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

It is entitled:
Applying UX design approach to Cardiac Home Care Education: Design case studies with print and digital Materials

Student’s name: Jiani Zhu

This work and its defense approved by:

Committee chair: Heekyoung Jung, Ph.D.

Committee member: Craig Vogel, M.J.D.
Applying UX design approach to Cardiac Home Care Education:
Design case studies with print and digital materials

A thesis submitted to the Graduate School
of the University of Cincinnati
in partial fulfillment of the requirements for the degree of

Master of Design

in the School of Design
of the College of Design, Architecture, Art and Planning
by
Jiani Zhu
Bachelor of Art, Jiangnan University,
Wuxi, China June 2015

Thesis Committee:
Heekyoung Jung, Ph.D.(Chair)
Craig Vogel, M.I.D.
Abstract

With the development of information and communication technologies, most user experience design projects increasingly focus on digital features of mobile apps and services, rarely leveraging the benefits of print materials. However, printed booklets, with their tangible and familiar material qualities, still have unique values in communicating information to users in intuitive and graspable forms. Either mobile apps or print booklets cannot be a perfect solution by themselves for any user experience problems; and this study investigates the experiential qualities of both components and explores their complimentary integration to coordinate users’ optimal information navigation and communication.

For doing so, this thesis takes the Cardiac Home Care Education System Design Project, which was conducted for 12 months from 2016 to 2017, as a case study to compare and contrast the design processes and outcomes of an app and a booklet developed based on the same instructional content. The thesis discusses about benefits of either components in various aspects of user experience as well as similarities vs. differences in their design considerations. The findings of this study will provide useful design implications and guidelines regarding which material component—between a mobile app and a printed booklet—would be a more appropriate solution for a given information navigation problem and furthermore how both components could be integrated toward a holistic user experience.

Keywords: User Experience Design, Design process, Home Care Education, Digital Application, Print Booklet
Acknowledgment

Through the whole experience of writing thesis is always struggling to me, I would like to express my sincere appreciation to Heekyoung, my committee chair and advisor for helping me to deal with all the problem during the whole process, and elevating my thinking to a higher level. Also, I am thankful to Craig and Gerald, committee member and advisor, who gave me suggestions to my thesis structure, and always support me to build my confidence. Thank to all of you on the committee, for helping me finish the thesis and making me better.

To my design team in Live Well Collaborative, especially is Blake, he gave me lots of support for the case studies, and because of him, I can perfectly finish this thesis.

Finally, I would like to thank my family and Tai hung. They always stand by my side and support me all the time.
Content

Abstract ............................................................................................................................................... ii
Acknowledgements ........................................................................................................................iii
1. Problem statement .................................................................................................................. 1
2. History ......................................................................................................................................... 1
   2.1 History of Cardiac Home Care Education ......................................................................... 1
   2.2 What’s the opportunity for CHD ...................................................................................... 2
   2.3 What’s the content for CHD .............................................................................................. 6
3. Method ......................................................................................................................................... 7
   3.1 Study design method ........................................................................................................ 7
   3.2 User experience design for Cardiac Home Care Education ........................................ 8
      3.2.1 Why user experience design matters ..................................................................... 8
      3.2.2 The elements of user experience design ............................................................... 9
4. Argument .................................................................................................................................... 10
   4.1 The design of print booklet ............................................................................................. 10
      4.1.1 Overview of design process .................................................................................. 11
      4.1.2 Design outcome .................................................................................................... 23
   4.2 The design of digital application ..................................................................................... 28
      4.2.1 Overview of design process .................................................................................. 28
      4.2.2 Design outcome .................................................................................................... 40
5. Finding ........................................................................................................................................ 41
   5.1 The comparison elements of two design cases ............................................................... 41
      5.1.1 Ideation .................................................................................................................. 42
      5.1.2 Co-creation ideation ............................................................................................ 43
      5.1.3 Refining ideation .................................................................................................. 45
      5.1.4 Co-creation testing ............................................................................................... 46
6. Conclusion .................................................................................................................................. 48
7. Bibliography .............................................................................................................................. 50
1. Problem statement

The purpose of this study is to apply user experience design to develop multiple effectiveness educational tools used to enhance parental Congenital Heart Disease (CHD) Education. This study also aims to analysis the findings of comparing design process and elements for printed materials and digital materials, and ultimately provide insights and guidance for future designers and medical professionals.

2. History

2.1 History of Cardiac Home Care Education

The definition of Congenital Heart Defect (CHD) in WebMD says that Congenital Heart Defect (CHD) is another way of saying your heart had a problem when you were born. There are many types of congenital heart defects, ranging from those that pose relatively small threat to the health of the child to those that require immediate surgery. So this is a complex life-long illness. Dr.Sandy (2000) said: “Children with CHD may have significant co-existing conditions that further complicate their care and require special consideration” (P. 1).

“More children die from Congenital Heart Disease (CHD) each year than are diagnosed with cancer. Although CHD is the most common human birth defect, the etiology of the vast majority of CHDs remains unknown” (Srivastava, 2000, P. 1). So it’s very dangerous for parents who have child with CHD, which means they should pay more time and more attention to take care of their child, because any strange action if they don’t know, their child will face to the risk of die.
2.2 What’s the opportunity for CHD

After understanding how dangerous about this disease, so the children’s parents is most important role is to save their child’s life by learning medical knowledge, better communication is based on the same information platform, but parents can’t like doctors to learn very professional knowledge, so when they received information from the doctors, which should be translate much easier and more efficiency for parents to understand.

