

Post-Operative Care Assistant Final Report

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Executive Summary

While nurses are being frustrated by countless incoming calls from patients, patients are also overwhelmed by the number of things they need to remember when in a helpless emotional state. From discovery, we have found that the first 48 hours after discharge is critical to the patient's healing process, and it's during the first 48 hours that nurses are asked to repeat the most on the information already included in the discharge papers. Our goal is to motivate patients to become self-reliant in the first 48 hours after discharge which will reduce interruptions to nurses' workflow. For our final product, we designed an app which we named Hebo 2.0, which addresses the 48 hour dressing change, self assessment for bleeding, as well as a Q&A function.

Introduction

We have been working with Bryan T. Carroll, MD, PhD, who is a dermatologic surgeon and director of the Dermatologic Surgery clinic in the Falk Medical Building at UPMC Presbyterian. He specializes in Mohs surgery and cutaneous oncology for the treatment of skin cancer. Our team has begun working to find a solution that will better assist patients during this post-operative period. In our research, we geared towards understanding the drawbacks of the previous BHCI capstone team's solution, who worked on this project last year, as well as filling in the research gaps that they may have missed. In this phase of the project, we narrowed our scope to address the common post-op concerns within the first 48 hours after surgery as well as coaching the patient through the 48-hour dressing change process.

Research Insights Recap

During our lo-fi prototyping phase, we narrowed down project scope and re-ordered project goals as following:

- Help patients *follow* post-op care instructions
- Help patients *understand* post-op care instructions
- Free up nurses & physicians' times to help more patients
- Help nurses & physicians have a less interruptive workflow
- (Long term goal) Draw meaningful conclusions on healthcare research questions

Based on our research findings, we decided that our solution will focus on creating a simple interface with personalized, easy-to-understand instructions for patients, while

providing encouragement and reassurance throughout the post-operative process. In addition, the solution should be able to address common concerns from patients in order to reduce the workload of clinic staffs. We also listed our patient needs from our key insights from the research phase, and communicated with Dr. Carroll to rank the identified needs by priority. In this way, we narrowed down the primary needs that we want to first meet as below:

- Make the assistant accessible to elderly users
- Provide quick responses to patient's questions and concerns
- Address unique personalized concerns of patients in post-op care
- Educate patients on basic post-op care knowledges
- Having visual aids in addition to text instructions
- Reassure patients with normal post-operative symptoms
- Remind patients when they forget post-op care details
- Allow patients to easily find post-op do's and don'ts

Thus, for our design of the assistant, one central focus would be addressing their questions and concerns in a easily-understandable and trustable way. The above needs makes it important for us to construct trust between the patients and the assistant, and thus enable the assistant to provide better reassurance for patients in needing situations. The findings suggest that we want to present the information clearly and without much cognitive load to patients and to make this experience of interacting with the assistant more pleasant and comfortable, thus help them better follow the instructions and have better post-operative care outcomes. Accessibility to elderly users is also critical in our design of the patients due to the characteristics of our target users.

Methods

Research Phase

When defining the scope of our problem, we found that there were three main stakeholders we will need to design for: doctors, nurses, and patients (including caretakers). To find a solution that would balance all of their needs and goals, we needed to understand the different perspectives of post-operative care from their points of views. Utilizing the information provided from the last BHCI team, we found holes in their research that we wanted answered as well as wanted to gain more insight on what worked and what did not work from their prototype.

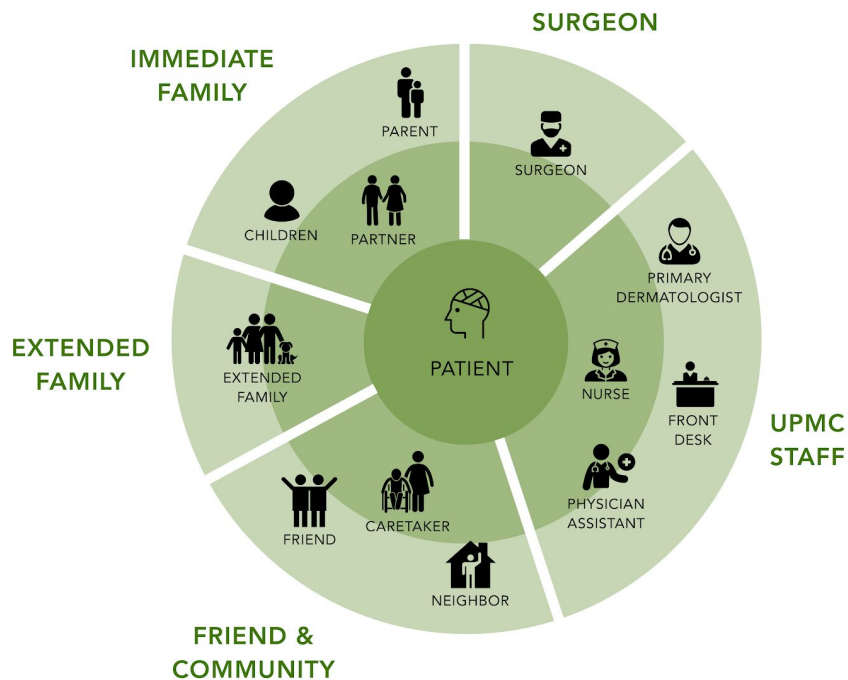
We started with a comprehensive literature review to not only understand the current post-operative care process, but also gain knowledge on pain management and the current relationship elderly people have with technology. We also researched the kinds of accommodations that that current target age of patients would need. Focusing primarily on their vision, hearing, motor, and cognitive abilities. Information from this literature review helped supplement our first-hand findings and filled in some aspects that we did not fully understand from our client meeting.

We then conducted a heuristic analysis of Hebo - the mobile chatbot designed by last years' BHCI team. This helped us identify successes and restrictions of the chat, pinpoint additional user research we needed to conduct and find possible areas of improvements or new directions of design. We also ran a think-aloud of Hebo with patients during out clinic visit, and observed how patients perform the tasks given, thus discovered some existing issues in the design of Hebo.

To gain a more thorough understand of what patients and clinical staff undergo, we did job shadowing in the UPMC Falk clinic, observing surgery, lab work, dressing change, patient guidance, etc. This helped us to identify current processes and breakdowns. We also performed contextual inquiries and interviews with patients and clinic staffs, including surgeons, nurses, residence doctors and assistant physicians. During the interviews, we prepared card sorting activities for both patients and clinic staffs, and asked them to rank what they feel - for patients after surgery and for nurses and physicians when they received phone calls from patients. The card sorting activity helped better understand their feelings and emotions and thus identify their implicit needs during post-operative care.

