

Campus Health System

1. Problem Statement:

College students generally don't take care of their health properly and make poor lifestyle choices. This makes them prone to certain diseases and the lack of proper healthcare systems for health records and medication tracking can lead to late diagnoses and delayed care. This increases the risk of outbreak of mass diseases like flu, dengue, COVID-19 etc. which if monitored properly, can be avoided.

2. Goals:

- Help students monitor their health regularly through symptom logging.
- Provide insights and actionable advice based on health records.
- Detect and prevent potential health issues (e.g., flu, COVID-19, dengue) by alerting campus clinics and university administration when certain symptoms trend upward.
- Provide easy access to medical records, appointment scheduling, and tracking of medication schedules.

3. Actors and Roles:

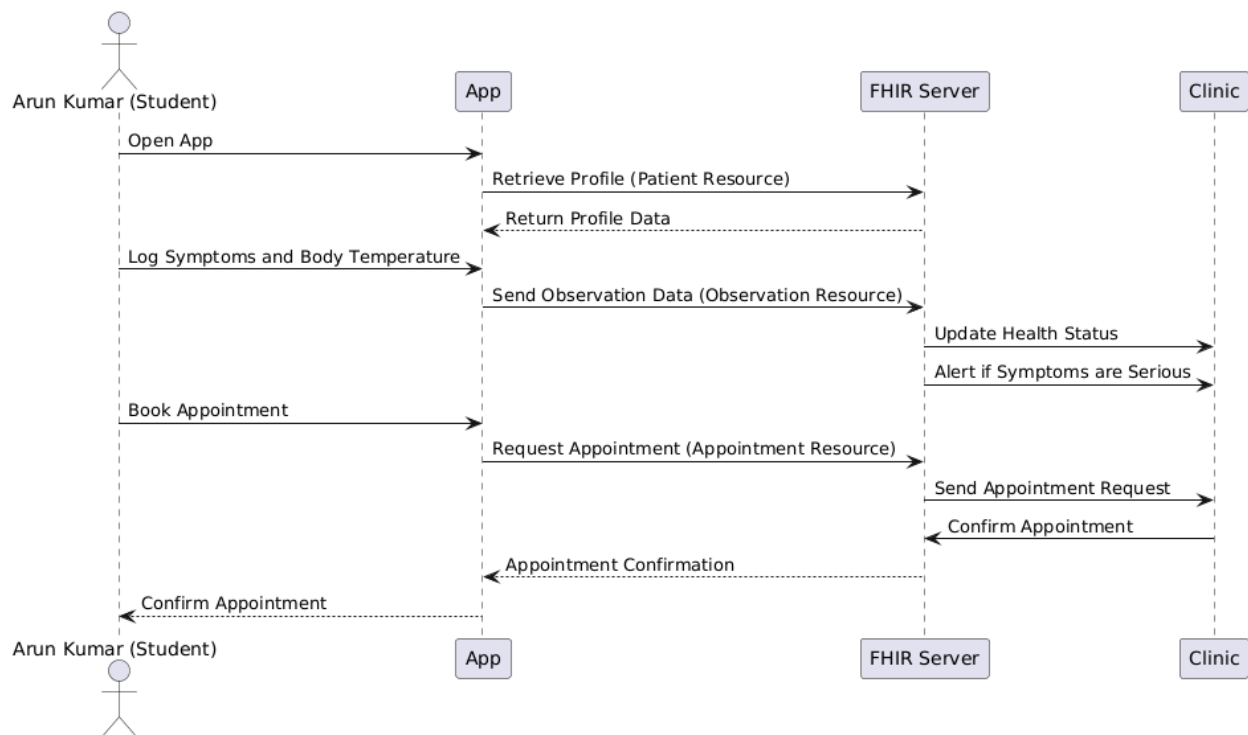
- **Students** logging their day to day health information and accessing healthcare facilities available on campus
- **Campus Healthcare Providers** provide healthcare and medical assistance by tracking health trends, diagnosing students with concerning trends, etc. This could be in the form of a campus clinic consisting of many practitioners like resident doctors, visiting doctors, nurses etc.
- **University Health Admin** monitor trends and take preventive measures when necessary to ensure campus wellbeing.
- **FHIR Server** that handles health data storage, retrieval, and communication.