But from doctors perspective, the problem is parents may have difficulty to understand the condition, the treatment and how to manage their child’s ongoing health care needs at home. This is due to multiple factors such as time, education and delivery. The consequences of parents being ill prepared for discharge from the hospital and the ongoing life-long home care requirements of children with CHD are significant. They include failure to thrive and growth retardation, inappropriate avoidance or participation in activities, development of vulnerable child syndrome, medication errors, hospital readmission, and potentially death. Therefore, early and repeated education is important to prepare parents for managing their child's health at home.

So from both perspectives, what design team learned is the inefficient education between parents and doctors. But inefficient education is the most biggest problem from this project, it's not the main opportunity for designers. So the first step for designer to find opportunity is to understand the problem, which is the same as Jesse James Gareett mentioned in his book named The Elements Of User Experience, he said, “The first step of User Experience Design is to find user needs and product
objects” (Gareett, 2011, P. 36). So for the next chapter I will explain more clearly about the definition of User Experience Design, and how User Experience Design will relate to my thesis.

Therefore, based on the first step, we’re going to understand our user and the objects, then we planned to do the benchmarking, interview our stakeholders and map out the experience. So for the benchmarking, we did the online research for existing education systems with the goal of identifying effective elements and trends from three aspects: face to face, paper and web. Cincinnati Children’s hospital also gave us lots of help, they have shown us what is meaningful education communication between the patients and hospital. At the same time, They also shown team the program they were used for home care education named The Parent Education Discharge Instruction (PEDI) program which teaches nurses how to efficiently impact post-discharge home care information to parents in order to improve post-cardiac surgery outcomes for children in resource-constrained environments. These information all comes from nurse scientist named Sandy Staveski.

So for the benchmarking, we have concluded four insights on the below, this helps us to understand more clearly:

1. Right information at the right time.

Education exists for different reasons and this affects the medium. A hands-on demonstration is effective for learning a skill while a website is useful for learning factual information.
2. Information should be concise and easy to find.
Because websites hold a vast amount of information, it should be easy to navigate. People do not want to spend a long time searching for information.

3. Medium and timing are related.
Hands-on demonstrations and face-to-face education are important but difficult to replicate. Supplemental resources should be paired with demonstrations to provide this information in a secondary method.

4. General and specific information should be balanced.
Many websites have an option to “learn more” about the referenced content. This provides the opportunity to give more in-depth information for those who need it without overwhelming those who do not.

For the interviews, we conducted interviews with a variety of clinicians and families to better understand the current state of communication and education, as well as identify the ideal situation for both stakeholders. During the interviews, we talked to 12 clinicians and 10 family members. We have three steps to interview them: general questions, treatment process and cards sorting.

1. General questions
For general questions, we utilized the interview questions provided by the Heart Institute team and added in an interactive component. The aim is to understand what tools they are using right now and what the directly problem they have.
2. Treatment process

And treatment process, in order for us to better understand the treatment process, focus group participants were asked to map out the process from their perspective. The clinicians included more general touch points while the families filled in detailed accounts of their child’s treatment. So we can better understand what's the pain points for the whole experience. For the cards sorting, participants were asked to organize information on cards and work collectively to develop their ideal education system. So this can help us to get quantity and quality data for the future direction.

3. Cards sorting

For analyzing the card sorting, comparing the results, the commonalities showed which educational tools are ideal for clinicians and parents alike. So the design found three overlapping preferred educational tools between the clinicians and the families. These tools became the foundation for the direction of the intervention.

After interviews, we synthesizing the research collected to come up journey map and analyzing the card data. Based on the treatment process to created stories of two different families going through the CCHMC's Heat Institute. The scenarios are based on the two different families treatment process mapping that the clinicians and families completed during their interviews, which is to help us to understand and explain more clear about the problem and to find the opportunities based on this analyze. The first scenario represents a family whose child received a prenatal diagnosis and will need surgery a few months after birth. The second one represents a single mother
whose child’s needs are diagnosed prenatally and requires surgery immediately after birth.

We comparing the two scenario and common points showed the most important areas to address: Overwhelmed by the amount of information received at a time, people frustrated when plans change, surprise and frustration when families do not know what to expect, parents don’t know who to call, uncertain of different clinician’s role, and disconnect between CICU and A6 Central.

From the research gathered, the team found the opportunity is design a system involving a printed quick reference guide and a mobile website that promotes a platform for open educational communication between parents and clinicians.

2.3 What’s the content for CHD?

All the education content are from Cincinnati Children’s hospital, Dr. Sandy has shown the design team bunch of the education prints, which is too much professional information and too hard for diversity of parents to read. Therefore, based on this exist education content, design team have plan to interview the same parents and clinicians to better understand and to choose the content for them. The team introduced the activity by asking focus group participants to prioritize information commonly received at the hospital. The participants worked collectively in groups of 2-3 to organize the information into categories. The three ways information was categorized are:

1. Chronologically

Information is organized based only on when it is needed by looking at the process as
2. InPatient vs. OutPatient

Content was divided into two sections before being prioritized. There were few overlaps between the two sections.

3. Chronologically with baseline information

Informations organized chronologically with key components prioritized for different reasons at each point. For example, relevant services should be constantly given and prioritized to families at each stage of the treatment process, but general information should be given throughout each stage.

