Team ReBoot.

Requirements Document

Version 1.2

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Team Members:
Bianca Altman, Jennie Dallas,
Victoria Leafgren, Isai Martinez,
Cindy Valentin

Sponsor: Dr. Emery Eaves

Mentor: Dr. Eck Doerry

Accepted as baseline requirements for the project:

Client Signature: _____ Date: _____

Team Signature: _____ Date: _____

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1.0 Introduction

Over two million Americans struggle with opioid addictions, resulting in more than 130 people in the US alone dying every day from opioid overdoses[1]. Addiction to opioids, such as prescription pain relievers, heroin, and fentanyl, has become a national crisis, costing the US $78.5 billion a year for healthcare, lost productivity, and addiction treatments. Not only are overall rates of opioid addiction increasing, but the rates of pregnant women who suffer from opioid use disorder are growing as well. Between 1999 and 2014, the number of women with opioid use disorder at the time of delivery quadrupled, with the rate currently at 6.5 per 1,000 deliveries[2]. Use of opioids during pregnancy is a particularly serious problem, as it can result in newborns being born with a withdrawal syndrome known as neonatal abstinence syndrome (NAS). Babies born with NAS may experience poor feeding, breathing problems, body shakes, excessive crying, and more[3]. Longer term, NAS can cause cognitive or behavioral impairments[4]. From 2004 to 2014, there was a five-fold increase in the number of babies born with NAS in the United States, which has consequently resulted in a steady increase of the amount of money spent on treating these babies. In 2014, an estimated $563 million in hospital costs was spent on treating infants with NAS, compared to the $90.9 million spent in 2004[5].

Pregnant women with opioid use disorder who want to start on the path to recovery are typically placed in a comprehensive treatment program. The treatment program involves medication, addiction counseling, and attentive prenatal care and education. Methadone is a commonly used medication for treating pregnant women with opioid use disorder and is administered daily. Being treated with this medication not only helps these women in their recovery, but also reduces the rates and severity of NAS in their newborns[6]. Counseling appointments may be in a one-on-one or group setting, depending on the needs of the individual. The goal of counseling is to help these women cope with feelings or situations that might lead to relapse and is integral to an effective treatment program[7]. If these women wish to keep their babies, they are evaluated by an appointed case manager over the course of their

[1] National Institute on Drug Abuse. (2019, January 22). Opioid Overdose Crisis.
[2] National Institute on Drug Abuse. (2019, January 22). Dramatic Increases in Maternal Opioid Use and Neonatal Abstinence Syndrome.
[3] The Recovery Village. (2019, October 14). Long-Term Effects of Neonatal Abstinence Syndrome.
[4] Seattle Children's. (2018). *Neonatal Nursing Education Brief: The Long-Term Outcomes of Infants with Neonatal Abstinence Syndrome*.
[5] National Institute on Drug Abuse. (2019, January 22). Dramatic Increases in Maternal Opioid Use and Neonatal Abstinence Syndrome.
[6] National Institute on Drug Abuse. (2017, July). Treating Opioid Use Disorder During Pregnancy.
[7] Center for Substance Abuse Treatment. Substance Abuse: Clinical Issues in Intensive Outpatient Treatment. Rockville (MD): Substance Abuse and Mental Health Services Administration (US); 2006. (Treatment Improvement Protocol (TIP) Series, No. 47.) Chapter 4. Services in Intensive Outpatient Treatment Programs.

pregnancy and recovery. The case manager will then determine whether the mother is capable of staying clean and raising her child.

Our client, Dr. Emery Eaves, is a medical anthropologist at Northern Arizona University whose research focuses on the opioid epidemic among pregnant women in Arizona. Through recovery programs and support groups in Phoenix, Dr. Eaves finds pregnant women with opioid use disorder to interview; using this research to come to a better understanding of these women's situations and to identify their biggest recovery obstacles. She also aims to develop novel tools and techniques that could help improve the recovery process for these women and increase the rates of success.

Through her research, Dr. Eaves has identified that a major obstacle for pregnant women in recovery is attending the many meetings and responsibilities required in a recovery program. This is especially challenging for women living in rural areas or who are transportation-limited, as they have to struggle to find the time and means to travel to their appointments. The following section explains these obstacles in more detail.

2.0 Problem Statement

Traditionally, the recovery process for pregnant women with opioid use disorder involves making daily trips to a Methadone clinic to receive that day's dose of Methadone. Another treatment requirement is to attend one-on-one and group counseling appointments on a regular basis. The number of total appointments these women attend will vary for each individual depending on their needs but could be up to five sessions a week[8]. Additionally, if the woman has any pregnancy concerns, she is expected to make trips to a prenatal care clinic to get her questions answered. Depending on the stage of pregnancy a woman is in and how many additional questions or concerns she has each week, she may have to attend up to two or three prenatal care appointments weekly[9]. All of these responsibilities are added to a woman's regular day, which might include working full time and taking care of other errands and responsibilities. As depicted in Figure 2.0, a typical day for this woman could involve up to three visits to various required treatment sessions and might end up being up to 17.5 hours long due to all of the appointments and obligations.

[8] Center for Substance Abuse Treatment. Substance Abuse: Clinical Issues in Intensive Outpatient Treatment. Rockville (MD): Substance Abuse and Mental Health Services Administration (US); 2006. (Treatment Improvement Protocol (TIP) Series, No. 47.) Chapter 4. Services in Intensive Outpatient Treatment Programs.
[9] What to Expect Editors. (2019, May 21). Prenatal Appointments.

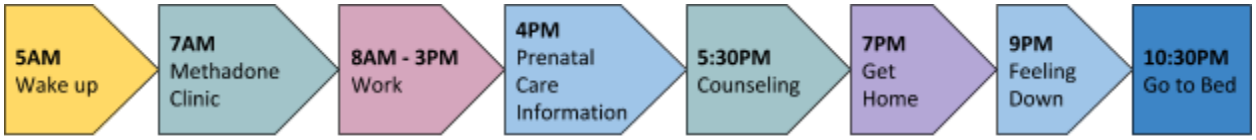

Figure 2.0: A typical day for a pregnant woman in recovery

Women that are in opioid recovery are encouraged to find new social groups and to dissociate themselves from those who supported their addiction and are still engaging in a lifestyle with drug misuse. Finding new friends and a new source of social support is difficult in itself but can be even more difficult for women who feel embarrassed about being pregnant and in recovery for opioid use disorder. They are often openly judged by not only their peers, but by case managers and medical professionals as well. Figure 2.0 indicates how a pregnant woman in recovery could easily end up feeling exhausted and depressed at 9PM due to a stressful, appointment filled day. Being at home alone without social support after a long day of facing judgement from others could result in the woman feeling isolated and discouraged in her ability to be successful in recovery. Without strong social support, this could lead to dropping out of the recovery program and subsequent relapse.
By examining the challenges a typical day for these women presents, we can say that the following are the major issues our software solution will address:

- **Attending medication and counseling appointments** - As previously mentioned, pregnant women in recovery have to attend medication and counseling appointments in addition to their prenatal care appointments and working full time. The number of engagements and consultations these women are required to attend add up very quickly and could be as many as 17 in a single week. For women living in rural areas where the medication and counseling clinics are in a completely different town or city, attending all of these appointments could become a huge burden if they need to travel long distances for each one. The number of engagements could also be a problem if the woman doesn't have access to reliable transportation.

