OPIOID TRACKER

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Background Summary

Every day, more than 90 Americans die after overdosing on opioids. [1] To put this into perspective, Parkinson's Disease affects 60,000 Americans and is the 14th leading cause of death, only kills 77 people per day.[2] The opioid addiction is on the rise (Figure 1). It causes loss beyond life. Social and economic welfare is also affected. The Centers for Disease Control and Prevention estimates that the total 'economic burden' of prescription opioid misuse alone in the United States is $78.5 billion a year, including the costs of healthcare, lost productivity, addiction treatment, and criminal justice involvement.[1] The opioid epidemic has spiraled out of control. While there are many theories on how to stop the addiction to opioids, there are very little implemented practices in place.

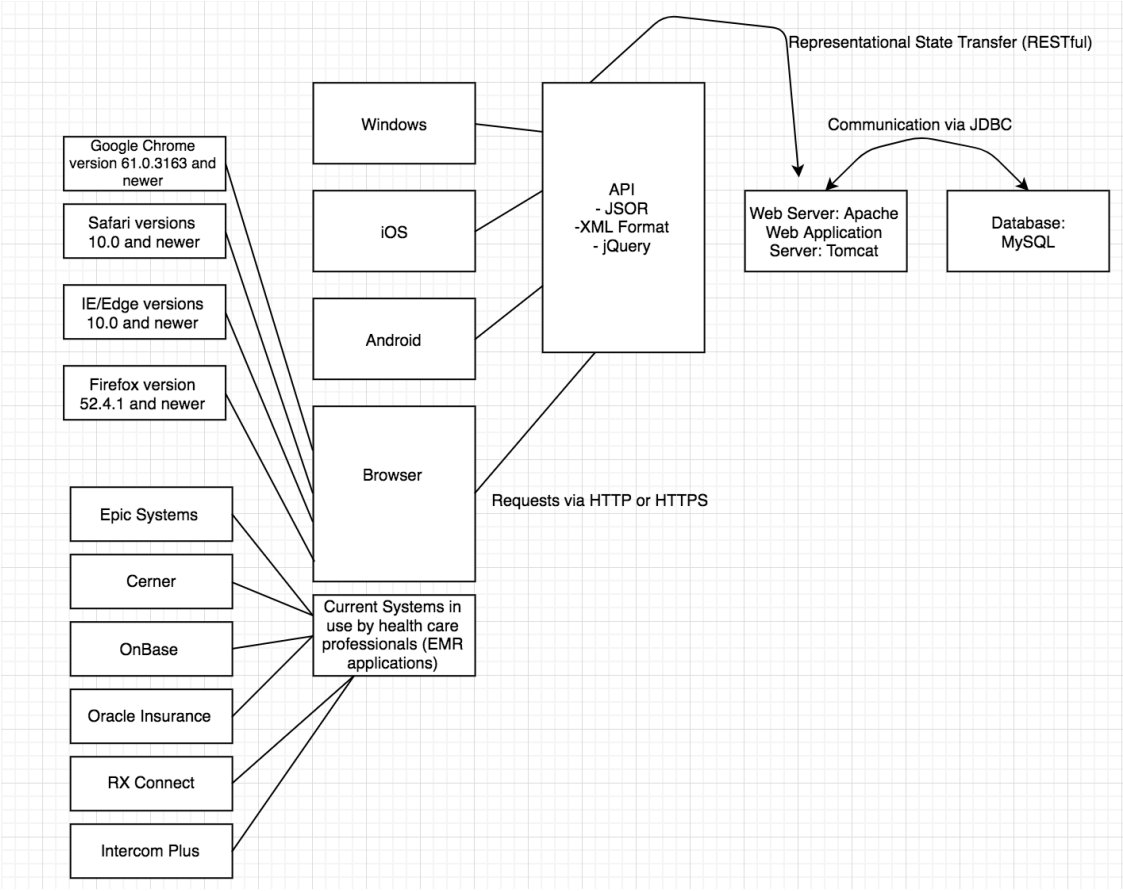
One of the theories proposed on combating and preventing the epidemic is integrating drug treatment into healthcare settings. Medication-assisted treatment will be most effective when offered within the larger context of a high-quality delivery system that addresses opioid addiction not only with medication but also with behavioral interventions to support treatment participation and progress.[3] With the use of Opioid Tracker, patients, pharmacists, physicians and even insurances companies can be involved in the process of combating the opioid addiction. This app will allow all key players to have open means of communication. An open channel for communication will help physicians and pharmacists who usually do not have any contact, share information on patients. This application will also highlight questionable or risky behavior. Features of this system will help generate usage reports and promote proper medication habits to ensure a high-quality delivery system.

Proposed Solution

The solution to preventing the continuation of the opioid addiction is an application used by the patient, the pharmacist, the physician, and the insurance companies. This application will give all the key users an open channel of communication and the ability to share knowledge. At this point in time, the application will be limited to the use of opioid prescriptions.

We will be developing a web client and mobile application that can be used by pharmacists, physicians, insurance companies, and patients.

The architecture of the application is as follows with justification in the appendix:



In addition, both servers will run on Linux. The language for the web application will be HTML5, CSS, JavaScript, PHP, and Bootstrap. C#, Java, and Swift will be used in developing the mobile application. The application will utilize multifactor authentication and single sign-on

services. Each user will need a username and password in order to access the data. The users will also have different levels of access based off of their account type.

According to industry standards, maintenance of software/applications is around fifteen to twenty percent of the total cost. There will need to be a development team and a help desk/customer support line. Majority of the help desk employees will work during normal business hours (Monday-Friday, 9:00-5:00) when most general practitioners, specialists, dentists, and ophthalmologists are open. Healthcare does not limit itself to normal business hours, so there will need to be people working 24/7/365 to support hospitals and other emergency facilities. Initially, there will be a cost associated with training all the employees to become experts on the software and how to troubleshoot issues.

The largest competitor to this solution would be Medisafe. Their solution relies heavily on the wireless pill bottle and pill sorting containers. The wireless bottle could become an added cost to the patients, which would be a deterrent to use. In comparison, Opioid Tracker uses compliance surveys which results in no added costs. The added component of the wireless container would also add an additional cost to training employees and maintain the product.

Value Statement

This solution will help prevent more people of becoming a victim of the opioid epidemic. According to the American Society of Addiction Medicine, drug overdose is the leading cause of accidental death in the United States. There were 52,404 drug overdoses in 2015. 20,101 were from prescription painkillers, while 12,990 were from heroin.[5] Women and adolescents aged 12 to 17 are considered an at-risk population. In 2015, 276,000 adolescents were using nonmedical pain relievers and 122,000 had an addiction to pain relievers. Most adolescents were getting prescriptions from family members or friends. Women are more likely to be prescribed pain

relievers and use them for extended periods of time. Women may also become more dependent on pain relievers than men. [5] With this solution, there can be a system in place to monitor opioid prescriptions. Doctors and pharmacists can see who has leftover pills and can ensure that they get disposed of properly. Opioid Tracker is a simple solution. It is easily integrated into current software that is already in use. There is a small amount of additional work for the patient, but it rewards good administration habits.

