“Memedicine”: Task Analysis & Design Sketches

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The Medicine Reminder App

Taking prescription medication is a routine part of everyday life for nearly half of all Americans. Modern pharmaceuticals are tailored to treat an expansive variety of ailments including potentially life-threatening conditions such as high cholesterol, depression, heart disease, and diabetes. However, even when faced with the dangerous consequences of failing to take these essential medications, patients of all ages can still fall prey to simple forgetfulness and accidentally neglect to follow their regimen correctly. Memedicine seeks to liberate patients from the memorization and guesswork of tracking their prescriptions themselves and instead organize it for them on their mobile devices. With Memedicine, patients can finally get back to doing what their prescriptions were supposed to afford them all along: living happy, healthy lives.

Task Analysis & Updated Tasks

But Who Will Use the System?

Memedicine will be used by individuals of all ages, who have the ability to take medicine without caregiver assistance. Our interface and design will require little to no technical knowledge, but will require users to be able to follow simple tasks. Therefore, children and elderly individuals with dementia may have difficulty taking their medicine without supervision, even with our system.

Current Tasks

Currently, individuals perform tasks that allow medicine-taking to become routine, so that he or she can better integrate the act into their daily schedule. Such tasks include placing their medicine in locations that will have a higher chance of attracting the user’s attention, pairing the medicine with other items when packing for trips, and repeating the act of taking the medicine either at a particular hour of day, or before or after another routine daily activity.

Desired Tasks

But no matter how often or well users perform their current tasks, all experience some degree of forgetfulness. The users that we talked to for our contextual inquiries voiced a

common opinion: they wanted a device or system by which they could remember to take their medicine or remind them if they already had. Users preferred a system that requires little effort to set up and would allow for personalization and flexibility.

For example, User 1 takes medicine that requires her to take one pill a day an hour before eating. She said that she would benefit from an alarm that would go off and remind her that, because she has lecture at 9:30am and would have to leave 45 minutes earlier at 8:45am, she would want to eat at 8:15am and therefore would need to take her medicine at 7:15am. This task would require her to input information such as the time that she wanted to eat, and when the system reminded her at the appropriate time, she would turn off the alarm and take the medicine.

User 3's concern was that he needed an incentive to take his medicine. He desires a task that would give him a word of warning and an incessant reminder to take his medicine. Once he input his required medication into the system, it would remind him with an annoying alarm to push him to take the medication; this would take the place of his wife, so that she would not have to remind him herself. Also, the system would show what would happen to his health if he forgoes his medication with a certain frequency or amount of time, thereby presenting a real and scary picture of what his laziness could cause.

How Users Learn Tasks

Current tasks are learned from explicit directions given to the user by a professional. For prescription medication, the doctor verbally tells the user how to take the medicine, and then provides written directions that are placed on the container so that the users will remember the correct way of taking it. Non-prescription medicine also has directions on how and when to take the medicine or supplement. Most users learn to take their medicine by simply reading and memorizing the instructions. However, the task of preparing to take the medicine, whether by coming across it in a single location or planning a time of day to take it, is not something that a professional teaches, but instead is one that the professional assumes the user will take care of on his or her own. This latter task is learned by repetition and fear of consequences.

The "Where?"

Users generally perform medicine-taking tasks at home, before they head out to work or school. One reason given is that locational uniformity promotes regular, repetitive behavior. Users mentioned that they often forget to take medicine when it is out of the usual place. For those who travel often, like User 2, medicine-taking tasks are performed in differing locations each day. Such users depend on time over location to perform their daily tasks (e.g. remembering to take medicine immediately after waking up, instead of remembering to take it when they walk into the bathroom in the morning and see it). These users may take their medicine virtually anywhere: in a hotel room, at the office, or even at a coffee shop.

Users, Data & Privacy

With current medical practices, patient data is confidential and not easy to come across.

Medical files' access is restricted, and the simplest way to discover what medicine an individual takes is to find the container itself. Since most users do not carry their medicine around with them, the existing system is good from a privacy standpoint.

Other Tools

Other tools that the customer has include generic alarms, calendars, and note-taking devices, both paper and digital, offline and online. These items are used for memory aid, so that the user may make a regular habit of taking medication. Others, such as User 3, depend on family and friends to remind them to take their medicine.

