

# *CSHARE EHR*

# *ITERATION 3*

*John Harrison, Katie Wokoek, Matthew Morris, Sam Shenoi,  
Alejandro Navarro, Jordan Hurt*

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## Design Patterns

Below are the design patterns included in the project and the class locations that they are present in.

### State

The state design pattern allows for the program to behave differently based on the current “state” of the system. We implement this design pattern when determining what type of screen to show the user after their credentials are checked. If the user is a doctor, we show them the provider screen. If the user is a patient, we show them the patient screen. If the user is a staff member, we show them to staff screen.

Classes Involved: Doctor, Patient, Staff, User, EHRRunner.

### Singleton

The singleton design pattern only creates one instance of an object throughout the entire application. We use this design pattern for the creation of a SQLConnectionPool which manages our database connections. Since we do not want multiple connections to be open at once, the pool allots the connection objects in a FIFO manner. We do not want there to be multiple SQLConnectionPools as this would ruin the whole point of having it in the first place. Therefore, we implement a singleton that allows for only one SQLConnectionPool to be created.

Classes Involved: SQLConnectionPool, SqlConnection

### Composite

The composite design pattern allows for the building of a hierarchy. We implemented this design pattern most pronouncedly in the Staff part of our screen. In this subsection, we defined multiple subclasses that were then implemented in our screens such as Calendar, OfficeScheduleData, and ProvidersSchedule . This allowed for a class hierarchy as well as reusable interface.

Classes Involved: Classes in Frontent.Staff package

### Facade

The facade design pattern allows for hiding of a subsystem of code from another section. This allows for one single interface to be used. We implement this design pattern as part of the ProviderService class. This class is the only data access point for the entirety of the frontend. It allows for the access to DAO objects through one single interface.

Classes Involved: Backend.DAO, ProviderService

## Modules

Modules allow for the separation of code into distinct packages. We implement modules by separating our code into three main layers (frontend, backend, business layer) and then further subsections. This allows for related code to be contained within subsections.

Packages Involved: Backend, Frontend, Businesslayer

## Abstract Factory

We created an abstract factory design in the backend of our project. We used an interface that defined 'generateObject', which was designed to return a new instance of a class. The interface was implemented by all of our backend classes. We implemented this in our DAO classes, but unfortunately, it did not work as expected.

Classes Involved: Classes in Backend.DAO package

## Adapter

The adapter design pattern allows for the program to interact with different classes which may have different attributes and methods. We implemented this design pattern in order to interact with Health Care Providers whenever the distinction between doctor and staff is unnecessary. The constructor for the adapter determines whether what it is adapting is a doctor or a staff member, and makes the necessary adjustments in order to house the correct attributes.

Classes Involved: PersonAdapter, Staff, Doctor

## SpotBug Analysis

We ran our SpotBug within our Eclipse IDE. Below is an example of some of the feedback that we got from running spot bug.

```
13  -----
14  public class Calendar {
15      static JLabel lblMonth;
16      static JButton btnPrev, btnNext;
17      static JTable tblCalendar;
18      static JComboBox<String> cmbYear;
19      static Container pane;
20      static DefaultTableModel mtblCalendar; // Table model
21      static JScrollPane stblCalendar; // The scrollpane
22      static JPanel pnlCalendar;
23      static int realYear, realMonth, realDay, currentYear, currentMonth;
24
25      public JPanel makeCalander() {
26          // Create controls
27          lblMonth = new JLabel("January");
28          cmbYear = new JComboBox<String>();
29          btnPrev = new JButton("Prev");
30          btnNext = new JButton("Next");
31      Write to static field frontend.provider.Calendar.mtblCalendar from instance method frontend.provider.Calendar.makeCalander() [Of Concern(15), High confidence]
32          private static final long serialVersionUID = -673206566701975821L;
33
34      public boolean isCellEditable(int rowIndex, int mColIndex) {
35          return false;
36      };
37      tblCalendar = new JTable(mtblCalendar);
38      stblCalendar = new JScrollPane(tblCalendar);
39      pnlCalendar = new JPanel();
40
41      // Set border
42      pnlCalendar.setBorder(BorderFactory.createTitledBorder("Calendar"));
43  
```

Running the SpotBugs plugin on our CShare Electronic Health Record project yielded 22 found bugs.

