

SCHOOL OF DESIGN

MASTER THESIS

CARNEGIE MELLON UNIVERSITY

Project care

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Abstract

The purpose of this thesis project was to explore the relationship and communication between physicians, patients, and caregivers, and reexamine the implementation strategies for post-acute care treatment plans. Our goals were to understand (1) the difficulties that elderly patients with chronic conditions face (2) to design an intervention that would help them to better understand, implement, and manage their chronic conditions at home.

The risk of developing a chronic condition, such as heart disease or diabetes, is based on both genetic makeup and lifestyle behaviors. While individuals are not able to control their genetic predisposition, it is widely known that common lifestyle behaviors, such as exercise and diet, can contribute to the reduced risk of the development and progression of chronic diseases.

Effectiveness of communication and individualized planning greatly influence a patient’s motivation and ability to adhere to their treatment plans at home. However, due to the limited appointment time and infrequent interactions, healthcare providers struggle to gain a holistic understanding of their patients resulting in treatments and care that can feel impersonal.

Based on this we looked to address “how might we empower elderly chronic patients to better understand and manage their treatment plan at home?” Through research and design, we discovered it starts by improving the patient-physician relationship through patient-centric services and systems that allow greater autonomy in their treatment plans, health, and lifestyles.

Our project, Care Clinic, is a reimagining of the primary care clinic check-in process and waiting room experience. With digital touch points and a welcoming environment, Care Clinic provides an opportunity to gain a holistic picture of the patient, while encouraging positive and supportive social interactions, with the ultimate goal of improving the patient’s receptiveness, attitude and impression of their overall care.

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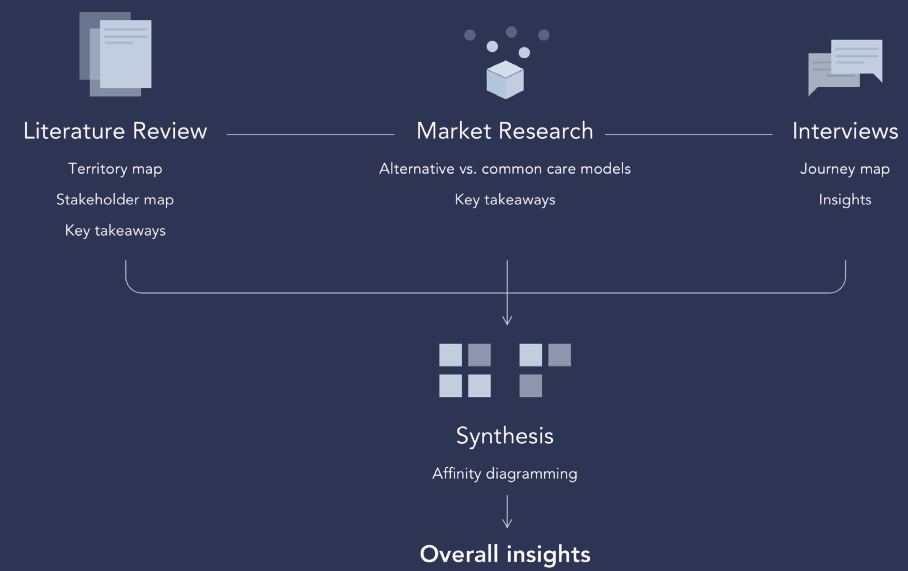
Introduction

The purpose of this project was to explore the relationship and communication between physicians, patients, and caregivers and reexamine the implementation strategies for post-acute care treatment plans. Our goal was to understand the difficulties that elderly patients with chronic conditions face to design an intervention that would empower them to better understand, implement, and manage their conditions at home.

Our decision to focus on the elderly population and chronic diseases stem from three main points. First, the elderly population, which consist of individuals who are 65 years and older, is projected to increase to 88.5 million by 2050 (Vincent et al., 2010) This is a result of the baby boomers, people born between 1946 to 1964, aging with the last of that generation reaching the age of 65 by 2030. This growing population presents a clear need to look at designing healthcare interventions for the aging population trend.

Secondly, chronic diseases has become the leading cause of death within the United States. Currently, 6 in 10 adults in the United States having one type of chronic disease and 4 in 10 adults having two or more (Center for Disease Control and Prevention, 2018). Chronic diseases encompass a range of conditions, including heart disease, diabetes, and obesity. The risk of developing a chronic disease is based on both genetic makeup and lifestyle behaviors. While individuals are not able to control their genetic predisposition, it is widely known that healthy lifestyle behaviors, such as exercise and diet, can contribute to the reduced risk of developing and the management of chronic diseases. This presents an opportunity to look at why and how a healthcare intervention can improve the management of chronic conditions through communication and behavior change.

Lastly, there has been an increase in readmission rates among patients with chronic diseases. The surge of high readmission rates is one the largest issues that our current healthcare system is facing. Currently high readmission rates associated with chronic heart disease contributes \$190 billion to the United States's annual \$2.7 trillion healthcare spending (Butala, Neel M., et al., 2018), with medicare alone spending approximately \$528 million annually on readmission of patients (Zohrabian et al. 2018). This information presented clear benefits to tackling at home solutions which would benefit both patients, as well as our healthcare financial systems. For the purpose of our project and reasons stated about, we used chronic heart disease as a case study.



01

Understanding the problem space

Literature Review

We conducted a literature review to gain an understanding of the topic area and medical landscape that we would be investigating. It was important to gain a general understanding of heart disease, as well as the healthcare system’s current workflows, solutions, and problems. This knowledge acted as a basis for the development of our territory and stakeholder map, and our interview questions/guidelines.

We looked into the following nine topics through an extensive compilation of 51+ articles and case studies. In addition, we utilized public online patient forums as a resource to gain an insight into the patient experience.

- Cardiovascular Disease Symptoms, Risk and Prevention
- Discharge Planning and Coordination
- Post-acute Care Treatment and Management
- Post-acute Care and Readmission Rates
- Current Disease Management Solutions
- Physician-Patient Communication
- Patient Psychological and Emotional Factors
- Perception of Aging and the Effects on Health Behaviors
- Relationship between Cost, Insurance, and Readmission

As we explored these topics, we discovered five main takeaways: (1) complexity of the disease, (2) importance of behavior-based treatment, (3) role of self-perception, (4) administrative complexity, and (5) communication.

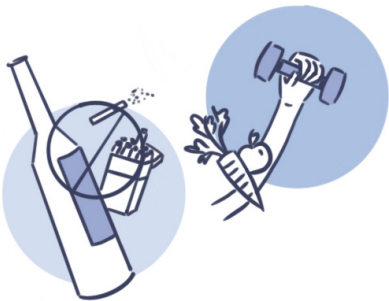
COMPLEXITY OF THE DISEASE

One of the main issues when looking at a patient with heart disease is that you are not able to view them solely as a heart disease patient. The likelihood of a patient experiencing heart disease in isolation is extremely low. Many patients may have other chronic conditions, such as high blood pressure, high cholesterol, diabetes or obesity (World Health Organization, 2018). In addition, elderly patients may experience cognitive and mobility issues, such as dementia and muscle weakness, as a result of the natural process of aging. The effects of living with multiple conditions can cause the diseases to progress faster and symptoms to be exacerbated causing the management and treatment to become more difficult for a patient (Bottle et al. 2018).



IMPORTANCE OF BEHAVIOR-BASED TREATMENT

While patients may develop heart disease as a result of their predisposition based on their genetic makeup, many times lifestyle choices is the culprit of the development of the disease. Poor diet, lack of exercise, excessive alcohol, and smoking are the four main behaviors that increase the risk of developing heart disease. As a result, in addition to prescribed medication, many of the treatment plans focus on lifestyle behavior changes as a method of management (Mayo Clinic, 2018). With that said, the patient’s willingness and commitment to behavioral change often determines successful adherence to the treatment process, and ultimately the patient’s overall wellness.



ROLE OF SELF-PERCEPTION

The concept of perception of aging suggests that a person’s understanding and acceptance level of the natural aging process can have negative or positive effects on their physical and mental health. It is even suggested that a person’s view on aging can affect their lifespan. During a community-based study with 660 participants by the Ohio Longitudinal Study of Aging and Retirement, they found that “individuals with a positive perception of aging live 7.6 years longer than for the ones with negative self-perception” (Levy et al. 2002).

A patient’s perception of aging and emotional status heavily influences their motivation to adhere to their recommended treatment plans. Patients with a negative view of aging tend to be less motivated in establishing health related behavior changes, such as exercise, because they believe that their disease is caused by aging, not their behavior (Han, 2018).

It is found there is a strong connection between physical well-being and mental well-being. A patient’s views on aging can affect their mental and social engagement, which has been found to affect their bio-physiological functioning. In an article by Anna Kleinspehn-Ammerlahn et al, in The Journals of Gerontology, suggests that a positive perception of aging by elderly patients serves to improve their bio-physiological functioning by helping boost their self-esteem which assists in sustaining a higher level of social engagement (Kleinspehn-Ammerlahn, 2008). Ongoing social interactions are important for a patient’s health management and overall well-being, especially when looking at elderly patients who may suffer from social isolation and depression.



ADMINISTRATIVE COMPLEXITY

The healthcare system is a complex network that a patient has to navigate on their own. Patients often have to deal with multiple administrative aspects including scheduling appointments with multiple physicians, organizing multiple medications, filing insurance, and arranging transportation, which can be confusing and stressful. This can be overwhelming for elderly patients, who may suffer from cognitive and mobility impairments, such as dementia and arthritis. Often times, elderly patients may have a caregiver who will help them. Sometimes the caregiver is an adult child who may not have the time to help with all aspects, resulting in the patient having to deal with the majority of these administrative aspects on their own.



COMMUNICATION

Communication between the patient and physician plays a important role within the healthcare system. The effectiveness of healthcare management is dependent on the patient’s memory retention. A patient’s ability to recall and articulate health history on the spot is crucial because physicians heavily rely on the patient’s self-reported medical and social history for diagnosis and treatment planning (Vermeir, 2015).

Adherence to medical advice is also dependent on the patient’s memory due to the lack of accurate reference upon discharge. Most of the communication is done through dialogue between physicians and patients, and the printed discharge instructions are often generic to the disease type and not personalized based on the actual discussion that happened in the room (Ubbink, 2014). Furthermore, the information exchange between inpatient and outpatient clinics is not streamlined, makes it extremely difficult to coordinate care among medical stakeholders (Graetz et al., 2014).



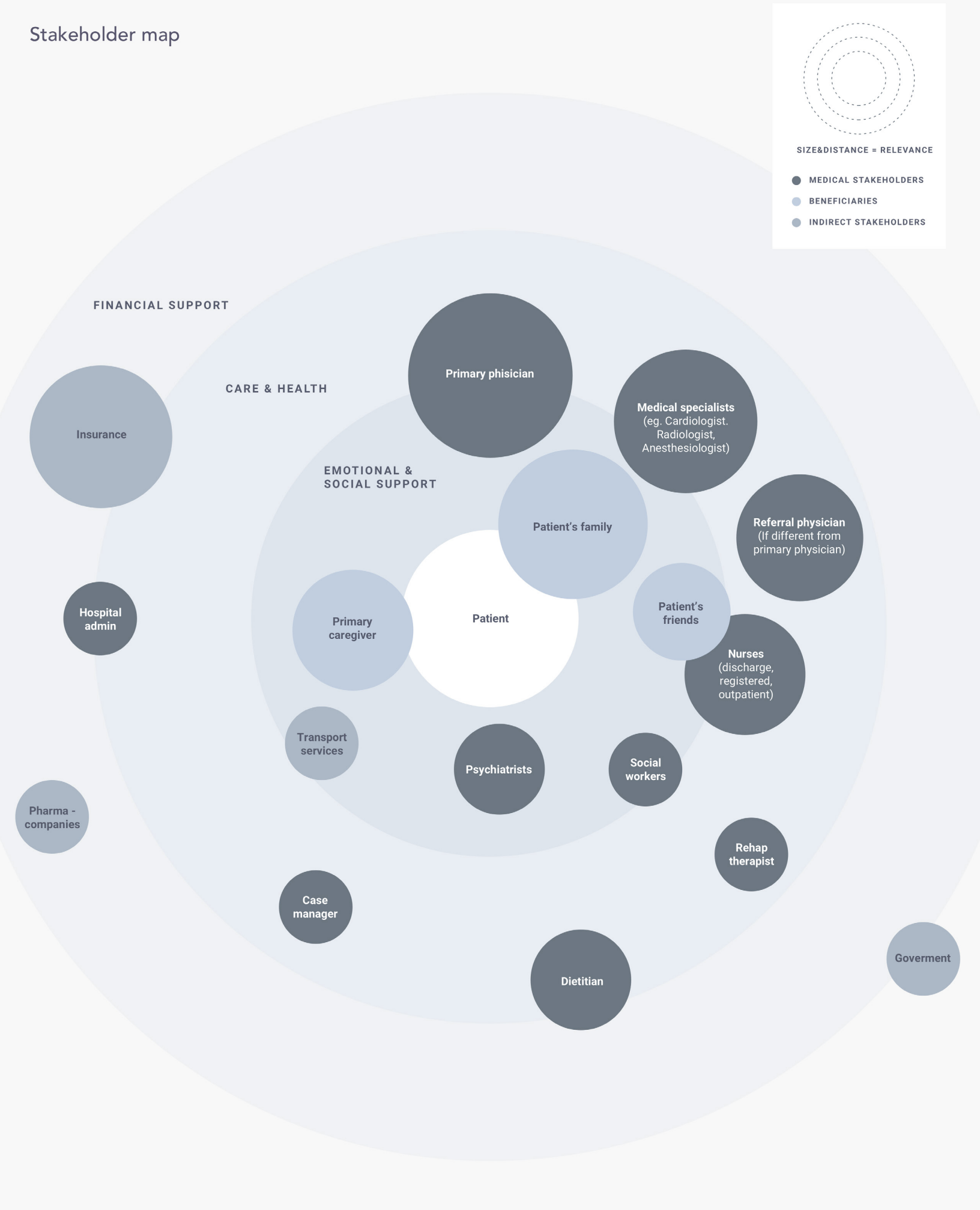
Defining territory

We focused on four main categories for our territory map: (1) Methods, (2) Environments, (3) Tools, and (4) Finance. We were interested in understanding the different areas and elements that patients interact with, as well as the different ways they achieve these interactions. For example, we looked at the methods of communication, both remote and in-person, that are currently available to patients. This territory map provided us with an overview and starting point to understand the many aspects and complexity of the system that patients have to deal with throughout the patient journey.

Territory map



Figure 1: Territory map



Defining stakeholders

We used our stakeholder map as a exercise to gain an understanding of the roles that different stakeholders played during a patient's health management process. Focusing on direct influence on patient behavior, we found that a patient's personal relationships with family, caregivers, neighbors, and friends plays an equally important role as their medical interactions with their physicians and nurses. This is a result of the frequency and length of interactions that a patient's personal relationships have in comparison to the short and staggered interactions with their medical providers. The social engagement and emotional support that a patient's personal relationships provide demonstrates the importance of a well developed support system outside of the hospital setting, which can boost motivation to encourage the patient to actively combat their disease.

Figure 2: Stakeholder map

Common care model

Self Diagnosis (Web Search)

Google symptoms, Web MD, Patients like me, etc.

- Overloaded misinformation

Office visits / ER

Admission to hospital & get treatments
Visit private doctor's office & get prescription

- + Face to face interaction
- Long wait time

Discharge paper

Verbal explanation, discharge paper

- Easy to lose, forget
- Generalized

Office visit

Meet with primary care physician or referral physician

- Difficulty scheduling
- Burden for patient with mobility impairment
- + Face to face interaction

Self regulation

Self regulate based on memory, panner, apps

- No guidance
- Depends on patient's memory
- Invisible progress to physician

Alternative care model

Telehealth

Check symptoms with AI chatbot or talk to to physicians remotely via video call, phone call, or texting.

- Technical literacy required
- + Can replace triage process
- + Information confirmed by physicians

Micro hospitals

Small scale inpatient facility that reflects the needs of local community

- Can't handle all situations
- + Tailored to community need
- + Convenient and faster access

Internet based care

Get or access discharge instruction via email, patient's web portal, or text

- Technical literacy required
- Privacy concern
- + Access anytime

Home visit

Physican or nurse visits patient's home once a week with medical kit to check on patient's progress

- Often not covered by insurance
- + Learn about patient's lifestyle context

Internet based care

Monitor progress with automated chatbot or medical providers through telehealth

- No customized monitoring yet
- + Step by step guidance
- + Transparent progress to physician

Market research

For our market research, we focused on exploring the alternative care models that are trying to intervene within the current healthcare space, and compare the alternative care models to the common care model to gain an understanding of the pros and cons to both systems.

We looked into 32 market examples and discovered four main types of alternative models: (1) Telehealth, (2) Micro Hospitals, (3) Home Visits, and (4) Internet-based care. We found that these four alternative models were each targeted to intervene within one main section of the common care model, which we divided into four phases: (1) Discovery, (2) Diagnose & Admission; (3) Follow Up; and (4) Maintenance.

Figure 3: Alternative care model overview

DISCOVERY PHASE: ONLINE SEARCH (COMMON) VS. TELEHEALTH (ALTERNATIVE)

The discovery phase focuses on the discovery of a medical event and subsequent actions a patient may engage in, including research and decision making for next steps. In a typical scenario, a patient may try to self-diagnose by utilizing the internet to research their symptoms or asking questions in patient forums. The problem with online searches and crowdsourced information is that the patient may be informed by incorrect information that leads to a false diagnosis and conclusions not confirmed by a professional medical practitioner. This self-diagnosing process can lead to patients misjudging their existing symptoms and causing them to not seek out appropriate treatment.

In comparison to online searching, telehealth provides an alternative method of self-diagnosing for patients. Telehealth systems are services that allow patients to have remote appointments with physicians and nurses through video chat, phone calls or text messaging features. These systems may utilize artificial intelligence (AI) as a method to streamline and provide a low cost service while still maintaining confirmed information by medical practitioners.

For example, Babylon Health is a telehealth platform that utilizes an AI chatbot to streamline the transition between self discovery and online appointments. The AI chatbot serves as a triage to gather basic medical information, such as symptoms and medical history, while providing suggestions and information confirmed and developed by the practicing physicians. Patients can then interact with real physicians via video chat or phone call and receive prescriptions without having to go to a hospital if appropriate. By providing confirmed information and replacing triage processes, telehealth platforms aim to reduce the amount of transition periods and misleading judgment that occurs during the discovery phase.

While telehealth systems provide patients with a low cost and convenient method of accessing physicians at home, there are shortcomings to this type of model. Currently, telehealth only works in scenarios where patients are experiencing minor conditions that can be diagnosed through dialog and remote imagery. In addition, telehealth relies on technology as a means to provide a low-cost solution, however this requires patients to have degree of technical literacy, which elderly patients may not have.

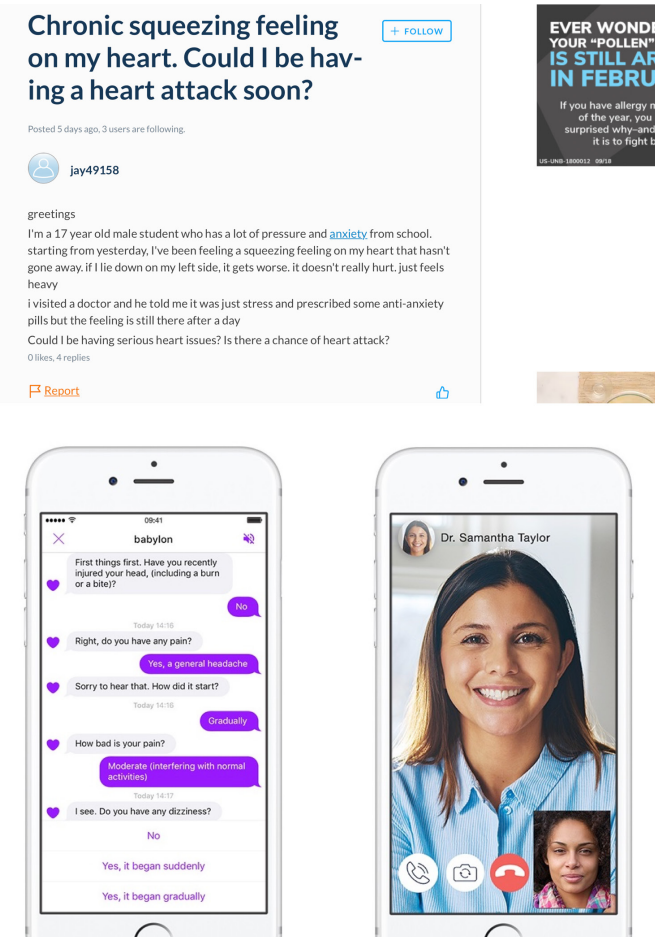


Figure 4: Patient forum (www.patient.info/forum) (top) vs. Babylon Health (<https://www.babylonhealth.com>) (bottom)

DIAGNOSE & ADMISSION: MAJOR HOSPITAL (COMMON) VS. MICRO HOSPITALS (ALTERNATIVE)

The diagnose & admission phase focuses on the patient’s journey from traveling to the hospital and process of diagnosing and admission for treatment. In a typical scenario after searching their symptoms online, a patient will either schedule to see their physician, or more commonly, a patient will go to the emergency department at their local major hospital. When a patient’s medical event is unclear and urgent, a patient will often seek out their closest major hospital over a local clinic because major hospitals are considered a one-stop solution with various medical specialists and equipment. However, since major hospitals service large areas, they are often very congested with continuous incoming patients, which can result in long waiting times for patients and overworked medical staff.



Figure 5: Emergency room at major hospital

In comparison to large major hospitals, which may feature 500+ beds, micro hospitals are smaller hospitals that provide many of the same services and may feature as few as 8 beds. Because of their small scale, micro hospitals focus on tailoring their services to the community and their specific needs (Mirza, 2017). For example, if the community population has a high percentage of elderly individuals, medical staff and equipment will be tailored to specialize in age-related chronic diseases, such as cardiovascular disease, diabetes, and arthritis. In this model, there would be multiple micro hospitals throughout a city, as supposed to one major hospital servicing a large area. This would reduce the amount of congestion that major hospitals experience because incoming patients would be spread out resulting in reduced waiting times.

While the tailored services and multiple locations of micro hospitals provide patients with more convenient access to in-person care, there are issues with this model. One issue is that the tailored services may actually create more transitions for patients. If a patient has a medical event that their micro hospital does not have the services to deal with, the patient will then have to be transferred to a different doctor at a different hospital.



Figure 6: Emergency room at micro hospital

FOLLOW UP: DOCTOR’S OFFICE (COMMON) VS. HOME VISITS (ALTERNATIVE)

The follow up phase focuses on the 30 day readmission period, where a patient will have a number of follow up appointments based on the severity of their medical event and treatment. In a typical scenario, after a patient is discharged with their recommended treatment plan, the patient is often asked to schedule a follow-up appointment to review progress and adjust their on-going treatment. On average for patients with chronic heart disease, these appointments can be once every 1-3 months with multiple physicians from cardiologists to family physicians. In most cases, patients need to go to the office to meet with their physicians, which requires them to arrange transportation and schedule appointments. For elderly patients, managing these various administrative tasks can put a lot of burden on them, which can be an additional stressor on their health (Gallacher et al., 2011).

Home visit programs provide an alternative to traditional office visits for patients. In a home visit program, such as Heal (<https://heal.com>), physicians or nurses would visit the patient at their home with the required medical equipment. This model provides an ideal opportunity to learn about the patient’s living context by providing the medical providers with a glimpse into the patient’s living environment. While this model is ideal, especially for elderly patients who may have mobility issues, but it is currently more expensive than traditional office visits and it may not be covered by insurance.



Figure 7: Doctor’s office (top) vs. Home visit (bottom)

MAINTENANCE: SELF REGULATION (COMMON) VS. INTERNET-BASED CARE (ALTERNATIVE)

For maintenance, patients usually self regulate based on their memory of the treatment plan discussed with the physician. Some patients keep journals or pill organizers to keep track of their tasks and progress, however, certain behaviors, such as journaling, often do not last long.

Internet-based care, such as chatbots and automatic reminders, can be used to help patients with maintenance, by providing remote support and guidance. Sense.ly is UK based AI chatbot that helps diabetic patients better manage their condition. Sense.ly’s mobile application is connected to measuring devices, such as blood pressure cuff or weight scale, via Bluetooth and automatically logs the patient’s progress data and notify nurses when the patient needs attention. Sense.ly utilizes an AI nurse avatar, Molly, to help guide the maintenance process by providing automatic reminders and step by step voice & visual guidance in each task.

Internet-based care could provide an easier way to manage tasks, opportunity to understand and reflect on self-progress, and foster transparency between patient and healthcare provider. However, most of the solutions are not very flexible to adapt to each individual’s lifestyle and specific needs.