- **Lack of information access** - As depicted in Figure 2.0, there is not much leisure time left in the day for a typical pregnant woman in recovery. Due to these time constraints, it can be difficult for these women to properly seek out key health or pregnancy information specific to their recovery. This leads to a lack of knowledge of certain recovery strategies that these women should adhere to, or medical advice that could help make the recovery process easier.

- **Lack of social support** - Although women in recovery are encouraged to find a new social group, it is difficult for these women to simply find new people to talk to who are supportive of their recovery process. It can be especially difficult if they have a hectic

schedule and don't have time to meet new people, or if they live in rural areas and aren't surrounded by a lot of people in their general demographic. If these women can't find social support, they wouldn't be able to talk to anyone about their pressures and burdens. This can become an impediment for successful recovery.

- **Stigma** - The stigma surrounding these pregnant women's addictions and recovery not only makes their experience more isolating but presents another obstacle for being successful in recovery and keeping their babies. Case managers often dismiss these women as another addict, instead of acknowledging their effort and taking their strides in recovery seriously. This results in these women feeling even more judged and discouraged.

With all of the obstacles that the traditional recovery process presents, the rates of relapse are relatively high: 56% of women who are six months postpartum experience relapse[10]. To help these women overcome the problems discussed, we have devised a solution to help address each of these issues.

3.0 Solution Vision

As this is such a serious and complicated problem, there was much to consider when trying to design a solution. Working with Dr. Eaves, we have envisioned a solution centered around a mobile application, which we call iMATter, that can assist pregnant women with opioid use disorder by taking aspects of the recovery process out of the physical space and into a secure, virtual environment.

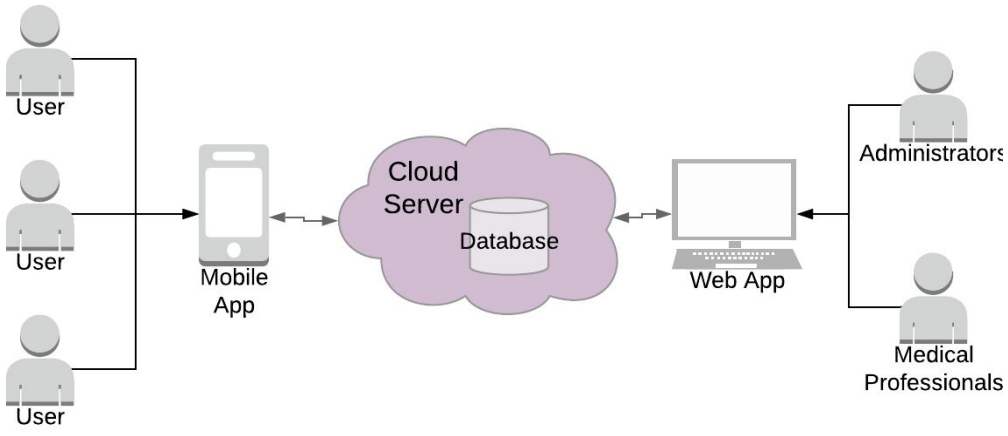

Figure 3.0: General System Diagram

[10] *Goodman, Daisy. Should Maternity Care and Treatment for Opioid Use Disorder Be Integrated? [PowerPoint slides].*

This application will provide a safe, virtual space for pregnant women in recovery, while allowing these women to remain completely anonymous. It aims to bring these women together for social support and allow them to learn and ask questions about pregnancy and recovery in a judgement free space. Our general solution can be seen in Figure 3.0. Users, administrators, and medical professionals will be using applications that are connected to a cloud server and database. For this solution to work as a recovery tool, iMATter will provide users with the following:

- **Virtual learning space** - users can watch videos, take learning modules, and expand their knowledge on their pregnancy and recovery.
- **Chatroom** - Users will be placed into chatroom groups based on their due months. Users in these groups will be able to talk to one another, discuss their experiences, and give and receive advice in a chat room. This provides an outlet for these women to talk about their burdens with those who can understand and relate on a personal level and is a source of social support for women who feel isolated in their recovery experience.
- **Calendar** - a place where users can keep track of appointments, and other events may be added. Calendar events can be configured so the user is reminded of their occurrence.
- **Notifications** - iMATter will send notifications to remind users of appointments or medication consumption times that were added to their calendar, alert them that new information was added to the application and engage them in motivational activities.
- **Threaded forum** - this will serve as an information desk, where users may go to ask a medical professional more recovery or medical-based questions. This will reduce the need for women to make special trips to prenatal care clinics to get their questions answered, saving them time in their already hectic daily schedule and decreases the number of appointments they need to attend.

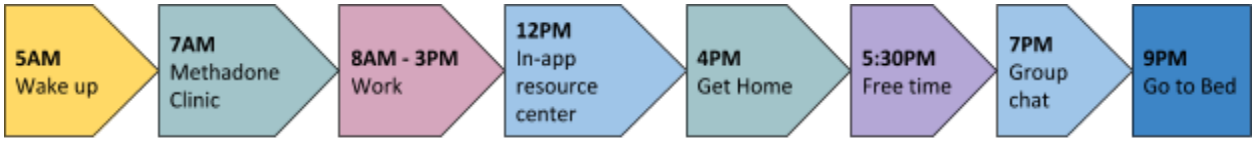

Figure 3.0.1: A typical day for a pregnant woman in recovery using iMATter

Traveling to multiple appointments every day, dealing with a lack of social support, and possibly facing stigma from those who are aware of the recovery situation can be difficult for women in recovery. To help alleviate these challenges, iMATer can serve as a valuable virtual space that's accessible from anywhere at anytime, where women can manage their recovery. Figure 3.0.1

shows a typical day for a pregnant woman in recovery after being introduced to iMATter. As previously depicted in Figure 2.0, she had to go to a prenatal care clinic after work to get her pregnancy questions answered. Now, during her 12PM lunch break, she can ask the in-app medical professional at the information desk any questions she may have or watch videos in the learning module to address her concerns. Instead of getting home at 7PM, she gets home three hours early at 4PM and even has some free time in the evening. If she's feeling down at night when she's alone, she can access the iMATter group chat feature and talk to other pregnant women in recovery and receive the social support that she needs.

Women will sign up for this application using a pseudonym so they may remain anonymous. The chatroom feature provides an easy-to-access and readily available source of social support that can be accessed at any time, day or night. Participants can share a supportive, anonymous, real-time conversation with other women who are going through the same recovery and pregnancy process. The information desk forum connects pregnant women in recovery to medical professionals who can address their pregnancy concerns, which saves them the time it takes to travel to a prenatal care clinic to ask questions in person.

To use this application, women will receive a code over the phone from Dr. Eaves or another registered iMATter administrator. They will then download the mobile application and enter the code upon first opening of the app. Ideally, our solution will be implemented on both iOS and Android to maximize its accessibility and impact.

