I, Aidi Xu, hereby submit this original work as part of the requirements for the degree of Master of Design in Design.

It is entitled:
How Design Thinking Can Improve The Patient Experience and Provide Innovation in Hospital Care Delivery

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How Design Thinking Can Improve The Patient Experience
and Provide Innovation in Hospital Care Delivery

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Abstract

Design thinking methodology is becoming a new approach to understand and determine the true need of patients and families and to generate a better solution for healthcare service in the hospital. There are two frameworks for design thinking: design thinking in the management realm and in the design realm. In this thesis design thinking is defined from a designer’s perspective: the whole process of how professional designers design. The purpose of this thesis is to demonstrate that design thinking has a positive impact on a patient experience and provide innovation in hospital care delivery. This thesis also describes the value professional designers have brought to hospital projects. In the research, three design projects with different levels of designers’ integration were analyzed. All three projects are from Cincinnati Children’s Hospital Medical Center. Results indicate that generally design thinking has a positive impact on hospital design projects. However, the impact varies according to a designer’s integrated level; the better a designer is integrated, the more effective the solutions will be. In addition, the more types of designers and stakeholders that are integrated the more diverse opportunities will be generated and reviewed during the design process. Furthermore, by learning and practicing the general design thinking process and design techniques, hospital staff can generate more empathetic insights, think more creatively, and push the design solutions more efficiently. Research findings suggest that a successful hospital design project will need the hospital staff to learn both design thinking process and design techniques. More importantly, they must learn how to work with designers and know each other’s capabilities.
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Hypothesis

Design thinking can improve the patient experience and provide innovation in hospital care delivery. Design thinking is the general practice model that professional designers would apply in their design process, as well as designers’ professional design skills, knowledge, experience and empathy.

Introduction

We are living in a world with radical transitions in society, economy, technique and science everyday. The healthcare industry is also involved in this radical evolution; “By 2030, the industry will move toward a structure that supports personalized medicine, which at its core, is predictive and preventative, driving medical practice to be predominantly focused on wellness” (Vitalari, 2010, p. 2). In other word, people will no longer be satisfied with the basic health treatment. They will have higher expectations for their care delivery experience. One way care delivery can be improved is through a patient centered approach; according to Bretthaur, “Successfully delivering healthcare in a manner that is both efficient and effective calls for a patient centric focus. That is, recognition of the end user – the patient – is critical when designing and managing healthcare systems” (2015, p.1030). The end-user patients have become much more important since the switch from doctor centric care. This results in the quality improvement (QI) methodology used in healthcare becoming insufficient when the problem is involved with addressing users’ needs and providing them new solutions for a more positive experience. According to Mark R. Chassin and Margaret E. O’Kane, “The evolution of (QI) quality improvement has been a steady response to the need to correct errors” (2010, p. 2). The
application of QI methodology in the healthcare industry focuses on increasing the efficiency of the healthcare delivery process, improving the outcomes and minimizing the preventable errors. The major part of QI is quality measurement and the measurement is always the statistical data collected by the hospital. We can see that the QI methods lack a connection with the actual patients and their families. It cannot create a new service concept solution based on users’ needs. What QI can do is to improve the existing service system.

Design thinking is a methodology that focuses on people’s needs. Compared with other methodologies, it emphasizes users instead of formal methods, requirements and specifications. It is a flexible, iterative design methodology (Norman & Draper, 1986). This triggers healthcare organizations to try to approach design thinking methodology to understand and determine the true need of the patient and to innovate a better solution for healthcare service. At the same time, the development of information and communication technology (ICT) has dramatically changed the way patients interact with health care providers. Patients are able to communicate their own thoughts, feelings and information with each other and with healthcare providers. The fact that patients get more power during treatment brings the need of patient-centric approach. Last but not least, information communication technology (ICT) allows more opportunities to provide better care and understand patients.

I worked as a designer with clinicians and researchers at the Cincinnati Children’s Hospital Medical Center (CCHMC) in several research projects. Many design thinking methods were employed in the research projects. Apparently design thinking methodology has inspired many of the hospital staff, many of whom have already participant in design training sessions. While these people may have any job from being a doctor, nurse, caregiver, social worker to healthcare employee, they are all non-designers. The way they utilize design thinking methods is
much different compared to what we do as designers. There is a huge gap in between. The objective of this thesis is to first demonstrate that design thinking methodology has a positive impact on the patient experience and care delivery in hospitals by the use of real case studies. Second, this thesis attempts to find out how design has impacted each phase. Third, the study discusses the different between designers and non-designers’ ways of practicing design thinking methodology and then provides suggestions of how to use both successfully. The outcome of this thesis will benefit both designers and hospital staff by facilitating improved teamwork in healthcare projects, getting a better and more synthesized understanding of user needs, and generating more innovative solutions and better design output for complex problems inside hospitals. Furthermore, it will help provide more positive patient experiences and improve the efficiency and effectiveness of healthcare delivery.

**From doctor-centric to patient-centered**

Studies have shown that there has been a doctor-centric approach in the hospital service system in the past and still exist to a degree today. According to Alfredo (2015, p.15), patients are used to doing whatever doctors tell them to do, and they do not have the power or control to express their own thoughts and feelings. Doctors do not have to share much information or have many interactions with the patients because of this procedural way of doing things. However, many patient-centered approaches in the healthcare industry have been appearing recently, from clinical trials (Sharma, 2015) to hospital food service (Altan, 2009). Since medical techniques have gone through numerous advances and so many individual healthcare clinics are emerging every day, it is no longer enough to just focus on improving medical technique. According to Dziersk (2014), “The ability of healthcare organizations to consistently deliver positive patient
experiences will be much more important. It will decide whether the healthcare organization will be able to own the future of healthcare.” In order to prove that patient-centric approaches are becoming the main trend in the healthcare industry, I am going to share two interesting cases. Case one is by Mast (2015), who wrote a roundtable discussion record of several foremost radiologists discussing the patient-centric future of radiology. “The shift in focus to patient-centric health care will put radiology at the forefront of patient care, and make us more visible. I believe that is key” (Rajesh Krishnamurthy, 2015, p.65). This means the radiologists do not totally rely on the radio technique now. They start to build a consistent relationship with their patient by sending emails and instant messages. The radiologists are concerned about patients’ comfort and try to reduce the discomfort by shortening the exam time. They also mentioned many informative tools like RSNA Image Share, which is able to share the exam image between radiologists and patients on their personal health record account. The radiologists described a future of radiology with innovative solutions based on patient-centric approaches.

Sharma, N. S. (2015) describes companies whose clinical trials are now looking for new innovative ways to launch their medicine to the market more efficiently. What they found that has an incredible impact is the patient-centric approach. They start to treat patients like real human beings instead of the source of their statistic data. By seeking feedback from the patient in the early stage of the trial protocol, they are able to understand patients’ cognition of the Informed Consent Form (ICF). Furthermore, the researchers start to gather the information related to a patient’s lifestyle, life experience and income to design a patient-friendly trial protocol.

From the two examples above we can see when problems involve patients’ emotional needs and the holistic experience. The design problem will become complex, because we can’t
really use statistic analysis to tell what the users are feeling and experiencing; however as patient centered becomes the trend of healthcare in the future, those kinds of problems that involve patients’ experiences and emotions will get more and more attention.

