PS2: Problem Analysis & Modelling - Project Sprint 2

Group Name: ICD – 5

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Use Case B: Clinician to lab - orders from EHR to be generated as a lab worklist item

Introduction:

In this project we have created model diagrams for our use case 'B'. UML and BPMN are the model diagrams which have been created for the case study. UML is abbreviated as "Unified Modelling Language". UML displays the architecture of classes, interpretations, and their interrelations. UML have several aspects that most semantic data languages do not have, which includes profiles, international configurability, and adaptation mechanisms (Baclawski et al., 2002). BPMN (Business Process Modelling Notation) is a user-friendly language used to prototype business (institutional) systems. In the wider definition, it is a software program that allows for the characterization and relatively simple visual image analysis of complex interactions (Scheuerlein et al., 2012).
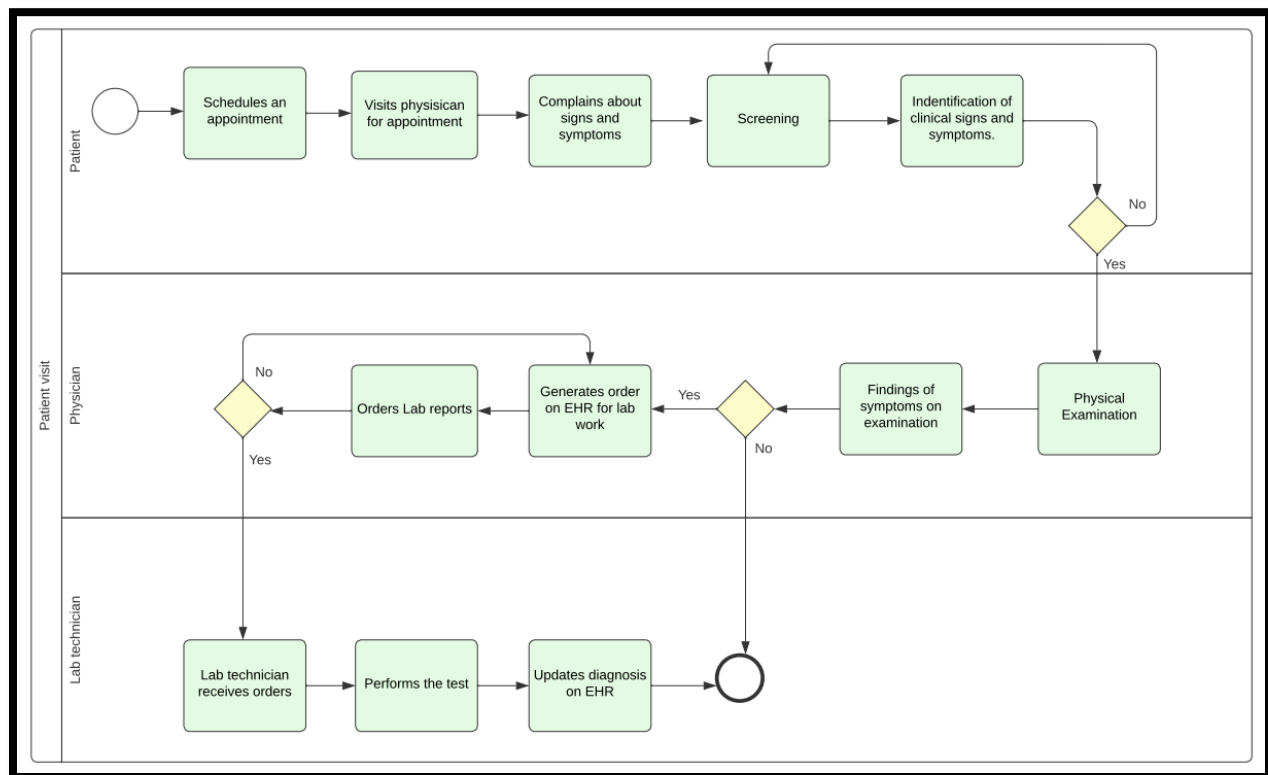
Model Diagrams:

1. Business Process Modeling Notation (BPMN) for use case study B

The Business Process Modeling Notation (BPMN) contains semantic workflow model of interoperability. It is used to represent the workflow of any working system. It uses a number of symbols such as circles (events), diamonds (gateways), rectangles (activity/tasks), and lines (connections). In the given used case, the workflow of the patient visiting the physician and receiving orders from the physician for laboratory works. These events are represented in as a chain of events that are depended on the previous event.