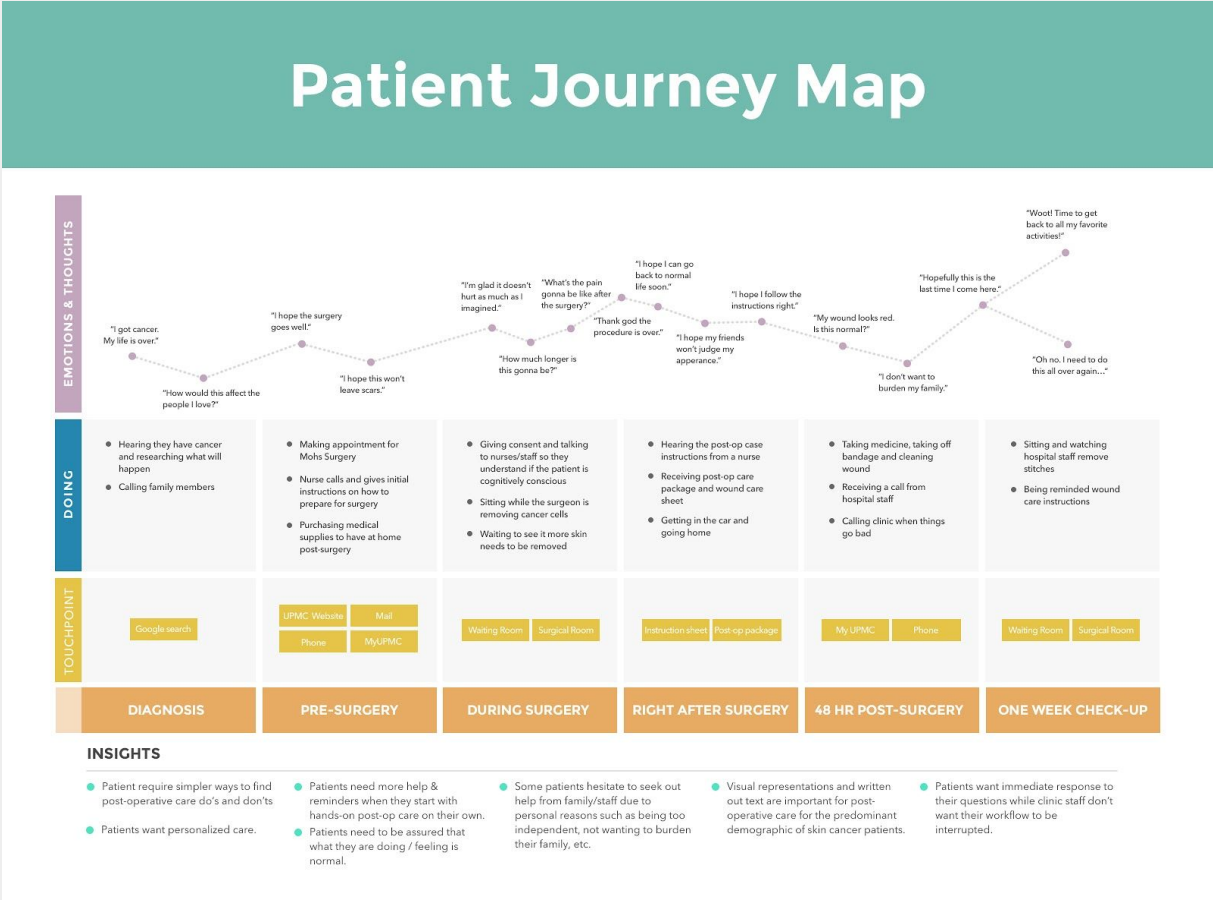
Synthesis Phase

After we conducted our initial phase of research we began to synthesis our findings. We created a stakeholder map dividing our stakeholders into several parties, based on their interactions with patients in post-operative care. The surgeon who carries out the surgery; UPMC staff who help patients change dressing, call patients for check-up and answer questions; patients' immediate family, extended family, and friends and community who might take care of them during the post-operative process.



Stakeholder Map

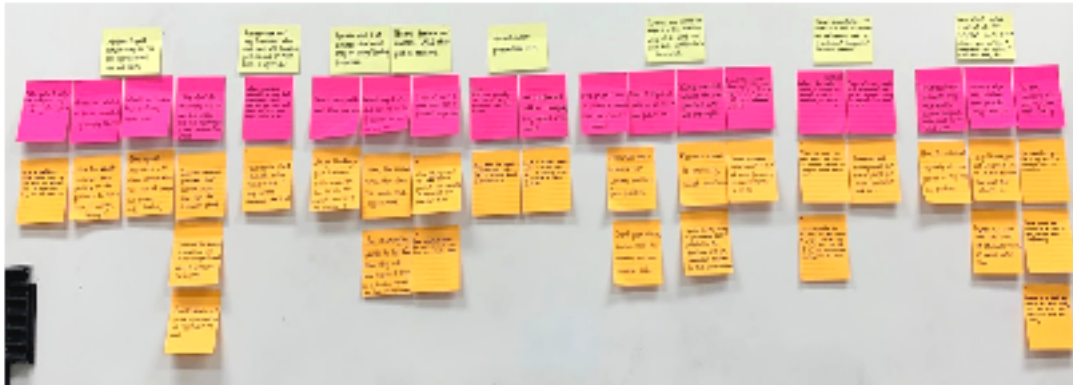
We then created personas for the three main types of patients families ages 60-80: those with families who are supportive and will function as a caretaker post operation, those who live alone but are capable of following the instructions independently, and those who need significant hands-on help from the clinical staff. These personas will help us make sure we are designing for the various different type of patient.



Customer Journey Map

We then conducted a journey map for nurses and patients, which will help us better understand the goals and needs of these stakeholders. We looked at the surgery procedure by the six phases: diagnosis, pre-surgery, during surgery, right after surgery, 48-hour post-surgery, one-week check-up and later. For each phase, we discussed patients' emotions and thoughts, their tasks and touchpoints, in order to better understand each part of the surgery process and discover opportunities. Based on that, we used sticky notes to discover existing pain points in different phases of surgery, especially the post surgery phases.

Lastly, we synthesized the pain points we found by grouping them together and discovering insights from each group. For each pain point we identified, we also brainstormed possible design ideas to solve the problem, and will later use them for our ideation process.



Pain point synthesis and design opportunities

Lo-fi Prototype Phase

From Insights to Design

As we summarized our research findings and discovered the following means to achieve our goals as listed in previous sections of the report, we tried to brainstorm scenarios of users needing this assistant and corresponding design ideas in the different scenarios.

- ***Make the assistant accessible to elderly users.*** The interaction of the assistant should be simple and intuitive. Additionally, it would be important to have clear contrast and big fonts on critical information.
- ***Provide quick responses to patient's questions and concerns.*** The assistant needs a question answering conversational UI, which can be easily triggered by simple user interactions.
- ***Address unique personalized concerns of patients in post-op care.*** The assistant needs to have knowledge about relevant user information, especially their time and area of surgery, and can thus provide accurate suggestions or reminders. The assistant also needs to have knowledge about medicine plan of the user.
- ***Educate patients on basic post-op care knowledges.*** The assistant should not only resolve users' concerns when needed, but should also bring up explanations or relevant knowledge so that users could understand suggested action terms and learn over time.
- ***Having visual aids in addition to text instructions.*** The interface of the assistant needs to always have pictures with text description to provide visual assistance in helping the users understand instructions and processes.
- ***Reassure patients with normal post-operative symptoms.*** We considered designing a self assessment tool for patients, so that when they feel concerned

about post-operative symptoms such as bleeding, they could use the self assessment tool to determine level of severity and find out what to do for themselves. Thus, the patients would be less inclined to feel overly worried about normal symptoms and the clinic would also receive less redundant calls.

- **Remind patients when they forget post-op care details.** As the assistant would have knowledge about personalized information of patients, it could remind patients when to change dressing 48 hours after the surgery, or remind patients when they needed to take pain medication.
- **Allow patients to easily find post-op do's and don'ts.** We consider using the conversational user interface to allow patients to ask questions, thus directly get answers and suggestions when they are confused about what to do and what not to post-operatively.

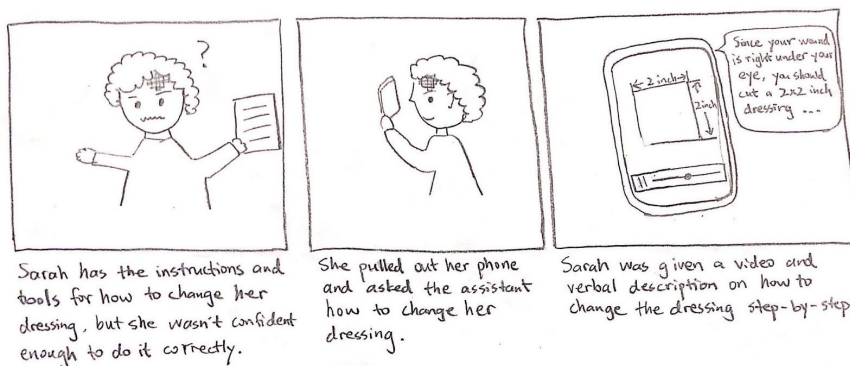
Storyboarding

We started our ideation process by creating storyboards for each of the eight primary needs from the client, and identified four major design opportunities from the initial storyboards. Then we condensed our initial storyboards into four, each targeting a major design opportunity and two needs.