Of the 22 bugs:

- 17 were caused by writing to a static field of a class (as shown in the image)
- 4 were caused by dead stores (a variable that is initialized but never read from or used)
- 1 was caused by catching an exception that was never thrown in the above try block

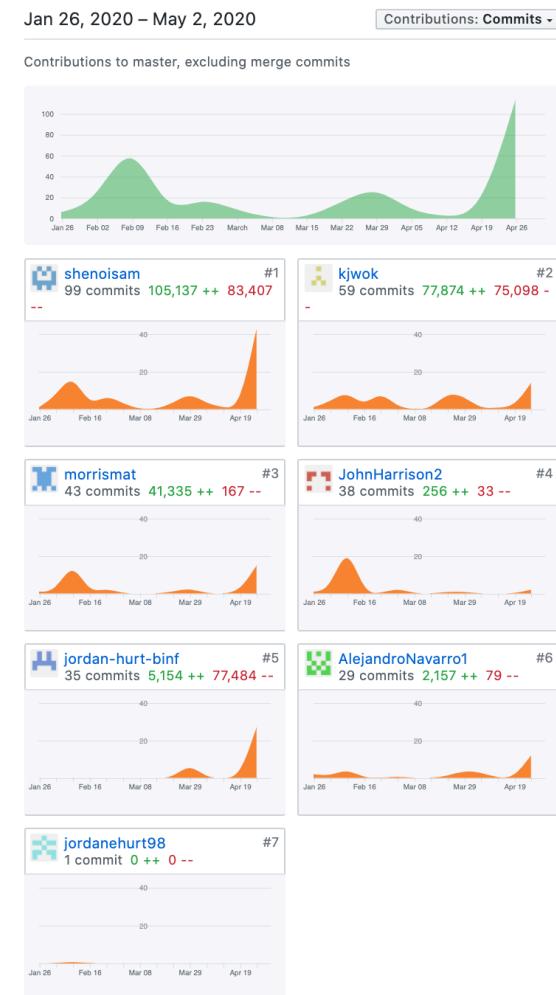
In order to fix the issue of writing to a static field, we removed unnecessary “static” keywords from many of our attributes contained within our class implementations. For the dead store bugs, we simply removed the line that initialized the variable because the variable is never used anywhere else anyway. For the issue where an exception that was never thrown got caught, we removed the try/catch block surrounding the segment of code.

## Git Analysis

We used GitHub as our version control system, which allowed for us to keep track of each user's commits, lines added, and overall contribution to the project. Links to these parts of the project can be found in the "Links" section of this document.

Overall, the project had 520 commits and 35 issues throughout the project. These commits and issues were spread out between members of the project.

Below is a screen grab from the insights section of our GitHub page:



### Group Member Usernames:

John Harrison – JohnHarrison2  
Katie Wokoek – kjwok  
Matthew Morris – morrismat  
Sam Shenoi – shenoisam  
Alejandro Navarro – AlejandroNavarro1  
Jordan Hurt – Jordan-hurt-binf & jordanhurt98

## Test Coverage Plan

Below is the test coverage plan that we used to develop the tests for our application. The tests are separated out into the users that the action falls under.

### Doctor Tests

1. Test that a doctor get data for a specific patient
  - a. Test that a doctor can get prescriptions
  - b. Test that doctor can order tests
  - c. Test that a doctor can get referral information
  - d. Test that a doctor can update a patients health sheet
  - e. Test that a doctor can diagnosis a patient
2. Test that a doctor can interact with appointments
  - a. Test that a doctor can view their appointments
  - b. Test that a doctor can create notes associated with an appointment
3. Prescriptions
  - a. Test that prescriptions can be sent out
  - b. Test that a prescription can be created
  - c. Test that a prescription can be stored
4. Test
  - a. Test that a test can be created and linked to a patient
5. Test Result
  - a. Test that a test can be linked to a patient
  - b. Test that a test result cannot be updated after its creation
6. Diagnosis
  - a. Test that a diagnosis can be created for a patient

### Staff Tests

1. Appointments
  - a. Test that a staff member can create an appointment
    - i. Test that appointments can be created between doctor and patient
  - b. Test that appointments can not be created if there is already another appointment at the same time
2. Billing
  - a. Test that a staff member can bill a patient
  - b. Test that a staff member can correctly code insurance information
3. Population Health
  - a. Test that population health parameters can be generated correctly
  - b. Test that population health can be shared in a csv file

## Patient Tests

1. Test that a patient can view an appointment
2. Test that patient can access test results
3. Test that a patient can edit their intake information
4. Test that a patient cannot access other patients' information

## General Tests

1. Test that viewing of screens is access specific

## Test Users

The following users are available for evaluation of the system.