4. Storyboarding

Scenario 1: Symptom Tracking

A 20 year old male student named Arun Kumar (at XYZ university) is experiencing frequent headaches, cough and fever. His lifestyle is sedentary, and he follows a poor diet and sleep schedule. He often deals with high levels of stress too. Arun opens the app on his phone to log his symptoms. The app pulls Arun's profile (FHIR **Patient** resource) from the FHIR server,

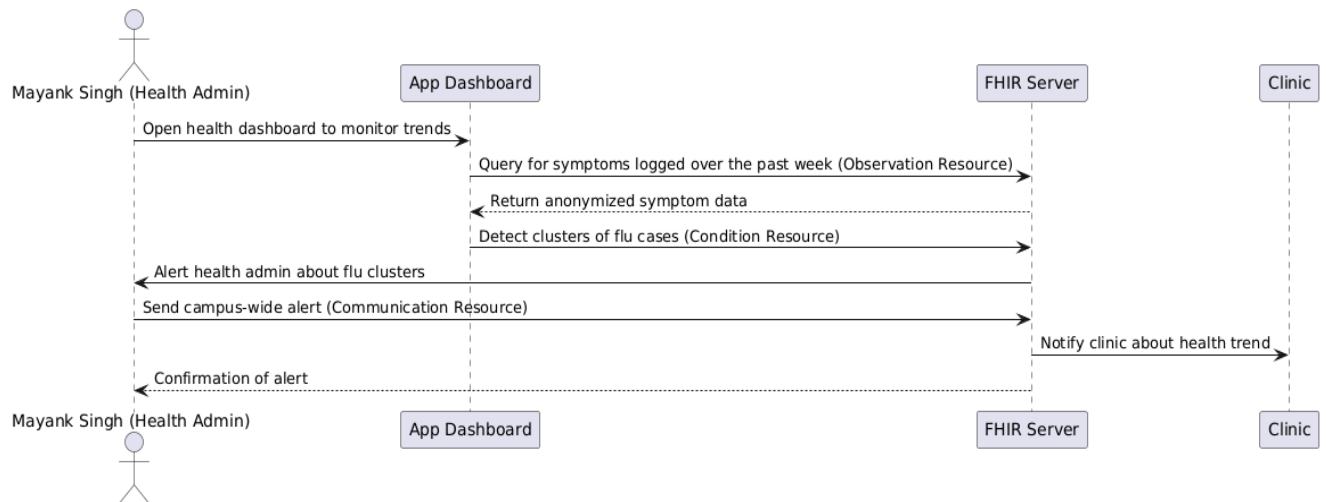
which stores the student's name, age, gender, roll no and other important information. He selects symptoms (fever, headache, cough) and logs body temperature. The FHIR **Observation** resource stores the logged data (body temperature, symptom code from SNOMED, etc.) along with a date and timestamp. The app cross-references the logged symptoms against predefined severity thresholds stored in the FHIR system and alerts Arun when the combination of fever, headache, and stress levels are above the threshold for concern. It prompts Arun to book an appointment at the campus clinic. FHIR **Appointment** resource interacts with the clinic schedule, and fetches available times, allowing Arun to book a slot. Arun selects a time that works for him and confirms the booking. Arun's health status is shared with the clinic and an automated alert is sent if his symptoms are severe, so that his visit can be prioritised.



