Sternberg, 2009).

Our sense of where we are is continually being created and re-created in our brain, through our experiences and memories. Place can have a positive or negative effect on us through an experience or feeling and can impact our bodies, minds and spiritual health. Our immune system is in constant reaction to internal and external stresses and affects our health. The field of *psychoneuroimmunology* (PNI) is a relatively new area of study that looks at the interactions between the central nervous system and immune system, and the relationships between mental processes and health. PNI research sheds a great deal of light on many aspects of wellness and provides important research on stress. PNI studies have found many correlations between life events and health effects (Scott, 2018).

Our physical surroundings can change the way we feel, support our bodies, minds and spirits and can support the healing process (Sternberg, 2009, pp. 16-20). It is fascinating that the brain protects us from trauma. We stop laying down memory during traumatic experiences and yet, our bodies remember. Children who have experienced trauma in their past often react to places and situations, causing challenging behaviors related to stress or anxiety. They may not be aware of why, but they feel a physiological reaction to the smells, sights, touch, feel, or sounds of an environment that triggers behaviors related to fear, stress and anxiety.

To clearly gain understanding for the built environment's effects on health, healing and overall well-being, a growing body of research has evolved incorporating fields of neuroscience, immunology, psychology that has informed architecture and design (Amedeo, et al., 2009, Cama, 2009, Eberhard, 2009, Scott, 2018, Sternberg, 2009, Straub & Cutolo, 2017). Developing interdisciplinary models and using a multidisciplinary team approach to the design process has become a growing focus of research and design and is bridging the gap to understanding how to create places that promote healing. Diverse disciplines, as well as the combination of scholars and practitioners are shedding light onto the effects of the environment on healing. The concept of interdisciplinary models in the medical field is not new but collaborating with architectural design is becoming an appropriate bridge to the development of the healthcare design field. We spend most of our time in a built environment and it makes sense to find teams to work together who understand the correlation of the environment with the brain and body responses. We are all being stimulated by our surroundings and yet our responses are very different from one another due to our own neurological make-up, psychological preferences, and backgrounds. Drawing on research can shed light into creating designs that are universal for all users in promoting health and well-being.

3.11 Interdisciplinary Design Research

"Interdisciplinary research is a mode of research by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice" (National Science Foundation). There can be many different types of disciplines and

methodologies utilizing an interdisciplinary model when it comes to Healthcare Design. This has led into the movement for *Evidence Based Healthcare Design*.

The influences of *neurobehavior*, *neuroscience*, *psychoneuroimmunology*, and *salutogenic* methodologies are providing a wealth of understanding and knowledge in creating spaces. Healthcare designers want to provide places for people, behavioral scientists want to understand how physical environments relate to people, and a neurosensory approach wants to understand why individuals react to their environments. When combined to design a space for multiple users, it is important to find a link in creating common ground for researchers and designers to share information.

Consideration of what these disciplines bring to the design process can only develop a more rich and engaging experience for users in the physical environments, the effects on human behaviors, and being human in these environments (Cama, 2009). Universities have started to adopt a multidisciplinary approach to their curriculum, bringing together schools of architecture, health, medicine, nursing, and engineering. The Center for Health Design has led the way in this thinking and research. Debra Levin, president of The Center for Health Design has stated that it is the blend of art and science that makes a truly memorable building, one that celebrates the soul is one you know values you as an individual. It is exactly these types of buildings that we should aspire to build because nowhere can design truly elevate those in need more than in healthcare settings *(*Levin, D., 2018*)*. A review of five different interdisciplinary methodologies for design of the healthcare built environment is provided as follows.

3.12 Evidence Based Healthcare Design

The Center for Health Design defines *Evidence Based Design* (EBD) as "the deliberate attempt to base building decisions on the best available research evidence with the goal of

improving outcomes and of continuing to monitor the success or failure for subsequent decision-making." This includes:

- A decision-making process that begins with the analysis of current best evidence from an organization and from the field.
- It finds, at the intersection of this knowledge, behavioral, organizational, or economic clues that when aligned with a stated design objective can be hypothesized as a beneficial outcome.
- Provides a platform from which to add to an existing base of knowledge or to launch innovation.
- Has an ethical obligation to measure outcomes and share knowledge gained for particular design successes and failures, ideally in a peer reviewed fashion.
  (Cama, p. 7)

A large and growing body of evidence attests to the fact that the physical environment impacts patient stress, patient and staff safety, staff effectiveness and quality of care provided in hospitals and other healthcare settings. Evidence Based Design is what informs decisions about physical space based on the research and data. It uses an interdisciplinary team model typically comprised of representing client, stakeholders, and appropriate design disciplines including researchers in the investigation, design, and analysis of a project. The idea of EBD is to start with an interdisciplinary team during the beginning phase of any design project. A well-designed building is generally aesthetically pleasing, functionally effortless, and extraordinarily experiential and the measurements of its success is often subjective. The subjective data or assessment of the impact on behavioral outcomes has not been measured as much as the solution of how to divide space and capture light (Cama, 2009).

The Center for Health Design has conducted studies with rich data pertaining to how the design of the built environment impacts healthcare in patient-related outcomes, staff satisfaction,

quality, safety, operational efficiency and financial performance. These studies and more information can be found at www.healthdesign.org. There have been more valid data about patient-related outcomes than staff-related outcomes on performance and well-being. The concept for healing environments has emerged from this research and design model. Qualities of a healing environment have been described to include air quality, materials used, wayfinding, building layout, ergonomics, single patient rooms, noise, windows, light, access to nature, positive distractions, furniture arrangement (Cama, 2009; Caspari, et al., 2006; Hathorn, 1998; Jenkins, et al., 2015; Sternberg, 2009; Ulrich, 2009, Vance, 2015). The use of evidence-based design has been adopted by many design firms to create health care environments that improve outcomes. This field has drawn on several methodologies to inform the research and recommendations for architects, designers, and healthcare facilities.

3.13 Environment Behavior Design Methodology

Architectural Design begins with generating ideas for changing an existing environment and presents in a form to guide construction. Stages of design include programming, preliminary design, final design, working drawings, and construction supervision. Research helps to inform decisions and provides deeper insight into a topic, better understanding of a problem, clearly defined opportunities for and constraints on possible action, measurement of regularities, and ordered descriptions.

Environment-Behavior (E-B) research is used by designers to face problems of design. Understanding and assessing behavioral responses to a built environment can help guide the design process. John Zeisel describes, in his book *Inquiry by Design*, that designers' main objective is to change physical settings; that is, they want to control the behavioral effects of the design decisions they make. They want their buildings, open spaces, and objects to meet the

social, psychological, and developmental needs of those who use them (Zeisel, 2006). There is a gap between the designer, decision maker, and user of the physical space and that is often too great to be overcome by designers using only a personal perspective. Therefore, designers have teamed up with Environmental Behavior Consultants to help fill this gap to assess the built environment and the behaviors associated with it.

The environment behavior researcher makes more visible to designers the needs, desires, and reactions of users to their surroundings, thus enabling designers to better negotiate with users and understand the effects that decisions will have on them. This process provides opportunities for the researchers and designers to learn from the users and each other in the design process.

The collaboration between designers and environment behavior researchers helps in making decisions about creating a space that has positive effects on its users. It helps in determining cultural, social, and psychological impacts for the design of a built environment. Designers want their building to meet the social, psychological, and developmental needs of those who use them. It's hard when designers build for strangers. The gap between decision maker and user is too great to be overcome by designers using only a personal perspective which is why there has been a movement toward collaboration with researchers. A team of designers and environmental behavior consultants have worked together to employ change to the built environment and understanding of impact on users. This process has made more visible to designers the needs, desires, and reactions of users to their surroundings. This information enables the designers to better understand the effects decisions will have on them. This method has offered both researchers and designers opportunities to learn from the users.

An environment behavior research project begins with the definition of a problem. Assessment of what is known about a space and what is to be learned helps to create the plan for

design. The collaboration between designers and behavioral researchers identifies important variables in the design to guide the creation of the built environment. The Environment Behavior paradigm involves the study of behavior, attitudes and opinions to determine how people in different organizations and cultures carry out tasks and actions related to their physical context (Zeisel, 2006, p. 95). The information gathered from case studies, observations, focus groups, and archives provides the information needed to make knowledgeable decisions about creating spaces for users.

3.14 Person Environment Behavior Methodology

Person-Environment-Behavior (PEB) approaches in research explore a variety of spatial and environmental influences in human activities and experiences (Amedeo, Golledge, & Stimson, 2009). Research has shown how the importance of geographic patterns of activities in built environments help us to understand how people use spaces. It gives understanding to the what, where and when features of such patterns are useful for planning the built environment.

Approaches frequently used to describe or explain participation can be based on psychological theories that encompass external circumstances such as situations, opportunities, constraints, and consequences, personality traits and abilities, motivational needs, and information processing (Amedeo, Golledge, & Stimson, 2009, pp. 3-5).

Understanding of the relationship between human activity and experiences within the context of environmental factors can be very complex and requires a variety of approaches in research to improve this comprehension which is where person, environment and behavior inter-relate. Architects, planners and designers are concerned about the degree to which their proposed schemes for physical social settings support and facilitate intended uses of those settings. An environmental psychologist might have an interest in the degree to which place

"enters" into people's notion of "self" involving certain levels of face-to-face social exchanges (Amedeo, et al., 2009). It is an experience-related interest.

The significance of space in the human context is exemplified in many ways. Space is part of movement and communication in society and provides a social context. It is a fundamental dimension of life, processes, patterns, and organizations of things and events seen throughout a social system. Space appears in a variety of approach-avoidant types of behavior in societies and is manifested in such things as social distances, personal spaces, territories, privacy, and other patterns that can influence the built environment. These are key concepts for architectural design. This engagement helps identify the space, relate to it, orient to spaces, and can create memories both good and bad (Amedeo, et al., 2009, pp. 5-8).

Studies about various forms of spatial presence in human contexts are extensive. The research explores how these forms are manifested in interpersonal relationships, in behavior and experience, in human perception and cognition, and in numerous situational circumstances or environments. These studies conceptualize the nature of relationships among persons, environments, and behaviors (Amedeo, Golledge, & Stimson, 2009, pp. 8-9). Research Methods for person-environment-behavior include qualitative research using surveys, questionnaires, focus groups, pre-posttest evaluations and interviews. The research uses an ethnographic approach of exploring people in their environment

3.15 Neuroscience Methodology

Neuroscience is the study of how the nervous system develops, its structure, and what it does as far as focus on the brain and its impact on behavior and cognitive functions. Understanding the nervous system and how it reacts and relates to the environment is an important aspect to consider when assessing the built environment. People relate to the built

environment through use of wayfinding, perceptual and cognitive mapping, imaging, and designing.

The *Environment Behavior Neuroscience* methodology (EBN) provides a richer understanding of the effects of the built environment on the nervous system. Understanding how people's brains and minds develop and function in different situations helps the understanding of how they evolve over time to respond to physical environments. The environments designed to support these activities and user needs will contribute to people's quality of life, creativity and survival (Eberhard, 2009).

A large part of environmental understanding is based on precognition process of receiving sensory information through our visual, auditory, tactile, proprioception, vestibular, and olfactory senses. The relationships of these inputs from our environments through our sensory systems has an impact on how users engage in their spaces. This process is called *sensory processing* and plays a role in memory of an experience through our senses and the feelings that occur at that time of the experience. Using the Environment Behavior Neuroscience model helps to explain why people behave in certain ways when they interact with their environments. Built environments that are not informed by evidence-based design can set patients, families and children up for ongoing stress within a medical environment. The brain plays a central role in our learning, memory, orientation and perception and can be affected strongly by the environment and our emotions such as joy, fear, stress, anxiety and traumas. Neuroscience provides an understanding of how the brain controls all bodily activities that ultimately affects how we think, move, perceive, learn and remember (Eberhard, 2009). Our brains and minds are consistently interacting with the architectural settings in which we live, work, worship, and move about our communities. These built environments influence our

sensory responses causing conscious or subconscious reactions to different spaces and environments. EBN adds understanding of neurological and biological function to psychological, sociological and anthropological environment-behavior knowledge (Eberhard, 2005).

When considering creating spaces for people with disabilities, we start from the observation of interaction with space. Individuals with disabilities can appreciate spatial qualities to which architects or other designers are not always attuned. This holds for people living with sensory impairments such as blindness or low vision, but also for people living with particular mental conditions like autism spectrum disorders or dementia. How these people experience and understand space may invite architects and other designers to conceive space in novel ways, both in terms of what they design and in terms of how they design (Heylighen, 2012). Another reason for using an interdisciplinary model for the Environment Behavior Neuroscience approach is to have greater understanding of the effects of space on all individuals. A neuroscience perspective can give a more thorough understanding for the environment-behavior concepts of place, territory, wayfinding, and personalization of an environment and the effects on users. These architecture design concepts can have more impact when informed by neuroscience knowledge and understanding when designing to create supportive places.

3.16 Psychoneuroimmunology Methodology

The *psychoneuroimmunology* field has emerged over years of research with accumulated knowledge to understand the connections between the brain and the immune system working toward maintaining health. Research has looked at the assumption that physical places that set the mind at ease can contribute to well-being, and those that trouble the emotions might foster illness (Sternberg, 2009). There has been extensive research on brain-immune interactions and

the effects of the brain's stress response on health. This is a growing field that specializes in research that studies the interactions between social, psychology, behavior, brain, and the endocrine and immune system of the body.

Psychoneuroimmunology is essentially an integrative discipline. It seeks to shed light on how mental events and processes modulate the function of the immune system and how, in turn, immunological activity can alter the function of the mind. Links between the central nervous stress system and peripheral immune cells in lymphoid organs have been detailed through 50 years of intensive research. The brain can interfere with the immune system, where chronic psychological stress inhibits many functions of the immune system (Straub & Cutolo, 2017). It is recognized that stress reactivity is programmed for a lifetime during a critical period between fetal life and early childhood, which then influences stress behavior and stress responses in adulthood. The early childhood stress and memories are held in our bodies and may not show behaviors until a trigger from memory of a situation or environment causes the stress behaviors. A place that evokes a certain mood or an emotional memory can revive in full force and change the brain's hormones and nerve chemicals to help or hinder healing (Sternberg, 2009, p. 14).

The science from the psychoneuroimmunology provides even greater understanding and awareness of the importance for creating designed space to support users. Designing to engage the senses becomes more apparent. Looking around, what do you see, feel, smell, and hear? This creates the capability to design into our environments more soothing solutions that demonstrate connection to nature. One example of a project that achieved a connection to nature in the healthcare facility was a cancer center and ambulatory care center in Ontario. They used evidence-based design to measure the effects of space and design on staff and patient satisfaction with emphasis placed on creating efficient circulation and workflow patterns, assess to natural

light, and direct views of landscaped courtyards and therapeutic gardens (Cama, 2009, pp.232 - 234). The main lobby was programmed as the "village gathering place" where wood was selected to be used for its inherent emotive qualities and its ability to evoke feelings, meanings, and sentiments by connecting our inner and social selves.

3.17 Salutogenic Methodology

Salutogenic design focuses on the positive impact of design on human health. The term was first adopted by Aaron Antonovsky, a professor of medical sociology. It is derived from a mix of Greek and Latin that translates to a meaning of "health origins" and describes an approach that focuses on factors supporting human health and well-being, rather than on factors causing disease. It has become an alternative model of care about the relationships between stress, wellness, and human health. It is a measurable aspect of design that can help a building's inhabitants operate at their peak performance and can help them maintain physical and mental well-being. It is the ultimate investment in people, in an architectural sense (Rickard-Brideau, 2017).