### Provider User

Username: testuser@test.com

Password: Test

### Staff User

Username: testuser1@test.com

Password: Test

### Patient User

Username: testuser2@test.com

Password: Test

## Links

Below are links to various parts of our project.

Project Website

<https://shenoisam.github.io/Software1/>

Timecards

<https://shenoisam.github.io/Software1/aboutUs.html>

GitHub

<https://github.com/shenoisam/Software1>

Issue Tracking

<https://github.com/shenoisam/Software1/issues>

Presentation Video

<https://www.youtube.com/watch?v=z2G-nIQDR1A&t=8s>

## User Guide

The rest of the document is the user guide for the CShare application. This can also be downloaded separately on our website.

# USER GUIDE FOR CSHARE ELECTRONIC HEALTH RECORD SYSTEM

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## 1. Introduction

Welcome to CShare Electronic Health Records system. This application is designed to help you and your health care office streamline record keeping processes and ease the paper burden. This application accounts for all documentation, test or prescription ordering, and appointment scheduling for the healthcare office. The following user guide will introduce you to the CShare system, including step by step guides for user actions, to help you start using CShare in your office.

## 2. Users

### Credentials

Each user will have their own set of credentials. The user will use their email address as their username within the system. Each username must be unique, ensuring full confidentiality for patient health records.

### Adding Users

Due to security issues, there is not a way to add users to the system within the application. In order to add users, contact the site's system administrator to add the user to the system. Please provide the administrator with the new user's first and last name, their email address, and if they are a staff member, a patient, or a provider. Due to the limitations on the system, the user can only have one role within the system. The administrator will contact the user to set up a password for the account and notify the new user when they are able to use the application.

### User Roles

CShare provides three different types of users; staff, patients, providers. Each has their own view of the system and different actions that they can perform. Users can have only one role within the system and cannot switch in between roles.

#### Staff

The staff user is designed for a staff member in the healthcare office that is not a healthcare provider and takes care of the administrative tasks within the office. In CShare, staff members are allowed to see the office schedule for the day, schedule appointments for patients and providers, see information on all patients, and manage the billing of insurance companies.

#### Patients

The patient user is designed for those that have come to the healthcare office seeking the medical services. In CShare, they have the most limited view of the system. Patients are only allowed to edit their intake information forms and view their test results when they log in.

## Providers

The provider user is designed for those that provide the healthcare services to patients; i.e. doctors, dentist, nurse practitioners. Within CShare, providers are allowed to document their visit with the patient, prescribe medications, refer patients to other providers, and order lab tests for the patient. Additionally, providers can view general information on the patient, tests that have been ordered, and see their personal schedule for the day.

### 3. User Actions

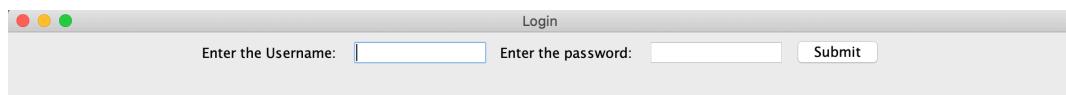
As mentioned previously, each of the user roles has their own actions that they can perform. The following sections provide step by step guides to these processes.

#### All User Actions

The following three options are available for all three users.

##### *Login*

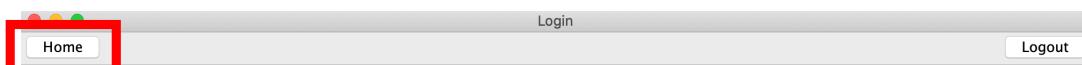
1. Start the application.
2. Enter your username into the username box.
  - This is usually an email address.
3. Enter your password into the password box.
4. Click the submit button.
5. Your application will redirect you to your home screen.



##### *Return to Home*

This action allows you to return to user's home screen from any user screen.

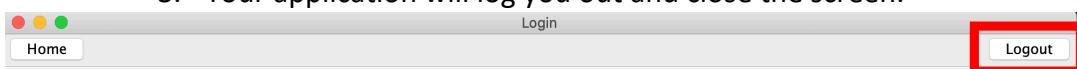
1. Locate the home button in the top right-hand corner of the screen.
2. Click the home button.
3. Your application will be redirected to the user home screen.