Scenario 2 : Monitoring Campus Health Data

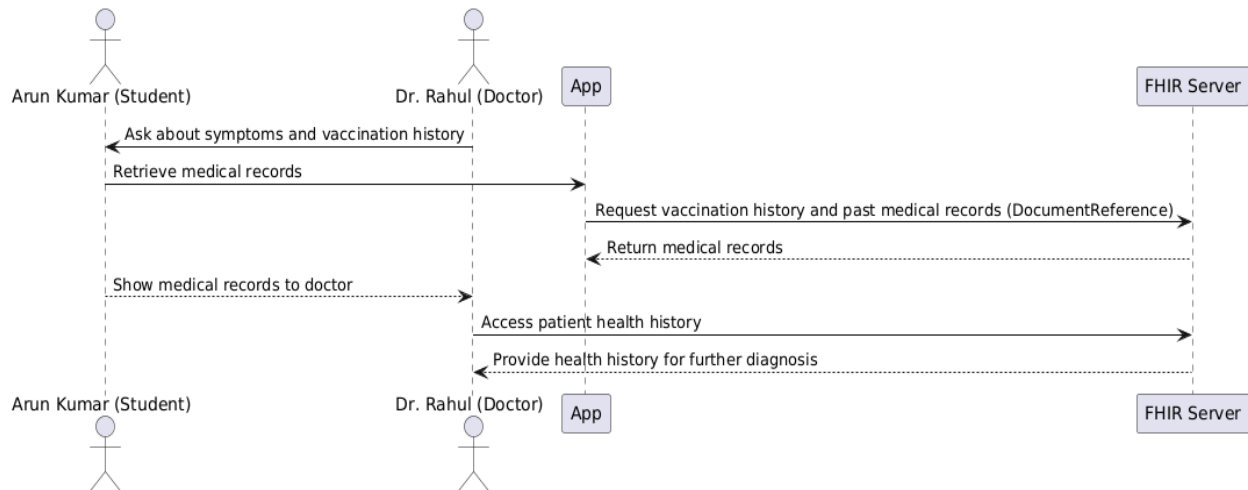
University XYZ has a health admin named Mayank Singh. He checks the dashboard for current health trends on campus using anonymized data. The system queries the FHIR **Observation** resource for symptoms logged by students over the past week. It visualises the trends for the past week. Mr Singh checks the data for flu-like symptoms, and notices a spike in fever, fatigue, and headaches. The system detects that 15% of students have logged flu-like symptoms (fever, fatigue, headaches, sore throat). The system aggregates anonymized data from multiple FHIR

Observation resources and applies a threshold detection algorithm to flag clusters of flu-like cases using the FHIR **Condition** resource. The health admin is alerted and sends a campus-wide notification advising students to take precautions (wearing masks, etc). The FHIR **Communication** resource facilitates the alert. Mr Singh uses FHIR **CarePlan** resources to provide students with flu prevention tips and steps to follow if symptoms worsen.