Our bodies respond to cues in the environment, and much of what is designed today is giving our systems the wrong message. This is another model that looks at the relationship between architecture and neuroscience to gain a more complete understanding of the human body, specifically the brain, and how it responds to the environments that surround it. Wellness and well-being are about having a positive impact on human health at the molecular level. On the most basic level, certain environmental factors are universal, like circadian rhythms. Morning light is blue spectrum light that cues our bodies to release cortisol and wakes us up; evening light, conversely, is red spectrum light that causes our bodies to release melatonin, preparing us for sleep and physical restoration. In other cases, these environmental factors are very personal

and specific, based on our genetic wiring that sets the stage and the environment activates those genes in different ways. Our evolutionary memory responds to biophilic elements, like plants and natural materials (Rickard-Brideau, 2015). These considerations become central to design and the field of salutogenics helps to guide understanding and knowledge of the importance for design that supports our nervous systems.

Jan Golembiewski is a leading researcher in architectural design psychology and has several academic papers on salutogenics in architecture. He believes that concepts like comfort, coziness, joy, and aesthetics are the psychological bricks and mortar of all healthy buildings (Golembiewski, 2012). These concepts are at the heart of health and designing spaces for aesthetics and joy can elevate any building towards health and well-being. Much of his research has been on creating designed spaces to support mental illness. Today, there is a growing movement within the healthcare industry to incorporate Antonovsky's salutogenic principles into the world of design. Indeed, salutogenic design is already being used to construct many of the world's most modern hospitals and this methodology of design aims to build structures that make people healthier and happier. Golembiewski's research has found that when we're healthy, the effect of the environment on health is minimal, but when we're sick, the effects of architecture are amplified and reports that about a 30% difference in the rate of recovery where the only variable factors are architectural (Golembiewski, 2012).

3.18 Summary of Interdisciplinary Design Research

There are several methodologies that are being used in the field of Healthcare Design with a more recent focus on exploring the sensory environment in understanding health and well-being. The Academy of Neuroscience for Architecture was developed to promote the advances in knowledge that links neuroscience research to a growing understanding of human responses to the

built environment. The profession of architecture has become a partner in developing the application of this knowledge base in order to increase its ability to be of service to society. Design research is showing us that to create rich environments for users, architecture and design needs to consider engaging in this interdisciplinary model that incorporates not just the behavior and environment connection but having a deeper understanding for the neuroscience and psychoneuroimmunology effects from the environment. Salutogenics is a shift in thinking from environments for disease to creating built environments for wellness and well-being. This focus has an impact on users from all levels including social, behavioral, neurological, immunological and the more molecular levels within our bodies and brain.

3.2 Sensory Processing

Sensory processing refers to the way the nervous system receives messages from the senses and turns them into responses. The brain organizes, synthesizes, integrates and uses this information to understand experiences and organize appropriate responses. The processing of information allows individuals to respond automatically, efficiently, and comfortably to the sensory input received. The neurobiological process consists of five stages: registration, modulation, discrimination, integration, and praxis. This is central to the cognitive processes of attention, visual perception, memory, and planned action (Jorquera-Cabrera, Romera-Ayusa, Rodreguiz-Gil, & Triveno Juarez, 2017).

There is a growing body of literature describing sensory processing as an important factor in human behavior. Researchers describe four patterns of sensory processing that occur across all age groups and seem to occur more intensely in vulnerable populations (Dunn, 2007). Dunn (1997) hypothesized that there is a relationship between a person's nervous system operations and self-regulation strategies, and that the interaction of these functions creates four basic

patterns of sensory processing. What was found is that these patterns of sensory processing occur in each age group from infancy to older adulthood, and that people with disabilities including autism, attention-deficit/hyperactivity disorder (ADHD), schizophrenia, and developmental and learning disabilities have both distinctive and more intense patterns of sensory processing than do their peers without disabilities. Individuals who experience trauma also have heightened nervous system responses (Spiegel, 2006; Engel-Yeger & Dunn, 2011).

Individuals who experience a sensory processing disorder have challenges because their brain has trouble organizing information from their senses. Sensory processing issues can include oversensitivity to sights, sounds, textures, smells, spaces, movement, and touch. Our responses to the environment are determined by factors of neurological thresholds and self-regulation. Both are on a continuum and each person has a personal range of thresholds for noticing and responding to sensory events in everyday life (Dunn, 2007, pg. 85). These patterns of sensory processing are characteristic of every human being's experience in daily life, whether at home or in their communities and moving in and through various built environments.

There are four patterns of sensory responses that include: (*a*) sensation seeking, which represents high thresholds and an active self- regulation strategy; (*b*) sensation avoiding, which includes low thresholds and an active self-regulation strategy; (*c*) sensory sensitivity, which includes low thresholds and a passive self-regulation strategy; and (*d*) low registration, which represents a high threshold and a passive self-regulation strategy. It is helpful to understand the functional characteristics of each pattern.

- When persons have a *sensation-seeking* pattern, they derive pleasure from sensations in everyday life.
- When persons have a *sensation avoiding* pattern, they tend to withdraw from situations very quickly.

- When persons have a *sensory sensitivity* pattern, they tend to be reactive in situations.
- When persons have a *low registration* pattern of sensory processing, they fail to notice what other people notice readily because of their high thresholds.

Everyone has an individualized pattern of sensory processing. Understanding the relationship between sensory processing and everyday life informs intervention and design possibilities. Sensory input from the environment and from the body itself provides information that the brain uses to understand experiences and organize responses. This information provides important concepts in designing and building spaces that support individual's nervous system to promote health.

Using sensory tools can help develop strategies for calming when feeling stressed or anxious. These strategies can also be ways to explore our places that support our sensory reactions. Research has been done on the use of our senses to relieve stress. For example, *aromatherapy* has been used to reduce nausea, decrease the amount of anesthesia needed in surgery, decrease pain, and lower blood pressure. Scent activates the limbic system, the emotional center of the brain.

Sensory processing focuses on the input from our sensory systems to the central nervous system. Psychoneuroimmunology, as mentioned earlier, is the study of interactions between behavior, neural, endocrine function, and immune processes (Ader et al., 1995). This is a complicated interaction our bodies and minds respond to from our environments in relation to stress, anxiety or other responses.

Stress results from any situation that requires behavioral adjustment. Examples include invasion of privacy, no control over noise, acute or chronic pain, separation from family and things familiar, feelings of helplessness, and loss of control over events and the immediate environment. The healthcare environment can make strides to creating a calm space that supports

an individual's nervous system. People enter the facility with a heightened central nervous system due to stress or anxiety. It is important to create spaces that support our nervous system, especially to promote feelings of calm, decrease stress and anxiety, and support a person's ability to interact within healthcare settings.

3.21 Sensory Processing Methodology for Design

A *Sensory Processing Methodology* combines the understanding for the nervous system responses to external environmental factors and internal processing of the sensory information. This body of knowledge can bring a rich awareness and understanding on users to create a more universal design for all. By identifying patterns and routines that are challenging, strategies can be developed to support the sensory processing needs of individuals and an overall sense of well-being.

Community healthcare facilities often support the most vulnerable individuals, such as children and families affected by stress and anxiety, an impoverished population, individuals with a range of disabilities and ages who are much more likely to have intense sensory response patterns. When intense sensory responses are combined with other characteristics affecting health, adaptive responses in everyday life can be challenging. When designers, community health programs, administrators and providers understand the meaning of these types of behaviors from a sensory processing perspective, they can create a more "sensory friendly" environment for their community, patients, staff, and clinicians.

Exploring the experience of the sensory characteristics in public environments can provide crucial information for creating spaces that limit barriers and facilitate support of emotional regulation toward health and well-being. Healthcare environments can have a strong impact on creating a calm space that supports emotional regulation by decreasing stress

responses to allow for better attention, engagement, and participation. Individuals with sensory processing challenges can become easily stressed and overwhelmed in built environments. Having thoughtful and informed choices in creating these spaces will promote health and well-being for all users.

3.22 Sensory Design Model vs. Sensory Processing Methodology for Design

There are links between our mind and body. Research continues to inform the many ways that stress impacts the nervous system and the endocrine system. Medical design of environments has explored use of music, visuals, light, acoustics and aromatherapy to help reduce symptoms of pain and stress. Sensory Design and multisensory models have looked at the role of senses in the perception and appreciation of environments. There has been an ongoing question of how to make the built environments appeal to all sensations for an experience. An essential understanding of why environments affect us, our moods and our emotions draws on the neuroscience and cognitive understanding of this link between the mind and body.

Erwine, in her book Creating Sensory Spaces; The Architecture of the Invisible, explores this idea that environments have been created with results of spaces that are everywhere the same and nowhere special, environments that are acceptable but not inspiring, comfortable but not comforting, and predictable but not memorable. These spaces seem to have no sense of place, time, or cultural identity (Erwine, 2017). It is important to understand and incorporate the diversity and richness of a multisensory environment, one that isn't just engineered and designed for survival but one that is an integrated, connected and fully celebrated place (Erwine, 2017). This framework for the design of sensory spaces includes light, color, temperature, smell, sound, and touch. Bridging across disciplines of architecture, engineering, phenomenology and

perceptual psychology to inform the design of buildings and neighborhoods that reclaim the role of the body and all the senses in creating memorable experiences of place and belonging.

When taking into consideration individuals who struggle with Sensory Processing Disorders affected by stress, anxiety, or other disabilities, the consideration for creating sensory spaces can be described as the process by means of which a *space* becomes a *place* (Mostafa, 2008). A groundbreaking study completed by Magda Mostafa assessed the built environment on children with Autism (ASD). Many studies have been completed to create design parameters for spaces for ASD. This is a challenging population and many of the concepts discovered can be used in all designs to make the spaces more universally accessible for all. According to Humphrey (2010), considerations using a Sensory Methodology in creating spaces includes:

- *Calm, order and simplicity:* The sense of calm and simplicity is not limited to the way in which the plan and sections have been designed, but also applies to the use of materials; creating a sense of order.
- *Minimal details and materials*: Minimize the visual distraction excessive detailing brings. Any unnecessary detail should be avoided, altogether with hard edges. Reducing the background visual stimulation to a minimum. Also, it is a good idea to consistently define heights of elements such as doors, handles, light switches and others.
- *Proportion*: Create harmonious proportions on buildings and spaces designed for people with autism.
- *Natural light:* Extensive use of natural light, but avoid dazzling sun entrance, deep shadows or excessive contrasts, patterned or rhythmic shadow-light sequences may produce visual overstimulation.
    - Sandblasted glass generates a convenient diffuse and homogeneous illumination out from natural light.
    - The precise design and placing of windows determine the way natural light spreads out in a given space.
    - Skylights windows can also provide diffuse lighting.

- *Proxemics*: Proximity relationships in people with autism may be different to the usual ones. Individuals with ASD may need more space for social relationships.
    - Consideration for this needs to be considered in the design process –including classrooms, corridors, halls, exam and clinical spaces, waiting rooms.
- *Containment*: Create a safe place that allows for containment but ability to walk freely. Design exterior walls that are not obtrusive nor unpleasant.
- *Observation*: Create spaces that allow for observation without excessive intrusion in the child's activities or interactions.
- *Acoustics*: People with ASD often must make an enormous effort to differentiate sounds and are more sensitive than other people to noises.
    - The acoustic properties of materials and constructive elements and systems must be considered (Humphrey, 2010).

3.23 Multisensory Design

The sensory methodology has made its way into the design world. Sensory design has evolved from creating experiences in design to thinking about how people experience and react to the space both consciously and unconsciously. *Multisensory design* stems from the idea that humans experience spaces in many ways. Sight is what people tend to think of first when it comes to design and architecture, but more understanding and awareness has been made to the responses to strong sounds, smells, temperature, humidity and textures. Workplace design, product design and architecture are all using the multisensory design concept. Concepts being considered include factors of volume and quality of sound, temperature of a space, and navigation through spaces. These are seen as affecting both the mental and physical health of users in a space (*Center for Healthcare Design)*. The focus for wellness in the built environment also plays a strong movement for concepts of multisensory design (Marsh, 2017). Becoming a wellness certified building or workplace requires the stimulation of various senses. Air, light,

levels of comfort, and nourishment are just a few of the various wellbeing factors that play a key role in multisensory design (Marsh, 2017).

Going deeper into the design and the effects on the central nervous system from considerations for daylight to nature provide greater understanding of the importance for aligning our senses with design. Our circadian rhythm is stimulated by the cycle of day and night. This type of knowledge to inspire design has increased the awareness of the effects on the physical, mental and behavioral health of individuals. Access to sunshine and vitamin D promotes bone health, modulates immune function, and reduces inflammation (Sternberg, 2009). Access to natural light is imperative for a healthy multisensory workspace. Colors of surfaces, walls, decreasing a sense of crowding, and having clear sight lines are all visual inputs that can contribute to productive and healthy environments (Humphrey, 2010; Marsh, 2017; Mostafa, 2008; Mueller, 2017).

Sounds can be relaxing or energizing, and a space can support auditory information that either facilitates calm and regulation or effects stress and anxiety. Considerations for positive and negative effects of sound in design have created sound-masking technologies and materials used in design of spaces that can increase concentration and confidentiality or support privacy or social and collaborative spaces (Jenkins, et al., 2015; Gilliam, 2018).

Consideration of touch in multisensory design addresses concepts for coming in contact with surfaces, boundaries, textures and materials used in design. The sense of touch also contributes to awareness of humidity levels of spaces, airflow and temperature. Every experience in design is multisensory and research is backing up the importance for the consideration of our senses and the reactions we have to the built environment (Jenkins, et al. 2015; Marsh, 2017).

3.24 Summary of Sensory Processing Research

We can understand how sense perceptions trigger emotions that send our nervous system, endocrine system and immunity into action. We see the behaviors that individuals have to their environments, but behavior is also often affected by their internal thresholds toward stress and ability for self-regulation. Those individuals who are challenged by anxiety, sensory processing disorders, cognitive impairments, and physical and emotional challenges can help give rise to better knowledge for universal designed spaces that benefit everyone. We must rethink and collaborate with disciplines and research in order to create environments that promote wellness, health and healing through a holistic approach to design. It is important to bridge across disciplines in order to create rich, engaging, and supportive spaces.

Since each of the patterns of sensory processing represents a particular way of responding, *sensation seeking, sensation avoiding, sensory sensitivity and low registration* (Dunn 1997), it is important to review the responses one might expect, and provide some ideas about how to create a more universal and supportive built environment for all. Occupational therapists have a unique awareness for understanding this methodology because sensory processing is part of the core knowledge in this profession's education. Specialized knowledge also includes the ability to detect signs of overload, and the ability to adjust intensity of behavioral responses based on skilled observation during engagement in spaces in all built environments.

Sensory processing knowledge has developed over the last several years. Evidence indicates that both children and adults with and without disabilities exhibit the four basic patterns of sensory processing that was described in Dunn's model (Dunn, 1997). This understanding of these four of four basic patterns of sensory processing gives a new perspective for interpreting

behaviors of users within the built environments and can help guide design for health and well-being.

3.3 Arts and Healthcare Design

The arts are an integral part of our world around us, found in nature, music, colors, sights, and smells that all contribute to our perceptions and understanding of our creative self, our sense of self, and our overall health and well-being. The arts are central to the human experience, creating connections and community. Our experiences and memories tie into the places we have lived and visited. How we view our surroundings can directly affect our health. There is a body of research providing evidence that the arts have an important purpose in improving health and healthcare. The arts can provide positive distractions, support, and engagement that further exemplify the healing process. The expanding field of arts in healthcare are seen in clinical practice related to care of patients and families, in education of professional and nonprofessional groups, and research into the efficacy of art and the arts therapies as holistic healing modalities (Graham-Pole, 2007).