##### *Logout*

This action allows you to logout of the application from any user screen.

1. Locate the logout button in the top right-hand corner of the screen.
2. Click the logout button.
3. Your application will log you out and close the screen.



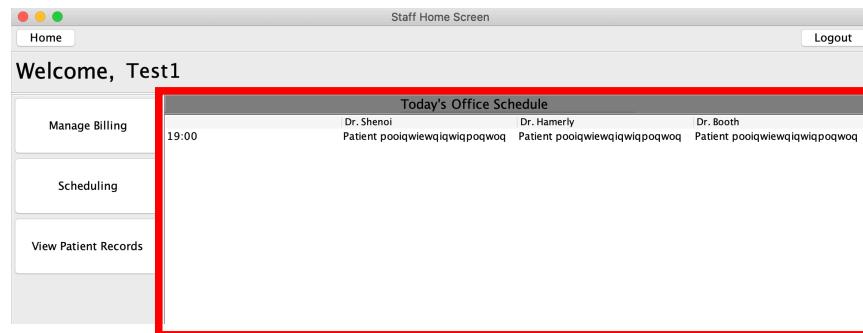
## Staff Actions

The following options can only be performed by the staff users.

### *View All-Office Schedule*

This action allows for the staff member to see the office schedule for the day.

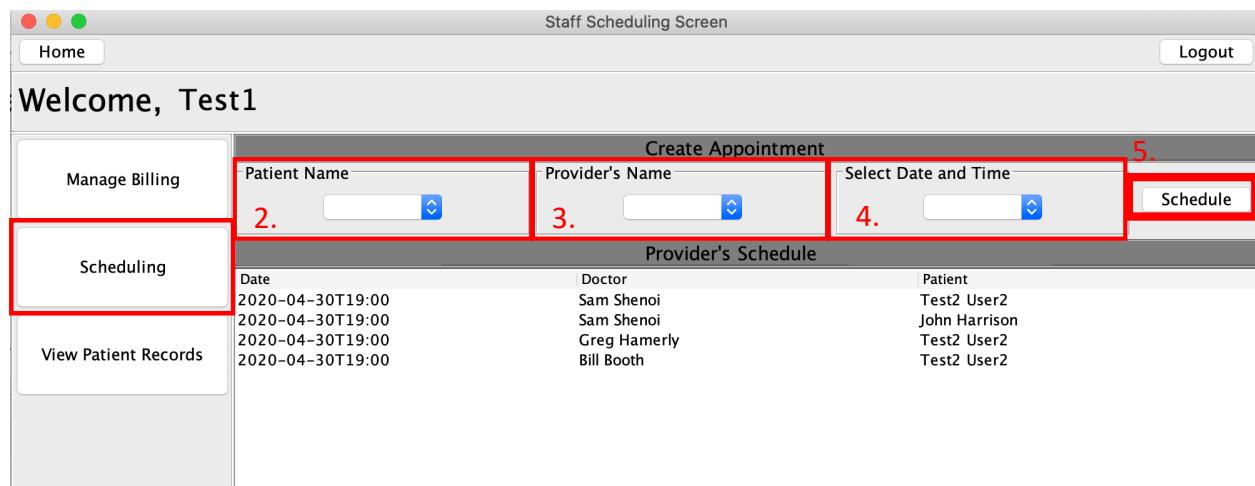
1. Navigate to the home screen by either logging into the system or by clicking the home button in the upper right-hand corner.
2. View the office schedule in the main panel.



### *Schedule an Appointment*

This action allows for the staff member to schedule an appointment between a healthcare provider and a patient.

1. Navigate to the schedule screen by selecting the button labeled "Scheduling" on the left-hand side of the screen.
2. Select the patient from the Patient Name drop-down menu.
3. Select the provider from the Provider's Name drop-down menu.
4. Select the date and time for the appointment from the drop-down menu.
5. Click the Schedule button.
6. The appointment will appear in the schedule section.



### *Manage Billing*

This action allows the staff to see when patient bills have been sent.

1. Navigate to the Billing page by selecting the button labeled “Managed Billing” on the left-hand side of the screen.
2. Patient’s name and the date of the bill that was sent will be presented in the main panel.