Project Deliverables

Deliverable	Description
Web Application	Web interface to be used by physicians, pharmacists, and insurance company. Each user will have a unique page or mini-application within for their specific use.
Mobile Application	The mobile application will be used by the patient.
Calendar	A place where the patient can input dates and times when to take the medication. It will also be able to track when a prescription is about to expire. The physician/pharmacist will also have access and can input recommended dosing schedules, appointments, etc.
Pop Up Notifications	A pop-up notification containing a compliance survey would serve as both a reminder to take the medication and to input data. The notifications would work in combination with the calendar's schedule. A few minutes after the medication should have been taken, a notification will pop up asking (1) did you take the medication, (2) did you follow special instructions (ex. Take with food). If the patient confirms they took the medication correctly, they will get a congratulations message and receive a reward point. There will be a special option if the directions were to take as needed so that the patient will not be reprimanded for following instructions.
Messaging Component	All key players involved will be able to send messages to each other. It will help open communication between the pharmacist and the physician and the pharmacist and the patient.
Drug Profile	Each drug will have its own profile. This will be stored in the database and contain all consistent information about a drug. It may include drug compound, side effects, drugs that would counteract, and what are the generic/name brands. Administration schedule and dosing information might be left off depending on how standardized the medication is.
Rewards System	The system will give a message of congratulations when the user answers the compliance survey with all the right answers. In addition, they will earn a point. Points can be traded in for prizes. Insurance

	companies will also be able to see a point to help them decide if they wanted to give them a discount.
Reports	The software will allow any of the users to generate reports to help track their progress over the last 30 days.

Insurance companies will be attracted to the product since it will help keep their costs lower. The opioid epidemic is forcing insurance companies to raise their prices because of the increase of visits.[4] Pharmacists and physicians are inclined to use this solution because they want the best for the patients. The application will be integrated into their current operating systems, so it will not be a hassle to use. This way both provider and pharmacist will have all the information on a patient. Pharmacies will want to use the application so that they can see what other pharmacies some of their customers are getting their prescriptions from.

The application will be able to support many users. It has to be able to handle multiple physicians – hospitals, specialists, general practitioners, and ophthalmologists, insurance companies, and pharmacies simultaneously. The servers will also have to be able to withstand constant connections with the mobile application users.

Conclusion

The opioid epidemic is a problem. It is the number one cause of accidental death in the United States.[5] With the use of Opioid Tracker, a number of people addicted to prescription painkillers would be reduced.

Appendix

SWOT

SWOT Analysis: Opioid Tracker

Strengths

- There is already a market for consumption
- There are established channels for distribution
- Network of people capable of assisting in research, development, and implementation
- Processing systems are pre-existing (web servers, phones, computers, etc.)
- The opioid epidemic exists everywhere

Weaknesses

- Limited knowledge of healthcare
- New problem with not a lot of precedent to help guide development

Opportunities

- Adding more than just opioids into the application
- Integrating with other fitness, nutrition, and health applications
- High market demand for this solution
- Due to the nature of the problem, everyone will be moving quickly to get the solution developed and distributed

Threats

- High demand for the solution --> a lot of competition
- High cost to train employees and to staff a 24/7/365 call center
- There could be a different solution besides integrating healthcare to solve the epidemic
- HIPAA Laws
- Could only attract patients that are not at risk for addiction

Technical Justifications

Linux Servers – Linux is a more stable platform that can handle multiple processes. Linux is more secure since it was developed for multiple users. Linux is an open source and mostly free service. [8]

MySQL – MySQL runs on a Linux server. It is a free and open source. Can subscribe to MySQL Enterprise which offers automatic software updates, proactive monitoring/advisory tools and 24/7 access to support staff. [9] It works well with PHP.

PHP – PHP is used by 85.9% of websites whose server-side programming language is known. It is also integrated to work with MySQL. [10]

Bootstrap – Necessary to reformat web pages to fit on all devices. Some places might uses iPads while others use desktops, so the web client needs to be able to work on both.

HTML5 – Used by over 10,000 of the top websites. It appears the same across all platforms. [18]

Apache – It is open source and free. It is fast and reliable.

Single Sign-On – makes the process more streamlined. Users will not get frustrated that they have to keep entering a username and password. It reduces the possibility of phishing and heightens security. [12]

Multi-Factor – Information is highly sensitive and is in HIPAA compliance [20]

Epic Systems – Epic software is used by 72% of HIMSS Stage 7 hospitals. [13]

Cerner – The other big name in healthcare EMR software. Around 532 hospitals in 2013 use Cerner. [14]

OnBase – Insurance ECM used by over 800 companies[16] and can be integrated with the top EHR systems like Epic and Cerner [17]

Oracle Insurance – Produced by Oracle, which is a well-known company. Can offer customer support if needed.

RX Connect – Used by CVS pharmacy which is the largest chain in the country with over 9,600 locations. [15]

Intercom Plus – Used by Walgreens, the second largest chain in the industry with over 8,100 locations. [19]

Graphs

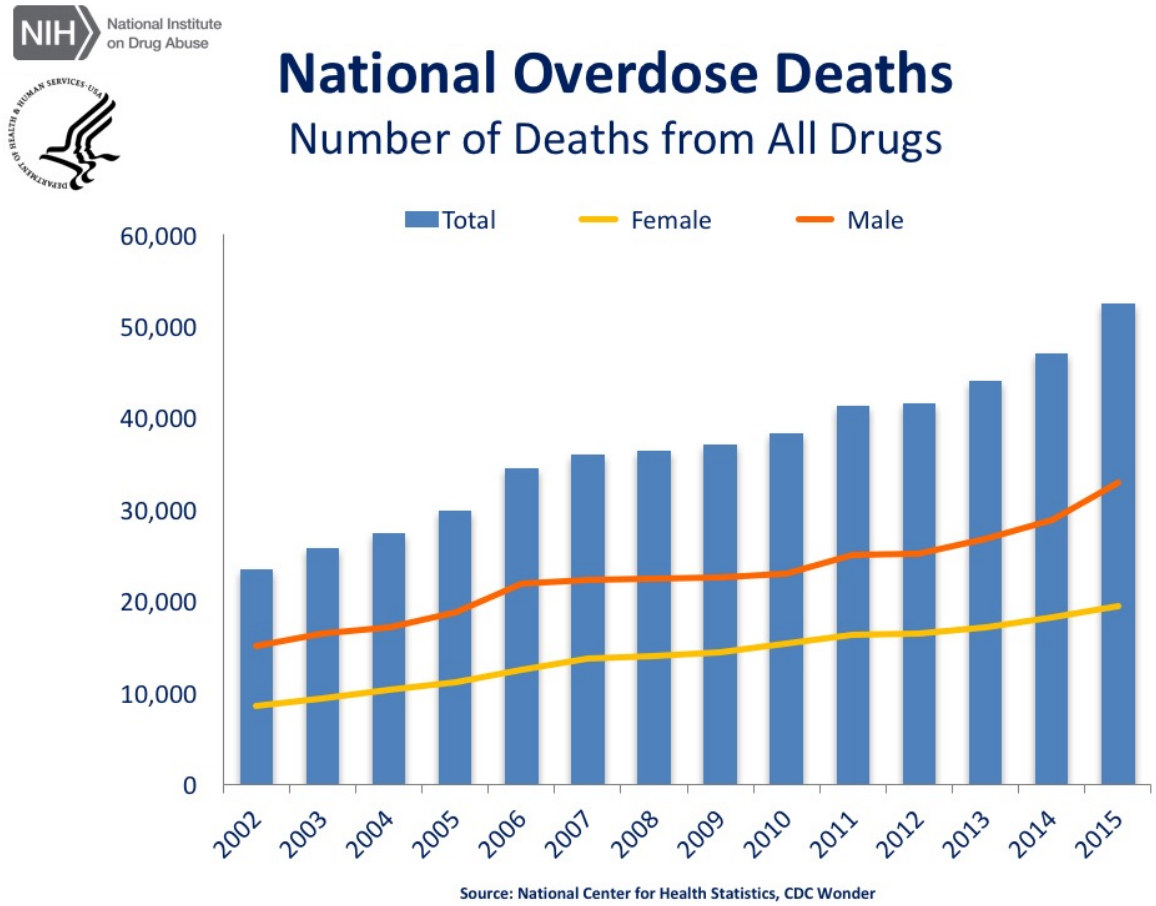


Figure 1: National Overdose Deaths
Source: National Center for Health Statistics, CDC Wonder [2]

