NoteX – The Clinical Note Enhancer
User Manual

1 ACCESSING THE APPLICATION

The application is currently deployed to Georgia Tech's GitHub Pages and is available by a web browser. It is built using SMART on FHIR technology and is accessible via the app launcher with the following URL:

https://launch.smarthealthit.org/?auth_error=&fhir_version_1=r4&fhir_version_2=r4&iss=&launch_ehr=1&launch_url=https%3A%2F%2Fgithub.gatech.edu%2Fpages%2Fbritchie3%2FHealthcare-Note-Enhancer%2Flaunch&patient=494743a2-fea5-4827-8f02-c2b91e4a4c9e&prov_skip_auth=1&prov_skip_login=1&provider=37881086-7b05-4b18-a279-08e331f50e9b&pt_skip_auth=1&public_key=&sb=&sde=&sim_ehr=0&token_lifetime=15&user_pt=

2 DEPLOYMENT

The application runs in the user's web browser and can be served from any web server. All deployments require an active Internet connection as the application uses the following external resources:

1) SMART on FHIR launcher (https://launch.smarthealthit.org/)
2) Azure Cognitive Services (for Speech to Text)

To build and deploy remotely or run the application locally, the following tools must be installed:

- A git client – These instructions use the command line version (available from https://git-scm.com/downloads) but you can use any client you wish.
- Node Package Manager (NPM) – This is installed as part of the NodeJs install available from https://nodejs.org/
- Angular CLI – More information available at https://cli.angular.io/
  Install from a command prompt / terminal session:

```
npm install -g @angular/cli
```

Next, you'll need to download the code and restore the dependencies:

- Start a command prompt / terminal session
- Change directory to the location you wish to download the code and execute the following commands.
- `git clone https://github.gatech.edu/britchie3/Healthcare-Note-Enhancer.git NoteX`
- `cd NoteX`
- `npm install`
- `ng add angular-cli-ghpages`

2.1 Setting up the Azure Dependencies

All of the Azure Dependencies required for using this application have already been created.

The following steps are simply to document the process of setting up this service for the first time or changing it in the future.

- Login to your Azure account - https://portal.azure.com
- Click, create a resource, select Cognitive Services, click Create button
- Select a subscription, select or create a resource group, select a region, and name the resource "SpeechServices". Click review and create.
- Once the resource is created, select the resource and then click Keys & Endpoints. The "Key 1" is required in the next step.
- Update the source code src/app/clinical-note/clinical-note.component.ts Modify the following line:

```
const speechConfig = SpeechSDK.SpeechTranslationCon-
fig.fromSubscription('<<your subscription ID', '<<re-
gion>>');
```

2.2 Deploying to GH Pages

The application is setup to deploy to GitHub Pages. This pushes the compiled output to the gh-pages branch of the repository. The GitHub repository is configured to enable GitHub pages which serves the gh-pages branch to https://github.gatech.edu/pages/britchie3/Healthcare-Note-Enhancer/

To deploy the latest application to GH pages:

- Start a command prompt / terminal session
- Change directory to the root folder of the source code and execute the following command:
- `ng deploy`

The App Launch URL is:
https://github.gatech.edu/pages/britchie3/Healthcare-Note-Enhancer/launch

To launch through the SMART on FHIR app launcher:
https://launch.smarthealthit.org/?auth_error=&fhir_version_1=r4&fhir_version_2=r4&iss=&launch_ehr=1&launch_url=https%3A%2F%2Fgithub.gatech.edu%2Fpages%2Fbritchie3%2FHealthcare-Note-Enhancer%2Flaunch&patient=494743a2-fea5-4827-8f02-c2b91e4a4c9e&prov_skip_auth=1&prov_skip_login=1&provider=37881086-7b05-4b18-a279-08e331f50e9b&pt_skip_auth=1&public_key=&sb=&sde=&sim_ehr=0&token_lifetime=15&user_pt=

2.3 Deploying and running locally

To build and run the application locally:

- Start a command prompt / terminal session
- Change directory to the root of the source code and execute the following command.
- `ng serve`
- The application is automatically built and is now running on localhost port 4200

