




CANCER TREATMENT FACILITIES: USING DESIGN THINKING TO EXAMINE ANXIETY AND THE PATIENT EXPERIENCE

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ABSTRACT

Worldwide, 14 million people were diagnosed with cancer, and 8.8 million victims of cancer died in 2015 (Cancer, 2017). There is no doubt that cancer is a traumatic experience. Using design-thinking strategies, the purpose of this qualitative study was to examine if the built environment in cancer care facilities influences anxiety in patients and to generate patient-driven solutions to reduce stress. Due to its human-centered and codesign emphasis, design thinking is uniquely qualified to explore cancer treatment facility design. Yet, little research using a design-thinking approach examines how the built environment influences stress among patients in an oncology unit. Eight stakeholders ($n = 8$), including cancer survivors, patients, caregivers, and staff, participated in three design-thinking workshops generating ideas for oncology units. In Workshop One, participants identified issues that caused anxiety through journaling and experience diagramming, including amount of travel within the facility, small uncomfortable waiting rooms, smells, and institutional spaces. Using prioritizing strategies, participants concluded with, "How can we optimize patients' time and movement within a facility?" This question informed subsequent workshops where participants brainstormed and prototyped ideas. The final solution addressed patient time and movement through the creation of individualized Patient Treatment Pods (PTP) that provided control, privacy, comfort, and minimal travel within oncology units. Participants clustered the PTPs around a restroom, patient lounge, nurse's station, and nutrition. Utilizing participants' personal experiences along with design thinking led to a prototype that creates a cancer treatment facility that may better suit patient needs while potentially reducing anxiety.

INTRODUCTION

Cancer is one of the leading causes of death worldwide. Fourteen million people were diagnosed with cancer, and 8.8 million people died of cancer across the world in 2015 (Cancer, 2017). In the United States alone, over 1.6 million people had cancer in 2016, and the World Health Organization estimates that the number of new cancer cases will rise by 70% over the next two decades (American Cancer Society, 2016b; Cancer, 2017). There is no doubt that cancer is an emotional, stressful, and traumatic event (American Cancer Society, 2016a). As noted by Fullbright (2015, p. ix), "Few generalities can be made about the cancer experience, except that—for most people—it is the scariest time of their lives. It might be the loneliest time, too."

Individuals diagnosed with cancer may experience feelings of tremendous anxiety (American Cancer Society, 2016a). Browall, Sarenmalm, Persson, Wengstrom, and Gaston-Johansson (2016) found that breast cancer survivors in their study ($n = 131$) felt emotional distress during diagnosis, surgery, and infusions. According to Mullaney, Nyholm, Pettersson, and Stolterman (2012, p. 28), "significant psychological distress is common across all the stages of this life-threatening disease, impacting one-third to one-half of the patient population"; thus, there is a need to consider the patient experience throughout the diagnosis and treatment of cancer (Lehrman, Silvera, & Wolf, 2014). As high-quality patient care becomes the expectation, the patient experience will likely remain a central concern in health care (Lehrman et al., 2014). Hablutzel (2014, p. 1) explains the importance of the patient experience as "Being able to define, measure and analyze patient satisfaction and adjust practice operations accordingly." One way to achieve this goal is through design thinking, which can aid in the continuous process of improving the

patient experience due to stakeholder involvement and participation (MacFadyen, 2014). Design thinking works to gain empathy for patients by putting people first, which can lead to developing and implementing creative solutions to better the health care system (Agutter, 2011; Brown, 2008; Carmel-Gilfilen & Portillo, 2016; Kelly & Kelly, 2013).

Negative patient experiences are common, not due to substandard care but difficulty in understanding medical terminology, feeling lost, stressful built-environmental features, or an inability to have emotional needs met to name a few (Agutter, 2011; Sherman-Bien, Malcarne, Roesch, Varni, & Katz, 2011; Ulrich et al., 1991). Looking specifically at patient emotional well-being, medical technologies (e.g., radiation fixation devices) designed to improve patient health can actually result in negative and even traumatic experiences, causing a great deal of anxiety (Agutter, 2011; Mullaney et al., 2012). Furthermore, aspects of the built environment—such as noise—affect patient and family well-being (Sherman-Bien et al., 2011). Emotional distress and anxiety due to medical procedures and treatments are particularly common in oncology units (American Cancer Society, 2016a; Browall et al., 2016). Cancer patients can feel disempowered and can suffer emotionally as well as physically (American Cancer Society, 2016a). Nausea, vomiting, fatigue, less effective medical decision making, and a reduction in chemotherapy adherence may be exacerbated by anxiety (Mullaney et al., 2012). Individuals receiving chemotherapy infusions could spend up to 6 to 8 hours in the treatment space. As a result, many health care professionals are advocating holistic approaches to cancer care. Providers believe that treating patients' physical and emotional needs is a necessary improvement that the current health care system requires (Mullaney et al., 2012).

Although health care providers believe that focus on the emotional needs of cancer patients is essential, little has been done from a design perspective to advocate this mindset. While some action has occurred to provide coping techniques to patients, such as education, therapy, and relaxation techniques, there is a lack of environmental research focusing on ambulatory health care, specifically cancer infusion facilities (Wang & Puksza, 2017), and on how the design of the built environment can reduce stress (Mullaney et al., 2012). The purpose of this qualitative study was to use design-thinking strategies to examine if the built environment in cancer care facilities affects patient anxiety, contributing to negative experiences, and to generate user-driven solutions that may help reduce stress.

REVIEW OF LITERATURE

THE IMPORTANCE OF POSITIVE PATIENT EXPERIENCES

Patient experience is defined as “the sum of all interactions that influence patient perceptions across a continuum of care” (Mullaney et al., 2012, p. 27). Modern health care and the implementation of the Affordable Care Act now link the performance of hospitals and patient experience metrics to reimbursement, meaning the pay of providers is partly based on how their services are rated by patients (Merlino & Raman, 2013). The patient experience movement was originally inspired by demands from consumers to acknowledge, understand, and improve the patient experience in the medical system. The voices of patients matter to a hospital's reputation and ability to operate. The patient experience movement has expanded due to research that shows a correlation between positive patient experience and clinical outcome measures, safety, and readmissions (Lehrman et al., 2014). “Awareness of patient experience and the imperative for patient engagement now seem pervasive in hospitals and other healthcare settings across the continuum of care—from board rooms to bedside” (Lehrman et al., 2014, p. 9).

Merlino and Raman (2013) initiated an industry survey asking hospital leaders what would improve patient experiences. Top recommendations were new facilities, private rooms, food on demand, bedside interactive computers, unrestricted visiting hours, and quiet time. The problem with these recommendations is that they are based on hospital executives rather than what patients want. The most important part of improving the patient experience is to interact with, and gain the perspective of, patients. Thus, the traditional view of the patient as a passive recipient of design recommendations has changed to a codesign approach, where the patient

participates in the design process to improve innovation (Bate & Robert, 2006; Brown, 2008; Reay et al., 2016).