Inter-user Communication

Patients communicate with each other by talking in person, or sometimes in online forums. Individuals may speak with acquaintances and friends about their medical situation, and gain information from peers. If the patient is somewhat internet-savvy, he or she may turn to online forums to gain information from those afflicted with the same condition, or "professionals" that give the patient information on how to better face their condition. Unfortunately, both of these methods of communication tend to spread incorrect information.

Supporting Frequent and Non-frequent Medicinal Intake

The frequency at which a task is performed varies from patient to patient. Some patients may have to take medication multiple times a day, while others only have to take their medicine once a week. In addition, related tasks such as checking blood pressure or drinking a carefully specified amount of fluids are necessary for some patients but not others. Any new tasks created with our system must support those who must carefully watch their health multiple times a day, as well as those who do not have to take medicine as often. For example, the former group may have to be reminded frequently throughout the day, because they have so much to remember, whereas the latter group may have to be reminded once a week when they must take their medicine, because the long intervals can lead to forgetfulness.

The Importance of Taking Medicine on Time

It is crucial for patients to be aware of the time constraints on their tasks. Prescriptions are given by professionals to fit a patient's needs. It is absolutely necessary for a patient and those close to him or her to promote a regular habit of taking medicine. To further prove this point, the contextual inquiries that we conducted showed that time-related issues most affected users' currently performed tasks: namely forgetfulness, laziness, and busyness.

Worst-case Situation

Being too forgetful, lazy, or even paranoid can lead to an incorrect frequency in dosage, which could render the medicine ineffective, or even worsen the patient's condition. Without accurate information from trained medical professionals, misinformed patients could perform tasks that

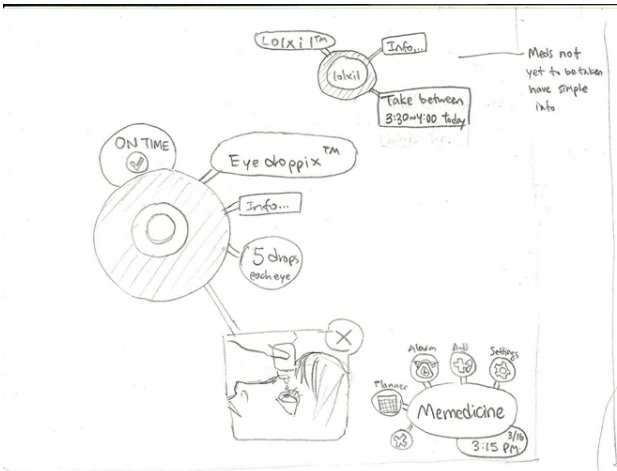
harm themselves (e.g. overdose, take clashing medication/supplements, or perform tasks such as excessive exercise that could put strain on the body and make the patient more susceptible to the side-effects of a drug). The worst-case scenario varies from prescription to prescription, and individual to individual. Depending on the severity of the condition and the strength of the medicine, side effects may range anywhere from slight discomfort when urinating, to headaches, to death. Also, people who have family histories of diseases or conditions may be more likely to experience such side effects. Medicine can cause such drastic changes in one's health in wellness, and it is the top priority of medical staff, pharmacists, patients, and friends and family of the patient to make sure that the patient uses it correctly.

Revised Tasks

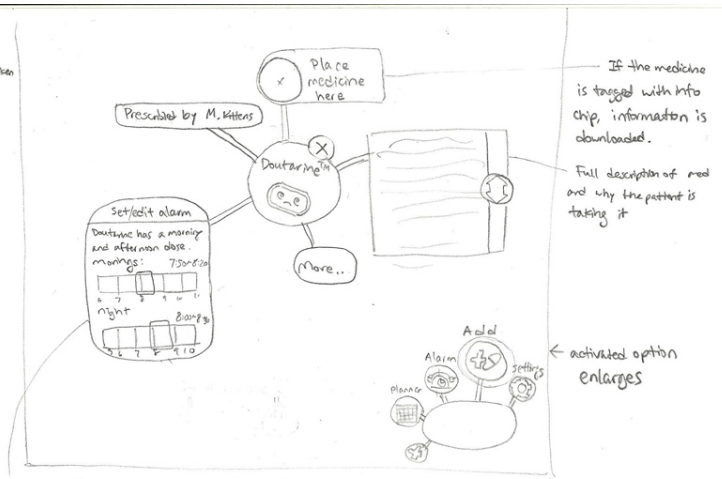
Our team decided that a revision of our three tasks was necessary to address the most common needs of the majority of patients. The most important points when taking medicine is to take the accurate medicine at an accurate time in an accurate amount. Our revised tasks reflect this primary goal: the simplest task would be to take one's medicine, the moderate task would be to set an alarm to make sure one takes it at the appropriate time, and the difficult task would be to manually input the medicine into the system.