The screenshot shows a window titled "Staff Billing Screen". At the top right is a "Logout" button. On the left, there's a sidebar with buttons for "Home", "Manage Billing" (which is highlighted with a red box and labeled 1.), "Scheduling", and "View Patient Records". The main panel displays a table with four columns: First, Last, and Date, each containing five entries. A red box highlights the entire table area, and a red number 2 is placed next to the "Billing Information" label at the bottom of the table.

First	Last	Date
Test2	User2	2020-04-30T19:00:00
John	Harrison	2020-04-30T19:00:00
Test2	User2	2020-04-30T19:00:00
Test2	User2	2020-04-30T19:00:00

### *View All Records*

This action allows staff to filter patients based on three different criteria’s; diagnosis, provider’s name, and prescriptions. The page will filter the patients based on the given parameters.

1. Navigate to and select the View Patient Records button.
2. Determine what diagnosis you would like to filter based on, if any.
3. Determine what provider you would like to filter based on, if any.
4. Determine what prescriptions you would like to filter based on, if any.
5. After determining the proper filters, click the submit button

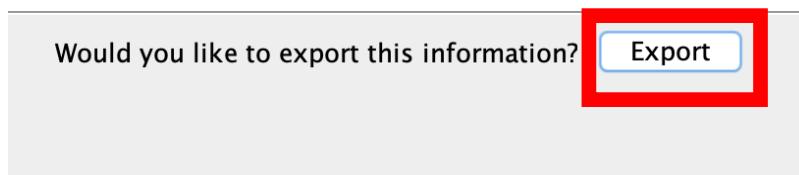
The screenshot shows a window titled "Staff Patient Records Parameters". At the top right is a "Logout" button. On the left, there's a sidebar with buttons for "Home", "Manage Billing", "Scheduling", and "View Patient Records" (which is highlighted with a red box and labeled 1.). The main panel has a header "Select Parameters for Patient Records" with numbers 2., 3., 4., and 5. positioned above three dropdown menus labeled "Diagnosis", "Doctor", and "Prescriptions". A red box highlights these three dropdown menus.

6. The application will generate a screen that shows all of the patients for the given criteria.
  - If there are no patients shown, then there were no patients that fit the given criteria.

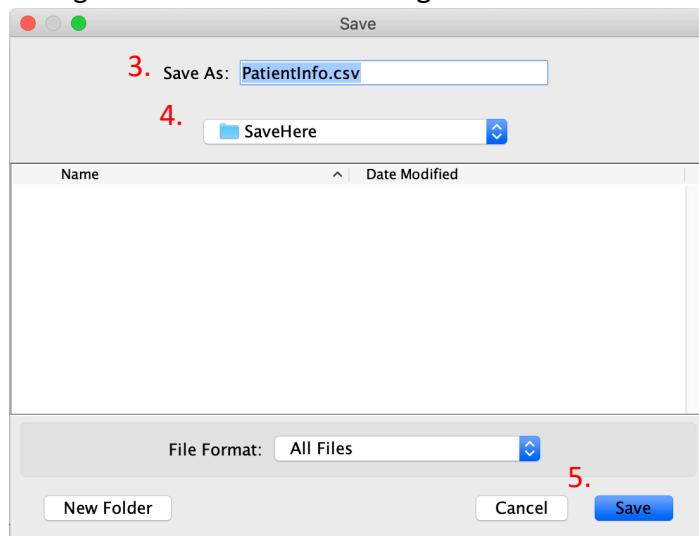
### *Export Patient Information*

This action must be performed after filtering the patients based on diagnosis, provider, or medication.

1. Navigate to the bottom of the results page.
2. Select the export button.



3. In the pop-up field, enter the name of the file that you would like to create.
  - It is recommended that the file extension would be .csv to reflect how the information will be stored.
4. Select the location to store the file.
5. Select Save in the bottom of the screen
6. The application will generate a CSV file with the filtered information to the given file name and in the given location.



### *Patient Actions*

The following actions can only be performed by the patient users.

#### *View Current Diagnosis*

This action will allow the patient to view their current diagnoses.

1. Navigate to the home screen by either logging into the system or by clicking the home button in the upper right-hand corner.
2. View current diagnoses within the top panel of the home screen.