One aspect of the healing arts is its contribution to the aesthetics of physical healthcare environments, through architecture, signage, and installations of art and sculpture (Graham-Pole, 2007, p. 2). Roger Ulrich is an environmental psychologist who is frequently cited internationally for his research in evidence-based healthcare design of the healthcare environments on recovery and healing for patients. One such study reviewed patients recovering from surgery who had views of a small park with trees and flowers. These patients had better nurse evaluations, took less medication, and shorter stays than individuals with brick views (Ulrich, 1984, 1991). Ulrich explored the use of visual exposure to natural environments, views of nature and water through windows into gardens, parks, or even nature scenes through paintings and photography with

positive findings for reducing anxiety and stress over urban images. Patients experienced less postoperative anxiety and required fewer doses of pain medications with nature views, whether from windows or with nature paintings or photos. His recent work has dealt with the negative impacts of hospital noise on patients and nurses, and how nature, gardens, and art can lessen pain, stress, and healthcare costs. His research has made a profound contribution to the healthcare design world and the importance for arts in healthcare settings.

The arts can provide a sensory experience that supports emotional responses that facilitate health within the healthcare facility through music, art engagement, and connection to inner thoughts and feelings with writing, humor or eliciting emotions from watching or moving. These responses in combination with a supportive space, can further the healing process affecting the whole person's experience by supporting the effects on the nervous system and immune system. This is an exciting time for the Arts in Healthcare field to lead further development of environments and communities that promote health, wellness and healing for all.

3.31 The Healthcare Environment

There has been much written about the built environment and its impact on the health and well-being of those who inhabit healthcare spaces. The ambiance of a space has an effect on people using that space. The practice of incorporating positive distractions has now become an accepted part of the modern design of healthcare environments (Chambers, 2016, p. 47). Positive interactive elements relieve anxiety of patients toward procedures, tests or other negative associations within a healthcare environment. The environment can be set up to subconsciously support each person by engaging in a sensory experience through the use of art and design that supports the visual, auditory, tactile, smell, and movement experiences. Creating environments that stimulate and

support the senses is an important aspect to consider when creating positive interactive elements that relieve stress in the built environment.

Research has broadened the awareness for arts and health programming into the design of healthcare spaces. The research increasingly shows the influence of the physical environment on stress, safety and overall healthcare quality (Ulrich et al., 2004). Art and architecture are finding a way to work in harmony to enhance an individual's experiences and access to natural elements within the healthcare environment that promotes the healing process (Chambers, 2017). There is a holistic approach to healthcare design that integrates the arts with architecture to create an environment that better addresses the needs of the patients, their families, visitors, and caregivers. This seamless infusion of the arts within an architectural framework creates a healing environment, which includes: positive distractions, opportunities for interactions; varieties of colors and textures; support for theming, branding, and storytelling; and varying scale and elements designed to stimulate the senses (Chambers, 2017, pp 48-49).

It can be considered a journey when creating an environment in healthcare. It begins with a clear vision and mission of the space, the community being served, and understanding of the barriers to health. A space can help to support our physical, emotional, mental and spiritual being, and can prepare us for engaging in our surroundings to become active participants in the healing process and in our care. This engagement begins with the entrance into the building. The entrance should feel welcoming and the healthcare environment can incorporate such spaces that enliven and engage our senses as well as supporting our internal regulation to decrease anxiety and stress. The most successful environments that integrate the arts and architecture include interdisciplinary and inclusive planning and coordination of architects and the arts with clinical and human centered

philosophies (Chambers, p 49). Projects that lead with art and culture will have outcomes that are shown to uplift and enliven people to connect and promote health.

3.32 Developing a focus for Arts and Healthcare: Creative Placemaking

Hospitals often are seen as stark, cluttered, intimidating institutions with multiple entrances, unclear signage, and disorienting corridors. Small rural clinics are often housed in old buildings that may have barriers affecting the access of care for many in the community. These clinics may also become places for the community that provides social supports. According to the website of the former Global Alliance for Arts & Health (also formerly known as the Society for the Arts in Healthcare), "Arts in Healthcare is a diverse, multidisciplinary field dedicated to transforming the healthcare experience by connecting people with the power of the arts…" (Dewey Lambert, P., Rollins, J., Sonke, J., & Cohen, R. 2016).

Developing a plan for revitalizing healthcare spaces, renovations, remodels, or new construction will support all areas of engagement and healing. This plan can draw on concepts of *creative placemaking* which is the means of strategically shaping the physical and social character of places around arts and cultural activities. Creative placemaking animates public and private spaces, rejuvenates structures and streetscapes, improves local business viability and public safety, and brings diverse people together to celebrate, inspire, and be inspired (Markuson & Gadwa, 2010).

Bringing the concepts of creative placemaking into rural and community health programs and clinics can enhance the community's engagement, sense of place and belonging, and support health. Health clinics often become one of the centers of a rural community. Arts in healthcare can serve as the bridge to connect a community's engagement in creating this healthcare home. Using various arts and design principles paired with concepts of creative placemaking will inspire

greater community development in the design for community and rural health facilities. Early engagement with the community is one of the best ways to build a place that locals will embrace (Hardy, 2017), especially for community health centers. By investing in these institutions with creative placemaking in the rural healthcare facilities will facilitate economic, financial, educational and cultural development of the community. This makes for a healthy community at large.

Design professionals have a significant impact on the spaces that shape communities (Borrup, 2006). It is important in the planning phase for design to consider principles in *creative placemaking* for community healthcare development. Borrup outlines these principles in his partnership with Livable Communities which include the following concepts to consider:

1. Beginning with the end in mind and envision what you would like and not like.
2. Bring artists and the community together on a project early; Arts and Culture need to be central to project designs.
3. Creative placemaking works best when using local community assets through "Radical Listening" which is a process of seeking to understand.
4. Engage local artists from the community, region.
5. Understand and articulate stakeholders, focus on community driven outcomes
6. Form cross sector partnerships.
7. Identify critical skills needed to deliver on project goals and outcomes.
8. Look for early wins to generate excitement, visibility and buy in.
9. Consider programming that keeps the community engaged and the place alive.
10. Pursue creative financing (Hardy, 2017).

These key principles can be used to support the development for aesthetics within community and rural health clinics. Engaging local artists to facilitate art projects within the healthcare facility can develop a sense of belonging and pride. Art Projects provide positive engagements with a healthcare clinic. The art and projects in the environment can be set up to

subconsciously support each person by engaging in a sensory experience. Participating actively or as an observer of the arts in built environments can deeply affect the ways we feel, think, and behave. This focus supports not only patients, caregivers and families, but also the staff who are dedicated to bringing quality care to their communities.

Creative Placemaking principles along with a commitment to the arts helps to create a successful environment that integrates the arts and architecture by engaging in an interdisciplinary and inclusive planning process. It is important to have collaborative processes with the community to guide the interior and exterior design process. Using varied art forms and planning spaces to showcase the arts or support art programming are important conversations. Another important aspect for creative placemaking in the healthcare design is creating spaces that appeal to a variety of ages, developmental levels, and cultures, making the space accessible to all.

3.33 Aesthetics through the Arts

In the healthcare environment, art is often the most visible component of a space. The use of visual arts is an important aspect for creating an aesthetic environment that promotes health and healing within medical facilities. In the *State of the Field Report: Arts in Healthcare 2009*, several areas of focus were examined. The incorporation of the arts into the healthcare experience and environment were found to have a positive impact on patient health outcomes. The arts were found to benefit patient's physical, mental, and emotional recovery, decreased anxiety, and affected the perception of pain. Art within the healthcare environment creates a safe, more supportive and functional facility. Healing environments have included the architectural design and consideration for space of the internal and external environments, art, access to natural lighting, nature scenes and healing gardens. The physical environment has a significant impact on reducing patient, caregiver and staff stress, improves health outcomes, enhances patient safety and quality of care,

and reduces costs. For staff, it has an important role in increasing the effectiveness in providing care, reducing errors, and improving job satisfaction (State of the Field Report, 2009).

Creation of an aesthetic healing and health environment, together with high-quality working conditions, reduces stress factors, strengthens immunity, and heightens the contentment of staff. Research has confirmed the importance of awareness for addressing the aesthetic dimension in hospitals and maintaining the quality concerns for the physical, psychological, ethical, aesthetic, intellectual, mental and spiritual aspects within the environment. (Caspari, Eriksson, & Naden, 2006). Research also confirms that the physical design of healthcare settings can contribute to positive or negative outcomes for patients (Sadler & Joseph, 2008). These types of environments help patients and families deal with serious illness, aide in part of the physical recovery, and contribute to a healing community through a thoughtful design of space. Buildings and the space can be designed to encourage social connectedness by providing places for engagement, both private and social. Connections with family, friends, and caring providers are also an important aspect of care. Thoughtful consideration of aesthetics to make the space beautiful enhances the care and connection between physical, emotional and spiritual health.

3.34 Art in Healthcare Design

There is increasing evidence that the display of visual art, especially nature images, can have a positive effect on health outcomes, including shorter length of stay, increased pain tolerance, and decreased anxiety (Kain, et al, 2001). The use of visual arts, music, interior design with color, form and space considerations provide positive sensory influences within the healthcare environment that promote health and healing. The physical effect of a thoughtfully built environment positively influences our minds, bodies and spirits. The arts should be recognized as being integral to health, healthcare provision and healthcare environments.

The healthcare environment is multifaceted. It is a work environment for staff, healing environment for patients and families, a business environment, and a cultural environment for the organization to fulfill its mission. The research shows the positive effects from the environment affecting moods, anxiety, stress reduction, pain reduction, and shorter hospital stays. When considering interior colors for patient's rooms and waiting rooms, furniture, and with commissioned art, it is important to realize the psychological effects of color and design on the brain and body. An early study investigated the effects of color and state of anxiety scores finding increased heart rate and respiratory rate with the colors red and yellow (Jacob & Suess, 1975). These colors provoked high levels of arousal and anxiety. The nature scenes and colors of blue and green have been found to be calming. Colors that elicit high levels of pleasure with low levels of arousal are most likely to induce a state of calm and the use of light, color and views from windows help in recovery.

Several studies indicate that briefly viewing nature can produce physiological changes in blood pressure, heart activity, muscle tension, brain electrical activity affecting the stress levels. This restorative effect of viewing nature is manifested within minutes as a combination of beneficial physiological, emotional, and psychological changes (Ulrich, 2009). Nature photography elevates positive feelings such as pleasantness and calm and can lessen negatively toned emotions such as anxiety and anger (Ulrich, p. 137). Color photography, when coupled with nature, can be a healing medium on conscious and subliminal levels (Oberlander, 1979).

3.35 Healthcare Art and Placement

There are three critical success factors when considering Arts in Healthcare. These are content, placement, and size. When considering art, it must be a positive distraction, engaging, enduring and nurturing depending on the patients. Based on an extensive body of both scientific

studies and anecdotal accounts, Ulrich outlines representational art that depicts the following categories and subject matter as guidelines (Ulrich, 2009, pp. 141-142).

- *Waterscapes*
    - Calm or non-turbulent water (no stormy conditions)
- *Landscapes*
    - Visual depth or openness in immediate foreground
    - Landscapes of warmer seasons with verdant vegetation
    - Scenes with positive cultural artifacts (barns and older houses)
- *Flowers*
    - Healthy and fresh
    - Familiar
    - Garden scenes with open foreground
- *Figurative art*
    - Emotional positive faces
    - Generational and cultural diversity

Research findings conclude that evidence-based selection of emotionally appropriate art contributes an important environmental dimension to patient care by decreasing patient stress, pain, and improves other medical outcomes (Ulrich, 2009, p. 143).

When deciding where artwork should be placed in the hospital setting, it is important to consider stress levels, length of viewing time and age of the viewer. High stress areas include waiting areas, exam rooms, labs, procedure rooms and emergency rooms. Artwork to be considered should offer serene, easily recognizable, and full color spectrum scenes ofnature with distant horizon lines and clear skies. The higher the stress, the more important to offer comforting imagery. Familiar nature scenes can offer comfort as they remind the viewer he is close to home.

Low stress areas include the elevator lobbies and corridors. These areas have shorter viewing times and can offer different art opportunities. Placing memorable or identifying artwork in strategic locations can aid in wayfinding by establishing a visual reference point for patients and families traveling through the hospital. Consideration for placement of art is also important.

Artwork should be hung at multiple heights and locations and provide positive distractions and opportunities for viewers of all ages and heights. For exam tables or beds, considering location from a patient's natural position in different scenarios of their time spent in the facility.

Hathorn (1998) described the importance for considering the placement of art as an integral part of the planning and design process from the physical size of the space and art piece to the viewing distance. For public spaces the art should be larger than exam room art or corridor art. Images larger than life can provide details often missed when viewed in a natural setting. Hathorn describes three aspects of art consideration for healing environments have been outlined and include the following:

- Location of artwork (considering where the artwork is going to be located and how it can be the most effective in enhancing the physical environment and developing a healing atmosphere).
- Needs of special patient populations (evaluating the unique needs of the kind of patients who will view the artwork. For example, art for pediatrics may differ from art for palliative care. This is discussed further in the next section.).
- Role of demographics in the healing environment with consideration of ethnicity, gender, and age makeup of the location of artwork and choosing art accordingly (Hathorn, 1998).

3.36 Summary of Arts and Healthcare Research

Art is an important part of the planning and design aspect in creating the healthcare environment and plays an important part in healing. The literature leads us to conclude that the aesthetic dimension has great importance for human health. Art helps patients and staff feel better, provides a positive distraction by allowing patients and visitors to focus on something other than their condition, and aides in decreasing stress. Art improves the perception of care at the hospital

or clinic and serves as an element that the community can identify with and creates landmarks for wayfinding. Art engages our sensory responses and can create a sense and feeling of calm.

The consideration of aesthetics to include art in the healthcare environment needs to be a part of the whole design process, from the beginning of the planning and designing process to the creation of the physical space. Assimilating art into healthcare design has a significant impact on reducing patient and caregiver stress, improving health outcomes, providing improved quality of care and reducing overall costs (Chambers, 2016).

Arts in healthcare serves as the bridge to health and design by creating a connection to the local community by engaging in various arts and design principles paired with concepts of creative placemaking that inspires community development in rural health. The public spaces of these healthcare facilities can be designed with art and creative placemaking to enhance the healing environment that promotes health and well-being.

3.4 Design for Health and Well-Being

Research using many methodologies for design have helped to develop ongoing conversations and engagement in developing spaces that promote health and well-being. The literature review and research show the importance for interdisciplinary models that bridge across disciplines in order to create rich, engaging, and supportive spaces. *Evidence-Based Healthcare Design* has used this informed integration of interdisciplinary models that have guided architects and designers on best practices for developing healthcare environments that promote health and well-being for all users. The importance for informed understanding of how the built environment affects all users has drawn from *environmental-behavior-psychology*, *neuroscience*, *psychoneuroimmunology* and *salutogenic methodologies* described earlier. Design interventions have aimed to improve the physical, emotional, and psychological well-being of patients and staff

and research continues to help inform key aspect for design (Amedeo, et al., 2009; Cama, 2009; Eberhard, 2009; Golembiewski, 2012; Newman, T. 2016).