The insights from testing that help the team to develop the final organization of content. The content information is divided into three sections: General Information - Diagnosis and Resources, Your Child's Surgery, and Caring for Your Child At Home. So in the future design, the design team will based on this content but different way to organize into the printed quick reference guide and a mobile website.

3. Method

3.1 Study design method

This case study is going to design a system involving a printed quick reference guide and a mobile website that promotes a platform for opening educational communication between parents and clinicians based on the same content of Cardiac home care education project. In the further case studies, this thesis will use user experience(UX) design apply for the two different design case, to analyze how user experience design affect the design process and design result, the interesting thing is all the UX design
was discuss the digital interaction a lot, and less discussion for the traditional media, so this study will gave the insights for how user experience rebuild two different cases and came up a guidance for the future if UX designer has met the same problem, how can they deal with that and have some innovation ideal to support their project.

3.2 User experience design applies for Cardiac Home Care Education

For this section, the study will focus on why and how user experience design apply to the Cardiac home care education, and talk about what’s the key elements affect two different case studies and that will discuss more on the argument.

3.2.1 Why user experience design matters

Jesse James Garett (2011) said, “User experience design often deals with questions of context. Any user experience effort aims to improve efficiency” (P. 19). This basically comes in two key forms: helping people work faster and helping them make fewer mistakes. Improving the efficiency of the tools you use improves the productivity of the business as a whole. And He thinks the biggest reason user experience should matter to designer is that it matters to users. If you don’t provide them with a positive experience, they won’t use your product. So user experience design is based on understanding user, that is good for analyzing the needs between parents and clinicians on the Cardiac home care education.

The user experience design process is going to take into account every possibility of every action the user is likely to take and understanding the user’s expectations at every step of the way through that process. So based on the design process, project can be easy managed to peel away the layers of the experience and start to focus on
the decision making. So based on this methods and design process, it can be much more easier to design and manage to make decisions in the future.

3.2.2 The elements of user experience design

Jesse James Garett (2011) has explained, “How user experience design elements and process can lead designer to do the successful design project in his book named the Elements Of User Experience. There are five elements about the UX design process: strategy, scope, structure, skeleton and surface” (P. 38). The strategy is about understanding user needs and product objectives, the scope helps designer understand the functional specifications and content requirements, and this two planes talk about research part to help designer to understand the project requires and user needs, so this study have already explained how this helps team to find the opportunities and the content for the Cardiac home care education project previously. Because of different healthcare projects, the content and users are definitely different. Meanwhile, this study will not talk about the five plane -- surface plane, because this plane on Jesse’s book is discussing the sensory design which is about five sense (vision, hearing, touch, smell and taste), so this employ depends on the type of product, it's not related to this study. So for this thesis, will explain how the structure and skeleton planes to help and affect cardiac home care education design project from a designer perspective.

On the functionality side, the structure plane is about interaction design and information architecture, this the most important for the design process. He said, "Interaction design and information architecture share an emphasis on defining patterns and sequences in which options will be presented to users. Interaction design
concerns the options involved in performing and completing tasks. Information architecture deals with the options involved in conveying information to a user. They’re about understanding people—the way they behave and think. By building this understanding into the structure of our product, we help ensure a successful experience for those who use it” (Garrett, J. J. 2011, P. 62).

On the information side, the skeleton plane is about interface, navigation and information design. He said, “On the structure plane, we looked at the large-scale issues of architecture and interaction; on the skeleton plane, our concerns exist almost exclusively at the smaller scale of individual components and their relationships. On the functionality side, we define the skeleton through interface design —the familiar realm of buttons, fields, and other interface components. But information products have a unique set of problems all their own. Navigation design is the specialized form of interface design tailored to presenting information spaces. Finally, crossing both sides, we have information design, the presentation of information for effective communication” (Garrett, J. J. 2011, P. 80). So the two design cases will be compared in terms of their processes, interaction design, information architecture, interface design and navigation design.

4. Argument

4.1 The design of print booklet

This study will present the overview of the design process and design outcome for the print booklet. For the design process, it will talk about the process start from ideation to the refinement, and explain what is final design result.
4.1.1 Overview of design process

After design team have conclusion of design opportunities, the next step is about ideation and refinement to better understand user experience.

1. Ideation prototyping

At the end of the research phase, the design team selected four different print materials to create and test. The selections were based on clinician and family feedback, benchmarking, and the stakeholders’ ideal educational system. Four printed tools were developed into prototypes to be tested based on size, binding style, organizational structure, text formatting, color, and use of images and icons. The Figure.1 shows four prototypes are binder, pamphlet, flip book and pocket guide on the below.

Figure.1 Print booklet: four ideations for different prototypes
2. Co-creation prototyping

The design team conducted one interaction session with clinicians and another with parents. The majority of the time was focused on the discussion around prototypes — what elements were working, what elements did not work, and how the content should be represented. Clinical staff and parents participated in qualitative co-creation sessions to provide feedback for the four prototypes created by the design team. These sessions provided the foundation for future refinement of the prototypes. So the team talked to 9 clinical staff and 6 parents, what tested is size, binding style, organizational structure, paragraph styles, colors, images and icons.

3. Questionnaire

To accompany the qualitative co-creation session, the LWC team created an eight question survey designed to collect quick data on participants’ preferences. The questions related to three main categories:

• Structure

The design team has plan to do the research for structure, which is going to test the size, binding style and navigation for all the ideation prototyping to understand all the clinicians and families perspective, the Figure.2 and the Figure.3 all have organized all the data analysis.