When this application is deployed, it could potentially work alongside local and regional recovery clinics to provide nationwide access to mobile recovery support. By providing unprecedented versatile and readily available tools to help women succeed in their recovery, iMATter could form a national cornerstone for opioid recovery during pregnancy.

3.1 System Architecture

When creating our system's architecture, we had to consider the necessary elements of the project. We needed a database, a framework for our mobile and web applications, and analytic tools. We knew that the administrators and medical professionals would need a web application, the users would be using the mobile app, and the analytic tools would need to collect information from the mobile app and display it to the web app. Our reasoning for deciding on a mobile application for users (pregnant women in opioid recovery) is because the mobility factor would allow users to be able to use this application anywhere, without needing a desktop setup. We chose to use a cloud server as it allows for scalability and is more convenient for development. In the early stages of this application, there will be a small number of users, but this number has the potential to grow. It would be more convenient for us to connect the application to a cloud server from the beginning so that in the future, as the

number of users increases, the keepers of the application will not have to worry about maintaining a local server.

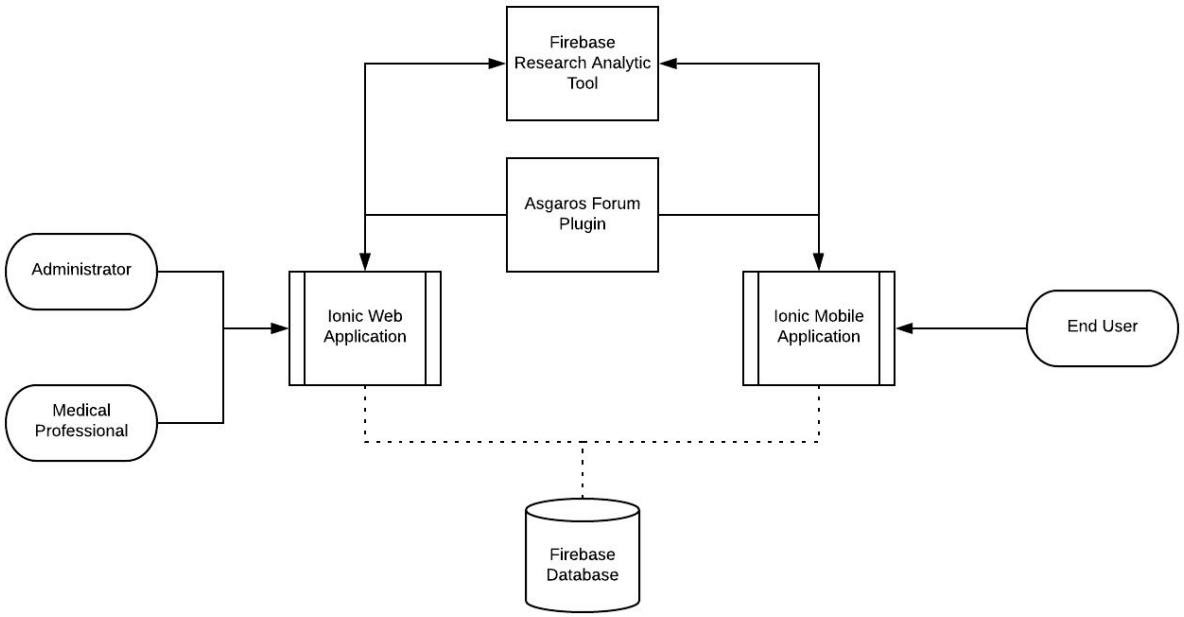

Figure 3.1: System diagram

As seen in Figure 3.1, the end user will be using a mobile application, while the administrators and medical professionals will use a web application, both being implemented with an Ionic framework. Both the web application and the mobile application will connect with Firebase's research analytic tools.

To help Dr. Eaves analyze the efficacy of the iMATter concept, data will be collected from users to see how they are using the application. This includes time spent on the app, log in frequency, survey results, commenting activity, and more. This will help her receive knowledge about how an application like this can potentially improve the lives of these women. This data will be stored using Firebase and analyzed with Firebase's research analytic tools.

In the next section we will outline the requirements that will need to be implemented to create our envisioned solution.

4.0 Project Requirements

To develop an application that will implement our solution vision, our application will require specific features. These requirements have been divided into three different sections that each build off of the section before: domain-level requirements, functional requirements, and performance requirements. We start with domain-level requirements, which break down into our functional requirements, and then our performance requirements. To help provide an idea of how we decided on our requirements, we will begin by presenting use cases we created.

4.1 Use Cases

In order to develop our requirements, we created multiple use cases, or specific ways a user may use the application, to help us understand what each user would be expecting from this application. We created three user cases that consider three different users of this application: mobile application user, which is a pregnant women in opioid recovery; administrative web application user, in this case Dr. Eaves; and a medical professional web application user, which is someone that works with recovery clinics that has been given access to use the information desk.

4.1.1 Mobile application user

Use case: Pregnant woman in recovery is using mobile application.

Actor: Pregnant woman being treated for opioid use disorder.

Description: The user logs into the mobile application and utilizes its features.

Preconditions: The user has been given a sign-up code and can create an account.

Post-conditions: The user receives the support they need in their recovery.

Main Flow:

1. User opens mobile application for the first time and enters sign-up code.
2. User enters the prompted information needed to create an account.
3. User is prompted to log in with their newly created credentials.
4. User is taken to the home page.
5. User may tap on a button to go to the information desk forum, the group chat for their assigned cohort, or the in-app calendar.

Alternate Flow (branches off step 5 in Main Flow):

1. User taps on the button to go to the information desk.
2. A page showing a forum appears.

3. User taps on a post in the forum to view it.
4. User taps a button to reply to the post they are currently viewing.

Alternate Flow (branches off step 5 in Main Flow):

1. User taps on the button to go to the group chat for their assigned cohort.
2. A page showing messages from other people in the user's cohort appears.
3. User taps a field to type a message.
4. User taps a button to send their message to the group chat.
5. User's message appears among the other messages in the group chat.

Alternate Flow (branches off step 5 in Main Flow):

1. User taps on the button to go to the in-app calendar.
2. A page showing a calendar with any existing events for the user appears.
3. User taps a button to add an event to the calendar.
4. A pop-up with empty fields for the new event appears.
5. User inputs information about the event.
6. User taps a button to save the event to the calendar.
7. The new event appears on the calendar.

4.1.2 Administrative web application user

Use case: Administrator uses web application to perform administrative tasks.

Actor: Dr. Eaves

Description: User logs into web application to monitor mobile application activity and perform administrative actions.

Preconditions: User has the credentials needed to log into web application.

Post-conditions: User completes their intended tasks.

Main Flow:

1. User logs into web application using a username and password.
2. The home page for the web application appears.
3. User may click on link to view research analytics, mobile user group chat content, or a list of current mobile users.

Alternate flow (branches off of step 3 in Main Flow):

1. User clicks on link to view research analytics.
2. A page containing application research analytics statistics appears.

3. User inputs what specific analytics information they want shown.
4. Page updates with the specified analytics statistics.