Provide quick responses to patient's questions and concerns Address unique personalized concerns of patients in post-op care



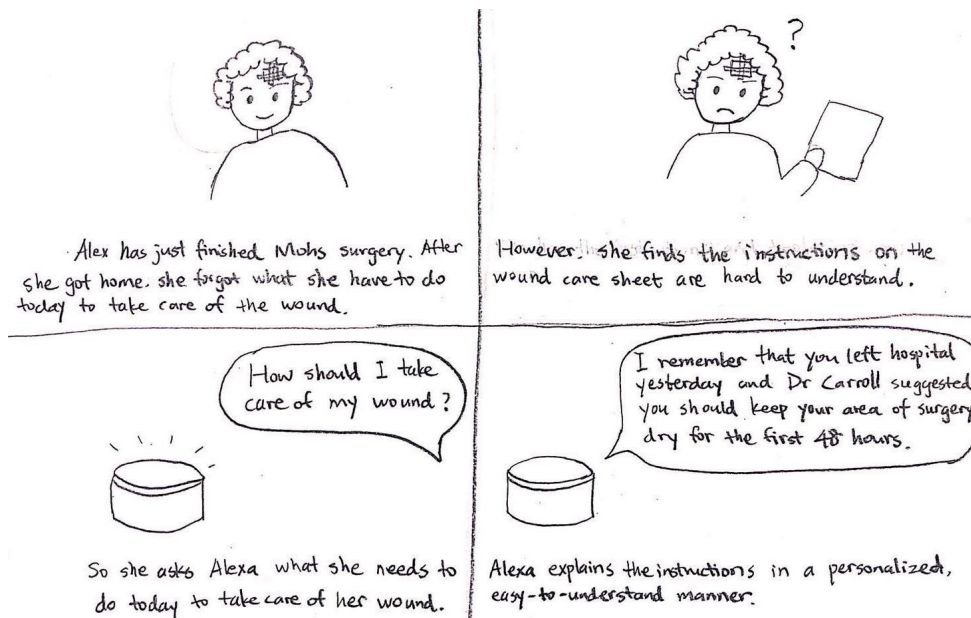
Educate patients on basic post-op care knowledges Remind patients when they forget post-op care details



Reassure patients with normal post-operative symptoms Having visual aids in addition to text instructions

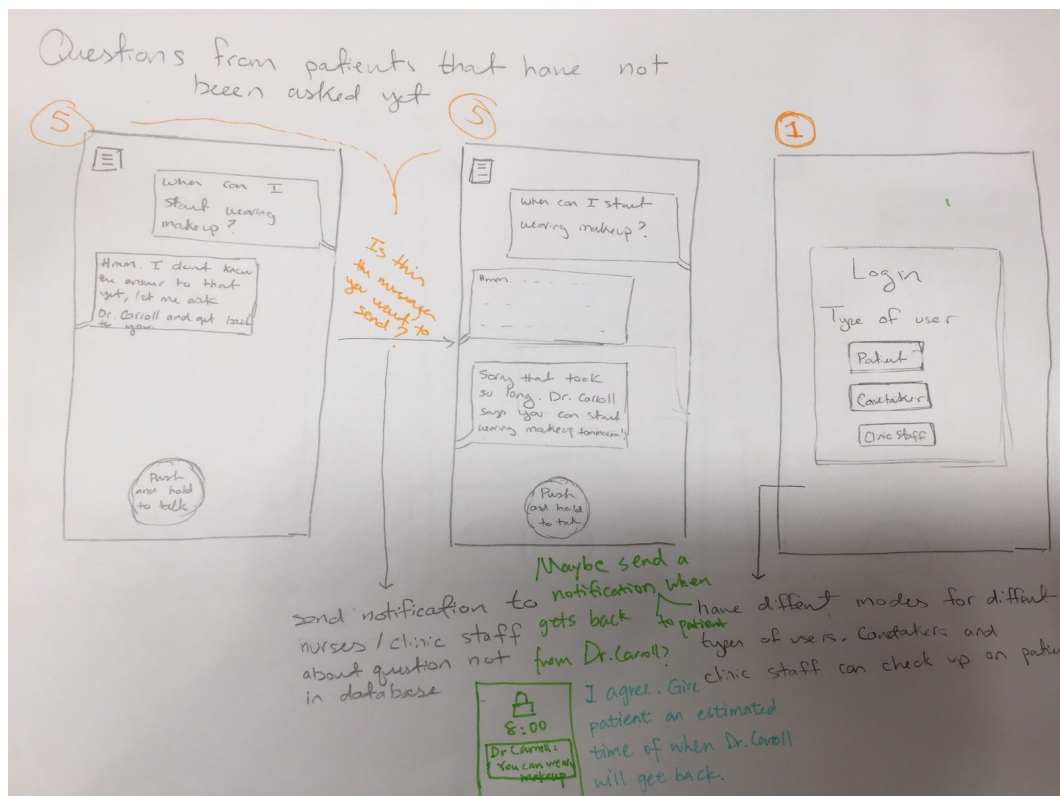


Make the assistant accessible to elderly users Allow patients to easily find post-op do's and don'ts



Collaborative Sketching

Following individual sketching, we came together and looked at each other's ideas while adding onto one another's screens. We found that we generated a number of new ideas. Below are examples of what we did.

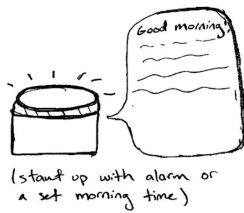
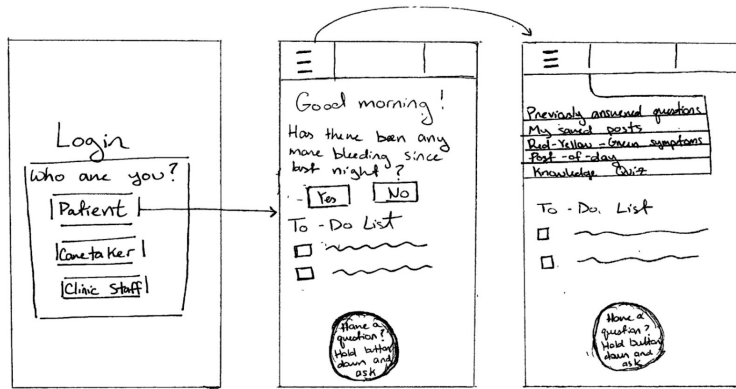


Screen from collaborative sketching

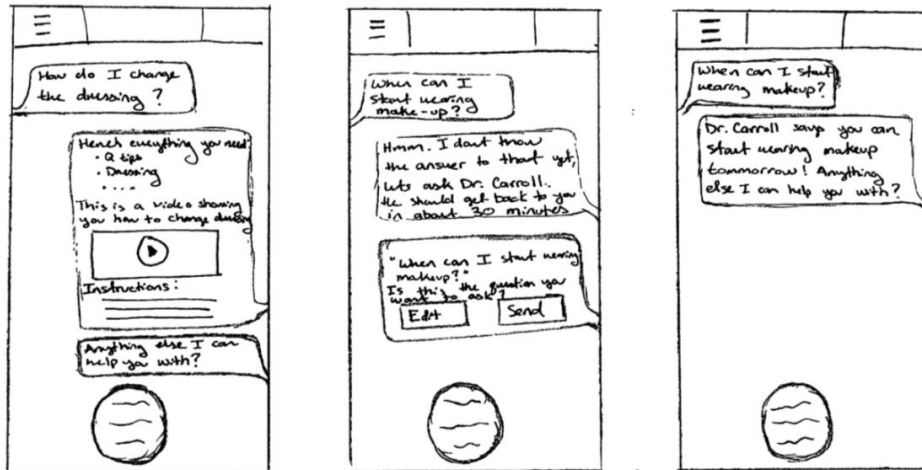
Low-Fi Prototype

After completing the storyboards, we categorized different ideas for our post-operative care assistant into main groups and discussed the different features we wanted each section to have based on the storyboards. We then each generated the first iteration of one section and refined each other's ideas during the collaborative sketching. Below are the second iteration screens after incorporating the feedback from collaborative sketching.