Patient Home

Welcome, Test2 User2

Your Next Appointment is at: 2020-04-30T19:00

[Home](#) [Logout](#)

[Patient Intake Form](#) **Breast Cancer: This is a cancer affecting breast tissue**

[View Test Result](#)

Current Medication:		Current Providers:
Prescription	Dosage	Sam Shenoi
Apple	Dosage is 1.00 a day.	Bill Booth
Benzethonium	Dosage is 3.00 a day.	Greg Hamerly
Levothyroxine	Dosage is 2.90 a day.	
Vitamin D	Dosage is 1.00 a day.	

### *View Current Medications*

This action will allow the patient to view their currently prescribed medications.

3. Navigate to the home screen by either logging into the system or by clicking the home button in the upper right-hand corner.
4. View your current medications in the lower left-hand corner of the main panel.

Patient Home

Welcome, Test2 User2

Your Next Appointment is at: 2020-04-30T19:00

[Home](#) [Logout](#)

[Patient Intake Form](#) **Breast Cancer: This is a cancer affecting breast tissue**

[View Test Result](#)

Current Medication:		Current Providers:
Prescription	Dosage	Sam Shenoi
Apple	Dosage is 1.00 a day.	Bill Booth
Benzethonium	Dosage is 3.00 a day.	Greg Hamerly
Levothyroxine	Dosage is 2.90 a day.	
Vitamin D	Dosage is 1.00 a day.	

### *View Current Providers*

This action will allow the patient to view their currently healthcare providers medications.

1. Navigate to the home screen by either logging into the system or by clicking the home button in the upper right-hand corner.
2. View your current medications in the lower right-hand corner of the main panel.

Patient Home

Welcome, Test2 User2

Your Next Appointment is at: 2020-04-30T19:00

**Patient Intake Form** Breast Cancer: This is a cancer affecting breast tissue

**View Test Result**

Current Medication:		Current Providers:	
Prescription	Dosage	Sam Shenoi	
Apple	Dosage is 1.00 a day.	Bill Booth	
Benzylthentanol	Dosage is 3.00 a day.	Greg Hamerly	
Levothyroxine	Dosage is 2.90 a day.		
Vitamin D	Dosage is 1.00 a day.		

### Fill Out Patient Intake Form

This action will allow the patient to fill out their basic intake information within the application.

1. Select the Patient Intake Form button on the left-hand side of the screen.
2. Fill out the text areas that are prompted for.
  - a. If the Date of Birth field is not filled out and the submit button is selected, the text field will display as red.
3. Select the submit button when the form has been completely filled out.

Patient Intake

Welcome, Test2 User2 2.

Your Next Appointment is at: 2020-04-30T19:00

**Patient Intake Form**

1. **View Test Result**

First Name:	Test2	Middle Initial:		Last Name:	User2
DOB:	mm/dd/yyyy	Married:			
Gender:					
Demographic Information:					
Ethnicity:	Race:				
Medical History:					
Allergies:					

3. **Submit**

### View Test Results

This action will allow the patient to view the results of the test that have been previously ordered.

1. Select the View Test Results button on the left-hand side of the screen.

- The application will present all of the tests that have been requested and have results back.

Patient View Test

Home      Logout

Your Next Appointment is at: 2020-04-30T19:00

Patient Intake Form	Test Name	Date of Test	Result
View Test Result	Colon Cancer	2020-04-30	positive
	Hashimoto	2020-04-30	positive
	HIV	2020-04-30	negative
	Parent	2020-04-30	negative
	Steroids	2020-04-30	positive
	Typhus	2020-04-30	negative

1.

## Provider Actions

The following actions can only be performed by the provider users.

### *View Schedule*

This action will allow the provider to view their schedule for the day.

1. Navigate to the home screen by either logging into the system or by clicking the home button in the upper right-hand corner.
2. View the schedule for the day in the middle

Patient View Test

Welcome, Sam Shenoi      Your Next Appointment is at: 2020-04-30T19:00

Today's Schedule

Fri May 01 20:59:06 CDT 2020						
Appointment Time: 2020-04-30T19:00 Patient Name: Test2 User2 <a href="#">View Patient</a>						
Diagnosis: Breast Cancer Reason for Visit: Checkup						
Appointment Time: 2020-04-30T19:00 Patient Name: John Harrison <a href="#">View Patient</a>						
Diagnosis: None Reason for Visit: Checkup						
Appointment Time: 2020-04-30T19:00 Patient Name: Test2 User2 <a href="#">View Patient</a>						
Diagnosis: Breast Cancer Reason for Visit: Checkup						
Appointment Time: 2020-04-30T19:00 Patient Name: Test2 User2 <a href="#">View Patient</a>						
Diagnosis: Breast Cancer Reason for Visit: Checkup						

Calendar

May 2020

S	M	T	W	Th	F	S
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

### *View Patient Information*

This action will allow the provider to view the individual patient information.