**Information and communication techniques can support a patient-centered approach**

Information and communication technology have changed the way patients and their families interact with hospitals. According to Wikipedia, “Information and communications technology (ICT) is an extended term for information technology (IT) which stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals), computers as well as necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information.” There is this huge opportunity area to improve delivering healthcare and the patient experience in hospitals because of this technology. Also, the technology gives design thinking a huge opportunity to help make changes in healthcare.

- The appearance of electric health record (EHR) systems provided a whole new world for patients and family. According to Winkled at el.: “The EHR systems are multifunctional and include patient administration, continuous narrative documents of diagnostics, treatment and care, order entries for laboratory and radiological exams, tools for reviewing their results, medication lists for generating prescriptions, inter organizational data exchange including telemedicine services, and at least optionally, a decision support system. The narrative, image, and biometric data of these EHRs are highly integrated with a unique nationwide patient identification code” (2011, p.118). The users have access to manage their own diagnostics,
treatment, exam results, and medicine. In addition, this system also provides a telemedicine service as a new communication way to connect patients to care providers.

- Among the new information and communication techniques, E-mail, instant message and video chat are the main breakthroughs in tele-health service. According to Melanie (2015, p. 93), “Mobile platforms and health applications are also useful to medical professionals for real-time communication, information access, and telemedicine. 81% of U.S. physicians are using smartphones, and 62% of those surveyed in one study are using the iPad professionally.” Those techniques tremendously bring patients closer to doctors and increase the communication between patients and doctors.

- The community websites give patients a place to find support and advice from community members. On this type of site, patients can communicate their own treatment experience and feelings; they have much more initiative to express their thoughts and their needs. Furthermore patients have more control over their own health condition than ever before. A great example is the website Inspire, which serves for patients to share and learn about their medical conditions, treatment and support. It’s a huge community with the most trusted partners.

The current hospital quality improvement (QI) methodology is not enough now

QI methodology is a main research method applied in hospital research projects nowadays: “There are a whole host of successful quality improvement initiatives that have been used in health care today including improvements in patient safety, management of chronic disease and preventative medicine” (Beers, L.S. 2011, p. 258). It’s an efficient way to improve the quality of health care service. But considering patient centered will be the way healthcare develops in the future, The QI method will not be enough to solve all the problems in care
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delivery and the patient experience. By understanding what QI research is I will be able to get an overview of how people are doing research in hospitals currently.

What is QI Methodology?

So what is QI methodology? According to Beers: “Quality improvement can be defined as a structured analysis of a system’s performance with a view to improvement” (Beers, L.S, 2011 P.257). As I mentioned earlier QI is a method aimed to correct the errors in the system. We can describe QI methodology as a system improvement method that produces high quality services and products, efficiently and precisely. Despite how QI came to be, I am more interested in the main process and techniques used in QI methodology.

One interesting concept in QI is to reduce variations in the system to improve the quality of the system (Walter Shewhart, 1924). According to Shewhart there are two kinds of variations: one is “special-cause,” another is “common-cause.” The special-cause variation is very dangerous which may cause a huge failure in the system. For instance a small sanitation problem may cause the failure of a surgery. In order to distinguish these two variations Shewhart invented a control chart. This has made him the father of “statistic quality control.”
Shewhart also proposed another concept “Shewhart cycle,” which is also known as “Deming cycle,” the Plan - Do - Check - Act (PDCA) cycle (figure 1). The “Shewhart cycle” is the main process in quality improvement methodology, even though it has many variations. This “Shewhart cycle” is a repeating cycle that utilizes different steps of the system to test ideas out (Beers, L.S. 2011, p. 259). After identifying a clear goal, what changes are going to be made and how to measure the outcomes, the cycle process will be produced; Plan: to make the testing plan; Do: to implement the improving plan, collect data; Check: to analyze the data, find out the problem; Act: to optimize the concept, solve the problem. With a new optimized plan coming out every time, the “Shewhart cycle” will be carried out to test the new concept. For example, applying “Shewhart cycle” to improve patient handover in a hospital.

**What are the limits of QI methodology?**

Compared to the design thinking process, which will be explained in the ensuing chapters, this “Shewhart cycle” focuses on testing out the ideas instead of generating the ideas. The main evaluation system in quality improvement is statistic based. The limits can be summarized as:

![Figure 1 The PDCA cycle in Quality Improvement](image)
• The plan part of quality improvement is very fast and straightforward which can easily result in making a bad decision. Without enough exploration, the bad decision can cause time and commercial waste and make the testing phase become meaningless.

• Usually, QI methods can only be applied to a well-defined problem. The typical one will be to reduce the waiting time for the coffee shop and customer can spend more time on enjoying their coffee instead of in the line.

• The way QI works is often only adding or changing a small element in the whole system. The solution only solves the problem straightforward, it seldom looks deeper to find out the cause or reason of the problem.

• The solutions usually will not change the flow or experience and consider people inside the system, only study the system. The QI methodology treats people like objects functioned in the service system, it does not consider people’s emotions or thoughts.

The main limitation is that QI will not go back to the user, spend much of the effort to deeply understand the user’s true needs empathetically, or generate the idea from the needs. This makes this methodology limited in the healthcare patient-centric approach. On the other hand, design thinking methodology will be more helpful in helping people generate creative and innovative ideas based on users’ needs.

What is design thinking?

Compared to QI methodology, design thinking is a general concept with a number of different definitions both in theory and practice: “Design thinking is a concept used both in theory and practice” (Ulla, Jill, Mehves, 2013, p.121). Although design thinking was first labeled by IDEO and spread into the market, it actually already existed way back when designers created
artifacts to solve the problem. The article written by Johansson-Sköldberg describes there are two frameworks for design thinking: one is in the realm of management and another is in the design realm. “In our previous work we observed two distinct discourse on design thinking: one in the design-based, scholarly literature, and the other in the widely accessible business media ” (Johansson & Woodilla, 2010). Design thinking in the design realm is taught in design school, both art schools and universities. There are graduate, undergraduate, and PhD programs. Design thinking in the management realm is taught within organizations and companies. These programs aim to teach awareness and the value of design thinking, as well as how it can make everyone do their job better. Design thinking in these two realms are different, but there is often confusion between the two. As I have been educated in design, I am going to define design thinking from a professional designer’s perspective. By doing so this thesis will create an opportunity for people to learn more about design, to be better at working with designers and also recognize what value designers have brought to the table.

For the purpose of this paper I define design thinking as the whole design practice process. Inside the process designers use their professional design skills, knowledge and own experience to empathetically understand all stakeholder’s needs, synthesize the insights, define the design challenge, consider all possible solutions, make the prototype, test it out and reflect on the feedback, and finally determine the optimum solution.

- A professional designer’s skill and knowledge refers to designer’s technique skills and design ability in each designer’s specialties: 1. Graphic designers’ (who deal with symbolic and visual communications) ability to transfer information and synthesize it into words or images that solve communication problems; 2. Industrial designers’ (who design material objects) ability to deal with the physical, psychological, social, and cultural relationship between subject and
human being by designing the material, form, color (MFC) of a product; 3. Architects’ (who design complex system or environment for all living activities) specialties are in system engineering, architecture, urban planning, or functional analysis of the complex whole and their subsequent integration in hierarchies (Buchanan, 1992, p. 10). Different designers have priority skill sets and knowledge in different fields. For example, graphic designers master visual design computer software and print knowledge, industrial designers master physical modeling, 3D modeling software and material knowledge. Besides that, some skills and knowledge are shared by all designers. According to Schon (1992, p.5), designers have the ability to make sense of their own actual or virtual design world through process (seeing-drawing-seeing) of the reflective conversation with materials and design situations, “A designer sees, moves and sees again. Working in some visual medium (drawing, in the examples in this paper), the designer sees what is 'there' in some representation of a site, draws in relation to it, and sees what he/she has drawn, thereby informing further designing.” Which means besides using their mind, designers utilize their senses and body to do design.