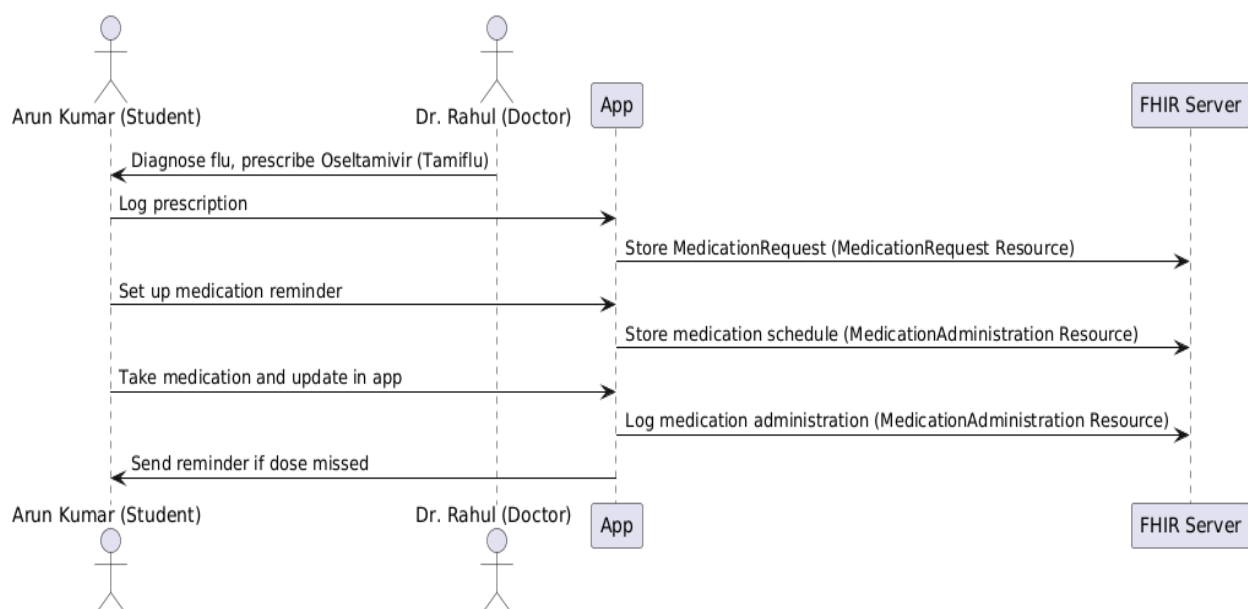
Scenario 3 : Access to Medical Records

Arun Kumar meets Dr. Rahul, a visiting doctor at the campus clinic. Dr. Rahul asks Arun about the symptoms based on his logs on the app. He suspects Arun may be infected with some kind of flu. He asks Arun for his vaccination history and past medical records. Arun opens the medical records section in the app and selects 'View Past Records.' The app fetches F previous health records, test results, and vaccination certificates in reverse chronological order that are stored using HIR **DocumentReference** resource. Dr. Rahul uses this information for further diagnosis. He notices that Arun has not been vaccinated for influenza and notes that Arun falls sick quite frequently, indicating low immunity.