Research is also helping us understand how our senses and perceptions trigger emotions that send our nervous system, endocrine system and immunity into action (Straub, & Cutolo, 2017; Sternberg, 2009). We see the behaviors that individuals have to their environments that often is affected by their internal thresholds and ability for self-regulation. Those individuals who are challenged by anxiety, sensory processing disorders, cognitive impairments, physical and emotional challenges can help give rise to better knowledge for universal designed spaces that benefit everyone. Sensory processing is another methodology that helps to give understanding to the effects our environments have on our central nervous system affecting our responses for well-being. The unique outlook on understanding the sensory nervous system that can help or hinder the barriers to health are at the central focus for the field of *Occupational Therapy*. This perspective provides an important contribution to the field of *Healthcare Design* by having a clear awareness for the responses and reactions one might have to the built environment and provide vital information about how to create a more universal and supportive built environment. Through the skills for observation to detect stress, anxiety or sensory overload for individuals engaging in spaces due to issues related to visual, auditory, tactile, movement or spatial cues, this researcher developed a *Sensory Design Assessment Tool (SDAT)* integrating concepts from the interdisciplinary design models, art and creative placemaking, and sensory processing methodology. This chapter introduces the SDAT in detail.

The field of Occupational Therapy uses a *Sensory Profile Questionnaire* to assess sensory responses to various areas of daily life and the determined functioning in four patterns of sensory responses outlined by Dunn (Ermer & Dunn, 1998, Dunn & Westman, 1997). The

SDAT was developed by adapting topic areas from the Sensory Profile Questionnaire of vision, auditory, tactile, movement/spatial, and oral to create the subcategories that assess spaces in a built environment. Concepts from creative placemaking provided informed subcategories for understanding the community, culture, and themes of the built environments. Consolidation of all relevant literature was used as a reference to inform the development of the *Sensory Design Assessment Tool (SDAT)*, Appendix 6.

3.41 Sensory Design Assessment Tool

The *Sensory Design Assessment Tool (SDAT)* was also adapted from Creative Placemaking concepts for community and cultural development, and the Sensory Profile developed by Winnie Dunn, PhD, OTR, FAOTA. The Sensory Profile is a measure of responses to sensory events in daily life. It provides an overall picture of an individual's sensory processing patterns. Results of the Sensory Profile are used to consider how these patterns might be contributing to or creating barriers to performance in daily life. The sensory profile uses eight sensory input domains including auditory, visual, taste/smell, activity level, body position, movement, touch and emotional/social.

This profile inspired the development of the *SDAT* used for this study. The concepts were adapted to focus on design aspects of the built environment that affects the sensory reactions that can either support or hinder healthy responses. Key concepts for design, arts, and aesthetics were subcategorized under each of the sensory nervous systems that would be impacted by its presence or lack of presence in the environment. The *SDAT* was developed to assess spaces both new and old of built environments. The information can then be used to inform design and gain insight as to what works in the spaces that decrease anxiety, stress and high threshold responses or reactions to the built environment.

Taking a quick survey for how the space *feels* sets the immediate awareness to begin analyzing each aspect of the space. The feeling is subconscious and our sensory nervous system takes in this information and informs us as to feeling safe and calm, or stressed, anxious, agitated or fearful.

Next, understanding cultural themes, color themes and patterns lay the foundation of a place. It is important to ask questions as to whether themes exist through colors, materials, artwork, and if the local community and culture are represented. Understanding the space and breaking up the key architectural concepts of human context in the design helps to analyze those features that work in the space and create a welcoming and usable environment for all.

The checklist then breaks down concepts of the environment through the different sensory responses that include *Movement, Visual, Tactile, Auditory, Oral, and Spatial*. It was important to use these categories as it provides a breakdown of our senses and explores the effects of difference elements in the built environments. The subcategories under each section outlines elements of human context for design and universal design that were informed by research for best practice and provide cues to assessing the environment and understanding what works and what could use improvements. These concepts fit into the framework of sensory processing and the goal to this project was to recognize how sensory processing concepts can be applied to the built environments of community healthcare spaces.

With reference to Figure 3a, the SDAT consists of nine sections that help to assess a space and determine what features work or don't work to help guide recommendations for renovations, remodels or considerations for new construction. Through the assessment of space using the lens of sensory engagement, we can recognize how to integrate sensory processing insights in the built environments that will support all in their health and well-being. Following

Figure 3a contains the key human context of design and architectural concepts and terms that have been integrated within the SDAT and are discussed in further detail.

Figure 3a: SENSORY DESIGN ASSESSMENT TOOL (SDAT) Content Areas

Categories	Subcategories	Description
1. Themes	Cultural Themes	- This section is important for understanding the culture of the community and understanding how the space supports its community and engagement within the space.
	Color Themes	- This section is concerned with the use of colors and color placement: consideration of saturated colors vs muted colors, earth tone and natural colors vs bold or bright colors - Colors of materials, textures, floor coverings, furniture, paint colors
	Patterns	- This section looks at not only patterns in design, but patterns used in materials, flooring - Wayfinding, movement through the space
	Art/Artwork	- Color choices, types of art - Use of different mediums, types of visuals and visual aids/cues in the space that help create the aesthetics.
2. Space	Proxemics (Sociofugal/Sociopetal)	- Spaces that bring people together, distances between people Sociofugal - space minimizes contact between people Sociopetal - designed to bring people together
	Privacy vs Social (alcoves, nooks, openness of room)	- Creating spaces that are sociofugal or sociopetal in the design - People do well with choices so is important to think about creating different kinds of spaces.
	Propinquity	- This is looking at the idea of being close to others. - Consideration for waiting areas and assessing the proximity of individuals in the space.
	Territory	- Separation of space - Spatial Scripts, creating defined spaces - Choices within the space - Images on walls creating a sense of personalization of the organization, community.
	Locationality (front stage/backstage)	- Consideration for creating the front stage, public space

		- The transition areas between public and clinic/private spaces (backstage)
	Connection to Nature	- Windows, location - Healing gardens, atriums, use of plants - Nature theme artwork
	Age variability	-Universal for all ages, shapes and sizes - Children's play area separation for other seating
	Safe Havens	-This section is concerned with having a welcoming environment and what creates this feeling of being welcome. -What are safety features in the space
3. Movement	Flow through the space	- Circulation between spaces - Having a connective function - The experience of moving our bodies around a building - Barriers - Physical features that limit or prevent people with disabilities from using the space.
	Paths Nooks Nodes	- Consideration for the path to get from place to place - Interior and exterior paths - Places for rest, retrieve
	Accessibility of Space	
	Opportunities to move: Opportunities to rest	- Structures, visible stairs, sculptures - Seating, nook, Stairways/Elevators/Ramps
4. Visual	Wayfinding Nature scenes Windows/Daylighting Clutter Simple Design/Complex Too much visual input Control of lighting/overhead lighting Positive Distractions - visually Minimizing visual distractors Staircase at a glance Lines of view Barriers	- How used, what & where, Is it Culturally relevant - Colors - Artwork: visual, performance, music, poetry
5. Tactile	Materials: Furniture, Flooring Positive Distractions	- Objects for tactile play/exploration - Size/Shape, Activities
6. Auditory	Acoustics Positive Distractions Sound Privacy Public Restrooms: noise of flushing toilets Sociofugal/Sociopetal spaces for privacy or conversations Safe Havens Low stimulation environments Sound barriers	

	Music: location/type	
7. Oral	Water fountains/water stations Size for all ages Materials of furniture Cafe/Vending machines Kitchen facilities Staff Areas	- Bite proof, ability to clean, durable
8. Spatial	Safety Variability in Space: all ages Exposure to environment: outdoor spaces, garden Layout/Decor of spaces for social interactions, privacy Furniture Placement Functional use of space: wheelchair, disability	- Doorways, hallways, entrance, - Transition areas inside/outside
	Olfactory/smells Air quality Outdoor Shelter: Protection from weather Temperature Humidity Accessibility of hallways, entry, waiting areas Safety and Security	

3.42 Architecture Concepts for Human Context of Design

The human context of design considers all aspect of the built environment and effects on people. This section dives into the architecture key elements and terms for understanding how humans engage with the built environment. There are many design principles used by architects for considering spaces and patterns in the built environments. The architectural patterns of design used for this study include *proxemics, territoriality, privacy, wayfinding, sociopetal and sociofugal* (Gilliam, 2018). The SDAT categorized these terms within one of the sensory systems outlined above to describe the effects and responses of people to the built environment.

Proxemics is a term used in design to define spaces and distances among individuals using a space. These spaces include intimate distance, personal distance, social distance, and

public distance. Spaces can be designed to either bring people together (sociopetal) or designed to minimize contact between people (sociofugal) (Gilliam, 2018). It is important to design spaces that give choices for people to gather or retreat and is important in the consideration for public spaces.

Territoriality is a term associated with nonverbal communication that refers to how people use space (territory) to communicate ownership or occupancy of areas and possessions. This can be important in design to create separation in spaces, providing choices, and defining spaces with personalization in the spaces that shows ownership of the community (Gilliam, 2018). This can be through community public engagement and the use of art in the spaces.

Privacy used for this research refers to the creation of spaces that provide choices for engagement or privacy. For healthcare facilities it also considers an individual's right to privacy especially around personal information, checking in, and clinic spaces. *Wayfinding* has become an important aspect in design. It encompasses the ways people orient themselves in their physical environment and space and the ability to navigate from place to place.

Personalization can refer to the psychological needs of human beings in creating their spaces. Considerations for design that can be universal in the aesthetics and culture of the community can address this area. Wayfinding is a term used in finding one's way within the built environment. It provides the cues to where you are in an environment, knowing where your desired location is, and knowing how to get there from your present location.

It is important to have considerations for transition and gathering spaces that provide opportunities to enhance the environment and provide a sense of place and safety. The use of colors, materials, textures, lighting, paths, nooks, nodes, overhangs, entrance doorways are ways of creating these spaces. There are multitudes of patterns in design that are taken into

consideration in developing the built environment that affects and supports all users in the space. Extra consideration can be informed by using principles of *Universal Design* to exceed recommendations especially when the design is for all users and all abilities.

These concepts are important for the human context when designing successful spatial layouts, interior design and arrangement of furniture, art, and considerations for aesthetics to enhance social interactions, need for privacy, allowing for individual or group engagements, and considerations for finding one's way in the space. The field of healthcare design has evolved over the years and keeps refining important aspect of design that promote health and well-being. These concepts are an essential aspect in understanding space used to inform the development of the Sensory Design Assessment Tool (SDAT) which provides a holistic approach to assessing space and guiding principles for designing a more universal healing environment.

3.43 Universal Design

Universal design is a method of planning and design that responds to as large of a population as possible and is as inclusive as possible (Vance, 2015). The Center for Excellence in Universal Design developed seven principles to help guide the design of more usable environments, products and communications (National Disability Authority, 1997). These principles include:

- *Equitable use*. The design is useful and marketable to people with diverse abilities.
- *Flexibility in Use*. The design accommodates a wide range of individual preferences and abilities by providing choices, function, and adaptability.
- *Simple and intuitive*. Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level or cognitive ability.
- *Perceptible information*. The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities. Use

different modes for presentation of essential information (pictures, verbal, tactile cues), provide visual contrasts in spaces, and differentiate elements for wayfinding.

- *Tolerance for error*. The design minimizes hazards and the adverse consequences of accidental or unintended actions. Consideration for safe features and arrangement of elements in the environment to minimize hazards.
- *Low physical effort*. The design can be used efficiently, comfortably, and with a minimum of fatigue. Doors that open automatically for people with a wide variety of physical characteristics demonstrate the application of this principle.
- *Size and space for approach and use*. Appropriate size and space are provided for approach, reach, manipulation, and use regardless of the user's body size, posture, or mobility. The use of clear lines of sight, comfortable reach in different positions, accommodations for various hand and grip sizes, adequate space for assistive devices and mobility.

The Americans with Disabilities Act (ADA) prohibits discrimination against, or segregation of, people with disabilities in all activities, programs, or services. Its parameters greatly affect the design, construction, and operation of buildings and facilities (*ADA Overview, 2019)*. Universal Design proposes adhering to ADA requirements but leaves room for organizations to improve barriers to care and reduce risks to safety. To exceed requirements, a facility can also engage aesthetics with universal design that creates an environment that also supports overall environments feelings and sense for wellbeing. Universal Design methods apply to all, including seniors, bariatric, handicapped, all ages of individuals with and without disabilities. The concepts for Universal Design are important to consider when creating spaces that promote health and well-being for all users.

Specific areas that were examined for this research include spaces promoting accessibility for all which includes physical, visual, auditory, cognitive disabilities and individuals with autism and other sensory processing challenges. Design principles addressed

issues of accessibility through wayfinding, lighting, sounds and acoustics, order and simplicity in the design, texture and durability of materials, transition areas, and creating variety in spaces for all users.

Magda Mostafa was among the first to research spaces designed for children with Autism and assessed the built environment's effect on these children. She created sensory spaces and described this process as the means of which a space becomes a place when taking into consideration individuals who struggle with Sensory Processing Disorders (Mostafa, 2008). Since her groundbreaking study, many other studies have researched the design parameters that go beyond the recommendations of Universal Design have been pursued when creating spaces for individuals with sensory processing disorders such as Autism (Feehily, 2015; Humphrey, 2018). This is a challenging population and many of the concepts discovered can be used in all design to make more universally accessible for all. Simon Humphrey, an architect with an interest in Autism, contributed to design with key principles that directly dovetail with concepts of sensory processing methodologies and were adapted in the SDAT to include considerations for:

- *Calm, order and simplicity*: The sense of calm and simplicity is not limited to the way in which the plan and sections have been designed, but also applies to the use of materials. Sense of order.
- *Minimal details and materials*: Minimize the visual distraction excessive detailing brings. Any unnecessary detail should be avoided, altogether with hard edges. Reducing the background visual stimulation to a minimum Also, it is a good idea to consistently define heights of elements such as doors, handles, light switches and others.

- *Proportion:* Create harmonious proportions on buildings and spaces, which is important to consider when creating universal design, especially for people with autism.
- *Natural light*: Use an extensive use of natural light but warns against some possible errors such as dazzling sun entrance, deep shadows or excessive contrasts, patterned or rhythmic shadow-light sequences that may produce visual overstimulation. Sandblasted glass generates a convenient diffuse and homogeneous illumination out from natural light. Also, the precise design and placing of windows determines the way natural light spreads out in a given space. Skylights can help get this kind of diffuse lighting.
- *Proxemics*: Proximity relationships in people with autism may be different to the usual ones. Individuals with ASD may need more space for social relationships, and this has to be considered in the design process –including classrooms, corridors, halls, exam/clinical spaces, waiting rooms.
- *Containment*: Create a safe place that allows for containment but ability to walk freely. Design exterior walls that are not obtrusive nor unpleasant. Her consideration for nooks or nodes in pathways gives places to retrieve.
- *Observation:* Create spaces that allow for observation without excessive intrusion in a child's activities or interactions, this can also be important for older individuals with Autism.
- *Acoustics*: People with ASD often must make an enormous effort to differentiate sounds and are more sensitive than other people to noises. The acoustic properties of materials and constructive elements and systems must be taken into account (Humphrey, 2018).

3.44 Aesthetics and Art

Research has confirmed the importance of being aware of and addressing the aesthetic dimension in hospitals and clinics. Creating the environment through art and thoughtful aesthetic design in colors, furniture, sculptures, artwork, images, creative wayfinding, and nature through gardens and landscape is important in developing and

maintaining a quality environment. This approach has concerns for the physical, psychological, emotional, mental and spiritual aspects for all users and the environment of clinics and hospitals (Cama, 2009; Caspari et. al, 2006; Chambers, 2016).