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Opioid Tracker: Requirements Document

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Introduction

This document contains the system requirements for *Opioid Tracker*. These requirements have been derived from several sources, including the Request for Proposal, stakeholders, and online resources relevant to the opioid epidemic, various systems out in the market working in relation to the opioid crisis in America.

Types of Reader

In this section, there is a list of the different types of reader this document is aimed at. For example, database administrators, software developers, end users, etc. For each type of reader, it is clearly stated which sections are most pertinent to them, and all others may be safely skipped.

Database Administrator
- Availability and Performance Requirements
- General Constraints
- Product Functions
- Sustainability Requirements

End Users
- Functional Requirements
- Product Functions
- User Characteristics

Graphic and Interface Designers
- Functional Requirements
- Product Functions
- User Characteristics
- User Interface Requirements

Marketing and Advertising Professionals
- Functional Requirements
- Product Functions
- User Characteristics

Project Managers
- Availability and Performance Requirements
- Functional Requirements
- General Constraints
- Product Functions
- User Characteristics

Software Developers

- Availability and Performance Requirements
- Functional Requirements
- Sustainability Requirements
- System and Integration Requirements

Technical Background Required

Users with basic understanding of operating web or mobile applications similar to Medisafe.com and MyTherapyApp.com will be able to use this application without technical issues. Our application will be simple to use and does not have in-depth details. Software developers and database administrators will need to have a thorough understanding of system and integration requirements, and functional requirements. Graphic and Interface designers will need to have good understanding of functional and user characteristics keeping the end users in mind while developing the system interface.

General Description

This section will give the reader an overview of the project, including why it was conceived, what it will do when complete, and the types of people we expect will use it. We also list constraints that will be faced during development and assumptions we made about how we would proceed.

Product Functions

Opioid Tracker will allow the patient to track their opioid prescription from the date that the patient receives the prescription from the provider to the end of the drug regimen. The end date of the regimen will be decided upon by the provider and the patient base on the regulations and standards set forth by the medical field.

The patient will first learn about the web and mobile applications in the provider's office that prescribes the medication to the patient. The provider's office will consist of the doctor and the administrative staff that supports the office. The office manager, front desk staff, registration personnel, and nursing staff will be educated on this epidemic with the pamphlets. The pamphlets will be given to the user to show the importance of this epidemic. The pamphlet will contain statistics of the epidemic and a brief overview of the web and mobile applications.

After the patient has seen the provider, the patient will then speak with the administrative personnel who will educate the patient before leaving the provider's office. The administrative staff will give share the pamphlet with the patient and briefly describe the benefits of being in contact with their provider and pharmacist throughout the opioid regimen and the risks associated with taking an opioid regimen. Finally, the administrative staff will give the patient their unique ID to begin the registration process on the website. Giving the patient their unique ID before leaving the office, will give the patient the opportunity to set up the password and fill in their profile on the web and mobile applications prior to leaving the provider's office. This will allow immediate access for the patient to see the activity from the provider and the pharmacist. The patient will be able to contact the provider or the pharmacist via the web and mobile applications in case there are questions once the patient leaves the office or the pharmacy.

When the user logs into the *Opioid Tracker*, the user will type in the unique ID given to them and will be prompted to select a password that is at least six characters long that will include at least one capital letter, lower case letters, and three symbols from the OWASP password special character list ("Password Special Characters"). Then it will prompt the user to fill out the user profile, which includes the providers name and phone number and the pharmacy's name and phone number. The user will also have an option to type in their rewards card from one of the selected pharmacies: CVS, Walgreens, Rite Aid, or Giant Eagle. The rewards card will link to the rewards center within the Opioid Tracker for discounts and freebies at the user's pharmacy. After the profile information has been entered, the patient will be able to see the opioid prescription added by the provider.

After the provider sends the prescription to the pharmacy via the patient's account, the pharmacy will notify the patient when the prescription is ready for pick up via push notification from the application. Prior to the notification to the patient, the pharmacist will receive the opioid prescription information from the provider. The prescription information will include the dosage, times, and days to take the medication. This information will be stored in patient's profile under the "My Medicine" section. The pharmacist will confirm the patient is cleared to receive the medication by checking their state's Prescription Drug Monitoring Program (PDMP) website to make sure the patient has not had another opioid prescription recently (Hopkins, 11). After the patient is cleared, the pharmacist will proceed with filling the medication, and then will hit "Complete" on the patient's record and automatically set reminders in their calendar.

When the patient picks up the prescription and completes the sale of the opioid prescription, the calendar and reminders will be released to the patient's account. While in the pharmacy, the patient will be able to look at the details of the prescription in the drug profile to see if there are interactions with other over the counter drugs, food or beverages. This will allow the patient to ask the pharmacist questions while still at the pharmacy. Having the drug interactions available to the user will enable the patient to plan their drug regimen and not interfere with other over the counter medications.

Reminders will be in placed in the calendar to prevent missed dosage. There will be a 10-minute reminder prior to the time the patient needs to consume the medication. At the time of administration of the medication a notification will alert the patient asking a simple series of questions. Shown in Figure 1 below are mockups of the notifications shown to the user when it is time to take the medication. A "Yes" answer must be given on the first screen to move on to the next screen. If a "No" answer is given, the application will remind the user again about the dosage 15 minutes after the scheduled dosage time. The user will also have the ability to add comments, shown as a clipboard in the image below, if they so desire. After the questions are answered, the last screen will display that the user has earned 2 reward points before disappearing.

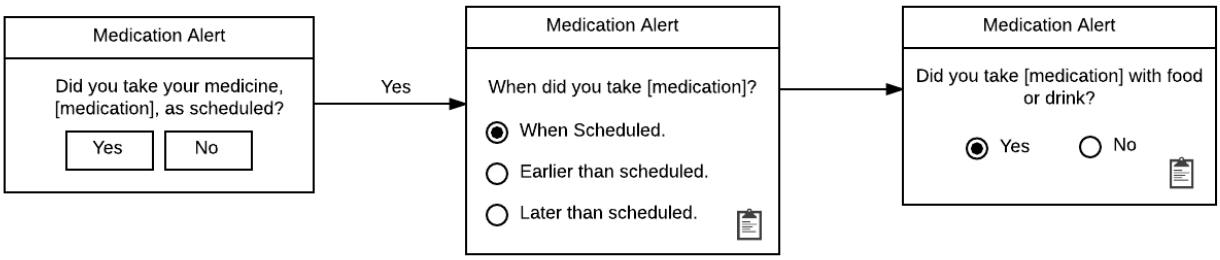


Figure 1: Mockup of notifications to confirm patient has taken medication.