Initial Login screen, welcome page and dropdown menu



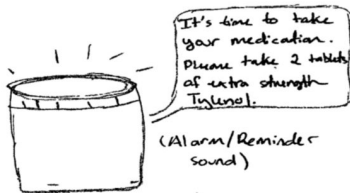
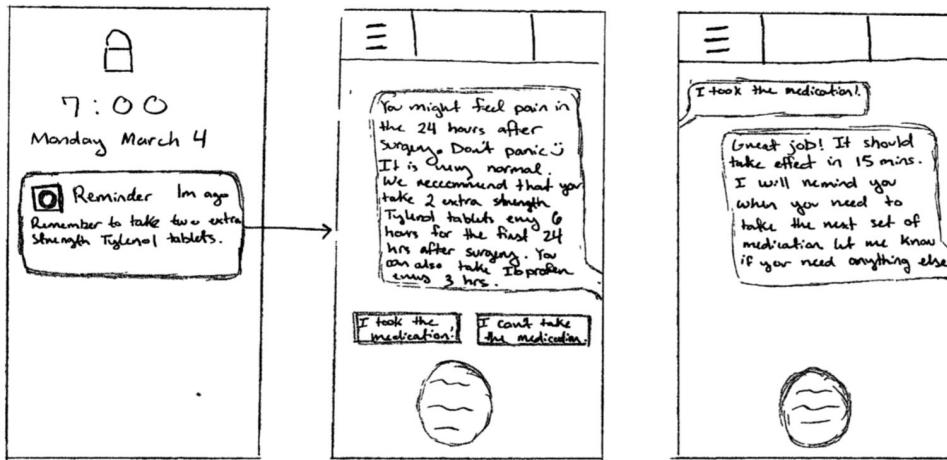
Question & Answer



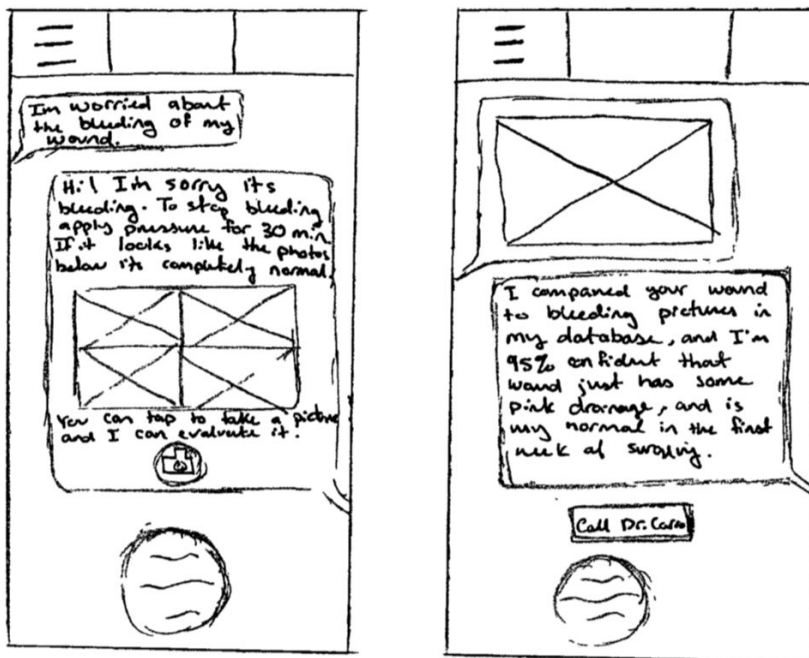
Microinteractions:



Reminder to take medication



Self Assessment Tool



Question Ideation

Since we plan to build our assistant in the form of a chatbot or conversational user interface, we also started to write the script for the assistant. We collaborate with Alyce Palko, an English major student at University of Pittsburgh specializing in health literacy, who is helping us with the assistant's wording and language of the instruction delivery. We have together generated a list of 140 distinct questions that could potentially be asked by patients. We started with the current post-operative care instruction sheet and list out 11 categories of questions: wound care, pain, bleeding/redness, bruising, swelling, splitting stitches, diet, activity, emergency, signs of infection, and miscellaneous questions.

What do I do when my stitches are coming out?
Can I take my own stitches out?
Can my family member take my stitches out?
Why do I have stitches?

Activity

When can I go back to gym?
Can I do yoga?
When can I start doing heavy lifting?
When can I start to feed animals on my farm?
Can I cook?
Can I lift weights?
Am I allowed to go grocery shopping?
Can I go swimming?
Can I sit in a hot tub?
Can I go to the spa?
Can I go to the beach?
When can I start driving?
Can I go camping?
When can I go back to work?
Can I hold/lift my child?

Diet

If I had surgery around my mouth, what can I eat?
Are there foods I'm not allowed to eat?
Should I be eating healthier?
I'm feeling light headed, is that normal?
Should I be eating before taking my pain medication?
How soon after surgery can I eat?
Do I have to use a straw?

Emergency

There's lots of blood when I take off the dressing. What should I do?
My stitches popped open and there's blood everywhere. What should I do?
Help please
I'm seeing more dark spots on my body, is my cancer back?
I feel like I have been hit with a baseball bat, is there something I can do to stop it?
Do I have to go to the emergency room/can I go to the emergency room?
I can't breathe, what should I do?

Wound care

What supplies do I need to clean my wound?
Where can I get these supplies?
When should I clean my wound?
How do I clean my wound?
When can I remove my bandage?
Do I have to use the same dressing as my doctor?
Do I have to get all of these supplies?
What is Telfa?
What is Hypafix?
What is vaseline?
Should I leave my bandage on all day?
Can I change my bandage if there's a lot of bleeding even if it hasn't been 24 hours?
My dressing is coming off, what do I do?
Why doesn't my dressing look like the one the doctor gave me?
Should I put as much vaseline on it as the nurse did?
There is dry blood stuck to the dressing, is that normal? What do I do?
How often should I apply vaseline?
How do I change my dressing?
How do I keep my wound from drying out?
How do I put dressing on a place I can't see?
How often can I change my dressing?
How should I be applying pressure?
My wound is itchy!
How can I stop it from being itchy?
Does itching mean I am having an allergic reaction?
Can I put itch cream/hydrocortisone on my wound?
Can I put neosporin/antibiotic ointment on my wound?
Can I put lotion/cream on my wound?
Do I have to use Vaseline?
I ran out of gauze, how can I get more?
My bandage is stuck to my wound, what do I do?

Pain

What should I do if my wound hurts?
My wound hurts so bad. Is it normal?
My pain medicine isn't working. What should I do?
I can't sleep because my wound hurts. What should I do?
How long should I ice my wound for?

Signs of infection

What if my wound is sore or if it has liquid coming out of it?
My wound smells bad when I take the dressing off. What should I do?
My wound is leaking pink/green/yellow/clear/white liquid. What should I do?
My son got pink eye and I'm afraid I just got infected.
My family member is sick, what if I get sick too?

Miscellaneous questions

Can I breastfeed my baby?
When can I apply makeup?
What soap do I use?
Is this soap okay for me to use?
Can I shower now?
Should I keep my dressing on when I am in the shower?
What is the best way to shower?
Can I take a bath?
Should I wash my wound in the shower?
How do I reduce scarring?
I am worried about scars
They told me it wouldn't scar but I can see one forming
Is scabbing okay?
What is a physician assistant?
How should I sleep?
When can I start showering?
When/How should I brush my teeth?
Do I have to use mild soap on the rest of my body?
Can I still use my own hair care products?
Can I shave?
Can I use perfume?
Can I clean my ears?
Can I wear contacts?
When can I have sex?
Can I use other skincare products?
Can I treat my acne?
A hair got stuck in my stitches/bandage/wound, what should I do?
Can I apply sunscreen?
Can I use bug spray?
Should I avoid people who are sick?

How much Tylenol should I take?

What is acetaminophen?
What is ibuprofen?
When can I take ibuprofen?
When can I take Tylenol?
How does the ice help with pain?
The ice isn't reaching my wound, can I take off the dressing?
Can I use a hot pad/heating pad/hot water bottle on my wound?

