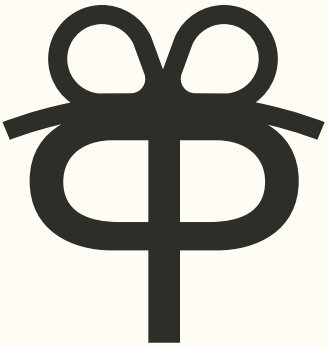


Pill Pal

PROCESS BOOK

Table of Contents

The Prompt

THE GOAL OF THE PROJECT

The goal of this project was to create a wearable device to increase medication adherence for patients with heart disease. Pill Pal functions as a discrete ring around the patient's finger that can either light up or vibrate to alert the patient that it is time to take their medication. Light colors around the ring correspond to colors around the pill bottles to decrease patient error rates. Overall, the goal is to make patients' and caregivers' lives easier and create a product that is both functional and aesthetically beautiful.

THINKING ABOUT ADHERENCE

Medical adherence--the degree to which a patient follows the recommendations of their healthcare provider--is extremely important for the success of a treatment. However, 50% of U.S. patients with prescriptions do not follow their medication regimens. Whether due to lack of understanding or forgetfulness, poor medication adherence is a widespread issue that costs both companies and patients. In this project, we were tasked with designing a wearable device that aids a patient in their health adherence.

Research

PRIMARY RESEARCH

PRIMARY RESEARCH

For our primary research, we interviewed 14 people, including patients aged 18-75 who regularly take medication and physicians who have had experience with patient medication non-adherence. We asked them questions on their medication adherence and what helps and hinders this process.

SECONDARY RESEARCH

We also conducted mini experiments on ourselves and noted what affects our own medication adherence, as well as secondary research on wearable technologies, medication adherence, and current technologies for patients who struggle with medication adherence. We used this research and the pain points established in our interviews to start our ideation process

THE QUESTIONS CONSIDERED

Age
Profession
Gender Identificaion
Any current prescriptions
Length of current prescription
Medication adherence interferences
Your dependents
Experience with wearble tech

User Flow Mapping

From those interviews we conducted, we extracted the goals, thoughts, failures, and feelings patients had during every step of the medication adherence process.

KNOWLEDGE

Patients can forget if they've already taken their medication for the day.

Reminders on instructions to ensure that patients take the correct dosage.

Reinforcement of consequences of not taking medication on time (side effects).

TIMELINESS

Patients become engrossed in work and forget to take medication.

Patients are often too busy and prioritize other things over taking medication.

If there is no way to "snooze" an alarm, patients can forget to take the medication later in the day.

TECHNOLOGY

Can be expensive

Notifications can be an annoyance if they cannot easily be turned off

Reminders must be uninstrusive for patients who may be busy when alerts go off.

Often give up on apps with difficult, long, or complicated set up processes.

MEDICATION

Busy young adults will have different schedules everyday, and may not be home when it is time to take medication.

Simple phone reminders can be insufficient for patients managing multiple medications

The Specifics

We chose to focus on creating a device for heart disease patients. From coronary artery disease to hypertension, there is a variety of heart diseases that are often comorbid, leading to patients having to take many medications regularly. Medical adherence is also a prominent issue in heart disease treatment, making it an ideal target for our solution.

50% of the 187 million US patients do not take their medications as prescribed.

Nonadherence is particularly common in heart disease patients.

1 in 4 of American deaths is caused by heart disease; the leading cause of death.

6.8 medications are taken on average for heart failure patients.

In a 2016 study, many patients did not know the number of drugs they were prescribed.

80% is the threshold of missed beta blocker doses that makes the patient four times more likely to experience cardiovascular event.

Ideation

Our early ideas involved a different set of devices, each with the end goal of promoting good medicine adherence.

A SCALE

On concept was to create a scale within the bottle that would track changes in weight of the bottle to see if you're taking your medications.