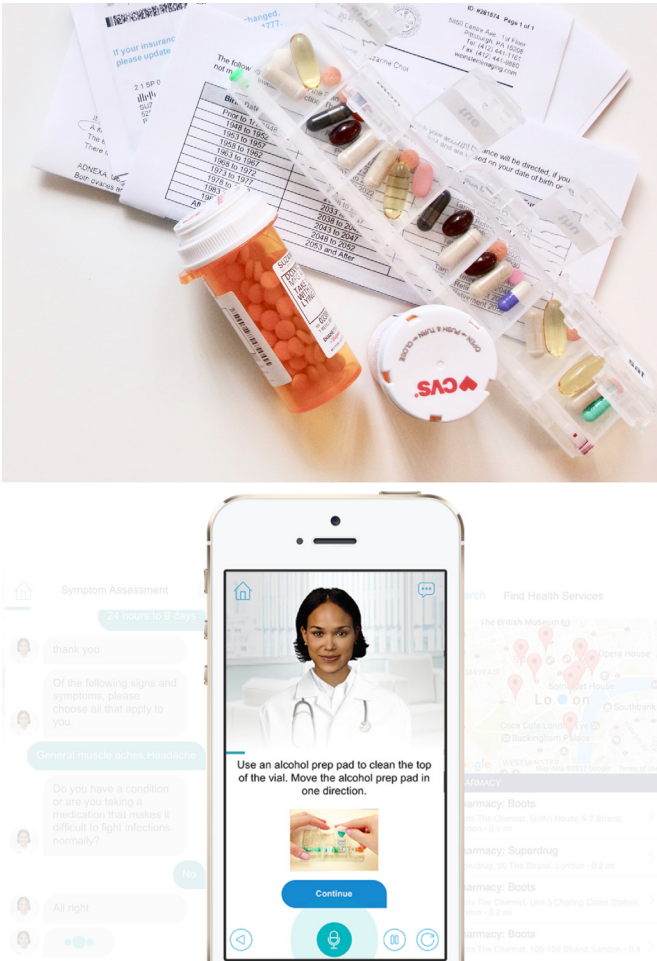


Figure 8: Self regulation (top) vs. Internet based care (Sense.ly - <http://www.sensely.com>) (bottom)

From our market research, we discovered four main takeaways: (1) preventing misinformation, (2) getting contextual detail, (3) considering holistic patient journey, (4) flexibility and technical literacy.

PREVENTING MISINFORMATION

First, the uncontrolled, crowdsourced information from online sources may increase anxiety and probability of misleading judgments in patients during the discovery and maintenance phases.

For example, there was a case where a cancer patient experienced nausea after chemotherapy and found a testimonial about conquering cancer with natural herbs online, and decided to withdraw from therapy to switch to the ‘miracle-cures’ plan. Although this may sound dangerous, surprisingly the National Institute of Health reported that 38% of adult patients choose Complementary or Alternative Medicine (CAM) over conventional medical treatments. Furthermore, the use of CAM is greater in people with higher education levels and income (Barnes et al., 2008). Maureen Salamon from Memorial Sloan Kettering Cancer Center also urged the danger of ‘miracle-cures’ by stating that “the people promoting these treatments might not necessarily have a medical or oncology background. In addition, patients who try these therapies may find, when they come back to seek mainstream treatment, that it’s too late and their cancer has already spread” (Salamon, 2015).

We found that telehealth and internet based care solutions may prevent the misleading judgement from patients by providing information that are developed and confirmed by the medical practitioners, as well as by serving as a direct channel to reach professionals at home to aid decision making process.



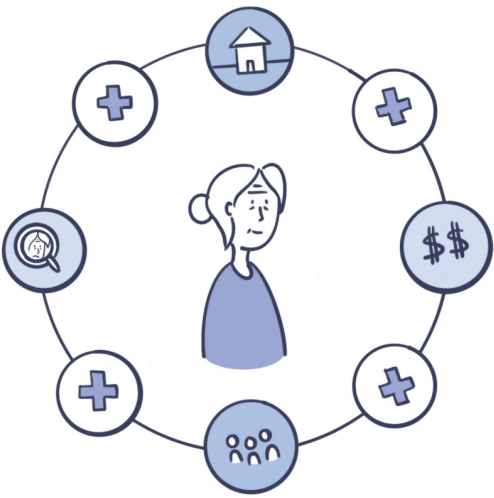
GETTING CONTEXTUAL DETAIL

Second, as discussed in the earlier section, the complexity of heart disease suggests the importance of behavioral adjustments in treatment plans. To maximize adherence to treatment plans and encourage behavior change, a full understanding of a patients living context is crucial. For example, a gym-based exercise plan may not work for a patient who lives in an isolated area where access to gyms is limited. By only meeting in a hospital setting, the physician is unable to glimpse this contextual detail. If the physician had an opportunity to learn about this patient’s living context, they would be able to tailor behavioral treatment to focus on recommendations that fit seamlessly into the patients daily routine, for example, walking around the neighborhood for 30 mins. Additionally, hospital environments may escalate the patient’s fear of their disease. With aforementioned points, we believe the alternative solutions, such as home visit or video chat, would help physicians personalize patient’s treatment plans to maximize patient motivation and adherence to the treatment plan.



CONSIDERING HOLISTIC PATIENT JOURNEY

When designing for a healthcare intervention, we believe that it is important to consider the patient’s complete journey from their time interacting with their physicians in the hospital to their at home experience. The contextual influence (e.g., geographic restrictions and advantages), societal influence (e.g., social bias and self-perception), relational influence (e.g., level of support system and personal relationship), and socio-economical influence (e.g., ability to purchase and adhere to treatment plan) can all play a role in influencing a patient’s motivation in maintaining and adhering to their treatment plan. For example, a patient’s overall experience may not be satisfying if the wait time at the hospital is stressful even if the interaction with physician is positive. Similarly, the level of support upon discharge may influence patient’s motivation to adhere to the treatment plans. Therefore, it is vital to gain a holistic understanding of patient’s entire journey and pinpointing the potential gaps between the experience.



FLEXIBILITY AND TECHNICAL LITERACY

Lastly, there are few applications that are aimed towards elderly patients or caregivers. These applications often provide generic information that is not customizable. For chronic patients, due to the complexity of their diseases, the ability to personalize information and interactions to account for personal living patterns and goals would be ideal. Moreover, many alternative market solutions currently focuses on digital interactions, which requires technical knowledge. Although many elderly patients possess smart phones and computers, advanced interactions like reviewing complex charts or booking an appointment online may be obscure for them. For elderly patients, information should be presented in simple, digestible chunks, and provides auditory or visual support to reduce cognitive loads.



Interviews

We conducted 16 one-on-one in-depth interviews with patients, caregivers, medical professionals, and subject matter experts. The patients we spoke with were 55 yrs+ and had been living with a chronic disease for varied amounts of time. The caregivers were individuals who helped care for family members who had chronic diseases. The medical professionals ranged from general practitioners, nurses, to cardiologists.

We reached out to our personal contacts to recruit interview participants. In addition, we use flyers posted in churches, libraries, and medical offices as a method to recruit potential interview participants.

The goal of the patient interviews was to better understand their experiences living and managing their chronic conditions at home. We were interested in the difficulties they had experienced, both in terms of implementation and maintenance of the treatment plans, as well as in communication with their medical providers.

The goal of the medical professional interviews was to better understand the experiences and difficulties they experienced with the discharge process and development, as well as the communication of treatment plans to their patients with chronic conditions.

The goal of the caregiver interviews was to learn about their experiences with assisting a patient with a chronic condition and the difficulties they experienced assisting them maintain their treatment plans.

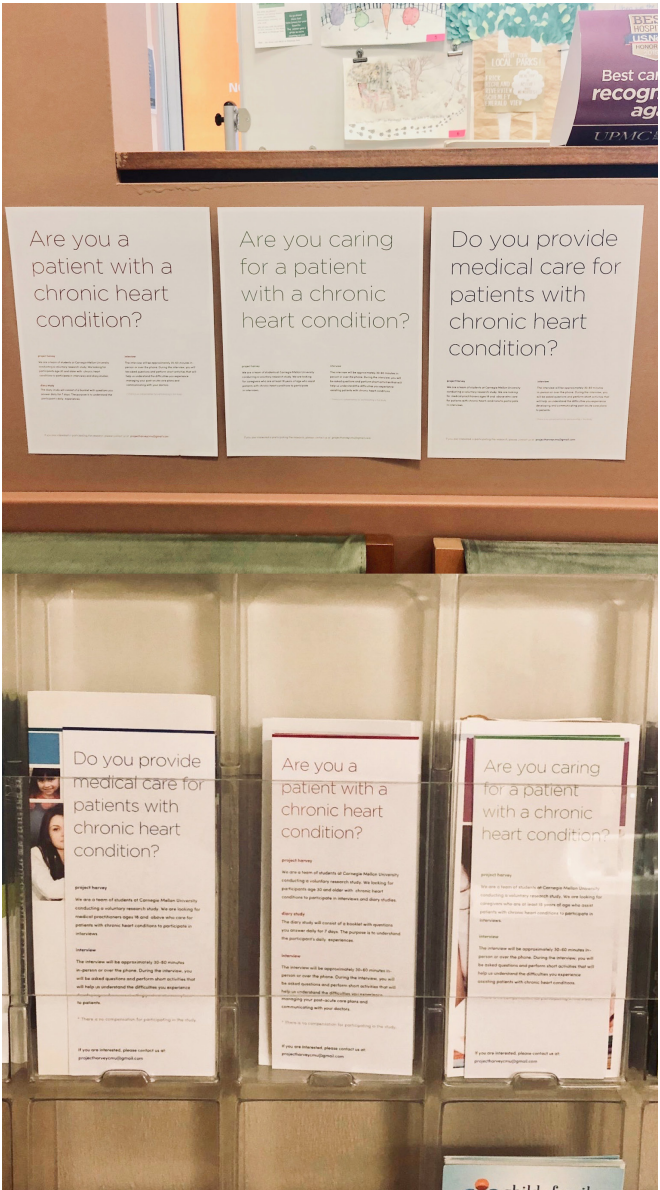


Figure 9: Interview Recruiting

Journey map

From the interviews, we were able to have a better understanding of a typical journey that the patient would go through from once they admitted to the hospital to their daily disease maintenance at home. With the journey map exercise, we tried to surface their emotions, thoughts, point of interactions, aiding tools, and role of different individuals they interact with to identify design opportunities.

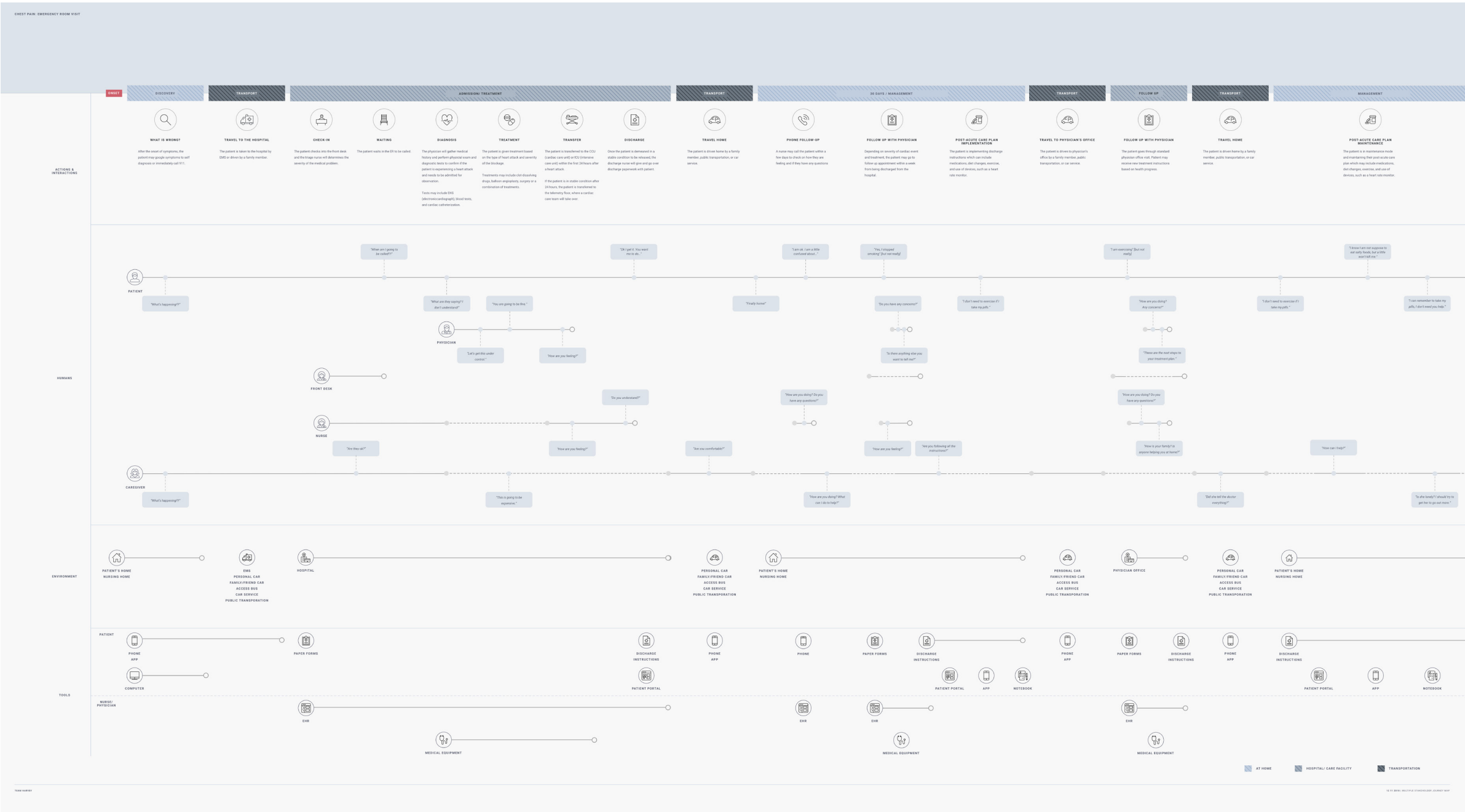


Figure 10: Journey map

Synthesis process

Following our research, we synthesized our findings by transferring our interview notes to post-it notes and clustering common experiences and themes. We color coded our affinity diagram: patient (yellow), caregiver (green), medical professional (pink). We further synthesised our findings and identified 7 sub-categories, which we used to develop our insights.

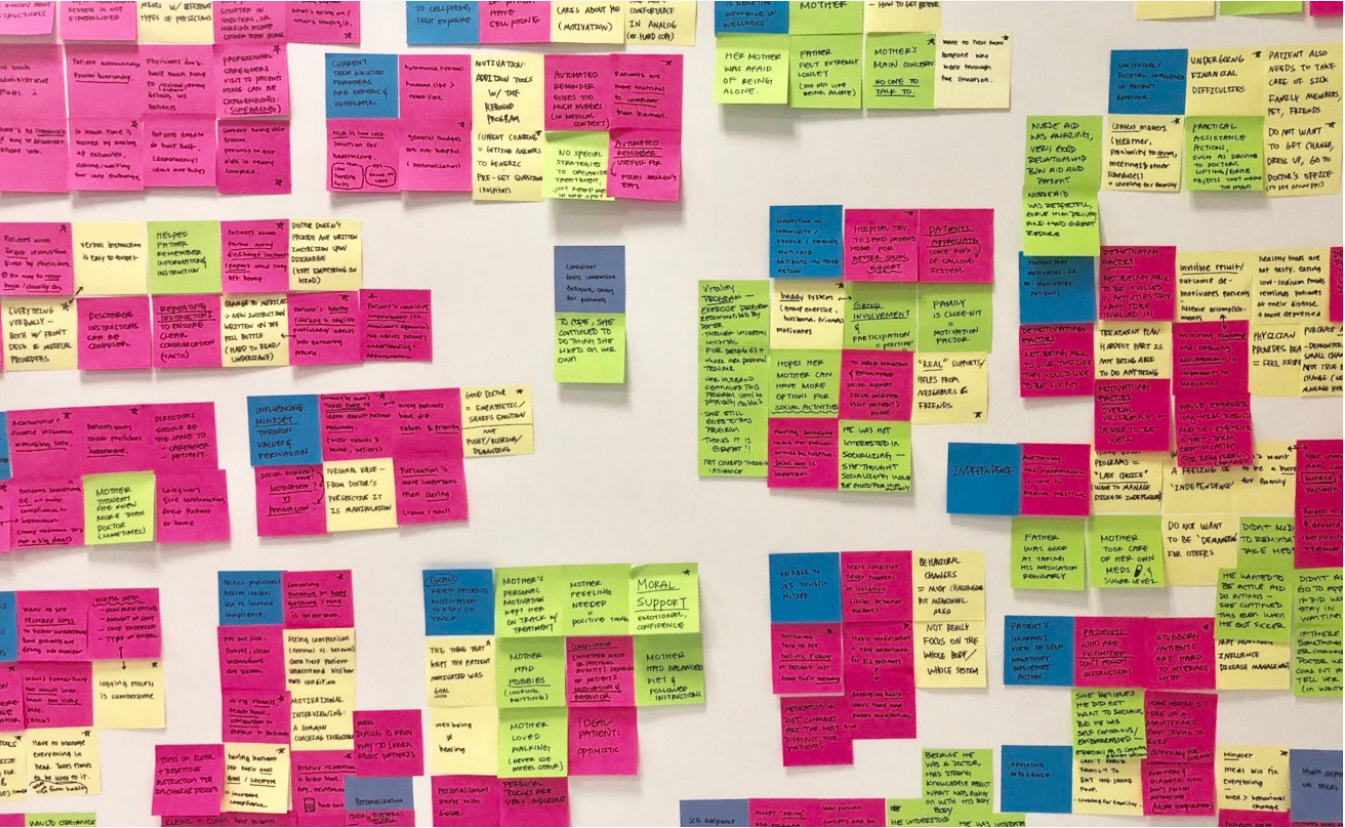


Figure 11: Affinity Mapping insights from interviews

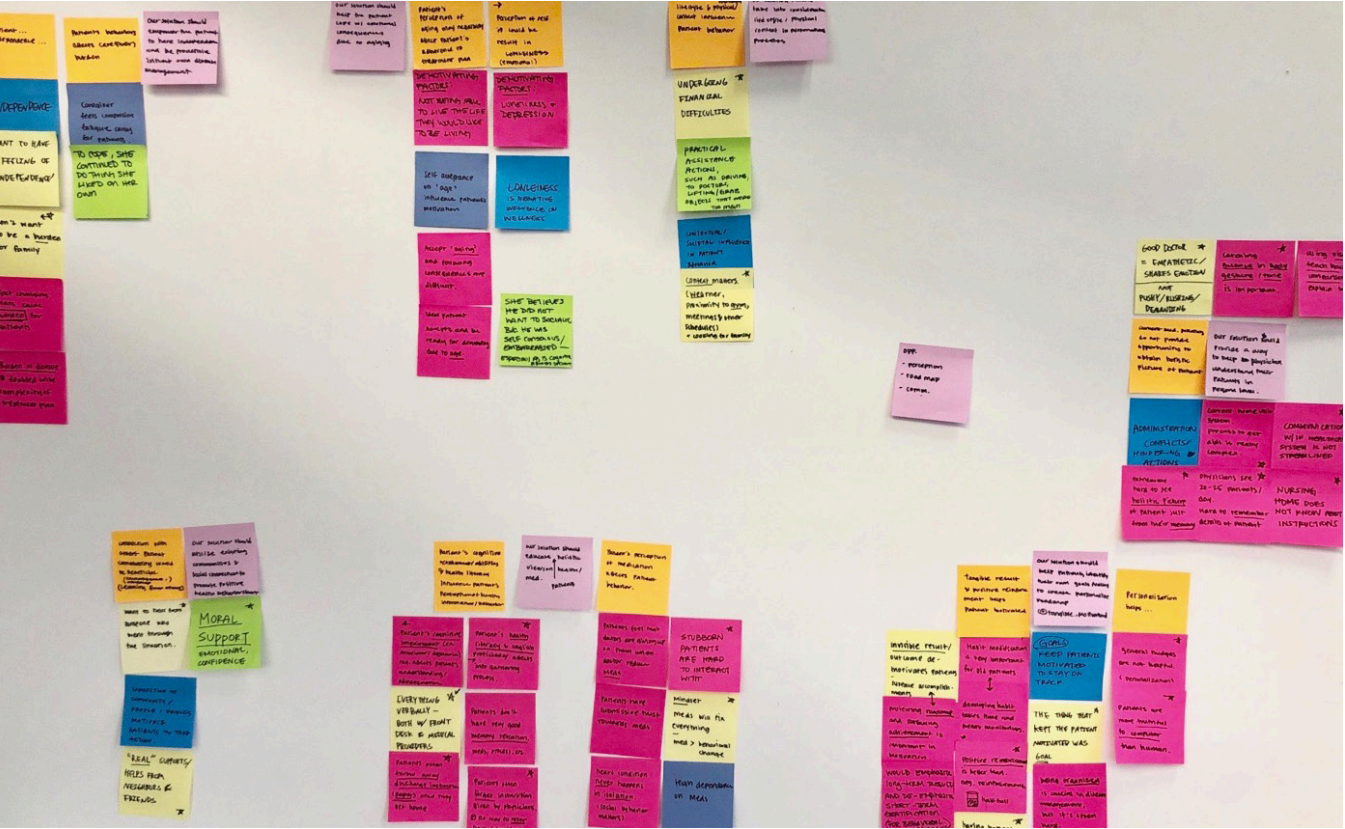


Figure 12: 7 sub-categories identified

Insights

We developed 9 insights from our research which we grouped into three categories: Perception, Roadmapping, and Communication.

Going into our interviews, we expected to find that patient’s struggled with the technical elements of their treatment, such as medication management. However, we found that the behavioral and lifestyle changes, such as dietary changes and exercise, were the most difficult to implement. It is due to the long-established diet and physical activity preferences of elderly patients which negatively affected their commitment to sticking to their physician’s recommendations.

We also discovered there are many elements that are out of the control of the patient, which influences the maintenance of their treatment plans. These included environmental elements (ex. proximity to grocery stores), social elements (ex. proximity to family who can help), and the effects of aging (ex. declining cognitive abilities).

Insights and how they are connected

While we categorized insights into three main categories, these do not live in isolation from one another.

For example, communication quality can influence the patient’s perception of healthcare as well as the roadmapping process.

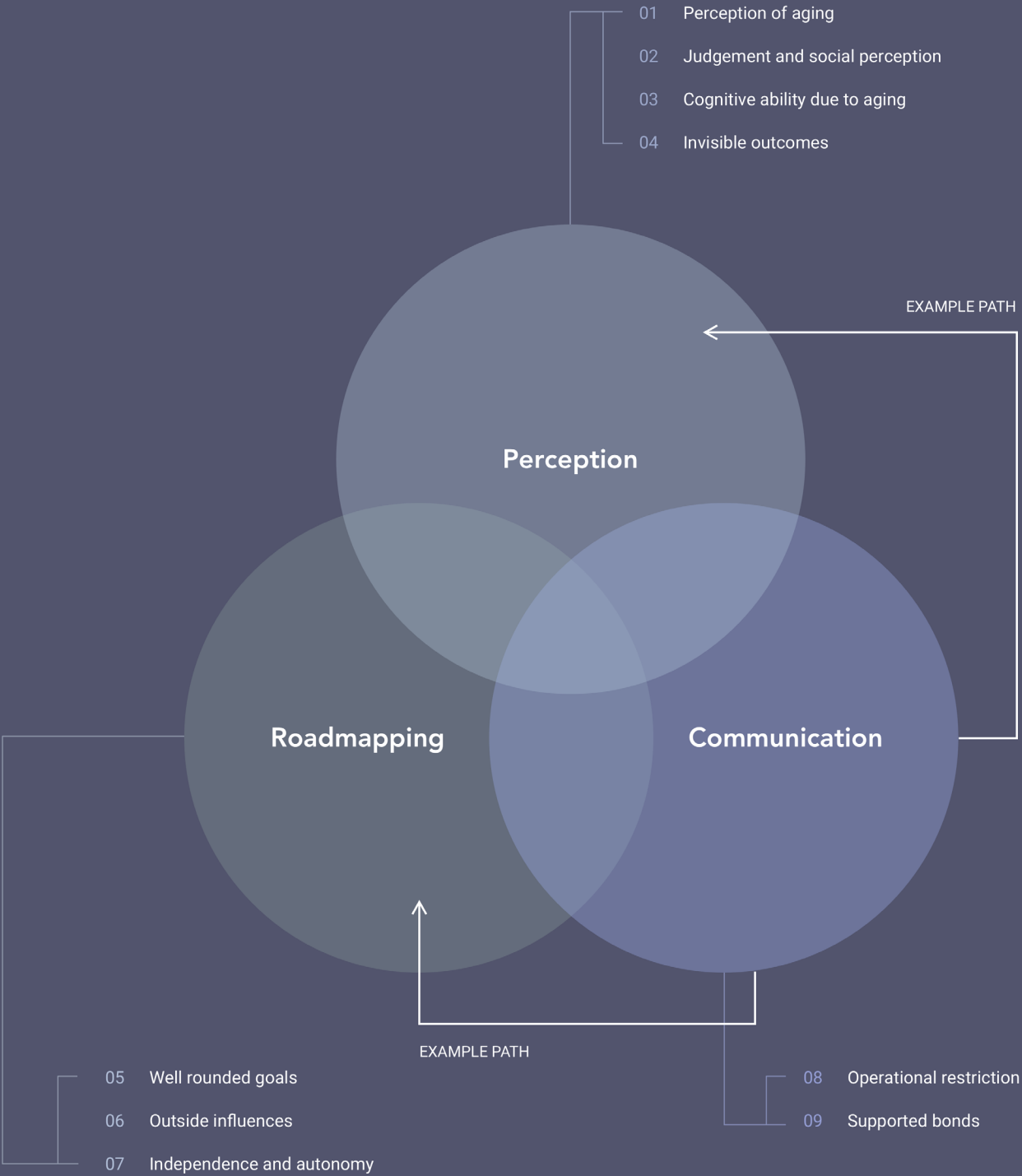


Figure 13: Insight grouping diagram

INSIGHT 01: PERCEPTION OF AGING

Perception of the aging process significantly affects elderly patient’s willingness to accept or adhere to the doctor’s recommendations.

This takes into consideration the patient’s understanding of how the natural aging process and their disease are connected. For example, if a patient believes that the progression of their disease is a result of their aging instead of lifestyle behavior, they are less likely to implement treatment recommendations from their physicians.



INSIGHT 02: JUDGEMENT AND SOCIAL PERCEPTION

Patient’s desire to continue their current lifestyle affects their motivation and commitment to follow their behavioral treatment plan.