From clinician’s perspective:

Clinician staff prefer pocket guide style a lot, most of them likes the pocket guide size because it is pretty portable for user, and hand much easier out to others. The organization structure is more user friendly and more organizable which is very
convenience to keep. And for the sections divided, they all prefer mix color coding and tabs which is more friendly for user to read and to get used to remember the key information.

![Pie chart showing preferences for binding style, size, and organizational structure.](image)

**Figure 2 Print booklet: data analysis for clinicians**

From parent’s perspective:

Because most of families received printed information from clinicians, they got information mostly like letter size paper and binder. So they are more familiar with binder, that's why they like binding style a lot. But most of them prefer pocket guide size, and organizational structure they prefer flip book. Which shows the team, actually family just know what they don’t want and dislike part but they don’t known what they want in the future, so what’s the design team’s job, that is offer a better user experience for families. And for the sections divided part, they also prefer tabs and color coding in the future.
Figure.3 Print booklet: data analysis for parents

So the chart has shown the result from both perspective from clinicians and families, the design team analyzed the questionnaire data in comparison to the qualitative co-creation sessions. The Figure.4 shows all the datas combined from all the stakeholder’s perspective.

Figure.4 Print booklet: data analysis for all stakeholder
• Binder analysis

So this project includes clinician and 4 families support this ideation. For the clinician perspective, the pros is easy to insert and to remove the pages, but the cons is binder is too bulky, too much information inside and not used by families. And for the families perspective, the pros is binder is necessity to create out, which is easy to insert and remove pages, it's the correct size for standard size to print out and it contains very detailed information. But the cons is binder is very bulky for user.

• Pamphlet analysis:

The pamphlet just 1 clinician and 1 family support. For the clinicians perspective, they think it’s very easy to lose and not enough information inside. For the families, they think that good for generic information especially to use at home, but not enough information for them to use.

• Flip books analysis:

The flip books has 3 clinicians and 0 families to support. From clinicians perspective, what they like is good size for tucking in a diaper bag and easier to add and remove pages than the pocket guide. What they dislike is not as sturdy with only one ring and difficult to navigate because the pages are so loose. For the families, they also like the size, but they think it’s too difficult to add or remove pages, and not enough information can be included.

• Pocket guide analysis:

The pocket guide has 6 clinicians and 1 family support. From clinician perspective, they like the size and the way to add and remove pages, but it contains more
detailed information than the others without being bulky like a binder. For the families, they feel more sturdy than flip book and the size is very user friendly. But they don’t like wrong size for standard size prints.

4. Information presentation

Different text formatting were compared to see how clinical staff and families preferred to receive content. So the Figure.5 shows the ideation analyzing for the bullets, paragraphs and icons to test and analyzing their feedback.

![Figure 5: Print booklet: data analysis for all stakeholder](image)

- **Bullets:**
  
  From clinician’s perspective, they think this is very simplified and straightforward for families, which is the same feedback as families, they think this is very efficient for them to use.

- **Paragraphs:**
  
  From clinician’s perspective, paragraphs seems too “heavy” for people to read and they do not read it all. And family members think paragraphs are very overwhelming but it provide necessary details when content is more complex.
• Icons:

From clinician's perspective, they think it's very clearly to introduce topics. And families loves it a lot, they think icons are very straightforward, and makes informations more easier to read.

5. Design preference

Illustrations and images were compared to see how clinical staff and families preferred to receive visual information. So the Figure. 6 shows the test results of few real images and illustrations, and the design team has analyzed their feedback.

<table>
<thead>
<tr>
<th>Which do you prefer — real images or illustrations?*</th>
</tr>
</thead>
</table>
| ![Chart showing preferences between illustrations and real images](chart)

Figure.6 Print booklet: data analysis for graphic design

• Illustrations/Icons:

From clinician’s feedback, they think it’s very simplified and less confusing, which is easier to understand, and sometimes look nicer than the real images. But for the families, icons and illustrations are more generic, simple, less “scary” and confusing for them, sometimes whimsical images do not apply but it transfer to a “fun” icons will be better.

• Real images:

From clinician’s feedback, too much information can be distracting and difficult to
find the perfect one. It's more personable and helpful to orient families. And for families, real images can convey caring and comforting.

6. Icon & Image testing

**Figure 7 Print booklet: icon testing**

Icons and images were developed and tested to begin to evaluate efficacy and understanding of major themes/topics within the prototypes. The Figure. 7 shows icons and images were first tested with clinical staff, revised based on staff suggestions, and then tested with parents.

**Figure 8 Print booklet: image testing**

Initial testing with clinicians and families

Modified after testing

Refined final image approved by clinicians and families
The Figure.8 is how the design team develop the icons and illustrations after several tests, pictograms also went through numerous iterations. These modifications were based on real images as well as feedback from clinicians and families. Below is a sample of the process.

The team focused on refining the icons and illustrations after receiving positive feedback from clinicians and parents. The next step will be deciding which topics need real images. Below are some qualities that will be used to select images: orientation (hospital specific), convey caring, personal, impactful and comfort.

So before going to do the refinement, the team identified three major characteristics that the educational tool must fulfill based on the qualitative responses and the questionnaires from the clinical staff and families. These characteristics are: sustainability, usage and visual language.

- **Sustainability**

  The tool needs to be continually updated and personalized for different patients. The ability to add/remove pages is critical. Custom tabs and printing costs need to be considered as well.

- **Usage**

  The new tool needs to be sturdy so that it does not get ruined going back and forth from the hospital.