DESIGN THINKING AND ITS RELEVANCE TO HEALTH CARE

Part of the codesign movement entails design thinking, currently “one of the most popular problem-solving processes on the market” (MacFadyen, 2014, p. 3). Design thinking creatively solves problems (Kelly & Kelly, 2013; Orthel, 2015) through divergent and convergent thinking and seeks innovative solutions to initiate change (Kelly & Kelly, 2013; MacFadyen, 2014) through an empathetic understanding of other people’s problems (Kronqvist, Lee, Mattelmaki, & Vaajakallio, 2013). A design-thinking model is illustrated in Figure 1, which shows the various processes used in a nonlinear approach. Design thinkers work fluidly using the various participatory processes diagrammed in Figure 1 to understand individual viewpoints and the design problem while ideating and prototyping solutions (Carroll, 2015; Orthel, 2015; Point of View, 2014). This means that persons from all sectors of life or within an organization can contribute meaningful ideas to solve problems. Everyone is creative when provided with the proper tools, placed in the correct setting, and asked the right questions (Kelly & Kelly, 2013; Kronqvist et al., 2013). This eclectic mixture may enhance creativity and provide multiple perspectives on the issue in order to transform current conditions into an improved future (MacFadyen, 2014).

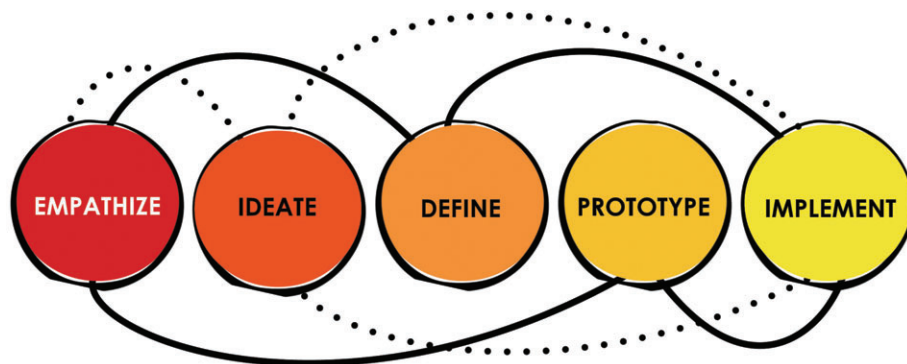
A key tenant of design thinking involves human-centered design that engages and interacts with users and allows immersion into the user’s experiences (i.e., the empathize process) (Carroll, 2015; Kelly & Kelly, 2013). The empathize process allows design thinkers to set aside their own assumptions in order to gain valuable insights into how people think and feel (Carroll, 2015). Defining strategies help frame the problem and allow a deeper understanding of various stakeholders, while the ideation process encourages diverse ideas and solutions. Prototyping is another critical part of the design-thinking process that encourages making in a variety of forms, including storyboarding, physical objects, drawings, videos, etc. (Carroll, 2015; Kelly & Kelly, 2013). Prototyping also allows reiteration and learning from failure (Carroll, 2015) (see Figure 1).

The Florida Hospital in Orlando is already using design-thinking strategies in the form of an innovation laboratory, and the hospital reports a significant savings in time and cost as a result (MacFadyen, 2014). Patient complaints dropped from 37 to 0 in 1 month, zero patient falls occurred for 108 days, and employee retention increased from 46% to 75%. These statistics illustrate the varied problems and innovative changes that occurred at Florida Hospital (Florida Hospital Innovation Lab, 2018). Design thinking allows health care to create services that better meet the needs and desires of end users (Brown, 2008; Florida Hospital Innovation Lab, 2018); yet, there is little research on patients’ perceptions of health care built environments (especially oncology units), specifically what is most important to their experience, well-being, and stress reduction (Douglas & Douglas, 2005; Wang & Pukszta, 2017).

RESEARCH ON THE BUILT ENVIRONMENT AND CANCER TREATMENT FACILITIES

According to Wang and Pukszta (2017, p. 1), “Empirical research focusing on ambulatory cancer care settings is lacking.” While top health care interior design firms, such as Perkins and Will

Figure 1 Design-thinking process. Adopted from Hasso Plattner Institute of Design (Point of View, 2014). Empathize: looking and understanding strategies. Ideate: understanding and making strategies. Define: understanding strategies. Prototype: making strategies. Implement: making strategies.



(2017) and Cannon Design (2016–2017), publish whitepapers, we found few that follow the research process and only one article on outpatient cancer care.

Wang and Puksza (2017) surveyed 166 individuals and observed 252 patients who were receiving chemotherapy in a cancer treatment facility to determine their preferences for private, semi-public, or public spaces and “environmental items” important when receiving infusion treatments. Relevant to this research, patients who could choose the space where they received chemotherapy felt less stress. Of the environmental items mentioned by patients, windows with a view reduced stress and increased a sense of hope. This research supports the seminal study by Ulrich (1984) and Ulrich et al. (1991) suggesting that window views are beneficial to patients, and control is important in cancer treatment spaces. Malkin (2007) and Hamilton and Shepley (2008), lead researchers in the field of health care design, also state that nature reduces patient stress. Likewise, the Cannon Design firm, in their solution for the UW Cancer Center at Pro-Health Care in Wisconsin, provided patient control over privacy, daylight, scenic views, and operable windows (Cannon Design, 2016–2017).

Carmel-Gilfilen and Portillo (2016) explored empathy using narrative inquiry through an outpatient cancer treatment facility designed predominately by undergraduate interior design students ($n = 18$) during a 12-week time period. Student teams of four to five participated in information gathering, observations, interviews, and narrative inquiry to generate solutions that “embodied a holistic approach to care” (p. 142). Solutions included zones encouraging engagement with others to reduce stress (e.g., small group areas for prayer, personal reflection, and meditation and large group areas for cancer advocacy and education); healing aspects such as gardens and a community café, and private, semiprivate, and public experiences for infusion treatment. More importantly, the narrative inquiry part of the project allowed the students to provide human-centered solutions for all stakeholders.

Both of these studies address aspects of the built environment for oncology units, and both point to the importance of patient, staff, and family control. Wang and Puksza (2017) found no patient preference for public, semipublic, or private treatment infusion spaces, but giving patients a choice on which they preferred increased control and reduced stress. Carmel-Gilfilen and Portillo’s (2016) student solutions, inspired by using a design-thinking approach (narrative inquiry) with traditional evidence-based design strategies (e.g., interviews, observations), also advocated for patient choice through a variety of space options that optimized healing, advocacy, education, and preference. What is missing, however, is a codesign approach where key stakeholders in the cancer treatment process, such as patients, caregivers, and staff, actually develop the solutions themselves to reduce stress in the built environment.