Bleeding / Redness

What if my wound has crusty material on it?
What if my wound is bleeding?
My wound is bleeding through the bandage. What should I do?
How much blood is too much?
How do I stop the bleeding?
Why am I still bleeding when I've applied a lot of pressure?
Help I'm bleeding
Is bleeding normal right now?
What level of bleeding is normal?

Bruising

What if my wound is bruised?
The bruising is not going away, what should I do?
I'm bruising far away from my wound, what does that mean?
Can Dr. Carroll do anything about my bruising?

Swelling

What if my wound is swelling?
I cannot open my eyes, what should I do?
I cannot move my (X body part), what should I do?
How do I elevate my wound site if it's on my back or side?
When will my swelling go down?
Do I need to see Dr. Carroll if my wound is swelling?
My wound is swelling really really fast, is this normal?

Splitting stitches

How do I know when my stitches are splitting?
My stitches look weird, is that normal?

140 distinct questions that could potentially be raised by patients

Mid-fi Prototype Phase

Review with Client

During the lo-fi prototype phase, we came up with four major features and 11 categories of potential questions. Moving into mid-fi phase, we need to narrow down the project scope in order to focus our design effort on the most essential problem to solve. We explained to our client, Dr Carroll, about how limiting the scope would help in designing a better product. Then we discussed what were the most mission critical issues from the client's perspective that should be our priority moving into higher fidelity. Finally, the client identified the following needs to be the top priorities of the product:

- The user's initial 15 seconds of interaction with the app should be satisfying such that the user will be willing to continue using the app.
- The app should at minimum, cover the instructions on the post-op instruction sheet.
- The first 48 hours after surgery is the period that patients are most vulnerable and need the most reassurance. Especially the 48 hour dressing change is the time they are exposed to the wound for the first time. Following the correct guidance during their first dressing change is considered to be the most important step in the post-op process.

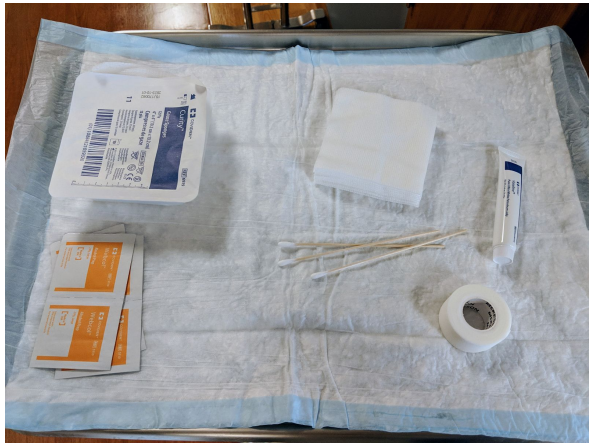
Lecture with Ian Hargraves

To gain a better understanding of how to design for the health care we attended a talk with Ian Hargraves who is an alumni of the CMU Design program. He began by discussing some issues in the the human centered and patient centered design sphere. Something that stuck out with our group was how he compared health care to taking an airplane and how currently they want health care to be similar to taking a plane where to the patient, the pilot is not relevant and to the pilot, the patient is a blur.

He also discussed how collaborating on treatment is extremely important between the client and the clinicians. He believes that this is the only real way for the patient to be okay complying with the treatment and feel like the doctor picked a treatment that was specific to them.

Empirical Research

After we narrowed the scope of our project, we decided to start approaching the design from the 48-hour post-operative dressing change process, which is a critical process that every patient after surgery has to go through, usually at home by themselves or assisted by caretakers. To gain more insights of details and existing challenges in the 48-hour dressing change, we went to the UPMC Falk clinic and did further research by experiencing the dressing change ourselves. A nurse helped put the dressing after surgery onto our face, and we tried to follow the instruction sheet step by step with the materials provided for the 48-hour dressing change.



Things needed for dressing change



Nurse putting on dressing for us

By going over the instruction sheet and actually carrying out dressing change by ourselves, we got a better understanding of patients' situations, both physically and mentally, and gained some more insights through the research:

- *Some patients might forget to prepare everything needed for the dressing change before getting started.* Even though everything for the first 48-hour dressing change is provided by the clinic and patients don't need to buy themselves, it would make dressing change harder if patients have to grab things from places in the middle of the process.
- *Some patients might be unsure about whether or not to leave dressings on while showering, as the instruction sheet did not go into that much detail.* Thus, it would be helpful to let patients know that leaving the dressing there while showering should help them more easily take off the dressing.
- *Some patients might need to look at the instructions multiple times during the process.* As patients' hands might not be that available during dressing change, more hands-free interactions are potentially more preferred to assist patients with the dressing change process.

- *Some patients might not understand how exactly they could carry out certain steps merely following the text on the instruction sheet.* For example, the instruction sheet only tells patients to apply vaseline using Q-tips before putting on the gauze, while a patients might not know exactly how much vaseline would be enough. Additionally, a nurse mentioned that it usually works better to use 2 Q-tips at a time and spread out the vaseline. Thus, demonstrations of each step using pictures or animations might be helpful.

Iterations and Refinements

To test out our mid-fi prototype and improve the design, our team conducted three rounds of user testing in the UPMC Falk clinic. We tested the prototype with various different potential user groups of the assistant, including clinic staff (residential doctors, physician assistants, and nurses) as well as patients. During user testing, we set different scenarios for our users, including being discharged from the clinic, changing dressing at home for the first time, concerned about bleeding, and feeling pain. For the different scenarios, we asked the users to use the InVision mockup of the assistant to complete our pre-designed tasks in these scenarios, and asked them a few survey questions afterwards. In the meantime, we received multiple rounds of design critique and integrated these feedback as well as our observations during user testing into our prototype to improve the design.

Overall, we received very positive feedback during the three rounds of user testing in the clinic. Except for feedbacks on the design of the assistant, we've also put a lot of focus on the accuracy of medical terms and processes to ensure that the assistant gives correct instructions and suggestions, and received valuable feedback during user testing.

1st Round of User Testing

The feedback we got from the first round of user testing included

- The assistant needed more feedback to the user along the process, for example, when they selected among multiple options on a page, or when they are done with some process.
- The assistant needed heavier explanations, especially for users who are not very tech savvy. For example, users who are not very familiar with conversational user interfaces might not know how to ask a question without clear explanation in text for the button.

- Some medical terms and processes needed to be changed for better accuracy. For example, we changed the wording of “choose your preferred medication” to “talk with your nurse, then select your medicine plan” for choosing between Ibuprofen and Tylenol vs. Tylenol only, as this is usually due to medical restrictions only instead of patient preference.

We also went through design critique after this round of user testing, and some critique we received included

- The assistant needed to have progressive disclosure to users, especially in the dressing change tutorial section. The steps needed to be broken down into even smaller steps.
- The information on each screen (especially text) needed to be more succinct and thus would have less cognitive load for the users.
- Button designs needed to be changed so that the design of each type of button would be unique to its functionality.
- Pictures of clinic staff could be added to convey a sense of familiarity and authority to the patients.

With the feedback, we improved our prototype by first changing the medical terms and processes as suggested. Then we re-organized the dressing change tutorial section to include more details that are delivered to users stepwise - for example, changing the single step of taking a shower to: (1) wet bandage, (2) take off bandage, (3) wash wound. We also iterated on the design of buttons and changed the shape, layout as well as color scheme.

2nd Round of User Testing

After refining our design based on feedback and critique from the first round of user testing, we conducted a second round of user testing in the clinic by going through a similar process as in the first round, and had very positive results. Some points of improvement we got from the second round of user testing included

- The assistant needed better pictures that match with the text and convey the right thing to do for users. For example, the pictures for the three levels of bleeding (blood covered by gauze, blood soaking gauze - gauze about to fall off, and streaming blood from dressing) needed to better match the descriptions.
- Also for the self assessment section, the clinic would prefer patients to always apply pressure first before calling the clinic, even if it's the highest level of bleeding.