Additionally, designers have the great visual communication skill to draw their thoughts on paper or digitally. All those design skill sets and knowledge require years of training at design schools. A designer’s own experience refers to their personal life experience and design experience, and it is essential because it is related to the design style. Buchanan suggested, “Individual designers often possess a personal set of placement, developed and tested by experience.” That means that each designer has his or her own appreciation system that drives his or her design.

- Empathetically understanding all stakeholders’ needs helps a designer identify the opportunity areas. So what is empathy? “Empathy is the ability to understand and share feelings of another
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person” (Oxford American Desk Dictionary and Thesaurus, 2010.) And designers are trained to be empathetic, according to Alfredo’s (2015) research of scale the empathy level of design students during their design education. In addition to empathy, all stakeholders should be considered because the design outcome would serve all of them. For example, the design project inside hospitals should consider care providers, patients, and patients’ family members.

- The design practice process is the general step-by-step model a designer would use. According to Buchanan (1992, p.15), “Although there are many variations of the linear model, its proponents hold that the design process is divided into two distinct phases, problem definition and problem solution.” By detailing these two phases, the design process can be depicted as conducting design research, generating insights from research, defining design challenges, diverging possible solutions, prototype the solutions, testing them to get feedback and refine the design solutions.

Methodology

In order to answer the questions: 1) Does design thinking have a positive effect on improving the patient experience and innovate care delivery? 2) How does design thinking impact the whole project in each phase? 3) What are the differences between designers’ practice and hospital staff’s practice in design thinking projects? Three Cincinnati Children’s Hospital Medical Center (CCHMC) projects were studied and analyzed. The research was conducted as a case study to describe findings. These three hospital projects all used the design thinking approach, while each had different levels of professional designers’ involvement. The main research methods of these three case studies include literature review, semi-structured interview, and observations. The literature review part includes reviewing all the articles that have been
published to describe each project. By connecting the leadership in each project, the presentation reports on each step and projects’ outcomes were also shared and reviewed carefully.

Observation happened in the second project (shared decision aid project) because I had the chance to participate in this project as a core professional designer. I observed and recorded every design activity in each phase, especially how hospital staff practiced or responded to each design activity, and the outcome of each phase. By analyzing the whole project process and design outcome, the impact of design thinking would be discovered.

There are two parts of the semi-structured interviews. One is with the leadership in each project in order to generate a better understanding of how design thinking is applied in the whole project. Another is with the medical team members aimed to have an empathetic understanding of hospital staff’s attitude of design thinking methodology and their own understanding of the methodology. In all, nine in-depth, one-on-one 40 minute qualitative interviews with clinical staff and researchers in Cincinnati Children’s Hospital Medicine Center (CCHMC) were conducted. All the interviews happened in the participants’ offices. The conversation is open-ended and I observed their body language and expressions to get their emotions and attitudes. The interview guideline was designed to reflect on their responses. The whole conversation was actually lead by my participants and they had the opportunity to expand and share their whole experience of applying design thinking in their hospital research projects.

Participants

The core leadership members who participated in my interviews included Julie Elkus who led the Orthopedics outpatient clinic project; Courtney Brown, who led the behavior therapy referral decision aid tool design project; and Craig Vogel, a design professor who led the Sickle-cell Disease project. In addition, I also interviewed six participants. They are doctors, nurses, QI
researchers in CCHMC James M. Anderson Center for Health Systems Excellence. The Anderson Center department aims to elevate Cincinnati Children’s focus on quality improvement, and propagate the impact of this work. Inside this department, there are over 50 quality improvement (QI) staff and they work closely with clinicians to identify patients’ and families’ voices and true needs. The Anderson Center staff try to figure out the solution to improve the quality of care delivery and experience of the patient and their families. The reason those participants were chosen is because they were quite interested in the design thinking method. All six participants were recruited through Julie Elkus’s recommendation. Elkus, who I mentioned before, is the director of innovation and design in CCHMC. She conducts design training and leads design projects inside CCHMC.

Data collection

I audio recorded all the interviews and transcribed them into text. Notes and photos were taken for each conversation and observation. The 40-minute conversation applied a semi-structured and open-ended question guide, which I developed. See Appendix A for the copy of the interview guide. The interview started with the question: “Tell me a little bit about yourself and your work at CCHMC.” This question is perfect for starting a conversation. After we got warmed up, participants were asked to describe their first encounter experience with design thinking, their attitude, feelings and thoughts. The interview kept going deeper to find out their understanding, attitudes, feelings and the way they operate design thinking in CCHMC by asking them to describe their design thinking training experience and the application of design thinking in the hospital projects.
Analysis

The interview audio record was transcribed into digital text after each interview. The first three transcriptions were read closely with the line-by-line method (Smith, 2008, p. 94). After analysis the content by each line, the emergent categories were identified. By doing this content analysis six main themes have been summarized (see Appendix B). The findings were merged into the description of each case study.

Case Study

Cultivating Patient Experience in Outpatient Orthopedics using Design Thinking and Quality Improvement Methods

Background

According to the research and data analysis conducted at Cincinnati Children’s Hospital Medical Center in 2012, families were unsatisfied with the long waiting time. The overall report showed they did not have a good experience in the orthopedic outpatient clinic. Compared to quality improvement methodology, design thinking would be a better approach to help make improvements and solve the problems. The orthopedic outpatient clinic then worked together with the innovation and design department. They made this project the first one that applying design thinking methodology at the hospital.

The objectives of this project are: 1) to improve the patient and family experience in orthopedic outpatient clinic; 2) to spread design thinking to the hospital staff. The project was sponsored by the division director for orthopedics and led jointly by the director of innovation and design and a clinical director for orthopedics. The team was structured in a multi-disciplinary way, which involved almost all stakeholders that are part of the orthopedic clinic
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visiting process (one physician, two frontline staff nurses, one medical assistant, one orthopedic technician, one radiologist, and one parent), one graduate design student at University of Cincinnati’s College of Design, Architecture, Art, and Planning (DAAP), the director of innovation and design, the business director for division, one quality improvement consultant and one data analyst.

**Process**

The whole project used a design thinking approach. It involved some design techniques and activities to empathetically understand the experience of patients and families, identify and reframe the design opportunities and refine the designs output in the iteration phase. The whole process is framed below in (Figure 3). Training in design thinking was provided throughout the project and team members practiced the methodology “in real time” (Julie, 2016). They learned the methodology by practicing it in the project.

During the research stage, in order to achieve the goal of understanding the experience both for patient and family, the team was divided into several smaller groups for primary research. Before each group began, they received training on effective interview and observation...
techniques. By doing so, the team members knew what to observe and what to ask during the research stage. One of the groups conducted the shadowing activity with the patient throughout the entire clinic appointment from entering to exiting the clinic. Another group completed observations in the waiting room in order to understand what patients and families were doing and saying and the state of the environment. The third group interviewed parents about their experience in the clinic. They also did an analogous exercise in which the team went to Nordstrom, the Apple Store, and the Cincinnati Children’s Museum to learn about different customer service solutions.

