Target Users

Medical practitioners: administrators, doctors, nurses and physician's assistants, face the burden of transcribing all observations and orders. They represent one-half of our user base and the group that will be less directly helped by our tool. These individuals receive career-oriented training for 2-4 years at specialized schools, they then gain experience through clinical training at a hospital and continue their career here or some other healthcare institute. Their first duty is always to the patient and they generally feel happiest when they can restore an individual's health. As a broad generalization, they dislike paperwork and find that it can sometimes get in the way of providing the best quality of service. Filling out more forms, charts and orders means less time for them to care for patients and thus reduces their satisfaction. Specifically, the individual we picked to interview in this category is a clinical physician and fit into the general model. This person spent 4 years in medical school accompanied by 2 years of clinical rotation and is serving as a second year medical resident. He or she also complained almost 20% of the workday is used for paperwork. The doctor states that "considering the amount of data we put down, there is a very poor return."

Pharmacists are trained in fields including pharmacology, chemistry, pharmaceutical chemistry, physiology, anatomy, biochemistry and hepatology. Pharmacists are a critical source of medical knowledge in clinics, hospitals, and community pharmacies in general. They bridge the gap between patients and physicians to ensure that proper medical therapy is chosen and implemented in the best way possible. They have many roles but more traditional and common role is to provide general health advice and specific details to patients about disease states and medications. Jim and Tom, both hold a Doctor of Pharmacy (PharmD) degree from a prestigious university. They've both been working in pharmacies for more than 10 years now. In general, pharmacists enjoy advising patients on how drugs can help them keep them healthy. They dislike making anyone wait for medication and delays in reading prescriptions. The pharmacists chief priority of is quickly dispensing medication to patients. For the purposes of description the Walgreen's pharmacist will be referred to as Jane Smith. Jane works at the Walgreens pharmacy in Berkeley on Shattuck. She has been working there for a few years since graduating from School of Pharmacy at her university. At her university, Jane started her career as a student intern, then as a graduate intern, and finally receiving a pharmacist position at Walgreens. Although most of the responsibilities that her job entails were learned at school, the processes on how to fill prescriptions and deal with customers were reinforced by training from Walgreens. She is assisted by a pharmacy technician, who manages the administrative details of the job such as handling phone inquiries, entering patient purchases, and assisting with filling prescriptions.

Contextual Inquiry Interview Description

(Note: Gender pronouns are chosen randomly and we make every effort to preserve the anonymity of our generous volunteers).

The inquiry with the clinician took place at a county hospital. It occurred on one of the upper levels of the hospital where clinics are typically held. Two individuals from our group monitored appointments with the doctor mentioned in the "Target Users" section. We tried to be as discreet and respectful as possible when the doctor was interacting with the patient. We often asked questions when the physician left the room to fill certain forms (which is convenient for us since this was the actual task we wanted to witness and question dynamically).

All the patients we encountered already had medical identification with the hospital and hence a pre-existing chart. The unique identifier for any patient is an ink imprint of the patient's medical ID card. (A financial card is also used for identification purposes and billing.) When we arrived the waiting area was quite full and a long line streamed from the admit area. A nurse eventually calls the registered patients from the waiting area, into an exam room. He measures certain basic physiological values (for example, temperature and blood pressure) and asks for the patient's principle complaint – noting all information on their chart. After a short delay the doctor arrives and examines the notes on the chart the nurse has left for him. Comments, figures, measurements and almost any relevant observed phenomenon are recorded. If a procedure is performed there are additional specific forms which must also be filled. As possible differential diagnoses are narrowed down, experience and intuition yield a definitive diagnosis.

If the patient needs to be medicated, the doctor decides to write a prescription on a standard form. These 4.25"x 7.6" slips are first stamped with the imprint of the medical ID card in the upper-right hand corner. The doctor must still write the patient's name despite this stamp. The form is dated and at least eight pieces of information are used to verify the doctor's identity. Additionally, another vital piece of information is included: the diagnosis. Up to three drugs can be prescribed on one form. For each medication the strength, quantity, patient instructions and refills are recorded. We requested that the doctor "think-out-loud" as she filled out the form, though the task is quite mundane for this user. The physician noted that the prompts provided by the existing form are very helpful if you are new to the layout but she rarely uses them anymore because she is so accustomed to the form. She moved much more slowly filling out the medication information, noting the specific brand of drug to be prescribed. However, she did say that had she not been as conscious of her actions as she was now she may have proceeded more hastily noting only the generic drug name.