This can result from patient personal beliefs, as well as social pressures from their family and friends. For example, patients may pick and choose which treatment recommendations to follow based on how they fit into their current lifestyle, or make small adjustments that are not significant enough to make improvements in their disease management. In addition, a patient may feel they are being judged by their peers and medical providers which can affect their interactions with them. For example, a patient may withhold information, such as smoking, because they are aware of the social perception of it and do not want to be seen in that light.



INSIGHT 03: COGNITIVE ABILITY DUE TO AGING

Cognitive abilities of elderly patients is an important element to take into consideration.

Elderly patients may be suffering from diseases, such as dementia, which can affect their communication with their doctors and understanding of their condition and treatment recommendations. This misunderstanding can cause the patient’s to have a skewed view of their health and make implementation of their treatment difficult once they are at home without assistance from a medical provider.



INSIGHT 04: INVISIBLE OUTCOMES

Chronic diseases are long-term conditions, which results in fluctuation in tangible results.

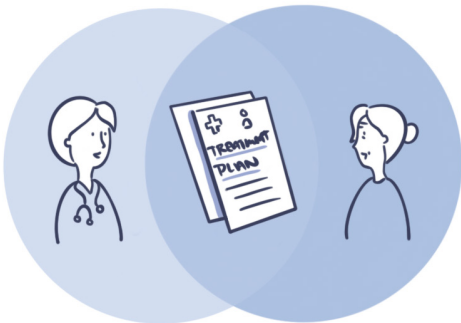
Patients may see visible results when they begin implementing diet changes and exercise, however, at a point, their progress becomes difficult to see. This can result in patients becoming demotivated and believe that their actions are not affecting their disease management in a positive way. Providing more opportunities for visible results and positive reinforcement could influence a patient’s motivation to adhere to the long-term maintenance necessary for chronic conditions.



INSIGHT 05: WELL ROUNDED GOALS

Establishing connections between lifestyle and medical goals is important in developing personalized roadmaps, which allows patients to see how achieving their medical goals affects their home and social interactions.

When a patient receives their treatment plans, many times it focuses solely on achieving the necessary medical goals to combat the disease. However, it is important to take into consideration of patient’s personal lifestyle goals as a method to influence and motivate a patient. This holistic approach is more relevant and motivating to a patient.



INSIGHT 06: OUTSIDE INFLUENCES

Especially with lifestyle recommendations, the patient’s environmental context, such as proximity to grocery stores or gyms, can affect the management of their condition.

When a patient receives their treatment plan, it may include instructions, such as taking medication and exercising. However many times these instructions do not take into consideration the patient’s environmental and social context which can influence their ability to implement these changes.



INSIGHT 07: INDEPENDENCE AND AUTONOMY

Treatment plans and independence go hand in hand because many times patients must manage their treatment plans by themselves once they are home.

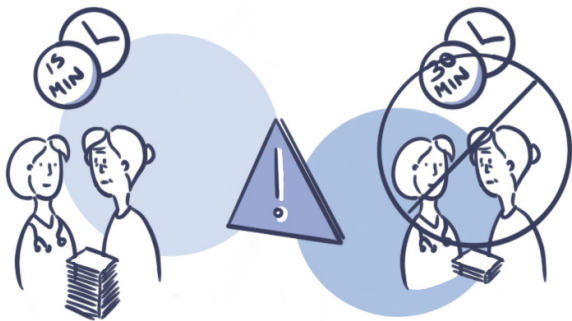
The ability to maintain independence is extremely important to patients. There are many factors that contribute to a patient’s ability to maintain independence, including the patient’s physical, mental, and financial capabilities. In addition, many times patients prefer to be able to independently manage their health without the help of others. This demonstrates the importance of treatment plans that are personalized to a patient’s contextual situation.



INSIGHT 08: OPERATIONAL RESTRICTION

The current medical practices are focused on establishing and maintaining efficiency within the workflow, instead of focusing on the patients.

For example, short appointment times allow doctors to see more patients a day, but limits the time for communication. This focus on efficiency inhibits opportunities to obtain a holistic picture of the patient, which is extremely important in providing personalized care and treatment.

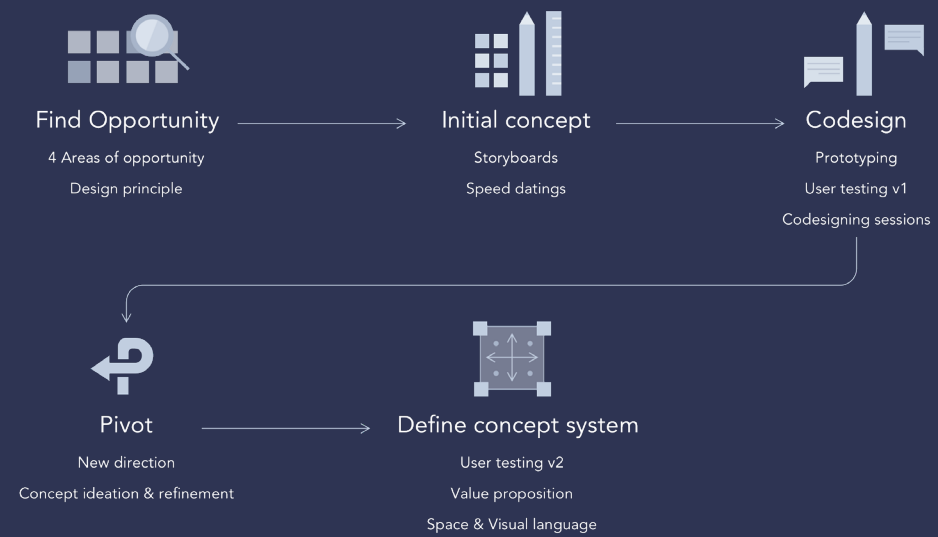


INSIGHT 09: SUPPORTED BONDS

Providing opportunities to allow patients to connect to a larger patient community can motivate patients through support, advice and encouragement.

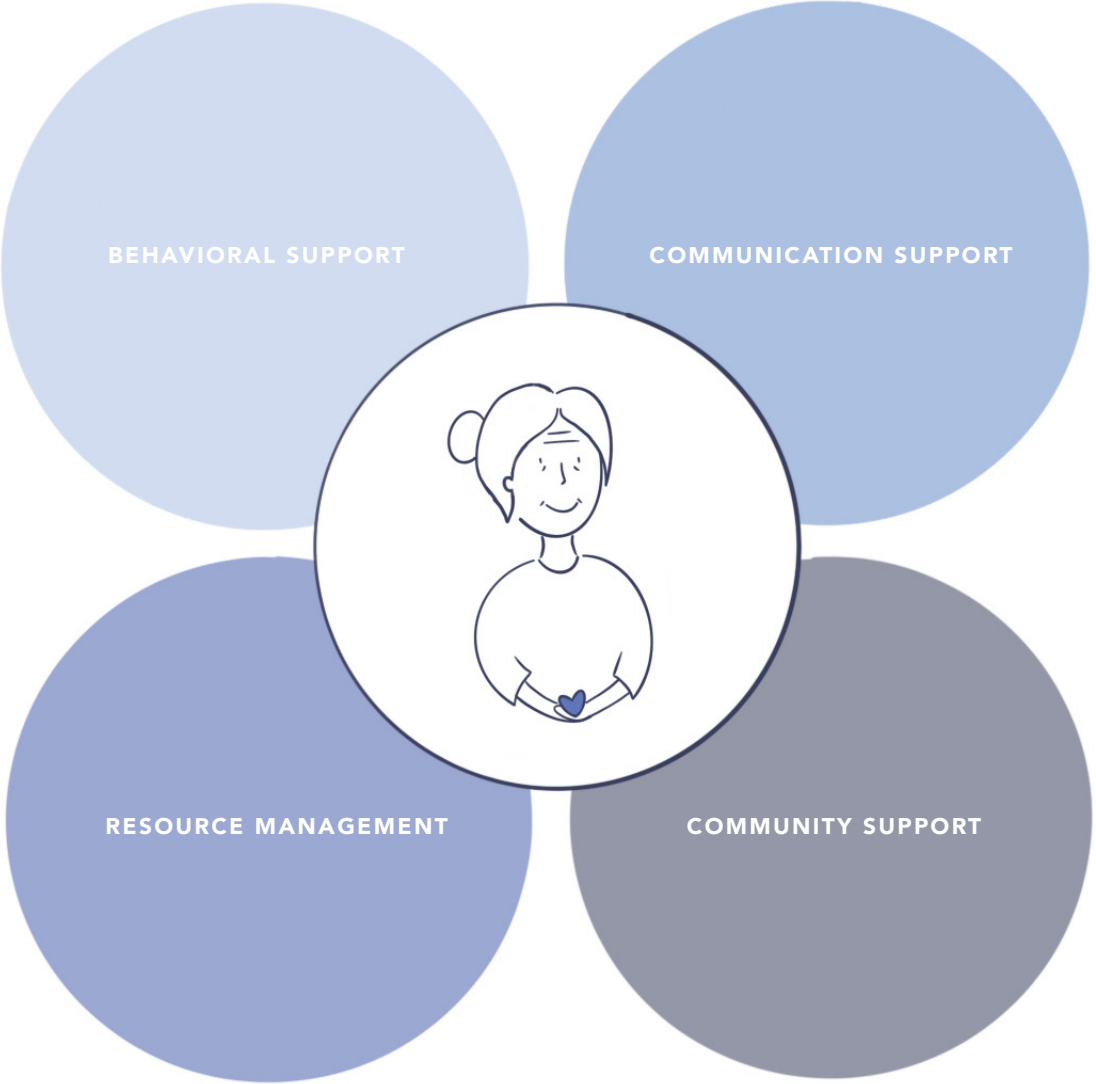
Many patients feel they lack connections to other patients who are going through a similar experience. In addition they sometimes feel that their doctors do not understand from a emotional/mental viewpoint because they have not personally experienced the disease.





02

Defining direction and concept development



4 Areas of opportunity

Based on the insights we discovered from our research, we moved into concept development. We sketched out storyboards which we speed dated with elderly patients who had a range of chronic conditions.

We focused on four areas of opportunity: Behavioral support, resource management, communication support, and community support.

BEHAVIORAL SUPPORT

More frequently, elderly patients struggle with implementing and maintaining the lifestyle changes (ex. dietary change) that are commonly given in treatment plans for chronic diseases. Behavioral support would address assisting elderly patients with the lifestyle changes in improving access to resources and motivation.

COMMUNICATION SUPPORT

Dialogue is the main method of communication within healthcare and this can result in opportunities for misunderstanding, especially for elderly patients who may have experienced decrease cognitive abilities due to aging. Communication support would address improving patient-doctor communication, both in terms of clarity and accessibility.

RESOURCE MANAGEMENT

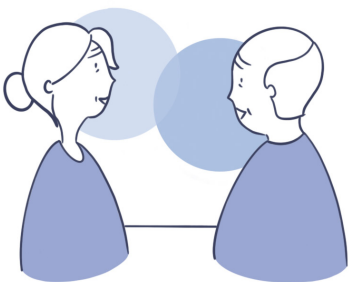
Elderly patients typically suffer from multiples conditions, for example they may have heart disease, high blood pressure, and be medically obese. Having to deal with multiple treatment recommendations can make at-home management more difficult for elderly patients, who may also be suffering from cognitive decline, such as dementia. Resource management would address assisting with organization of instructions and resources to improve and ease treatment adherence.

COMMUNITY SUPPORT

Many elderly patients see the benefit in connecting to peers for advice and motivation but they struggle to form strong support systems for various reasons, such as being more homebound. Community support would address providing opportunities for elderly patients to connect to their local patient community and use them as a resource to support their patient journey.

Design principles

We developed six design principles based on our insights which focused on supporting positive human interactions and facilitating communication that would improve the patient experience on an individual level.



HUMANISTIC

By facilitating human interactions with health providers and the larger community, patients can build supported bonds to help influence motivation.



POSITIVE

By projecting a positive tone within the interactions and design intervention, patients are subconsciously influenced to hold a positive attitude about healthcare.



VOLUNTARY

Encouraging patients to participate in interactions by utilizing the tone of written content and imagery.



PERSONALIZED

By providing opportunities for personalization, patients are able to receive care that is tailored to their needs and context, which provides the patient with more autonomy and independence.



STREAMLINED

Maintaining a streamlined patient journey where touchpoints build-on one another to help patients feel their voice is heard and provides efficiency for health providers.



SIMPLE, NATURAL INTERACTIONS

By utilizing simple interactions to reduce cognitive load, elderly patients with cognitive and mobility impairments can easily and intuitively move through the patient journey.

Storyboards and speed-datings

We sketched five main concept directions which addressed four of the opportunity areas we had identified. Many of our concepts touched on more than one of the opportunity areas, such as the value-based roadmapping subscription box, which addressed behavioral support, resource management, and communication support.

INITIAL CONCEPT 01: SOCIAL EXERCISE POINT SYSTEM

This concept utilizes a reward system to motivate patients to exercise and socialize actively that is run through an insurance company with partnership from local gyms, grocery stores, and transportation services.

INITIAL CONCEPT 02: VALUE BASED ROADMAPPING AND SUBSCRIPTION BOX

This concept utilizes a subscription service that focuses on developing personalized roadmaps based on the patient’s values and lifestyle preferences. The patient would receive support boxes that featured resources (food, medications, etc) to help them stay on this roadmap.

INITIAL CONCEPT 03: MATCHING OLD AND YOUNG

This concept utilizes a peer learning environment that would match patients of different age ranges, mindsets, and values. These pairs would exchange resources, information, and motivate each other.

When developing these five concepts, we looked to bring in the different design principles we had identified earlier. By using other patients as a resource, we looked to address the humanistics and positive nature we wanted to incorporate. In addition we addressed the building nature of a streamlined solution by including points of personalization, which would allow patients to independently maintain the solution.

INITIAL CONCEPT 04: MEAL BUDDY

This concept utilizes a food subscription service to encourage socialization and health eating by providing food/recipes based on the patient’s dietitians suggestions and an online platform that allows patients to connect with other patients, family, and friends to socialize over a meal.

INITIAL CONCEPT 05: PHYSICAL TRACKING SYSTEM

This concept focuses on tracking personal progress and health behaviors through a physical tracking system that focused on indicating behaviors through color, texture, and pattern, as supposed to detailed number data.

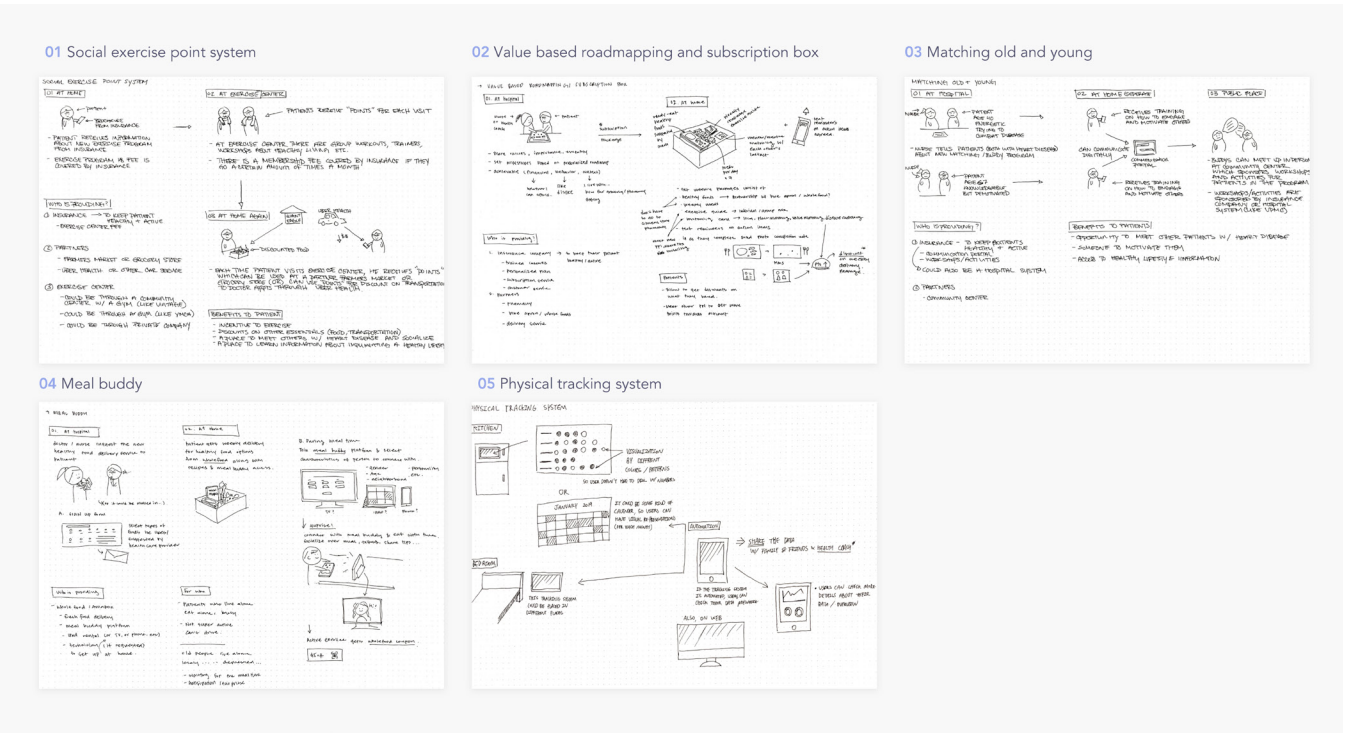


Figure 14: Initial concepts

SPEED DATINGS

With these initial concepts, we performed eight speed dating sessions with elderly individuals, 56 and older, with a variety of chronic conditions. The nature of speed dating, through quickly explaining and probing, helped us identify the essence and limitations of each concept, focus on specific scenario, and brainstorm alternative solutions with the participants. From the speed dating feedback, we were able to better understand the advantages and disadvantages of each concept and narrow our focus for further development.

In general, participants were positive about socialization, both in-person and digitally, convenient access to resources, such as food and expert advice, and having autonomy in selecting what they want.

The participants were opposed to managing multiple aspects simultaneously, such as diet, exercise, medication, and socialization all together in the value-based roadmapping subscription box concept, and having one-way communication via auto-generated notifications. From the speed datings, we realized that we need to consider patient’s short term and long term motivations to encourage continuous engagement. The feedback we received further emphasized the need to focus on the incorporation of the principles of humanistic and streamlined because they are aspects that elderly patients desired.

Vintage user testing + co-design session

We further refined 3 concept directions, which we user tested with elderly individuals at Vintage, a community center for seniors. For these sessions, we developed storyboards, mockups of the digital elements and props to help the participants better understand our concepts and the different elements they would interact with.

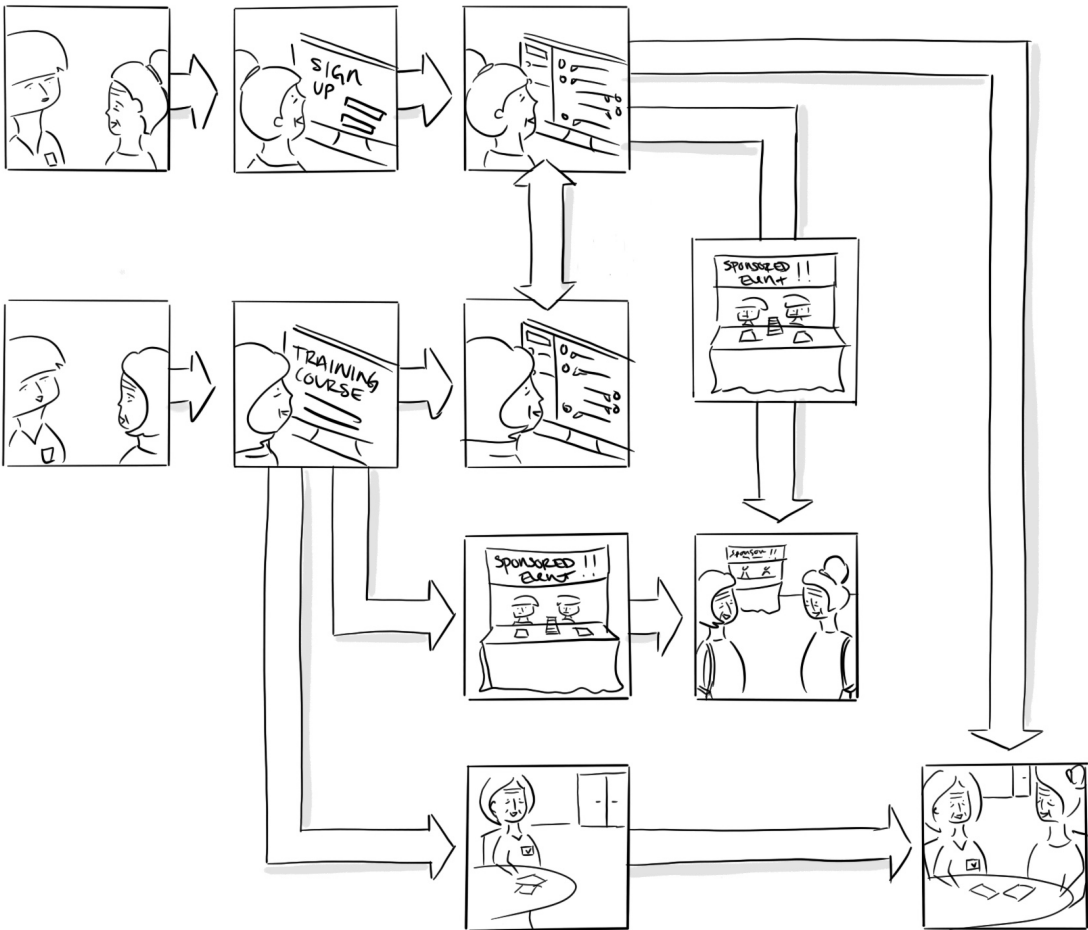


Figure 15: "Mentor program" storyboard

CONCEPT 01: MENTOR PROGRAM

This concept looked at using connections between patients through a mentorship program as a method to provide behavioral and resource support. Elderly patients would learn about the matching service from their doctor. They would be able to sign up and connect to the patient mentor, who is a fellow chronic disease patient who has received training through the mentorship program. The mentors would provide motivational support and act as a point person for the patient to ask questions and learn about available resources. They would be able to chat online, meet in person at sponsored events, and during weekly patient meetup times.

In general, participants liked the social interaction associated with this concept. They saw benefit in connecting to other patients and having different options to meet up, preferring the option to meet up in person over chatting online. Participants suggested we look at how we could use existing programs and facilities as a way to keep the cost down and build stronger ties with the larger local community.

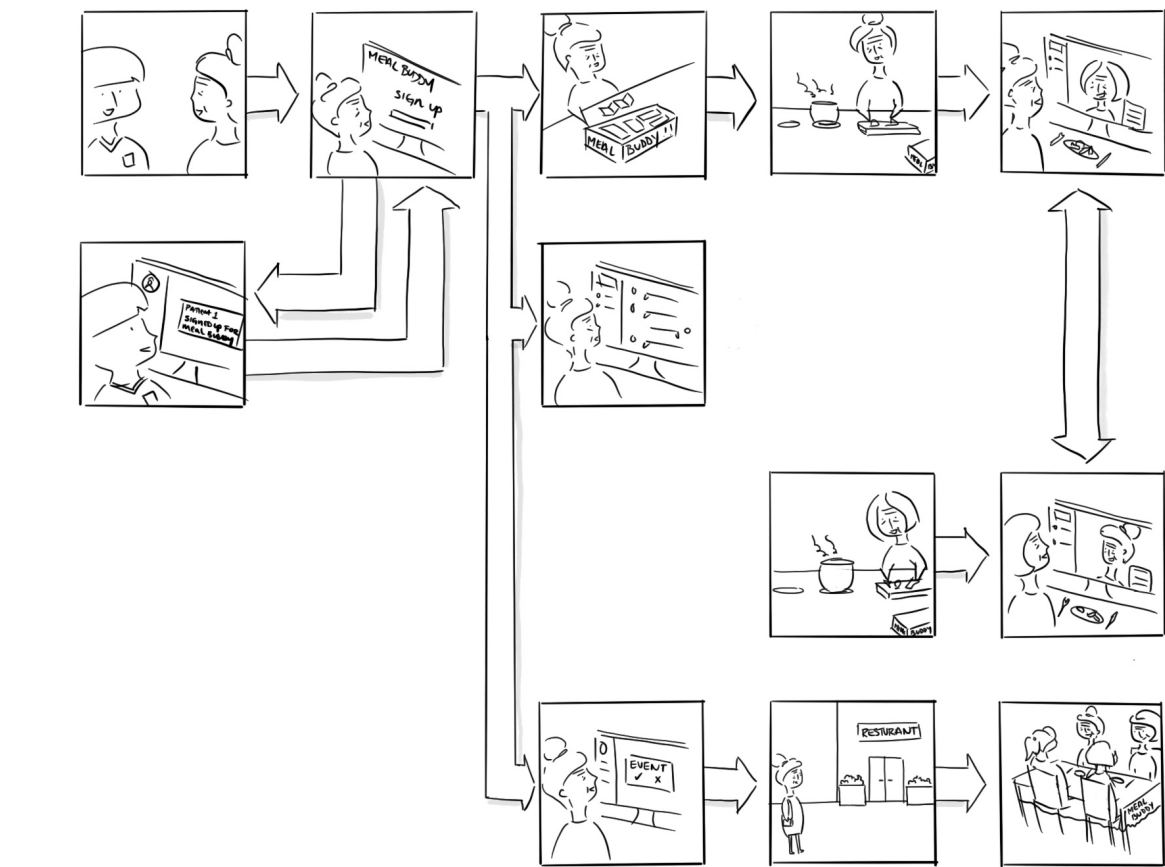


Figure 16: "Meal buddy" storyboard

CONCEPT 02: MEAL BUDDY

Meal Buddy is a food subscription box service that incorporates different resources to support lifestyle changes and make connections with other chronic disease patients through the act of meal time. This concept was targeted toward elderly patients who were more homebound. The patient would learn about the food service from their doctor. They would sign up and be able to personalize their subscription box based on the types of food they enjoyed and topics they are interested in. The patient would receive bi-weekly meals based on their doctors recommendations. The patient would be able to chat online with other meal buddies and video call with them and share a virtual dinner together.