Alternate flow (branches off of step 3 in Main Flow):

1. User clicks on link to view mobile user group chat content.
2. A page showing the group chats for different cohorts appears.
3. User clicks on a link for the group chats for a specific cohort.
4. A page containing the current chat messages for the specific cohort appears.
5. User selects a specific message in the group chat.
6. User deletes the message.
7. The message disappears from the list of messages shown in the group chat.

Alternate flow (branches off of step 3 in Main Flow):

1. User clicks on link to view a list of current mobile users.
2. A page listing all of the mobile users enrolled in the application appears.
3. User clicks on button to add a new user to the system.
4. A pop-up with an automatically generated sign-up code appears.

4.1.3 Medical professional web application user

Use case: Medical professional uses web application to view and answer the questions in the information desk forum feature of the mobile application.

Actor: Medical professional

Description: User logs into web application and is only able to view the content in the information desk forum. They are able to answer questions posted.

Preconditions: User has the credentials needed to log into the web application.

Post-conditions: User has viewed and responded to some questions in the forum.

Main Flow:

1. User logs into web application using a username and password.
2. The contents of the information desk forum are displayed on the screen.
3. User clicks on a post in the forum.
4. The selected post provides the option to reply to it.
5. User clicks on the button to reply to the post.
6. User types in their response to the post and clicks on a button to submit their response.
7. User's response appears as a reply under the original post.

Now that we have provided how we conceptualized our requirements with our use cases, we will present our requirements. To easily distinguish requirements of each of these types, each domain-level requirement uses the header “DR”, each function requirement uses “FR”, each performance requirement uses “PR”, and each environmental constraint uses “EC”. We will begin by discussing our domain-level requirements.

4.2 Domain-Level Requirements

Domain-level requirements consist of the basic functions our application must provide in order for our application to function. These requirements will be the general requirements a user will need for the application to function as expected. We have obtained these requirements from meeting with Dr. Emery Eaves about twice every month, as well as meetings with both Dr. Eaves and Dr. Doerry that occurred weekly. During these meetings, we asked questions about different use cases to understand what overall features the application should have. Our domain-level requirements are the following:

- **DR1 Support Accounts**: There should be the ability to create accounts. Any user data should be stored securely.
- **DR2 Different Account Types**: There are three account types: users (expecting mothers in recovery), administrators, and medical professionals. Permissions and what certain accounts can access should change based on account type.
- **DR3 Information Desk**: To help aid in the ease of recovery, there should be a way for the users to ask a medical professional questions when they may have a question they feel cannot be answered by their group.
- **DR4 Way to Message Other Users in Cohort**: A main goal for this app is to give pregnant women in recovery a support system, as they are told to leave behind their social group. There should be a way for the users to talk to one another and be able to ask for and give advice and support.
- **DR5 Interactive Components to Aid Learning and Recovery**: As this app is to help aid pregnant women in their recovery, there will be components they may interact with to help learn and keep up with their recovery process. Some of these components are a calendar, baby development updates, and a mood survey.
- **DR6 Reward System**: Certain interactions with specific components will allow the user to gain points, which they may then redeem for a gift card.

- **DR7 Reminders**: To keep users interested and interacting with the app, there will be notifications/reminders sent for certain events to remind the users, including: calendar dates entered, cohort messages, new surveys, and new learning modules.
- **DR8 Research Analytics**: As this app is going to build upon after this first implementation, it is important that the administrators are able to view user statistics in a graph format to get a better understanding of how the app is being used.

Next, we will discuss our functional requirements, which will detail the specific system functions and capabilities needed to support and implement the domain requirements.

4.3 Functional Requirements

These functional requirements are specific functionalities the system must provide to support the previously listed domain-level requirements. These requirements are presented in a hierarchical format, beginning with high level requirements based off of our domain-level requirements, leading down to the lower level functionalities that are required to implement the high-level ones.

DR1.FR1 Secure Accounts and Information

In order for users, administrators, and medical professionals to be able to use the applications, they will need to be able to create accounts for themselves. These accounts should be password protected to protect personal information and restrict accessibility to those that should not have access.

DR1.FR1.1 User Accounts

We define a user an expecting mother in recovery that received a unique code from an administrator.

- User account profiles will be viewable by all other users. This way users may feel more personal with one another, even though the application is anonymous.
- Users must enter a unique code given to them to be brought to sign up page. This code should have been received from Dr. Eaves or another authorized person from over the phone.
- User accounts require the following to create their profile:
    - **Pseudonym for username:** users will sign up for the application under a username in order to remain anonymous, as this username will be

displayed for other users to see. Users will input their desired username themselves.

- **Password:** To keep user accounts secure, users must create a password for authentication purposes that will be used before accessing application content.
- **Avatar picture:** Users will be able to have an avatar picture that is displayed on their profile, which they may choose from a provided set of avatar pictures.
- **Due date:** Users will have information provided to them based on where they are in their pregnancy. As well, users will be placed into cohorts based on what month they are due. Therefore, users will need to provide their due month.
- **Recovery email address:** Users will provide an email that will be linked to their account so that in the case of a user losing their phone or having to get a new phone and they do not remember their login information, users will be able to recover their account information with this email.
- **Answer to a security question:** In the case of a user losing all information related to their login (i.e. email, password, username), users will have a security question they may answer in order to recover their account.

- Users will have the option of including the following in their profile:
  - **Location:** Having a location provided by the user will allow for the application to provide resources to the user.
    - If location is provided, users will be given resources (i.e. hotlines) that are based on their area.
    - If location is not provided, users will be given national resources.
  - **Short biography:** To allow users to feel more personal with one another without revealing their identity, users will have the option to write a short biography about themselves that will be visible to other users.
- Users <u>will not have</u> the option to edit their username, as frequent username changes can confuse other users.
- Users <u>will have</u> the option to edit the following information:
  - Password

    - Recovery email
    - Location
- After signing up, users will be automatically placed into a cohort that is based on their due month (i.e. Someone whose due date is April 25 will be placed into a group where all members are due in April). This way users may relate to one another as they are all around the same weeks in their pregnancies.
- Once a user exits the app, they will be required to enter their password the next time they open the app.
- Users can not delete their profile, as administrators will need to be aware when a user stops using this application.
    - Users will be able to see a phone number that they can call if they would like their information to be deleted.

DR1.FR1.2 Administrative Accounts

We define an administrator as someone is allowed access to user information and has authority to add and remove data to the application.

- Administrators will require the following to create a profile:
    - Username
    - Password

DR1.FR1.3 Medical Professional Accounts

We define medical professionals as clinic workers or opioid recovery resource center volunteers/workers that have been given access to the information desk from an administrator.

- Accounts will be started by administrator with the following required information:
    - **First and last name:** A full name will be required from medical professionals using this application, as administrators will need to be able to identify medical professionals using the application.
    - **Date of birth:** Similar to the name, administrators should be able to have identifiable information for medical professionals using the application.
    - **Email:** Emails will be used to provide medical professionals with notifications of new posts in the information desk. The provided email

will also serve as a way for medical professionals to recover their account due to a forgotten password.