The effects of images, color, and light are powerful tools for healing within healthcare settings. The arts are integral to healthcare environments and the use of colors, colorful images, nature views, photography and artwork, windows, gardens, landscape, ideas of simplicity, and daylighting are all concepts that engage and create a more natural, positive, and fresh environment that promotes health and well-being. It becomes an expression of the community and the culture of the organization. The use of art, colors, acoustics, images in design can create the images and feelings of the organizations mission and vision (Graham-Pole, 2007; Markusen & Gadwa, 2010; Rickard-Brideau, 2015; Ulrich, et. al., 2009).

3.45 Summary

The *Sensory Design Assessment Tool* was developed to assess public spaces and the design for human context that promotes health and well-being. It is important to understand how the built environment effects all its users especially environments that support community and rural health. Adapting a sensory tool used by Occupational Therapists to understand issues of sensory processing challenges that affect individual's ability to participate in their daily lives was used to create the SDAT. Within each sensory category (Movement, Touch, Visual, Auditory, Oral, Spatial), subcategories include concepts of architectural design, universal design, creative placemaking and arts in healthcare are examined to determine best practices that support the body, mind, and spirit for health.

The SDAT was used in this research of assessing the built environments and spaces within community health centers in western Oregon. Data collection using the SDAT and

interviews were completed during Stage 2. These next chapters will discuss the results of the data collected and articulate the scope of concepts for best practices being utilized in the built environments. The results will provide informative guidelines for best practices to be used and considered in the built environments for rural and community health centers that support universal design, aesthetics and art, creative placemaking. These recommendations will strongly support the sensory nervous systems of users that decrease stress and promote overall well-being for positive engagement in the public spaces and clinical spaces of healthcare facilities.

Chapter 4
Research Findings and Analysis

This research began with a question as to the need for an interdisciplinary approach to designing healthcare spaces that promote health and well-being. It is felt that architects and designers alone cannot begin to understand the complexity of individuals reactions and responses to the built environments. Through an extensive literature review, I discussed in Chapter 3 several interdisciplinary models are being used to inform the planning, design, and construction of healthcare facilities. Evidence based healthcare design has been informing the design field for years. There is an extensive literature review exploring the influences of *environment psychology, neuroscience, neurosensory, psychoneuroimmunology, and salutogenic methodologie*s that provides a wealth of research, knowledge and understanding in creating spaces. These different disciplines, combining scholars with practitioners, have evolved and continues to shed light onto the effects of the environment on healing. The concept of interdisciplinary models has developed the healthcare design field for nearly two decades.

It is from this wealth of knowledge using key principles from these design models combined with my professional expertise as an occupational therapist that *The Sensory Design Assessment Tool (SDAT)* was developed. Having a clear understanding of how spaces affect the sensory nervous system that can affect stress, anxiety and overall health is an important component to improving the built environment. Many of the key principles used from the interdisciplinary models and human context of architecture design could be assessed through considerations of the sensory systems (visual, auditory, movement, tactile, spatial). The *SDAT* filtered out important elements of design to be considered and address that supports the different

sensory systems. By understanding these key architectural and design concepts along with sensory challenges and barriers can inform and create spaces that promote calm, engagement, and relieve stress.

Stage one of this research assessed two urban pediatric hospital's public space that used Evidence-Based Healthcare Design principles in their new facilities. The pilot use of the *SDAT* was used to assess the functional use for understanding key design principles that support health looking through the lens of sensory processing supports (*movement, tactile, visual, auditory, spatial, oral/olfactory)*. The *SDAT* was then refined and used for Stage Two of this research field study in the assessment of six Community Health Centers in Western Oregon. Interviews were conducted with the Executive Directors and/or CEO of each community health program to gain insight into their understanding of the built environment of their clinics, what works or doesn't work that supports the community of users. Interviews were also conducted with key informants in the field of healthcare design to help guide understanding of key principles for design that support health.

Chapter 4 provides an analysis of the interview data in *Figures 4.1a - 4.1d*, and outlines key principles of healthcare design that contributes to the design and aesthetic of the built environment that promotes well-being, considerations of public spaces and universal design, and considerations for community health projects in the design or upgrading of older community health centers. *Figure 4.2a* reviews the SDAT results and findings of each sensory section taken during the field research of six community health clinics and outlines the consolidated results to understand the features of the built environments assessed for this study. This information will be used in formulating recommendations that will be discussed in Chapter 5.

4.1 Interview Findings

The theories and concepts of design and the use of interdisciplinary methodologies were discussed extensively in the literature review in Chapter 3. To gain greater understanding for the use of interdisciplinary models for healthcare design, key informants were interviewed for best practices being used in the field of healthcare design. Understanding the best practices in the healthcare design world helps to inform how these models can be used in rural and community health. There is wide consensus that it takes an interdisciplinary team in planning and designing healthcare spaces. There needs to be engagement at the early conceptual planning phase through the design and construction. Working through design scenarios, engaging multiple disciplines to include staff, physicians, architects, designers and artists helps to inform what the needs are in the space.

The use of an interview questionnaire was used to understand several important areas in design during phone interviews with several key informants. These key informants were chosen for their contribution to design, considerations of art in spaces, and sensory design exploration from the field of architecture.

Misty Chambers is a clinical operations and design specialist with ASa Architects. She has a background as a clinical nurse and administrator understanding the needs of healthcare design. Misty has lead design research efforts with Center for Health Design, Americans for the Arts, and the Planetree Visionary Design Network. Misty brings her clinical and evidence-based design knowledge to her current work at ASa Architects.

Annette Ridnour is a multidisciplinary design leader in the healthcare design field and a pioneer for the field arts and healthcare. Her knowledge helps to create the physical development

of healthcare spaces that reflects institutional mission and goals using local culture and arts in the design.

Barbara Erwine has been an architect for years and an educator at the University of Washington. She brings her perspective for sensory design and returning to our senses as we experience the built environments. In her book, "Creating Sensory Spaces," she explores "the deep sense of place that emerges when all the senses are engaged" (Erwine, 2017). It is this perspective of exploring aesthetics and beauty to create the sense of space that supports our healing and informs this research and SDAT.

Each of the key informant helps to support principles of design which include aesthetics, universal design, and the use of sensory features that support health. The key principles that contribute to aesthetics in the built environment promoting well-being have been described as materials used, function, bringing the outside in, culture of the community/people, having synergy between the exterior and interior spaces, and considerations of color and palette. "Healing is rooted in the nature of place" (Ridenour, 2019). It is important for healthcare design to be collaborative, working closely with staff, planners, clients and a healthcare design team. This begins the conversations for the design and the importance for the needs of the professionals and staff using the space (Chambers, 2019). Understanding key principles in the design that exceed basic regulations can develop a more intriguing, supportive and aesthetically beautiful environment.

Analysis of the interview data will be presented in figures *4.1a, b, c, and d*. The data collected outlines the key principles from these interviews that support this research and contribute to the assessment of community health centers. Prior to each figure will be a description of the key point that the figure will be addressing to answer a research question.

Figure *4.1a* describes some of the key principles discussed in the interviews for health that contribute to the design and aesthetics of the built environment.

Figure 4.1a

What are some key principles that contribute to the design and aesthetics in a built environment that promote well-being?

Natural ventilation (Erwine, 2019)

- Variation over time and connection to weather, outdoors, and nature. This helps to ground people in the world, create connection to your place in the world.
- Operable windows, daylighting, skylights; creates natural ventilation and lighting.

Materials (Chambers, 2019)

- Considerations for the materials being used and how it fits and works together in the whole project/environment.
- Avoidance of HAI (Healthcare Acquired Infections)
    - Materials that provide another barrier for health.
    - Fabrics with different qualities that includes durable materials, washable.
    - Every finish needs to be in compliance with HAI/healthcare.
- Function first
    - Consider the function of an environment, the space needs to respond to the function. This helps in the design and planning of spaces.
    - Considerations for how to use the materials to support function.
- Bringing the outside in.
- Culture of people being served and the community characteristics of where they live. This can inform the space, colors, materials, and artwork used that represents the community.
- Synergy between exterior and interior. Creating a balance of the interior designed space and exterior designed space.

Arts in Healthcare (Ridenour, 2019)

- Focus for healthcare design is to understand the uniqueness of each facility.
- Before beginning a remodel, renovation, or construction, consider the following:
    - Need to do a deep dive to understand the client and the community.
    - What is the population being served?
    - Clinic Focus; what is the function of the space?
    - Unique Culture and community being served by this facility, environment.
    - Relationship to community.

Art as a tool in the toolbox (Ridenour, 2019)

- Arts are used as a valuable enhancement to the healing going on in the physical environment.
- Consider colors, materials, and subject matter of art/interior design.
- Converge relationship between artist and facility; bring in the artists to understand the environment and community being served.
- Art used for rural clinics
    - Consider what art is in the community; music, woodworking, storytelling the history, agriculture, environment, etc.
    - Be Authentic.

4.12 Key principles of design and aesthetics of public spaces

This section outlines the key principles of aesthetics in design that are important for consideration in design to help decrease anxiety and stress. Several themes were found to be consistent with all key informants. These included continuity and consistency of color and themes throughout the environment. Themes consistent with place/geography will provide greater sense of belonging to the environment which supports health. The use of natural lighting is also a consistent theme discussed. Providing choice and variability in the spaces, creating clear signage and graphics for wayfinding will help to provide a balance of safety and interest. These key principles help to decrease anxiety and stress in public spaces. *Figure 4.1b* provides some more considerations of key features discussed with key informants.

Figure 4.1b

What are key principles used to develop the design and aesthetics of public spaces?

Prepare for transitions (*Chambers, Erwine, 2019)*

- Inside to outside, outside to inside transitions are important.
- Consideration for preparing individuals to walk out into the world, to unexpected weather. Consideration for windows, outside overhangs, interior foyer as transition between the inside to outside.

    - May cause fear or stress if the transition and change does not allow for preparation.
- Use of windows, viewing spaces, daylighting.
    - Provide lighting that can be electronically changed/dimmed or brightened as needed.
    - Be cautious of artificial light changes.
- Natural light important to the healthcare spaces.
- Views from outside; windows, glass doors.
- Sounds - approach outdoors, entrance areas.
- Protected areas in transition.

Choice and variability (Erwine, 2019)

- Prospect and Refuge
    - The theory of "prospect and refuge" seeks to describe why certain environments feel secure and thereby meet basic human psychological needs. Environments that meet such needs will often provide people with the capacity to observe *prospect* without being seen *refuge* (Dosen & Ostwald, 2013).
- Consider the sun throughout the day in design; windows, daylighting, gardens.
    - sun/shade, privacy/public, quiet/loud, important to have variations in spaces.
- Manipulatory lighting can increase or decrease moods.
- Skylights good, create daylighting without views.

Provide clear information (Chambers, Ridenour, 2019)

- Simplified aesthetics in public design can be calming, organizing.
- Clear signage and graphics.
- Positive Distractions, access to art.
- Art/Design starts with consideration of the palette, colors of a space or the environment.
- Aesthetic rooted in the geography of the place.
- Build palettes around rocks, earth, sky.
    - Example: Sagebrush - what colors, light, textures exist?
- Materiality deals with function, start in public spaces then move into clinical spaces.

4.13 Universal Design principles for all users of spaces

Universal design expands beyond meeting ADA specifications. Creating environments that exceed these requirements needs to take into consideration aesthetics, art, colors, textures, natural lighting and different ways to support and provide a sensory experience that supports

calm and health. Accessibility to an environment can be beautiful. Understanding disability and meeting the ADA specifications can give a blueprint for the needs a built environment must have but understanding the key principles and sensory responses can create a beautiful health clinic. Further aspects of the built environment that can be considered when creating a healthcare clinic that supports and exceeds universal design are described in *Figure 4.1c*.

Figure 4.1c

What universal design principles are consistently addressed in healthcare projects for accessibility of all users? (sight, movement, hearing, cognition, physical)

Transitions (Erwine, 2019)

- Transitions can be difficult for many people. Preparing for this change is important to consider in the design.
    - Inside to outside, outside to inside.
    - A place to gather self, shelter.
- Consideration of light issues, visual impairment. Provide spaces that gives time for eyes to adjust, especially transitions outside to inside.

Sequencing transitions (Erwine, 2019)

- Consider the sequence of moving through the space. The front stage environment to the backstage (waiting area to clinic).
- Private space to public space, public to private spaces.
- Spaces can empower or disempower people by putting them into situations they are not prepared for such as weather or light changes. Need to have considerations of these types of transitions.

ADA recommendations (Chambers, 2019)

- Considerations for all disabilities and abilities: Bariatrics, seniors, ergonomics, Individuals with autism, cognitive impairments, visual, auditory, and/or physical challenges.

- Bariatrics
    - Different door width, x-ray tables, floor mounted toilets, grab bars to take more weight, larger wheelchair width of doorways, hallways, ceiling mounted lifts.
    - Consideration for furniture size.
- Seniors
    - Lighting (sight changes)

- Transitions - in flooring, details to support sight changes, avoid trips.
- Avoid trips, slips and falls.
- Carpet - solid surface, smoother transitions, how to detail transitions.
- Shorter travel distances, places to rest in hallways, at entrances both inside and outside.
- More direct routes, wayfinding.

ADA - total compliance (Ridenour, 2019)

- Two ways to think about ADA compliance.
  - To meet or to exceed ADA requirements.
  - Considerations for aesthetics exceeds basic requirements.

Think about disability and barriers in the space (Ridenour, 2019)

- Seating arrangements for all shapes and size.
- Navigating through the space and the world around the built environments.
- Limiting obstacles for individuals with disabilities.
- Think about how to create for all abilities.
- Exceed sight - considerations for palette, light against dark colors.
- What presents comfort (not just ADA).
  - Meet - exceed
  - To create comfort, need to exceed ADA requirements.
  - Creating accessible environments for all.

4.14 Key areas of focus for Community Health Centers

The primary focus for most community health centers is to improve the well-being of communities by providing availability and access to affordable, quality, and patient-centered care. Through interviews with the administrators of several clinics, they discuss several key areas and intentions they bring to creating the spaces of the community health centers. A common theme is the consideration of location and accessibility. A clinic should be located near public transportation and bus lines. This reduces barriers for the community in their access to care. It is important to understand the culture of the community being served when beginning the design process. Access and equity of care should be considered throughout the planning and

design phases. Welcoming environments that provide safe spaces is another area of interest for these community health centers.

A consistent theme noted was to create trauma informed care beginning with the design of community health clinics. Things to consider are the colors and palette choices to promote calm, lighting and use of natural lighting as much as possible, signage and wayfinding that is clear and universal, artwork to celebrate the place and community. The attention to detail in these components in planning and design help to create a safe space and one that is welcoming. Creating spaces that exceed basic building requirements will break down barriers and be good for everyone in the community no matter cultural or socioeconomic differences. It can be a place that celebrates the community of patients, staff, clinicians and visitors.

Further considerations are outlined in *Figure 4.1d* that were discussed in the interviews with the key informants from the fields of architecture, healthcare design, and arts and health consultancy. This list outlines considerations for planning and design of spaces in community and rural health centers that promote health and can decrease stress.

Figure 4.1d

What are considerations for community health projects? What are key areas of focus in design and upgrading older buildings? (Chambers, Erwine, Ridenour, 2019)

- Budget
    - Consideration of the size of the project.
    - Guidelines from the programs and their needs in the space.