In addition, the patient would be able to access at-home exercise programs, have virtual appointments with their doctors, and interaction with an AI chatbot that would provide information and answer general health questions.

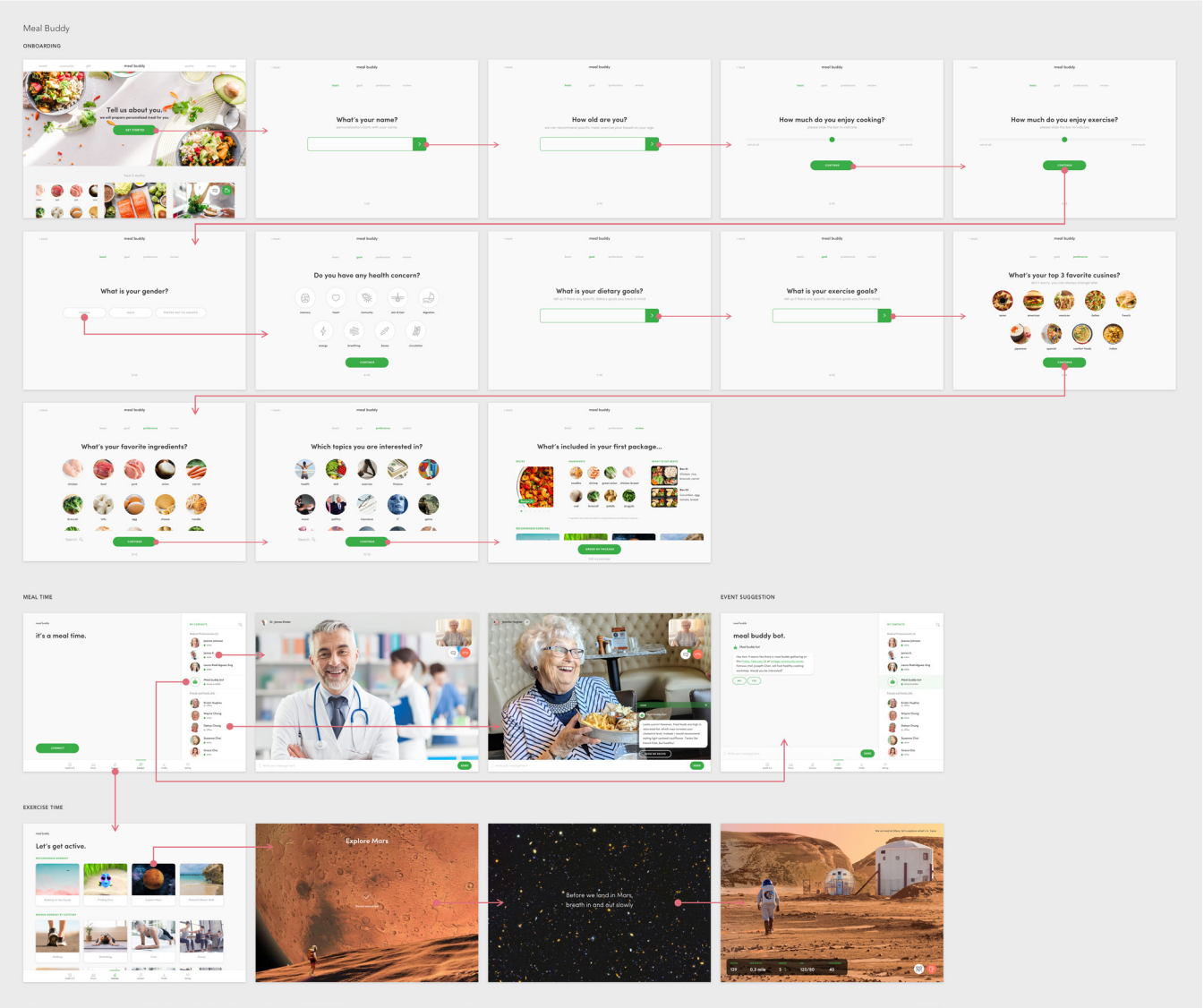


Figure 17: "Meal buddy" wireflow

In general, participants did not have much interest in the food service element saying that it would be nice but is not something that is necessary. In addition, they were not as interested in the at-home exercise and preferred to exercise in group settings with others because it motivated them and allowed them to develop little social support systems. However, participants were intrigued by the elements that helped with administrative complexity, such as virtual appointments and the AI chatbot that would be able to point them in the direction of services and resources.

Many of the participants we spoke with saw benefit in remote appointments for small things like refilling prescriptions or going over test results, because it can be a hassle to schedule and get to appointments. In addition they saw benefit in getting targeted health information about resources and health questions because they find it difficult to filter through all the information online.

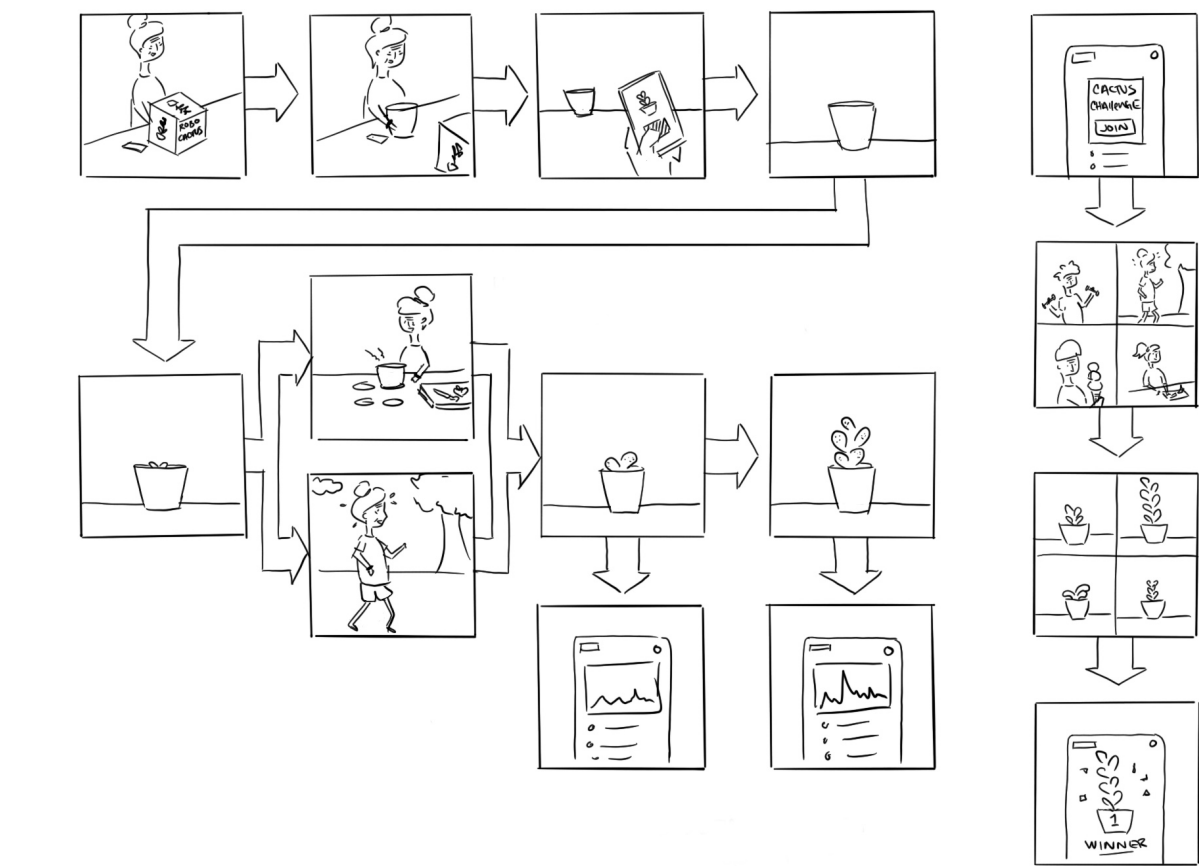


Figure 18: "RoboCactus" storyboard

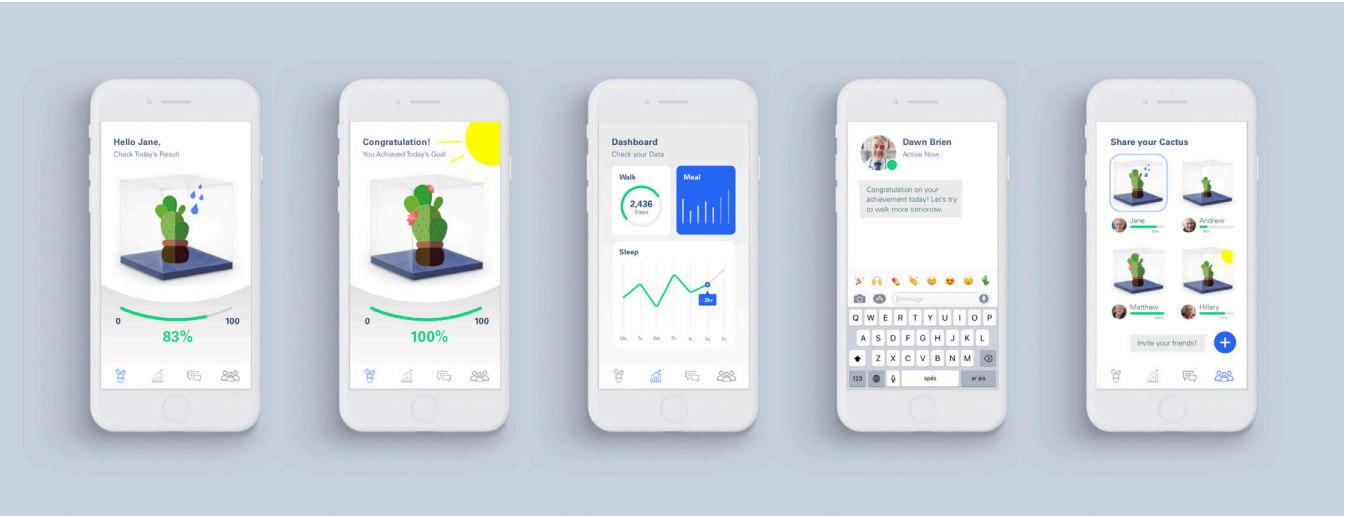


Figure 19: "RoboCactus" wireframes

CONCEPT 03: ROBOCACTUS

RoboCactus is physical activity tracker that would track exercise and diet and act as a motivational object for the patient. The RoboCactus would react to the patient's diet choices and exercise by "growing" and "dying" based on the patient's choices. The RoboCactus acts as an ambient representation of the patient's progress and they would be able to access more data-centric information through the mobile app. The patient would be able to connect with other RoboCactus users and participant in games and challenges to increase motivation. In addition, they would be able to send their progress information to their doctor and chat and receive motivational messages.

In general, participants were not interested in this concept. They were very concerned about the feasibility of how the robot cactus worked and did not feel that it would be very motivating as a object. They did find the competition element interesting and thought it would be motivating for some people but not for everyone. The one element the participants agreed on was that they liked the ability to communication with their doctor, however they said they would prefer if it was video chat verse text message because they desire the face-to-face interaction.

Key takeaways

Overall the session at Vintage provided further insight into what elderly individuals desire in their healthcare experience, as well as their priorities and perceptions of health and its value to them. The following are key takeaways we took with us into our next phase of concept development.

IMPORTANCE OF DOCTOR RELATIONSHIP

The elderly desire and emphasized the importance of face-to-face communication with their doctors. While they appreciated the convenience of remote and video appointments, they still hold the personal relationship with their doctors as an important element of their healthcare experience.

DIFFICULTIES AND STRESS FROM ADMINISTRATIVE COMPLEXITY

The elderly find is extremely stressful when they have difficulties performing tasks which should be simple. Whether refilling prescriptions or booking appointments, the roadblocks they encounter performing these types of tasks really stick with them and shape their perceptions of their healthcare experience.

HARD TO FIND AND FILTER

The elderly are familiar with technology and prefer simple use cases for it. Complex processes and interactions are undesirable and can be uncomfortable and confusing. They see the benefit of technology acting as a resource for finding information and see it as a convenient option to questions they many have. However they struggle to filter through the information overload that is associated with online searching, which can cause them unnecessary stress.

POWER OF COMMUNICATION AND SUPPORT

The elderly see the positive power of communication and support. They emphasized the need to build connections with others as a method to spread awareness and promote motivation in themselves and others. Many times these outside support systems act as a surrogate family to them. They shared stories, advice, and generally look out for one another.

These further insights and understanding of the elderly population and their desires influenced our subsequent pivot in our concept direction and approach to addressing at-home treatment adherence.



Shifting Approach

SHIFTING FROM BEHAVIOR CHANGE TO HOLISTIC UNDERSTANDING OF WHO THE PATIENT IS

From the Vintage visit, we realized that we were focusing on providing resources to help patients with behavior change and lost the value of perception from our initial research. Although lifestyle change is an essential part of the treatment plan that critically influences the patient’s long term psychological and physiological well being, having more resources is not adequate to influence a patient’s motivation to change long-established habits and behaviors.

When addressing behavior change, we found that the patient’s perception of their treatment and their capability to implement it is crucial to address. This can be affected by the communication and relationship between the patient and physician, which the elderly see as very important element to their health and care. Therefore, we decided to shift our focus to help physicians gain a holistic understand of the patient, including their contextual, emotional, and perceptual information, within the office environment. By obtaining a holistic understanding, it enables physicians to personalize an achievable and desirable treatment plan to each individual patient and build an empathetic patient-physician relationship.

FOCUSING ON COMMUNICATION

As previously mentioned, the elderly value the relationships they build with their physicians and these relationships result from the communication and bedside manner they experience during their appointments. A strong relationship and communication greatly influences the patients receptiveness to their physician’s recommendations. By providing an opportunity to understand a patient’s lifestyle, cognitive ability, and emotional status, the physicians can prevent misunderstanding from the beginning and improve patient comprehension, receptiveness, and treatment adherence.

TACKLING THE OFFICE ENVIRONMENT

For the elderly, the importance of interacting directly with their physicians influences their views of healthcare being associated with their physicians within the office environment. This association emphasizes the importance of designing an office experience, where the patient feels cared for and receives clear and personalized communication. Many times the patient will have to apply information they are given by themselves once they return home. By obtaining a holistic understanding of a patient, the physician is able to tailor treatment recommendations to empower patients to take control of their health influencing their at-home treatment adherence.

ROLE OF PRIMARY CARE

Primary care physicians play an important role for patients with chronic conditions. They generally have the most contact with patients for the longest period of time. So building a solid relationship between them is extremely beneficial to the management of chronic diseases because they are lifelong conditions. In addition, insurance companies are promoting the importance of having a primary care physician and the role they can play in overall health and wellness of a patient.

STARTING FROM THE BEGINNING TO INFLUENCE ATTITUDE AND RECEPTIVENESS

The patient journey is a complex one with many stops along the way. One of the first points of interaction for the patient is the waiting room, which plays an important first step for patients. The patients waiting room experience here can influence their attitude and subsequent interactions with their physician once they start their appointment. Waiting rooms are currently being underutilized as an opportunity to gather more information about the patient and get the patient in a health-centered mindset before their appointment starts.

By focusing on the primary care waiting room, we look to use design as method to influence patients through an activity that they have to perform multiple times a year. Their experience here can set the tone for the appointment resulting in how receptive the patient is to the physicians recommendations, which in turn can affect their at home adherence to their treatment plan.

EXPLORING THE NEW DIRECTION

SHARING STORIES INTERACTIVE PUBLIC INSTALLATION AT CLINICS + HOSPITALS VALUE - SHARING STORIES MAKE THE PATIENT FEEL HEARD - PATIENTS READING STORIES WILL MAKE THEM FEEL NOT ALONE AND HELP WITH ACCEPTANCE - MEDICAL PROVIDERS READING STORIES WILL HELP BUILD EMPATHY FOR PATIENTS - STORIES PROVIDE MEDICAL PROVIDERS INSIGHT INTO PATIENTS PERSONAL EXPERIENCE	UNDERSTANDING VALUES VALUES BASED ACTIVITY / GAME VALUE - PATIENTS WILL UNDERSTAND THE CONSEQUENCES OF THEIR ACTIONS / CHOICES - PATIENTS WILL UNDERSTAND AND VOCALIZE THEIR PERSONAL VALUES - PATIENTS WILL BUILD SOCIAL CONNECTIONS WITH OTHER PATIENTS
GAINING KNOWLEDGE DIGITAL PLATFORM WITH AI AGENT VALUE - EASY ACCESS TO INFORMATION - PERSONALIZED INFORMATION / RESOURCES - REDUCE ADMINISTRATIVE COMPLEXITY - MEDICAL PROVIDERS GAIN INSIGHTS OUTSIDE OF HOSPITAL CONTEXT —> MORE THROUGH HEALTH RECORDS	SPREADING AWARENESS PUBLIC CAMPAIGN VALUE - PUBLIC AWARENESS ABOUT CHRONIC DISEASE - BUILD EMPATHY FOR PATIENTS - TRUST PLACE FOR INFORMATION - BRING AWARENESS TO YOUNGER DEMOGRAPHICS

Figure 20: Values for exploring new direction

With this new focus on how design interventions within the primary care waiting room can influence at-home treatment adherence, we started developing design concepts building on the discoveries and concepts from our past conversations with the elderly. We focused on interventions within the office environment, while also exploring how we can connect these experiences to the at-home experience addressing top concerns we heard from the elderly.

How might we help elderly patients with chronic conditions better understand and manage their treatment plan at home?

Value proposition

Before moving onto the prototyping phase, we generated six values we wanted to express with our concept. By understanding the values, we were able to have a reference point to hold our design decisions to once we were deep into the prototyping phase.

Much of the value of our design proposition lies in the way we design the interactions around collecting

meaningful data from the patients. The point of time and method of data transfer allows the physician to gain a better sense of who the patient is at the right time, to personalize the communication approach and treatment plan. Moreover, the cumulative data collection helps build a comprehensive patient profile to support them within and outside of the clinic environment to increase their autonomy in managing their conditions.

VALUE 01: TAILORED ENGAGEMENT

In human to human interaction, communication details- such as nuance, language tone, and gestures- influence how the person perceives the interaction quality. By tailoring approaches in engaging with the patients based on their emotional status, the clinic staff and healthcare providers can set a positive tone for their visits, and influence the patient’s receptiveness and satisfaction.

VALUE 02: PERSONALIZED TREATMENT

Every patient is unique and has different goals, values, and needs. By helping the physicians understand the patient’s outside influences—such as living and social context, or personal concerns—the physicians can personalize treatment plans based on individual capabilities and needs to increase the chance of successful implementation.

VALUE 03: SERVICE RECOMMENDATION

By understanding the patient’s living context and support needs, the clinic can provide personalized service and resource recommendations so patients can use these resources to manage their conditions.

VALUE 04: EFFICIENT DISCUSSION

Information about the patient’s health literacy levels, personal concerns, and appointment needs can better inform physicians to personalize their communication with the patient to utilize limited appointment time more efficiently. By having vitals pre-checked that the start of the appointment, healthcare providers can focus on meaningful discussion.

VALUE 05: PATIENT COMPREHENSION

Patient comprehension of their treatment plan is crucial in their ability to retain and implement suggestions from their physicians. By collecting data about the patient’s cognitive ability and health literacy levels, the clinic and healthcare providers can personalize the language they use to increase patient comprehension.

VALUE 06: AWARENESS AND EMPATHY

Although we are focusing on chronic elderly patients, it is important to prevent the disease by implementing good health behaviors within the younger generations. Patient’s personal stories can inform other patients (in primary care clinic from kids to adults) understand the importance of lifestyle habits, and allow physicians to build a proper understanding of their patients.

Value proposition

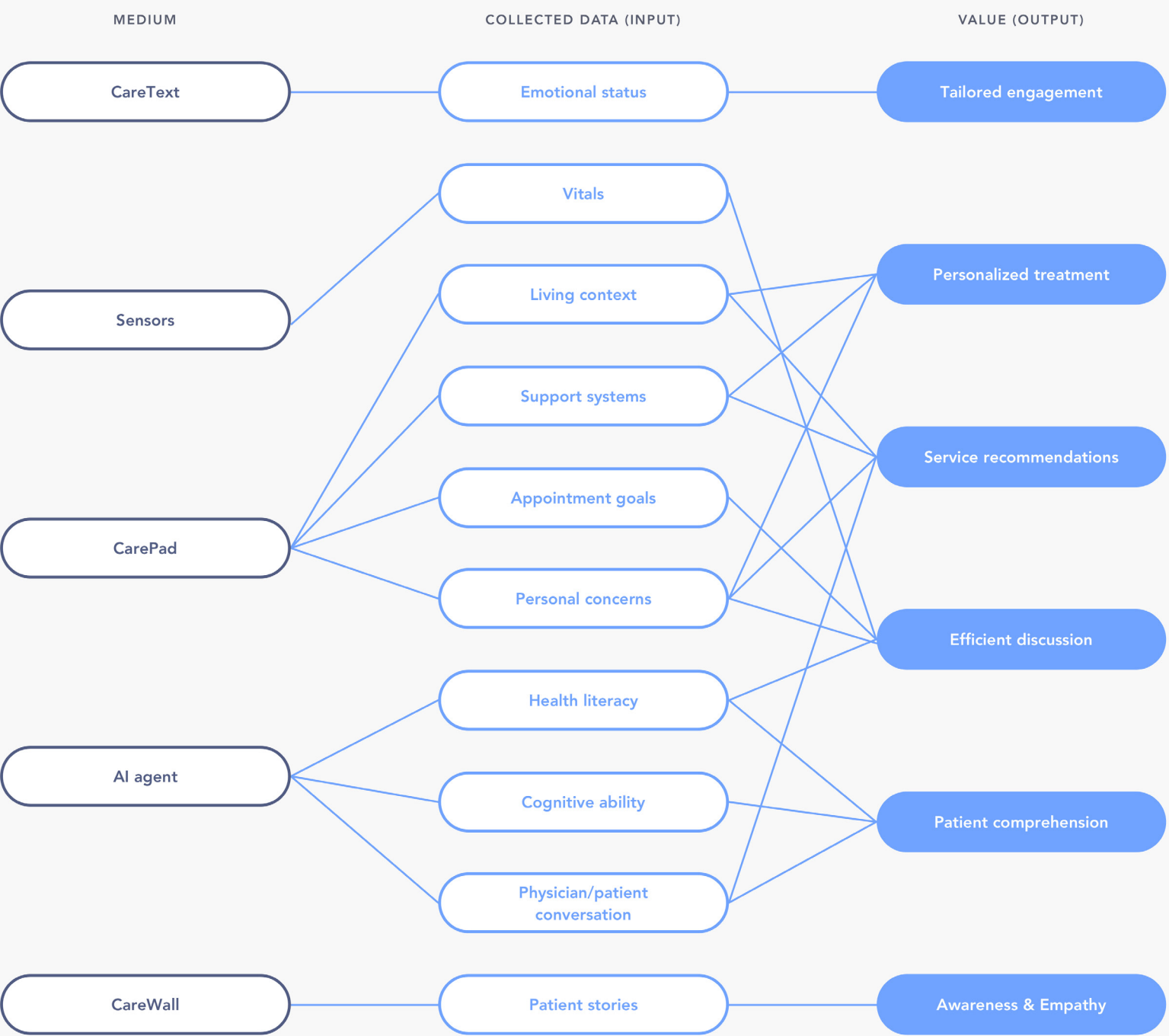
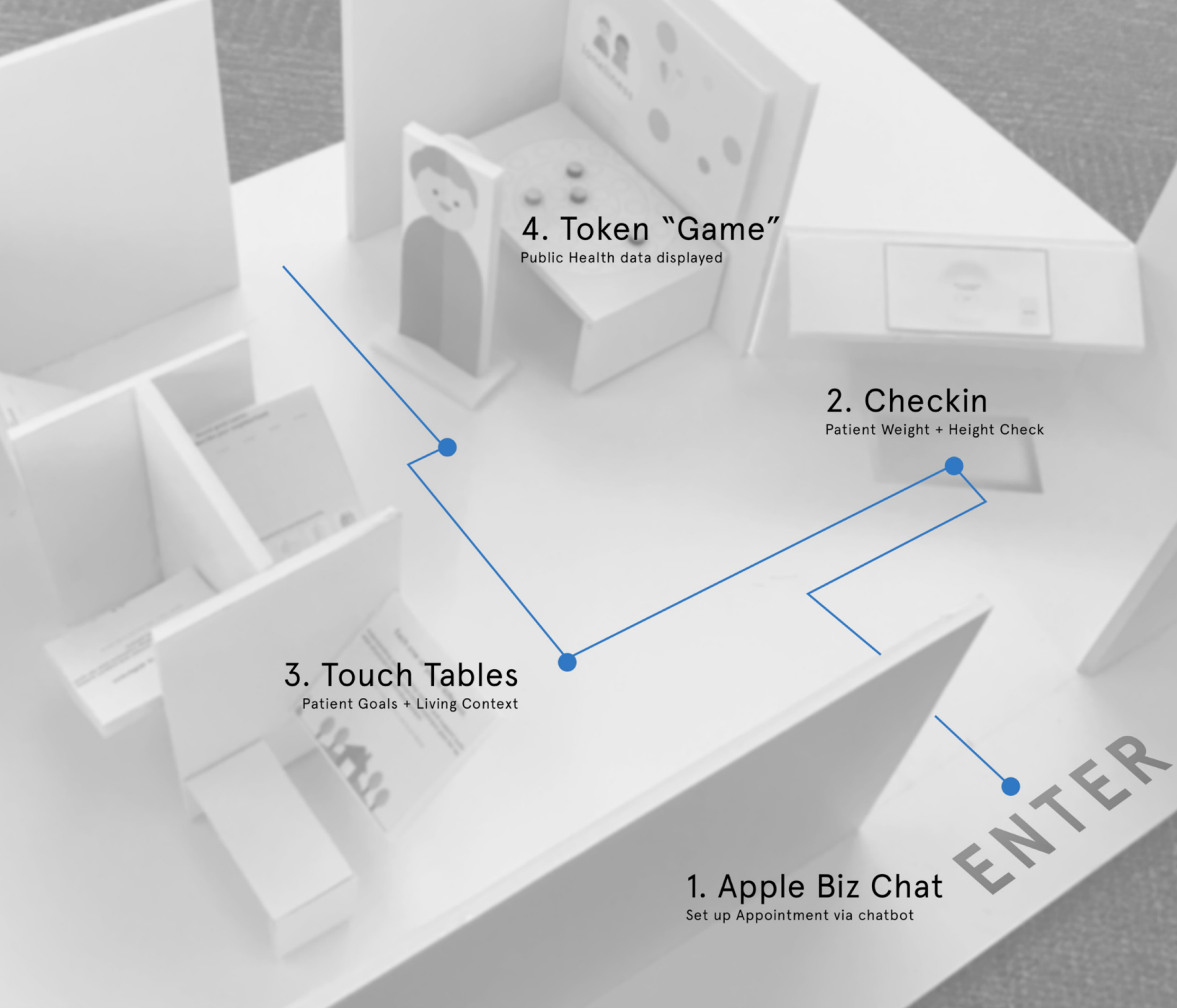


Figure 21: Value proposition



Concept user testing V2

After rapid prototyping with foam core models and wireframes, we performed five user testings sessions with two subject matter experts and three design students to test usability and feasibility of our concept direction. We incorporated the previous user testing information from the Vintage session, including usability for the elderly, and applied it to the new concept and prototype. From these testings, we made four major refinements.