- Account profiles will be viewable by all users so they may get a better understanding as to who is answering their questions.
- Medical professionals will require the following to create a profile:
    - **Username:** This will be displayed and visible to all users on the application, so to allow some anonymity to medical professionals they will need to provide a username.
    - **Password:** To keep medical professional accounts secure and to only allow access to those that are authorized, medical professionals must create a password to use when they sign in.
    - **Avatar picture:** Medical professionals will be able to have an avatar picture that is displayed on their profile that will be able to identify them as a medical professional and not a user, which they may choose from a provided set of avatar pictures.
- Medical professionals will have the option to write a short biography about themselves and their work and assistance with recovery that will be displayed on their profile.

DR1.FR1.6 All Account Signup Specifics

- Users will have a predetermined set of avatars they can choose from, with a photo being automatically set if they do not choose one.
    - Avatars will feature a special symbol for medical professionals to distinguish them.
- Username will have a 21 max character length limit, so they are not too long to display for chat and forum.
- Passwords must be strong for extra security, so we have set requirements for creating them:
    - Passwords will be alphanumeric, with symbols (!@#$%^&*) also being accepted.
    - Passwords will have an eight character minimum.

- Unique code will be 6 alphanumeric characters, randomly generated.
- Security questions will be available from a pre-set selection of questions. Users will be able to choose one to serve as their security question.

DR1.FR1.7 Information Stored Securely

- User information will be stored in Firebase database
    - User account information will be tied to code used for signing up

DR1.FR1.8 Account Recovery

- In the event that users forget their password, they will be able to recover their accounts by entering the following information to prove that it is them trying to change their password:
    - Recovery email
    - Answer to their security question
- If recovery information is correctly inputted, users will be able to set a new password for their account

DR2.FR.2.0 Levels of Privilege

Each account type should only be allowed access to certain functionalities of the applications depending on account type. After login, the program will immediately decide based on credentials what authority and access a person logging in has. The accessibilities for each account types are defined in this section.

DR2.FR.2.1 Users

- Users will exclusively use the mobile application to perform the following actions:
    - **Interact with profiles:** users can view other user's profile pages in addition to their own.
    - **Interact with built in calendar:** users can view and add or delete events in the calendar.
    - **Participate in group chat and information desk forum:** users will have a group chat room to send a receive chat messages. They will also access a forum to ask questions to medical professionals.

- **Interact with learning modules:** users will watch informational videos and answer questions that aim to provide guidance in their personal healthcare and well-being.

DR2.FR.2.2 Administrators

- Administrators will exclusively use the web application.
- Administrative accounts will have the ability to:
  - Moderate forums to ensure no negative dynamics are developing.
    - Can delete a thread if they need to.
  - Add learning modules, surveys, and videos.
  - Maintain user and medical professional accounts.
    - Can add accounts.
    - Can delete accounts.
    - View user analytics.
  - Send out notifications
    - Notifications can be sent to users' mobile applications to inform them of some event

DR2.FR.2.3 Medical Professionals

- Medical professionals will only be able to access what is called the information desk
  - Will only see questions from users that are specifically asked in the information desk forum
  - Will only be able to answer the questions that are in the threaded forum.

DR3.FR3.0 Threaded Forum

There will be a threaded forum that serves as a place for users to ask medical professionals questions. This will serve as a place where users may go to ask questions they may either be embarrassed to ask their cohort members or want the opinion or answer from a medical professional.

DR2/DR3.FR5.1 User Capabilities

- Users will be able to post medical-related questions that will be answered by a medical professional.
    - Each new question will create a new thread/post
- To avoid users not wanting to feel embarrassed to ask a question, the user asking the question will have the option to keep their identity completely anonymous with no username displayed.
- Questions asked and their respective answers will be able to be viewed by all users, regardless of which cohort they are in.
- All users will have the ability to respond to thread.

DR2/DR3.FR5.2 Medical Professional Capabilities

- Medical professionals can answer any questions and continue discussions in the comments on the main thread.

DR3/DR7.FR4.0 Calendar

A calendar will be provided to users to serve as a place where they can maintain and keep track of their recovery.

- Users will have a built-in interactive calendar in the application that will display user-added events.
- Users can add events to the calendar, specifically:
    - Medication (consumption times)
    - Appointments (doctor's, methadone clinic, etc.)
- Events on the calendar will trigger push notifications for reminding the user of the event before the event occurs.

DR4.FR5.0 Cohort Chat Room

To provide users with a space where they may support one another, give and receive advice, and share experiences, users will have a chat room where they may talk to one another in real time.

DR2/DR4.FR5.1 User Capabilities

- Users will be able to participate in a chat room that consists of their cohort members.
- Users can send messages in the room, which will then be visible to other users in the same cohort for a certain period of time decided by an administrator.
- Users can read other users' messages that are in the same cohort sent into the chat.

DR2/DR4.FR5.2 Administrative Capabilities

- Administrators will be able to view all user discussion threads from the web application.
- Administrators can delete any threads or comments.
- Administrator can choose a set time from a list for how long chats should be viewable. For example:
    - 1 hour
    - 2 hours
    - 24 hours
    - 48 hours

DR5.FR6.0 Learning Center

As this application is a tool to help aid in recovery, there will be a center where users may go to learn about recovery and their pregnancy. Data in this center will be decided and added in by administrators.

- Users will have a page that will provide interactive learning and mindfulness material to help them learn and gain awareness about their pregnancy, mental health, recovery, and more.
- Certain material in the learning center will change based user's stage in pregnancy.
- Users will be able to do the following:
    - Watch provided videos on the application that were provided by administrator.

- Take interactive learning modules here.
- Answer multiple choice question/answer prompts.
- Earn points based on their participation.
- Interact with a provided link.

DR5.FR7.0 Widgets

We define widgets as components that will be displayed in the application that users may interact with.

DR5.FR7.1 Mood Survey

- Users will have a mood survey on the home page at all times where they may select their current mood from a selection of faces.
- Users will be able to select their mood from the following options:
  - Positive Moods:
    - Excited 🤗
    - Happy 😃
    - Love 🥰
  - Neutral Mood:
    - Indifferent 😐
  - Negative Moods:
    - Sad 😢
    - Angry 😡
    - Sick 😷
    - Overwhelmed/Frustrated 😩
- Any mood selected will be sent to the user's chat room to publicly show their current mood.
- After a neutral mood is selected, users will receive a message recommending a certain learning module.

- After a negative mood is selected, users will:
    - Receive a message reminding them of helplines and resources available to them.
    - Receive a message recommending a certain learning module

DR5.FR7.2 Baby Development Fact

- Users will be able to see how their baby is developing. They will be able to see information such as:
    - **Size of their baby:** the size of the baby will be compared to a fruit or vegetable for scale.
    - **What trimester they are in:** first, second, or third trimester.
    - **What the mother may be experiencing:** this will be physical symptoms of pregnancy that align with the current stage of pregnancy.
    - **What is happening to the fetus that week:** physical developments or milestones that the fetus is reaching.

DR5.FR7.3 Resources and Helplines

- Users will have a list of phone numbers and links for resources they might need for their opioid addiction recovery accessible to them.