1. Navigate to the desired patient, either through the Schedule view, through patient look up, or through selecting the Patient Overview button.
2. Select the “View Patient” button.
3. The system will then move you to the patient overview screen.

### *Prescribe*

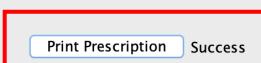
This action will allow the Provider to prescribe medication to the user.

1. Navigate to the Prescribe button on the left-hand side of the screen.
2. Select the medication to prescribe from the drop-down menu on the top panel.
  - This drop-down menu allows you to search all possible medication.

3. Determine the frequency of dosage by selecting the number of times for the medication to be taken and the time frame for the number of times.
4. Determine the length of the dosage by selecting the number and the time frame of the dosage.

3. 
  
4.

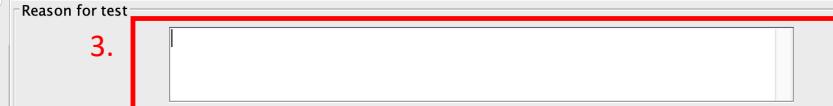
5. Providers can also add notes to the pharmacists to be included in the prescription.
6. Click the Print Prescription button to send the prescription to the pharmacy.
  - When the prescription is properly submitted, there will be a “Success” message shown.

5.  6. 

### *Order a Lab Test*

This action will allow providers to order lab tests for their patients.

1. Navigate to the Request a Test button on the left-hand side of the screen.
2. Search for the test to be ordered in the test name box
3. List the reason for the test in the “Reason for Test” Box.
4. Select the name of the lab to send the request to.
5. Click the button if fasting is required for the test.
6. Add notes to the order if there is anything that the lab needs to know.
7. Select the “Generate” button to send it to the lab.

1.  2.  3.  5.  4.  6.  7. 

### *View Test Results*

This action will allow providers to view the test results of the patient.

1. Navigate to and select the View Test Results button on the left-hand side panel.
2. View the test, date of test, and the result of the test in the main panel

The screenshot shows a software window titled "Test2 User2". At the top, there are buttons for "Home", "Logout", and patient information: SEX null, DOB -, PCP Dr. Ima NotReal, and Allergies None. On the left, a sidebar has buttons for "Patient Overview", "Patient Visit", "Prescribe", "Request a Test", "View Test Results" (which is highlighted with a red box and labeled 1.), and "Referrals". The main panel displays a table of test results:

Test Name	Date of Test	Result
Colon Cancer	2020-04-30	positive
Hashimoto	2020-04-30	positive
HIV	2020-04-30	negative
Parent	2020-04-30	negative
Steroids	2020-04-30	positive
Typhus	2020-04-30	negative

A red box highlights the entire table area, and the number 2. is placed next to the "View Test Results" button in the sidebar.

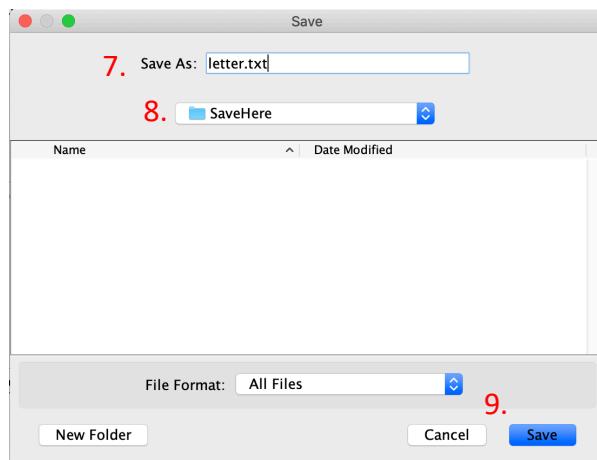
### *Create a Referral Letter*

This action will allow providers to generate a referral letter for their patient to another doctor.