We also went through design critique after this round of user testing, and some critique we received included

- The design did a much better job in breaking down the instructions, but needed clearer language and action terms for users.
- The button design still needed better feedforward and clear semantics.

We refined our prototype based on the feedback and observations during our second round of user testing, and replaced the original pictures with more accurate ones, both for the dressing change tutorial and self assessment sections. To make it clearer to users where they are in the process of dressing change, we added a progress bar on the top of each page of the dressing change tutorial section. Moreover, we further iterated on the design and layout of buttons after receiving feedbacks from users on their preferences among multiple designs we presented.

3rd Round of User Testing

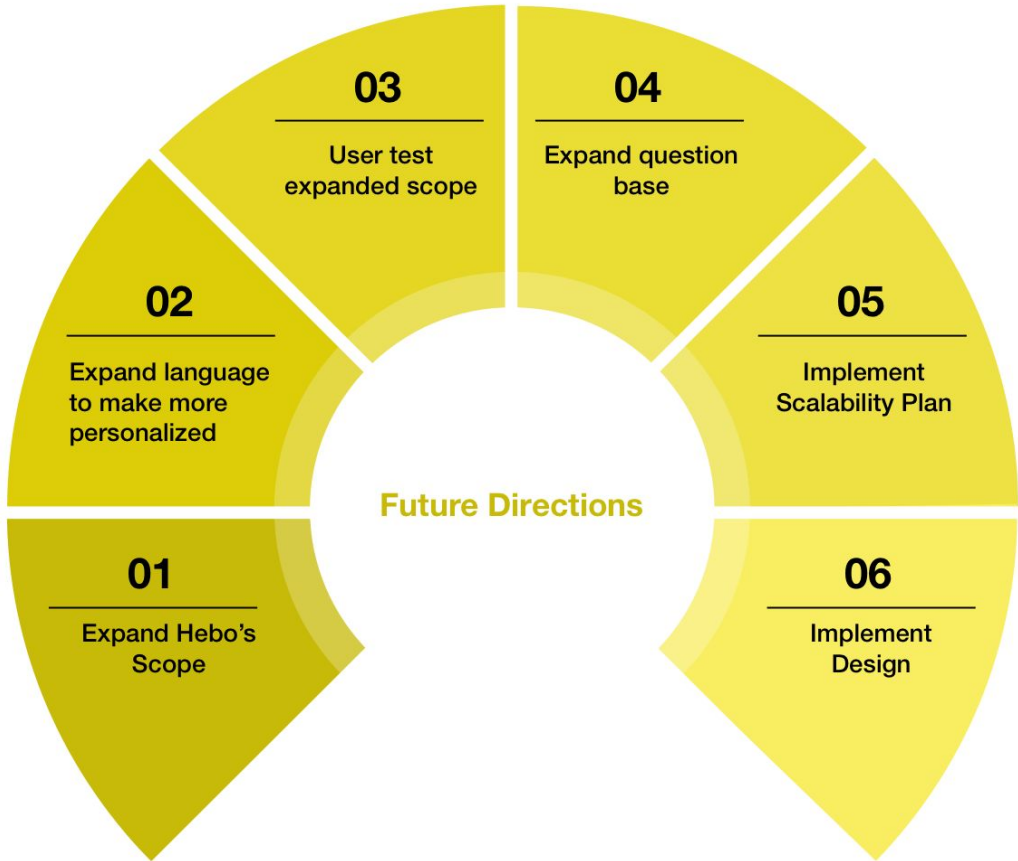
As we only received comments from clinic staff as our users in our second round of user testing, we conducted a third round user testing in the clinic to gather more comments from the patients, who will be the main target user group of this assistant. The users generally liked the assistant a lot, and some feedback we got from the third round of user testing included

- The assistant could better reassure the patients especially when they are bleeding or having pain.
- Some pictures needed further changes, for example, using two Q-tips instead of one Q-tip or the finger to spread vaseline.

For this round of design critique, we mainly focused on small design details on each page and made further improvements. The design of the assistant was proved to be straightforward and easy to understand from the multiple rounds of user testing, thus we focused on refining the details in our design after the third round of user testing and came up with the final design.

Next Steps

Our team has worked to create a detailed design solution that can be handed off for implementation. Through our numerous rounds of user testing and research we believe that our design best meets the goals and needs outlined by our client. Specifically (1) focusing on the initial interactions that establish trust, (2) making sure that during the first 48 hours after surgery (when patients are most vulnerable) the application serves as a source of comfort and knowledge, and (3) addressing common questions related to the post op sheet. We believe that in order to successfully carry out the remainder of this project, our client will need to consult with a group to complete the following steps: expanding Hebo's Scope, expanding language to make more personalized, user testing expanded scope, expanding question database, implementing scalability plan, and implementing design.



Expanding Hebo's Scope

Currently, we have limited Hebo's scope to focus on the first 48 hours after surgery and specifically on the first dressing change conducted at the 48 hour mark. This has allowed us to focus our design on the most critical parts the application, the 48 hour mark as that is when we believe the user will be most vulnerable and need assistance. We believe that given the parts of the application that were designed, it will be simple to expand the scope past the 48 hour mark. The following list of necessary implementations are things we discovered in our research that can follow our design specs:

Necessary Future Implementations:

- Self-Assessment for Bruising
- Self-Assessment for Swelling
- Self-Assessment for Infection
- Dressing Change after the first 48 hour dressing change
- Specifying dressing change for different areas of the body
- Pain Management (optional)

Expanding Hebo's scope will mean implementing these necessary features. We believe that this can be done by following the template outlined through the self-assessment for bleeding and the dressing change.

Expanding language to make more personalized

Through our research we found that patients prefer for the instructions to be as personalized as possible. We believe that it increases the amount of trust in the application, therefore in the future roadmap we envision offering more personalized instructions. For example, smaller wounds can be covered by a Bandaid and some patients might prefer taking a bath over taking a shower. We found that many users are looking for support and reassurance in their postoperative care. Therefore having a more personalized Hebo can be created by using positive language as well as having personalized check-ins. Using language such as "I'm sorry you are in pain" and "you're doing great" emphasize Hebo's personal comfort feature. Also if Hebo can remember to check up on the patient after they asked a question about bleeding, pain, bruising, etc. we can learn more about what the patient is looking for out of a post-operative care assistant. In the far future, we hope that Hebo could predict a complication before it

happens, and address and monitor questions with the highest level of efficiency with each interaction with Hebo being logged and updated.

User testing expanded scope

From our user testing we found Hebo to be very comprehensive and easy to use by a majority of patients. To make sure that the expanded scope was implemented in a way that users will still be able to understand it, we recommend user testing the application in stages. We found that doing Think Alouds with the patients is the most effective way to get good feedback.

Expanding question base

Over the course of this project we have begun to collect an extensive list of potential questions that patients could ask and have placed them into individual categories. As the project expands past the 48 hour mark the database of questions needs to be expanded to fit the new use cases of the application. We encourage the future team to begin adding questions to the database while getting the responses from the clinic staff.

With each category a number of intents needs to be created and within those intents, all of the potential utterances and then the response and potential error messages.

Implementing Scalability Plan

During our meetings with our client they discussed one of the long term goals as being able to introduce Hebo to multiple different clinicians serving Mohs surgery patients. To do this we encourage the team to be implementing the scalability plan as they are implementing the design. What we mean by this is making it easy to trade out the instructions easily and with little knowledge on how to code.

Implementing Design

Design Specs

Link to detailed design specs (Figma):

<https://www.figma.com/file/Vh4BPimkJkjq3eiwwE0Mxkq7/HEBO-2.0?node-id=0%3A1>

Link to final design screens (Figma):

<https://www.figma.com/file/Vh4BPimkJkjq3eiwwE0Mxkq7/HEBO-2.0?node-id=1%3A98>

Note: View screens for different functionalities by selecting the tabs under 'Pages' section on the top left corner.