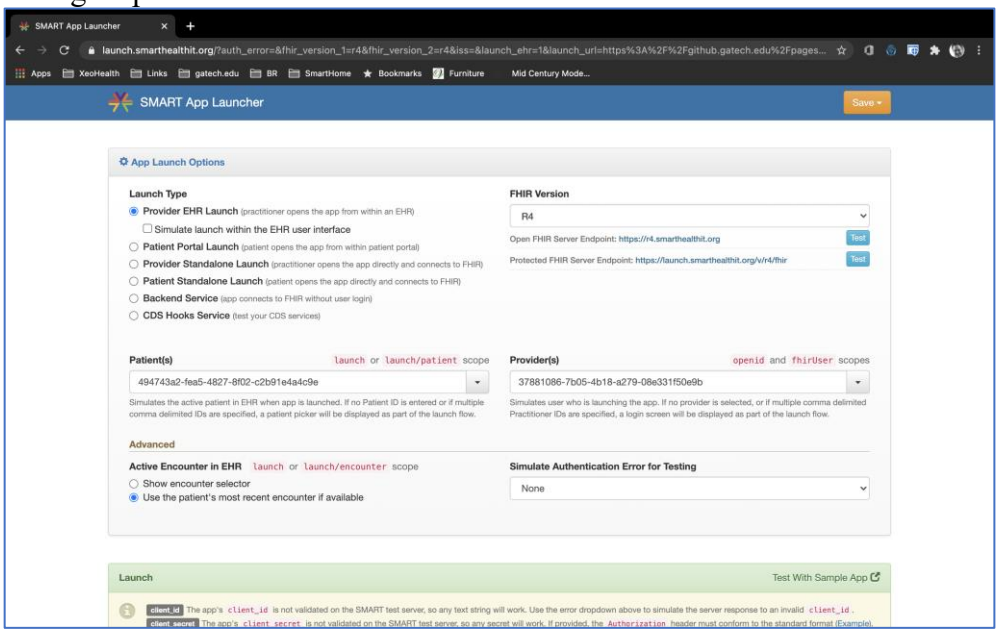
The App Launch URL is:
http://localhost:4200/launch

To launch through the SMART on FHIR app launcher:
https://launch.smarthealthit.org/?auth_error=&fhir_version_1=r4&fhir_version_2=r4&iss=&launch_ehr=1&launch_url=http%3A%2F%2Flocalhost%3A4200%2Flaunch&patient=&prov_skip_auth=1&provider=&pt_skip_auth=1&pt_skip_login=0&public_key=&sb=&sde=&sim_ehr=0&token_lifetime=15&user_pt=fc200fa2-12c9-4276-ba4a-e0601d424e55

3 USING THE NOTEX APPLICATION

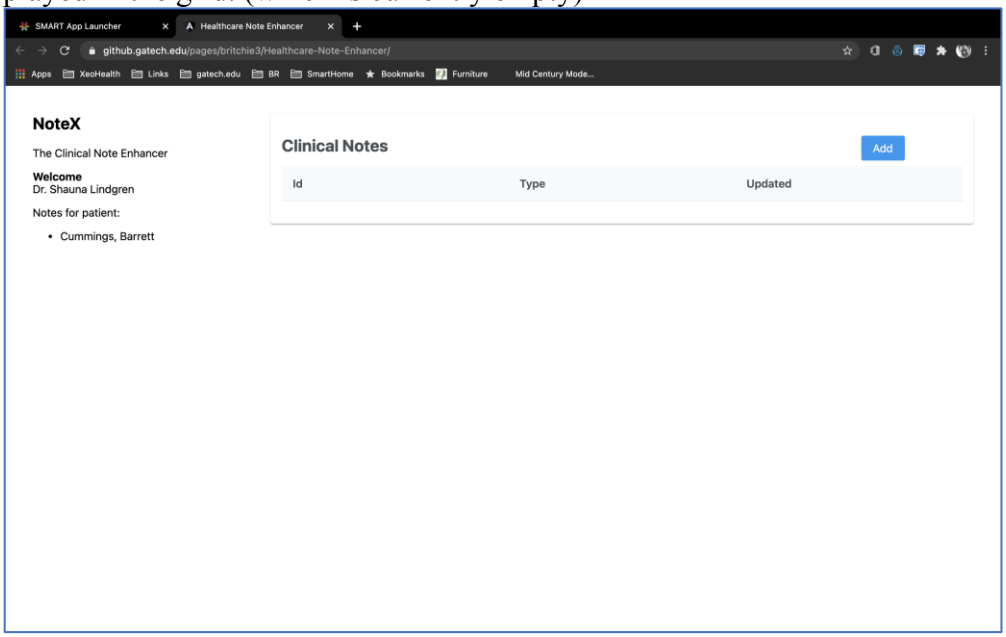
3.1 Launching the application

Start with the SMART App Launcher to simulate launching the application through a provider's EHR.