If these questions are not answered within one day, a notification will be sent to the pharmacy and the provider to show the time and date of administration missed. This will show that the patient is adhering or not adhering to the medication schedule. If the patient does not comply with the medication regimen three days in a row, a message to the patient will advise the patient to reach out to the provider or the pharmacist. It will prompt the patient with a push notification to set up a phone call with the provider or schedule an appointment, so the provider can speak with them about why the medication regimen has been missed for those three days. This will allow the provider to access the situation and decide if changes need to be made.

User Characteristics

The Opioid Tracker will be directed towards any person that is prescribed an opioid prescription from a medical provider within Allegheny County, Pennsylvania ranging in ages of 18-45. The user will need to have access to a supported mobile client or to a computer with a supported web browser, both of which are defined in the Specific Requirements section below. The first launch of this product will be directed to any beginner to advanced technology user. A beginner by our definition is anyone that uses a computer or a mobile device to search websites, add demographic information, and accept push notifications from a mobile application. This user also is familiar with downloading an application on their mobile device and can navigate that application once it has been downloaded. Having a basic system allows everyone to have access to utilize *Opioid Tracker* and prevent deaths and abuse in the future. A set of personas has been built to describe our intended audience and is shown in Figure 5 in Appendix A.

The patient will use *Opioid Tracker* for fear of abusing the opioid medication and being a part of the statistics of failure and death. The gamification that is a part of the application second motivation for continuing to use this web and mobile application. The user will stay on track to obtain the coupons and discounts described below. Once the user begins to obtain coupons by adhering to the regimen, the user will be more motivated to continue to use this product until the drug regimen has been completed. The gaming system that is recorded will be in the Rewards Center section of the web application. The reward center will be on a point system:

Ways to achieve points:

- accepting the calendar reminders at the time of required dosage (1 point)
- answering the two questions following the calendar reminder (1 point)
- scheduling an appointment with your provider regarding missed doses (2 points)

The user will be eligible to start earning points on the first dose that is mandated by the prescription from the provider. After earning ten points, the patient will receive one of the seven colors of the rainbow. After each level is reached the user will have the rewards in Table 1 to choose from and have random coupons to achieve. Once the user accepts the coupon from the achieved level, the user's points will be reset. The user will have one year from the date of the coupon to redeem the coupon. Once a drug regimen has been completed by the provider the reward center will reset, and all the coupons that the user has earned will remain active until the expiration dates. If the patient begins a new opioid regimen the reward system will start fresh with zero points.

Table 1: Reward Levels

Level	Points	Rewards Available
Purple	10	Subway ("Our People, Our Communities"), Qdoba ("About QDOBA Mexican Eats"), Panera ("In the Community")
Blue	20	Random coupons*
Green	30	Nike, American Eagle Outfitters, Forever21 (Matousek)
Yellow	40	Random coupons*
Orange	50	A ticket at 50% off for any University of Pittsburgh sporting event
Red	60	Random coupons*
Pot of Gold	70	$50 off your next prescription at your preferred pharmacy

***** *Random coupons include the pharmacy discounts, clothing coupons, sporting event tickets, as well as meal discount tickets. This is based on the level of compliance related to the color code. The coupon will be sent to the patient at random times throughout the day or the week once the patient has unlocked that random coupon level. The randomization will be a push notification to alert the patient they have a coupon available. This action will keep the patient engaged with the application.*

The health care system spent $78.5 billion in costs on the opioid epidemic in 2013 (Office of the Assistant Secretary for Public Affairs). Therefore, the two major insurance providers in the Allegheny County area should be more than willing to partner with *Opioid Tracker* to make these rewards possible. University of Pittsburgh Medical Center (UPMC) is expected to be the first to partner with us also takes patient care very seriously by stating on their community engagement section of their website that they support "programs that combat hunger, collaborating with local leaders to make a positive change in their communities, creating targeted interventions to improve the health of families" ("Community Engagement"). We expect Highmark to partner as their values include "working to improve the health of the communities we serve and wisely managing the assets which have been entrusted to our care" ("About Us"). This shows their commitment to helping the community to combat this opioid epidemic. As we grow we hope that more insurance providers will see the benefits of partnering with us to help make these rewards better and more valuable to our users.

The obstacles the user might encounter could be that they lose internet connection while at home during a storm as well as lose signal from their cell phone. This could potentially prevent them from receiving the calendar reminders and allowing the patient to answer the questions for compliance reports. If the patient loses, drops or destroys their mobile device for any period of time, they will have to rely on using a computer with internet connection until they replace the mobile device. Again, this will prevent the calendar reminders from being sent to the patient.

Constraints

The system is technologically constrained to servers at the University of Pittsburgh, where it will be hosted. Additionally, the system will be constrained by developmental limitations by the platforms, mobile or otherwise, that are being supported. These are outlined in the Specific Requirements below. Compatibility with existing software is also important. Connectivity with the Pennsylvania PDMP and pharmacy platforms Epic and Cerner are essential to incorporate pharmacies and providers into this solution. *Opioid Tracker* is going to voluntarily be Section 508 compliant, meaning that the application will be accessible by all users of all abilities ("What is 508 Compliance?").

The system will also be constrained by HIPAA. In order to be HIPAA compliant, any ePHI should be transferred via a secure channel with end to end encryption. The entity must have access controls in place. These controls will ensure that a limited amount of authorized users can access protected health information. In addition to access controls, HIPAA requires additional controls that allow devices to be audited. There needs to be a way to view who attempted to gain access to the information, whether they were successful or not.

Assumptions and Dependencies

For *Opioid Tracker*, we are depending on University of Pittsburgh servers to handle all of our code and the applications. We are also assuming that there will be little to no push back from providers and pharmacies using our product. We are depending on them accepting our application and helping us market it to their patients. In addition, we are under the assumption that all users will have reliable and continuous access to computers and the internet (provider and pharmacy) or a smartphone with internet access (patient). They will also have the basic knowledge described in User Characteristics. The application will require administration to maintain HIPAA, HITECH and Section 508 compliance. Administration will also be in charge of maintaining up to date workflow diagrams of data and inner-system dependencies, application documentation both online and offline, document configuration settings, work at the right security/privilege level when diagnosing and resolving a problem, and properly source administration accounts ("Application Administration").

Specific Requirements

This section of the document lists specific requirements for *Opioid Tracker*. Requirements are divided into the following sections:

1. User requirements. These are requirements written from the point of view of end users, usually expressed in narrative form.
2. Availability and Performance requirements.
3. System and Integration requirements. These are detailed specifications describing the functions the system must be capable of doing.
4. Sustainability Requirements
5. User Interface requirements. These are requirements about the user interface, which may be expressed as a list, as a narrative, or as images of screen mock-ups.

User (Functional) Requirements

Search Query

The provider will introduce the patients to *Opioid Tracker*. The administrative staff will explain the details of the application and importance to sign up for it. The patients will receive an email from the administrative staff with a link to the website. The website could also be searched for on the internet or the app store on their phones. The pamphlet explained and distributed by the administrative personnel will also have details and directions to search the website or download the application on the mobile devices.

User Login

The patient can create a password with the unique ID that is given to them. The user will select a password that is at least six characters long that will include at least one capital letter, lower case letters, and three symbols from the OWASP password special character list ("Password Special Characters"). This will enable the users to use *Opioid Tracker* securely and have a personal experience with their profile.