- Color
    - Neutral tones/calm colors.
    - Painting is a wonderful tool for lower budgets, freshens the environment.
- Materials
    - Can be creative and cost effective.
    - Durable materials - different types for HAI requirements.
    - Materials of upholstery/flooring - different kinds for different budgets.

- Repeat themes/colors

    - Creates sense of calm.
    - Creates continuity.
    - Simplicity.

- Equal concentration on public and clinic spaces.

- Arts rooted in the community.

- Encourage community engagement (Philanthropy for projects).

- Consider ways to upgrade older buildings.
    - Carpet
    - Wall coverings (wood panel)
    - Change access and improve wayfinding
    - Community engagement and local culture

- Take cues from the culture in the design of the space.
    - Design the space for a variety of cultures and abilities.
    - Address the comfort/safety needs of the most vulnerable population.

- Avoid creating spaces that make people feel excluded.

- Exceeding ADA requirements can create improved environments that support comfort, engagement and calm.

4.15 Key features that support movement in the built environment

Flow through public spaces is important in consideration for design. Landmarks and wayfinding will guide the movement. It is important to have good spatial and clear cues in the environment. Artwork can support the flow and paths as a way of providing this visual cue to movement through the environment. Another aspect to consider is to create pauses in the movement through nooks, nodes, places to pull off and have conversations for smaller groups. For seniors or others, it helps to give a place to rest, such as long hallways that may not have a break. Ramps provide ease in transitions (Chambers, Erwine, Ridenour, 2019).

4.16 Key features for vision

Considerations for light, color and patterns is important in the design of spaces. Artwork serves several purposes, visual interest and positive distractions, simulates an outdoor connection, providing visual cues of the environment that helps with wayfinding, creating landmarks, and memory of a place and can help with cognitive mapping. Windows are important and essential, tells time of day, gives brightness to spaces and supports alertness. Windows and lighting provide safety, comfort and delight of a space. Lighting should be integrated between natural and electric lighting. This is important to think about early in the design phase (Chambers, 2019; Erwin, 2019; Ridnour, 2019).

4.17 Consideration of Place

A community health center fosters feelings of community and a sense of caring. It is important to consider spaces that support the sense of belonging. With thoughtful design, taking into consideration all these aspects discussed previously, the environment supports health by creating a space that people feel cared for and comfortable. Going beyond basic ADA recommendations creates comfort for all users. How the space looks and feels to the body will support health. Art color, and attention to detail in materials, lighting, variations of space can create the subconscious feelings of safety and support. Sensory variations such as quiet/loud, bright/dim, sun/shade, or active/calm gives people choices between spaces to gather or for privacy furthers their sense of support. Choice and variability are very important for different populations and cultures (Erwin, 2019). It is a balance in creating spaces that are both safe and interesting to help support the user's sensory responses for calming.

4.2 Sensory components of architectural design that supports health

This section reviews the *SDAT* results and findings of each sensory section taken during the field research of six community health clinics. *Figure 4.2a* outlines the consolidated results from the site visits using the *SDAT* to understand the sensory and architectural design features of the built environments assessed for this research study. Through the sensory components which include Space/Spatial, Movement, Vision, Tactile, Auditory, and Oral, each section reviews how the clinics were able to design the space to provide sensory support for health and best practice of design informed through the literature reviews. This assessment tool is used to gain better insight and understanding of what works and doesn't work in these particular spaces.

Figure 4.2a SENSORY DESIGN ASSESSMENT TOOL (SDAT)

SPACE	*Proxemics* ● Creating spaces that promote choices in seating; groups for conversation and spaces for individual/private conversations. ● Considerations for how to design interior spaces is important and can be done by furniture placement/arrangement, use of ½ walls. ● Proximity - placing furniture to encourage closeness for conversation and spaces for privacy or intimate conversations. *Privacy* ● Considerations for Front Stage (public spaces, entries, waiting areas) and Backstage (transitions into clinics, clinic hallways, clinic rooms, offices). ● Having separate employee entrances into backstage from patients keeps the flow in patient areas down with less movement in/out of the space. This can support health and decrease stress. ● It is important to create a privacy space for intake and exchange of patient information. ● Nooks found helpful, use of ½ walls to separate waiting area from reception. ● Open spaces, less private. *Territory* ● Use of ½ walls, define spaces ● Furniture, different suites, use of colors can separate and define spaces. ● Thoughtful consideration for separating spaces. *Locationality* ● Consideration of separate employee entrances from patient/waiting room into clinic spaces.

	Connection to Nature ● Windows/glass doors ● Views of outdoors ● Gardens/plants ● Aquariums *Safe Havens* ● Window seats ● Alcoves ● Creating a calm space/sense of harmony (feeling of safety) ● Separate children spaces to play *Safety* ● Waiting rooms open, locked separate entrance for staff ● Windows to hallways ● Private locked clinic areas ● Entrance to clinics near reception area *Age variability* ● Children play spaces ● Reading material ● Separation of waiting room spaces *Exposure to Outdoors* - windows/glass doors *Transition Areas* ● Entrance, foyers ● Covered outdoor areas at entrance ● Ramps or level entrance *Considerations for disability* ● Old buildings with narrow corridor and hallway, low ceilings, dark lighting (not supportive of disabilities) ● Improved space with LED lighting, brighter (supportive) ● New furniture, durable materials, variation in size of furniture ● Windows, contrasting colors floor to ceiling ● Automatic doors ● Limited signage, small, busy
MOVEMENT	*Flow through Space* ● Hallways, doorways accessible for wheelchairs, curved corners, contrasting floor, wall colors, no clutter/clean ● "Jack and Jill" reception area between clinics and central reception areas with clinic areas around waiting area. *Barriers* ● Clutter, poor signage, views of stairway/elevators ● Need for automatic doors, open spaces, clear pathways

	Movement support ● Ramps, stairs, elevators, ● Floor patterns, wall/corner curves, contrast between wall/floor with dark strip can support flow and movement. ● Signage/wayfinding - needs to be clear, visible *Nooks* ● Window seats, furniture placement, privacy nook with reception/intake. ● Creating reading or play areas. *Opportunities to move* ● Children's play area, gardens, entrance, ramps ● Stairs can become a central point encouraging movement ● Open space *Accessibility* ● Doorways, automatic doors for entrance/clinic ● Bathrooms ● Elevators, ramps, stairs ● Consideration for visual impairments, auditory challenges, physical challenges.
VISION	*Colors* ● Neutral colors, soft, earth tones ● Yellow/orange - bright, cheery, inviting ● Grey, orange, browns, taupe - earth tones, calm ● Blue, brown, tan, natural light wood - calm ● Brown, teal blue *Patterns/Design* ● Simple, clean ● Patterns used in flooring, carpet tiles and durable furniture ● Colors on floor tiles creating path *Artwork* ● Themes for Oregon nature ● Children themes - whimsical ● Mosaic tiles, etched glass to help create division of space but use of privacy glass. ● Many of these clinics had very little to no artwork in their public spaces. *Wayfinding* ● Many of these clinics did not have good wayfinding, hard to follow or find way in clinic without being led. ● Colors helped to define the different clinic suite. ● Use of paper signs while under construction. *Nature Scenes* ● Doors with privacy glass to let light in

	● Windows to outside; clinic area, full of light using windows along outside walls, operable windows ● Nature murals ● Waiting Rooms with windows, entrance doors with windows and side windows ● Patient rooms/offices with windows, or plants if not windows, interior windows into outside hallways to let in light. *Visual Overstimulation/Clutter* ● Waiting areas open space, older furniture with magazines, books ● None of the sights were visually overstimulating ○ Other than the business of clinics ○ Construction due to remodel going on in the space. *Lighting/Control of Lighting* ● Old dark, dingy, fluorescent lighting being changed to new LED lighting, much brighter, cleaner ● Dimmers on lights in clinic/exam rooms ● Use of smaller lights/overhead lights with fixtures for reception area, reading areas ● Fluorescent lights - intense, glaring *Positive Distractions* ● Children's play area ● Reading areas ● Aquariums ● Music ● Water features/sounds ● Colors to create calm/windows *Staircase at a glance* ● Many clinics are in older buildings, staircases behind walls, limited signage ● Renovation of one clinic to keep beautiful staircase, open railing, wood floor, visual center point in the clinic. *Components of the spaces that works*. ● Multi patterned carpet tiles ● Colored tiles arranged to create pathway ● Contrasting colors of wall to floor, darker cove molding ● Seating arrangement ● Designated play area for children ● Color palette, neutral tones ● ½ wall for division of space (reception from waiting area) ● Furniture placement for social or privacy conversations in waiting areas, nooks ● New flooring, chairs, LED lighting for bright ● Windows ● Open spaces ● Privacy glass/etched glass used in clinic areas/reception areas
TACTILE	*Materials* (furniture, flooring, size/shapes/textures)

	• Visual patterned floor tiles • Texture (indoor/outdoor) carpet tiles • Modular furniture/durable material that can be easily cleaned • Bariatric furniture - loveseats, larger size single chairs *Objects for touch/Positive Distractions* • Children's spaces within the waiting rooms, washable toys/objects • Busy boxes • Books/Magazines
AUDITORY	*Acoustics* • Sound Ceiling Tiles • Half walls between reception/waiting areas • Noise reducing dividers between patient intake • Nooks/quiet spaces • Music overhead • Water feature in waiting area *Positive Distraction* • Music overhead • Water feature/water sounds • Television with health instructions • Aquarium sounds *Sound Privacy* • Waiting areas busy and can be loud • Privacy glass, overhead music, water features, acoustic tiles • Seating arrangements to encourage engagement and options for privacy *Barriers* • Noisy waiting areas • Furniture arrangement and plant dividers, half walls used to increase sound barriers.
ORAL	*Oral seeking - considerations for eating, drinking, mouthing* • Materials used for furniture, durable, bite proof • Water stations to fill water bottles, different size water fountains for children/adults • Break rooms for staff • Coffee shops in building
ENVIRONMENT	*Olfactory* • Considerations for smells in clinic and reception areas • Open, fresh, clean air quality *Protection from weather* • Overhangs at entrance • Places to sit at entrance, inside and outside

	Accessibility ● Hallways ● Bathrooms - automatic doors, grab bars, ADA ● Entrance ● Elevators, stairs ● Clinic rooms

4.3 Key Principles of the spaces in Community Health Centers

Key principles in design that are noted from each of the community health centers that decrease stress are in italics and includes the use of *open layouts and furniture arrangements* to allow for choices in conversation or privacy. It is important to provide choices for individuals. This helps decrease anxiety and stress for people to seek out where they are most comfortable. When considering arrangement and placement, most of these facilities align chairs along the wall. It is felt that the most successful rooms provide *dividers, privacy walls*, and arrangement in groupings and more intimate spaces of 1-2 seats in an area separated by tables, wall or in a nook.

Two of the six clinics observed offered *separate play spaces for children* with child size furniture, separation walls with benches/chairs for parents, and activity boxes, toys, and books. This provides a safe confined place for children to engage and can help decrease their anxiety with positive distractions. It also allows for separation from older children and adults.

Positive distractions included visual, auditory, and tactile opportunities. Each clinic used a different sensory experience to support patient and visitors in the clinic spaces. Auditory supports were found to include water sounds, overhead music, and privacy glass and dividers. Visual supports also included the water features, aquariums, privacy etched glass, natural tones and soft or bright colors, reading materials and one clinic had a television with health information/discussions. Several of the clinics had very little artwork. The spaces were clean and inviting by the use of color, patterns of furniture, variability in seating, and

simplicity/spasticity of the space sensory systems. Tactile supports provide opportunities for reading materials. One clinic is dedicated to supporting the community by providing materials for barriers to literacy. Variations in picture books with limited words. Busy boxes, consideration for various "fidget" activities can help decrease anxiety during waiting times.

It is important to have considerations in the built environment for *protection from weather from indoor/outdoor transition areas*. Overhangs at entrances, foyers, and defined entry areas were present on a few of these clinics. These provide support and protection allowing patients and visitors to prepare for the change and transition inside to outside. Clear lines of vision and paths help to create the positive movement in and out of buildings.

Daylighting, windows, and lighting are key factors into creating a space that can support patients, clinicians, staff and visitors. New LED lighting, limited fluorescent lights, adding dimmers, having excessive windows and views of outside/nature were found to be positive in these clinics. Using etched privacy glass allowed natural light into interior spaces, waiting rooms or clinic rooms while also providing privacy.

Universal design and ADA requirements can be thoughtfully integrated artistically to make the spaces aesthetically beautiful while supporting all individuals. Ramps, automatic door openers, furniture that can also be used for bariatric patients, signage, use of colors, bathroom accessibility, variations in water stations/fountains to allow for all ages, patterns, placement, and variations of seating, privacy walls and spaces, and at least minimal ADA requirements for accessibility. A few of the community health departments are in the process of renovation or in new buildings. These considerations have been implemented. Creating spaces that support all abilities and disabilities will decrease anxiety and stress as it offers choices and ease of accessibility.

Colors, patterns, and art create the atmosphere of a place. The newer clinics which include Benton County Community Health Center, Siskiyou Community Health Center, La Clinica, and Umpqua Community Health are using the natural tones of tans, beige, blue, browns, yellow and orange. Furniture with patterns, indoor/outdoor patterned tiles, and laminate type tiles are used for ease of care, durability, and more functional for spaces of traffic. Creating continuity throughout these clinics offers predictability and is calming to all senses. Primary themes used in these clinics had to do around colors and furniture/flooring design. Artwork was limited in most clinics but when used, themes for the nature and geography of Oregon, mosaic and tile artwork were used. La Clinica created spaces of harmony and peace through the use of water features in all waiting areas, brown and beige tones with accent orange/yellow colors, large windows in waiting areas and nature photographs.

Wayfinding is very important to decreasing anxiety and stress. Community Health Centers are housed in a variety of building types. It was found that wayfinding and signage was present but without emphasis. Because of this, the wayfinding and signs were not always clear or visible. Those facilities that used colors, floor patterns, and wall curves provided better pathways and awareness to define and guide through the spaces. Very few had braille options.

Accessible bathrooms are another important aspect for decreasing anxiety and stress. Community Health Centers of Benton and Linn County have added this feature into the new building. Most bathrooms were universal for all genders. The WIC clinic had specific children sized toilets beside adult toilets. All bathrooms had grab bars and wall mounted sinks without cabinets below. Three clinics had bathrooms that would be difficult for someone using a wheelchair to get in or out without assistance due to lack of automatic doors and narrow hallways. These were in the older buildings that have not yet been renovated.

4.4 Summary

Chapter 4 reviewed the data collected from the key informant interviews outlining principles that contribute to the design and aesthetics in a built environment. Understanding the design principles that support universal design and health were also discussed and outlined through *Figures 4.1 a, b, c, and d*. Findings from each site visit using the SDAT were consolidated into *Figure 4.2a*. Creating themes and gaining understanding of best practices in design informed by the awareness for how environments affect our sensory nervous system are important for gaining insight into the built environment and design that promotes health for all users. It is clear that exceeding ADA requirements can create beautiful and aesthetic spaces for all users with the understanding of culture, community, and art as a means in developing the sense of place. The SDAT is a tool that can be used to help understand the current spaces, what works or doesn't work, and can provide recommendations for creating spaces that support health.

The final chapter will provide a discussion of best practices for healthcare design that have been informed by this research. Guidelines will then be outlined for consideration of universal design and key principles for creating aesthetics in the built environment for community, rural and public health centers. The recommendations that follow in Chapter 5 are informed through the lens of my professional background as an occupational therapist with specialty in sensory processing. By creating sensory designed spaces that support all users can provide a beautiful and aesthetic environment that diminishes stress and anxiety for all users.