In the use case chosen by our team, there are three swim-lanes that represent interoperability in three sections viz, patient's lane, physician's lane, and the laboratory technician's lane. The first layers define the human interoperability layer. The events in this lane include scheduling an appointment, visiting the physician, communicating signs and symptoms, screening, and clinical identification of signs. This further opens a gateway towards the physician's lane.

If there are clinical identification of signs, the patient has to undergo steps in the physician's lane such as finding of symptoms, that further also leads to generation of workflow, and ordering lab reports. Again, a gateway opens to the Lab technician's lane. To receiving lanes, performing tests, updating diagnosis on EHR. This is the final step of the interoperability system.

Model 1: BPMN diagram illustrating the Patient-Physician Examination flow

2. Unified Modelling Language (UML) for Patient-Physician workflow
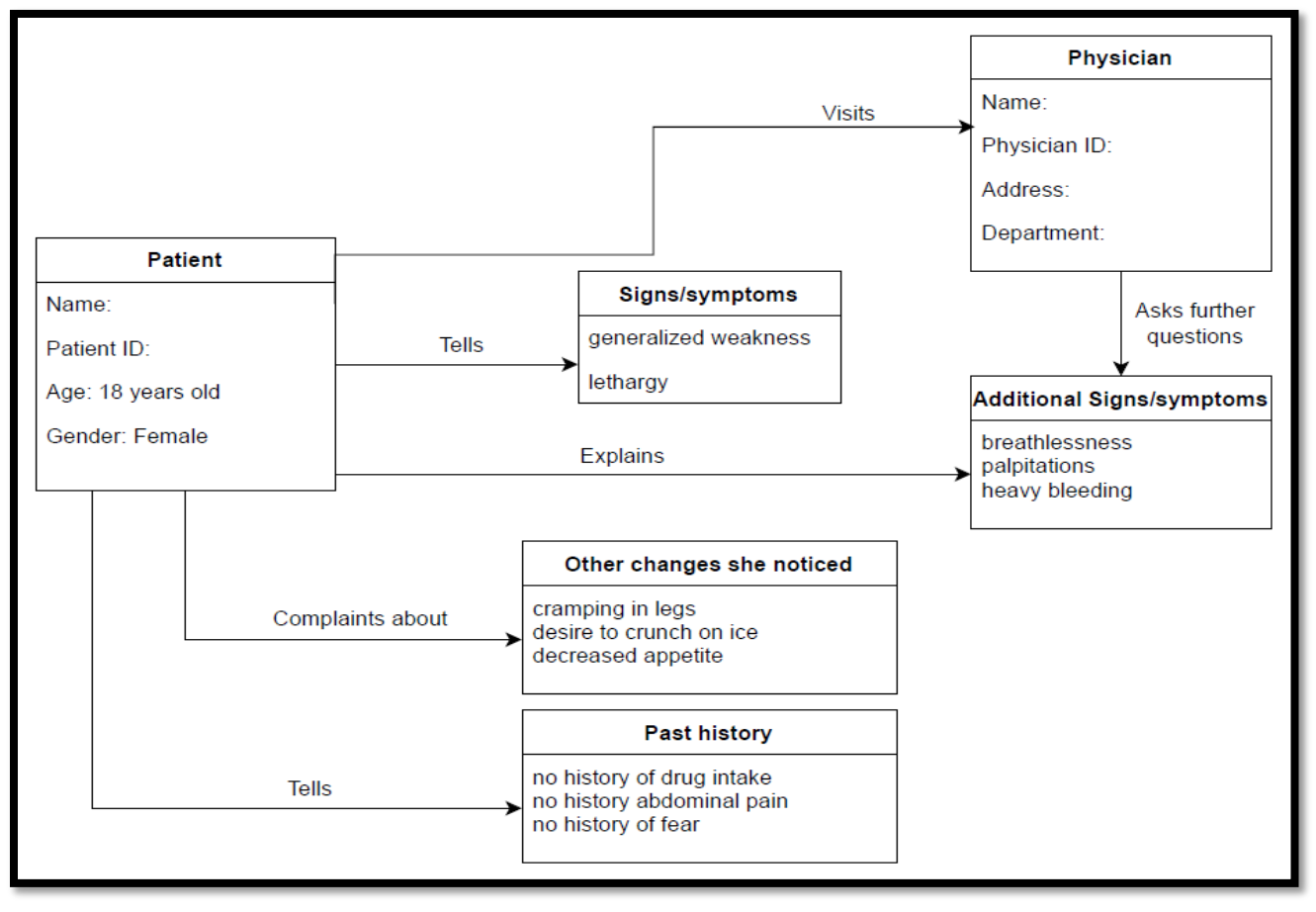
Data Elements:

In the below UML diagram, we demonstrate an appointment encounter between a patient and her physician. The patient in our use case is an 18-year-old female who registers for an appointment as she was observing some signs and symptoms like generalized weakness, lethargy. The physician asks her further questions related to her health and she explains other changes that she noticed in her body like decreased appetite, breathlessness, and palpitations while climbing stairs. She also complained to the physician regarding some other symptoms like desire to crunch on ice, cramping in legs. The UML diagram explains the associations of the classes and the objects in a system. From the diagram all the signs/symptoms and the changes she told the physician were the information that was passed on from one actor (patient) to other actor (physician) in the system. We have two actors in our case one is the patient and the other is the physician. The signs/symptoms are the attributes of the patient.

Footnotes:

• 	There is a unique ID both for the patient and the physician which helps to identify them distinctly.

• 	The signs/symptoms and the health-related changes in the patient help the physician to identify the issue appropriately and design her treatment plan accordingly.

Types of Interoperability:

Semantic: This scenario addresses the semantic interoperability. Semantic interoperability is where two or more systems communicate with each other for exchange of information in such a way that both can interpret it. Here in our case, the information that was passed on from the patient to the physician has been recorded in the patient Electronic Health Record (EHR) which is further taken as the input by the examination tool which yields out her final diagnosis.

Model 2: UML diagram illustrating the Patient-Physician workflow

3. Unified Modelling Language (UML) for Physician-Lab Technician workflow

Data Elements:

Upon examination, the physician discovered that the patient had tachycardia, pale gums and nail beds, and a swollen tongue. Given her history and the results of her physical examination, the physician suspected the patient was anemic and requested a blood sample for analysis. The lab orders from the EHR should be generated and added to the worklist item in the lab information system. The lab technician took orders from the clinician and carried out the test. The EHR should be updated with the test results.

Definitions: "diagnosis_code" and "procedure_code" indicates the appropriate terminology's code for the diagnosis or the procedure that is conducted. This may vary from clinic to clinic. For instance, it would be SNOMED-CT for physician but LOINC for the lab technician.

For the Physician attribute, the physician_name is the name of the physician who will conduct the examination, physician_id indicates the unique value associated with each physician, and conducts_examination is the activity performed by the physician on the patient.

For the Physical Examination attribute, patient_signs_symptoms, patient_history, and patient_findings are the clinical findings associated with the patient in the use case study that were examined by the physician during the consultation.

For the Diagnosis and Procedures attribute, the diagnosis_name, and procedure_name, and contain information on the what the patient was diagnosed with and what were the procedures that were ordered by the physician after examination.

For the Lab Technician attribute, the lab_technician_name and conducts_test is the name and activity of the technician who will perform the requested test respectively, lab_technician_id indicates the unique value associated with each lab technician.

For the EHR attribute, lab_orders are added to the worklist item by the physician for the technician to perform and lab_results are the test results updated by the technician back to the EHR.

**Footnotes:**

patient_signs_symptoms have a major effect on the diagnosis provided.

Types of interoperability:

Process: This can be observed at attribute levels Diagnosis and EHR. The lab orders from EHR should be generated and added to the lab information systems worklist item.