APPLE WATCH

Since Apple Watches are an already established device, we would implement an app on a device that is already familiar to users.

A RING

We would creative a ring that syncs to a user phone that discreetly gives the user notifications when it is time to take their medicine. This is the concept we pushed further.

Something that we learned from our interviews is that users are reluctant to use wearable technology that eludes a tech personality. Because of this, our wearable approach would need to be discreet and not stand out from the lifestyle of the user. Here are the main takeaways from the interviews we needed to implement into our system.

FORGETTING THE MEDICATION AT HOME

Ring will buzz if you leave your house without your medication

FORGETTING TO TAKE MEDICATION

Ring is something you can always wear and provides discrete reminders

KEEPING TRACK OF HOW REGULARLY YOU TAKE YOUR MEDICATION

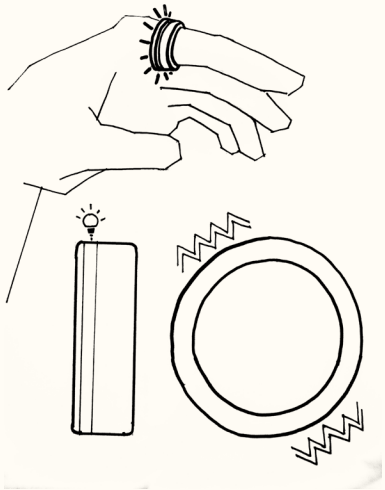
Calendar view of daily adherence

Early Ring Concepts

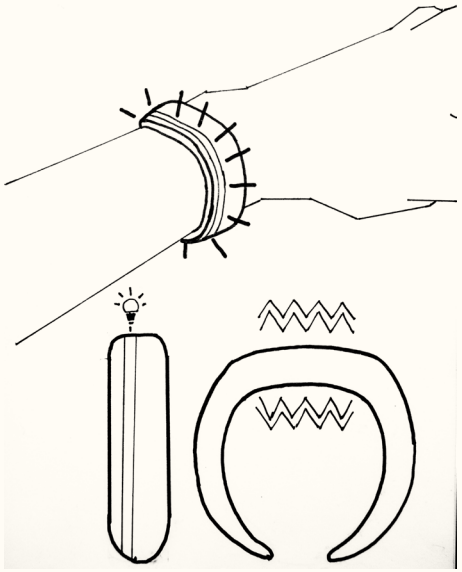
We wanted the ring to be a standalone device and for patients not to have to rely on checking their phone or crowd the already oversaturated app market. Through discussions with our partners at Capacity and ExpressScripts, we decided to take out unnecessary features within the app, such as messaging and notifications, and focus on tracking medication adherence. We also decided to implement a caregiver app for family members and health care professionals.

Here are some early prototypes of our ring. The ring takes the form of your average ring as to now stand out and become a focus point for your peers. It would feature lights that would shine with growing intensity when it was time to take your dosage. The ring would also vibrate lightly.

We also considered a band for younger patients as to not lose or break a ring due to size. But for the scope of this project, we narrowed it down to just the ring.



The Ring



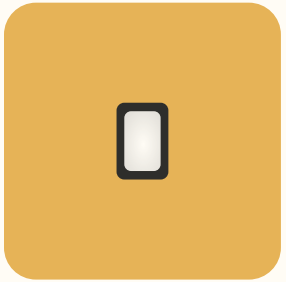
Band Version

System Architecture

Our implementation is a two piece system using wearable tech and an app. Patients are given a reminder ring that also connects to a backend system which Users and Caregivers can access. This system also employs AI to determine the best time to remind you over time.