Empathy map, “5Ws” ladder, Inspirational design target and Hero’s journey were used as design techniques to help the team generate insights and get a deeper understanding from their research. The team also did qualitative research content analysis to identify the main themes. Main design opportunity areas were defined during the research phase, and all the primary research findings were documented and summarized in Word files. One of the main findings related to communication within the whole system: families want to be informed of what is happening at the moment. In addition to having a long wait time, parents were frustrated by not knowing how long they would have to wait and why they had to wait. Hospital staff were also not well informed of the status of each family or where they were in the process. Further, the communication between different “services” (X-Ray, nursing team, registration, and residents) was not effective. Another main finding was the workflow in the waiting room caused parents to get up repetitively to go to different places, which both reduced the efficiency of the registration process and caused parents to panic. All these valuable findings were generated from going to the field, observing, and asking about families’ experience empathetically. Before this design project, hospital staff primarily used their professional and rational knowledge in their work.
This project encouraged hospital staff to bring more emotional, experiential, and empathetic communication with patients and their families.

The goal of the ideation and prototype phase was to generate solutions based on the research findings to implement them in the hospital. Several guided creative exercises were organized to inspire the design team. After evaluating all the ideas both inside the team and in the hospital with the families, 14 top concepts emerged and were documented. The concepts were focused on improving the facilities in the waiting room, optimizing the process flow, and improving the efficiency of communication between families and hospital staff. These concepts can be divided into two categories: one includes minor changes or solutions borrowed from other places to improve the existing clinic system and another includes larger-scale and new solutions. The first category contains concepts like, “an updated waiting room with improved seating table and iPads for kids to use,” which would make the waiting room a fun and comfortable place for kids to spend time. Other examples are “adding pagers to communicate with the family,” which would give patients and families more control of their time, and “a streamlined registration process,” which would make the registration process easier and more intuitive for patients and families. All of those concepts in the first category do not require many refinements or complex processes. They were tested in the PDSA cycle at the early stage. PDSA cycle is a typical quality improvement methodology previously mentioned in the introduction chapter. The second category contained concepts like creating “a welcome brochure and physician identification face cards,” which would give the family a overall introduction of orthopedic outpatients clinic, “a passport to your visit folder that included information on the clinic process and clinic staff,” and “a flow screen in Epic that identifies patient status and wait time at each key step in the process,” which helped communicate information in real time to the
family. These concepts were mocked up at first and went through several rounds of refinements and testing with patients and families.

Bobby, a team member and graduate design student with industrial design background at DAAP, brought essential design experience and knowledge to this project and participated in every phase. According to Julie, “given his familiarity with the design process, he was instrumental in process execution from beginning to end.” Besides helping with organizing the design activities and facilitating the whole design process, Bobby contributed greatly in creating the “appointment passport,” testing it out with the families, and refining the design in several rounds of iteration. He also summarized the whole orthopedic outpatient journey with the users’ emotional needs, information and process needs, the problems, and the solutions (Figure 4). This diagram greatly helped the team communicate the whole project to others.

Results

A survey (See Appendix C) was conducted to collect critical data of patients’ and families’ experiences before and after the team implemented the concepts. A line chart (Figure
5) was created to show the percentage of people selected either “agree” or “strongly agree” for the question “I had a positive experience in the waiting room.” The yellow box showed which concept was applied at each time point. The solid red line is the center line that represents the average number of how many people had a positive experience in the waiting room. While the data consistently increased above the center line for over 5 dots, the centerline increased. From the line chart, we can see that the percentage of people who had positive experiences in the clinic increased by about 10% after the design concepts were implemented. Furthermore, the data stayed consistently around 90% after 12/15/2014, except one day 4/20/2015. The reason is that the Epic system had gone down that day at the clinic, which caused huge chaos and inconvenience. Overall, we can say that by using a design thinking approach, the whole orthopedic outpatient clinic project has positive impact on patients’ experience in the hospital.
Besides positively impacting healthcare delivery and patient experience, design thinking also had great impact on the hospital staff. According to Julie, the design thinking approach made hospital staff feel more creative, as they enjoyed evaluating their own experience and brought both their emotional and rational sides to the work. In addition, design thinking encouraged an empathetic perspective, which staff may not typically use in their work at hospital.

**Design and Medical collaboration project- Shared Decision Making**

**Background**

The purpose of this collaborative quality improvement project for the Anderson Center Evidence & Measures team is to support clinical teams to improve communication and shared decision-making (SDM) between clinicians, patients, and/or their parents. SDM is a process that involves clinicians communicating information about treatment options and patients/parents communicating the personal value they place on the trade-offs involved with the goal of finding the best strategy for the individual patient (O’Connor, 2004). This SDM project involves design thinking methodology and has been proven to be effective in improving the whole treatment decision making process for the parents in several different applications (Brinkman et al., 2013).

**Behavior Therapy referral options**

When a parent has concerns about their children’s behavior and mental health, they often go to the primary care provider (PCP) to ask for help. Usually, the PCPs will propose a treatment plan according to the child’s symptoms and the family’s situation,
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and behavior therapy is usually one part of the treatment plan. However, the behavior therapy is provided outside of the PCP in other agencies, and the landscape of behavior therapy providers in any community can be very complex. Because of this complexity, it is often difficult for parents to understand all of the behavior therapy options and make a good treatment decision for their children. The PCP can also have difficulty finding a good way to explain complex information and treatment options to the family. Poor communication makes the whole referral process very difficult for patients and their families. Research has shown that there are huge barriers for parents to follow up with the pediatrician’s referral for behavior therapy. The influential elements include parents’ concerns about transportation, cost, long wait time for an initial appointment, stigma, previous negative experiences with mental health providers, or the belief that problems are not severe enough to warrant treatment (Brown, 2014, p. 407).

The objectives of this project include: 1) to develop a decision aid for behavior therapy referral with several reasonable options for the family; 2) design and implement the process of using this decision aid during healthcare encounters; 3) assessing the impact of this decision aid tool (Brinkman, 2014). Dr William Brinkman initiated this SDM project at Cincinnati Children’s Hospital. The behavior therapy team is lead by Courtney Brown, who is an assistant professor of pediatrics. She has conducted many research studies on behavior therapy treatment and is quite experienced with the entire process. The team members included another experienced physician, Mary Katie, a social work care manager, Lisa Leace, and a designer. This project used a design thinking approach combined with QI methods in the testing phase.
Process

The whole project lasted four months and included six two-hour collaborative sessions.

The process is illustrated in Figure 6. The designer was participated in this project for a couple weeks before the first “Kick-off” phase. The designer did literature reviews about SDM and assessed the team’s previous work to get an overall understanding of this project. Before the first meeting with the medical team, the designer prepared the question like: What is behavior therapy? Who will be our target patient? What are the barriers during the decision making process that have already been recognized? The second phase called “context is everything” is actually a user research and analysis workshop conducted with the medical team. Two parents and their children were invited to this workshop to work with the team in order to help the clinicians and the designer have a more empathetic and holistic understanding of their decision making experience.