Patient Profile

The user will create a profile, which includes the providers name and phone number and their preferred pharmacy's name and phone number. They can also upload their profile picture. There will be a chat window where the user can chat directly with the provider or pharmacist whenever needed.

Drug Profile

The pharmacist will fill the prescription after checking the patient's records in the PDMP website. The prescription details will be visible to the patient once the pharmacist clicks "Complete". The drug profile will be visible to the providers as well as the patients. The patient will get all the drug information and reminder details for the prescribed opioid medication.

Notifications

The patient will receive push-notifications number of times they need to take their opioid medication, as well as the two required adherence questions to be answered, as shown in Figure 1 above. The providers and pharmacies will also receive notifications of compliance from the patient's profile. This will be the main key to keep track of the patient compliance and the opioid prescription use or misuse. The patient will receive push-notifications to call the provider during non-compliance. This will enable the provider to review the record of the patient and make further decisions.

Calendar

The calendar, in correspondence with the notifications, will help the patient keep track of their drug intake compliance as well as the rewards they need to redeem based on their compliance.

Reward Center

The user will receive rewards for compliance to the regimen. This will attract and encourage the users to comply to the regimen. Rewards are based on the points achieved for complying to different activities of the regimen. Based on certain points gained, the user can benefit from the pot of random and specific discounts.

Availability and Performance Requirements

Opioid Tracker will be used by many different types of users; therefore, it needs to be accessible to all. The web and mobile applications will be available via multiple browsers as described in the System and Integration Requirements. To ensure proper functionality and to be available for customer support, the user is highly recommended to have the most up to date versions of the web browser or operating systems.

The provider of our server will be the University of Pittsburgh. The servers are located at the Network Operation Center (NOC). They will offer 99.99% availability. The NOC will perform around the clock monitoring, performs all backups, manages upgrades to operating systems, and coordinates the resolution of hardware problems. The NOC will also support Opioid Tracker's scalability ("Managed Server Hosting").

System and Integration Requirements

The proposed architecture for *Opioid Tracker* is shown in Figure 6 in Appendix A. The diagram shown may look complex, but is rather simple to build in order to get this solution up and running. On the back end, both the database and web servers will be hosted on Ubuntu distributions of Linux, which are both widely used and open source. The database that will be used to store information will be MySQL. Apache HTTP and Tomcat servers will host the web server capabilities. Connection to the front end of the solution will be provided through RESTful API, converted through JSON, and transferred via HTTPS. The programming for the front end will be done via HTML with the use of CSS and JavaScript, along with various frameworks. This will avoid the need to program for multiple native platforms and to have seamless functions for all users.

On the front end, users can access the application in a variety of ways. The mobile devices that can be used to access *Opioid Tracker* are those running iOS, Android or Windows software. A variety of web browsers can also be used to access the application, including Chrome, Firefox, Safari, Microsoft Edge, and Internet Explorer ("Web Browser Market Share"). *Opioid Tracker* will only be accessible through the officially supported versions of each of these softwares. This will allow the application to continue to develop and grow with current technologies. On the provider end, providers will have access to the application through the Epic and Cerner systems, which are the most widely used health care technology softwares.

Sustainability Requirements

Application Maintenance

The back end maintenance containing all the changes made by the stakeholders or general system updates will be handled by the development team. The development team will have a programmer, software developer, graphic and interface designers, and database administrator to assist in these technical demands. On the front end there will be a help desk and customer support team. The customer support team will accept phone calls and notifications from the users, providers, and pharmacist that are having technical difficulties with the system. The customer support team will act as a liaison to the development team to resolve these issues and ensure a successful usage of the web and mobile application.

Updates

Changes and updates to the *Opioid Tracker* will be sent to the user via the mobile application through push notifications. The user will need to accept critical updates via their mobile device in their application store. The user can also accept non-critical updates via a push notification. The user will need to be connected to Wi-Fi or the internet to upgrade the application. If the user chooses to use the web application, no action will be needed by the user. The web application will be upgraded automatically.

Scalability

We are targeting the users ages 18-45 in Allegheny County, Pennsylvania for our launch ("Analysis of Overdose", 20). According to the Allegheny County Medical Examiner's office, this group makes up 56.5% of the population who have overdosed from 2008 to 2017 ("View Overdose Death Data"). There is a total of 1.23 million people in Allegheny County according to the census website ("QuickFacts"). It was reported that 52.9 per 100,000 people overdosed in 2016 (see Figure 7 in Appendix B). There were 424 deaths in 2015 and 648 deaths in 2016 (see Figure 8 in Appendix B). This is a 52% increase for one year. Using this information, we have decided to launch with a user group of approximately 3,000 patients based on the calculations in Table 2 below. From there, we plan to increase the number of patients on the system by 52% each year.

Table 2: Calculations for Launch Audience

648 * 1.52 = 984.96	Estimated overdose deaths in 2017
984.96 * 1.52 = 1,497.14	Estimated overdose deaths in 2018 (estimated launch year)
1,497.14 * 2 ≈ 3,000	Estimated launch audience (double estimated overdose deaths in 2018)

User Interface Requirements

Whenever the user opens the web site or mobile application, they will be required to log in with their unique user identification and password. This will ensure that any ePHI is not compromised. After logging in, patients will see an overview screen as in Figure 2 to the right. This screen will allow the user to view their general personal information, an overview of their medications, a list of their doctors and contact information, and preferred pharmacy. From this screen, the patient can view their contact information as it appears to their pharmacists and providers. This information can be changed in the settings, as shown by the fourth tab with the gear symbol. The "My Medicine" section provides the patient with the name and a visual of their medication, the doctor who prescribed it, the number of refills available, and a button to view more information. Clicking that button allows the patient to view the drug regimen for that medication as well as additional information, such as food and drug interactions. The "My Doctors" and "My Pharmacy" sections contain names and contact information to allow the patients to stay in contact with their providers.