Storyboards for Three Interface Designs

Figure 1: Projector/intelligent surface for those who keep their medicine in one place
Figure 2: Big images, emphasis on medicine detail and schedule
Figure 3: Familiar mobile layout, emphasis on alarm, scheduler, adding prescriptions



Starts out blank until it detects motion. If it detects a simple motion (no medicine) it activates and shows this screen. Press menu choice & hold for further detail. Tap to go to option. "X" clears screen. Placing medicine on the surface triggers information windows.



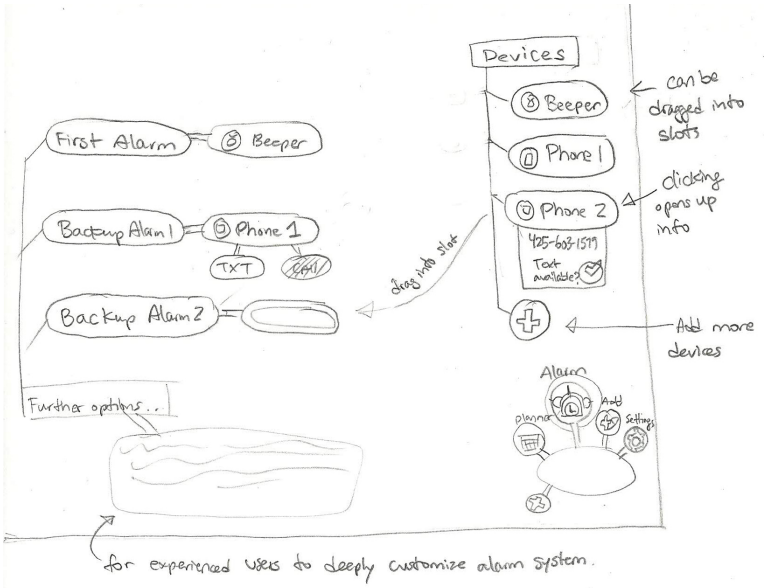
Customized for each medication, depends on tag settings.

Add medicine screen. If a prescription or support has an information chip it is read in and user is given customizing options. It is assumed all medicines will be info chipped.

General information:

All sub-elements are draggable and get bigger the farther they are from their focal (ie. mediche bottle).

The focal itself can be dragged.



for experienced users to deeply customize alarm system.

Figure 1: Interactive touch screen to visualize medicine plan and play video of medicine taking instructions