The “user journey map” (Bella, 2012, p.196) was used as a design thinking technique to visualize the main findings of our qualitative research. This map illustrates what the healthcare journey looks like for both parents and primary care providers, including their thoughts and feelings throughout the process, as well as barriers identified in each step.
The designer sketched the structure of the journey map on the whiteboard and guided the whole team to construct the whole journey map for behavior therapy referral. During this whole process, the medical team focused on structuring a primary care providers’ journey map from their own perspective. The designer played the role of speaking from the parents’ perspective. We also found that framing the final version of the patient journey map in Excel, a software program with which the hospital staff are quite familiar, will encourage clinicians to participate more in the design process, as they can edit and add new thoughts easily. According to the journey map, our team found out that the parents’ experience is totally different compared to the primary care providers’ experience. The providers experience a linear process of identifying the child’s symptoms, determining family circumstance, and then making the referral and follow up. However, the parents experience a frustrating, repetitive, and stressful process of first noticing the sign of their child’s behavior problem, waiting and observing, trying to make different parenting decisions, bringing their child to the doctor several times with concerns and uncertainty, and bringing the referral back home discuss with the family, still unsure what is wrong with their child. According to the interview with a team member, Courtney, this design exercise gives the medical team a different perspective to think about the problem. They become more empathetic about what the parents are going through and start to redefine the problems based on parents’ needs. After the collaborative sessions, the designer was invited by the medical team to do several shadowing observations with the patient and their family in Hopple clinic and Pediatric Primary Care Center (PPC). The designer started to understand more and considered how
to integrate both healthcare providers and parents within the whole behavior therapy referral process. The proposed content of the design started to become clear at this stage.

In the “Design 101” session, the “persona” design technique (101 Design Methods, p.517) was used. According to all the research insights the team had generated, three personas were created to represent types of parents who are: 1) very concerned about their child’s behavior and ready to take action; 2) a little bit concerned about their child’s behavior and not ready to take action; 3) not concerned at all. The team summarized the different needs, concerns, thoughts, and behaviors for each persona. A brainstorming session was then conducted to generate ideas and determine what information to provide and how to communicate that information. Several great ideas were identified on the white board, and the team designed two concepts by combining multiple ideas together (one concept is formatted on a sheet with all information and the other is formatted on a set of cards with less information on each). The design technique “persona” has been found to be a very efficient way of encouraging team collaboration and mutual understanding. It improved the communication between the team members and inspired the ideation phase by putting the user in the center. Furthermore, the sketching skills of the designer was an efficient communication tool to facilitate the generating the ideas and concepts.

The medical team was responsible for finding all information from the behavior therapy agency after the ideation session. A complex excel spreadsheet that contained the proposed content was shared with the designer (see Appendix E). The designer made the two prototypes by reorganizing the information, color-coding the content, transferring categories into identifiable symbols, and visualizing some statistic data. The designer,
who is experienced in interpreting and simplifying complex information, interviewed the medical team members, and organized that information in a readable and legible format, contributing to the success if the project. Also, the designer’s capability of rapidly building the prototypes with existing materials pushed the project forward in a powerful way and is reflective of the design thinking process. The medical team then brought the two prototypes back to the clinic and recorded parents’ feedback by conducting qualitative research. More positive experience had been found in the sheet format prototype. On the other hand, the card format was observed to be complex and hard to use by the parents and providers. The take home part, which was designed for the parents who felt concerned but not ready to take action, caught parents’ attention. The content of the cards include “behavior knowledge,” “what to do at home,” and “behavioral therapy may help.” Parents like reviewing this content at home because most of the stressful decision-making process actually happens at home with the family. During the several rounds of user testing and design refinement, many new design challenges were found. For instance, the patient had difficulty finding locations of agencies on the map because they were only familiar with their neighborhood, some symbols were confusing for parents, and the total time commitment including travel time was less important than scheduling flexibility. In this prototype and user-testing phase, the medical team was observed to be quite good at collecting professional, complex, rational and accurate content information. They are all very experienced pediatricians, and they can understand the parents’ experience well when they start to think empathically. The empathy was like a trigger for them; as the medical team acts as both the user and the designer of the Decision Aid, they provided first-hand feedback of the prototype. The designer was in
charge of designing the prototype based on the requirement and proposed content. The designer’s skill set and experience helped in improving the readability and legibility of the complex content for both parents and providers.

Results

The designer created the final version of the Decision Aid tool (Figure 7). The Decision Aid starts with a conversation guided by the question, “how concerned are you about your child’s behavior?” By helping the providers understand at which step the parents are, the providers can choose to continue the referral process by giving parents more specific treatment information or offer the take-home material to give parents extra time to consider options. The preliminary results of the pilot study show that the Decision

Figure 7. Behavior therapy referral Decision Aid Tool. Two legal size sheets, The yellow one is for the very concerned parent who is ready to make the decision of choosing a treatment. The pink one is for the parents who have little concern and can take home.
Aid: 1) was helpful in facilitating the conversation about behavior therapy referral between parents and providers; 2) prompted the health provider to talk through other issues that they usually do not discuss with the parents (e.g. transportation, insurance, and location); 3) helped in providers’ and parents’ own learning of the behavior therapy; 4) informed parents efficiently with more valuable information, helping them to make a decision at that moment. A larger sample will be tested in the future to get more accurate results of this decision aid.

**Livewell collaborative project: Sickle-cell Disease (SCD) project**

**Background**

According to the article written by Dunseath et al. on DMI summer 2013, this SCD project is a joint project between the Cincinnati Children’s Hospital Medical Center (CCHMC) and a non-profit design consultant organization, Live Well Collaborative (LWC). According to Dunseath et al.(2013, p.50), “Multidisciplinary team members include four DAAP students from graphic, digital, and industrial design, completing placements at LWC; two DAAP faculty supervisors from LWC; and a psychologist, psychology fellow, and three to five psychology research assistants from CCHMC.” Compared to the two case studies described previously, professional designers were the primary contributors to this project. The objectives of this project were: 1) to develop a patient-oriented solutions to help SCD patients manage and prepare themselves for the transition from pediatric care to adult care; 2) to educate to hospital staff about design thinking and encourage them to use it in their daily work (Dunseath et al., 2013, p.50).
Process

This project used an eight-week studio and a design thinking approach. We used the LWC’s research process model that focused on research, ideation, validation, and refinement.

The project process is summarized and illustrated in the diagram above (Figure 8). The research phase started with the team literature review with every aspect of SCD disease and was followed by stakeholder analysis with eight patients. After the team got a holistic and deep understanding of the SCD patient and the disease from primary and secondary research, they created a “mind map” diagram and a patient profile to show the common themes. The entire translation process was also framed in a visualized format. According to Dunseath et al. (2013, p.51), the benefit of having designers do the research is that the highly complex information can be summarized and visualized in a understandable way. This visualization of information increased the communication among team members. After they identified insights and design opportunities, the team applied a co-invention approach to the ideation phase, which generated three general concepts. The essential task in this stage was to visually represent the concept alternatives. In the co-creation session, all the concept alternatives had been tested, evaluated together with the stakeholders.
After several rounds of refinement, three design directions were generated: 1) Patient Profiles; 2) Transition Step, Milestone, and Power-up Cards; 3) Patient-Provider Interface (Linda et al., 2013, p.52). All three assistants successfully conveyed complex medical information and communicated with all stakeholders in an efficient way. The final design concepts made the medical material easier for the children to understand, which in turn allowed them to feel more comfortable discussing this information with others. From a broader point of view, the three assistant tools can function as a continuous reference for children to transition from pediatric to adult care, which will improve the patient’s entire experience in their long-term care journey. Furthermore, by informing the health providers with key information about patients in an effective way, the providers will understand the unique needs of each individual in every step and ultimately improve the hospital’s care delivery.