Human: This can be observed at attribute levels Physician and Physical Examination. Given the patients history and the findings on her physical examination, the physician conducted the diagnosis.
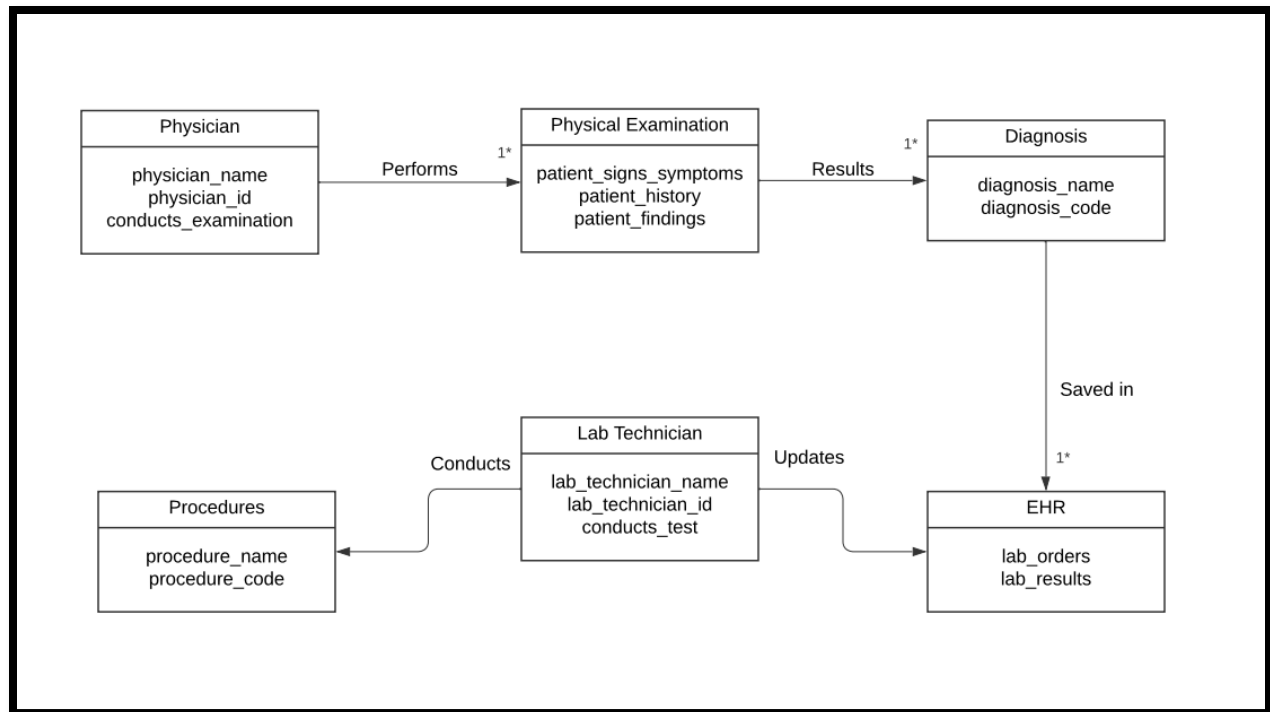
Model 3: UML diagram illustrating the Physician-Lab Technician workflow

Situation not modelled in the diagram:

We feel that the situation that is not being modelled here is the patient's past laboratory reports. Her past reports would have given a clearer picture of her blood sugar levels and other necessary components in her body. These reports might help the physician to understand her disease better and will eventually help in designing a more accurate treatment plan for her.

Conclusion:

Modeling is used to understand a complex system's performance in a simpler way. A clear, well-organized graphic aids in understanding the concept. Unified Modeling Language modeling can be used in the healthcare industry to visually represent events, the people involved, treatments

undertaken, prescriptions issued, and all other minor activities carried out in between

appointments that are easily understood and documented. However, the use of Business Process

Model Notation (BPMN) in the healthcare industry is growing. Both the efficacy of people's

health and the effectiveness of the healthcare system are improved. The provision of

interprofessional analysis is also aided by it.

References:

Baclawski, K., Kokar, M., Kogut, P. (2002). Extending the Unified Modeling Language for

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