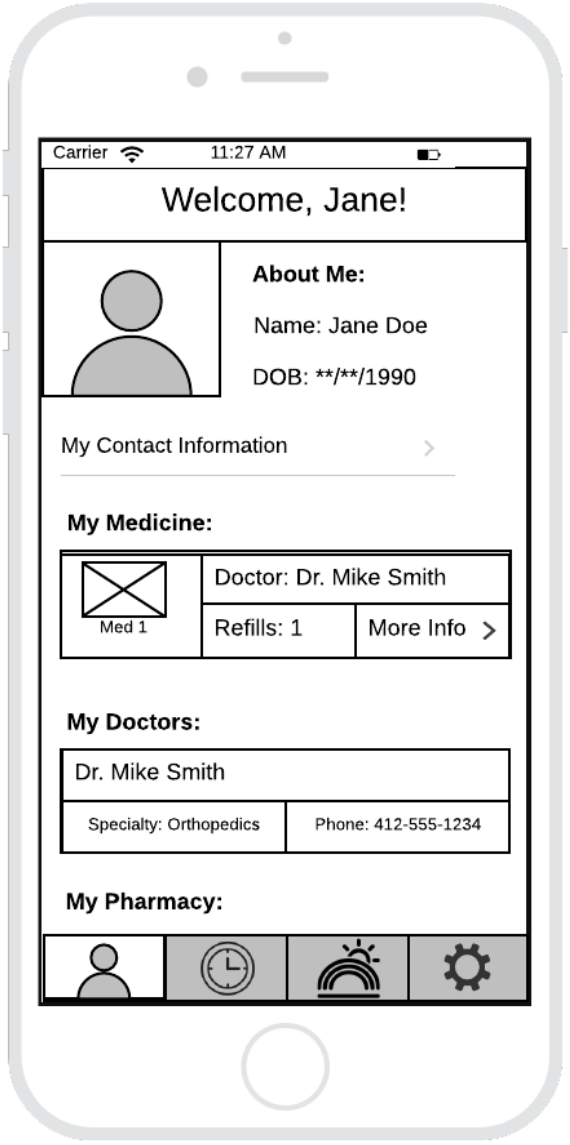


Figure 2: Overview Screen

The second tab, shown in Figure 3 below, is the schedule tab and it lays out the user's drug regimen. Shown in the image are scenarios for when the patient has taken their medication as directed (top), missed a dose (middle), and has an upcoming dose (bottom). There is also a button at the top of the screen that will allow the user to log an "As Needed" medication or an Over the Counter drug, such as Tylenol.

The third tab, shown in Figure 4 below, is the patient's Reward Center. Here they can view how many points they have earned from compliance with their drug regimen, what level of the rainbow has been unlocked based on the number of points earned, and the rewards available for the rainbow levels unlocked.

The fourth tab is the Settings tab. It is not shown below. In this tab, the user can change various settings including font size and contact information. The patient can also view their personal compliance reports in this tab, in the way that the pharmacists and doctors view it, rather than just through the Reward Center.