Discussion

If we compare the three case studies together, we can see they all seemingly used a design process with a similar structure, but there are also many differences:

1. The Orthopedics outpatient clinic project is an entirely internal hospital project with a very general goal set at the beginning. It involved only one designer, and the hospital staff played the major role in the project. Professional designers played a small part in the project. Therefore, this project has low integration with design. The majority of the project’s outcomes are not like the typical design solutions that come from a professional design team. The outcomes are improvement plans and decisions informed by excellent research insights. Furthermore, QI methodology was used in the concept testing phase in this project. This indicates that the design team did not jump out of the QI research methodology.
Additionally, although the designer helped with some of the visualization, the main way they communicated the research insights and concepts was through text.

2. Behavior therapy shared decision making (SDM) project is an internal hospital design project as well. It started with a very specific goal of what kind of design solutions will be delivered at the end of this project. It also only has one designer, but the ratio of non-designer and designer is 1:6, which indicates there was more design focus than in the Orthopedic project. The behavior therapy referral decision aid tool is the design output which was developed and reflected a comprehensive decision making process. This decision aid tool is a typical graphic communication design solution. During the design process, the variety of design possibilities that were reviewed was limited. However, by applying a design thinking methodology, this decision aid tool actually improved the conversation between doctors and families and the flow of the decision-making process.

3. The Sickle-cell Disease (SCD) project is the project with the highest level of integration with designers. In this project, hospital co-operated with the design consultant organization, Live Well Collaborative (LWC). The designers had a primary role both in the research and the design phases. This project had a general rather than specific goal at the beginning. Compared to the other two projects, it used an empathy approach and visualization in the research and concept development phases. Instead of refining the description of the ideas with words, designers simplified, refined, and validated the visual concepts. Each of the three design solutions generates a whole product system that aims to simplify the complex sickle-cell disease treatment experience. These three design concepts were further detailed and refined to a deeper level of product design comparing with other design solutions.
Conclusively, this SCD project is the most integrated project with the most varied and deepest level of design output among the three projects that are reviewed.

Overall these three case studies demonstrate that a design thinking methodology and approach in these projects can have a positive impact on patients’ experience and in the delivery of hospital care. However, the impact varies according to ratio and integration level of professional designers and non-designers. The three case studies demonstrate that if designers are integrated effectively into a project, a better solution will be generated. The more types of designers that are integrated and the deeper the level of design solutions that are generated, the more diverse the opportunities will be during the design process. How does design thinking help to conceive solutions throughout the whole process? This question can be explained in two ways: 1) how professional designers’ design skills, knowledge, experience, and empathy have influenced the projects.; 2) how the step-by-step design thinking practice process and design techniques used in the projects.

**How do professional designers impact the project?**

I. Designers’ unique skills and knowledge in different design disciplines help translate conceptual solutions into tangible or more specific design product output, which provides users with a more valid, efficient, and delightful experience. For example, designers clarify information through the use of different colors, shapes, symbols, space, and font styles to reorganize the complex behavior therapy referral information chart and make the medical information easier and more desirable for patients and families to understand and remember. Additionally, designers’ knowledge of design techniques and practice processes can facilitate and inspire the hospital staff throughout the hospital design projects.
II. Designers’ ability to use their senses and minds and to reflect quickly with design materials are some of the key reasons that design solutions can be refined, improved and delivered efficiently. Before the user testing phase, designers have already refined the design numerous times during the prototyping and ideation phases. For instance, in the SCD project, designers created concept alternatives with sketches. Compared to the simple sketches found in the orthopedic outpatient clinic project, the sketches in SCD project visualized how the design would look and function in detail.

III. The visualization ability of designers has been found to have great impact in all the three case studies. In the research stage, designers’ visualization ability helped them to summarize and clarify the complex research insights. By doing so, communication between all team members was dramatically increased. In the ideation phase, by visualizing the conceptual ideas, the design team was able to understand each other more effectively and were more inspired during the project.

IV. Designers’ ability to empathically understand the needs of patient and families helped convey their perspective to the medical team. In addition, designers consider and integrate all needs of stakeholders, which include providers, patients and families, while designing.

How do design thinking practice process and design techniques impact the project?

I. There is an increase of empathic insights especially in the research phase. By conducting the design research phase, applying design techniques (e.g. empathy map and customer journey map), and engaging patients, families, and designers in the project, the medical team started to see the problem from the perspective of patients and families. For example, in the orthopedic outpatient clinic project, the team understood the parents’ frustration of not
knowing the situation while waiting. In the SDM project, the providers started to see the importance of the information that matters most to the families. All these empathic insights helped to reframe the general project goal into more specific problems based on each stakeholder’s needs. For instance, the orthopedic outpatient clinic project started with a general goal to improve patients’ experiences and went deeper into how to simplify the registration process and improve the communication between families, providers, and the healthcare system. A well-defined design opportunity or problem will lead to innovation.

II. Designers stimulated the creativity of the team and pushed people into a collaborative process. Instead of just using their professional knowledge, the medical team started to bring their own experience and emotion into their work. They tried to use both rational and emotional perspectives to think about and generate solutions.

III. The rapid prototyping and testing cycles helped translate ideas into detailed design efficiently. By evaluating the ideas, concepts and prototypes with stakeholders, the team got instant feedback and refined the design quickly in an iterative circle. This also reduced the cost of testing. When the concepts were in the implementation stage, ideas had already been well designed and evaluated.

While hospital staff can master the qualitative research and improve their empathy by practicing design thinking techniques and design process, the role designers play and the impact designers have adds significance to the process. Understanding the unique capabilities of both designers and non-designers in a design thinking project will empower each team member to improve their work and will lead to a successful hospital design project.
Conclusion

The purpose of this thesis is to demonstrate how design thinking has a positive impact on improving patients’ experience and care delivery in the hospital. The study started with reviewing the background articles about why design thinking methodology started to be applied in hospital projects, which included information about the transition from doctor-centric to patient-centered approach in healthcare, the limitation of quality improvement methodology, and the opportunities that came from the new information and communication techniques. After that, I explained and defined design thinking from a designer’s perspective. The case studies were used as the main research method in this thesis. For each case study, I did literature reviews, qualitative interview with the leadership and medical team members, and observations of the whole design project. After describing each case study’s whole design process, design activities, outputs in each phases, and the final design solutions, I analyzed the similarities and differences among them. The main findings from this research are: 1) in general, design thinking methodology has a positive impact on improving patients’ experience and innovates hospital care delivery; 2) the hospital projects that have better integrated design will generate a deeper level of design solutions. The more types of designers that are integrated, the more diverse opportunities will be generated and reviewed. The way design thinking impacts the whole project is by having professional designers bring their specialties design skills and knowledge to organize research and translate concepts into a comprehensive level of final design. Designers’ ability of communicating complex information through visualization can bring people together, keeping them on the “same page” and improving the communication in a team. Designers’ ability to empathically understand all stakeholders’ needs and their system of prototyping are helpful in the hospital context. In conclusion, the whole design thinking practice process and design
techniques have a great impact on increasing the empathic insights and stimulating the creativity
of design teams, as well as refining the testing phase and decreasing the testing cost.

The limitations of this thesis include: 1) a small project sample that comes from the same
hospital (Cincinnati Children’s Hospital); 2) limited interviews with other fellow designers; 3)
research conducted around and by defined design thinking from a designers perspective but not
from the approach of design thinking in the management realm.