Link to final design prototype (InVision):

https://invis.io/YFRSW73NV27#/360986898_Onboarding-1_V2



TYPOGRAPHY

**h1 Roboto
40px Bold**

**h2 Roboto Medium
36px**

**h3 Roboto Bold
30px**

**h4 Roboto Medium
28px**

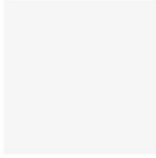
h5 Roboto Medium 24px

h6 Roboto Medium 18px

h7 Roboto Light 18px

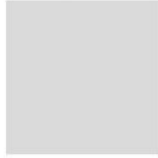
COLORS

Speech bubble



F6F6F6

Home screen button



DADADA

BACK/NO button



C4C4C4

Text



000000

Emergency



FF6A71

Selected Radio Button



FF6D00

Icon



FFA700

Yes button



F6C523

Input speech bubble / Header



FCE76C

Confirm Button



00C853

Reassure



37A53E

Start button

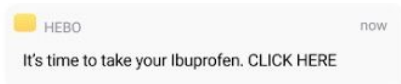


2979FF

Logo



REMINDER



LINKS / BUTTONS



Back button (height: 55px, width: 137px, corner radius 10px), Border/font color: #616161



Next button (height: 55px, width: 137px, corner radius 10px), Font color: #000000





Round button (height: 56px, corner radius: 30px, font color: #FFFFFF)





Choice button 1 (height: 73px, corner radius: 15px)

Implementation Spec

Tools

	
Mobile Application (React Native, Android, iOS)	Voice Assistant (Google Assistant SDK)
<ol style="list-style-type: none">1. Use React Native to allow cross-platform mobile application development2. Build the visual components of the App, following the detailed design spec and high fidelity prototype design screens3. Enable the native app capabilities to take in user voice input, and send to backend Google Assistant Service for speech recognition and matching response4. Enable push notification feature to send reminders	<ol style="list-style-type: none">1. The Google Assistant Library is written in Python.2. The library exposes a high-level, event based API that is easy to extend.3. Supported Features:<ol style="list-style-type: none">a. Hands free activationb. Audio capture and playbackc. Conversation state managementd. Timer and alarm management

	
<p style="text-align: center;">Web Application (Django, Bootstrap)</p>	<p style="text-align: center;">Database (PostgreSQL)</p>
<ol style="list-style-type: none"> 1. Use Django framework to build the initial setup web page of user account. 2. Bootstrap offers template for web forms, check here for examples. 3. The Django project also serves the backend of the entire Hebo 2.0 App including collecting questions from user, matching with existing question in the database and returning answer. 	<ol style="list-style-type: none"> 1. Store patient profile information and all questions/answers 2. Connected to the Web Application for creating new user account and log-in 3. Serve answer to incoming question from user 4. Store all questions from user, including those don't have answer yet, for the research team and clinic staff to fill in the answer later

Flow of App

Link to final design prototype (InVision):

https://invis.io/YFRSW73NV27#/360986898_Onboarding-1_V2

Initial Setup (by clinic staff):

We envision the initial setup of the patient profile to be through a simple web page that allows clinic staff to enter patient's *Name, Date of Birth, Date of surgery, and Surgery Site*. When the form is submitted, the backend will return a confirmation with a unique system generated username and password.

Onboarding (at the start of discharge):

During the discharge process, the clinic staff will guide the patient to download the HEBO app, log in with the patient-specific username and password, and let the patient walk through the three onboarding screens which briefly introduces the major functionalities of the App.

Sign-in is only required for the first time usage during the discharge.

Customizable User Preference (during discharge):

During the discharge process, the patient will fill out some personal preferences for the App to make customized response later. The questions include: *When do you usually shower*, and *Talk with your nurse, then select your medicine plan*.

The shower time information determines when will the App push reminder for the first 48 hour dressing change.

Morning → 8:30 AM on the second day after surgery

Afternoon → 4:00 PM on the second day after surgery

Evening → 9:00 PM on the first day after surgery

The medicine plan information determines the type of medication (Tylenol / Ibuprofen) shown in the reminder for medication.

User Training (during discharge):

Chatbot interface which guides the user through how to ask a question. The example questions include *What is my name*, *When was my surgery*, and *When should I change my dressing*. The reminder setting example is *Remind me when I need to take medication after I get home*.

The speech input is activated by saying the name 'Hebo'.

Onboarding (at home):

After the first use of the App during discharge at clinic, every time the user opens up Hebo, the App will first show the three onboarding screens, with Skip button at the bottom.

Home Screen (At home):

After the user go through the onboarding screens, the home screen will show up. It also serves as the menu screen to access all functionalities of the App including *48 Hour Dressing Change*, *Self Assessment*, and *Ask a Question*.

The user can go back to this screen by clicking on the Home button on the top left corner of each screen.

48 Hour Dressing Change:

The button for Dressing Change is muted before the system set time for dressing change, which is roughly 48 hours after surgery. User can access this link either by clicking on the push notification message of 48 Hour Dressing Change or through the button on home screen after the system-set-time for dressing change.

This functionality includes tutorial of the dressing change process with text, visuals, and verbal guidance (reads out the text instructions).

The user can navigate through the screens either by clicking on the BACK and NEXT buttons, or through simple voice commands *Hebo, next* and *Hebo, back*.

The user can also ask dressing change related questions throughout this process and get redirected to a chatbot interface. The chatbot interface is activated by hearing the name 'Hebo'. When the user is done with asking the question, they can exit the chatbot screen and go back to the dressing change step where they left off.

Ask a Question:

Chatbot interface which accepts verbal question input starting with the word "Hebo". The verbal input is sent to the backend, processed by Google Assistant Library, and matched with the most similar utterance in the Q&A database. Then the App will output the answer to that utterance through both text and voice format.

The full list of questions we generated can be found in Appendix IV: Question Ideation, we will need help from the clinic staff to fill out the answers to these questions. In addition, we have a list of 48 Hour Dressing Change related questions and answers in Appendix V: Dressing Change Questions and Answers.

Self Assessment:

The self assessment screen is currently only designed for bleeding. The user can select which of the three images best match with their own bleeding, and check if this is normal or needs immediate attention. They can also click *How to Apply Pressure* to see instructions on applying pressure, the flow of this subtask is similar to the flow of dressing change.

At the end of Applying Pressure tutorial, the App has a 30 minute timer, which checks back on the user if they are still bleeding. If the user selects YES on still bleeding, the App will pop up a *Call Clinic* button which automatically dials the number to the clinic.

Reminder for Medication:

The App should remind the patient to take two extra strength Tylenol tablets as soon as possible after the surgery and repeat every 6 hours for the first 24 hours.

For patients who select 'Tylenol and Ibuprofen' in the Medicine Plan question during discharge, the App should also send reminder to take two 200mg tablets of Ibuprofen every 6 hours starting 3 hours after the first dose of Tylenol.

Reminder is sent through the push notification of the smartphone. Design and language of the reminder can be found [here](#).

Helpful links

Google Assistant SDK:

https://developers.google.com/assistant/sdk/overview#steps_to_start_building_your_projects

React Native Framework: <https://facebook.github.io/react-native/>

Django Framework: <https://www.djangoproject.com/>

PostgreSQL: <https://www.postgresql.org/>

Note

The list of tools above is subject to change if there is better library/framework/tool found in the development process.

Appendix I: HCI Research Methods

Contextual Inquiry

Contextual Inquiry is a semi-structured interview method to obtain information about the context of use, where users are first asked a set of standard questions and then observed and questioned while they work in their own environments.

Storyboard

Storyboard is a technique usually used in ideation phase where designers identify user need and sketch out scenarios with potential solutions.

Speed Dating

As designers move from ideation to iteration, we need to identify which design opportunities and potential solutions best fit the user need. The design team first present a variety of storyboards to a set of target users to validate the design opportunities researchers found with the need users perceive. These storyboards help designers prioritize user needs, and narrow the design space for potential solutions.

Low-fidelity Prototype

A prototype that is sketchy and incomplete, that has some characteristics of the target product but is rather simple, usually used in the early design phase to quickly produce the prototype and test broad concepts.