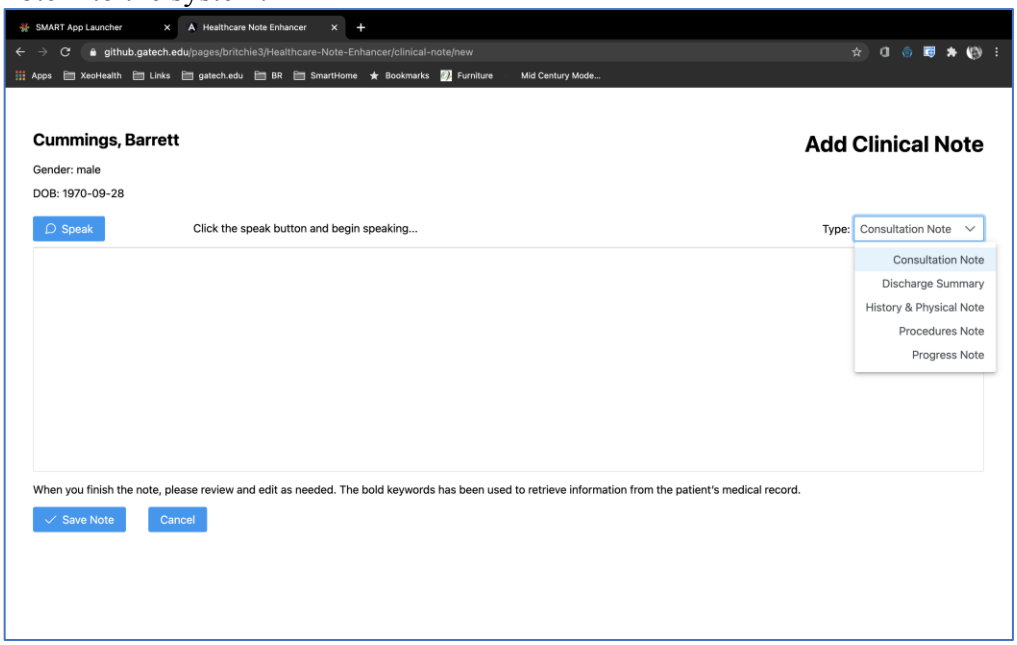
3.2 The NoteX dashboard

Click the "Add" button to create a new Clinical Note. Existing notes will be displayed in the grid. (which is currently empty)