Figure 22: Concept user testing session

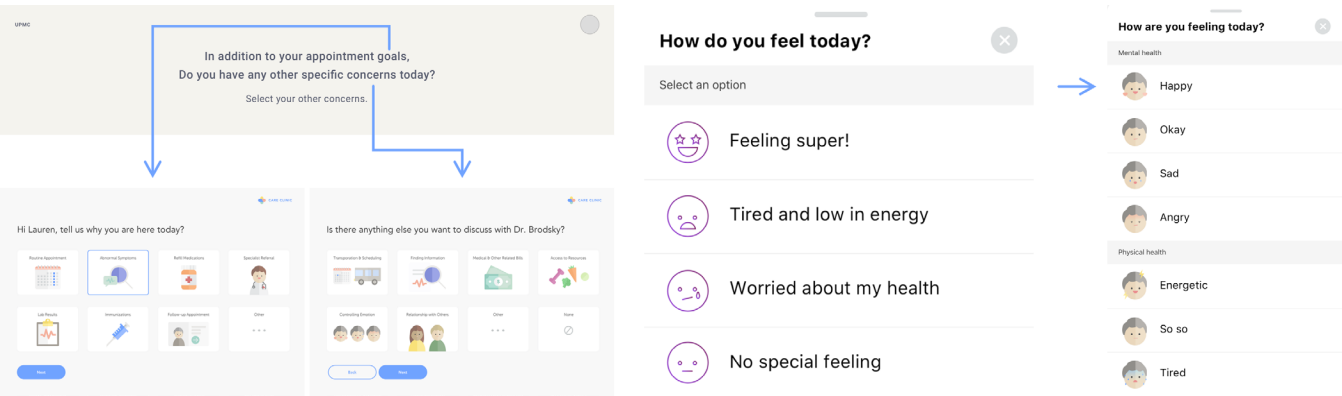


Figure 23: Content language refinement

REFINEMENT 01: CONTENT LANGUAGE

We spoke with a Ian Hardgraves PHD, from the Mayo Clinic, who performs research on improving patient-physician communication. This testing session focused on looking at the written and visual content and how it can be perceived by a patient when presented in certain contexts.

With the limited written content that informed the patient of the purpose of each task presented, we initially utilized clear content that leaned toward conversational but clinically sounding. We focused on using words that would be understandable to the patient, such as goals and concerns. However, after our testing session, we learned that the language we perceived as clear, actually is misleading and confusing for patients. Hardgraves spoke about how words like “goals” and “concerns” can have very different meanings for different people, especially when paired with the selection options we included which ranged from specific tasks to more abstract unknown discussions. He suggested we focus on developing content that was simple and leaned toward conversational, because it allows the patient to perceive

the questions based on their own understandings verse what we determine should be their understanding. Based on this feedback, we revisited our written content developing instructions that were more general but informed the patient that they should complete the task presented to them. For ex. “Do you have any other specific concerns today?” changed to “Is there anything else you want to discuss with Dr. Brodsky?”

In addition, we revisited the emotional representations. Initially we used general sounding feelings/phases, which stayed away from specific emotions. We found that this approach was confusing because it was too open to perception by the patient, which would be difficult for the clinical staff to understand. Based on this insight, we focused on using a specific and logical progression of emotions, such as happy and sad, which would be understandable to many different users. We also separated them into physical and mental health categories allowing patients to address the complex feelings they may be experiencing.

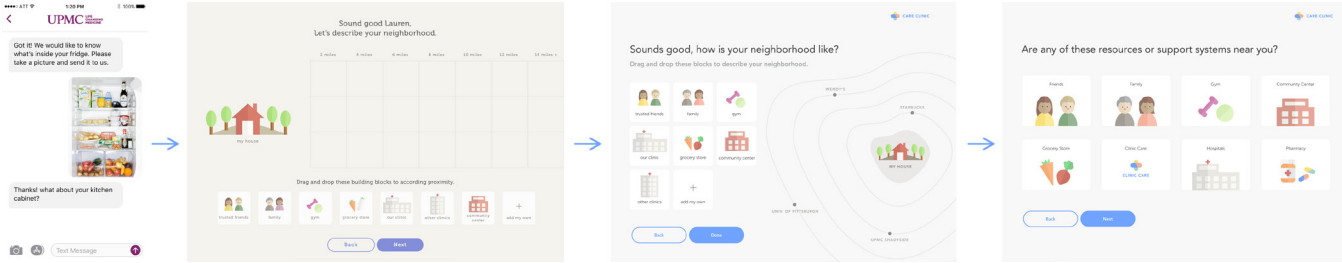


Figure 24: Interaction pattern refinement

REFINEMENT 02: INTERACTION PATTERN

Usability testing helped us refine the interaction patterns as well. For example, we initially imagined to gather the living context information via text bot, but we learned that sharing pictures of the private environment may be uncomfortable for patients. We then identified a few living and social context information that would help the physician make more informed decisions on the behavioral plan, and decided to gather the information at the clinic context during the waiting time.

In the following user testing session, we utilized a mile representation as a mean to help patients describe their neighborhood. From the testing, we learned that the patients might not recognize the exact distance to their support systems, so we revised the interaction pattern to include major landmarks and have them drag and drop different building blocks according to location.

From then on, we realized the drag and drop interaction might physically be challenging for patients with mobility impairments, such as arthritis, and what is essential is the indication of support systems that are near them, not the exact locations. Therefore, we changed the interaction pattern to simple tapping and removed all unnecessary requirements.

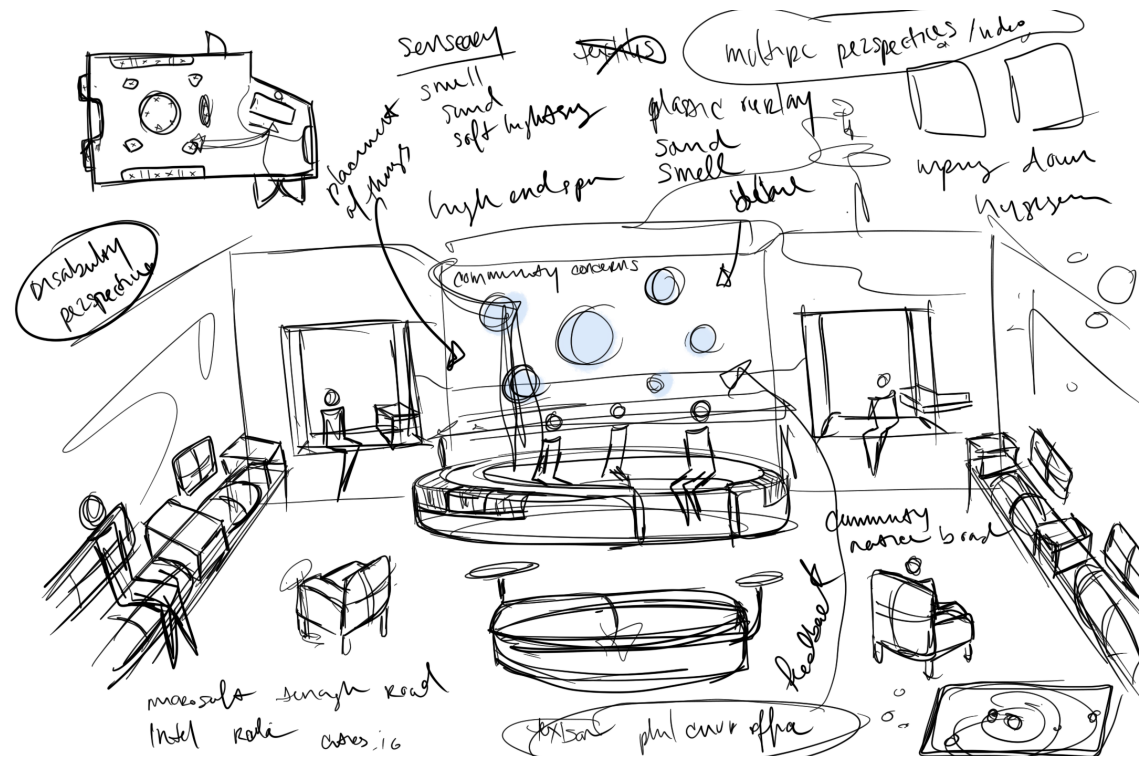


Figure 25: Space design user testing note

REFINEMENT 03: SPACE ATMOSPHERE AND ARRANGEMENT

We spoke with a Daragh Byrne PHD in the Architecture Department about the design of our clinic waiting room. When designing the space, we initially utilized research from Steelcase about healthcare space and furniture design as a starting point for the first iteration of our new waiting room. We incorporated principles from this research, such as providing multiple options of seating (private and communal) allowing patients to choose based on their preferences.

In addition, we considered how the waiting room would reference the visual design of our screens to provide the patient with a complete and welcoming experience that referenced all the elements we were designing.

After our testing session, we learned that while we were focusing on practical elements, such as furniture placement and type, which is important, we were overlooking elements that addressed the atmosphere of the space. Sensory elements, such as lighting quality, sounds, and smell, impact the atmosphere of a space greatly and can be influencing elements to patient emotions and attitude. Based on this, we iterated on our waiting room design looking at incorporating more atmospheric elements, such as natural light and nature features (ex. living wall and potted plants).

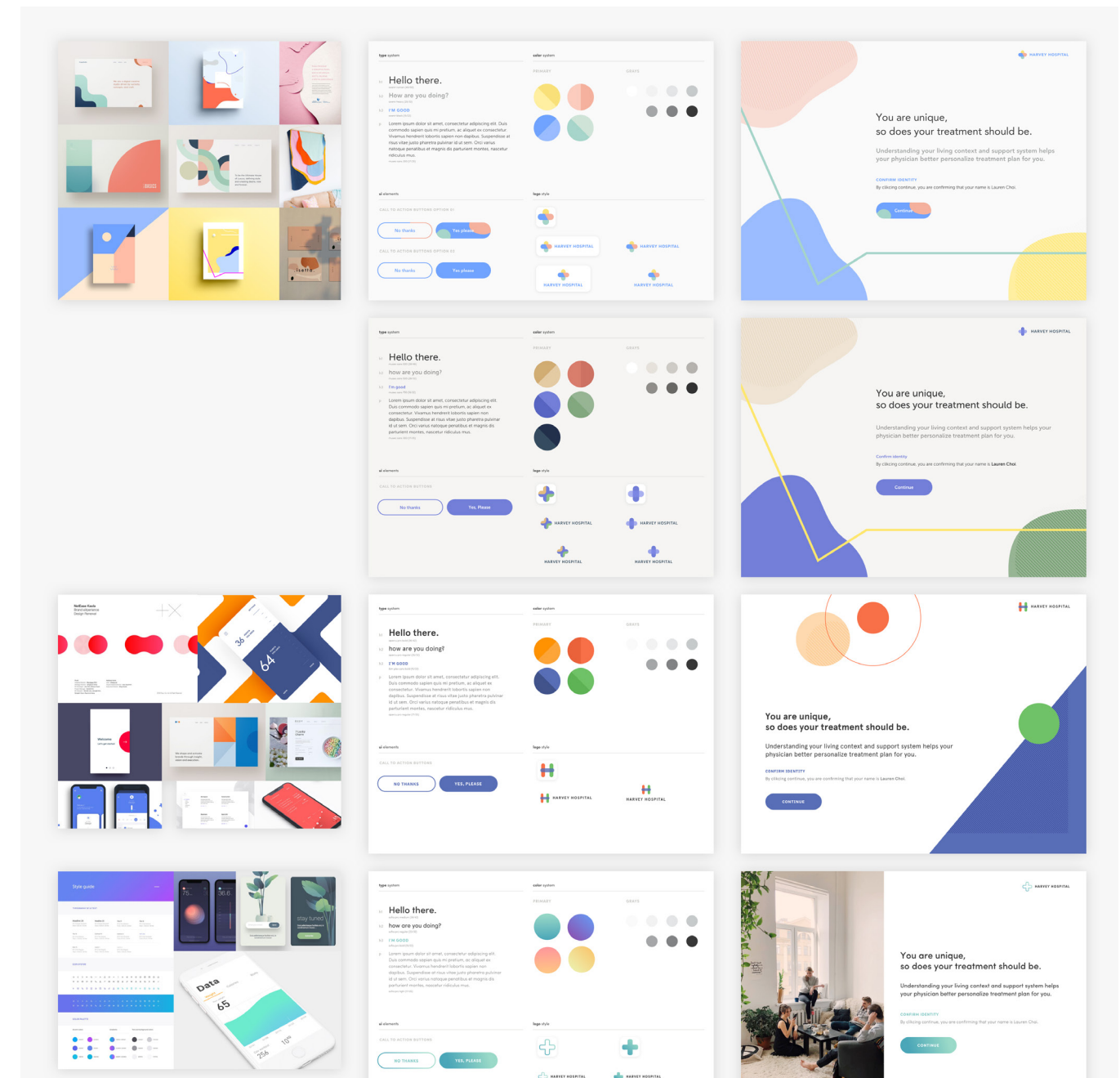


Figure 26: Visual style exploration

REFINEMENT 04: CONSISTENT VISUAL STYLE

The concept testings also helped us identify the visual voice and tone we wanted to portray with our space and interface designs. We aim to delineate a caring and encouraging tone to positively influence the patient's psychological and physical well being. We looked into various inspiration on interface design, branding, environment, and content voice and tone.

From then on, we generated three mood boards and the respective style options to quickly prototype various visual themes. We chose an organic theme to portray the humanistic nature of healthcare and the bright pastel color scheme to influence the positive and uplifting feelings. We named our project Care Clinic to emphasize the core values of medicine, care and compassion for a person.

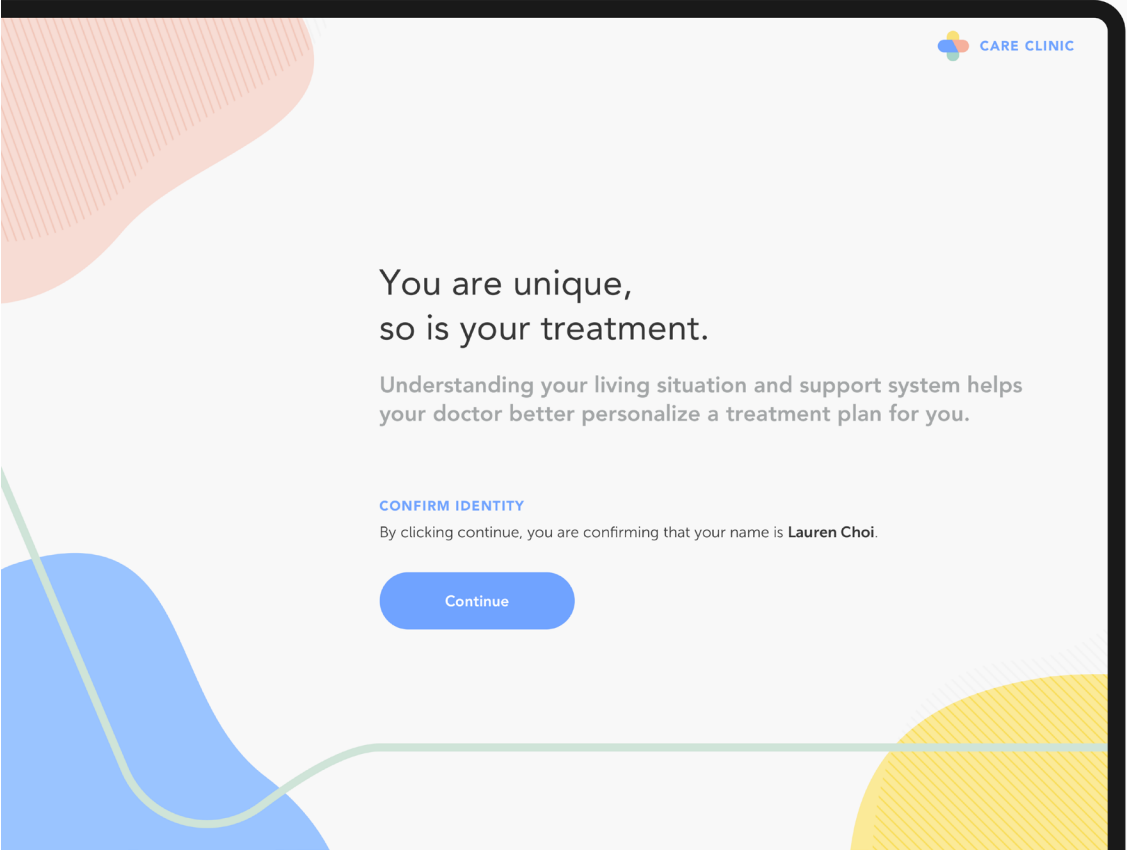
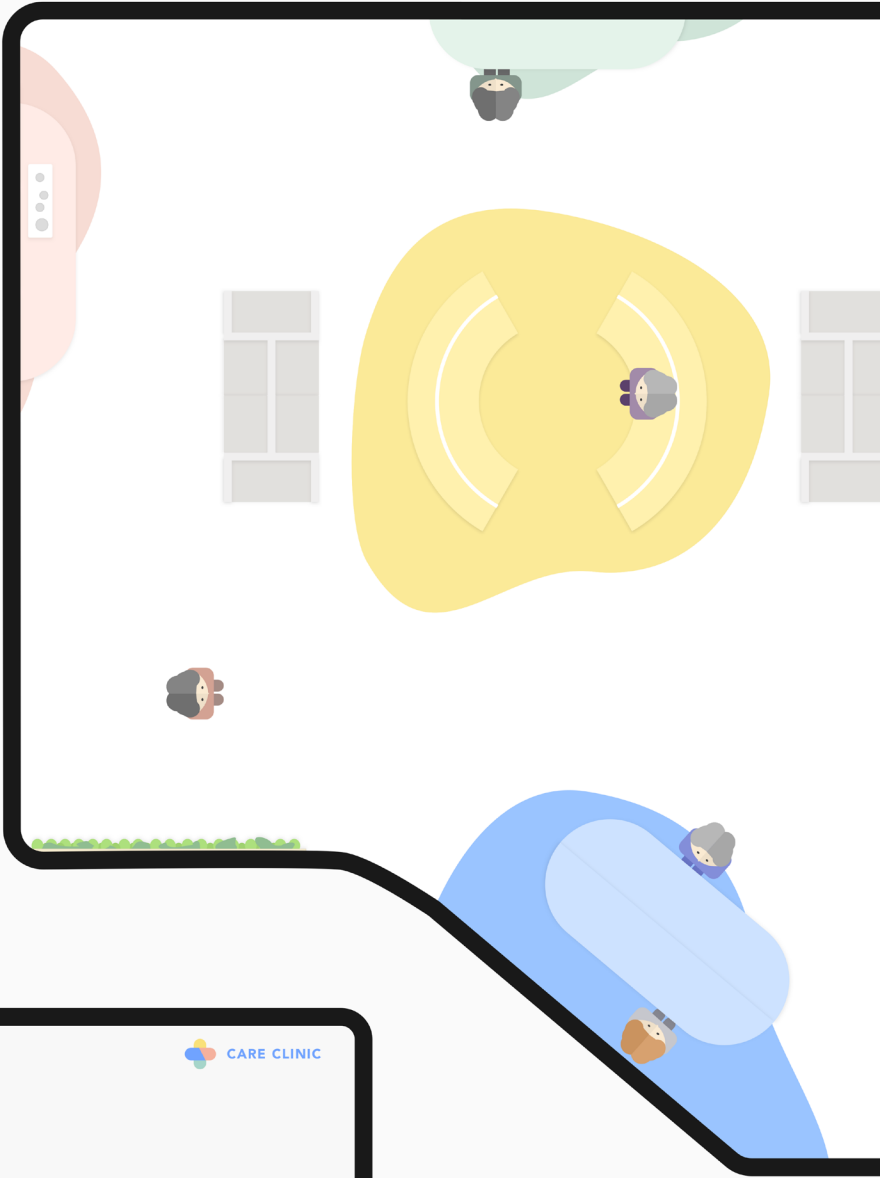
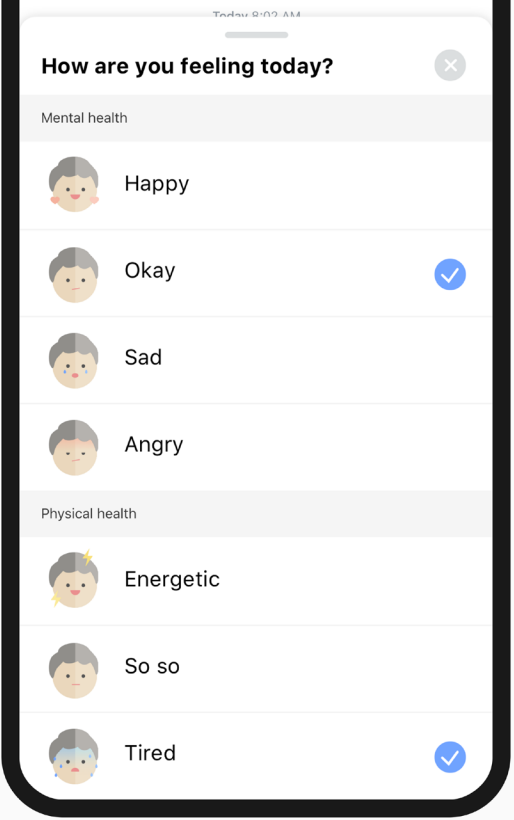
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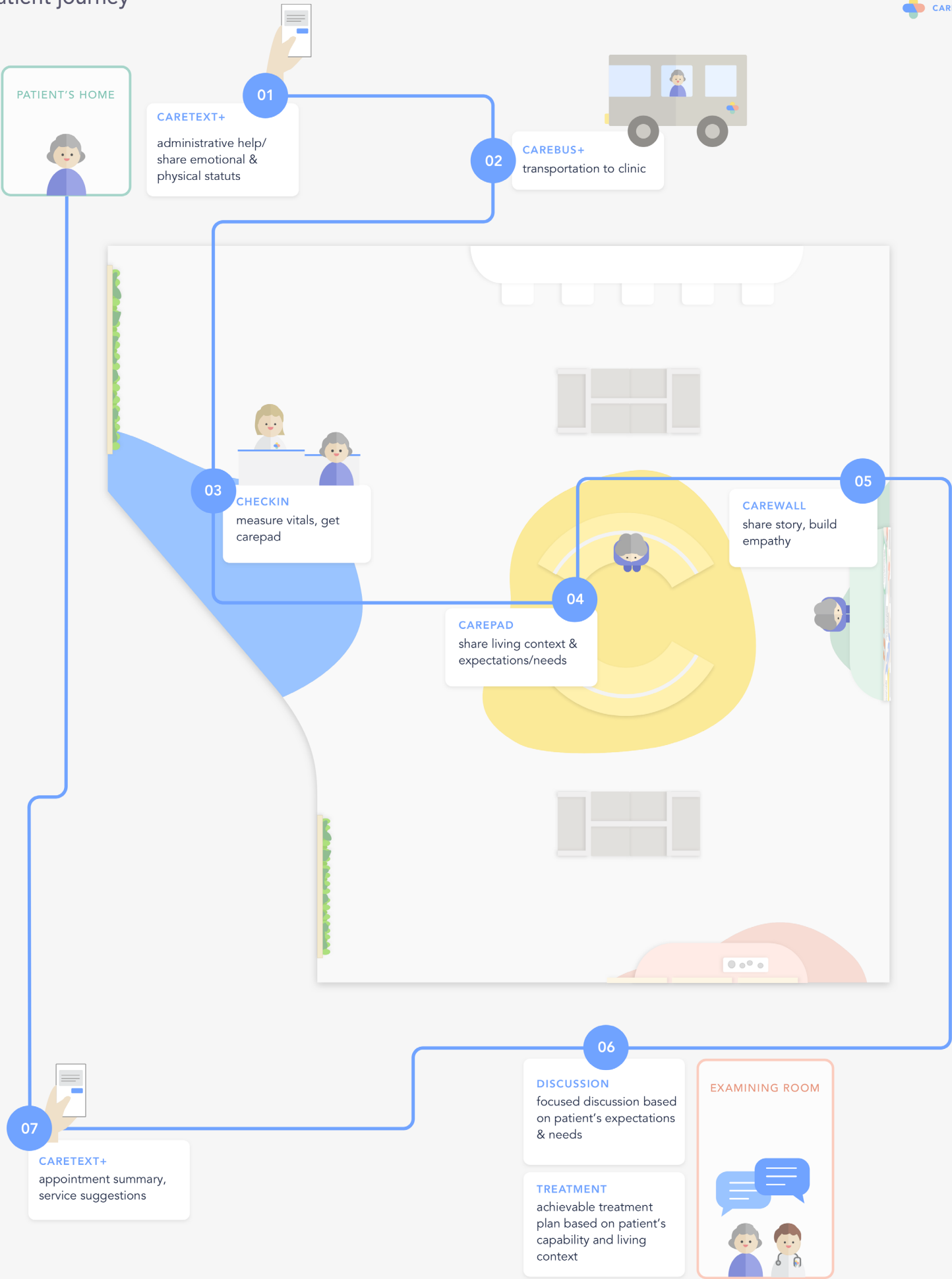
Design intervention

Care Clinic

Care Clinic is a reimagining of the primary care clinic check-in process and waiting room environment. Care Clinic aims to provide an opportunity for physicians to gain a holistic view of the patient to improve physician-patient communication, which affects the patient’s receptiveness, attitude, and impression of the overall care they receive.