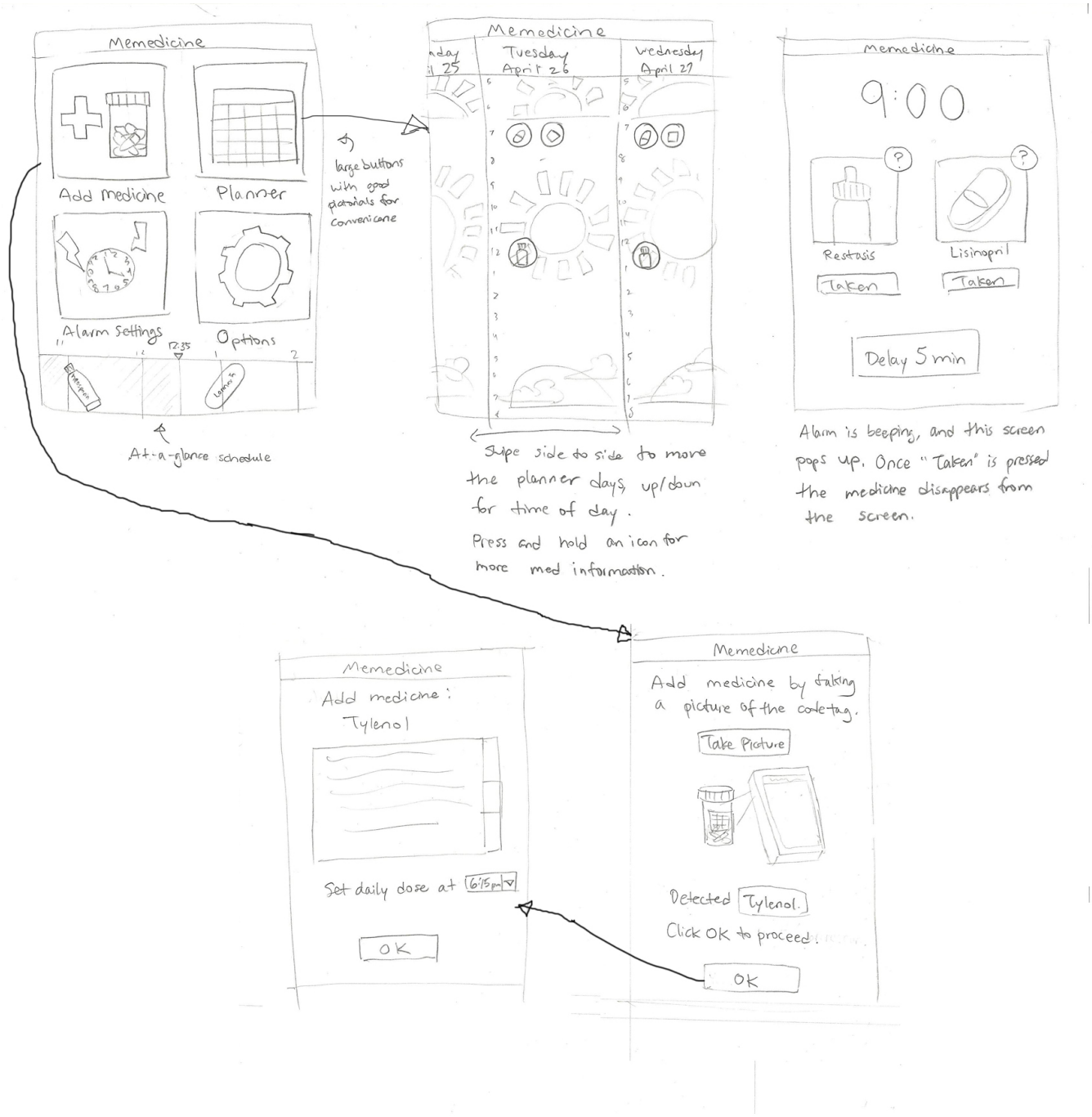


Figure 2: Mobile app details cautions when taking medicine, and integration into planner