DR6.FR8.0 Rewards Tracker

In order to keep users interacting with application, a rewards system will be put in place to allow users to earn points that may be used for rewards.

- Users will maintain points that they can gain through participation in the app.
- Points will reset after each month
- Users can gain points by participating in the following:
    - Logging in once a day
    - Taking surveys
    - Watching videos
    - Taking learning modules
- Users can see how many points they have

DR7.FR9.0 Notifications

As another way to keep users interacting with the application and keeping them on track with their recovery, notifications will be sent to users for different types of events.

DR5.FR9.1 Notification Events

- Users will be sent push notifications for the following events and reminders:
    - **Calendar Events:** A notification will be sent to the user on the day of their entered event.
    - **Reminder to check into application each day:** To help keep users on track with their recovery, a notification will be sent each day to remind them to use the application.
    - **New messages in cohort chat room:** As chat rooms will be real time, when a user sends a message into the chat it will send a notification to their cohort members that the message has been sent to other members know someone is on to chat.
    - **New questions at information desk:** As this application will provide users with learning tools, notifications will be sent to users when a question has been asked at the information desk. This way, users may interact with the discussion.
    - **Mood updates:** Mood updates will be posted to the chat room, as the chat room serves as a place for users to go to support one another. When a user enters their mood update on the mood survey, a message will be sent to the chat room which will then trigger a notification.
- Medical professionals will be notified when new questions are posted into the threaded forum.

DR7.FR9.2 Notification Configuration

- Users will be able to configure how far in advance they wish to be notified of:
    - Calendar Events: As users may want to be notified earlier than what time they have entered for the calendar event, users should have the ability to decide how far in advance they want to be notified.
- Users will be able to configure if they wish to receive all notifications or just specific ones.

DR8.FR10. Research Analytics Tool

As this application will serve as a functioning prototype for a grant, Dr. Eaves will need to be able to prove the feasibility of this application as a tool for recovery for feature implementations and releases. To be able to do this, we will need to be able to see how users are interacting with the application.

- Information the administrator will be able to view will all be logged into a database table. The administrators will want to view this data from the users of to prove the app's feasibility. This data may include:
    - **What section users are frequenting the most:** It is important to know where users are going to the most, as this can imply that functionality of the application is helping them.
    - **What moods they normally choose:** To see if moods are improving as users are interacting with the application, we will need to log user mood survey updates.
    - **Survey results:** Surveys are another way to see how users are improving with their recovery, so this data is important to be able to view.
    - **Scores on learning modules:** To see if users are learning from the modules they are taking, logging scores will help to better understand if the modules are helpful.
    - **How often they log in:** Understanding how often users are getting on to the application will help in proving the feasibility, as this will show if users are frequently interacting with this application.
- Information and statistics should be presented in a graph to give administrators a visualization of the data.

Now that functional requirements have been discussed, we are going to discuss performance requirements.

4.4 Performance Requirements

Our performance requirements outline what is to be expected from our functional requirements in terms of metrics. Similar to the functional requirements, we are going to relate our performance requirements back to the domain-level requirement, which the corresponding functional requirements fall under. These were determined by our best judgment, also considering that users may have never used an application like iMATter before.

DR1.PR1.0 Account Creation and Login

DR1/DR2.PR1.1 Users

- The signup pages and login page will all be clearly labeled, with specifications as to what is required for signup/login, and what is optional for signup. Considering this, the work through should be minimal. Taking into consideration that not everyone will understand these components immediately, the time to learn about and create accounts are the following:
    - For 90% of first-time users, user account creation should take in total ≤ 120 seconds.
        - Entering unique code after first opening of app should take ≤ 30 seconds.
        - Rest of account creation should take ≤ 90 seconds.
    - User account login should take in total ≤ 30 seconds the first time, ≤ 10 for experienced users.
    - Account recovery should take in total ≤ 180 seconds if all information is correctly inputted.

DR1/DR2.PR1.2 Administrators

- For 90% of first-time administrators, new administrator accounts signup should take in total ≤ 60 seconds.
- Administrator account login should take in total ≤ 30 seconds the first time, ≤ 10 after the first time.

DR1/DR2.PR1.3 Medical Professionals

- For 90% of first-time, new medical professional accounts signup should take in total ≤ 60 seconds.
- Medical professional account login should take in total ≤ 30 seconds the first time, ≤ 10 after the first time.

DR3.PR2.0 Information Desk

- Information on how the information desk works and how users can interact by asking questions and commenting will be provided to users, so we expect the following times for users to understand the forum:
    - Posting a question for the first time should take 80% of new users ≤ 2 minutes to understand, and ≤ 30 seconds after the first time or for experienced users.
    - Posting a comment should take 80% of new users ≤ 1 minute to understand, and ≤ 30 seconds after the first time or for experienced users.
- Questions, answers, and comments should take ≤ 1 minute to update.
- Notifications should send in ≤ 30 seconds to medical professionals.
- New questions posted by users should show up in the information desk within ≤ 5 seconds.

DR5.PR3.0 Calendar

- Understanding of how to interact with calendar should take ≤ 2 minutes for 90% of users, ≤ 30 seconds for experienced users .
- Adding events to calendar should take ≤ 10 seconds.

DR4.PR4.0 Cohort Chat Room

- As this component is more complex than others, we expect full understanding of this to take ≤ 5 minutes. For users who have experience with chat rooms, ≤ 1 minute.
    - Understanding how to send a message should take ≤ 1 minute the first time, ≤ 20 seconds after the first time
- New messages sent by other users should show up in discussion threads within ≤ 5 seconds.

DR5.PR5.0 Interactive Component Updates

- Due to the fact that this app is to be personalized on the homepage, computation speed to display may take up to 15 seconds.
- General navigation will be easy to understand, having suggested interaction options on the homepage that will navigate to the appropriate page. Otherwise, common icons

with occasional labeling will be used. We expect 90% of users to be able to fully understand all the app features in ≤ 1 hour.

DR5.PR5.1 Mood Survey

- Mood survey will use common face icons that express different emotions. If after first implementing this we find that it may be confusing, we will consider a way to see what each icon means. Otherwise, we expect this to be understood in ≤ 30 seconds for 90% of users.
- Input of mood survey should take ≤ 10 seconds.
    - Notification of mood to be sent should take ≤ 1 minute to send to the user's cohort.

DR5.PR5.2 Baby Development Fact

- This will be one of the first items a user sees once logged in. We expect 95% of users to understand how this works in ≤ 10 seconds.

DR5.PR6.3 General Surveys

- As any general surveys deployed will be added to the homepage, we expect 90% of users to understand how this works in ≤ 1 minute as they will take on common survey format. After first completing a survey, we expect users to be able to understand how to interact with surveys ≤ 20 seconds.

DR5.PR5.4 Learning Center

- After tapping on a learning module in the learning center, we expect that module to begin loading immediately.
- Given that learning modules have varying amounts of material to load, we expect that all material within any given learning module should load in ≤ 1 minute.

DR6.PR6.0 Reward System Updates

- Points should update in database in ≤ 5 seconds after user accomplishes a task that would add to points or points are reset.
- Points should update immediately on user page after a task is completed or points are reset.