THE RING

- Small & discreet
- Vibrates and lights up to remind you to your dosage
- RFC sensor to detect taking your dosage

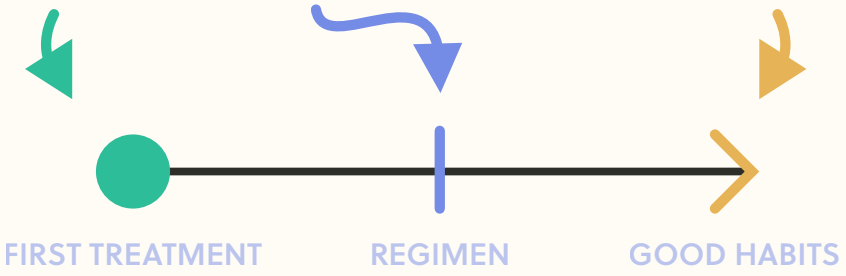


THE APP

- Shows daily dosage
- Adherence statistics
- Ring reminder settings
- Caretakers can also have access to your interface

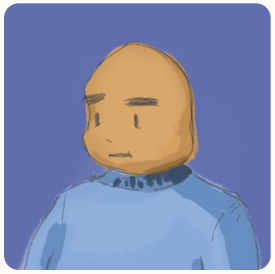
OUR GOAL

Jump in here, help sustain this, and get the user here.



Meet Walter

Walter is a 61-year-old fire inspector from Virginia. About seven months ago, he experienced a heart attack. His doctor diagnosed him with coronary heart disease and hypertension and prescribed him a number of medications. Even though he experienced such a dangerous cardiac episode, however, Walter still has trouble adhering to the regimen. His wife often has to remind him to take his medications throughout the day, and he simply does not register the gravity of missing doses.



AGE

61 years old

PROFESSION

Fire Inspector

LIVING IN

Virginia

FAMILY

Wife and 3 adult children

PERSCRIBED MEDICATIONS

Diuretic (Furosemide)

Anticoagulant (Warfarin)

Beta Blocker (Metoprolol)

Ace Inhibitor (Lisinopril)

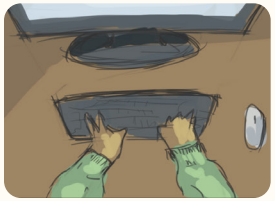
CONDITION BACKGROUND

Walter experienced a heart attack about 7 months ago and has been diagnosed with coronary heart disease and hypertension. His doctor prescribed him a combination of medications to be taken regularly, but Walter has been having trouble keeping up with them. His wife often needs to remind him to take his medications, and despite knowing the gravity of a heart attack, he does not register the importance of taking his pills.

Storyboarding

Walter has trouble staying diligent about taking his heart medications every day, and occasionally doubt their efficacy.

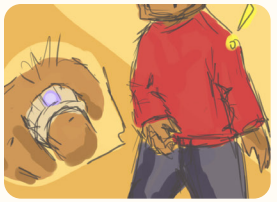
His doctor implores him to take them promptly, ad suggests using a reminding tool to help him stay on track.



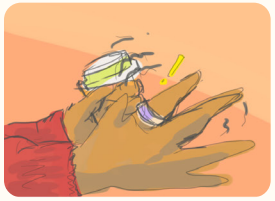
On Express Scripts' website, Walter places an order for his medication. He also selects the option to ship the PillPall reminder ring.

Walter receives Pill Pal and his next prescription refill in the mail, then downloads the mobile app for PillPall. The bottles come with color-coded stickers embedded with RFID.

Upon sensing the ring's proximity to a bottle for the first time, the app prompts Walter if he would like to track his adherence routine.



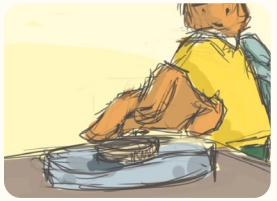
Over time, the ring learns the best times in the day it will light up and that Walter should be reminded to take his medication.



If the ring senses Walter reaching for the pill bottle with the wrong RFID, it will glow more intensely and vibrate to warn him.

When he takes his medication, the ring scans the customized sticker attached to the lid of the pill bottle and records that he has taken his dose.

Pill Pal utilizes different colors underneath the surface of the band to softly indicate which medication to be taken now. For the visually impared, haptic feedback could be selected in supplement or instead of colored lights.