1. Navigate to and select the Referrals button on the left-hand side panel.
2. Select the specialty to refer to.
3. Select the Provider to refer to.
4. Select the reason for referral.
  - All of the previous diagnoses that the patient has will be listed.
  - There will also be an “other” option to add a referral option that is not listed.
5. Add any additional notes to the other provider in the additional notes section.
6. When the information is complete, navigate to and select the refer button.

The screenshot shows the same software window as before. The sidebar has buttons for "Patient Overview", "Patient Visit", "Prescribe", "Request a Test", "View Test Results", and "Referrals" (highlighted with a red box and labeled 1.). The main panel shows fields for "Specialty" (highlighted with a red box and labeled 2.), "Provider" (highlighted with a red box and labeled 3.), and a "Reason For Referral" section (highlighted with a red box and labeled 4.). Below these is an "Additional Notes" text area (highlighted with a red box and labeled 5.). At the bottom right are "Refer" and "Request Information" buttons (highlighted with a red box and labeled 6.).

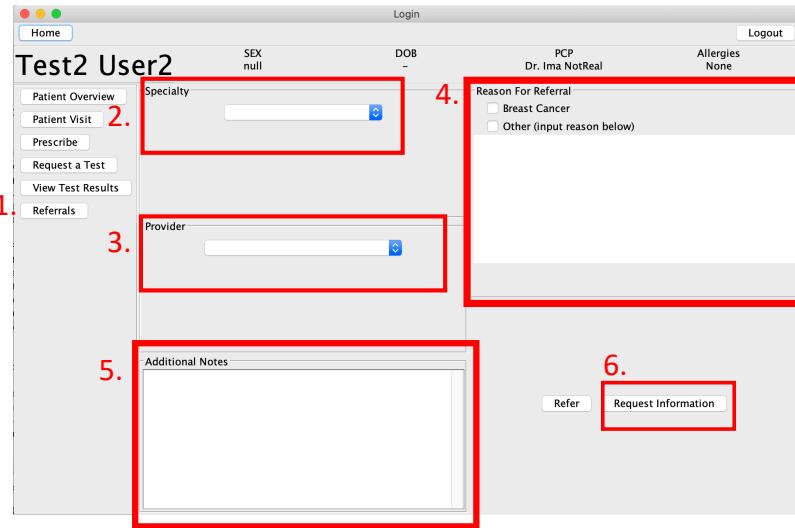
7. In the pop-up field, enter the name of the file that you would like to create.
  - It is recommended that the file extension would be .txt file to reflect the nature of the file.
8. Select the location to store the file.
9. Select Save in the bottom of the screen
10. The application will generate a text file with the referral letter and the imputed information.



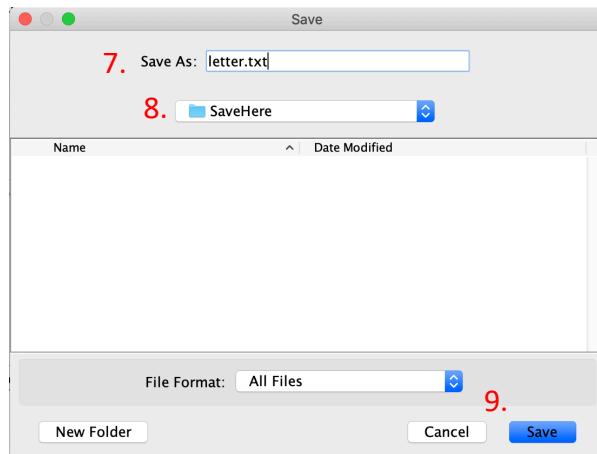
#### *Create a Request Letter*

This action will allow providers to generate a request letter to another provider for them to send information on the patient to.

1. Navigate to and select the Referrals button on the left-hand side panel.
2. Select the specialty to request from.
3. Select the Provider to request from.
4. Select the reason for the request.
  - All of the previous diagnoses that the patient has will be listed.
  - There will also be an "other" option to add a option that is not listed.
5. Add any additional notes to the other provider in the additional notes section.
6. When the information is complete, navigate to and select the request information button.



7. In the pop-up field, enter the name of the file that you would like to create.
  - It is recommended that the file extension would be .txt file to reflect the nature of the file.
8. Select the location to store the file.
9. Select Save in the bottom of the screen
10. The application will generate a text file with the referral letter and the imputed information.



## 4. Conclusion

We hope that you found this user guide helpful. If you have any more questions about the application, please visit our website: <https://shenoisam.github.io/Software1/>