DESIGN THINKING AND CANCER TREATMENT

As noted above, design thinking in health care is not a new concept, yet only a few case studies exist that identify how design thinking and the built environment can reduce anxiety in cancer treatment settings. The Breast Service, which provides breast cancer screening and treatment services in New Zealand, followed patients from diagnosis through treatment to improve their experience (Boyd, McKernon, Mullin, & Old, 2012). Twenty-one patients recorded their appointment through journey mapping, including their contacts, emotions, touch points, and improvements for The Breast Service. Experience-based questionnaires were distributed to all patients ($n = 182$) who attended an appointment or mammogram and allowed patients to generate specific suggestions.

Journey mapping determined that uninformed patients felt upset, scared, pressured, confused, and frustrated. Patients identified increased anxiety while waiting, especially if staff did not provide ongoing information, as well as during procedures (mammography and biopsy) and clinic appointments due to pain and the unknown. They suggested that improving the layout of the waiting room and redesigning mammography gowns could reduce stress. Even though the study concluded that a codesign approach provided “tangible improvements and demonstrated the value of engaging patients and focusing on their experiences” (Boyd et al., 2012, p. 76), most of

the suggestions related to staff issues and specifics regarding the built environment were not given.

Mullaney et al. (2012) used human-centered design to examine patients' interactions with care providers, technology, and the environment in order to focus on situational sources of anxiety during radiotherapy treatments. The goal was to use care that was preemptive rather than responsive to anxiety. The researchers used ethnographic research in the form of stories told by patients and caregivers, as well as detailed field notes and patient journaling.

Radiotherapy uses different fixation devices to immobilize different parts of the body to receive treatment. Observations of 62 patients, 1 of which included a panic attack, demonstrated a clear relationship between patient anxiety and the fixation device. The study opened a new window for moving beyond methods for coping with anxiety in cancer patients to the need to target triggers of anxiety within cancer treatment centers (Mullaney et al., 2012).

These two studies have applied design-thinking strategies by using codesign and human-centered design to improve the patient experience. Boyd et al. (2012) identified how interactions and services can provoke anxiety in hospitals, while Mullaney et al. (2012) discovered how the fixation device used in radiotherapy treatments causes major distress to patients in clinics. While both illustrate how design thinking gains insight on patient anxiety and well-being, Mullaney et al. (2012) focused on radiotherapy, and Boyd et al. (2012) examined breast care. Neither provides specific suggestions to improve the built environment. Little research conducted on outpatient oncology units where patients receive chemotherapy as part of their cancer care exists. Can design-thinking strategies identify stressful elements in the built environment to reduce anxiety, contributing to positive patient experiences within oncology units?

METHODOLOGY

Three separate workshops that lasted 1.5 hours each were conducted using qualitative design-thinking strategies (see Figure 2). The workshops were held in a private room at a local church in North Carolina. A nonrandom, purposive sampling technique was used, and participants included any cancer patient, male or female, sick or cured, diagnosed with, treated for, or monitored for cancer for at least a 3-month period within the past 10 years; any caregiver, grown child, friend, or family member who attended cancer diagnostic or treatment appointments or was present in the home with a cancer patient; and any nurse, physician, certified nursing assistant, or administrative staff member who worked directly with oncology patients for at least one calendar year. Including caregivers and medical staff along with survivors and current patients was important in order to hear multiple perspectives regarding patient anxiety. Based on these criteria, eight individuals were recruited by the principal investigator. Prior to collecting data, IRB approval was granted by the principal investigator's university.

The principal investigator and research team are trained using the Luma Institute design-thinking methods organized around Looking, Understanding, and Making. Each method includes numerous strategies used individually or in combination to address complex problems through a human-centered lens (Luma Institute, 2012). The team met to discuss which Luma design-thinking strategies to use in each workshop.

As noted in Figure 2, the goal of Workshop One was to gain an empathetic understanding, a key tenant of design thinking, (Kronqvist et al., 2013), of individuals diagnosed with cancer. In order to achieve this goal, we used journaling/experience diagramming because it allowed cancer patients to document their stress during their visit to the cancer treatment facility. Other design-thinking strategies, such as interviews, observations, contextual inquiry (interviews conducted on site), or walk-a-mile immersion (the researcher walking in the participants shoes), would not record the journey of the cancer experience in real time. The rose, thorn, bud strategy gave participants a voice while encouraging multiple perspectives (MacFadyen, 2014), and affinity clustering is the only design-thinking strategy that creates themes/patterns of collected ideas (Luma Institute, 2012).

Figure 2 Workshop descriptions (cited from Luma Institute, 2012).



For Workshops Two and Three, the goal was focused on solutions. Prototyping was first introduced to the participants using the round robin strategy, which was selected because it lets each stakeholder generate ideas related to the problem. Recall that design thinking encourages diverse ideas and multiple perspectives and suggests that everyone is creative (Kelly & Kelly, 2013; Kronqvist et al., 2013). Prototyping continued in the form of a concept poster and rough and ready prototyping because they do not require artistic ability and let participants make solutions in a quick and easy manner using sticky notes, paper, and markers (Luma Institute, 2012). Each workshop, along with the participants, is explained in more detail below.

WORKSHOP ONE

Five individuals participated in Workshop One (see Table 1). Prior to Workshop One, two participants (females aged 40 and 54) currently treated for cancer documented their cancer treatment visit from the time they left their house, through their experience at the facility, to the time they returned home. While journaling, they identified the people, places, and things they encountered, as well as the pros, cons, and raw emotions of their experience. Participants were prompted with questions such as: What do you think is important to share about your experience? What do you see? What do you feel? Who is around? They documented their descriptions and charted anxieties on an experience diagram where 1 equaled low anxiety and 10 equaled full panic. Their descriptions and diagrams informed the rest of the workshop.

Based on the journaling and experience diagramming shared with the group, the participants in the workshop were asked questions such as: What does it feel like? What do you like? What is driving you nuts? What are the pros? What are the cons? Participants wrote their responses on individual sticky notes that they displayed on the wall. Positive responses were termed roses, negative responses thorns, and opportunities buds (i.e., rose, thorn, bud) (see Figure 2). Next, participants grouped the individual ideas into clusters to reveal thematic patterns (i.e., affinity clustering). Based on the categories determined, the participants generated statement starters such as such as how might we reduce stress in cancer treatment facilities and voted on the statements they found most valuable in determining a solution. This information was used to inform Workshop Two (see Figure 2).