A wireless charging pad easily allows Walter to recharge his ring without worrying about keeping track of cords or fumbling with plugging it in.

The Ring

FEATURES

- 9 LEDs that correspond to color of medication in app
- Adjustable vibration haptic that fires with light
- 3 discreet materials

AI and machine learning calculates the time between initial reminder and completed dose to determine the best time to remind the user. A RFID sticker, color-coded to match its LED reminder light on the ring, will be on the bottle cap, which the ring can sense upon contact to register that the patient has taken their medication.

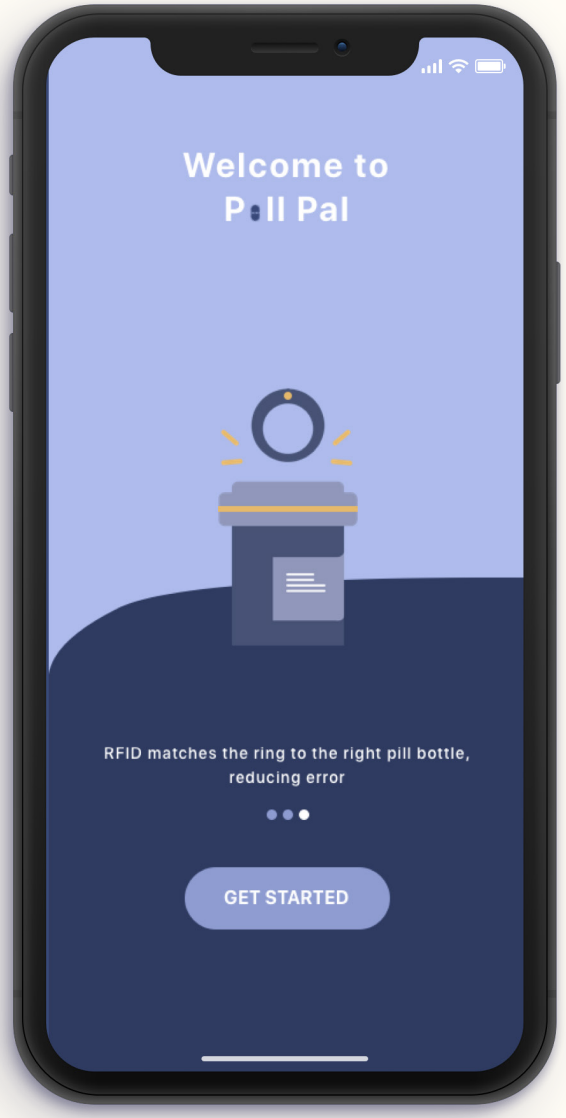
WOOD

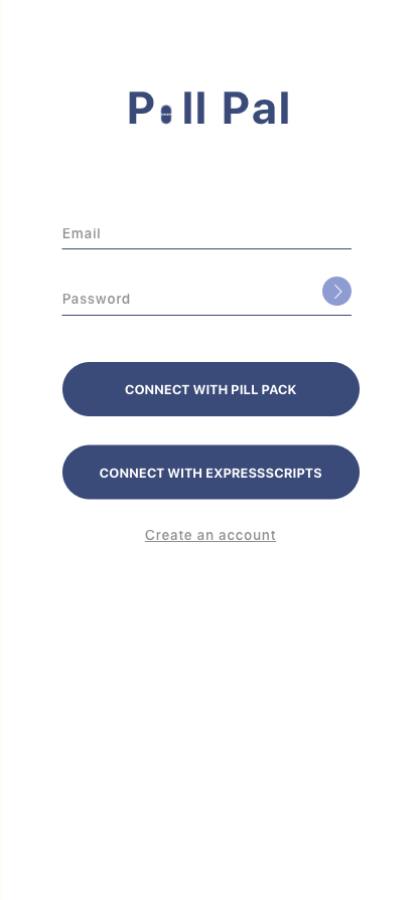
BRUSHED STEEL

SILICONE

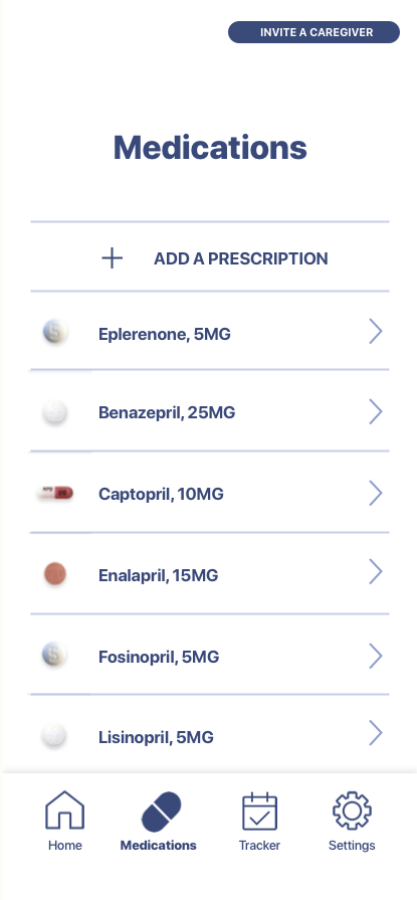
The App

There would exist an interface for both the patient and their caregiver. Each allowing them access to the patients adherence progress.

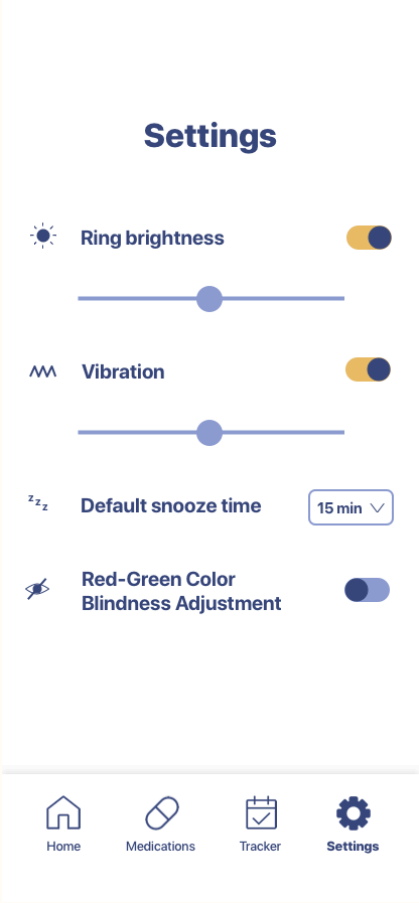




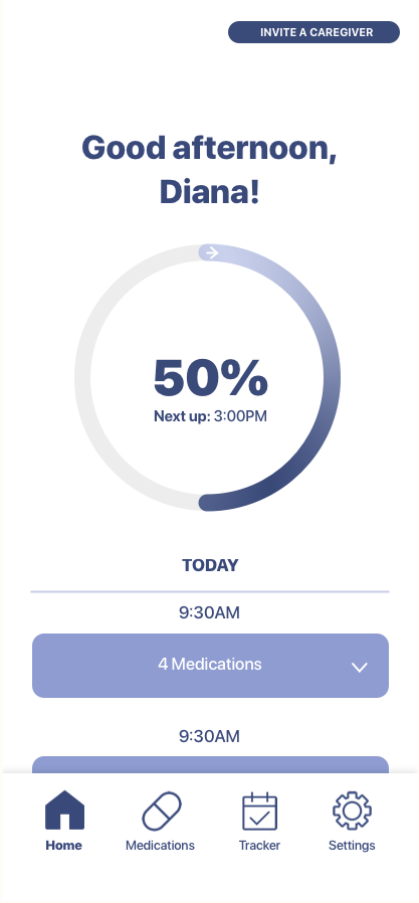
When users first open they app they are greeted with a sign in. This onboarding process can be either completed solo by the user or prefilled by their healthcare provider.