- **Visual language**

  Clinicians and families are both looking for simple elements that convey care and comfort. Visuals should make the tool easier to understand and navigate.
7. Refined prototypes

For the refinement, after the first round data analyzation, the design team consider the sustainability, usage ability and innovation to target the final direction is design the pocket guide as a quick reference and keep the binder ideal to stay in the archive system, which means the pocket guide is going to be further developed. To finalizing the design, the final focus group contained three main elements: choosing the design language, finalizing the content, and discussing challenges of implementation.

After the ideation, the design team reached out to parents to receive their feedback on the new direction. The information was incorporated into the final design and implementation strategy.

• Most important elements

The design team asked what content elements would be essential for them in a "survival guide." All of the parents mentioned needing a place to keep the most current information including test results, medication, and diagnosis information.

• Meeting an unmet need

Each parent had their own system for maintaining current information and passing it on to other important people such as babysitters, grandparents, and schools. This included creating word documents, making copies of handouts, and making individual folders for different things.

• Need for archive system

Every parent kept their child’s files in some way, most in a binder. This archive system contained all of their child’s medical records, was available for reference as
needed, and was used to identify patterns in their child’s behavior.

The design team also toured RPI Graphics, a print and marketing company on Cincinnati’s West Side, to see samples of different print materials. The trip allowed the LWC team to see more innovative prints, understand the printing process, and see paper samples and binding styles. So the Figure 9 shows three different ideal on the below for the next round usability testing: storytelling influence, clinical influence and contemporary influence.

![Image: Print booklet: ideation for refinement testing](image)

*Figure.9 Print booklet: ideation for refinement testing*

8. Co-creation testing

For the parent group, the last interaction focused on determining the final design language for the guide and finalizing the content. The clinician focus group discussed the implementation strategy and the importance of creating a system to hold clinicians responsible while not adding to their workload.

So this term is the second round testing, so the design team has shown user three different styles of pocket guide and the content of the book, to let parents and clinicians talk about their feelings and what they want to change or implement in the future design. The Figure.10 shows how the design team co-create the ideal
with stakeholders.

Figure.10 Print booklet: co-creating testing

All the stakeholders are very excited to join the second part of refinement because they feel their opinions and suggestions are very valuable for the design team. So after this co-creation section, the three key takeaways we consider is: implementation, design and content.

- Implementation

For the implementation, the design team should clearly define who is responsible for each section. Utilize after visit summaries (AVS) to eliminate duplication. The final thing is the guide should be given at diagnosis.

- Design

For the design, pockets were liked by both parents and clinicians. The binding needs to be expandable to fit additional handouts. And for the further design, clean and empathy is more temporary.
• Content

What we consider about content, is there any new tool replace the current handout, and if it fit or it can adapt for the different child’s ages.

4.1.2 Design outcome

About the final direction, while the clinicians drove implementation, parents focused on the design. The design team refined elements of the design to create the final version of the care guide. So the final design outcome, the team has considered the traditional elements for the prints and also added innovation elements to enhance user experience, this elements are content, typography, pocket, icons & illustrations, labels and pathway.

● Content

![Figure.11 Print booklet: booklet content](image)

The insights from testing helped to develop the final organization of content. The information is divided into three sections: General Information - Diagnosis and
Resources, Your Child’s Surgery, and Caring for Your Child At Home. And the Figure. 11 shows the layout for the booklet is follow the order to let user follow much easier.

● Typography

So for the typography, after did several testings, the team has narrow down the three color code and style to help user to follow. The Figure. 12 shows the icons and the title all set in front of the left top corner for quick access. If the page needs emergency calling information or any necessary call out information, and this information also will be highlight in red color.

![Print booklet: typography design](image)

Figure. 12 Print booklet: typography design

● Pockets

The pockets all set on the essential position if it need to keep the other related prints information. And the Figure. 13 shows the color code also help user to locate the key pockets if they need.
• Icons & Illustrations

All the iconography has been tested and refined for user understanding and they all help to define each section at a glance. And the Figure. 14 shows the illustrations all have tested as well, and they have depicting the key elements for user to read.
Labels

The labels all set on the left bottom corner, and the Figure 15 presents the content information which printed on labels to allow for multi-site use, which is very easy implement for clinicians and families.

![Labels](image)

Figure 15 Print booklet: labels

Pathways

The old version of pathway is very medical professional style, which is very difficult for families to follow. The final pathway has gone through three round of test, the newest one is going to offer a comfortable visual expectation for user to follow the milestone to understand their child pathway, and clinicians can write down some key information of the blank square to help different situations.
Implementation strategy

For the final implementation strategy, the design team aims to eliminate redundancies and incorporate the care guide into the current clinical system. Clinicians and parents stressed that the success of the care guide is dependent on implementation. The strategy incorporates these three main elements while aiming to eliminate redundancies.

A. Comfort

Parents are provided with a consistent resource that contains all of their child’s information. Each piece of information is contained and organized.

B. Maintenance

The care guide incorporates existing elements to help streamline the process. For example, the after visit summary includes information about medication, upcoming
appointments, and next steps. Utilizing the AVS eliminates the need for additional handouts.

C. Education

The guide is used throughout to augment the current education process. The guide becomes a familiar resource that parents can expect to use with clinicians.

4.2 The design of digital application

This study will present the overview of the design process and design outcome for the digital application. For the design process, it will talk about the process start from ideation to the refinement, and explain what is the final design result.