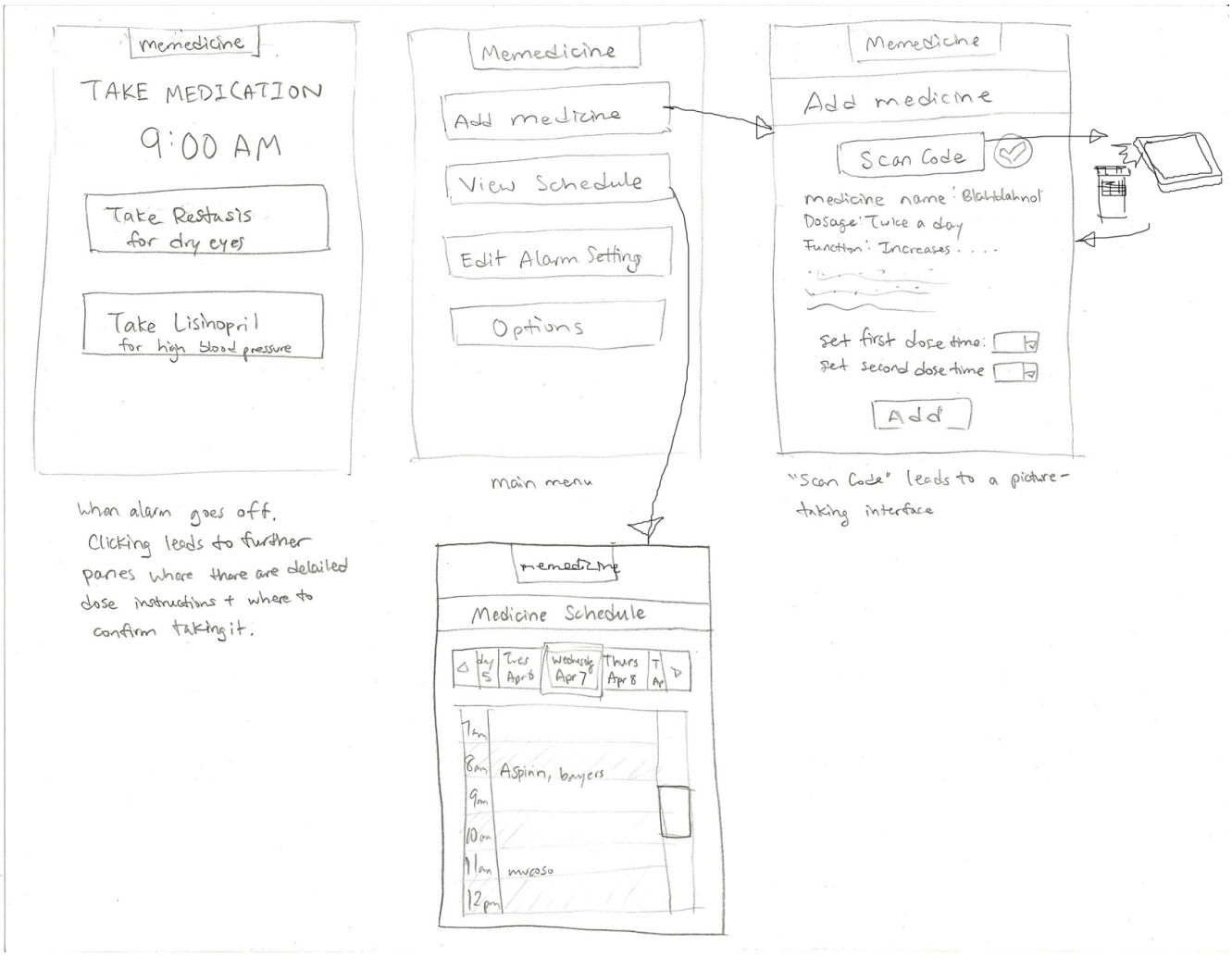


Figure 3: Schedules and adds prescriptions, centered around alarm feature

Selected Interface Design

The Chosen Design

Our design ultimately settled upon a standalone interface for smart phones. Packaging Memedicine as a downloadable app provides the greatest opportunity for rapid post-release adoption by prescription drug patients, given that smart phones comprise over 20 percent of the mobile phone market; 31 percent among persons aged 24 to 35. Smart phone owners are already comfortable with downloading and interacting with a variety of applications, so Memedicine should provide little additional challenge to ease of use.

Although expanding Memedicine to include surface computing, such as at the medicine cabinet or another analogous location, might prove an advantageous move in the long run, it is not practical for a first release candidate. Designing a surface product for release in the near

future would require dedicated hardware and might present unique usage challenges beyond those typical of smart phone applications. Restricting Memedicine to smart phones, at least initially, allows us to focus on designing for a platform with proven market viability.

Functionality

Memedicine enables users to scan in new prescriptions, set alarm reminders for when to take doses, and to receive guidance when taking a single dose or doses for multiple prescriptions.

New prescriptions are added by using the phone to read information bound to the medicine container; for the purposes of discussion here, we propose that Memedicine scans a barcode on the container using the phone's camera, allowing the retrieval of relevant information about the prescription either from data encoded within the barcode itself or at an Internet location linked to by the barcode. Consequently, users are spared the hassle of entering prescription data manually.

Users may schedule one or more alarm reminders for taking their medication depending on the frequency dictated by the prescription. Alarm times cannot be set arbitrarily; Memedicine guards against overdosing by preventing alarms from being scheduled too closely together.

The Interface

The interface consists of a main menu through which all other functionality is accessed via on-screen buttons. There are separate screens for adding prescriptions, viewing individual prescription information, viewing a calendar with each day's doses, and scheduling reminders.

There are two screens for registering a new prescription into Memedicine. In the first, users are prompted to scan the barcode on their prescription containers, with an example container and barcode presented as a guiding illustration. A live feed from the phone's camera is displayed, along with an overlaid framing box, to ensure that the barcode can be brought into the camera's field of view easily and correctly. Once a barcode is recognized, Memedicine moves to a second screen in which the prescription information associated with the barcode is displayed in a scrollable window. Users can review the prescription and either confirm that it is correct or go back to the scanning interface.