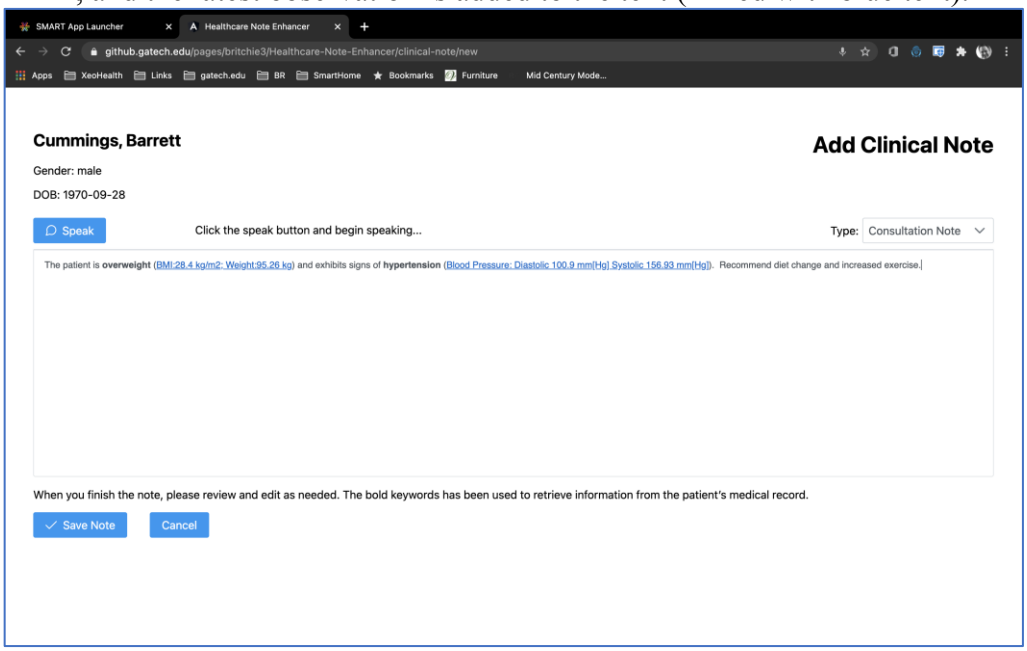


3.3 Adding a new note

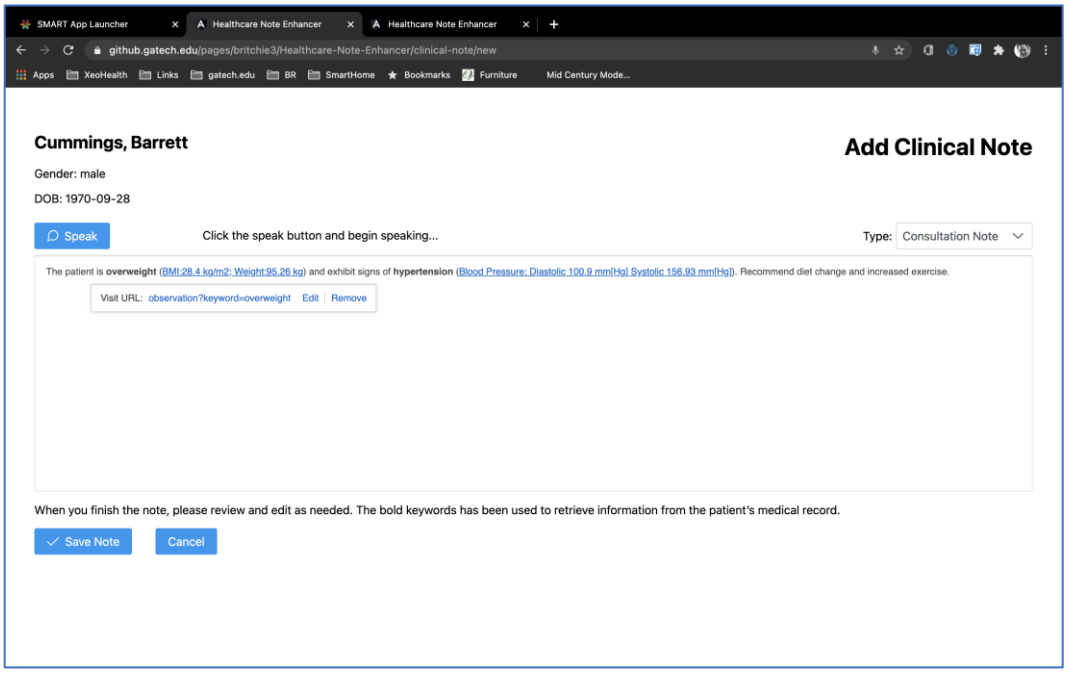
Select the type of note, and then click the “Speak” button and begin dictating the note into the system.



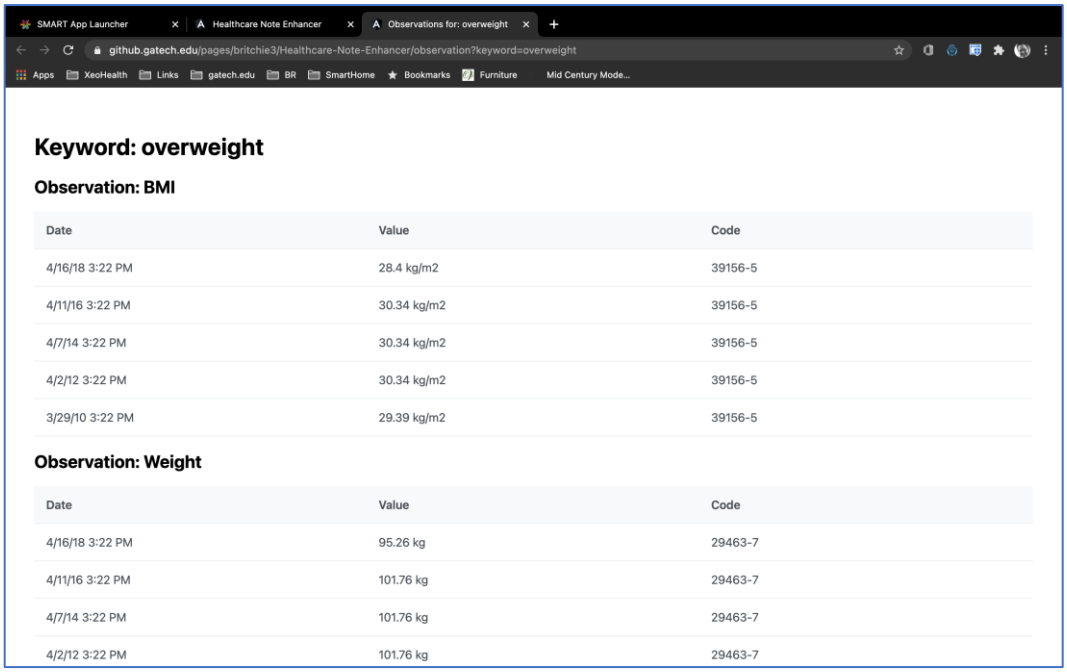
Once the dictation is complete, the speech will be converted to text. The text is added to the box, keywords are highlighted, observations are retrieved using FHIR, and the latest observation is added to the text (linked with blue text).