Care Clinic utilizes multiple digital and physical touch points within and outside of the clinic environment to influence the patient’s emotional and physical well being. Digital touchpoints gather a patient’s psychological, contextual, and perceptual information to better inform healthcare providers to personalize treatment plans and build a long lasting relationship with the patients. Physical touch points help set a positive tone for the medical services they receive by reducing wait time and providing a comforting atmosphere.





Patient journey

Care Clinic consists of seven touchpoints that consecutively builds up, within and outside of the clinic environment.

TOUCH POINT 01:

The CareText deals with easing the administrative process for the patients. With CareText, patients can schedule appointments and arrange transportation. In addition, CareText collects the patient's emotional status on the date of their appointment to personalize the Care Clinic experience.

TOUCH POINT 02

The CareBus provides transportation support for the patient. Based on the information from the patient profile, such as address and special needs, CareBus provides a personalized, safe ride to their local Care Clinic.

TOUCH POINT 03:

Once the patient arrives, a CareStaff aid welcomes them and begins the check-in process by measuring their vitals and handing out the CarePad.

TOUCH POINT 04:

Patients can then use the CarePad to share their living context and appointment needs with their healthcare providers before the appointment begins. A CareStaff aid floats around the waiting area to provide assistance to any patients that may need help.

TOUCH POINT 05:

The CareWall provides emotional support to the patient by serving as a supportive patient community within the Care Clinic environment. Patients can add their own stories or read stories from other patients. These shared stories help build empathy and act as a resource to learn, share advice, and support others.

TOUCH POINT 06:

The physician side of the CarePad summarizes the information collected from the patient. With visual aids and suggested discussion points, the physicians and nurses can have a targeted discussion about a patient's progress, appointment needs, and outside influences.

TOUCH POINT 07:

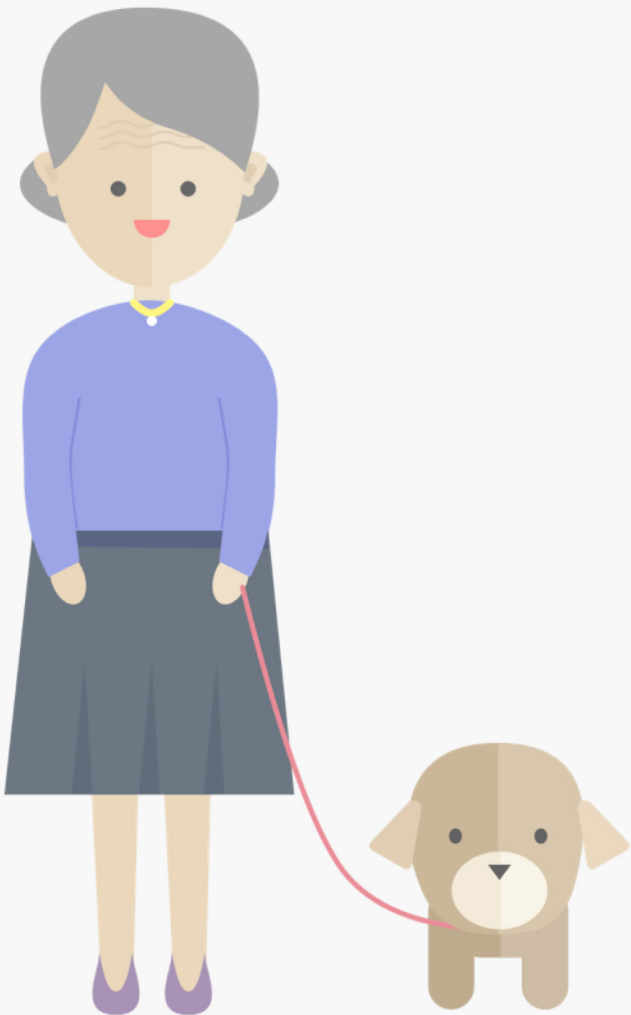
After their appointment, the patient receives an appointment summary based on the conversation that occurred between the patient and medical providers. In addition, they receive continuous support through service suggestions between their appointments throughout the year based on their patient profile.

Figure 27: Patient journey

Meet Lauren

Lauren is a 68 year old patient, who has chronic heart disease. She normally visits the Care Clinic every 3 months to check her on-going process and to discuss adjustments to future treatment plans. Not long after she and her husband moved to Pittsburgh, her husband passed away, and she now lives alone with her dog, Daisy. Following the death of her husband, Lauren felt lost and did not keep up with her healthcare as actively and missed her past routine appointment. While still suffering from grief, she is started to become more focused in addressing her health, as well as trying to make new friends to stay active and healthy. However, she is not very familiar with her neighborhood and unaware of the available resources and services she could be using. A few days ago, she experienced sudden chest pains and made an appointment to check with her doctor.

Meet Lauren



Background

Lauren is 68 years old chronic heart disease patient. She lives in a mid sized city, Pittsburgh, with her dog, Daisy. She often feels lonely and doesn't have a lot of friends nearby.

Goals

- Be more active and social
- Find a support system that motivates her
- Convenient access to things she need
- Find resources that fit with her current financial and contextual situation
- Take care of her dog, Daisy

Behavior

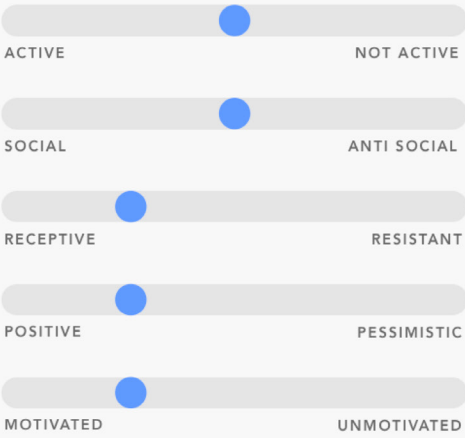


Figure 28: User persona

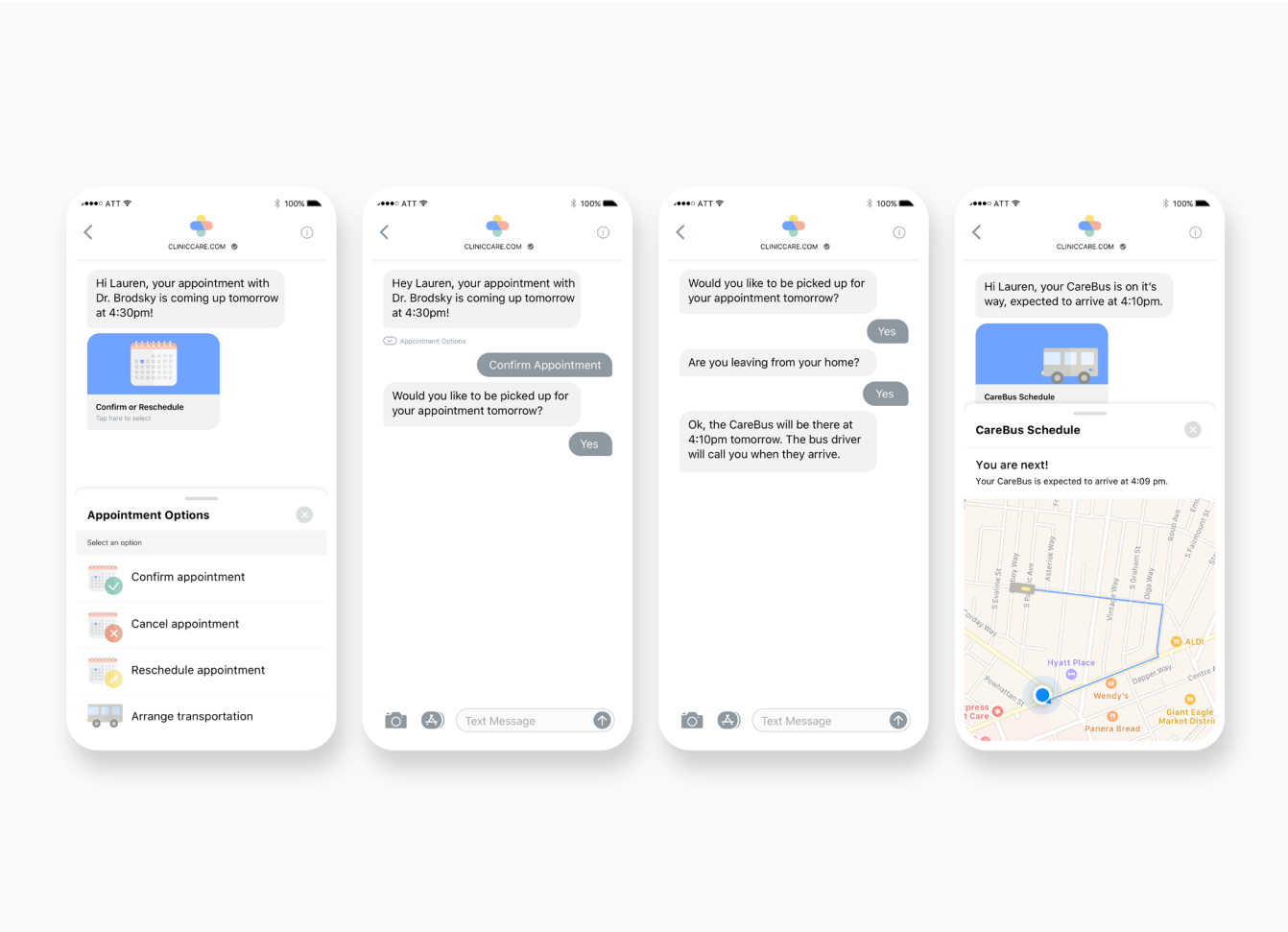


Figure 29: Care Text (administrative aid)

01: Care Text & Care Bus

The day before the appointment, Lauren receives a text message from the Care Clinic, asking whether she needs help rescheduling or getting to her appointment. She confirms her appointment and schedules a pickup.

She feels relieved that she doesn't have to worry about calling a cab tomorrow since she doesn't own car.

EASING THE ADMINISTRATIVE PROCESS

Many elderly patients struggle to manage administrative tasks on their own. The CareText is our first touchpoint to set a positive tone for the patient experience by simplifying the administrative process, such as arranging transportation and scheduling appointments, with a simple text interaction. It learns about the patient's preferences and behaviors to streamline the process, instead of asking too many questions. Based on the contextual information in the patient profile, such as home address and special needs, CareText automatically schedules the right transportation option for the patient. By providing a convenient way to reschedule or confirm the appointment, CareText can also reduce the frequency of missing appointments, making both physicians and patients happy.

The CareText utilizes Apple business chat to allow elderly patients to conveniently accomplish their tasks within regular iMessage without having to download a separate application. Text messaging is an interaction that the elderly are familiar with performing, making the CareText accessible to a range of ages. For Android users, we imagine the text comes in regular SMS Messages feature without Apple specific functionalities, such as option picker and map kit.

Design principle(s) used:
Positive, Streamlined, Simple and natural interaction

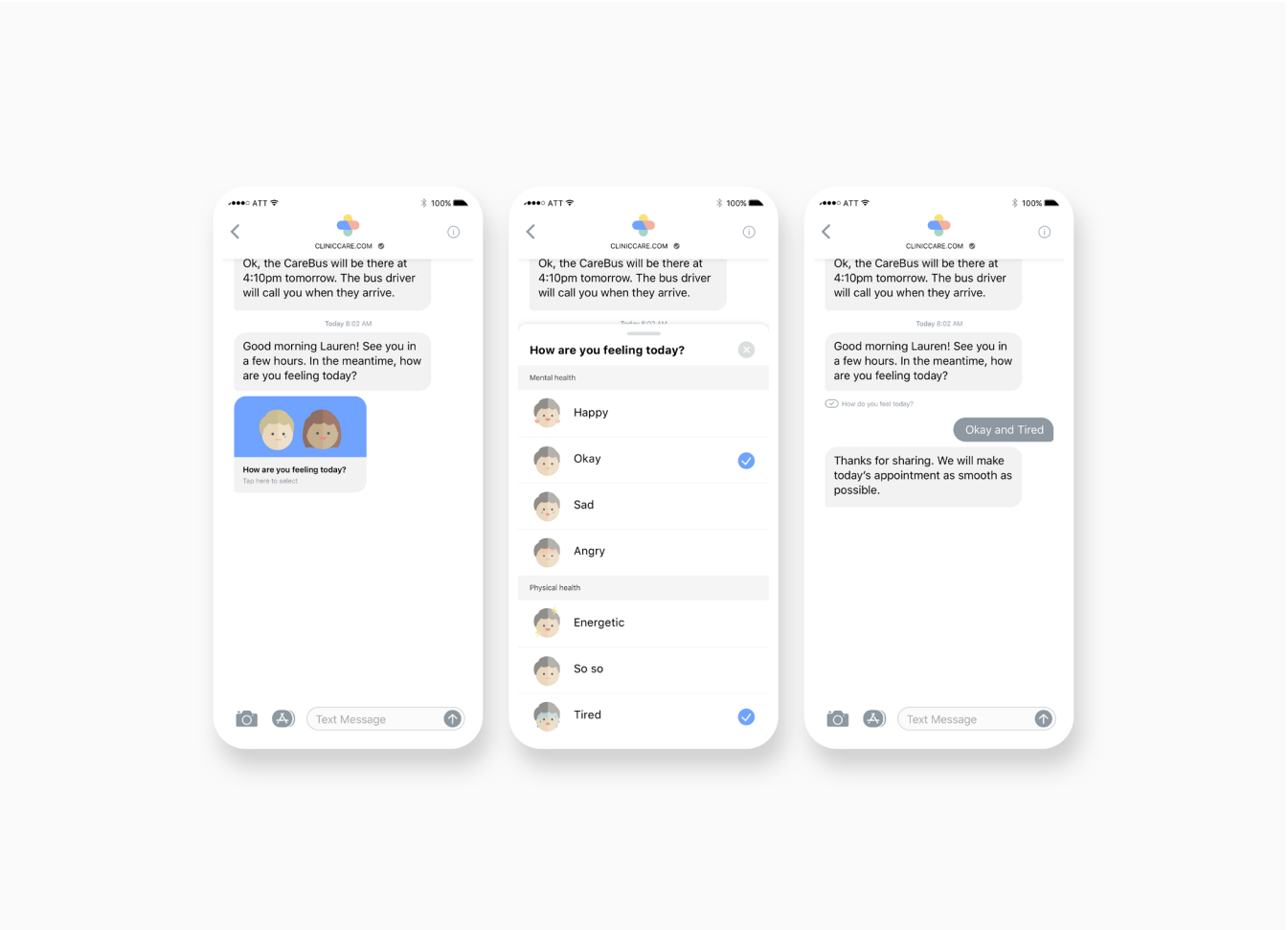


Figure 30: Care Text (emotional status)

02: Care Text (Emotional status)

On the day of the appointment, Lauren receives another text message from the CareText, asking how she is feeling that day, both emotionally and physically.

She shares how she feels, and is glad that the Care Clinic cares not only about her physical wellbeing, but also about her emotional wellbeing.

IMPORTANCE OF MENTAL HEALTH

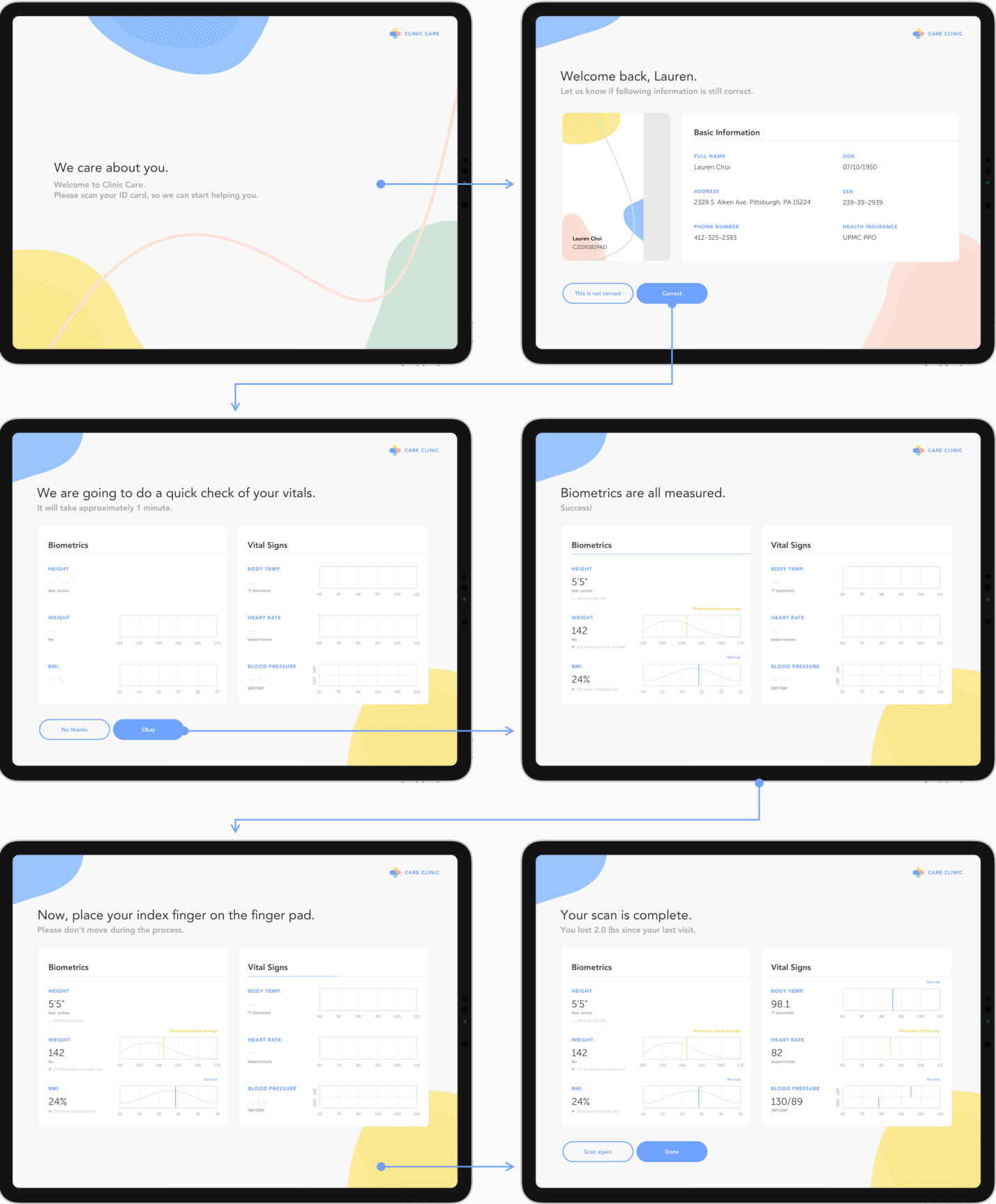
A patient’s emotional state heavily influences their receptiveness to the physician’s recommendations during appointment discussions. By collecting their emotional data beforehand with the CareText, it enables the clinic staff and healthcare providers to tailor their approach in engaging with the patient and adjust the appointments as needed. Depending on the selected feelings, patients get different responses from the CareText that portrays empathy and care for each patient.

Parie Grag and Sam Glick from Harvard business review also suggests that patients may feel more comfortable sharing their emotions with text bots than humans who they have never met before (Glick et al. 2018). Although CareText is not meant to provide extensive counseling service for the patient, it can help prepare patients to open up and share their inner feelings with healthcare providers once they arrive at the Care Clinic.

Text interactions are widely used for mental health counseling, such as Woebot (<https://woebot.io>), due to its inherent anonymity that assures patients.

Design principle(s) used:

Personalized, Streamlined



03: Check-in

Once Lauren arrives to the Care Clinic, a CareStaff aid welcomes her and begins the check in process by helping her measure her vitals. Lauren scans her Care Clinic ID card to bring up her patient profile. She confirms her personal

information and has her biometrics and vitals checked, all within the check-in station. She appreciates the friendly staff helping her throughout the process, as well as seeing her physiological improvements since her last visit.

STREAMLINING THE JOURNEY

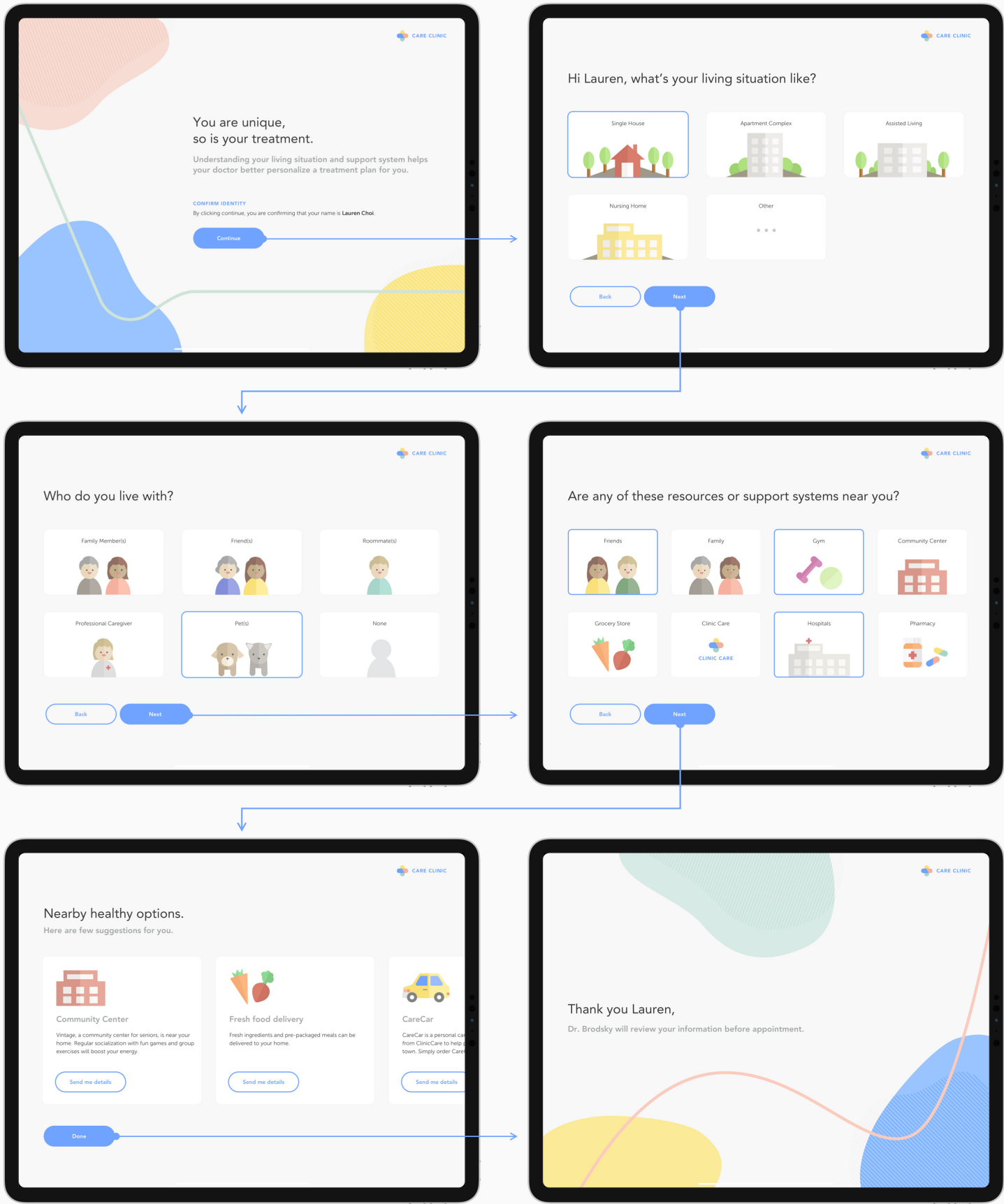
The nurse plays an important role in gaining insight into the patient's medical and social history, and this is normally done through conversations while she is checking the patient's vitals. For Care Clinic, we rearranged the patient journey to utilize check-in time more efficiently to allow more time for patient-nurse discussion. By moving the diagnostic process to the waiting room, the nurse gains more time to have uninterrupted conversations with the patient once the appointment begins.

As for the check-in station arrangement, we imagine a built-in weight scale on the floor, height scan sensors inside the side wall, and ECG/temperature reading finger pad on the check in table, so the patients can have their biometrics and vitals checked all in one stand.