We inquired whether writing a prescription is the same in all other departments. The doctor mentioned that very often it is, with two noticeable exceptions. In-patient orders are written on separate forms and filled in a different part of the pharmacy. Additionally, new laws require narcotic prescriptions be printed on special paper that is difficult to duplicate. Speaking to several nurses, receptionists and doctors as we left, we received incredible support for building any sort of automation into the current system.

Figure 1: Doctor filling out a prescription at the hospital

(Also see attached prescription form – ONLY INCLUDED WITH PRINTED COPY)

We also visited the pharmacy at the same hospital where we talked to the physician. The area is divided into two parts, an in-patient pharmacy and an out-patient pharmacy. As the names suggest, the first is for people admitted to the hospital and the other is for patients who do not need to stay at the hospital. Jim (not a real name) works at the window in the out-patient pharmacy where patients come and drop off their prescriptions. They update patient records on a computer and give patients a call number so they can pick up their medication when the number is called. There is another computer located to the side where all the new prescriptions get queued. Another individual who fills prescriptions checks these entries and completes the transaction after a patient's number is called.

As we reached out-patient pharmacy department, we observed a huge crowd of patients waiting to consult with a pharmacist. Jim informed us that the pharmacy recently installed new software for patient records. Jim was struggling with it a bit and while printing a call number, he expressed that all the systems were independent of each other. When a patient arrives at the window, he would ask the individual for his or her medical record card, provided by the hospital. He accesses patient records with the ID number printed on the card. Then he looks up medication in the database and writes them along with directions. He prints the call number using a machine resembling ones found at the DMV and tells the patient approximate waiting time, usually an hour. He points to the comment box on his screen and told us that sometimes when patients misbehave, he would specify that it in the record. The next time the patient comes to the pharmacy, he or someone else would know how to deal with the individual.

The in-patient pharmacy, on the other hand, has a very relaxed and quiet feel. Tom (again not a real name) sat in front of a computer looking at scanned prescriptions from doctors and updating patient records. He told us that often it is hard to read the prescriptions due to handwriting and lack of clarity on the screen. He said doctors would scan the

prescription after consulting with the patients and the he would go through it and update patient's profile. Just as in the out-patient pharmacy, someone would then fill the prescription. The drugs are the delivered to the appropriate department.

When trying to set up an interview with a pharmacist at a franchise, we called different drug stores with pharmacies in the local area, asking to speak with the on-site pharmacist. Many times when we mentioned we were students at Berkeley trying to interview for a project, the operator would hang up or respond with a vague answer stating that the pharmacist was not available for questions. When we mentioned we were researchers trying to develop solutions for pharmacists, the Walgreens pharmacy did not hang up the second time. We were then transferred to the on-site pharmacist. While speaking with Jane, the on-site pharmacist, we gave a 30 second overview of the project, and asked if she would be interested in answering questions in person about her daily work. When she agreed, we set up a time that was convenient for her and also during a time when she was not expecting many patients. At the time of the interview, we went to the pharmacy and verified that Jane was the on-site pharmacist, and asked our questions.

Before going to our interview at the Walgreens pharmacy, we went to the Longs and Target pharmacies for comparison on the different work environments. In general, the layouts of all the stores were similar. They all had cash registers at the front, items for sale in the middle, and pharmacies at the edge of the stores. All the stores sold healthcare products, over-the-counter medication, and similar items in the same vicinity as the pharmacy. Both the Longs and Walgreens pharmacies were located at the back, while the location of Target's pharmacy varied, sometimes on the right hand side of the store or at the back. The over-the-counter medication and healthcare products are placed in the same area as the pharmacy so that pharmacist or pharmacist technician can easily direct patients to products or patients can ask questions on what to use. The Walgreens pharmacy had two separate windows: one window for dropping of prescriptions and another window for picking up prescriptions and receiving consultation. The pharmacist technician sat at either of the front windows, while the pharmacist worked in the back of the pharmacy where the drugs are openly displayed and stored.

Jane works at the pharmacy five days a week, and sometimes on the weekend. The busiest times are usually in the afternoon between 12-6 regardless of the day. Her usual turn around time is one hour (just like the hospital's pharmacy). But this can vary depending on how many prescriptions are in the queue. If a prescription is not urgent, the patient can usually pick up the prescription in 24 hours.

Jane currently fills prescriptions for patients at Walgreens in any of the following ways after the doctor has written the prescription that contains the patient name, drug name, and dose/quantity: (1) the patient can bring a hand-written prescription directly to the pharmacy; (2) the doctor's office can send an "e-Prescription" from their office by computer – the information sent contains patient name, address, phone number, drug name, and dose/quantity; (3) the doctor's office can call the pharmacy with the patient information, drug name, and dose/quantity. After the prescriptions are received by the pharmacy, the prescriptions are put into a queue and filled in the order they were

received. If process 1 is used and the patient does not have an existing file at the Walgreens pharmacy, the patient has to create a file in order to have prescriptions filled. If process 2 and 3 are used, when the patient goes to the pharmacy to pick up the prescription, the patient has to have a valid ID to match against the records sent by the doctor.