Collaborative Sketching

Collaborative sketching is an ideation technique where we use the universal language of drawing to build upon other's ideas. Each member in the design team starts by drawing his/her ideas on a paper for 3 minutes, and switch to draw on other team members' ideas.

Empirical Research

Empirical research is research using empirical evidence. It is a way of gaining knowledge by means of direct and indirect observation or experience.

Appendix II: Question Ideation

Wound care

What supplies do I need to clean my wound?
Where can I get these supplies?
When should I clean my wound?
How do I clean my wound?
When can I remove my bandage?
Do I have to use the same dressing as my doctor?
Do I have to get all of these supplies?
What is Telfa?
What is Hypafix?
What is vaseline?
Should I leave my bandage on all day?
Can I change my bandage if there's a lot of bleeding even if it hasn't been 24 hours?
My dressing is coming off, what do I do?
Why doesn't my dressing look like the one the doctor gave me?
Should I put as much vaseline on it as the nurse did?
There is dry blood stuck to the dressing, is that normal? What do I do?
How often should I apply vaseline?
How do I change my dressing?
How do I keep my wound from drying out?
How do I put dressing on a place I can't see?
How often can I change my dressing?
How should I be applying pressure?
My wound is itchy!
How can i stop it from being itchy?
Does itching mean I am having an allergic reaction?
Can I put itch cream/hydrocortisone on my wound?
Can I put neosporin/antibiotic ointment on my wound?
Can I put lotion/cream on my wound?
Do I have to use Vaseline?
I ran out of gauze, how can I get more?
My bandage is stuck to my wound, what do I do?

Pain

What should I do if my wound hurts?
My wound hurts so bad. Is it normal?

My pain medicine isn't working. What should I do?
I can't sleep because my wound hurts. What should I do?
How long should I ice my wound for?
How much Tylenol should I take?
What is acetaminophen?
What is ibuprofen?
When can I take ibuprofen?
When can I take Tylenol?
How does the ice help with pain?
The ice isn't reaching my wound, can I take off the dressing?
Can I use a hot pad/heating pad/hot water bottle on my wound?

Bleeding / Redness

What if my wound has crusty material on it?
What if my wound is bleeding?
My wound is bleeding through the bandage. What should I do?
How much blood is too much?
How do I stop the bleeding?
Why am I still bleeding when I've applied a lot of pressure?
Help I'm bleeding
Is bleeding normal right now?
What level of bleeding is normal?

Bruising

What if my wound is bruised?
The bruising is not going away, what should I do?
I'm bruising far away from my wound, what does that mean?
Can Dr. Carroll do anything about my bruising?

Swelling

What if my wound is swelling?
I cannot open my eyes, what should I do?
I cannot move my (X body part), what should I do?
How do I elevate my wound site if it's on my back or side?
When will my swelling go down?
Do I need to see Dr. Carroll if my wound is swelling?
My wound is swelling really really fast, is this normal?

Splitting stitches

How do I know when my stitches are splitting?

My stitches look weird, is that normal?

What do I do when my stitches are coming out?

Can I take my own stitches out?

Can my family member take my stitches out?

Why do I have stitches?

Activity

When can I go back to gym?

Can I do yoga?

When can I start doing heavy lifting?

When can I start to feed animals on my farm?

Can I cook?

Can I lift weights?

Am I allowed to go grocery shopping?

Can I go swimming?

Can I sit in a hot tub?

Can I go to the spa?

Can I go to the beach?

When can I start driving?

Can I go camping?

When can I go back to work?

Can I hold/lift my child?

Diet

If I had surgery around my mouth, what can I eat?

Are there foods I'm not allowed to eat?

Should I be eating healthier?

I'm feeling light headed, is that normal?

Should I be eating before taking my pain medication?

How soon after surgery can I eat?

Do I have to use a straw?

Emergency

There's lots of blood when I take off the dressing. What should I do?

My stitches popped open and there's blood everywhere. What should I do?

Help please

Im seeing more dark spots on my body, is my cancer back?
I feel like I have been hit with a baseball bat, is there something I can do to stop it?
Do I have to go to the emergency room/can I go to the emergency room?
I can't breathe, what should I do?

Signs of infection

What if my wound is sore or if it has liquid coming out of it?
My wound smells bad when I take the dressing off. What should I do?
My wound is leaking pink/green/yellow/clear/white liquid. What should I do?
My son got pink eye and I'm afraid I just got infected.
My family member is sick, what if I get sick too?

Miscellaneous questions

Can I breastfeed my baby?
When can I apply makeup?
What soap do I use?
Is this soap okay for me to use?
Can I shower now?
Should I keep my dressing on when I am in the shower?
What is the best way to shower?
Can I take a bath?
Should I wash my wound in the shower?
How do I reduce scarring?
I am worried about scars
They told me it wouldn't scar but I can see one forming
Is scabbing okay?
What is a physician assistant?
How should I sleep?
When can I start showering?
When/How should I brush my teeth?
Do I have to use mild soap on the rest of my body?
Can I still use my own hair care products?
Can I shave?
Can I use perfume?
Can I clean my ears?
Can I wear contacts?
When can I have sex?
Can I use other skincare products?
Can I treat my acne?

A hair got stuck in my stitches/bandage/wound, what should I do?

Can I apply sunscreen?

Can I use bug spray?

Should I avoid people who are sick?

Can I get a flu shot/vaccination while I'm recovering?

Can I get Botox while I'm recovering?

Should I wear a mouth mask when I go out?

When can I drink alcohol?

Am I allowed to get high?

Should I stay out of the sun?

Appendix III: Dressing Change Questions and Answers

When should I wash my wound?

Wash your wound for the first time when you shower 2 days after your surgery. Starting on that day, you need to wash your wound once a day, every day.

My wound is swelling, what should I do?

Some swelling after surgery is normal. To help the swelling go down, lay down and put pillows under yourself to raise the area of your surgery higher than the rest of your body.

How much Vaseline should I put on my wound?

Put a very thick layer of Vaseline on your wound. Put the Vaseline on like you are icing a cupcake.

Should I keep my bandage on while I am in the shower?

Wear your bandage in the shower and get it wet. Then remove your bandage gently.

My bandage is falling off, what should I do?

Use tape to hold your bandage on your skin.

What soap do I use?

To wash your wound, always use a mild soap, like Dove.

Do I have to use the same dressing as my doctor used?

You do not have to use the exact same type of bandage. It is most important to make sure your wound is covered entirely with Vaseline and gauze or a Bandaid.

I'm having trouble getting the bandage off. What should I do?

Let water run over your bandage to get it very wet. Then, slowly peel the tape off.

Can I use something other than Vaseline to cover my wound?

No. Only use Vaseline and a bandage to cover your wound.

I'm having trouble getting the crust off. What should I do?

Soak gauze in warm water with mild soap. Hold the gauze on your wound for 15 to 20 minutes, then check your wound. If the crust is still there, hold the gauze on your wound again.

Why do I have stitches/things in my wound?

You may have stitches, which help your wound heal. They are supposed to be there. Don't pull at them or take them out.

Can I take out my stitches on my own?

No. Do not remove your stitches. Wait for your appointment with Dr. Carroll.

When can I take off my bandage?

When you wash your wound, wear your bandage in the shower. Get it wet, and take it off while you are in the shower.

How often should I change my bandage?

Starting 48 hours after your surgery, wash your wound and change your bandage once a day.

Should I leave my bandage on all day?

Yes. Only take off your bandage when you wash your wound.

There is dry blood stuck to the bandage. Is that normal? What do I do?

Some bleeding is normal after surgery, and the blood may stick to your bandage.

How often should I apply Vaseline?

Put on Vaseline once a day, after you wash your wound. Then, put on a new bandage.

How do I put a bandage on a place I can't see?

Use mirrors to help you see your wound, or ask someone to help you care for your wound.

My wound is swelling a lot. What do I do?

Some swelling after surgery is normal. Gently press on the swollen area. If it is soft and not blue, it is normal swelling.

If it is hard and blue, you may have a type of swelling called a hematoma. This is not an emergency, but Dr. Carroll may want to look at your swelling. You may want to call Dr. Carroll's office to check in.