According to the main findings of impacts of design thinking, the design thinking
practice process, design techniques, professional designers, and stakeholders are the key
elements leading to a successful design thinking project. The next step will be educating the
hospital staff about the design thinking practice process in a way they can easily understand and
apply to their internal hospital projects. At the same time, there is a need to help hospital staff
achieve an efficient and productive collaboration with professional designers, which is a crucial
issue. Understanding the impact of professional designers on the hospital projects will be a good
starting point for hospital staff to understand the special role of designers.

**Suggestions for hospital staff work on a hospital design project**

First, hospital staff should learn design thinking practice process and techniques by
practicing it in an actual project. The most efficient way will be to combine this design thinking
approach with their specialties. At the same time, they should try to understand the mindset of
patients and families and bring those perspectives to the center of this design project. This will
bring both rational and emotional perspectives to their work.

Second, learn to work with professional designers. This requires an understanding that
different kinds of designers have different abilities and prior experiences. For the project that
clearly defines the problem at the beginning and as well as the type of product it will deliver, a
designer who is capable of designing the final design output is most fitting. For the project that
has a general problem definition, different types of designers should participate in the project.
The communication between designers is also quite important and will determine how many
varieties of design possibilities will be reviewed in the ideation phase. It is also important to use
designers’ visualization skills in the research phase, ideation phase, and concept development
phase. By visualizing all the research insights, ideas, and concepts, the efficiency of team
communication will increase. Designers should participate in each design section and not only
the prototype phase. Designers will translate design in to deeper level through iterative reflective
conversation with the design materials. The understanding of the user and the whole system are
important components in the design materials. Lastly, hospital staff should be aware of
designers’ individual appreciation system approach, their design style, and design experience. By
reviewing designers’ previous work, it is possible to understand if they are a good fit for the
project.
Reference:


Winblad, I., Hamalainen, P., & Reponen, J. (2011). What is found positive in healthcare information and communication technology implementation?-the results of a nationwide survey in finland. Telemedicine and e-Health, 17(2), 118-123. doi:10.1089/tmj.2010.0138


DESIGN THINKING APPLIED TO HOSPITAL CARE


Appendix A

The interview guideline for core leaders in each CCHMC design projects

Questionnaire guideline for project team leader

Friday, September 25, 2015

Name: ____________________________ Age: ____________________________ Gender: ____________________________

• Tell me a little bit about yourself, your work at children’s hospital.
• How much do they understand of design thinking method?
• Tell me about the project you lead. What is the goal set of the project at the beginning and what is the how project process looks like?
• What is the team structure looks like? How many designer involved? Can you describe designer involved in which part in detail?
• What is the final design solution generated from the project? Do you have already test or implement them? What is the result looks like?
• Where do you thinking design thinking methodology have impact on this project?
• What impact do you think designers have brought to the project?

The interview guideline for hospital staff

Questionnaire guideline for hospital staff

Friday, September 25, 2015

Name: ____________________________ Age: ____________________________ Gender: ____________________________

• Tell me a little bit about yourself, your work at children’s hospital.
• How much do they understand of design thinking method:
  • When was the first time you heard about design thinking? How do you feel about it?
  • What is your understanding of design thinking?(apply this question further when they share about the design project experiences)
  • Did you have any design thinking training experience before? When did you take it?
    1. Tell me about this training experience.
    2. What was the hardest part you think during the training?
    3. Was the training helpful to you? How?
• How about the experience when they start to use the design thinking method by themselves:
  • What’s the first project you start applied design thinking by yourself without someone guide you? How about it? Did it go through well?
  • Can you share some of the project timeline with me? I talk about what activities in each step
  • Which part of design thinking method you used a lot? and why?
  • What is the part of design thinking method useful to you but difficult to apply?
  • What is the most difficult part you think of when you start to apply the method your self?
  • Do you have any design thinking method books or any other related resources? When do you usually use them? And How?
### Appendix B

The content analysis of the interview records

<table>
<thead>
<tr>
<th>THEME</th>
<th>QUOTE</th>
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<tbody>
<tr>
<td><strong>1. Have positive feeling of design thinking</strong></td>
<td>#1 I am inspired by how useful design thinking is in bringing teams together. It allows teams to get going quickly.  &lt;br&gt; #2 I thought it was very exciting.  &lt;br&gt; #3 Well, I have a very positive feeling about Design Method the first time I hear about it. I like the visualization part.  &lt;br&gt; #4 It’s an interesting concept, and I was excited to see if we can use it to make an improvement.</td>
</tr>
<tr>
<td><strong>2. Hospital staffs will use their own research methods (QI, qualitative research…) as ground knowledge to understand design thinking methodology</strong></td>
<td>#1 I became interested with the Design thinking method because prototyping really helps us feel quickly and get ideas out, which was hard with the quality improvement methods.  &lt;br&gt; #2 Qualitative interviewing is not the issue. I did that all the time in my research. Synthesis of the data and getting me the scenes. I did that all the time too.  &lt;br&gt; #3 There are overlaps in these approaches: the qualitative research in psychiatry, the mapping out the process in QI, and the PDSA in QI. You do small tests, and if it doesn’t work, you will go to somewhere else. We are tied to data in psychiatry, and we are trying to be creative and trying to think about the way people behave. That’s the overlap.  &lt;br&gt; #4 Before I got involved with Mike, I got some training on qualitative research methods which obviously were leveraged in the design process in terms of understanding the perspective of the user and having empathy and understanding what people are going through. So I had that kind of experience before I started with design. So I kind of have that kind of grounding. How parent and patients are experiencing.  &lt;br&gt; #5 You know some of the qualitative methods are similar. The part of trying to understand what’s needed and where are the challenges are similar.  &lt;br&gt; #6 Every time I get somebody who is new to this process, I find the video tape of the session they did before to at least get some sort of the background. To see whether there is any work that is similar to what they experienced before. Because I think some of the principles in design thinking are already used in some of the quality improvement work we did before.  &lt;br&gt; #7 In QI we really need to understand the user’s need. It emphasizes that in design thinking.</td>
</tr>
</tbody>
</table>
3. Their knowledge of design thinking is pieces. As they learn by doing so.

#1 During the training we did some observations and some interviews. I don’t remember all the terms, but I know it’s about ideation and prototyping. They have different names!

#2 I want to understanding design thinking and understand if there is an opportunity to use it.

#3 By thinking back the design thinking method (the implementation part), it might help with some of the sticky points.

#4 I like the visualization part. They are able to take a lot of data and put them into a visual representation that people can understand easily. Another thing I like is your benchmarking method. I think that’s really helpful.

#5 Beside this, Julie and some of the guys in the hospital also did a Design thinking 101 training project. So I kind of feel I am learning on the job.

#6 The Benchmarking might be hard because we are not sure how to do that. We kind of do it, but not really.

#7 I use a lot of what I call values clarification, but basically you guys do the same thing in your co-creations to test out the concept.

#8 And we primarily learn by doing. Getting exposed to different methods Mike employed.

#9 Once we got paired up with DAAP faculty and students, they helped us think about design challenges we had from here and what method would be good to employ.

#10 Then we started testing with a pool of parents reviewing the prototype and giving us feedback. So we kind of learned by doing.

#11 Or you end up with a distribution model with a bunch of people who aren’t really experts. Like with me, it’s applied in bits and pieces and they start to become experts.