WORKSHOP TWO

Four participants were a part of Workshop Two (see Table 1). The statement starters generated in Workshop One were shared with the group, and the four participants were given a round robin template and instructed to write the problem at the top. Then, each participant wrote his or her wildest idea, with no concerns for time or money. Once they wrote their ideas, they passed their template to the person on their right. This person listed reasons why the idea may fail. Once they finished, they passed it to the person on their right. The final person reviewed the problem, the wild idea, and the reasons it may fail and created a realistic idea to be

| Workshop | Participants |
|-------------------------------------|--|
| Workshop One (five participants) | Caregiver, male, 56 years old (caregiver for 6 years) Caregiver, female, 60 years old (caregiver for 2 years) Breast cancer survivor, female, 39 years old (worked in a cancer treatment facility as a registrar) Cancer patient, female, 40 years old (currently has metastatic lung cancer) Cancer patient, female, 54 years old (currently has breast cancer) |
| Workshop Two (four participants) | Caregiver, male, 59 years old (caregiver for 22 years) Caregiver, female, 60 years old (participated in Workshop One, caregiver for 2 years) Health care provider, female, 57 years old Colon cancer survivor, female, 57 years old (stage 4 colon cancer survivor) |
| Workshop Three (three participants) | Caregiver, male, 59 years old (caregiver for 22 years) Health care provider, female, 57 years old Colon cancer survivor, female, 57 years old (stage 4 colon cancer survivor) |

Note: The goal was to recruit different participants for Workshops One and Two for a variety of reasons. First, design thinking encourages multiple perspectives from different stakeholders who have an interest in the problem. Second, the workshops lasted 1.5 hour, which was a large time commitment for some participants. Participants from Workshops Two and Three are the same because they embody the idea generation and solution phase. During Workshop Two, participants ended with a preliminary prototype that was further developed in Workshop Three, thus the continuity in subjects.

implemented (round robin strategy, see Figure 2). The templates were displayed, and each person voted on their first, second, and third choice (visualize the vote, see Figure 2). Once the first-placed idea was determined by the group, they created a concept poster that displayed their idea to help reduce anxiety in cancer treatment facilities. Participants were encouraged to use short phrases and supporting details to explain why the idea was important and why it would benefit the audience. The information included on the concept poster informed the third design-thinking workshop (see Figure 2).

WORKSHOP THREE

The same four participants from Workshop Two were invited to Workshop Three, and three of the four participants attended (see Table 1). For this workshop, participants created a rough and ready prototype from the concept poster generated from the second design-thinking workshop. Once the prototype was complete, the participants shared their experience in real time while moving through the prototype (i.e., think aloud testing). The group reworked and improved a few aspects of its prototype based on the information provided during this think-aloud testing.

RESULTS

WORKSHOP ONE

Two participants (one for a chemotherapy treatment and the other for a cancer-related surgery) completed experience diagramming/journaling prior to the workshop. The lowest either participant scored themselves throughout the visit to a cancer facility was 3 of 10. The highest was 8 of 10 (recall that 1 equaled no anxiety and 10 equaled full panic).

The participant who completed journaling for a chemotherapy visit ranged in anxiety levels from 3 to 6 of 10. This participant was treated for the first time for a tumor in her lungs. The participant's anxiety was lowest, 3 of 10, as she left home for the 1.5-hour drive to the treatment center. The highest anxiety experienced was while being escorted to the treatment room. The participant described passing a great number of rooms and seeing other patients in various states of illness. The participant could see that some patients had beds in their treatment rooms, leading her to wonder how long treatment would last. A physician asked her about her anxiety levels during her treatment. While medication was given to help reduce her anxiety, her husband and spirituality reduced stress (see Table 2).

The participant who completed the activity for a cancer-related surgery ranged in anxiety levels from 4 to 8 of 10. The patient previously had two lumpectomies for breast cancer. Both were successful but did not have 100% clear margins. She experienced the greatest anxiety, 8 of 10, on hearing the questionable success of the second lumpectomy. The participant then decided, voluntarily, to have a mastectomy and reconstructive surgery. Upon making this decision, the participant experienced the lowest level of anxiety at 4 of 10. The participant did not experience anxiety above 7 of 10 during the actual surgery. She noted that her spouse, family members, and her spirituality helped her cope with her anxiety (see Table 2).

Utilizing information from the journaling/experience diagramming presentation, as well as information from their own personal experiences, participants completed the rose, thorn, bud strategy (see Table 3). Information generated from this strategy created four clusters: travel, logistics, facility, and emotional well-being. Once the clusters were established, participants used statement starters to create problem statements to be furthered into solutions, including: "How can we optimize patients' time and movements within the facility?"; "How can we promote emotional well-being for all when in the facility?"; "How might we make the environment more personal?"; "How can we help comfort/entertain patients and family?"; "How do we increase personal contact while ensuring the staff is compassionate and empathetic?"; "How might we make educational materials and tools such as wheelchairs more readily available within the facility to help patients?"; and "How might we make the facility more home-like, less institutionalized and better suited to patients' sensory needs?" The participants selected the first statement

Table 2. Journaling/experience diagramming highlights

Journaling/experience diagramming comments

Patient One (visit to chemotherapy facility for lung tumor):

"There are so many people. I am surrounded by families and patients as I wait for my beeper to go off for my lab appointment."

"After lab, we head up to the 3rd floor to check in with my oncologist. Though there are many people, they are on time and my wait is short. Anxiety is a little less at 4/10 as we sit and wait for the Physician Assistant to come in to talk with me. My mom and my husband are in the room with me."

"Next we head to the 4th floor to check in. I end up standing on the wrong side of the sign to check in."

"The room they bring me to has large windows and a view of outside. We passed so many rooms on our way here and I was able to see a few people in those rooms. Some had beds, which made me wonder how long those patients are staying. Some look more sick than others and it makes my anxiety remain at 6/10."

"There is one larger chair in the room that is more comfortable for me. The room is comfortable and I have asked my mom and husband to let me lead the tone and noise level in the room. I don't want a bunch of talking or having the TV on as I want to do some breathing to relax and listen to some Christian music."

"The curtain on the room closes, but isn't really private as there are people right across the hall. So, our conversation isn't very deep or very long. Anxiety is still around 5/10 as I haven't had much time to be still as I had planned. This is nothing like I planned. I really wanted to have quiet time and relaxation be part of this experience."

Patient Two (surgery for breast cancer):

"In outpatient area, there are not separate rooms but rather curtains that separate spaces. It is a very busy, somewhat noisy space..."

"The rooms seemed brighter and more institutional compared to the previous hospital, where I guess it felt a little more homey without so much fluorescence."

starter to advance to Workshop Two, "How can we optimize a patient's time and movement within the facility?"

WORKSHOP TWO

Each participant was given a template with the problem statement voted most worthy of exploration at Workshop One: Optimize patients' time and movement within a facility. The four participants' generated ideas that were similar to one another involving the patient remaining in one place for the duration of the visit eliminating constant movement of the patient. The patient would no longer be the moving part; instead, the treatment and providers would move to them.