4.2.1 Overview of design process

After design team have conclusion of design opportunities, the next step is about ideation and refinement to better understand user experience. Creation and testing of the mobile-based website mostly around the structure and architecture of the information. The team also tested several visual designs, including colors and layout. And the icons and illustrations has been tested during the print booklet testing, so based on the same content will be follow to use in the application. These all tests were to ensure that the final design would be usable and friendly.

1. Ideation prototyping

So before prototyping test, the design team going to come up ideation for prototyping before to do the interaction with clinicians and families. So based on
the same content, to design the first version of information architecture, navigation interaction and 4 different visual appeals.

- **Information architecture**

So based on the iphone screen, the design team considered the same content as booklet to design the four categories to build the information for user to follow, they are My Child, At Hospital, Home Care and Settings.

![Figure 17 Digital application: information architecture](image)

- **Navigation**

For the navigation, the design team design the several gray scale wireframes based on the information architecture to let user use, that usability tests is testing the information architecture and work flows to see how to change it better to fit user's understanding about the whole structure and experience. Basic black and white visuals were created for proper hierarchy, then color was added so it resembled what the final design could look like. The navigation part, the team need
to consider the elements like ease of learning, memorability and the efficiency of use for the better experience to user.

Figure.18 Digital application: navigation

- Visual appeals

Jesse was mentioned “Interface designs can employ a variety of tricks to ease users along the way to their goals.” So the design team prepare 5 different styles of gray scale layout to test, to see which variety is more easy to follow. The first is combine tab categories and top navigation which imaging user are used to follow from the top. The second one is based on the top navigation and with the listed categories, which to show the category more clear. The third one is listed the categories as well, but change the navigation to the bottom, that follow the most user behavior to use other apps. The fourth one is using icon to help categories and with the bottom navigation, this is wondering how different between the keywords and icons. The last is with the side navigation and listed categories, which all follow the sequence from left to the right.
2. Co-creation prototyping

So the team talked to 10 clinical staff and 5 parents, the design team conducted two interaction sessions with clinicians and parents. Clinical staff and parents participated in qualitative co-creation sessions to provide feedback for the four prototyping tasks created by the design team. The second session is focused on the discussion around navigation style — what elements were working, what elements did not work, and how the content should be represented. These sessions provided the foundation for future refinement of the prototypes.

- The four tasks

So the first interaction offers user 4 different tasks has been designed based on the invision to test the usability of work flow and the information architecture. And it has been analyzed like the diagram on the below, which helps team to see how the difficulty of the user’s experience. Then, the design team can based on the quality and quantity analyzation to know what user's feeling about the design, that can also help adjust the design components in the future.
Navigation styles

The second interaction is discussing which style of interface is better and which layout of information organization is more prefer. There is the conclusion for the 5 styles of navigation styles to extend more on the below, some components have effect future design a lot.
A. For the first one, the tabs were too small, which are hard to navigate. But user liked seeing all categories at a glance.

B. User felt having icons on the top is much easier to access, and the list categories are very clear.

C. This one is the most familiar and comfortable for users, and they prefer icons at the bottom with other navigation.

D. They like icons which is good for low literacy. And they think it looks like phone home screen.

E. The last one’s side navigation bar is too easy to accidentally hit, but they feel the color pops are fun and provide contrast.

3. Questionnaire

To accompany the qualitative co-creation session, the design team created an eight question survey designed to collect quick data on participants’ preferences. The questions related to two main categories: features and functions. The team compiled a list of different functions that the app could provide for the family. These functions were based on both personalizing information and accessing information in the quickest way possible. So after discussed functions and features, the team concluded all the opinions from clinicians and families, this will help the team moving forward to better understand what kinds of functions are most beneficial and what kinds of functions are unnecessary.

The team will begin implementing ideas for the most commonly liked features: Call clinicians, Educational tools, Make an appointment, View child’s current
Developing the features will include designing how the user interacts with the function and where it will be found in the app architecture. Some of these functions will be tested in the next round of interviews.

4. Information architecture

After co-creation prototyping session, the organization of content was modified based on feedback from session participants. The team also modified the final architecture based on cost and functionality constraints. Based on the first version, the team changed few keywords and functions for the information architecture, try to reduce the steps of workflow to help user go through the whole interactions. So the information categories changed to 4 sessions: My child, At hospital, Home Care and Options.

Considering the size of the screen, the design team try to keep the title to be short
and have enough space to set a bottom for user to touch. The extra category is options, this is for the extra functions to manage this app, like link to MyChart which is another app for their kids, and notes & questions which helps parents to communicate clinicians immediately.

![Home Screen Diagram]

**Figure 23** Digital application: information architecture refined

5. Interface design

After refined information architecture, the design team will focus on developing ideas and prototypes resembling options B, C, and D of the first version, while keeping in mind both negative and positive feedback from A and E. These new designs and prototypes will be implemented in the next round of interviews. So the team concludes the suggestions to design 5 new versions of the interface, this will help the team moving forward to better understand what kinds of functions are most beneficial and what kinds of functions are unnecessary. And this five different layout also can help team moving forward to design the navigation, because
different feature will affect user experience to the different direction.