Individual prescriptions may be accessed via the Info button on the main screen, directing users to a list of their prescriptions. Selecting one brings up a scrollable window much like in the second screen of the "Add Prescription" interface. The "Set Reminders" clock has vertically-scrollable sections for hour, minute, and AM/PM. The Calendar displays prescriptions by day and time.

Sample Scenarios: Simple, Moderate & Difficult

Stepping Through Taking the Medicine

Deanna is 67, has one set of pills to take for a heart condition, and also uses

prescription eye drops for dry eye. Because of her busy schedule and the varying frequencies with which she must take them, she finds it difficult to keep track of if and when she has taken her medicine. Luckily, her nephew recently downloaded and set up Memedicine onto her phone to help her remember. At 9am, Deanna's phone alarm rings. She picks up her phone and sees text on the screen that says "Take Restasis for dry eye" and "Take Lisinopril for high blood pressure". She presses the touch screen button that says "Take medicine", which takes her to the direction page for Restasis. She is prompted to scan the eye drop bottle, and when she does, she is taken to a screen with a video that directs her how to use the eye drops, and how many drops to do per eye. The video ends, and the words "Did you take the medicine as in the video?" appear on-screen. She sees two buttons appear, one saying "Yes, I am done" and "No, show me the video again." She presses the latter button, and watches the video again, as she follows the directions and uses the eye drops. This time, she presses the button "Yes, I am done". Now, the screen displays the direction page for Lisinopril. She scans the pill bottle when prompted, and as with the eye drops, follows the video directions on the next page. When done, she presses "Yes, I am done", and is taken to a completion page saying "You have finished taking your medicine at this time. Your next dose will be Restasis in 12 hours at 9pm." She presses the "OK" button and is taken back to the main menu. Deanna sets down her phone and smiles in awe at her convenient new app.

Setting the Alarm

Abby is 18, and has just been prescribed Amoxicillin for a urinary tract infection. Unlike once or twice a day medication that she can just take at easy to remember hours of the day (e.g. 8 am or 8am and 8pm), her dosage frequency is three times a day. She downloads Memedicine to help her remember, and after entering the medicine information, decides to set alarms to go off at 7am, 3pm, and 10pm. She chooses these times, even though they are not exactly 8 hours apart, because it is what fits her daily routine and gives her sufficient time to sleep and wake up in between doses. To set up the alarm, she opens the app and presses the "Schedule" button. She is shown a list of the medicine she has entered as having to take. She presses the only one on her list, "Amoxicillin", and is taken to a hourly schedule screen. The app knows that the dosage is three times a day, and is entered by default as to be taken at 7am, 3pm, and 11pm. She acknowledges that the first two times are accurate according to her plan, but wants to change the last time, so she taps on the "11pm" drop down menu. Trying to change the time to 10pm, she accidentally sets it to 10am. The app goes to a warning screen that says "Dosages are too close together" and displays a "Back" button. Abby presses the "Back" button and sees that the last time is set back to "11pm". She tries again and this time correctly sets it to 10pm. She presses the "OK" button and is taken back to the main menu. Abby closes the app, and goes about her business, knowing that she will be reminded when she must next take her medicine.

Adding All One's Medicines Into the System

Derek, 52, has just returned home from the doctor's office after being diagnosed with Type 2 diabetes. He has been prescribed Glucotrol, which he must take twice a day. Derek

hears about Memedicine from a coworker and downloads it onto his phone, to remind him to take his new medication. He opens the app, and selects the “Add Medicine” icon from the main screen. The screen that appears says “Scan the code on your medicine container” with a picture of where the code would be located on a pill or eye drop bottle, and the current camera image being projected from his phone camera. Derek places the pill bottle under the camera, and a red box appears superimposed on the camera image on-screen, lining the barcode-like segment of the bottle, along with the text “Please hold phone still...” The camera reads his medicine, and the information for Glucotrol appears on screen, including what the active ingredient is, what the dosage is, and what doctor from what hospital or clinic prescribed it. There are two buttons on the bottom of the screen, “Yes, this is the correct information” and “No, rescan.” Derek presses the first button, and the screen lists the words “Glucotrol added to system.” He presses the “OK” button, and is taken back to the menu screen.