Design principle(s) used:
Humanistic, Streamlined

Figure 31: Care Pad (Check-in) / Image on the right from: <https://resjescare.co.uk>



04: CarePad (living context and support system)

After Lauren completes her check-in, a CareStaff aid hands over the CarePad and explains that she has to update her living context information because it has been six months since her last appointment. Lauren finds a comfortable seat in the waiting area by the window. She likes the calm and welcoming atmosphere of the Care Clinic waiting room because she tends to get a little nervous before

seeing her doctor. She begins to input her living and social context information on the CarePad. After she finishes, she sees recommendations that match her needs. She feels empowered and wants to learn more about these services and resources that fit with her current financial and contextual situation.

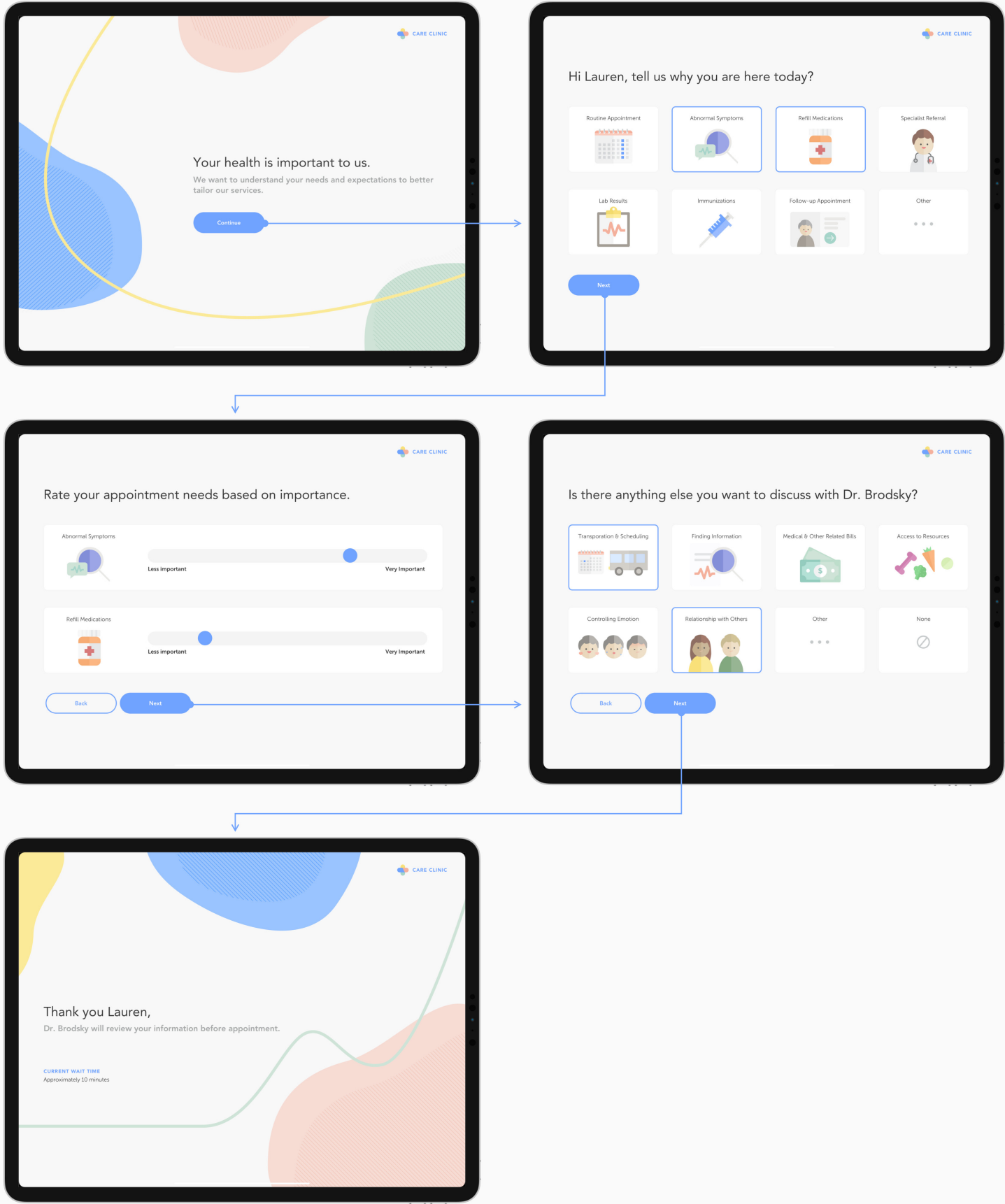
GAINING A HOLISTIC PICTURE OF THE PATIENT

A patient's living and social context are important factors to consider when diagnosing and planning their treatment. Home visit programs are ideal in providing an opportunity to examine the patient's environmental context, such as proximity to a grocery, to personalize the behavioral treatment plan and maximize the probability of actual implementation. However, home visit programs are often not available to everyone and can be burdensome for physicians due to extensive travel time. In the traditional office visit scenario, acquiring this information is even more challenging due to the limited time physicians have with the patient and the amount of information they must go through together.

By utilizing the wait time to allow patients to share their living and social context, the CarePad can better inform physicians and nurses allowing for more personalized treatment plans. Physicians and patients can collaboratively design a treatment plan based on their individual capability and resource availability to increase motivation and treatment adherence. Personalized service recommendations also enable greater autonomy for patients in managing their conditions at home.

Design principle(s) used:
Personalized, Simple and natural interaction

Figure 32: Care Pad (Living context and support system)



04: CarePad (expectations and concerns)

Continuing on the CarePad, Lauren shares her appointment needs and personal concerns while waiting. She appreciates that she is able to voice her opinion and have a say in how she would like to use her appointment time at the Care Clinic.

Before she joined the Care Clinic, she felt her concerns and priorities were not always addressed when she visited other clinics in the area.

SURFACING PATIENT EXPECTATION & CONCERNS

Although each patient comes to their appointment with different needs, the 15 minute discussion in the examination room is often generalized to the appointment type, making the patient feel directed and unanswered.

The CarePad provides patients an opportunity to voice their expectations and priorities for their appointment, as well as their personal concerns outside of the medical context. Based on this information, physicians can efficiently utilize the limited appointment time to have focused discussion, and address the lifestyle burdens that may be mentally weighing on the patients.

By allowing patients to share personal concerns with the physician, the CarePad enables physicians to build a trustful relationship with patients by showing empathy, making more informed medical decisions, such as choosing the right medication in affordable price range, and suggesting additional services or specialists tailored to the patient's needs.

Design principle(s) used:
Personalized, Streamlined, Simple and natural interaction

Figure 33: Care Pad (Expectation and concerns)



Figure 34: CarePad / Image from: <https://www.trustedreviews.com/news/ipad-pro-bent-3638977>

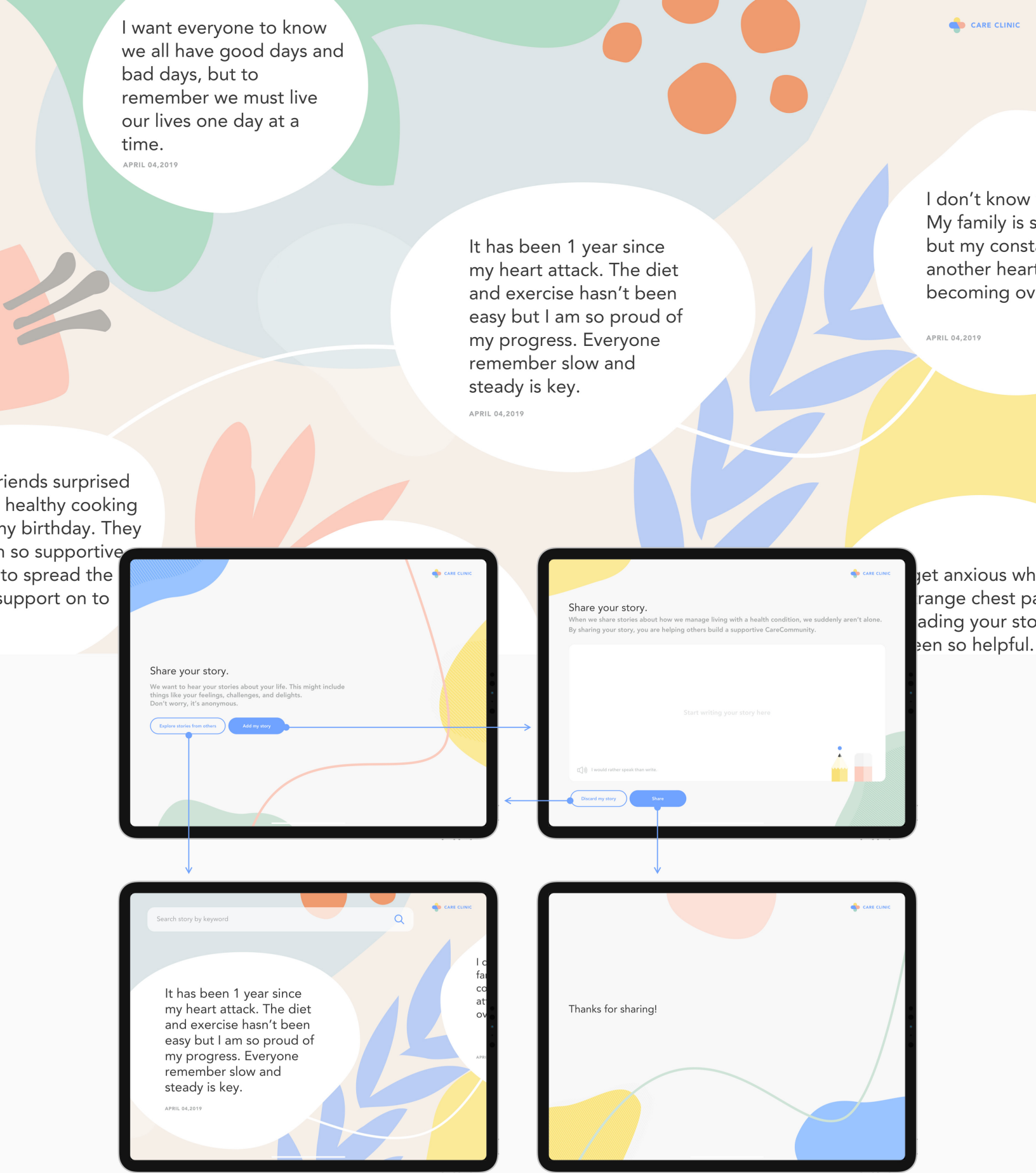
04: CarePad (background action)

COGNITIVE ABILITY & HEALTH LITERACY

A patient’s cognitive abilities and health literacy influences their perception of healthcare and their treatment plan, but physicians currently have no means to determine these aspects quickly and easily. The built-in camera in the CarePad tracks the patient’s eye movement during the process to identify the phrases and words they struggle with, and records the completion time to determine the patient’s cognitive ability.

Design principle(s) used:

Personalized



05: CareWall

After completing the check-in process with the CarePad, Lauren still has ten more minutes before she sees her doctor. She decides to read stories on the CareWall while waiting. She reads a story from another heart disease patient who has recently suffered the loss of a loved one

and Lauren is moved by their story. This small connection reminds her that she is not alone in her experience of loss and she must be strong and that her grief will pass. She reads another story that has suggestions about eating health and decides to try them out when she gets home.

SHARING IS CARING

When looking at holistic care, the emotional state of the patient is important to address because it heavily influences their motivation to take care of themselves. Many times when patients feel alone and scared, they seek out to connect with others, such as on online patient forums or in community centers.

The Carewall is a resource to help build a supportive patient community within the Care Clinic environment to share resources and build empathy. Patients can share their personal stories on the CareWall to express their feelings and experiences living as a patient. Patients can also search stories by keyword if they have specific questions or needs.

The purpose of these stories is to provide an emotional support by helping other patients see that they are not alone in this journey, and there are many others who understand what they are going through. By sharing their own experiences, the patient can feel that their voice is being heard. Since the CareWall is situated in the Care Clinic setting, it also provides additional insights to healthcare providers and helps them understand what their patients are experiencing.

Once the patient shares their story, it will appear on the CareWall with a time delay of 15 minutes. This anonymous, time-delayed display invites patients to comfortably share their feelings and experiences, without worrying about being identified.

StoryCorps (<https://storycorps.org>) is a successful example that utilizes the power of personal stories to build awareness and empathy with the public. However, it only highlights few big topics and requires extensive commitment, an hour long 1:1 interview, to share a story, making the unfeatured feel that they are not special. With CareWall, we aim to lower the bar so everyone can comfortably participate and feel that they are all valued and heard. The clinic context also helps control the scope of the stories, minimizing management efforts.

Design principle(s) used:
Humanistic, Positive, Voluntary

Figure 35: CareWall display (top) / CareWall input screens (bottom)

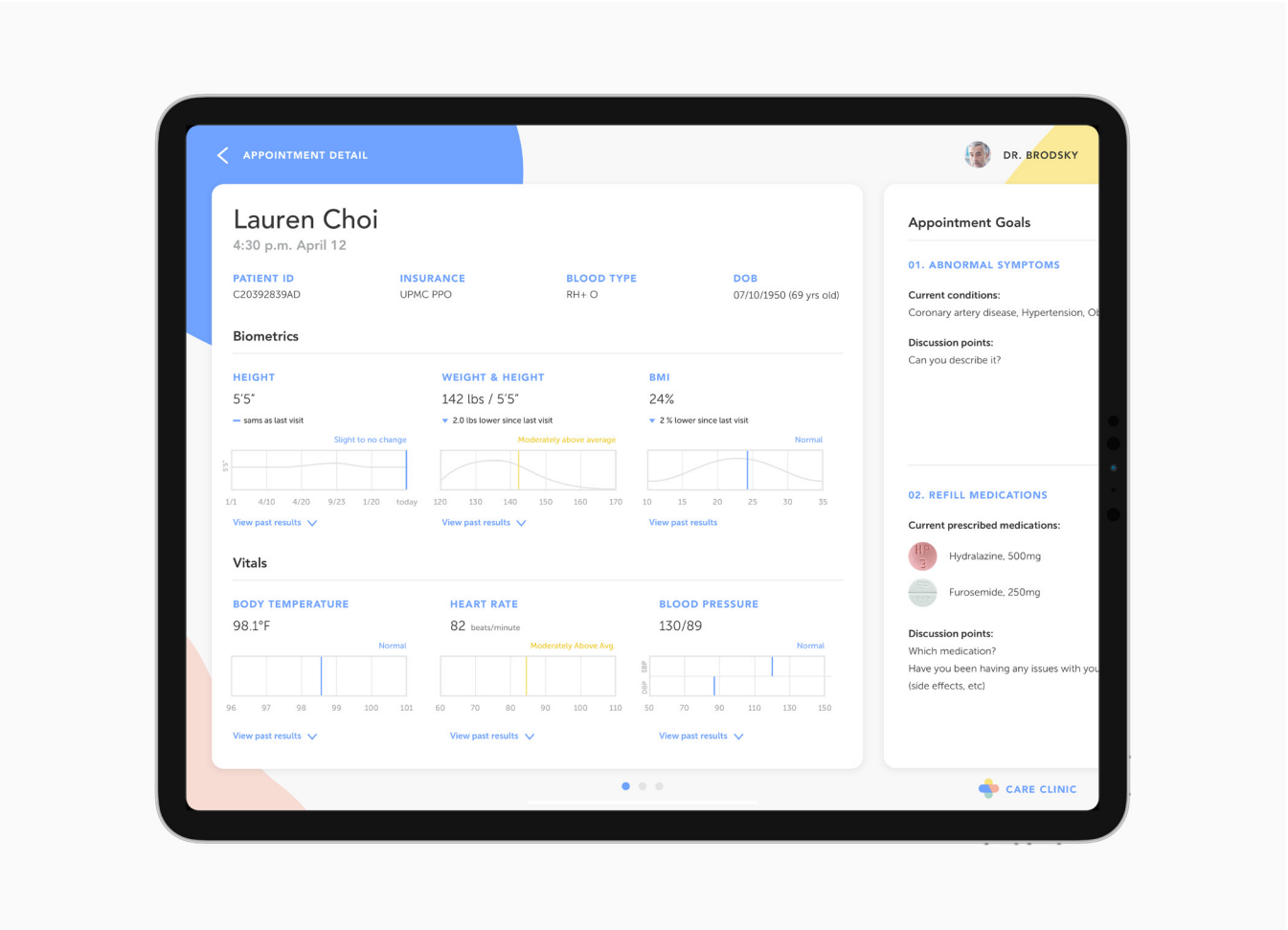


Figure 36: Physician side CarePad (progress)

06: CarePad (physician side)

Once in the examination room, Lauren discusses her progress, appointment needs, and outside influences with her physician to collaboratively come up with a treatment plan that works for her. Her physician reviews the information she previously input via the CarePad before the

appointment began to prioritize the discussion, so Lauren feels that her time is valued. Lauren appreciates that her physician remembers small details, such as her dog’s name and daughter Sarah, and not just knowing her by the medical information on her chart.

MAKING INVISIBLE, VISIBLE

Although patient’s motivation is heavily influenced by the tangible results and positive reinforcement, chronic patients experience difficulty understanding their progress because it is not readily visible to them.

By providing visual aids that the physician can use to review progress and patterns with the patients, CarePad enables physicians to make the patient’s at home actions more concrete to the them.

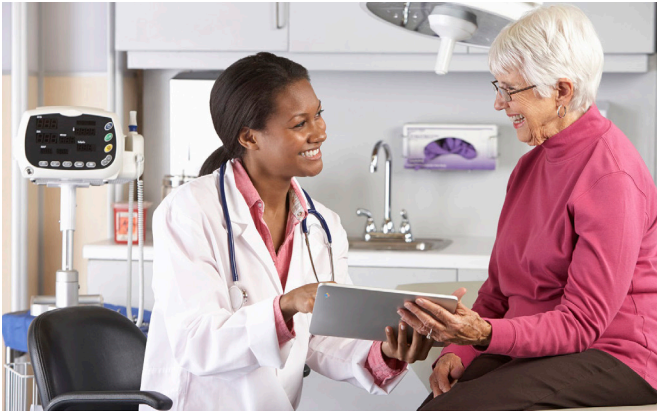


Figure 37: Discussion in the examination room / Image from: <https://www.americannursetoday.com/advancing-nurses-roles-care-coordination/>

Design principle(s) used:
Streamlined, Personalized

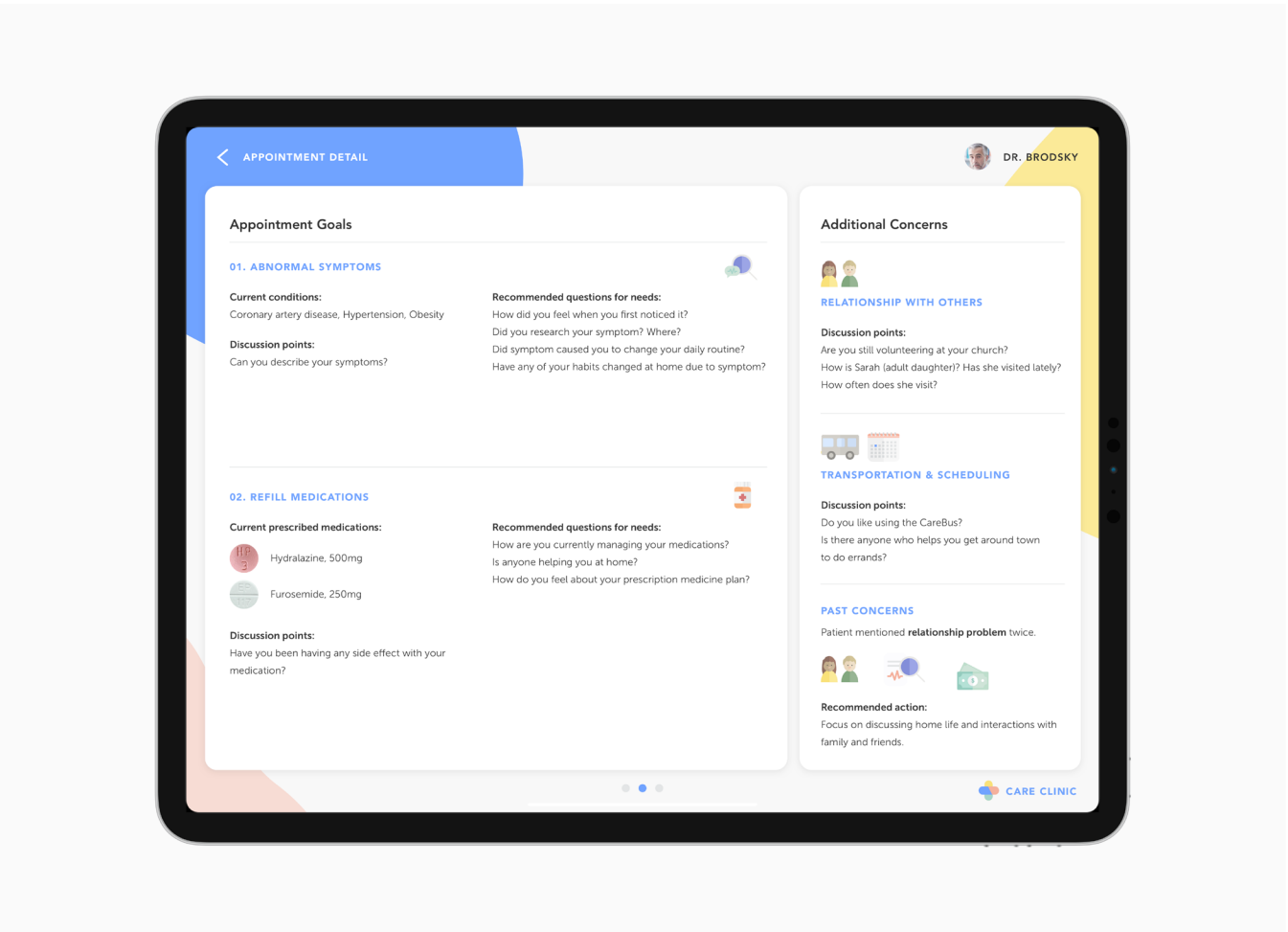


Figure 38: Physician side CarePad (expectations and concerns)

FOCUS ON TARGETED CONVERSATIONS

Meaningful conversations between the physician and patient is crucial in developing and maintaining a trustful relationship. The physician side of the CarePad provides personalized discussion guides and resources to enable physicians to quickly understand the needs and worries of their patients, allowing for more personalized, targeted discussions.

By prioritizing appointments based on patient indicated needs and by addressing personal concerns, physicians can make the patients feel that they are cared for and that their voice is valued.

Design principle(s) used:
Humanistic, Personalized, Streamlined

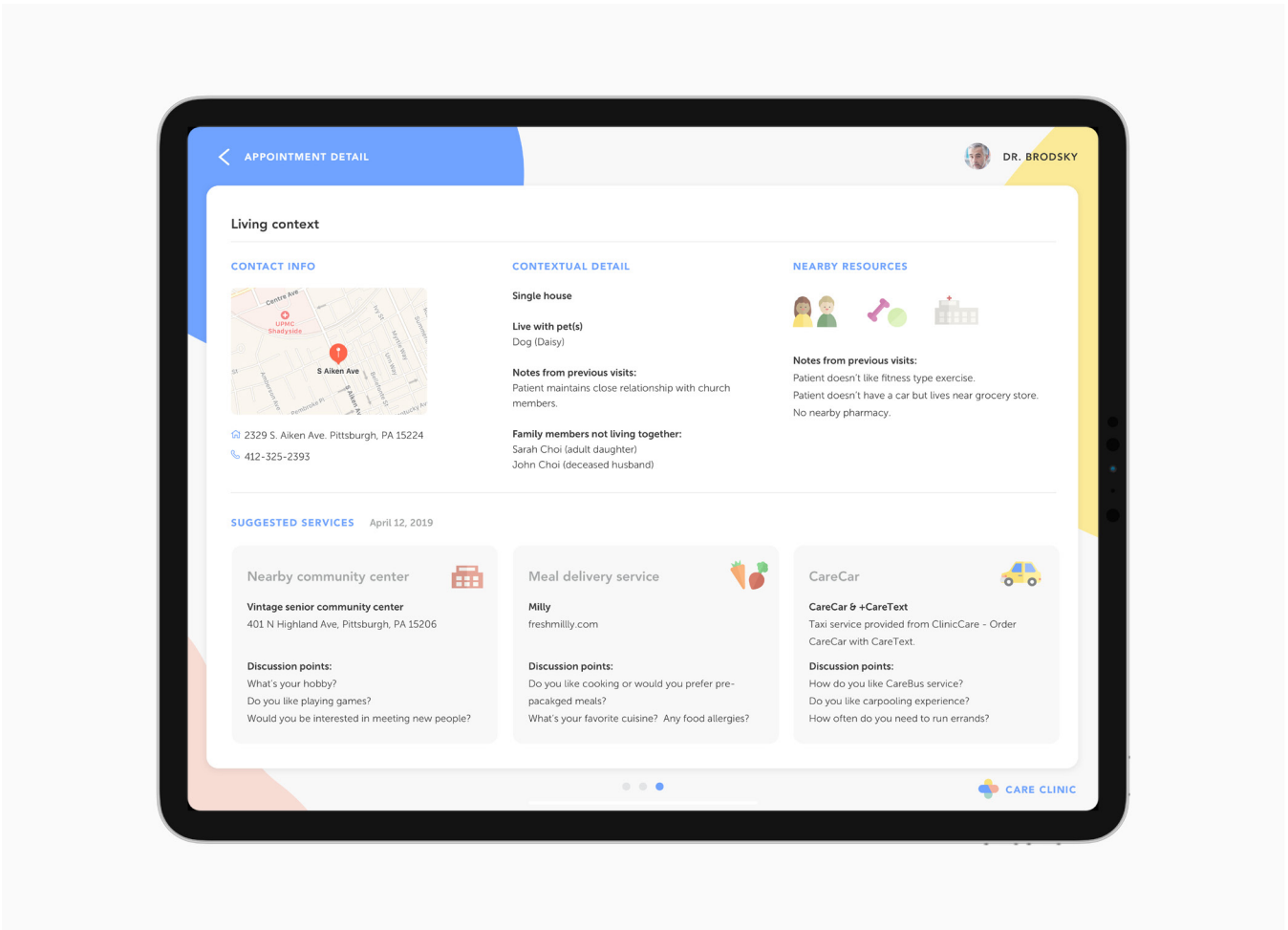


Figure 39: Physician side CarePad (living context and support system)

LEADING PATIENTS TO SUPPORT SYSTEMS THAT WORK FOR THEM

Meaningful conversations between the physician and patient is crucial in developing and maintaining a trustful relationship. The physician side of the CarePad provides personalized discussion guides and resources to enable physicians to quickly understand the needs and worries of their patients, allowing for more personalized, targeted discussions.