#12 We don’t have to remind ourselves we are using design thinking. Julie will lead us. She is the reminder.
4. Design thinking works more as a mindset

#1 It was a very great innovative approach. To designing and looking at new ways of improvement.
#2 I like some of this innovative thinking. Having the major topic we think of and trying to get out more engagement.
#3 I think a little more explosion to the methodology of the thinking would be helpful.
#4 Like if you are designing a toaster you also look into other products that are similar. That taught me a lot. Now I think broadly about that.
#5 I don’t know if I can be as creative as the concept in the ideation part. I am not sure because I always have someone help me.
#6 Over the year I have encouraged people to explore so that enables them to think in that way.
#7 But this design thinking method looks at the bigger picture, so I think this is the way that we really try to learn and to understand process from an variety of different angles rather than just from data.
#8 This little thing How might we... It’s very easy to get cut off and this is how we always do things and forgot there may be another way to do things. Not for perfect data but we are starting to explore more possibilities.
#9 If you are trying to be open-minded at the beginning of the process, it’s a challenge for those people who were very familiar with the QI process. We spend a lot of time trying to think of ideas and solutions. We have the problem of drowning out ideas.

5. Hospital staffs they don’t use the whole design process. They conducting hybrid research project.

#1 The main team involves is 30 people. A human computer interaction professor involved a method from computer science.
#2 We have everybody from different fields (some have expertise in design thinking and some in human computer) and they discuss the data together. I feel like they merge the method together in order to gather better results.
#3 The ideation portion of it. You know, we brainstorm it and than we kind of work through and work through. Yeah, that’s the part I used, but I don’t think I use the whole cycle.
#4 We use the design thinking method mostly in the ideation phase.
#5 The process we are using now is a hybrid. Putting together design thinking, quality improvement, and human factors psychological theory. We use all these four approaches together kind of.
#6 I think most of our projects have involved multiple stakeholders and the design process one or the other.
#7 Some of the design thinking methods are done superficially depending on how many resources each programs has.
#8 Design thinking fits in very well in other methodology. It expands the fact finding in the very beginning.
### 6. Many of them treat design thinking as an empathy tool to help them get insights and frame the design challenge

| #1 | It helps to get to the patient scene more quickly. In the orthopedic clinic we were looking at the patient wait time and trying to improve their experience. |
| #2 | I’m a very community patient engagement person, so it really brings out that voice into my research. It really added the tone. |
| #3 | We had done a lot of foundation work to understand experience. |
| #4 | I think it helps to ground the whole project, not only how people experience but also how they feel. |
| #5 | As we go further we get better at having the user be part of the team who makes decision along the way and contributes to the actual design of it. |
| #6 | This is something we used a lot. We do a lot to let people talk about their experience, and we do a lot observation in shadowing. |
| #7 | We did three full days of training, pretty intensively. We did half day kick off. One day off to find our site visit and then came back. We spend a lot of time outside. We try to understand design thinking and try to understand the problems we have in orthopedics. |
| #8 | I think the empathy concept is the biggest concept for me because I feel like we all think we understand where they are coming from, but until you really try you best to step into their shoes, I don’t think you understand. |
| #9 | Well, it shows me in particular what we do in the service industry was very focused on empathy and the experience and the perspective of the customer. |
| #10 | It focuses more on the understanding of the customer or the user at the beginning. |
| #11 | We are looking for the experience and the cycle time, the flow in the clinic. A lot of the time I felt building up the empathy was great. |
| #12 | I see the value of gaining empathy perspective, understanding the customer and the users better. |
| #13 | I also got a little bit of understanding of shadowing and interviewing. I think it’s really helped to spend time to try to build up the empathy. |
Appendix C

The survey collects critical data of patients’ and families’ experience before and after the team implemented the design concepts.

The Cincinnati Children’s Hospital Medical Center Division of Orthopaedic Surgery strives to provide the best patient experience. Please help us improve our service by completing the following survey. All responses will be kept anonymous.

<table>
<thead>
<tr>
<th>Day of your appointment?</th>
<th>Time?</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree/ Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Mon</td>
<td>☐ 7-12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Fri</td>
<td>☐ 12-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. I had to wait too long in the waiting room.

What length of wait time would you consider acceptable?

2. I had to wait too long in the examination room.

What length of wait time would you consider acceptable?

3. I had a positive experience in the waiting room.

Comment:

4. I was treated with respect and dignity by everyone I encountered in the Orthopaedic Clinic during my visit.

Comment:

5. I am confident in the clinical care my child is receiving from the Clinic Staff.

Comment:

6. The Clinic Staff kept me well informed throughout my visit.

Comment:

7. I had a positive overall experience during my clinic visit today.

Comment:

8. What could we have done better?

________________________________________________________________________

________________________________________________________________________
Appendix D

User journey map made for the behavior therapy referral process

<table>
<thead>
<tr>
<th>Project name: Decision aid for Behavior therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Process</strong></td>
</tr>
<tr>
<td>1. Problem recognition</td>
</tr>
<tr>
<td>2. Make strong action plans</td>
</tr>
<tr>
<td>3. Direct and involve the patient</td>
</tr>
<tr>
<td>4. See the patient again</td>
</tr>
<tr>
<td>5. Make referrer letter placed with treatment</td>
</tr>
<tr>
<td>6. Follow up</td>
</tr>
<tr>
<td><strong>Doing</strong> (what needs to be done)</td>
</tr>
<tr>
<td>Identify the behavior problem</td>
</tr>
<tr>
<td>Conduct an interview</td>
</tr>
<tr>
<td>Develop an intervention plan</td>
</tr>
<tr>
<td>Communicate the intervention plan</td>
</tr>
<tr>
<td>Implement the intervention plan</td>
</tr>
<tr>
<td>Follow up</td>
</tr>
<tr>
<td><strong>Thoughts</strong> (what are you thinking?)</td>
</tr>
<tr>
<td>In order to name the behavior</td>
</tr>
<tr>
<td>How can I evaluate the behavior?</td>
</tr>
<tr>
<td><strong>Feelings</strong> (how are you feeling?)</td>
</tr>
<tr>
<td>Uncomfortable</td>
</tr>
<tr>
<td>Comfortable</td>
</tr>
<tr>
<td><strong>Barriers</strong> (what are the difficulties?)</td>
</tr>
<tr>
<td>Unsupportive</td>
</tr>
<tr>
<td>Supportive</td>
</tr>
</tbody>
</table>

*Note: The table and diagram are placeholders for actual content.*
Appendix E

The excel table medical team made contents the proposed content of behavior therapy referral informations

<table>
<thead>
<tr>
<th>Patient Population: Preschool-aged Children in Primary Care with Disruptive Behavior</th>
<th>Options Offered</th>
<th>Effectiveness</th>
<th>Key Similarities and Differences That Matter to Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watch and Wait</td>
<td>Primary care</td>
<td>General interventions are more effective. Problems persist in 65% of cases.</td>
<td>N/A</td>
</tr>
<tr>
<td>Parenting Interventions at Home</td>
<td>Primary care</td>
<td>Written procedures for teaching skills (e.g., 3-3 Magic &amp; videos, Online Triple P)</td>
<td>N/A</td>
</tr>
<tr>
<td>Co-located psychology</td>
<td>Primary care</td>
<td>Primary care</td>
<td>Care management in primary care if eligible.</td>
</tr>
<tr>
<td>Parent-child Interaction therapy (PCTI)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parental mental health treatment</td>
<td>Parent's physician or social worker recommends options</td>
<td>Strong evidence of improvement in child behavior.</td>
<td>Community</td>
</tr>
</tbody>
</table>
Appendix F