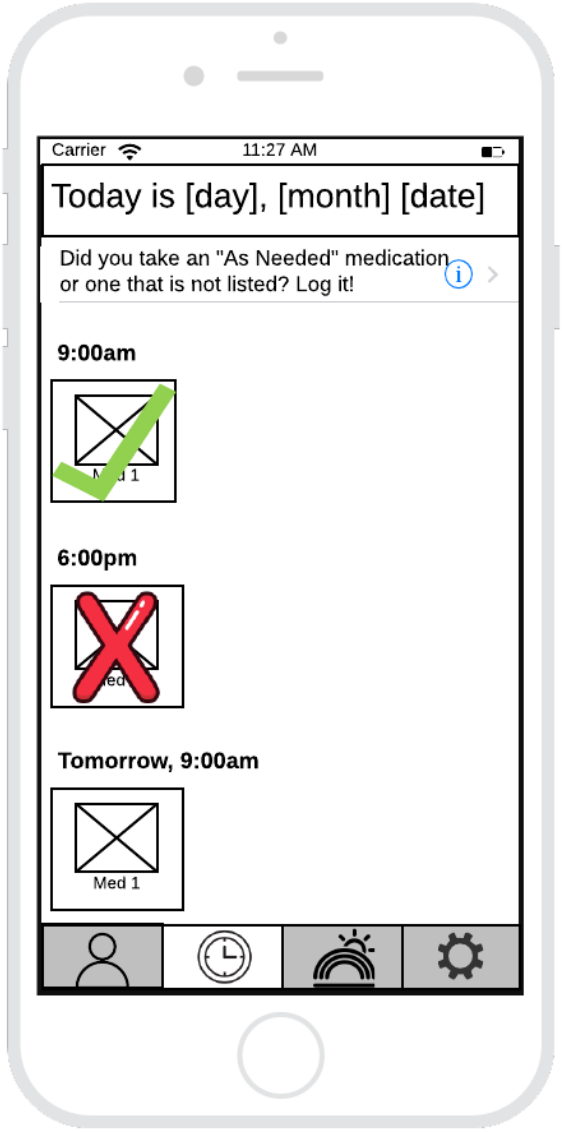


Figure 3: Medication Schedule

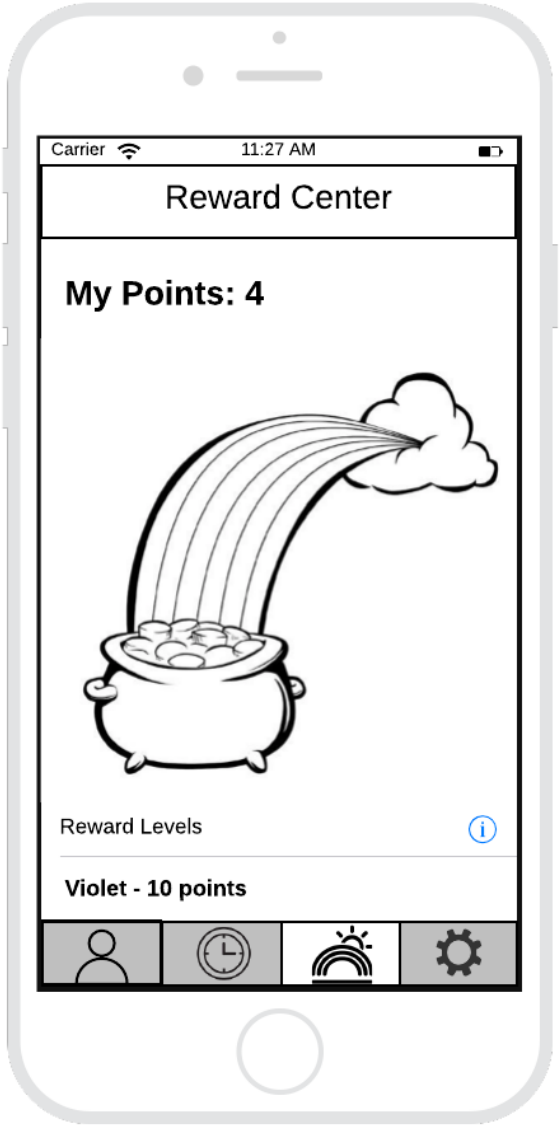


Figure 4: Reward Center

Appendix A: Technical Diagrams and Images

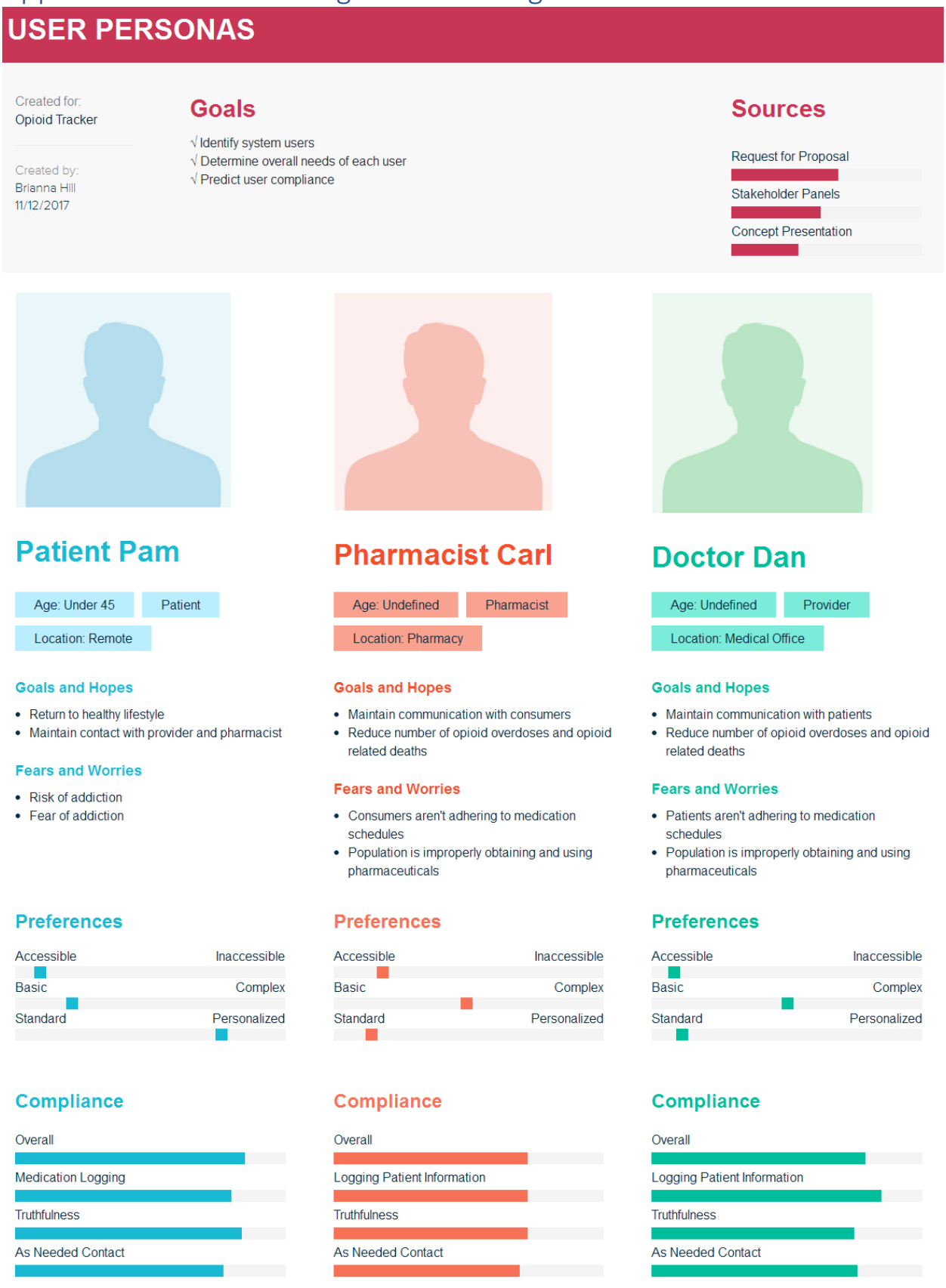


Figure 5: User Personas

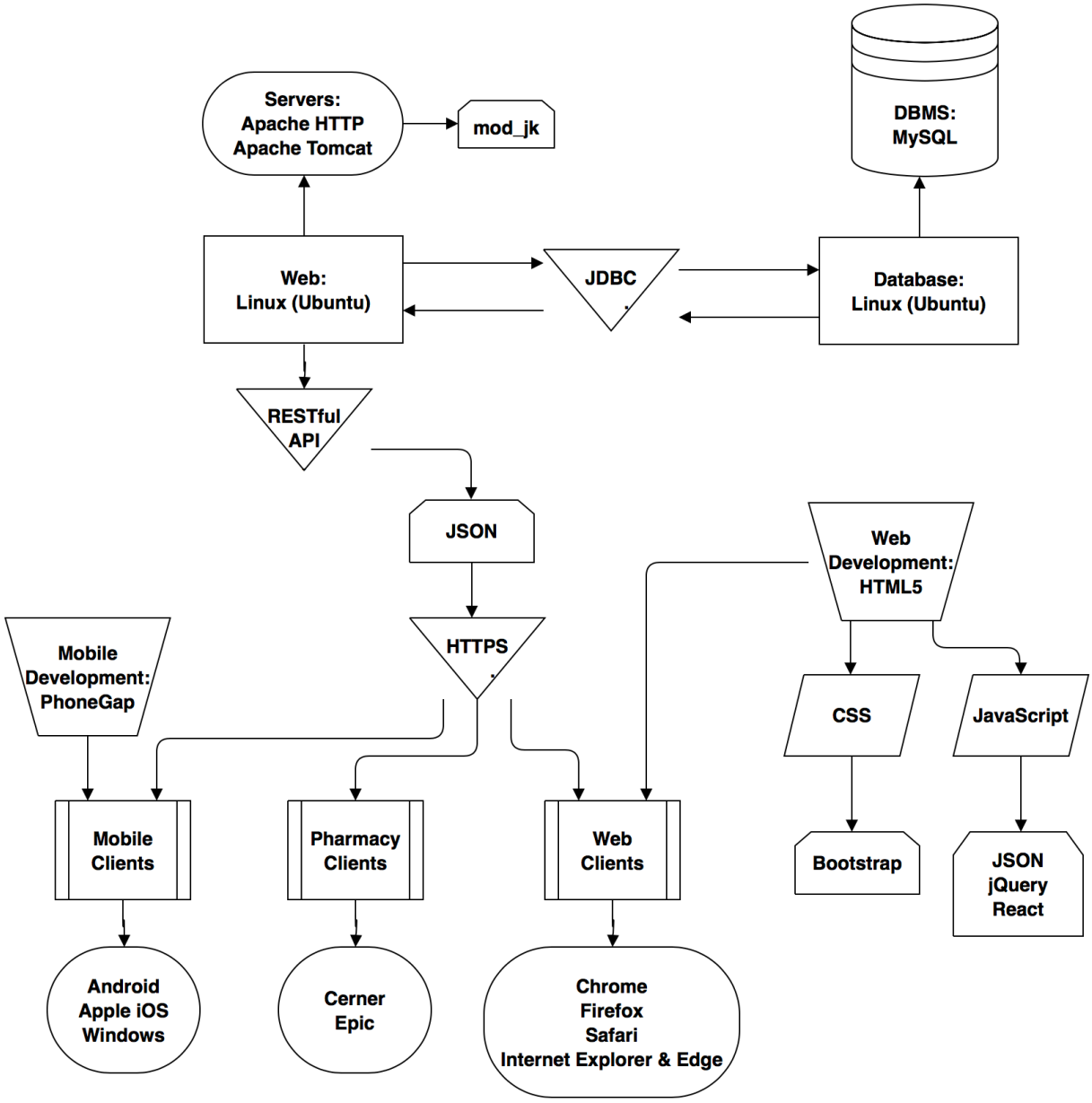


Figure 6: Proposed Solution Architecture

Appendix B: Reference Figures

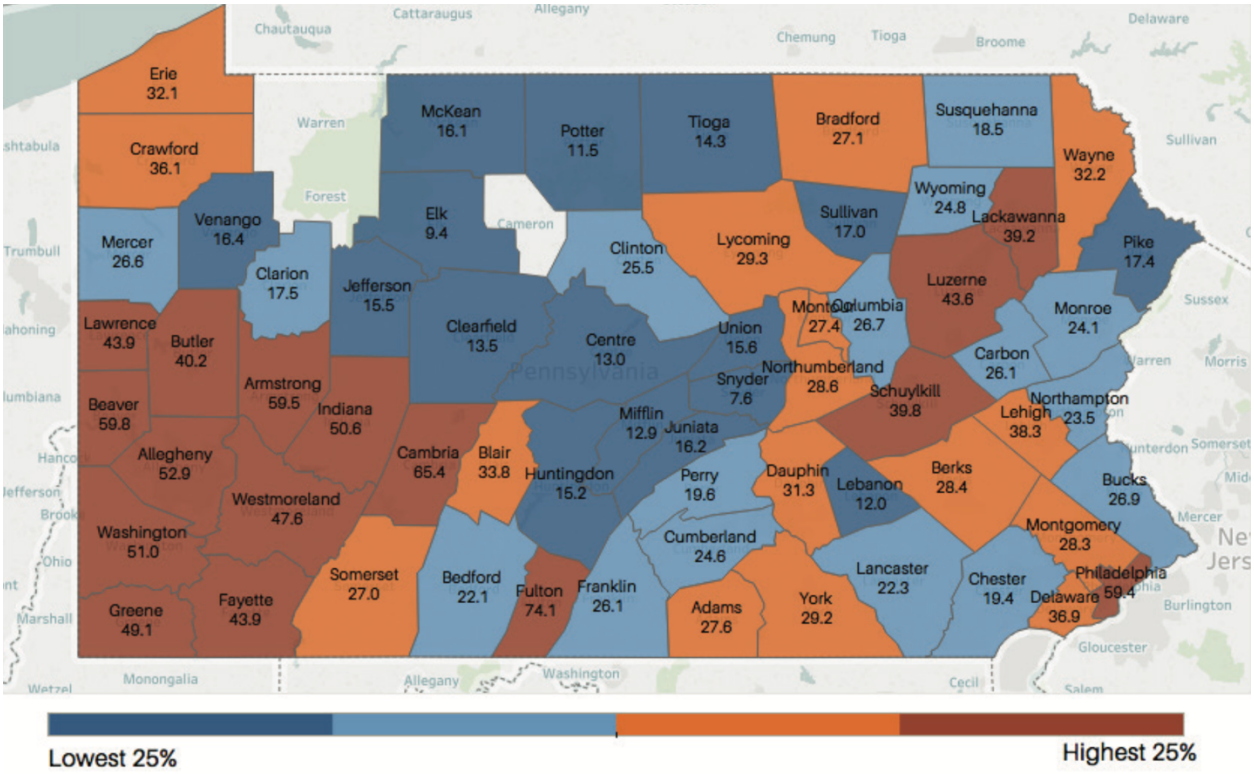


Figure 7: 2016 Rate of Drug-Related Overdose Deaths per 100,000 people in Pennsylvania Counties (DEA Philadelphia Division, 8)

Allegheny

2016 Overdose Count: 648

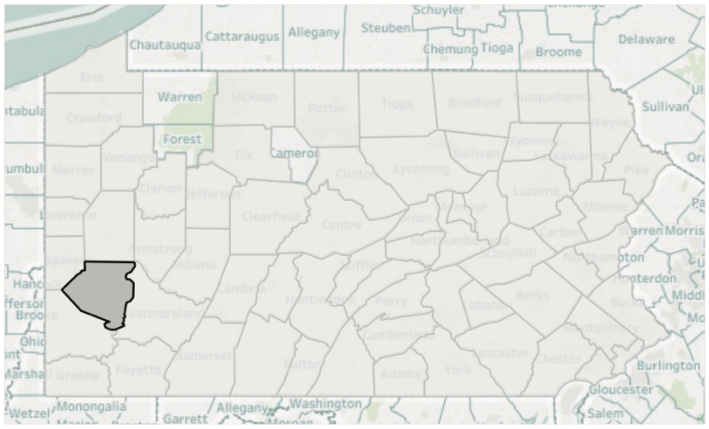
2015 Overdose Count: 424

2016 Rank by Rate: 6

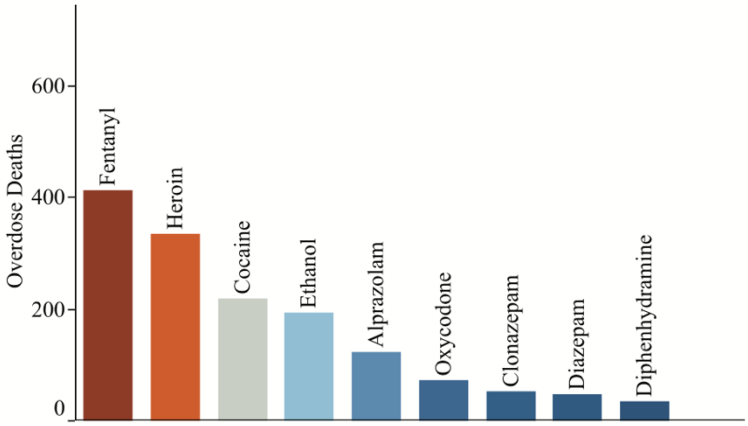
2016 Rank by Count: 2

2016 Rate: 52.97

Total Population: 1223348



Top 10 Drugs Present in 2016 Accidental Drug-Related Overdose Deaths



Age, Race, and Gender Distribution of Overdose Deaths in 2016

Race	Ages	Female	Male
White	0-14		
	15-24	14	24
	25-34	49	116
	35-44	36	96
	45-54	43	80
	55-64	23	54
	65-74	5	
	75+		
Black	0-14		
	15-24		
	25-34	5	12
	35-44	6	15
	45-54	7	21
	55-64	4	17
	65-74		7
	75+		
Hispanic	15-24		
	25-34		
	35-44		
	45-54		
	55-64		
	65-74		
Other	0-14		
	15-24		
	25-34		
	35-44		
	45-54		
	55-64		
	65-74		

Overdose Deaths

Less — More

Deaths by Drug Category per Quarter

	Q1	Q2	Q3	Q4
Fent./ FRC	35	62	120	213
Heroin	59	70	94	112
Pres. Opi.	16	31	35	51
Benzos.	32	43	54	72
Ethanol	25	30	52	87
Cocaine	27	42	57	94
Other Illicits		1	3	2

Percent Change from 2015 to 2016

Figure 8: Analysis of Overdose Death Data within Allegheny County (DEA Philadelphia Division, 45)

Glossary