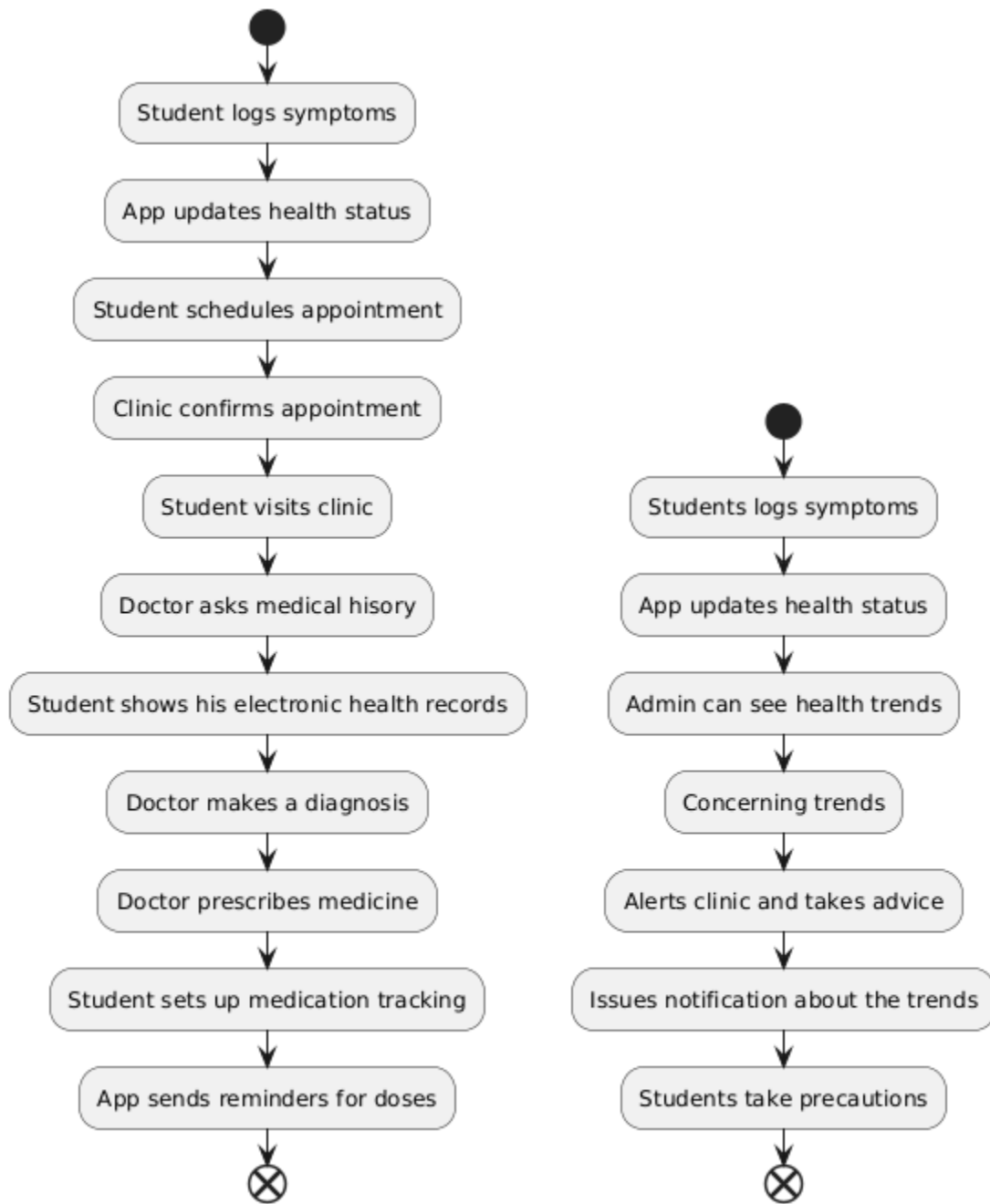


Scenario 4 : Health Records and Medication Tracking

After running Rapid Influenza Diagnostic Tests and Rapid Molecular Assays, Dr. Rahul diagnosed Arun with swine flu and prescribed Oseltamivir (Tamiflu). The prescription (drug name, dosage, and administration instructions) are recorded in the FHIR **MedicationRequest** resource, which lists the. Arun sets up a reminder in the app to take the medication according to the prescription. The app sends notification reminders to Arun at scheduled time for his medication. If Arun misses a dose, the FHIR **MedicationAdministration** resource logs the missed dose and triggers an alert, reminding him to take it as soon as possible. Each time Arun takes his medication, the app records the exact time and dosage in the FHIR **MedicationAdministration** resource, maintaining an accurate log of his adherence to the treatment plan



Activity Diagram Representing Workflow



5. FHIR Resources

Note: Though not explicitly mentioned, each resource will have an identifier too.

Resource : Patient

This identifies students and enables us to track the demographic data of students on campus.

Profiling and Value Sets

- name : Student's full name
- gender : <https://hl7.org/fhir/valueset-administrative-gender.html>
- birthDate : Date of birth of the student.
- id : Unique student identifier like roll no.
- address: Student's current residential address

Resource: Observation

To capture symptoms and vital signs recorded by students regularly on campus.

Profiling and Value Sets

- code: LOINC <https://build.fhir.org/valueset-observation-codes.html>
- valueQuantity: Value of observation (e.g temperature, blood pressure) <https://ucum.org/>
- effectiveDateTime: Date and time the observation was recorded.
- subject: Reference to the Patient resource.

Resource : Condition

To track diagnosed conditions such as flu or COVID-19 for students on campus.