The four participants worked together to create a concept poster using short phrases and drawings, which they titled "Patient Treatment Pod (PTP)." An overview drawing of their concept shows a centralized location on each treatment floor that contains the major tests and scans completed on cancer patients, as well as a laboratory and pharmacy. Surrounding the centralized treatment locations are patient rooms. Blood work, infusions, and doctor visits take place within this room, allowing the patient to remain in one location. If the patient needs to leave the room for scans or specialized treatment, a transport team takes them to the treatment by wheelchair, preventing them from making multiple trips down long hallways (see Figure 3 and Table 4).

WORKSHOP THREE

Three participants from Workshop Two continued and were a part of Workshop Three. Based on the concept poster generated in Workshop Two (see Figure 3 and Table 4), the group decided to prototype a floor plan of the unit that would house their PTP. Once the floor plan was complete, the team talked through the process (i.e., think-aloud testing). This led them to move some of the sticky notes to better facilitate the environment. It also allowed them to place arrows on the floor plan to show how a patient would move throughout the facility. Figure 4 shows how they followed a patient into the facility, through waiting, checking in, and into the treatment room. They then took the patient to the restroom and to a treatment via transport that required him or her to leave the PTP. Arrows with straight lines represent patient

Table 3. Workshop One: results from the rose, thorn, bud and affinity clustering strategies

| Participant comments | Themes |
|--|------------------------|
| Rose (positives): | |
| <ul style="list-style-type: none"> • Driving to and from facility (allowed time for you to collect your thoughts and talk to your spouse or family member) | Travel |
| <ul style="list-style-type: none"> • Warm blankets (provide warmth and comfort; feel like a warm hug) | Facility/EWB |
| <ul style="list-style-type: none"> • Homey waiting areas (makes the patient and family feel comfortable like they are in someone's home rather than a waiting room) | Facility/EWB |
| <ul style="list-style-type: none"> • New facilities are warmer and brighter (natural light is more comfortable, windows with sunlight provide a chance to warm up against the air conditioning; older facilities have fluorescent institutional lighting) | Facility |
| <ul style="list-style-type: none"> • Patient navigator (explain processes and expectations for appointments and treatments, helps you know what to expect) | Logistics |
| <ul style="list-style-type: none"> • Personal items (photos, blankets, encouraging t-shirts from friends make the space your own) | EWB/facility |
| <ul style="list-style-type: none"> • Flowers from doctor (one participant received flowers from her doctor after surgery making her feel hopeful and remembered) | EWB |
| <ul style="list-style-type: none"> • Program for children to understand and learn about cancer | Logistics/ EWB |
| <ul style="list-style-type: none"> • Ease of facility navigation (signage and wayfinding techniques) | Facility |
| <ul style="list-style-type: none"> • Parking (smaller facilities have parking out front that does not require much walking) | Facility/ travel |
| Thorn (negatives): | |
| <ul style="list-style-type: none"> • No valet parking (patients have to walk long distances or family member leaves patient at entry while finding a parking space) | Facility/ travel |
| <ul style="list-style-type: none"> • Lengthy travel time (excessive travel time to facility leaves patient exhausted and stressed) | Travel/EWB |
| <ul style="list-style-type: none"> • Smell (hospitals have odd smells, and chemotherapy patients often have sensitivity to certain smells) | Facility |
| <ul style="list-style-type: none"> • Older facility felt institutionalized (fluorescent lighting and other old hospital elements make the facility seem institutionalized) | Facility |
| <ul style="list-style-type: none"> • Small waiting room was overwhelming (small waiting rooms make you feel trapped, especially if there are a lot of people) | Facility/EWB |
| <ul style="list-style-type: none"> • Wait time (you arrive to wait, have one thing done, then wait some more, move somewhere else, wait more) | Logistics/ travel |
| <ul style="list-style-type: none"> • Travel within the facility (patients are constantly moving within the facility it would be nice to eliminate some of this travel) | Travel/ facility |
| Bud (opportunities): | |
| <ul style="list-style-type: none"> • Driving (driving can be a positive or a negative, room for innovation) | Travel |
| <ul style="list-style-type: none"> • Décor | Facility |
| <ul style="list-style-type: none"> • Inspirational quotes and bright colors (facilities could be more personal, uplifting and encouraging) | Facility/EWB |
| <ul style="list-style-type: none"> • Having personal mementos (patients could be encouraged to bring personal belongings with them, or hospitals could use technology to bring personalization to the room) | Facility/ logistics |
| <ul style="list-style-type: none"> • Access to wheelchairs (sometimes patients cannot walk to all of the various hospital locations, it would be easier to transport them if wheelchairs were readily available) | Facility/ travel |
| <ul style="list-style-type: none"> • Waiting room (the waiting room can be seen as a negative due to long wait times, but this is a place that could be utilized to promote comfort) | Facility |

| Table 3. Continued | |
|---|------------------------|
| Participant comments | Themes |
| Bud (opportunities): | |
| • Lighting (working with different types of lighting could promote happiness) | Facility/EWB |
| • Patients have heightened senses (could be used to the advantage of the patient by exposing them to smells that make them comfortable) | Facility/ logistics |
| • Knowing the journey of others within the space (efforts could be made for patients who choose to share their story with others they meet within the facility in order to create a community) | Logistics |
| • Seeing others laugh (one participant noted that when she went in for her first chemotherapy treatment, she saw a woman with no hair laughing with her husband during the infusion; this gave her the courage to embrace happiness through her infusion) | EWB |
| • Conversations about the anxiety being experienced (if nurses, doctors, other patients, and family members are willing to discuss the anxiety and distress that the patient is experiencing, it could help resolve it or make it easier to gain tools to help curb it) | Logistics/ EWB |
| • Maintaining a positive attitude (people working within the facility can help promote a positive attitude by sharing positivity and being kind) | EWB |
| • Spirituality if desired | EWB |
| • Social workers (to talk to patient, children, and family and help them find ways to ease the burdens that cancer brings) | EWB |
| • Financial counseling (provide counseling on how to handle medical bills, which bills to pay first, etc.) | EWB |

EWB, emotional well-being.

walking; arrows with squiggle lines represent the patient moved by transport. There are few arrows shown exemplifying the goal of moving the patient around as little as possible. Having a health care provider involved in the group allowed the participants to account for specific hospital needs, such as adequate nursing stations. Their design incorporates the needs of the patients, family, and visitors.