API - An application programming interface is a set of subroutine definitions, protocols, and tools for building application software that can make it easier to develop a computer program by providing all the building blocks, which are then put together by the programmer.

Consumer - A any person that is a patient that is obtaining and consuming an opioid drug regimen.

CSS – Cascading Style Sheets

DBMS – Database Management System

ePHI (Electronic Protected Health Information) - Any protected health information that is covered under the (HIPAA) dealing with the security regulations that is produced, saved, transferred or received in an electronic form.

HIPAA (Health Insurance Portability and Accountability Act) - United States legislation that provides data privacy and security provisions for safeguarding medical information

HITECH (Health Information Technology for Economic and Clinical Health Act) - Enacted as part of the American Recovery and Reinvestment Act of 2009, was signed into law on February 17, 2009, to promote the adoption and meaningful use of health information technology.

HTML – HypterText Markup Language

HTTP(S) – HyperText Transfer Protocol (Secure)

JDBC – Java Database Connectivity

JSON – JavaScript Object Notation

Patient (User) - Any person that has been prescribed an opioid prescription by a provider.

PDMP (Prescription Drug Monitoring System) - A program managed by the National Alliance for Model State Drug Laws, that tracks patients Opioid prescriptions state by state. The information is entered into the system by retail pharmacies, hospitals, and providers.

Provider - Any person that is legally able to provide an opioid prescription.

User- see *Patient*.

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[3] Document template.
[4] Used to create user personas.

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