DR7.PR7.0 Notification Sending Time

- Any notification sent should take ≤ 30 seconds to send to user after being triggered.

DR8.PR8.0 Analytics Loading

- Loading of an analytic graph should take ≤ 45 seconds.

4.5 Environmental Requirements

As we are not integrating into already existing software, our client has left majority of the technological choices up to us. The environmental requirement we have gathered from our client includes the following:

ER1.0 Multiple Platform Support

To reach as many users as possible, the ideal solution of this application supports iOS and Android.

Now that we have discussed the requirements and constraints for our project, we will talk about the risks we may face.

5.0 Potential Risks

With any software product, there are bound to be some risks that may appear. Being aware of these potential risks is key in preparing for how to deal with them. In the following table, we list potential risks that our product may have, the severity if they occur, the likelihood of them occurring, and how we are going to mitigate them.

RISK	SEVERITY	LIKELIHOOD	MITIGATION
User loses unique generated code before registering.	**Medium:** User would need to contact the correct administrator, who would need to retrieve it with the least amount of personal information as possible	**Moderate:** The code could be easily misplaced by anyone, but we expect most users to sign-up right after receiving code.	A piece of personal identifying information from the user is taken so that admin has an easier time recovering the code.

User loses email or password that they have their account linked with.	**Low:** This is slightly different than losing the unique code as they could reset the password with their email.	**Moderate:** Password are often easily forgotten.	Username/email would have to be provided to recover/update password.
Unclear or misunderstood survey questions	**Medium:** A lot of the research will depend on the answers that the users give on questionnaires.	**Moderate**: There could be unclear questions if the wording if difficult to understand to the average user.	Double checking for errors or misleading wording could be done before release of surveys. A select few users could review the questions before they are released to everyone.
Points awarded to the user are inaccurate, due to our faulty calculation system	**Medium:** If the points calculation system is not up to par, many users could feel frustrated they do not get the points that they earned. Even worse if users obtain more points than they earned as this could deplete the rewards faster than they are supposed to.	**Low**	Testing will be done to ensure that the points system works as intended so that users get the points that they earn.
Tasks do not register as completed or do not show up at all for users	**High:** If tasks do not register or don't show up, this could really take away from the learning potential of the user. This is because some of the tasks will be to watch videos or other ways that will help users learn more about their situation.	**Low**	We need to make sure that the tasks link to the correct activity, and that when the activity is completed the rewards are given.
Analytic tool not integrated properly	**High:** This is the tool that will	**Low:** Comprehensive	Additional testing with graphing could

	help us analyze user activity on our app. If the tool is flawed any data collected would be useless, wasting time and money.	testing and research has gone into implementing the correct analytic tool.	be made so that the data collected is as accurate as possible.
Negative Social Dynamics meaning one or more users harass another	**High:** The affected user could feel mistreated or isolated, this could discourage them from using the app.	**Low:** Many of these women just want to get better, and we aim to create a "sisterhood" environment where everyone feels welcome and free to share.	Administrators will have the ability to monitor the forums and delete posts. Additional precautions could be taken by implementing a flagging system.
Notifications from calendars, or anywhere, not showing up	**Medium-High:** Users could miss important appointments or meetings if they trust the application to notify them, but our app fails to do so.	**Low:** Notifications have been tested with the Ionic framework, and we do not see us having issues with this.	Notifications that are essential for the users will need to be comprehensively tested to ensure that trust in the app is kept.

As is seen in the table above, we have a variety of potential technical risks. These risks range from low severity, meaning that it might just be an inconvenience, to high severity, which means that it might completely render a portion of our application completely useless.

With that in mind, one of our high severity risks is having tasks show up and register as completed when it is appropriate. Tasks in this case are learning center modules or informational videos with survey questions that users can access and complete. Having these tasks appear in the application is necessary for users to learn important information about their health or situation and earn points for rewards in the process.

Another high severity risk is ensuring our analytic tool is integrated properly so that researchers can effectively learn more about user activities in the application and find out what helps them the most.

Lastly, we need to avoid the high severity risk scenario of negative social dynamics forming between users in the application, which could be a possibility in the group chat or information

desk forum where users are interacting with each other. Avoiding this scenario is important for creating a space where users can feel safe and accepted, which is one of the most important components of our application. These higher severity risks need to be our main areas of concern and should take priority before dealing with the less severe risks.

Now that we have discussed our requirements and risks, we will outline our schedule for implementation of the application.

6.0 Project Plan

We have segmented our project into different milestones to indicate the progress and the section of the project that we are currently working on. The components of the application are sectioned off by the needs of our planning progress. We have separated our plan into seven major milestones that will be described below, and three phases to come up with our milestones. For our three phases, we considered our front end for the mobile application, back end for the mobile application and web application components. We then used these phases and broke them down to multiple tasks which lead us to our milestones that will keep us on track. For our milestones, we also took into consideration some of the documents that have been created to lead us to our tasks. We have created a schedule to show the tasks that have been planned according to our sections of the mobile application.