DISCUSSION

Research shows that psychological stress impairs patients from healing, and although education about the disease, relaxation, and stress management training and group and individual support therapy may give patients the tools to manage their anxiety once it occurs, they do little to influence triggers of anxiety (Mullaney et al., 2012). The student work generated in the study by Carmel-Gilfilen and Portillo (2016) provided a variety of spaces that might help reduce stress, such as healing gardens, art therapy rooms, and prayer and advocacy centers, yet they never address immediate environmental triggers. The participants in our study noted that the facility itself prompted anxiety by seeing other sick patients, a lack of privacy, decreased control, a lack of convenience, lengthy travel, long wait times in small waiting rooms, old institutional spaces, and odd smells (see Table 2 and Table 3). The journaling/experience diagramming demonstrated a real need for quiet time, relaxation, and privacy (see Table 2). Moreover, a lack of control was a common theme expressed by many participants as a factor eliciting stress. “I don’t want a bunch of talking or having the TV on as I want to do some breathing to relax...” and “This is nothing like I planned” illustrate the need for infusion spaces that are tailored to a variety of patients (see Table 2).

The need for control and knowledge cannot be underestimated in health care. Boyd et al. (2012) point out that patients who do not have information feel frustrated and confused. During the journaling and experience diagramming, the patient who underwent breast cancer surgery experienced high anxiety due to the unknown status of the second lumpectomy. Yet, once the patient took control of the situation by electing to have the mastectomy, her stress levels decreased substantially. While the design of the facility did not appear to influence these decisions or emotions, interior designers can learn the importance of providing environments that create choice from personal statements such as these.

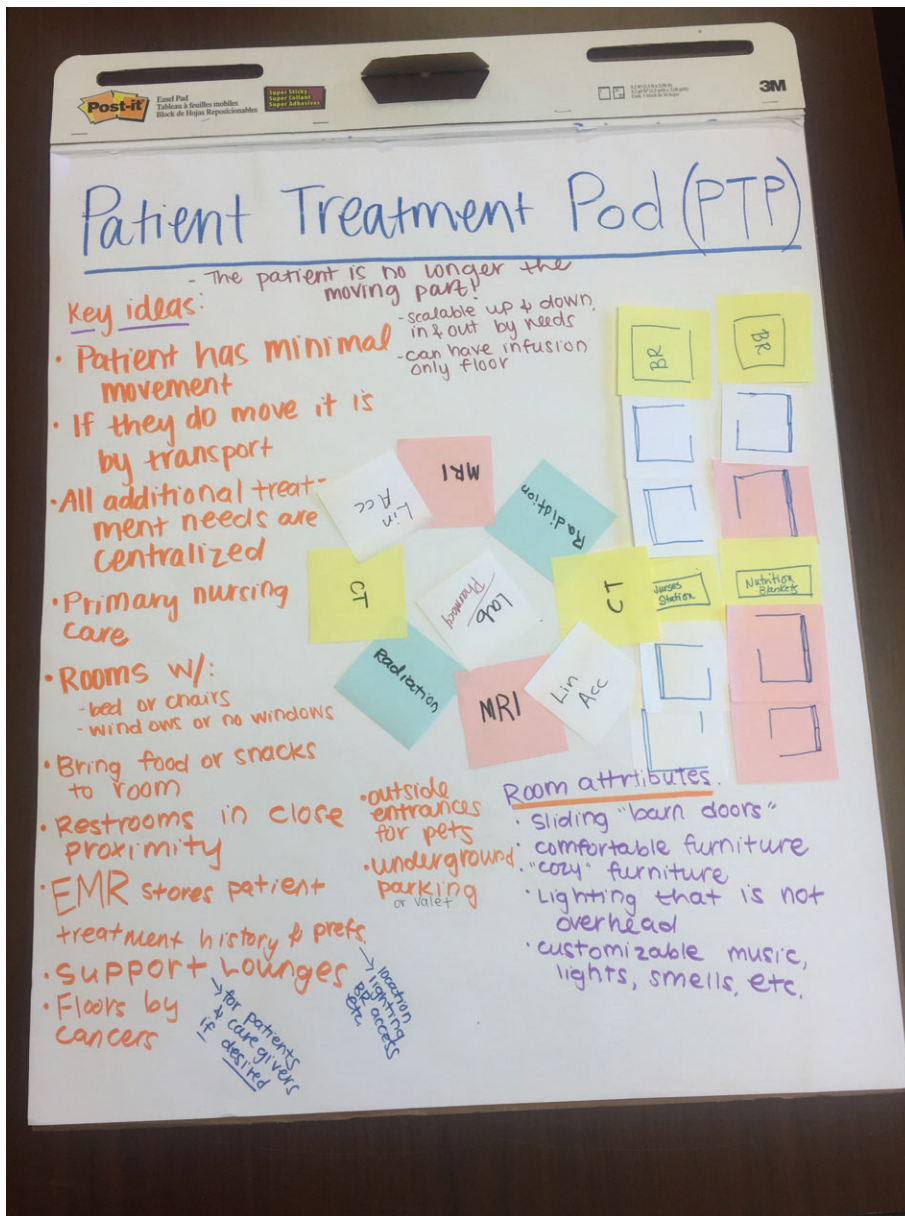


Figure 3 Workshop Two concept poster illustrating patient treatment pod (PTP) idea.

Comments from journaling and the rose, thorn, bud strategy noted movement within one facility from the third to fourth floor. No valet parking, lengthy travel time, and travel within the facility were negatives (thorns) as they leave patients exhausted and triggered stress (see Table 3). This led to participants concluding their work by selecting the major question that framed future workshops: “How can we optimize a patient’s time and movements within a facility?”

Based on this question, participants designed a customizable space that provided privacy, comfort, control, and minimal moving from place to place (see Figure 4). Douglas and Douglas (2005) explored patients’ perceptions of the built environment of health care wards. Their study concluded that patients need control of their environment. Likewise, Wang and Puskzta (2017), Cannon Design (2016–2017), and Carmel-Gilfilen and Portillo (2016) point to patient choice as an important aspect in reducing stress. Participants in our study designed an integrated space centered on the patient’s needs called the PTP, where minimal movement and maximum control could occur.

“Although large, spacious clinics may be visually appealing and soothing, the distance a weakened patient has to walk from the parking lot or front door to the treatment chair can be