Figure 24  Digital application: interface design

6. Navigation design

After the information architecture and interface design, the design team consider the second round refinement, so based on the different interface style and layout, then came up five new different navigation, to see which wireframe structure is more making sense for users. So during this design session, the wireframes design considered information design and navigation design work together which helping people understand where they are and where they can go, so the home page, subtitle page and key information page is a cohesive sequence to affect user experience, so different task can help team to better understand user experience in the future.
7. Refine prototyping

For the refinement (Figure.26), after analyzing the first round test result and preparing the second round’s tasks, the design team consider the sustainability, usage ability and innovation to target the final direction is design combination of the C and B style. To finalizing the design, the final focus group contained three main elements: choosing the design language, finalizing the interface style and navigation, and discussing challenges of implementation.

After the ideation, the design team reached out to parents to receive their feedback on the new direction. The information was incorporated into the final design and implementation strategy.

- Most important elements

The design team asked what content elements would be essential for them in a “survival App.” All of the parents mentioned needing the quick bottom to help them finding the quick information, but clinicians said this is not possible to respond to parents as soon as possible, so them will cut extra function in the end to keep the
experience better.

- Meeting an unmet need

After all the test, the most important elements of the application is the homepage
design, the team didn’t consider the homepage, but actually homepage is the first
time to meet the application, so they should know what’s is this application at the
beginning before they try to learn how to use it.

- Need for archive system

This archive system is not just all the content for this app, it also can link to another
app named My chart, so this app is designed based on the user experience, and
related to other information as they needed. The design team also work with
technology team, to see how to develop this app in the future. The technology
team gave team some very good suggestions for the next step co-creation. So
based on the second rounds task testing, the prototyping have been tested more
details for the next step. The design team came up three different ideal on the
below for the next round usability testing.

![Digital application: refined prototypes](image)

*Figure.26  Digital application: refined prototypes*
8. Co-creation testing

During the last sessions, the design team tested and refined the information architecture, interface style, and navigation design. Through discussions with the study team and the CCHMC coders, necessary modifications were made to the app due to financial constraints. The booklet, app, and pathways were refined and finalized (Figure 27).

For the parent group, the last interaction focused on determining the final design for the application and finalizing the interface and navigation. The clinician focus group discussed the implementation strategy and the importance of creating a system to hold clinicians responsible while not adding to their workload.

So this term is the third round testing, so the design team has shown user three different styles of application and tasks, to let parents and clinicians talk about their feeling and what they want to change or implement in the future design. All the stakeholder are very excited to join the third part of refinement because they feel their opinions and suggestions are very valuable for the design team. So after this co-creation section, the three key takeaways we consider is: implementation, design and options.

- Implementation

For the implementation, the design team should clearly define who is responsible for each section. Utilize after visit summaries, (AVS) to eliminate duplication. The final thing is the application should be download for everyone.

- Design

For the design, applications were liked by both parents and clinicians. The app
needs to be considered to fit additional situations. And for the further design, clean and empathy is more temporary.

- Options

What we consider about options, is there any new tool replace the current functions, and is it easy for people to use in the future.

![Figure 27 Digital application: co-creating tasks](image)

### 4.2.2 Design outcome

About the final direction, while the clinicians drove implementation, parents focused on the design. The design team refined elements of the design to create the final version of the application, icons and pictograms has been tested during the prints session, so based on that, all the staff has been transfer to the applications.

So the final design outcome, the team has considered the all the quality and quantity test results, this elements are has been integrated into the high quality wireframe to
offer a better user experience. So the team came up all the interface and gave all of them to the technology team to develop to the next step.

![Digital application: final delivery](image)

Figure.28  Digital application: final delivery

## 5. Finding

### 5.1 The comparison of two design processes

After discussing the design process of printed quick reference guide and a mobile website, this session is going to have some insights from the comparison of two design process, to see what is the key element to determine the final design direction and what's the same and difference between the traditional and digital media design. Because there are so many different projects, and the research part will be totally different, so this study just compare the ideation and refinement to give some insights about design perspective for the future design in the health care education field.

So both design process has been separated to 8 steps, from ideation prototyping until co-creation testing will be compared by 4 sections. The first one is preparing for the
ideation after research and product definition, the second section is testing ideals and co-creating with users together, the third one is about preparing refinement, after the first two steps, what the design team is to narrow down the final direction. The Last one is refinement before the final design, the design team consider how to deal with the final direction to approach the final design.

Figure 29  Design process: app and book

5.1.1 Ideation

This section is after research and design definition, the design team starts to prepare ideation focus on the print booklet & application. This period has during almost one week.

- Ideation prototyping

The most important thing for this section is to build the general picture for the future plan, the same thing for the prints and application is to consider benchmarking, clinician’s and family’s feedback and their ideal education system to help team build the first impression for user.
So the first impression is very important for designer to think about how to show it to the user. For the print booklet, the first impression is the size, binding style and cover page, all the following design is based on that. Therefore, for the application is another story, the essential thing for the user is the homepage, which is similar as cover page, but most different thing is not just about digital based interface, which is the fixed-size for application. So based on the size, the most significant thing for the app is the information architecture, navigation and visual appeals.

For the same content, what difference between the ideation prototyping for the design team is sensory design which is related to the first impression. So for the prints, the design team came up 4 different size, binding style, organization structure, color and etc. But for the application design, the sensory design is part of that, because usability is main things for the app design. So the visual styles of the home page is to let user feel which style is their favorites and feeling comfortable, and the grayscale wireframe navigation is to help designer to test information architecture flows, so the different visual styles and grayscale navigation tasks should be prepared for this session.