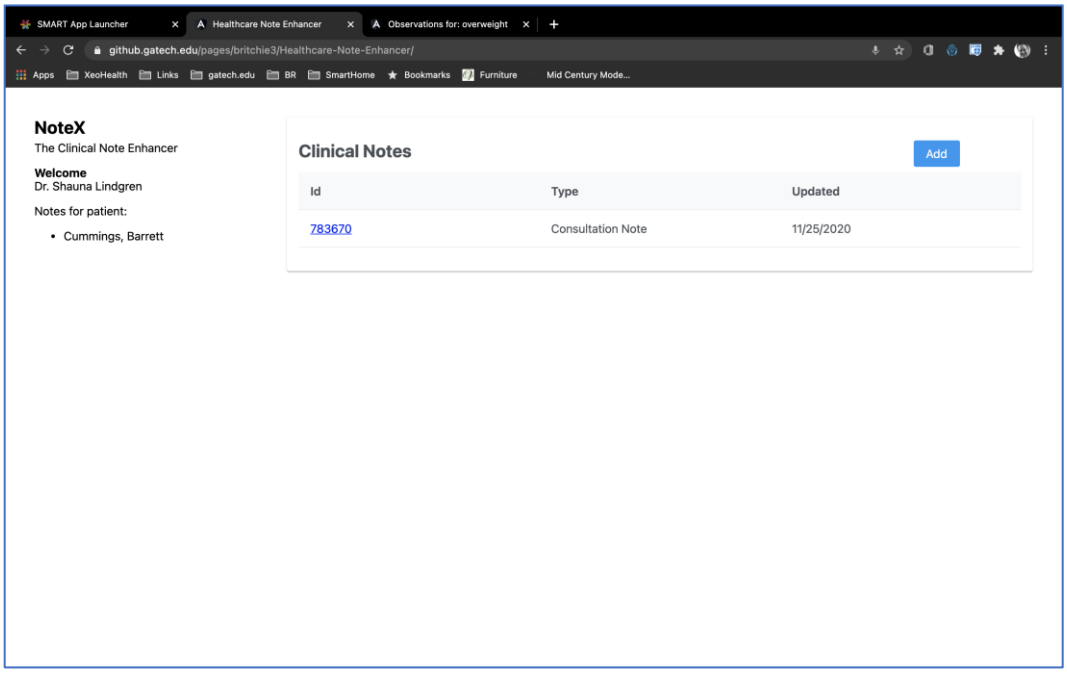
Clicking the linked text displays a popup providing a link to the observation details. To view the observations used to augment the note, click on the Visit URL.



All of the related observations are displayed. The most recent observation is used to augment the clinical note text.