Table 4. Workshop Two: results from concept poster summarizing key concepts of the patient treatment pod

| Workshop Two | | Patient treatment pod (PTP) |
|-----------------|---|-----------------------------|
| PTP | | |
| Key ideas | <ul style="list-style-type: none"> • The patient is no longer the moving part: Patient is given their own room upon arrival and does not leave the room from start to finish. If the patient leaves the room for a specialized treatment, a transport team will take them to the centralized location by wheelchair. • All specialized treatments that cannot be administered within the room are in one centralized location on the treatment floor. • Primary nursing care: Patients have the same nurse(s) for the duration of visit and for each treatment. • Rooms with beds or chairs, windows or no windows: Room setups should vary and match patients' needs and preferences. • Bring food or snacks to room: Food is brought to PTP during treatments. Patients and/or caregivers should not be taking long walks to restaurants or cafeterias to meet basic needs. • Restrooms in close proximity: Patients and caregivers alike need quick access to restrooms. • Electronic Medical Records store patient treatment history and preferences: Much like providers store detailed treatment information related to dosage, etc. in medical records, providers record patient preferences with regard to their space. This way the rooms can be assigned and set up to make the patient most comfortable upon arrival. • Support lounges: Designated areas should exist for patients and caregivers to visit before, during, or after their treatments to talk to other patients and/or caregivers. • Floors by cancers: Larger facilities could divide treatment floors by cancer. For example, the floor outlined on the concept poster could be the breast cancer floor. An identical floor could be above it for colon cancer. • Outside entrances for pets: Ground level floors could have outside entrances that would allow people to bring their pets in during their treatments. • Underground/valet parking: Simplifying parking could change the entire experience for the day. | |
| Room attributes | <ul style="list-style-type: none"> • Sliding barn doors eliminate noise and create privacy. This type of door will be quiet, easy to clean, allow access for transport, and stay out of the way. • Comfortable furniture that meets hospital sanitation requirements. • Lighting that is not overhead: Patients should have the option to turn off the overhead lighting and use a lamp or natural light. • Customizable music, lights, smells, etc.: Features could be available to change the music, lighting style, or smell of the room. The more customization available to the patient can help alleviate the stress associated with long treatment days in the facility. | |

daunting” (Wujcik, 2011, p. 5). This is the precise idea illustrated through the prototyping completed in the workshops. Participants created a floor plan of a cancer treatment facility that eliminated unnecessary movement and kept the patient in one place throughout his or her entire visit, other than to use the restroom, located a short distance from every room on the floor. If a patient does require movement for additional scans or tests, a transport team takes them to the centrally located spaces (see Figure 4).

While participants focused on minimal movement in the facility as a factor to reduce anxiety, we took the prototype developed in Figure 4 and comments from Table 4 and expanded it to include environmental triggers of stress identified through the design-thinking workshops in this study and the literature cited (see Figure 5). In this prototype, themes of control, nature to create relaxation, privacy, customization/personalization, and minimal travel are illustrated. The private rooms are large enough to include family and friends, which was a theme identified through patient journaling. Individual treatment rooms allow for personal comforts and customizable features such as music, smell, lighting control, warm blankets, flowers, and personal photos reiterated in the PTP idea as shown in Table 4. Rooms with windows provide natural light to brighten space, but window treatments provide control (see Figure 5, Tables 2–3 and 4).

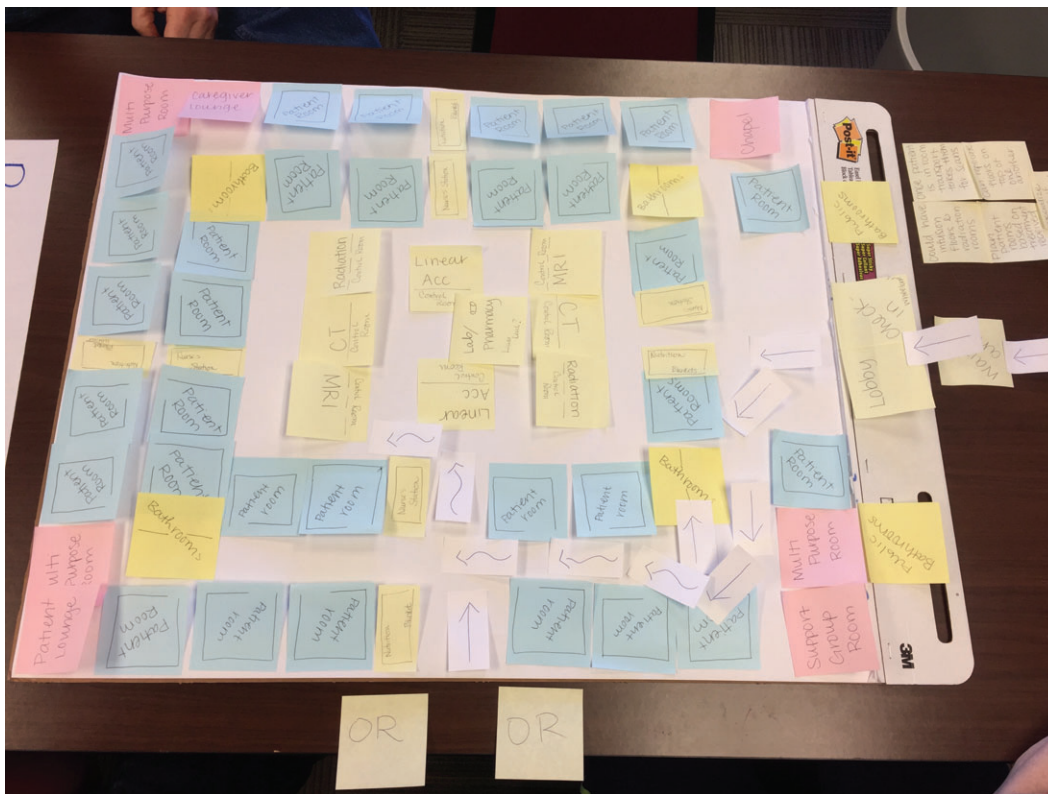


Figure 4 Finalized prototype of the patient treatment pod (PTP).

The results from this study concur with much of the literature cited, yet what is interesting and begins to expand the body of knowledge is the concept of the patient never moving. When a patient goes for chemotherapy infusions, they move from reception, to lab for bloodwork, to the exam room, and to treatment. Why is this movement necessary when it causes anxiety as noted by the participants in this study? Does it minimize medical mistakes? Does it help with infection control? Does it reduce nurse/staff fatigue? Does it reduce costs? While our participants wanted to eliminate this movement, these questions need to be addressed through future research.

The most important part of examining and improving the patient experience is to interact with and gain the perspective of patients (Merlino & Raman, 2013). Utilizing the participants' personal experiences led to the innovative idea of the PTP. Each participant applied his or her specific background to give ideas and feedback. The participants sought a prototype that would advocate and allow for the needs of patients and families while attempting to reduce anxiety before it occurs.

LIMITATIONS AND CONCLUSIONS

Bate and Robert (2006) state that hospitals need to improve the experience by making users an integral part of the design process, and Reay et al. (2016) argue that people not trained in design can make meaningful contributions to the design process. In this qualitative study, we brought participants together with various experiences and relationships with cancer and utilized design-thinking strategies to embrace empathy and understanding in order to better comprehend patient stress in cancer treatment facilities. The built environment of health care facilities is crucial to the well-being of current and future patients (Douglas & Douglas, 2005; Sherman-Bien et al., 2011). Poor design is linked to increased anxiety, greater need for medication, sleeplessness, and higher rates of delirium. Although beautiful cancer treatment centers exist, little research exists on what patients prefer (Wang & Puksza, 2017). As various plans for health care environments are developed, designs that help reduce stress and anxiety before it occurs must be implemented. Plans such as the one developed in Workshop Three could be considered to provide patients with the least amount of movement and the greatest amount of control, privacy, and personalization.