The computer at Walgreens contains its own patient database. It can check for drugs prescribed by the doctor that the patient specified after creating his or her account that should not taken. Jane contacts the doctor whenever there is a mistake in the prescription, either she cannot read the drug name, dose/quantity is not filled in, or her own patient records show that the drug is not suitable for the patient. The most common mistake is if generic or brand name or quantity is not specified in the prescription. In these cases, Jane calls the doctor to find out this information. However, the biggest concern is that the patient may not able to take the drug. The responsibility usually lies with the doctor, but if the patient does have a recent file in the pharmacy computer, the computer will check for such mistakes.

Jim and Janet both interact with patients and update their records. Both must deal with a busy environment on a day-to-day basis. As for the differences, Janet actually fills up the bottles while Jim has many others available to do the task. Additionally, Walgreens allow prescriptions from any doctor, whereas only the prescriptions written at certain hospitals are allowed at the hospital pharmacy.

List of Tasks

Easy:

(1) Making copies:

>   In order to make copies of files or records, the user can typically walk to the copy room on any floor of the hospital. However, if the file or record is not on hand, the user may ask someone else to find and make a copy.

(2) Writing a prescription:

>   At the end of a check-up, a physician will diagnose and prescribe medication for the patient. Using the standard form, the doctor identifies himself, the patient, the diagnosis and the drugs. All this information should be known already, so just writing it on the prescription sheet should be fairly trivial.

Medium:

(3) Detecting negative drug interactions when all drugs are known for a given patient:

Based upon the patient's medication record, a doctor, pharmacist or computer can be trained to determine which medications can be used safely together, minimizing side effects. Each medication is cross checked to determine whether their effects could cancel, add or multiply that of another drug.

(4) Making sure information gets where it should:

When the user wants information to be transferred to other departments, he must submit a record request form. Upon completion of the record request, the hospital passes the form down to the central filing room. From there, clerks locate the records and forward them to the destination department. Sometimes it is up to the patient to transmit instructions from one department to the other. The problem is that the messenger is not the person who wrote the directives; he or she is unequipped to verify information or answer questions.

Hard:

(5) Checking many records:

Looking at many patient records becomes extremely complex when all documents are written in pen-and-paper. The user must request the records for each patient from the record filing room. Although most of the forms are similar among patients, recorded data and observations may be made by several doctors in different locations on the various forms. Handwritten notes (especially made by doctors, trying to get to the next patient) can be difficult to decipher. Pulling out the information one wants can be nearly impossible if the sample size is sufficiently large. Complete patient charts can amount to more than 50 pages and any attempt to search the information by eye is going to be difficult.

(6) Designing a secure and informative medical document:

Deciding exactly what information to include on a prescription is a fairly difficult task. You don't want the form to be long and cumbersome but it can't be so terse the prescription cannot be filled. Security is a very important concern, especially when dealing with narcotics. How much identification information is enough to know the doctor really is who he claims to be? Even if every doctor is assigned 20 random unique identifiers, it only takes one lost or stolen prescription to obtain this information. (It should not be the job of the patient to safeguard the doctor's identity.) Though making the form understandable is no simple task, the difficulty mainly arises because of security and variability.

Task Analysis Questions

1. Who is going to use the system?

The primary users involved with the digital prescription application are doctors, pharmacists and patients. The doctors will write the prescription, which the Anoto pen will send via Bluetooth or dock. The information will be checked for proper processing and then automatically checked for discrepancies. Other healthcare workers will also be able to check the database for previously prescribed drugs and the corresponding diagnosis. When the prescription arrives at the pharmacy, it will automatically be placed in a queue in the pharmacy computer. The pharmacist will fill the prescriptions based on the queue. The patient will bring the paper copy or use personal identification to pick up the prescription at the pharmacy, where the pharmacist will provide the prescription and consultation.

2. What tasks do they perform now?

Doctors write prescriptions or send prescriptions electronically from their computers. They fill in detailed identification name for the patients, themselves and finally drug information. In situations where the prescription is lost or damaged copies must also be produced. If the pharmacy is setup for receiving electronic prescription, the pharmacist technicians put the prescription into a queue for the pharmacist to fill. Pharmacists can accept both paper and electronic prescriptions depending on the capabilities of the pharmacy. However, no matter how it is transmitted patients must bring paper copies of their prescription as verification. The prescriptions are filled based on an arranged queue. There are checks made somewhere during this process, currently this is a function of the pharmacy.