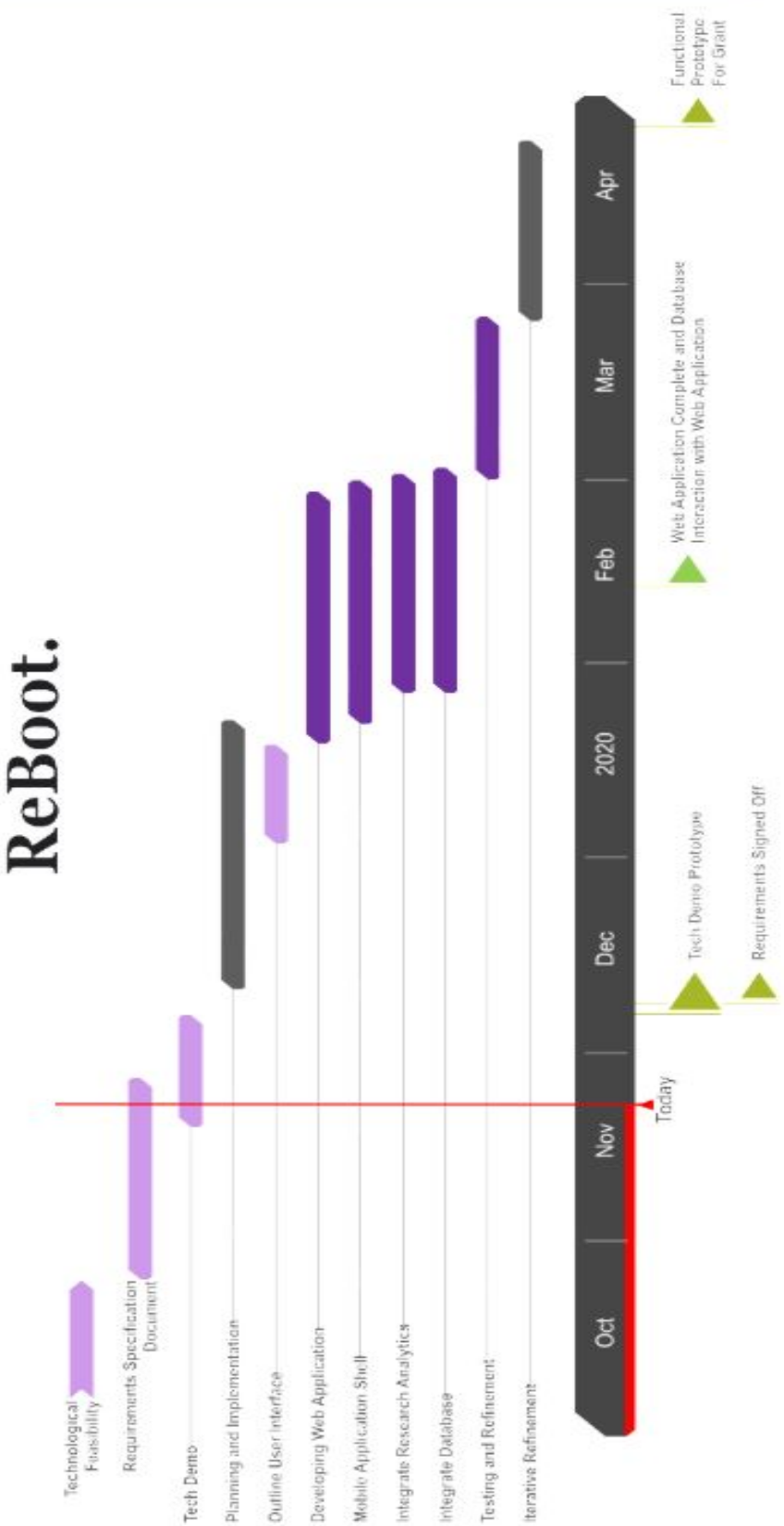

Figure 6.0: Projected team schedule for Fall 2019 and Spring 2020

Milestones:

As shown in Figure 6.0, the following is an estimated schedule which is planned around several major development phases.

Tech Demo Completed

December 2019

We have given this milestone three weeks for completion to allow us time to figure out what main features we want to implement into Ionic in order to demonstrate that our chosen technologies work. We will have several working programs implemented that each perform a different function and prove that the main features we need for our application are possible with our chosen technologies. Some of these features include playing videos, communication between mobile applications, communication between web application and mobile application, notifications being sent, chosen research analytic tool, updating data, and forum functionalities.

Planning and Implementation

December 2019 - January 2020

Beginning in December, we will be creating a general user workflow to help us understand how the application will flow between pages. We have allotted a little over a month for this task, as it is the foundation of understanding upon which we can build our user interface and back-end. Due to the significance of this task, it has also been designated as a milestone. For this milestone, we will complete the following subtasks as a team:

- Plan the user workflow of the application
- Discuss major design decisions

Outline the User Interface

January 2020

We have given ourselves roughly three weeks for this milestone to be completed. By mid-January, we aim to have an outline of our user interface, which will serve as a guideline to begin front and back-end development. This is task is a milestone because it is fundamental for providing a user experience that satisfies the use cases and requirements we have come up with. This task includes having a detailed plan on user workflow and mapping out where each feature of our application should be placed.

Basic Web Application Implementation

January 2020 - February 2020

We plan on taking a little over a month to develop a basic web application, which will have the main features needed to satisfy the requirements. This will later be fleshed out to be more suitable as a final product. This web application will have the administrative capabilities implemented and be able to communicate with the mobile application. The functionalities we plan on having implemented are as follows:

- A signup/sign in page
- A way to view research analytics
- A way to view users, chat, and forum data

Basic Mobile Application Implementation

January 2020 - March 2020

Concurrently with the basic web application, we will be developing a basic mobile application. This will implement the major functionalities expected from our mobile application requirements and will serve as a solid start to the final product. The expected functionalities for this basic mobile application include:

- User Interface
- Any local storage communications (i.e. users storing events on calendar)
- Research analytic tool is implemented and functioning properly

All App-Server Communications Implemented

March 2020

A crucial aspect of our software solution is having the web application communicating seamlessly with the mobile application, and having both connected to the database. We aim to have these three components fully integrated with each other and working correctly by March 2020. By this time, we expect all database functionality to be implemented and storing data properly, as well as allowing for real-time updates to happen between applications for different users.

Testing and Refinement

End of March 2020

With the expectation of running into obstacles and needing to make adjustments to our application, we have planned more than a month for testing and refinement of our software solution. This milestone includes testing and refinement along with our iterative task refinement. We will be running through our use cases once more to make sure we have covered all our scenarios and requirements. As we expect our mobile and web applications to be fully implemented by this time, we will be testing the products and refining them iteratively based on comments received from Dr. Eaves and Dr. Doerry. This will also include ensuring all requirements have been fulfilled with our clients.

7.0 Conclusion

Millions of Americans struggle with opioid addictions, and over 130 people die from opioid overdoses every single day. This national crisis is costing the US billions of dollars each year for healthcare, lost productivity, and addiction treatments, and is only getting worse. Not only are overall rates of opioid addiction increasing, but the rates of pregnant women who suffer from opioid use disorder are growing as well. Pregnant women with opioid addictions who want to start on the path to recovery are placed in comprehensive treatment programs. Due to the intensity of the requirements of the treatment plan, the relapse rates for opioid use disorder are relatively high. In order to help pregnant women be successful in their recovery, we have devised a solution that involves creating a mobile application that will simplify a few things in the recovery process.

This application will help pregnant women in opioid recovery receive social support, a way to learn about recovery and pregnancy, and resources to help aid their recovery. The lack of social support and stigma these women face creates an impediment for successful recovery, and this application can help them feel heard and safe, as well as provide a way for them to talk about exactly what they are going through without being judged. Overall, the mobile application will include the following main features:

- **A chat room**, which will be able to help women in recovery interact with other women that are experiencing similar situations. This feature will help them be able to receive and give support and advice. As women are grouped into cohorts based on the same month they are due, they will be able to better understand what one another may be going through at that time in their pregnancies.
- **A learning center**, which will help pregnant women in recovery learn more on their pregnancy and recovery. They will have a way to find verifiable information in a single place.

- **An information desk**, which will provide a safe and reliable source of information from medical professionals who are trained to help inform people in opioid recovery. Our users will be able to ask any questions in this part of the mobile application, as well as see other questions that have already been asked and what answers were provided. This will allow for women to ask questions they may feel scared or embarrassed to ask anyone otherwise, as they will have the option to remain completely anonymous, without even their username attached.

We have constructed in detail an outline of requirements necessary to have the iMATter application help simplify aspects of being pregnant and in recovery. Our next steps are to attempt to mockup a simple application with functionalities that satisfy our major domain-level requirements to verify that all of our technologies are the right fit for our target solution. We think our mobile application will provide strong support for the recovery process for many pregnant women in recovery, especially women who are struggling in under-served rural areas. Our team is very optimistic and excited with the outcome of this project after all of the research we've performed on various technologies. The iMATter App will provide pregnant women in recovery with a safe environment, social support, and educational material to help guide them to a successful recovery.