The medication dialog screen. Shows the users the list of medications they would need to take. Going into each medication will return more info on that medication, and their associated ring colors.

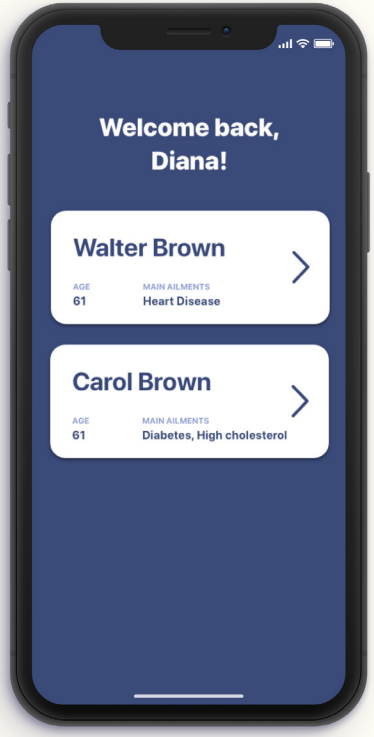


On the settings page, patients can adjust brightness and vibration settings to their liking.

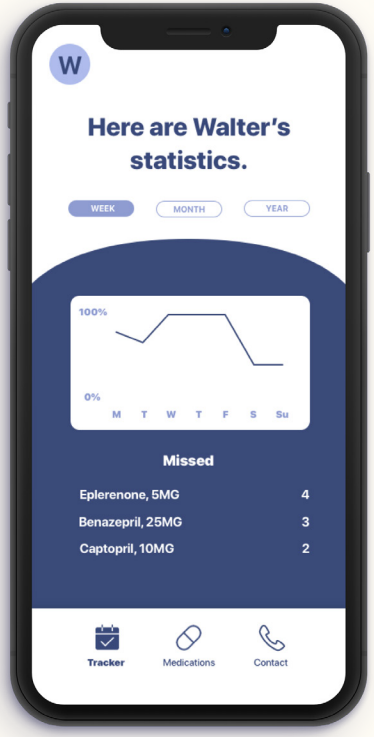


The home page helps patients get a snapshot of their day, and see what medications they should take with them if they will be out and about throughout the day.