3. What tasks are desired?

Physicians want prescriptions to be secure, but not involve so much verification the forms become a nuisance. Ideally, only the most basic information should be necessary. It is desirable to have automated methods for checking prescriptions that do not require looking up information recorded on paper. Additionally, the doctor prefers not to rewrite the same prescription for the same patient. It is a time-consuming task and major annoyance when a prescription is lost. They would like to have an account of all prescriptions and be able to reissue one on-the-fly with little hassle. The pharmacists would prefer to have all their prescriptions sent electronically because it is easier for them to place prescriptions in the queue and keep electronic copies. Patients would prefer to have the prescriptions sent electronically so that they know the prescriptions will be filled and do not have to worry about losing the physical copy.

4. How are the tasks learned?

The more basic tasks: copying, reading and writing are of course acquired at a young age. Doctors learn to write prescriptions by witnessing the procedure as a medical student or resident. Oftentimes, if the forms are labeled appropriately no learning is necessary and the physician simply fills in the appropriate information.

Electronic prescriptions systems are taught by a third party who sets up a system to communicate with pharmacy computers. Doctors and nurses are trained on these systems. Pharmacists practice filling prescriptions as student and graduate interns, but they learn how to fill and use electronic prescription through corporate training from their respective stores.

5. Where are the tasks performed?

Doctors write prescriptions either at a hospital or another facility where he or she practices medicine. Pharmacists fill prescriptions in pharmacies that are usually located inside drugstores or in hospitals. Patients typically transport prescriptions between these two locations.

6. What's the relationship between user and data?

Doctors produce the data; this includes information about who the patient is, who the doctor is, the problem with the patient and the medication they require. The pharmacist executes the directives; they take and fill the prescription based on the parameters listed previously. If information is missing, the pharmacist will contact the doctor to fill in the missing data. The patient is the conduit for the data and the beneficiary of the product. In other words, they transport the prescription and receive medication.

7. What other tools does the user have?

Both doctors and pharmacists have computers in their offices and areas of work. The computers are not necessarily used to communicate with each other, and in many cases for doctors, computers are used for tracking appointments and contact information.

8. How do users communicate with each other?

The obvious communication channel for doctors and pharmacists is the written prescription. If the doctor's computer is setup to communicate information to a pharmacy, the doctor's office and pharmacy can send information such as prescriptions back and forth. There are hospitals where terminals allow for universal communication of data between departments, but usually patient databases are not extensive. Otherwise, doctors and pharmacists communicate over the phone when there is missing information in a prescription or if a prescription needs to be filled. Another instance when the pharmacist contacts the doctor occurs when the pharmacies own patient database shows that the patient cannot take the drug. Patients usually interact in person with both doctors and pharmacists (though phone conversations and e-mail are used as well).

9. How often are tasks performed?

Depending on the type of doctor and number of patients requiring medication, the number of prescriptions a physician writes varies tremendously. In most cases, however, doctors deal with prescriptions daily. The physician we interviewed estimated he would issue 20 prescriptions that day. Filling prescription is the essential function and job of a pharmacist. Pharmacists spend the entire day dealing with prescriptions but the actual number varies depending upon the pharmacy's capacity and number of customers. From our contextual inquiries we found both pharmacies dealt with hundreds of prescriptions a day. As mentioned above every prescription has the potential for generating problems and involves all the steps discussed. Patient variability is probably the greatest. Those with chronic diseases that must be medicated may go to a pharmacy very often. Others might only get medication once in several years for serious acute problems.

10. What are the time constraints on tasks?

Doctors usually write a prescription at the end of an appointment, after meeting with the patient. The prescription is written quickly to allow the doctor to proceed to the next patient and the patient to have the prescription filled as soon as possible. From the interviews, pharmacists typically have a turn around time of 24 hours. One hour is possible depending on the urgency of the prescription.

11. What happens when things go wrong?

In the very worst case allergies or interactions can lead to the death of a patient. More common and less severe problems result from oversight or mistakes by the doctor or misinterpretation of the physician's request by pharmacists. A typical mistake is if generic or brand name or quantity is not specified in the prescription. In these cases, the pharmacist calls the doctor to fill in the missing information. Additional problems can result from delays in treatment. If for some reason the patient is unable to get the prescription filled, he or she might have to go back and seek medical attention or have the doctor issue a new prescription.

Names and Assignment Allotment

- [Student 1](#) - Clinician interview, interface design write-up and analysis of approach.
- Student 2 - Target users, problem and solution overview.
- [Student](#) 3 - (Hospital) pharmacist interview and list of tasks.
- [Student](#) 4 - (Franchise) pharmacist interview and task analysis questions.