Chapter 5
Conclusion

This research study explored architectural design and arts for healthcare to gain clarity and understanding for how the built environment can be designed for community health facilities and publics spaces that are aesthetically beautiful and accessible for all users. The main question addressed in this study is "What are best practices for community and public healthcare design that promotes health and well-being?" In order to answer this question, I needed to understand how design is informed through engagement with different disciplines and interdisciplinary models for healthcare design.

This research study consisted of two stages. The first stage, through an extensive literature review was completed in order to answer three main questions that inspired this research. The first question was "What are interdisciplinary models in design for healthcare environments?" The sub-questions analyzed were "What are the theories and concepts of design from different methodologies? How do interdisciplinary methodologies inform best practices in design? and What concepts, ideas, and terms are used to discuss key principles of design?"

Chapter 3 answered these questions and provides a thorough discussion of the models that informed this project and confirmed that interdisciplinary design research has shed light on the body and mind connection and how architecture design of built environments contributes to health and well-being (Sternberg, 2009). Chapter 3 also discusses key information about sensory processing and how we all react to our environments through sight, sound, touch, and movement experiences. Key principles for design from a sensory processing perspective that decreases stress and anxiety are discussed as well as the use of art and concepts for creative placemaking

contribute to creating aesthetically beautiful spaces. This literature review coupled with website and document analysis, key informant interviews, along with my professional experience as an occupational therapist informed the development of the *Sensory Design Assessment Tool* (SDAT) that was used to assess the built environments and spaces associated with the second stage of this project.

The second stage involved field research using the *SDAT* to collect data and answer the questions "What are key principles in design for healthcare environments?" Sub-questions analyzed were "How do these principles fit into a Sensory Design Model for creating spaces that promote calm, engagement, and relieve stress? What are the *Visual* components in the public space that work? That don't work. What are the *Auditory* components that work? Don't work? How does the space support *Movement*? Is it direct? Are there barriers? and How does the space provide opportunities for *Tactile*/*touch*?" This chapter responds to the overarching question "What are best practices for community and public healthcare design that promotes health and well-being?" What follows is a summary of best practices for design as informed by key informants and data collected during field research. Finally, recommendations using a sensory processing design perspective is provided to inform the built environment that will support all abilities and health.

5.1 Research Summary

This final chapter provides recommendations and guidelines for best practices of design for community health centers that support health and well-being in the built environments of health clinics. This research is expanding on evidence-based healthcare design models by outlining key principles of design through a sensory processing lens. It is important to have an understanding of how the built environment for public and clinic spaces can support health for

all users. Design that takes into consideration the senses, along with culture, community, and art engagement is a process that can lead to exceeding the requirements outlined in the Americans with Disabilities Act (ADA) and will create beautiful and aesthetic spaces in these community health centers.

Three professional perspectives inform this study; Barbara Erwin, an architect interested in sensory design, Misty Chambers, a healthcare design professional, and Annette Ridenour, a professional in the field of art and healthcare. These perspectives were imperative to outlining the breadth of design considerations that go beyond meeting ADA requirements to creating the built environment that supports health through aesthetics and thoughtfully design principles that create the beauty of a place. It is our sensory nervous system that responds to the built environments subconsciously and can either empower or disempower people by putting them into situations that provide positive responses or negative responses. Key principles that contribute to the design and aesthetics in a built environment have been described by the key informants as the following:

- Begin by understanding the community and culture, the mission and values of the organization. This will lead to design that supports the health of the particular community. Aesthetic are rooted in the geography of the place and the culture of the community (Ridenour, 2019).
- Access to views; considerations for daylight and windows, natural ventilation, connection to the outdoors and nature, artwork.
- Creating synergy between the exterior and interior spaces; simplicity, positive distractions and clear signage, color tones, cultural themes (Erwin, Ridenour).
- Consideration for the function of the space which leads to the materials to be used. What are the barriers of a particular population and address these needs? For example, bariatric considerations, seniors/senior living, pediatric (Chambers).

- Providing choices and variability within the public spaces; related to choices in seating, for gathering or refuge, quiet/noisy spaces, light/dark/shadow (Erwin).
- Preparation for transitions; protected areas such as overhangs at entrances, transition interior/exterior spaces to prepare for weather, windows, skylights (Erwin).
- Wayfinding/Signage can use landmarks through artwork as verbal and visual cues. For example, bathroom located by sculpture with balloons (Ridenour).
- Wayfinding and signage made easy to translate into multiple languages and disabilities, clear, simplified (Chambers, Erwin).

Understanding that cultures hold different preferences for polarities such as privacy and inclusion, calm or active, colorful or calm color tones, designers can take cues from the culture in the design of the space. These considerations along with design for the most vulnerable population will create an environment that is universal and accessible by all. Sensory processing design helps to further understand why these principals are useful and supportive for all users.

What are key sensory principles in design for healthcare environments? The SDAT was developed for this research study as a means to provide a tool to assess and understand the current spaces, of what works or doesn't work, and can guide recommendations for creating spaces that support health. Creating themes, patterns, and gaining understanding of best practices in design informed by the awareness for how environments affect our sensory nervous system are important for gaining insight into the built environment and design for all users. The information and guidelines for this final chapter are extrapolated from the research findings and informed through the lens of my professional background as an occupational therapist with specialty in sensory processing. A discussion of sensory and universal design guidelines follows by breaking down recommendations into each sensory component that includes *visual, auditory, movement, spatial, oral, and tactile* sections.

Simon Humphrey (2010) contributed to the body of knowledge in architecture for autism. These principles outlined blend beautifully with concepts of sensory processing methodologies. These principals are expanded further in the SDAT and contribute to recommendations for design in community health centers. Having a strong understanding of the influence that built environments have for this population can create design and environments that support all users. The considerations for calm, order and simplicity, minimal use of details or materials, considerations for proportion that creates harmony in spaces, the use of natural lighting, creating choices in proximity (relationship to people) in the public spaces and creating containment or safe spaces can address issues of stress and anxiety, not only for individuals with autism but all users of the community spaces.

5.2 Recommendations for Sensory Design of Community Health Centers

The goal of design should be to provide an environment that will help all individuals to interpret and organize sensory information in the environment so they can engage and participate fully in their care. Poor sensory processing can make it difficult for people to perform functional tasks and engage in the many occupations performed throughout their day. For example, running errands, going to appointments, or even getting oneself out of bed and ready in the morning due to anxiety, stress, challenges with transitions, or sensitivities to the noise, sights or barriers in the environment.

Considerations for the built environment of community health clinics is imperative to supporting the sensory nervous system in order for patients, families, staff and clinicians to be engaged in community care. The challenge is creating an environment that supports individuals who are both in a low arousal place (depressed, sick) or a high aroused state (anxious, stressed, angry). Creating this environment with the understanding of sensory inputs that support health

takes into consideration both spectrums of arousal. There are specific considerations using sensory input that supports environments for calm engagement or can provide an alerting environment for positive engagement and health. Following breaks down recommendations for design with considerations in each sensory system that supports health and well-being.

Vision

The visual system is the part of the central nervous system which gives the ability to process visual detail as sight, perception and supports memory. A beautifully designed environment with considerations of colors, patterns, art can support health. Visual memory is an important aspect in thinking about design and wayfinding. What images, signage, paths can be created to support individuals with visual impairments, sensory processing disorders such as autism or cognitive impairments. Designing for people with disabilities will lead to extraordinary design for all as will be shown below. It is imperative that visual cues be integrated throughout the healthcare environment. This becomes the first body sense through the visual system that supports calm by having considerations of visual cues from parking to entering the building. Creating patterns, contrasting colors/images, clear paths, visual clarity in doorways, hallways, artworks, and signage are aspects that support health. Further discussion of visual cues that support the sensory nervous system and health is as follows.

- Signage and wayfinding are extremely important. How do you know where you are in space/the environment, where do you go, how do you know if you have arrived, are questions that need to be considered in designing the built environment. The feeling of being lost, not knowing where one is, and overwhelmed can cause increased fear and anxiety. Visual aesthetics can be functional and done through art and thoughtful design in colors, furniture, sculptures, artwork, images, creative wayfinding, and nature through

gardens and landscape is important in developing and maintaining a quality environment. Repeating colors, patterns, shapes, or images can be considered in the visual cues for finding one's way through a space. This approach will support all users physical, psychological, emotional, mental and spiritual states.

- The arts are integral to healthcare environments. Art can be expressive of the community and the culture of the organization. Consideration for art, colors, and themes in the community health center can become a visual support of the mission and values of the clinic spaces. Art provides visual interest, can mark the arrival into a space or a visual end to a corridor. Cultural themes can create the focus of design, engage local artists and the community, and create a sense of "home and belonging" in the built environment.
- Windows and daylighting are important. Research continues to support views of nature to be important for health (Sternberg, 2009; Ulrich, et al., 2004; Mueller, 2017) are a few that have been sited in this research. Natural lighting and operable windows allow for a space to support the nervous system. Consideration for privacy glass or etched glass can provide privacy but allow natural light into center spaces. It is important to find ways to support the circadian rhythm for people, especially those working in these spaces. The circadian rhythm is a natural and internal process that regulates the sleep-wake cycle which is important for health.
- Lighting is important for safety and navigation through space. Highlighting objects and location can support safety, comfort and delight of a space.

Auditory

By designing a built environment that supports auditory considerations will support privacy in clinic spaces, areas for choices in open spaces, and decrease extraneous noises and

overstimulation of an environment. Sounds that are rhythmic, soft, and constant are calming. Rooms that are muffled from outside noises or next-door rooms support health. Sounds that are loud and variable are alerting, distracting, and can become overwhelming for certain people. Patients may have challenges blocking out background noise, following conversations, or may have difficulty pronouncing and speaking if stressed.

It is important to consider the acoustics of the built environments. This would include sound barriers and providing positive auditory distractions. There is a variety of choices in acoustic tiles and materials for the floor, ceiling, and walls. Design planning and construction decisions made early can address sound transference such as taking the walls between rooms all the way to the next floor/deck. Sound will be unable to travel above and over the ceiling tiles but will be blocked by the full wall. Often the attempt is to save money, but in the long run this will provide an environment that supports all users.

Large open spaces have a tendency for being loud. Artwork, water fountains, aquariums, soft background music along with use of sound barrier walls or half walls work to provide positive auditory distractions within a space. Half walls, privacy glass, and sound dividers are functional ways to divide a space that will support and diffuse sound in a large room. It provides both visual and auditory privacy.

Movement

Movement through space is a multifaceted sensory motor experience. We can take this for granted, but for individuals with motor, visual, or cognitive deficits, getting through an environment can be daunting, exhaustive, and overwhelming. People should feel they have their place and path without conflict, they should feel empowered by easily understanding how to

move from one place to another (Erwin, 2019). Paths guide the flow and is a sensory understanding of direction to move.

It is important to also consider transitions in the design of healthcare environments that support all abilities. Transitions in spaces include inside/outside, waiting room/clinic space, bathrooms, stairs/elevators, parking areas. The environment can be designed to support movement and these transitions. It is important to understand that movement and choices helps to decrease stress and anxiety. Outlined below are further considerations for flow through the space that supports accessibility in movement.

- The use of automatic doors is important, not only for entrances into/out of buildings, but for bathrooms, into waiting areas and clinic spaces.
- Consideration for a transition area between outside to inside. Windows, covered overhangs at entrance or interior/exterior transition space will help people prepare for changes.
- Hallway sizes, consideration for flooring that can provide subtle changes without abrupt steps, ramps, textured flooring, curved walls, paths. Considerations should be made in these areas to support individuals with visual, motor, and cognitive impairments.
- Stairs, ramps, and elevators at a view. Providing clear signage or paths will guide people through the space. Stairs as a focal point can encourage use and movement transitions. Consider using the spaces under stairs for choices in seating that provide quiet/privacy or feelings of safety and containment rather than in an open space of the entrance can incorporate the functional use of public spaces.
- Waiting areas should be easily accessible. Provide choices in seating is important Consideration for proxemics and choices for gathering or sitting alone can is supportive

of health and movement in the space. Creating nooks, window seats can be a way to functionally provide this selection in the public spaces.

- Children's play area. Creating a space where children can play within waiting area, child size furniture, consideration for small blocks/sculptures to climb on can be a positive distraction.
- Healing gardens, outside/inside path with spaces/seating to rest will support health. Providing nooks or places to rest allows people to move aside and be observers of a space
- Limiting movement in and through waiting areas is important. Considerations for separate entrances for staff from patients and families will keep the stimulation level down in the waiting areas.
- Wayfinding and signage using art, color, images, and paths are creative ways in developing functional cues for movement through the environment.
- Other considerations for paths and movement through spaces is taking advantage of other sensory inputs such as light, aroma, sound, and textures to highlight a path, intersection, and arrival.

Tactile

Touch is an important sense that gives feedback to our bodies as to how things feel, what they are, and can support comfort or increase stress. It is important for considerations in materials used in furniture, flooring and even walls if using textures. Avoidance of HAI (Healthcare Acquired Infections) by using materials that provide another barrier for health should be considered within healthcare facilities. The materials need to be washable and durable.

Attention for detail will create an environment of comfort. This can create a sense that people belong in the space. It can make people feel that they are cared for by making it

comfortable. It makes people happy. Primary considerations for attention to detail is the consideration of touch, how does it feel to the body. The use of materials in such things as doorknobs, handrails, comfortable seating, physical placement of automatic door switches, braille/tactile images in signage, and control for audible noise and lighting options are ways to exceed the ADA recommendations to create comfort.

Consideration for using objects in the space for positive distraction may include the following,

- Art or sculptures that can be explored through touch.
- Providing books/magazines in a simple uncluttered way.
- Separate space for reading, an informational library.
- Play area for children with manipulative objects such as busy boxes or washable toys.
- Access to computer plugs and recharge stations; options for use of desks or seats in these areas.

Oral / Olfactory

For the purpose of design, considerations for the oral sensory input includes water fountains, cafes, coffee shops. It is important to have variation in height for water fountains and use of water stations where people can fill their water bottles. Break rooms are important for staff with considerations for the design of this space that support eating and drinking. Understanding the use of cold/warm for preparing drinks and food is a means for supporting the sensory nervous system of the staff.

Considerations for olfactory (smells) is also important. Public spaces should be open, fresh and have clean air. When designing the clinic spaces, break and staff rooms that prepare

food should be away from patient care areas. Smells can trigger negative responses in an environment and considerations for air quality and air flow is important.

5.3 Summary of Research Recommendations

My research questions, design, and findings lead to the following takeaways and recommendations that inform this study.

1. There is a wealth of information and research available to professionals associated with healthcare design and how to make considerations for the built environment.
2. Interdisciplinary models of healthcare design exist and is informing architecture and design of the built environments that promotes and supports health.
3. It is important to have ongoing assessment and evaluation of the built environments to consistently strive to improve health outcomes through thoughtful and informed design.
4. Bringing different voices to the table in the planning phase is important, not only administrators, architects, and designers, but also disciplines with strong understanding for the population being served. It is important to have informed conversations with all individuals using the space; the patients, the staff, the clinicians, and visitors.
5. There is a need for additional research. Before and after research using the SDAT, interviewing patients and staff, and engaging in focus groups for feedback can provide further insight to what works or doesn't work in the built environment. This can further inform sensory design that is catered to the community health programs that supports all users and promotes health and well-being.
6. Healthcare design has the potential to exceed ADA design requirements by engaging in a thorough and thoughtful investigation of the community culture, functional needs assessment of the project, and designed for comfort using universal design principles for

the most vulnerable in the community, then it has the potential to exceed ADA requirements.