Figure 5 Revised patient treatment pod (PTP) based on workshop results and literature review.



NOTES:

1. PTP limits patient travel. Patients stay in one room for lab work, exam, and treatment to minimize stress. It promotes rest and relaxation due to limited movement.
2. Patient rooms are located along the perimeter to provide natural light and views to nature (Cannon Design, 2016). Wang and Puksza (2017) and Ulrich et al. (1991) note that windows with a view reduce stress. Window treatments are included to increase patient control.
3. Per Table 3, patients can choose a room upon entering the facility. Rooms have sliding partitions to allow socialization between patients if desired. According to Wang and Puksza (2017), patients do not have a preference for private versus public rooms but want control over privacy versus socialization (Cannon Design, 2016).
4. Sliding barn doors on patient rooms provide privacy and increase acoustics. Patients do not see other patients when entering the treatment area. Noise has been cited as a cause of patient stress (Ulrich et al., 1991; Sherman-Bien et al., 2011)
5. There is access to healing gardens from the patient's room and access to the outdoor patio for the inclusion of pets during treatment (Carmel-Gilfilen & Portillo, 2016).
6. Per workshop results, patients can personalize/customize their room for treatment. Using technology, pictures of nature, family members, friends, music, and smells can be individually streamed into the patient room.
7. There is a multipurpose room in each PTP for patient gathering and socialization. This room could be individualized per PTP to include prayer, advocacy, therapy, education, etc. (Carmel-Gilfilen & Portillo, 2016). The multipurpose room could also house individual offices for financial counseling and social workers.
8. Per workshops, there are centralized nurses who are close to each patient room. Patients have the same nurse for every infusion treatment.
9. A centralized restroom limits patient and family travel, and patient rooms are large enough to include family and friends.

There are, however, limitations to this research. Recruiting subjects for the workshops was difficult as encouraging individuals to participate for 1.5 hours was daunting. Moreover, individuals diagnosed with cancer or who are caregivers can be exhausted, nauseous, weak, and have limited time. Because cancer is a life-threatening disease, some who are cancer survivors or who are currently in treatment do not wish to discuss their experiences. Many of these factors led to a small sample, with only half ($n = 4$) of the participants having experienced cancer themselves. This limits the generalization of the findings. The volunteer status of participants made attendance sporadic. Three more participants had agreed to come to Workshop Two but were unable

to attend for various reasons. This made Workshop Two's attendance low and, as a result, led to low attendance at Workshop Three.

In examining the prototypes generated in Figures 4 and 5, future research should include health care interior designers, architects, landscape architects, graphic designers, code officials, health care administrators, and more health care providers along with additional stakeholders to refine the floor plan. How the prototype configures in a larger floor plan was not considered in detail by the participants, nor was the duplication of spaces such as nurse's stations and restrooms. Furthermore, the PTPs may not adequately address team-based care and collaboration as the nurses are scattered. If additional oncology doctors and nurses were included, they may be able to determine the viability of the PTP. In other words, is it feasible for the patient to remain in one room?

Participants generated a number of interesting statement starters during Workshop One, but selected optimization of time and minimal movement as the focus for subsequent workshops. Other statement starters, such as "How might we make the environment more personal?" and "How might we make the facility more home-like, less institutionalized and better suited to patients' sensory needs?," could be explored in future research. This study focused on the patient experience. Additional research should also address family, visitor, caregiver, and staff anxiety. Furthermore, only qualitative data were collected for this study. Future research should consider the use of quantitative methods to enhance our understanding of stress in oncology units.

While the sample for this study was small, the workshop format gave a deeper, more intimate understanding of cancer facility design. Utilizing a number of different design-thinking strategies allowed us to analyze the research purpose from a variety of approaches. The journaling/diagramming exercise provided knowledge of a typical day within an infusion center and documented touch points of anxiety, while the group statement starters prioritized the information. The rose, thorn, bud exercise and prototyping gave the participants a voice in brainstorming and making that encouraged innovation. Hearing the perspective from health care providers and caregivers broadened the viewpoints of patient stress, while the health care provider gave important insight regarding space requirements for the PTP.

Design thinking is allowing health care to create services that better meet the needs and desires of end users (Brown, 2008), yet there is little research on patients' perceptions of health care built environments specifically, the things they consider to be most important to their health and well-being (Douglas & Douglas, 2005; Wang & Puksza, 2017). The relationship between humans and their environment is symbiotic, meaning the environment influences their behaviors (Sherman-Bien et al., 2011). High stress levels have an adverse effect on patients' immune systems and healing, as well as on their overall patient experience; thus, there is a need for innovation in reducing stress for people with cancer (Homel et al., 2011).

The uniqueness of this study is through its use of design-thinking strategies that entailed a codesign approach in order to reduce stress. Design thinking adopts empathetic design principles to move beyond typical approaches and design an experience for patients (Agutter, 2011) while seeking solutions through an immersed understanding of other people's problems and points of view (Kronqvist et al., 2013). The use of design thinking in this study allowed us to work directly with patients, survivors, caregivers, and providers to determine what elements of the built environment could be improved to reduce anxiety levels. Research done by The Breast Service concluded that design within the facility provided "tangible improvements and has demonstrated the value of engaging patients and focusing on their experiences" (Boyd et al., 2012, p. 76). This study furthered this notion by giving participants the opportunity to formulate their own ideas, engage, and be a part of the solution.

Imagine you are greeted by a smiling staff member who escorts you to your PTP. The journey to the PTP is short. When you walk in, pictures of your family, favorite music, and nature scenes have been streamed and projected into the room, which you control. Because you love vanilla, the room smells slightly of this scent. Warm sunlight and a view of nature are in direct sight. You sit in your comfortable and adjustable recliner with a warm blanket. Your family and friends also have comfortable seating. The room is yours for lab work, exam, and treatment. You never have to leave except to use the

bathroom. During your treatment, you slide the partition to your right open and learn that the woman in the PTP next to you has the same type of breast cancer. You have an engaging conversation that is meaningful. She gets it. Halfway through your treatment, your family brings your dog, which enters through the green space and sits in your lap for the rest of your infusion. You turn the music off, slide the partition shut, close the barn door, and sleep for a while. This is exactly what you planned.

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Dr. Holly L. Cline is Department Chair for the Department Design and the online MFA in Design Thinking. She earned her Ph.D. in Interior Design and Housing from Virginia Tech, her Masters of Art in Interior Design from the University of Kentucky and her Bachelors of Fine Art from Centre College. Cline is certified by the National Council for Interior Designers (NCIDQ) and is a LEED Accredited Professional.