By prioritizing appointments based on patient indicated needs and by addressing personal concerns, physicians can make the patients feel that they are cared for and that their voice is valued.

Design principle(s) used:
Personalized, Humanistic, Streamlined

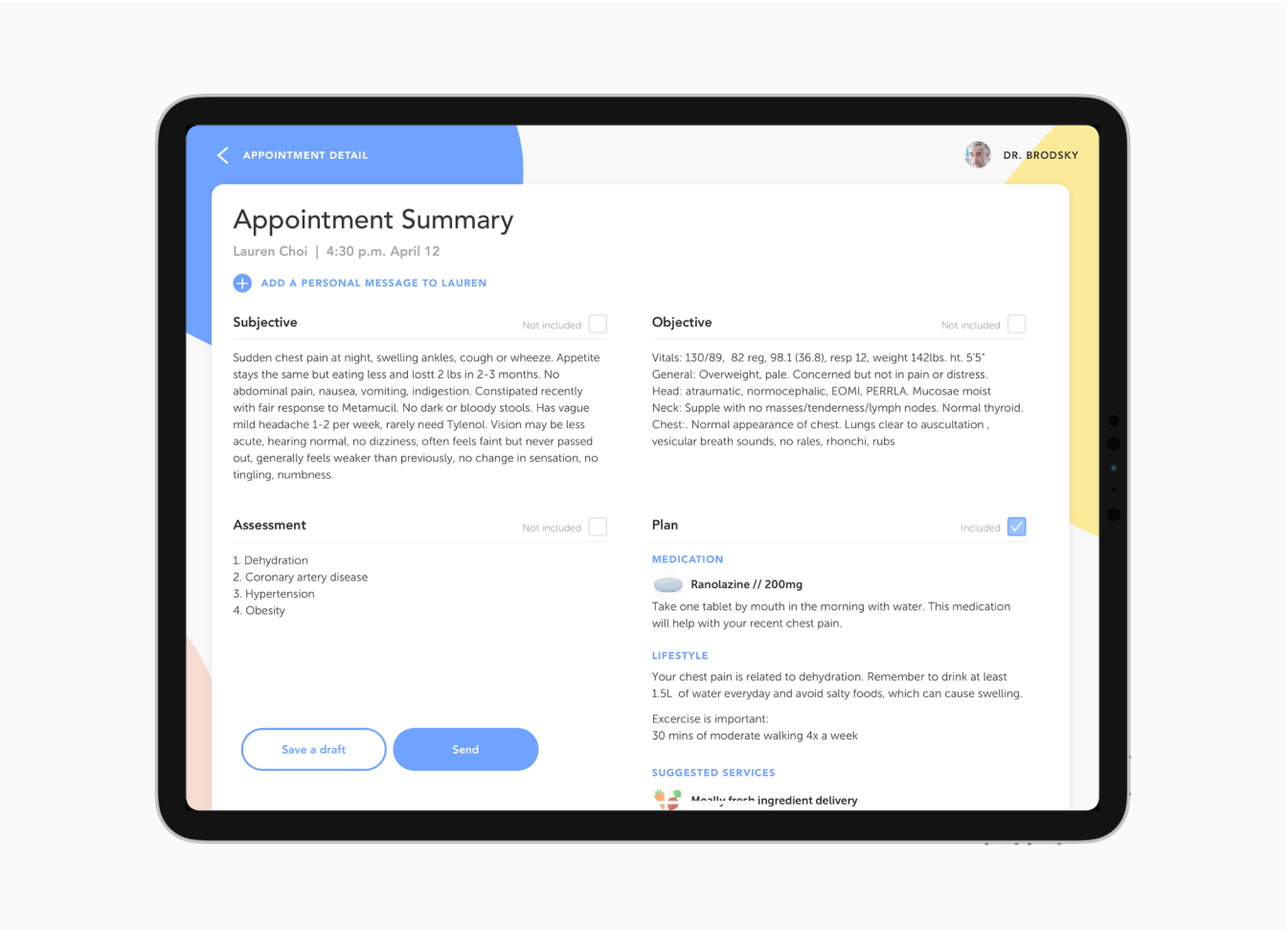


Figure 40: Physician side CarePad (Appointment summary)

06: CarePad (physician side-background action)

GENERATING APPOINTMENT SUMMARY

While the physician and patient are discussing in the examination room, the physician side of the CarePad silently takes notes of their conversation in the background to prepare an appointment summary for the patient. Physicians can edit the records generated by the AI agent, select parts of the notes to send to the patient, or add a personal message for encouragement.

With the emergence of electronic health records (EHR), physicians often struggle to focus their attention on the patient during the discussion due to the overwhelming documentation needs. The AI agent, utilizing voice recognition and natural language processing technology, transcribes and translates the physician-patient conversation in S.O.A.P (subjective, objective, assessment, plan) format to help physicians get a head start on their documentation.

Design principle(s) used:
Streamlined, Positive

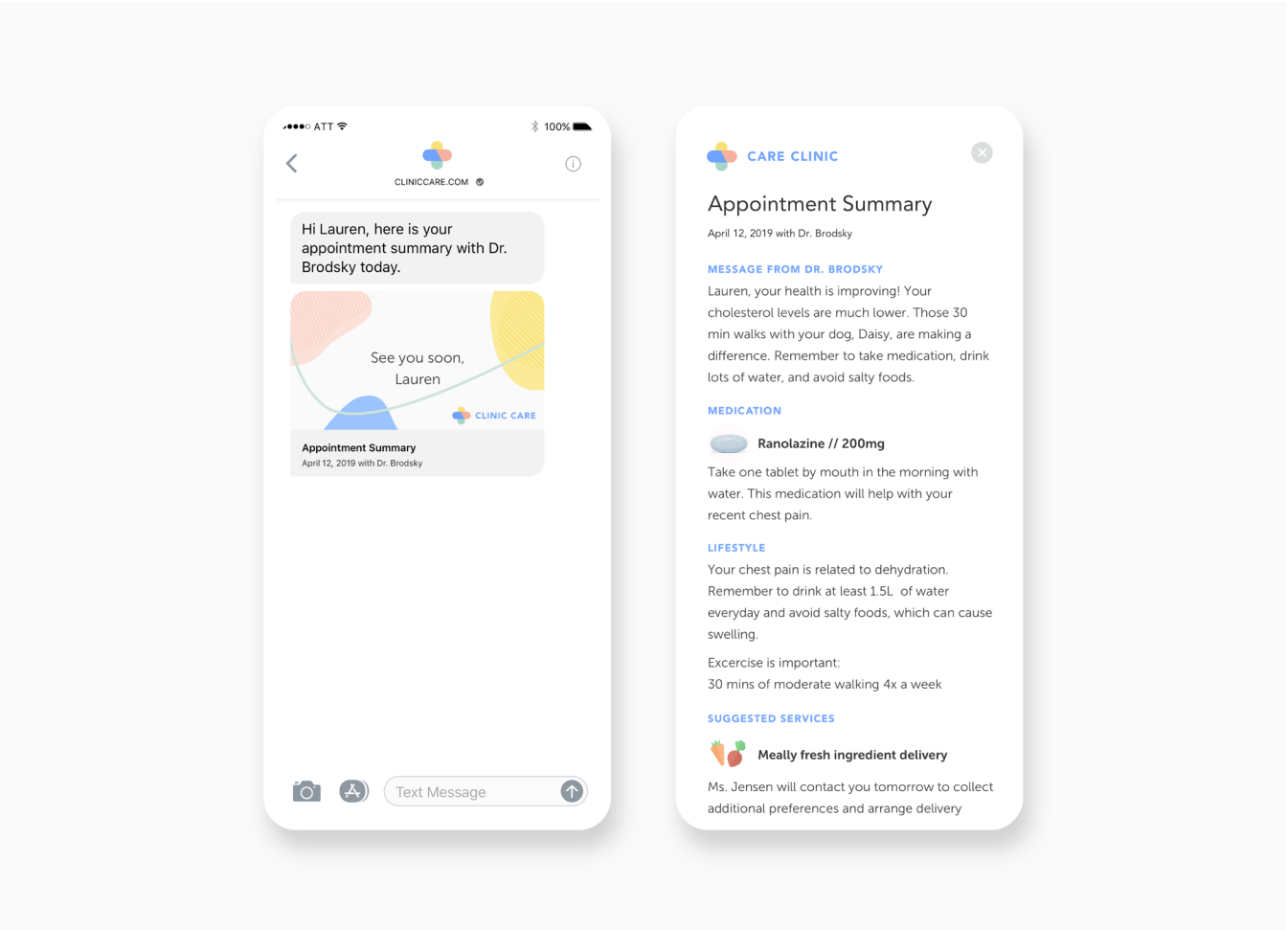


Figure 41: CareText (Appointment summary)

07: CareText (appointment summary)

On her way home, Lauren receives an appointment summary from the CareText. She is glad that she does not have to memorize all the things she discussed with her doctor today.

She reads through the appointment summary and appreciates her doctor’s personal encouragement message.

INFORMATION ON HAND

Most of the time, the treatment management process heavily relies on the patient’s memory retention rate. Even if they receive discharge papers, it is often generalized to disease type and does not reflect the conversation that occurred between the patient and the physician.

The Care Clinic’s discharge instruction is delivered through the CareText, so they can access it anytime. It summarizes the actual discussion from the appointment, in an understandable language, based on patient’s cognitive ability and health literacy levels.

Design principle(s) used:
Personalized, Streamlined, Simple and natural interaction

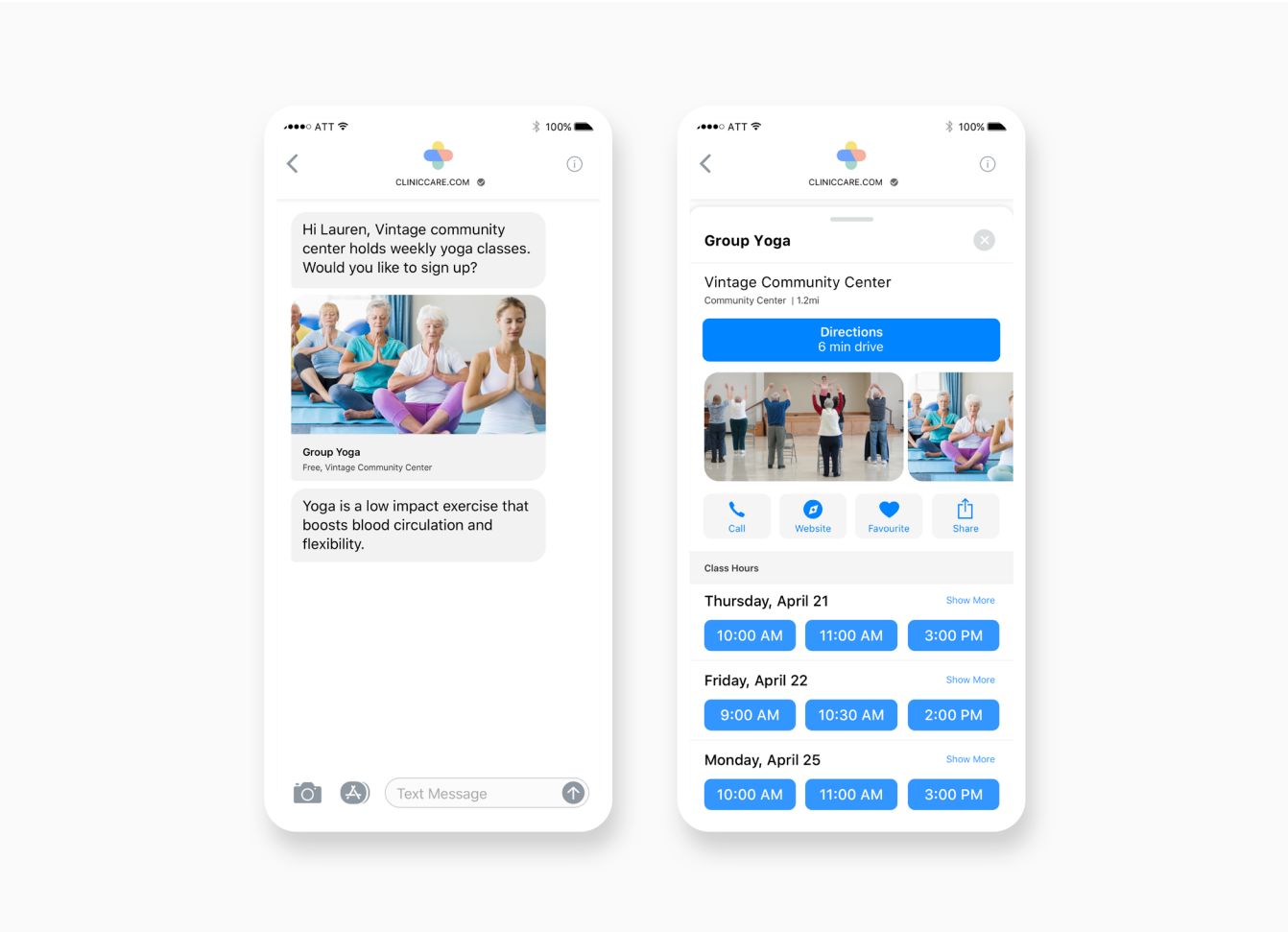


Figure 42: CareText (Service and resources suggestions)

07: CareText (service & resources suggestions)

Few days later, Lauren receives a group yoga class suggestion from the CareText. She remembers that she had discussed with her doctor how she wanted to make new friends who could help motivate her to stay active and

healthy. She appreciates that the suggestion fits with her needs and is excited to try out yoga and meet new people.

ONGOING SUPPORT

Elderly patients struggle to find both health-related and support services on their own due to limited technical literacy. While the elderly is familiar with searching online, they struggle to filter through all the information that is generated by these online searches and worry about if the information they are reading is accurate.

The CareText continuously provides support between appointments through personalized recommendations based on the information from the patient's profile. The patient is comforted to know that the information they are receiving is accurate and fits within their current living situation.

Design principle(s) used:
Humanistic, Personalized, Simple and natural interaction

08: Welcoming waiting room

WELCOMING ENVIRONMENT

How the environment looks, feels, and smells also plays an essential role in influencing the patient’s overall experience. We designed the Care Clinic as a welcoming space that promotes social interactions and positive attitude within the patient. Using uplifting colors and natural light, patients enter a calming space that relaxes them before they meet with their physicians.

As for the arrangement, we centralized the social elements in the center to facilitate the participation. Since we are addressing a primary clinic, we designed the furniture to be accessible and inclusive to a wide range of individuals from the elderly to children. Patients are provided with a variety of private and communal seatings, which they can choose based on their preference, making them feel in control of their waiting room experience.



Figure 43: Space design

Design principle(s) used:
Positive, Humanistic, Voluntary

04

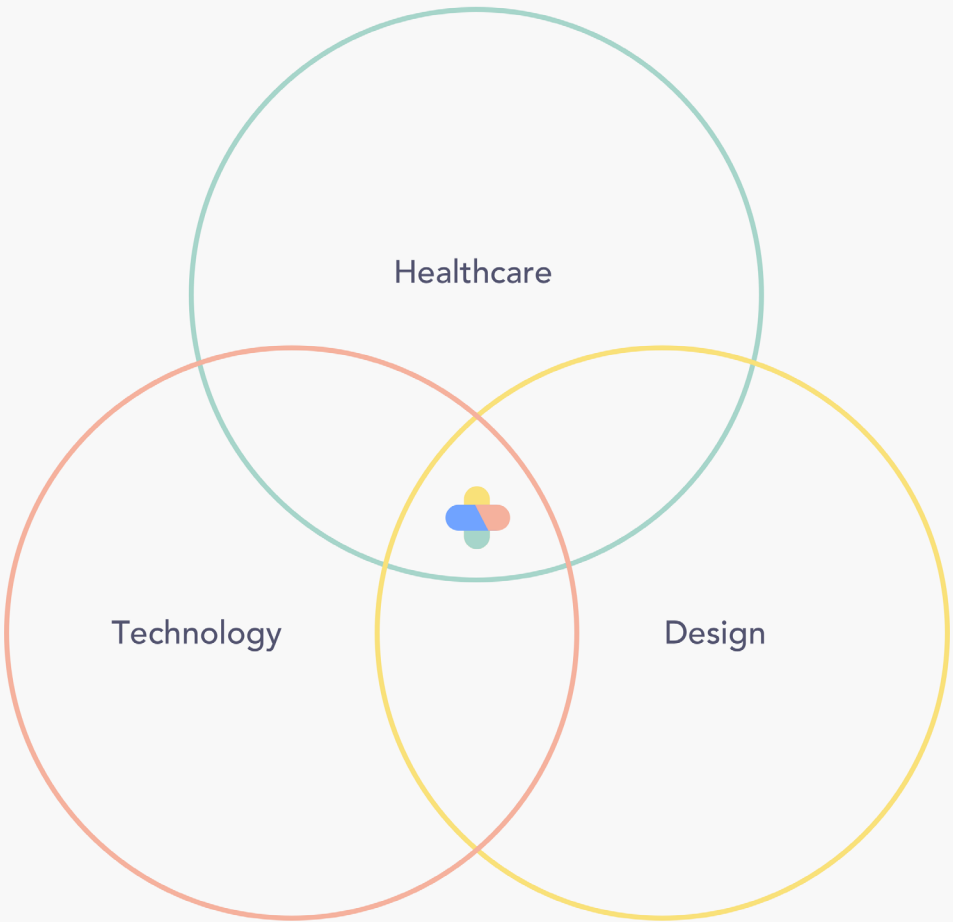
Conclusion and
future considerations

01 Healthcare

Core values of medicine are centered around care and compassion for a person

02 Technology

Technology advancements are being used to connect patients to their health professionals in new ways while providing community engagement.



04 Care Clinic

Future of healthcare where technology is used as a support, to move the focus back on the patient and strengthen the important human connections that both patients and physicians desire.

03 Design

Design provides the empathic lens on how we devise new products, communications, and ways of connecting the patient to the medical establishment, family and support services, and community.

Conclusion

When we began this project, the overarching goal was to explore how communication and relationships impact an elderly chronic disease patient’s health behaviors and design an intervention that would empower them to take control of their health management.

Through our research, we found that the communication between a patient and their physician impacts their perspective on healthcare and their motivation. A patient is a multi-dimensional individual, who must be looked at not just from a physiological perspective. We are all human and have other factors that we must deal with everyday. These factors, from our social support systems to living environments, all play an important role in our ability to independently manage our overall health.

Our design solution, Care Clinic, serves as a example for how technology can be used to, not only provide efficiency within the patient journey, but to provide a method to look at the patient through an empathetic lens. By allowing patients to share a complete picture of who they are and the worries they have outside of the clinic setting, we are able to provide opportunities to improve the communication and build stronger relationships between the patient and their physicians.

In conclusion, while the healthcare industry is a slow-changing one, we must remember the core values of medicine that are centered around care and compassion for a person. As designers, we must strive to design interventions that bring those core values to the forefront to support the values and connections that we all desire within the care we receive and our overall health.

Future considerations

For future studies, we believe it will be worth further looking into below 4 major areas.

AI AND PERSONALIZATION

For our design concept, we briefly touched on the artificial intelligence (AI) for analyzing personal needs and providing matching service recommendations. We believe the AI can be further utilized in the personalization process, especially with its ability to process high-dimensional data to distill useful knowledge and representations. By examining and extracting meaningful findings from enormous patient’s personal and medical records, AI can provide insights into the patient’s psychological and physiological influences to help physicians find an appropriate treatment for differential diagnosis.

AUTOMATION AND DOCUMENTATION

In the physician side of the CarePad, we imagined advance transcribing and translating capabilities, taking into consideration the weak signals that point to the current trajectory for the future development and application of this technology. We believe the speech recognition and natural language processing can be further developed and utilized to aid physician’s documentation needs to enable them to fully focus on the patient during the examination.

STAFFING AND TRAINING

Human to human interaction significantly influences the patient’s overall experience and perception towards the healthcare service they receive. We believe appropriate staffing and training should be designed and given to the healthcare staff and practitioners, to allow patients to receive proper and positive experiences when treated.

VOICE USER INTERFACES

In the medical context, especially for the interaction with elderly patients, natural and simple interactions are crucial to set a positive tone for the patient experience. We believe voice interfaces can be utilized to naturally collect patient information and provide guidance to patients within and outside of the hospital context. The natural data collection through casual conversation can help the patient comfortably open up and share their inner feelings and concerns. The collected data can be used to provide additional psychological and behavioral insights to healthcare providers and help patients better understand and reflect on their behaviors.

05

Reflection and
acknowledgements

Reflection

As designers interested in the healthcare industry, this project provided a joyful opportunity to examine the healthcare domain and learn how to work with restricting factors. By working with time-restricted medical stakeholders, we learned to prioritize our design process and communication behaviors to maximize work efficiency. Interactions with elderly patients helped us get a better sense of the medical landscape and in company shortcomings with their honest stories. The healthcare field, with high privacy and security, was challenging to work within, but was worth battling to explore inner worlds of patients and medical stakeholders to design around fostering care, and have a small but meaningful footprint in health, design, and people.

Acknowledgement

We sincerely appreciate all the invaluable guidance and unconditional love and support from our family, friends, advisors, colleagues, and furry friends who made this possible:

- Kristin Hughes
 - Wayne Chung
 - Dahye Chung
 - Grace Cha
 - Youngsook Son
 - Mansoo Choi
 - Kyung Choi
- Hyeran Kong
 - Iksoo Kwon
 - Aida Rodriguez
 - Luis Rodriguez
 - Andrew Sack
 - Rombi
 - Frasier

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29. “Perceptions of Aging during Each Decade of Life After 30”, West Health Institute/NORC Survey on Aging in America

30. “Positive Attitudes About Aging May Be a “Fountain of Youth””, Psychology Today

31. “Growing Old in America: Expectations vs Reality”, Pew Research Center

32. “Making Aging Positive”, The Atlantic

33. “Think Old Age Means Decline? Then it Probably Will”, Next Avenue

28. “Attitudes about Aging: A Global Perspective”, Pew Research Center

29. “Perceptions of Aging during Each Decade of Life After 30”, West Health Institute/NORC Survey on Aging in America

30. “Positive Attitudes About Aging May Be a “Fountain of Youth””, Psychology Today

31. “Growing Old in America: Expectations vs Reality”, Pew Research Center

32. “Making Aging Positive”, The Atlantic

33. “Think Old Age Means Decline? Then it Probably Will”, Next Avenue

Precedents reviewed

- 1. City Health Works (<https://www.cityhealthworks.com/>)
- 2. Heal (<https://heal.com/>)
- 3. Oscar Insurance (<https://www.hioscar.com/>)
- 4. Ada (<https://ada.com/>)
- 5. Florence (<https://florence.chat/>)
- 6. Babylon Health (<https://www.babylonhealth.com/>)
- 7. Safedrugbot (<https://www.safeinbreastfeeding.com/safedrugbot-chatbot-medical-assistant/>)
- 8. Your MD (<https://www.your.md/>)
- 9. Sensely (<http://www.sensely.com/>)
- 10. Vik Breast (<http://www.vikbreast.ai/>)
- 11. Bots4Health (<https://bots4health.com/>)
- 12. Gyant (<https://gyant.com/>)
- 13. Buoy (<https://www.buoyhealth.com/>)
- 14. Health Loop (<https://www.healthloop.com/>)
- 15. UCLA Live Health Online (<http://www.studenthealth.ucla.edu/Lists/ChannelContent/CustDispForm.aspx?ID=139&Title=LiveHealth%20Online&Channel=Services>)
- 16. MyUPMC (<https://myupmc.upmc.com/>)
- 17. Symptomate (<https://symptomate.com/>)

- 18. Catalia Health (<http://www.cataliahealth.com/>)
- 19. City Block (<https://www.cityblock.com/>)
- 20. Project Aim by Artefact group (<https://www.artefactgroup.com/case-studies/aim/>)
- 21. Uber Health (<https://www.uberhealth.com/>)
- 22. Veyo (<https://veyo.com/>)
- 23. Value Based Education (<https://www.valuesbasededucation.com/>)
- 24. Cactus, Mount Sinai Lab 100 (<https://www.cactus.is/lab100>)
- 25. The 100 days challenge, People Powered Results, Nesta Health (<https://www.nesta.org.uk/feature/six-initiatives-opening-health-innovation-around-world/people-powered-results/>)
- 26. Blue Zones Health (<https://www.bluezones.com/>)
- 27. Silver Cuisine (<https://silver.bistromd.com/faq.aspx>)
- 28. Mayo Clinic (<http://centerforinnovation.mayo.edu/portfolio-2/>)
- 29. StoryCorp (<https://storycorps.org/>)
- 30. Silver Sneakers (<https://www.silversneakers.com/>)
- 31. TVC the community volunteering charity (<https://www.tcv.org.uk/health>)
- 32. Little passport (<https://www.littlepassports.com/Ages-3-to-5/>)



Project Care