The Caregiver App



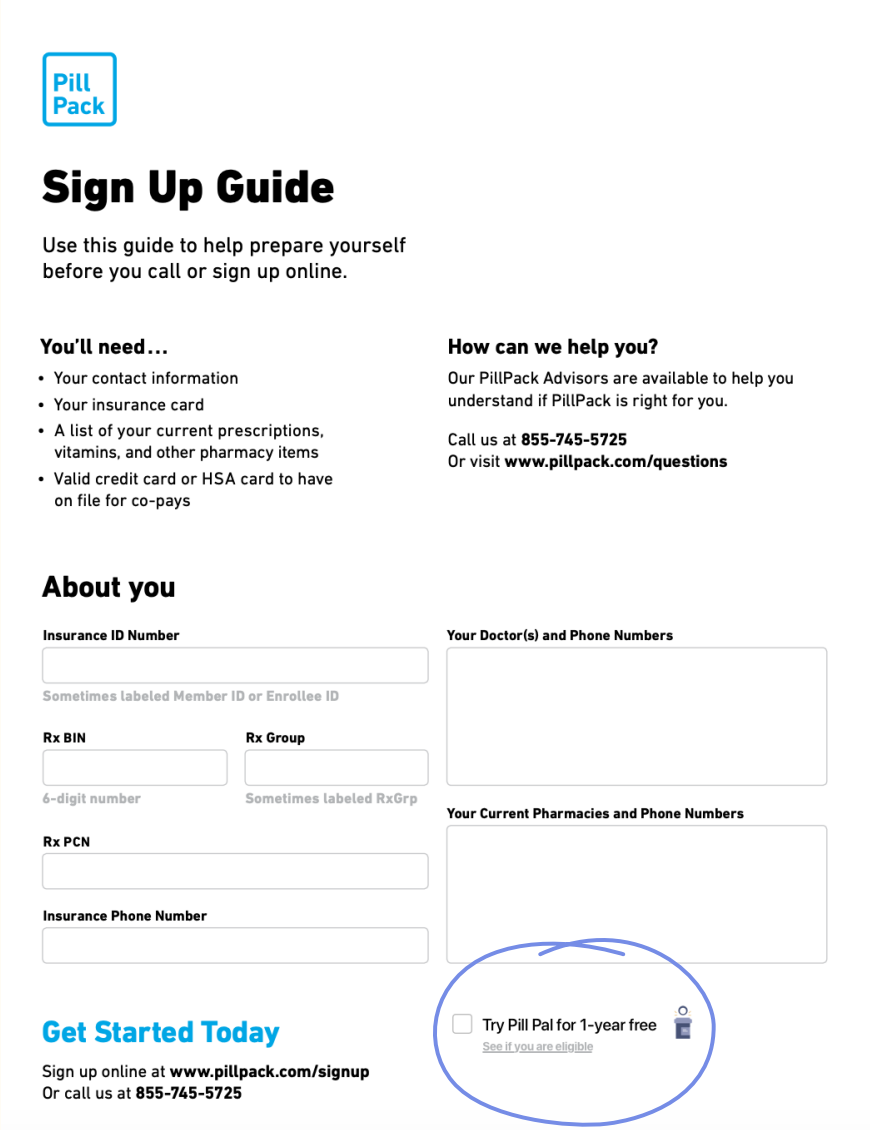
Caregivers can easily manage multiple patients.



The caregiver app focuses on tracking patient adherence, and can help start conversations regarding reasons for nonadherence.

Partnerships

Through our critiques with members of ExpressScripts, we determined that Pill Pal would best function as an incentive that prescription services provide, rather than something that patients acquire themselves. This is an example of how Pill Pal would be offered through a partnership with Pill Pack, through a 1 year free trial. As Pill Pal is meant for patients with chronic heart conditions, this would be a long term investment.



Pill Pack

Sign Up Guide

Use this guide to help prepare yourself before you call or sign up online.

You'll need...

- Your contact information
- Your insurance card
- A list of your current prescriptions, vitamins, and other pharmacy items
- Valid credit card or HSA card to have on file for co-pays

How can we help you?

Our PillPack Advisors are available to help you understand if PillPack is right for you.

Call us at **855-745-5725**
Or visit **www.pillpack.com/questions**

About you

Insurance ID Number

Sometimes labeled Member ID or Enrollee ID

Rx BIN

6-digit number

Rx Group

Sometimes labeled RxGrp

Rx PCN

Insurance Phone Number

Your Doctor(s) and Phone Numbers

Your Current Pharmacies and Phone Numbers

Try Pill Pal for 1-year free

See if you are eligible

Get Started Today

Sign up online at **www.pillpack.com/signup**
Or call us at **855-745-5725**

Next Steps

We love where we have taken Pill Pal so far. But we know there are more steps to make to further expand on this concept.

USER TESTING

Moving forward, we would like to gain feedback from users by giving them the opportunity to be fully immersed in this system. By doing this, we hope to gain insight on the unseen interactions that would come naturally to the user

Building and Printing the ring model to see how they interact with the device.

EXPANDING THE PRODUCT

ince we want the ring to function as an accessory as well as a health device, the ring could potentially be expanded into a line of many different forms of jewelry. Possible future directions include wristbands, necklace, and earrings

Thank You!

Thank you to Enrique, Express Scripts, Capacity, WUSM, and our interviewees for helping our design process!