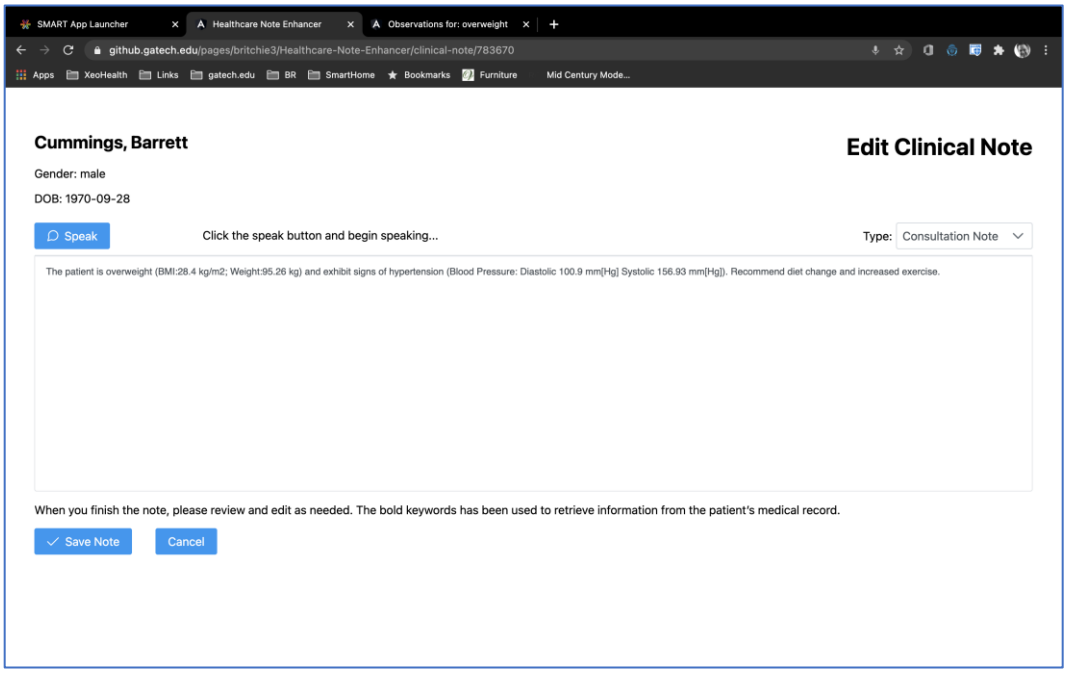


Clicking the ‘Save Note’ button will create a new note on the FHIR server and return to the NoteX dashboard.



3.4 Editing a Clinical Note

Clicking the ID of an existing note brings up the note for modification.



4 EXTENSIBILITY AND CONFIGURATION

4.1 Keyword Mapping

The keyword mapping configuration (src/assets/keyword-mapping.json) links a keyword in the dictated text to an observation in the Observation Mapping configuration. This determines which keywords are supported and which observations are augmented for the given keyword.

```
[
  {
    "keyword": "overweight",
    "observation": ["Weight", "BMI"]
  },
  {
    "keyword": "underweight",
    "observation": ["Weight", "BMI"]
  },
  {
    "keyword": "hypertension",
    "observation": ["Blood Pressure"]
  }
]
```

4.2 Observation Mapping

The Observation Mapping (src/assets/observations.json) is used to link a descriptive observation to a set of FHIR observation codes. The system will query the FHIR server using these codes and use the most recent observation for the text augmentation. The full set of observations will be available to the user by clicking the linked text.

```
[
  {
    "name": "Weight",
    "coding": [
      {
        "system": "http://loinc.org",
        "code": "29463-7",
        "display": "Body Weight"
      },
      {
        "system": "http://loinc.org",
        "code": "3141-9",
```

```
            "display": "Body weight Measured"
          },
          {
            "system": "http://snomed.info/sct",
            "code": "27113001",
            "display": "Body weight"
          },
          {
            "system": "http://acme.org/devices/clinical-codes",
            "code": "body-weight",
            "display": "Body Weight"
          }
      ]

  },
  {
    "name": "Blood Pressure",
    "coding": [
     {
      "system": "http://loinc.org",
      "code": "55284-4",
      "display": "Blood Pressure"
     }
    ]
  },
  {
     "name": "BMI",
     "coding": [
      {
        "system": "http://loinc.org",
        "code": "39156-5",
        "display": "Body Mass Index"
      }
     ]
  }
]
```


4.3 FHIR Resource

When a note is saved to the FHIR server by the application, it serialized as a DocumentReference FHIR resource. The resource has a specific LOINC code for clinical notes and the data is encoded using Base64.

Here is an example:


```
{
  "resourceType": "DocumentReference",
  "type": {
    "coding": [
      {
        "system": "http://loinc.org",
        "code": "18842-5",
        "display": "Discharge Summary"
      }
    ],
    "text": "Discharge Summary"
  },
  "subject": {
    "reference": "Patient/fc200fa2-12c9-4276-ba4a-e0601d424e55"
  },
  "content": [{"attachment": {
    "contentType": "text/plain",
    "data": "Tm8gYWN0aXZpdHkgcmVzdHJpY
  } }]
}
```