7. Universal design with a focus on arts and community engagement will create an aesthetically beautiful environment that will support all users. The subconscious will respond positively through sensory feedback of the space. Accessibility can be accomplished through a thoughtful and artful design process that will ultimately support the whole person's physical, emotional, mental and spiritual well-being.
8. Aesthetics is the means for exceeding basic requirements with consideration for arts in the design. Collaborating with arts and culture organizations can inform and integrate arts to improve the built environments for community health and wellbeing.
9. Ultimately everyone benefits in a well built and thoughtful design that incorporates universal design models with sensory processing design to support all abilities.

5.31 Avenues for further research

While there are numerous models for healthcare design, this is a unique perspective derived from my clinical experience as an occupational therapist. This research has led me to explore the importance for informed decisions in design that can support health related to sensory processing challenges and for creating built environments that support all abilities. Through my professional experience, I bring understanding from a sensorimotor perspective to seeing design barriers in the built environment and have skills for problem solving design and adaptations to an environment that supports all abilities of users. The creation of the SDAT is a first step in breaking down architecture principles for design looking through the lens of sensory processing. Pre and post evaluations and research would be beneficial in gaining insight from users what key principles from a sensory design perspective works best in the community health

centers. Research can also explore how education in this design process can inform decisions made for community health center remodels, renovations, or new construction projects. Another avenue for research may explore how art and community engagement can be used to expand universal design concepts that create aesthetics and beauty in the built environment. And finally, research in how forming partnerships within the arts community can inform design decisions for health.

5.32 Conclusion

This research study has revealed current models of interdisciplinary design that informs healthcare design of the built environments. Another perspective in the interdisciplinary models of design was introduced through the lens of sensory processing. The *Sensory Design Assessment Tool (SDAT)* was developed to look at architectural design principles in human context that support the sensory nervous system and decreases negative responses to the built environment. This assessment tool was used during the field research stage of this study. Finally, this study highlights sensory design recommendations that exceed ADA recommendations to include universal design and aesthetics. These recommendations provide a more inclusive and holistic approach to creating environments that support health and well-being.

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APPENDICES

Appendix 1: Sample Letter of Recruitment for Key Informant Interviews

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DATE:
ADDRESS:

Dear < Professional key informant > ,

You are invited to participate in a research project titled *Multisensory Design and Best Practices of Art and Healthcare Guidelines for Community Based Clinics,* conducted by Molly Pierce from the University of Oregon's Arts and Administration Program. The purpose of this study is to explore how multisensory responses to the built environment can inform arts and healthcare design for public health facilities and how cultivating a supportive built environment utilizing best practices contributes to the health and well-being of the community.

You were selected to participate in this study because of your leadership position and skills in_____. If you decide to take part in this research project, you will be asked to participate in a phone interview, lasting approximately one hour, in winter of 2019. If you wish, interview questions will be provided beforehand for your consideration. Interviews will be scheduled at your convenience. You may also be asked to provide follow-up information through phone calls or email.

If you have any questions, please feel free to contact me at # 541-517-1416 or mostlund@uregon.edu, or Dr. Patricia Lambert at # 541-346-2050.

Thank you in advance for your interest and consideration. I will follow up with you soon by telephone to answer any questions you might have and to hopefully schedule a time to meet for an interview.

Sincerely,

Molly Pierce, OTR/L
Occupational Therapist
AAD Graduate Student, University of Oregon
2470 Adams Street
Eugene, OR 97405

Appendix 2: Letter of Recruitment for Community Health Administrators

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DATE:
ADDRESS:

Dear < Community Health Administrator > ,

You are invited to participate in a research project titled *Multisensory Design and Best Practices of Art and Healthcare Guidelines for Community Based Clinics,* conducted by Molly Pierce from the University of Oregon's Arts and Administration Program. The purpose of this study is to explore how multisensory responses to the built environment can inform arts and healthcare design for public health facilities and how cultivating a supportive built environment utilizing best practices contributes to the health and well-being of the community.

You were selected to participate in this study because of your leadership position at _____. If you decide to take part in this research project, you will be asked to participate in an in-person interview, lasting approximately one hour, in winter or spring of 2019. If you wish, interview questions will be provided beforehand for your consideration. Interviews will be scheduled at your convenience. You may also be asked to provide follow-up information through phone calls or email.

If you have any questions, please feel free to contact me at # 541-517-1416 or mostlund@uregon.edu, or Dr. Patricia Lambert at # 541-346-2050.

Thank you in advance for your interest and consideration. I will follow up with you soon by telephone to answer any questions you might have and to hopefully schedule a time to meet for an interview.

Sincerely,

Molly Pierce, OTR/L
Occupational Therapist
AAD Graduate Student, University of Oregon
2470 Adams Street
Eugene, OR 97405

Appendix 3: Sample Consent Forms

Multisensory Design Best Practices and Art in Healthcare Guidelines for Community Based Clinics

Molly Pierce, Principal Investigator
Arts and Administration Program
School of Planning, Public Policy and Management
University of Oregon

You are invited to participate in a research project titled *Multisensory Design Best Practices and Art in Healthcare Guidelines for Community Based Clinics,* conducted by Molly Pierce from the University of Oregon's Arts and Administration Program. The purpose of this study is to explore how multisensory responses can inform arts and healthcare design for public health facilities and how cultivating a supportive built environment utilizing best practices contributes to the health and well-being of the community.

While it is the current practice for use of evidence based healthcare design in hospitals and use of engagement for the arts in the support of health of patients and staff, a significant gap exists in supporting the built environments of community public health facilities that care for the most vulnerable in our communities. The engagement and understanding for a multisensory design utilizing the arts and a community cultural design approach can contribute to healthier communities. To begin to address the need for multisensory and community healthcare design approaches for the built environments of public and community health clinics, this study aims to conduct a needs assessment of four public health spaces using current models for Healthcare Design and Arts in Healthcare to: (1) assess the built environment of four public health facilities, (2) inform the development of a Sensory Design Profile to be used in assessment of the built environments and effects on the sensory nervous system that can either support or hinder health, and (3) identify and develop recommendations to support health in community health programs.

You were selected to participate in this study because of your leadership position in the field_____. If you decide to take part in this research project, you will be asked to participate in an in-person interview, lasting approximately one hour, in winter or spring 2019. In addition to taking handwritten notes, with your permission, I will use an audio recorder for transcription and validation purposes. You may also be asked to provide follow-up information through phone calls or email.

Any information that is obtained in connection with this study will be carefully and securely maintained. All research records will be stored on a password-protected computer, and hard copies of documents will be stored in a locked file cabinet. Audio recordings will be immediately downloaded to password-protected storage and erased from the audio device. Research records will be retained through completion of this research project for validation purposes and shortly past publication of the master's research project; research records will be destroyed one year after completion of the study. Only the principal investigator and the faculty research adviser will have access to these records.

There are minimal risks (loss of privacy and/or breach of confidentiality) associated with participating in this study. To maintain credibility of the research, I intend to identify participants and use quotes from participants in the final publication. Your consent to participate in this interview, as indicated below, demonstrates your willingness to have your name used in any resulting documents and publications and to relinquish confidentiality. You will have the opportunity, if you wish, to review and quotes and paraphrasing of your statements prior to publication. It may be advisable to obtain permission to participate in this interview to avoid potential social or economic risks related to speaking as a representative of your institution. Your participation is voluntary. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time without penalty.

I anticipate that the results of this research project will be of value to the field of Arts in Healthcare Design, especially for the community and public health sectors and those engaging in developing these community health built environments. I cannot however guarantee that you personally will receive any benefits from this research.

If you have any questions, please feel free to contact me at #541-517-1416 or mostlund@uoregon.edu, or Dr. Patricia Lambert at # 541-346-2050. Any questions regarding your rights as a research participant should be directed to the Office for Research Compliance Services, University of Oregon, Eugene, OR 97403, (541) 346-2510.

Please read and initial the following statements to indicate your consent. Because interviewees differ in their wishes for information to be collected during the interview and in reviewing the information before publication, please specify your understandings and preferences in the list below:
_____ I understand that I will be identified as a participant in this research project._____I consent to the use of note taking during my interview.
_____ I consent to the use of audio recording during my interview.
_____ I consent to the potential use of quotations from the interview.
_____ I consent to the use of information I provide regarding the organization with which I am associated.
_____ I wish to have the opportunity to review and possibly revise my comments and the information that I provide prior to these data appearing in the final version of any publications that may result from this study. I understand that the principal investigator will send me by email a copy of all of the quotes and paraphrases that are directly attributable to me, and that I will have the opportunity to approve and/or revise these statements by a clearly defined deadline.

Your signature indicates that you have read and understand the information provided above, that you willingly agree to participate, that you may withdraw your consent at any time and discontinue participation without penalty, that you have received a copy of this form, and that you are not waiving any legal claims, rights or remedies. You have been given a copy of this letter to keep.

Print Name: _____

Signature:_____Date: _____

Thank you for your interest and participation in this study.
Sincerely,

Molly Pierce, OTR/L
Occupational Therapist
University of Oregon AAD Graduate Student
mostlund@uoregon.edu

Appendix 4: Key Informant Interview Questions

What are some (three) key principles that contribute to the design and aesthetics in a built environment that promotes well-being?

1. What are key principles used to develop the design and aesthetics of public spaces?

2. What Universal Design principles are consistently addressed in healthcare projects for accessibility of all users? (sight, movement, hearing, cognition)

3. Have you engaged in smaller projects such as community health clinics and public health programs?
    a. What were key areas of focus?
    b. How did you upgrade buildings and public space that contribute to aesthetics? Function? Design?
    c. Did you need to retrofit building for accessibility?

5. How does understanding the effects of the built environment on marginalized populations (stress and anxiety) affect your decisions in design for aesthetics and accessibility of public spaces.

6. What do you considered key features for movement?

7. Do you consider key features for vision?
    a. Colors
    b. Artwork
    c. Wayfinding
    d. nature/window
    e. Lighting
    f. Design barriers
    g. Other

8. Do you consider key features for tactile/touch/texture?
    a. Materials of flooring, furniture
    b. Positive distractions
    c. Signage, Braille
    d. Changes in flooring
    e. Other

9. Do you consider key features for Auditory?

a. Acoustics
b. Sound privacy
c. Public restrooms (noise)
d. Spaces for social/privacy
e. Low stimulation
f. Other

10. How do you determine the variability of space?
    a. For all ages: teenagers, small children to adults
    b. Placement of furniture (thinking of disability),
    c. Design barriers for separation of space
    d. Flow through spaces for all abilities and disabilities; wheelchairs, walkers, canes, strollers

11. Have you ever made consideration in the design for accessibility in bathrooms to include adults with disabilities needing help with changing? (For example: large platform at wheelchair height for transferring if needing to be changed by care provider) Other spaces?

12. Would having a checklist outlining key sensory considerations of a built environment be useful in planning and designing spaces?

Appendix 5: Research Instrument: Interview questions for public health administrators

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1. What do you like about this space/built environment?
2. What do you dislike about this space/built environment?
3. What do you see as important to creating a space that promotes health, decreases stress?
4. How is this space accessible for all abilities/disabilities?
5. Would you be open to having community art in this facility?
6. How do you see the role of art in this healthcare setting?
7. Would having a sensory design checklist help you to think about your space to create better health support for your staff and patients?

Appendix 6: Sensory Design Assessment Tool

SENSORY DESIGN ASSESSMENT TOOL

Site/Place:
Location/Address:
Date:

First Impression (Scale 1-7: 1 poor - 7 wonderful)

Aesthetically Pleasing Space

1 2 3 4 5 6 7

Welcoming Environment

1 2 3 4 5 6 7

Comfortable

1 2 3 4 5 6 7

Signage/Wayfinding

1 2 3 4 5 6 7

Use of Artwork in the design

1 2 3 4 5 6 7

SENSORY DESIGN ASSESSMENT TOOL

(Entryway, Lobby, Hallways, Public Restrooms, Outdoor/exterior, Healing Gardens, Staff areas/Break rooms, Cafeteria)

THEMES	Y	N	Describe:

Cultural Themes			
Color Themes			
Patterns			

How are cultural themes used in the design?

List observable patterns?

SPACE	Y	N	Describe:
Proxemics Sociofugal - solo spaces Sociopetal - group spaces			
Privacy Spaces Privacy vs. openness of room			
Propinquity - Proximity of space to promote interactions			

Territory Separation of spaces			
Locationality Front Stage Backstage			
Connection to Nature			
Social Support			
Age variability			
Safe Havens			
Other			

MOVEMENT	Y	N	Space/Describe:
Flow through the space			
Barriers			

Paths			
Nodes			
Nooks			
Opportunities to move. Structures, visible stairs, sculptures			
Opportunities to rest Seating, nooks			
Accessibility of space			
Stairways/Elevators			
Other			Describe:

How does the space support *Movement*? Is it direct? Are there barriers?

VISION	Y	N	Space/Describe:
Colors			

Artwork *Visual, Performance, Music, Poetry*			
Wayfinding: How used, what & where, culturally relevant			
Nature scenes Window Daylighting			
Clutter			
Simple designs			
Too much visual input			
Control of Lighting/overhead			
Positive Distractions			
Minimizing visual distractors			
Staircase at a glance			
Visual: Other			Describe:

Visual Components/Space: _____

1. Intensity of artificial lighting, windows/natural lighting, room exposure to sunlight, colors of spaces, artwork

2. What are the *Visual* components in the public space that work? That don't work.

3. How is wayfinding universal for special needs populations?

4. What is the use of art and color in the design? Is it effective? Not effective? Why?

5. Is the signage visible? Is it understandable?

TACTILE/TOUCH	Y	N	Space/Describe:
Materials Furniture Flooring Types, size, shape			
Objects for tactile play/exploration			
Positive Distractions			
Activities			
Other			Describe:

How does the space provide opportunities for *Tactile/touch*?

AUDITORY	Y	N	Space/Describe:
Acoustics			
Positive Distractions			
Sound Privacy			
Public Restrooms Noise of flushing toilet			
Sociofugal/Sociopetal spaces for privacy or conversations			
Safe Havens			
Low stimulation environments Sound barriers			
Music - location, type			

Other			

What are the *Auditory* components that work? Don't work? (Acoustic Strategies)

ORAL	Y	N	Space/Describe:
Materials used - bite proof, ability to clean, durable			
Water fountains/drinking fountains placed for all ages			
Cafeteria			
Vending Machines			
Coffee station/Cafe			
Staff break area			
Kitchen facilities			
Other			

Describe materials used for furniture.

Describe toys/objects in the space that could be mouthed.

SPATIAL	Y	N	Space/Describe:
Safety			
Variability in space All ages			
Exposure to environment/outdoor spaces			
Layout/decor of spaces for social interactions			
Furniture Placement Functional use for those with disabilities or wheelchairs			
Other			

Describe/Sketch the space:

ENVIRONMENT	Y	N	Space/Describe:
Olfactory/smell			
Air quality			
Outdoor Shelter Protection from weather			
Temperature			
Humidity			
Accessibility: hallways, entry, waiting areas			
Safety and security			

Questions: What key principles decrease stress levels within the public spaces? Art? Interior Design? Sensory components?

1. Is the space welcoming? Why?

2. What is my first impression of the space? The entryway and lobby?

3. Are bathrooms appropriate for all users? Accessibility?

4. Is the space designed for all ages with disabilities? (visual, hearing, mobility)

5. What makes this space inviting? Engaging? Supportive?