5.1.2 Ideation co-creation

After preparing ideation prototyping, the co-creation section is to help designer to prove their thoughts and to improve the ideation to find the final direction. So the co-creation prototyping testing and questionnaire provide designer quality and quantity result to analyze the data to better understand and improve user experience. This session has tested during 2 weeks.
Co-creation prototyping

After preparing the prototyping, the most important difference between the booklet and application is the information structure. For the prints, because of the fixed content limitation, so the styling and extra function is more important than the flow to gain user's interests. So during the co-creation, just let user feel more and talk more details about the design to understand what elements they like or dislike. But for the application, the styling just for the navigation style which like the booklet's layout, but because of the fixed size, so how to know the workflow making sense is relaying the usability test. Jesse was said “Every approach to usability seeks to make products easier to use. ” So the co-creation for application is after few tasks let user talk about their feeling and suggestion for the wireframes and workflows which can help designer better understand what user want.

Questionnaire

The questionnaire is another tool to analyzing quality and quantity data from user. For 4 different prototypes of the booklet, questionnaire will be more focus on narrow down the preference and indescribable elements like binding style, size, organizational structure and sections divided. All the perspective from user can be shown by the chart to help user understand more clear.

But for the application, the questionnaire has the same function as the booklet to analyze the navigation style, but it can also provide some new elements like functions and features. The design team can use the questionnaire to test which function and feature they prefer from clinicians and families sides, and find what's the same
functions they want from the both side, this part is more important for the application
design to help team to make decision.

5.1.3 Refining ideation

Refinement can be done for few rounds, so this study has done for almost 3 weeks.

After analyzing the first impression to know the general overview for the ideation, this
section is re-design and solve the problem which was be considered before.

- Information presentation / Information architecture

For the first thing for this section is about most important thing for both design, which is
about information. For the prints, the information is about which way and what style of
text formatting should be presented in the booklet, so how section should be divided,
how to present the paragraphs and how to clearly to introduce the topics, all of this
should be considered and tested about information to present in the future. But for the
application, information architecture is the essential part for the design, so based on
the first round co-creation and testing, the design team can change the flow and
categories of the information architecture, and add more extra function and features for
it to achieve a better experience for user.

- Design preference / Interface testing

This section is all about graphic design. For the prints is all about testing graphic
element preference, the preference of illustrations and real images is very important to
considered for the medical education design, because if some real bloody images is
pretty scary for reader to accept.
The graphic is also important for the applications, because after design information architecture, the future navigation design is based on the different interface design system, just like the prints, there is a inside graphic system to lead user’s experience, but the graphic elements should the test earlier than prints, because it will affect design progress for the application design.

- Icon & Image testing / Navigation design

Icons and images are all the essential elements for the prints, the interesting thing is this two elements are also important for the application, so consider the consistency for the toolkit system, the icon and image design will use for the both study. These icons and images were first tested with clinical staff, revised based on staff suggestions, and then tested with parents.

For the navigation design, this is the workflow of user experience performance, so based on the different interface design to come up few tasks, the aim of that is to let user feel all the individual design system and to see which one is their favorite. And during the test, user will mention elements from which design system is their preference, that will help designer to narrow down the direction further.

### 5.1.4 Co-creation testing

This section actually has connection with the refinement, this can be done several rounds before the final design. So this is after refinement to prepare the new prototyping and new co-creation testing to build the further structure.

- Refined prototyping

For the refined prototyping, this study build three tips to consider for the booklet and
application. The first is most important elements, because this time is approach to the deadline, so go back to consider what is the most important to be considered. For the prints is to considered information based, but for application is to consider functions. The second is meeting the unmet needs, after several rounds of testing, what is extra bonus for designer to think out of the box, what is user needs but they didn’t mentioned, this can be potential elements to consider for this part. For prints is like the pocket guide, this is like extra functions for users keep information and hand out to others. For the application is like the homepage, it was didn’t consider by designer, but user feels it is useful to know the overview of the app, so it has been included into the prototypes.
Third one is need for archive system, the archive system means what can we do further and what’s the limitation for the design project. For the prints, the team toured RPI Graphics to see the prints examples and discussed what’s can be true in the future. For applications, like there is another app named My chart, which is another app for user and clinician to use, so there is no need to overlap the function between both apps, so keep it simple is another work to do.

- Co-creation testing

After considering three tips and preparation of prototype, the design team is going to test the details of the final direction with clinicians and families again. Prints is more about the final styling and extra functions, for the application is also about the final design interface testing. Besides of prototyping co-creation testing, implementation is another thing to be considered for user, for the booklet which should be defined who is responsible for each section, and this is the same as the application, but for
application, this is also the touch point between technology group and design team to develop the application further.

6. Conclusion

After analyzing the case studies, this thesis comes up a guidance for the future designer how to deal with the problem. The Figure. 30 is the guidance for the future designer to follow the process.

There has some suggestion for the future designers:

1. Before choosing the material, to do the research with the users. Using some research tools like card sorting or questionnaires, to know what kind of tool is more helpful to help users, not just an app if it can be others.

2. The print material is more easier to hand out information when people need to deliver few informations to other stakeholders. And user can easier write down
some information to interact with other people. So don’t limited by the stereotype of the prints, designer can develop more interesting functions for prints.

3. The digital material is more personal interaction, which is very different with prints. So all the app designs have designed for hospital education has limited by remains uncertain, so designer should figure out what’s function can be used during the co-creation section.

4. When the designer designs multiple materials, it is important to consider consistency of the whole system. So for this guidance lays out what’s the common elements can be considered together, and what elements should be difference, and when designers will meet the same problem, this guide can help them make decisions more efficiency.
7. Bibliography