Profiling and Value Sets:

- clinicalStatus : <https://hl7.org/fhir/valueset-condition-clinical.html>
- code: <https://build.fhir.org/valueset-condition-code.html>
- onsetDateTime: Date and time when the condition was first identified.
- subject: Reference to the Patient resource

Resource : Appointment

To manage healthcare appointments between students and campus healthcare providers

Profiling and Value Sets:

- start: Start time of the appointment.
- end: End time of the appointment.
- participant: List of participants <http://hl7.org/fhir/ValueSet/participant-type>
- status: (e.g., booked, cancelled) <http://hl7.org/fhir/ValueSet/appointmentstatus>

Resource : MedicationRequest

To store prescribed medications for students, enabling medication tracking.

Profiling and Value Sets:

- medication: [Valueset-medication-codes - FHIR v6.0.0-ballot1](#)
- dosageInstruction: specific instructions <http://hl7.org/fhir/ValueSet/timing-abbreviation>
- subject: Reference to the Patient resource.
- authoredOn: Date the medication was prescribed.

Resource : CarePlan

To manage personalised care plans for students (including preventive, treatment, post-recovery)

Profiling and Value Sets:

- status: Current status of the care plan. <https://build.fhir.org/valueset-request-status.html>
- Intent: Plan/Proposal etc. <https://build.fhir.org/valueset-care-plan-intent.html>
- activity: Specific activities
<https://build.fhir.org/valueset-care-plan-activity-performed.html>
- subject: Reference to the Patient resource.

Resource: Communication

To send alerts to students and healthcare providers regarding potential health outbreaks

Profiling and Value Sets:

- status: <https://build.fhir.org/valueset-event-status.html>
- subject: Reference to the Patient resource.
- topic: <https://build.fhir.org/valueset-communication-topic.html>
- sent: Date the communication was sent.

Resource : DocumentReference

To store and reference documents related to the student's health (e.g., lab reports, prescriptions, vaccination certificates).

Profiling and Value Sets:

- type: (e.g., lab report, prescription). <https://build.fhir.org/valueset-doc-typecodes.html>
- content: The actual document, usually in binary format (PDF, image).
<https://terminology.hl7.org/6.0.2/ValueSet-v3-HL7FormatCodes.html>
- subject: Reference to the Patient resource.

To record the administration of medications to students, facilitating medication tracking.

- medication: What was administered <https://build.fhir.org/valueset-medication-codes.html>
- subject: Reference to the Patient resource.
- occurrence: When the medication was administered.
- dosage: Dosage details including amount and timing. [UCUM](#)

To represent healthcare professionals involved in patient care, enabling proper attribution of medical services and tracking of practitioner-related activities.

- identifier: Unique national and institutional IDs.
- name: Official name
- qualification: Details of the practitioner's qualifications, including the type of qualification and the issuing organisation.
- active: Indicator of whether the practitioner is currently active in their role.

The diagram is an Entity-Relationship (ER) model for a healthcare system. It features the following entities and relationships:

- Entities (Green Rectangles):** MedicationAdministration, MedicationRequest, Clinic, Communication, CarePlan, Patient, Appointment, Health Admin, Symptoms, Practitioner, Observation, Document Reference, Condition.
- Relationships (Yellow Diamonds):**
 - take doses:** Connects MedicationAdministration (0..*) and MedicationRequest (1..*).
 - creates:** Connects MedicationRequest (0..*) and Patient (1..1).
 - books:** Connects Patient (1..1), Appointment (0..*), and Practitioner (1..1).
 - shows:** Connects Patient (1..1), Symptoms (1..*), and Practitioner (0..*).
 - diagnoses:** Connects Symptoms (0..*), Practitioner (1..1), and Condition (0..*).
 - has:** Connects Clinic (1..1), Practitioner (1..*), and Appointment (0..*) via an unlabeled diamond.
 - issues:** Connects Communication (0..*) and Health Admin (1..1).
 - initiates:** Connects CarePlan (0..*) and Health Admin (1..1).
 - analyses:** Connects Health Admin (1..1) and Symptoms (1..*).
 - stored:** Connects Symptoms (0..*) and Observation (0..*).