

**Project report IF02A**  
**Analysis and design of IS for home hospitalization**

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## **1. Introduction**

Home hospitalization (HH) concerns patients with severe or chronic medical conditions, of all ages. Those patients prefer to stay at home for their treatment, instead of being hospitalized in a conventional ward.

In the Champagne-Ardenne region there are 9 home hospitalization establishments, distributed among public and private sector for different purposes. At the HH in Troyes, for example, a nursing team provides daily care in the comfort of the patients' homes. The coordinating physicians and nurses provide coordination, while a psychologist and a social worker handle the psychological and social issues of the patients and their relatives. The HH establishment also integrates a pharmacy for internal use, to ensure a secure drug circuit. The core business of the HH is coordinating the employees to provide patients with their prescribed care and to organize interventions by using the resources necessary to carry out the therapeutic project.

Since coordination in such an establishment is of utmost importance, it is therefore crucial to keep its information system up to date, fully functional and optimized.

## **2. Objectives of the HH new information system**

HH requires a model of information system that would make it possible to control the quality of care by reinforcing the coordination capacity of the professionals. The aim is to make this model of care known and recognized, as it will allow the HH to meet the current challenges of the sector's development.

Each organization that is in contact with the HH works with its own IS, which impairs the exchange of information dramatically, resulting in a huge loss of valuable time and delays in the start of the hospitalization. In some cases, a patient's health can deteriorate quickly while he is waiting for admission, and he would thus end up admitted to conventional hospitalization.

The documents that need to be completed at the patient's home can also pose problems, as the information is not integrated directly into the IS, often due to lack of network coverage. The use of paper documents means they can get lost easily, and the loss of information can have serious medical aftermaths.

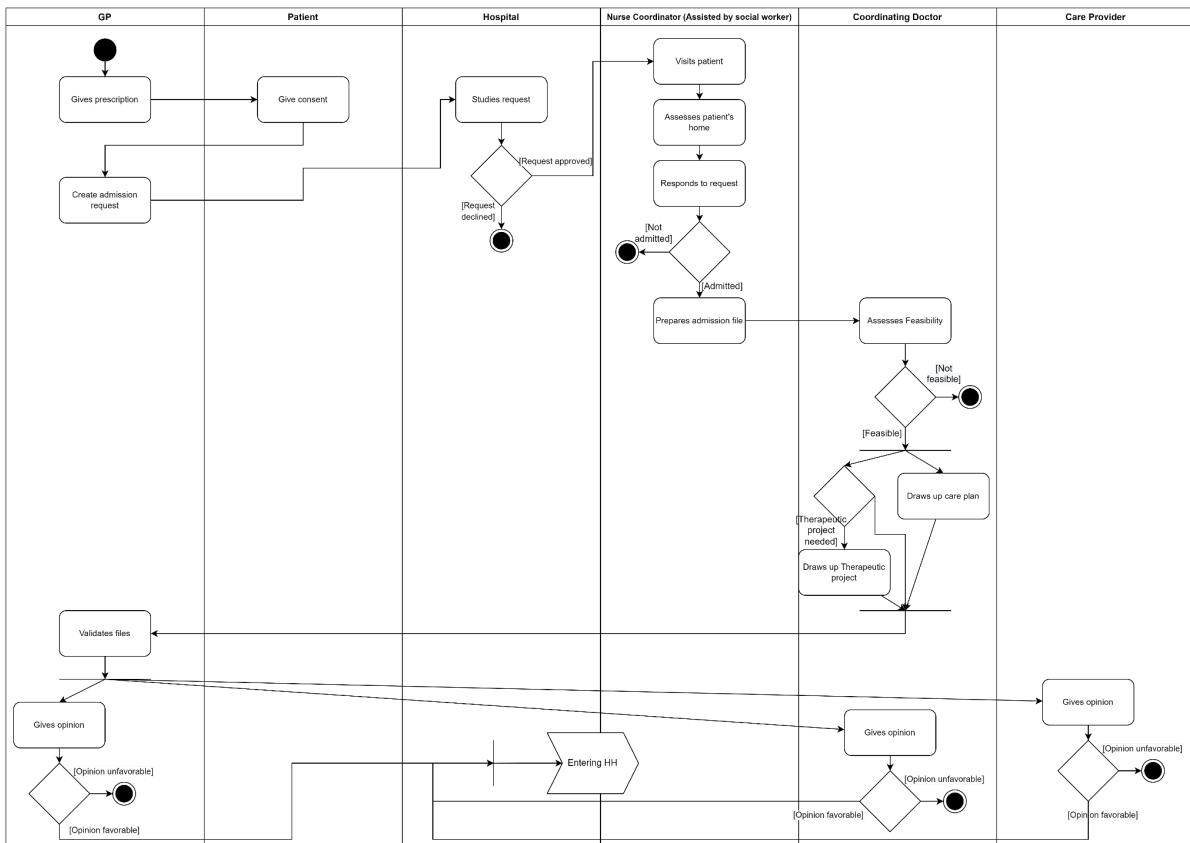
Given those reasons, the creation of a new information system is essential. The risks mentioned need to be prevented efficiently, and the stakeholders should be able to participate to ensure good coordination and integrated care of the patients in their homes.

### 3. Current processes - Activity diagrams

Before designing a new information system for HH, we analyzed the context of the project. We were able to identify four main processes in use by HH. This analysis helped to clearly distinguish the existing problems, and determine what new improvements could be made to the current system.

#### 3.1. Admission

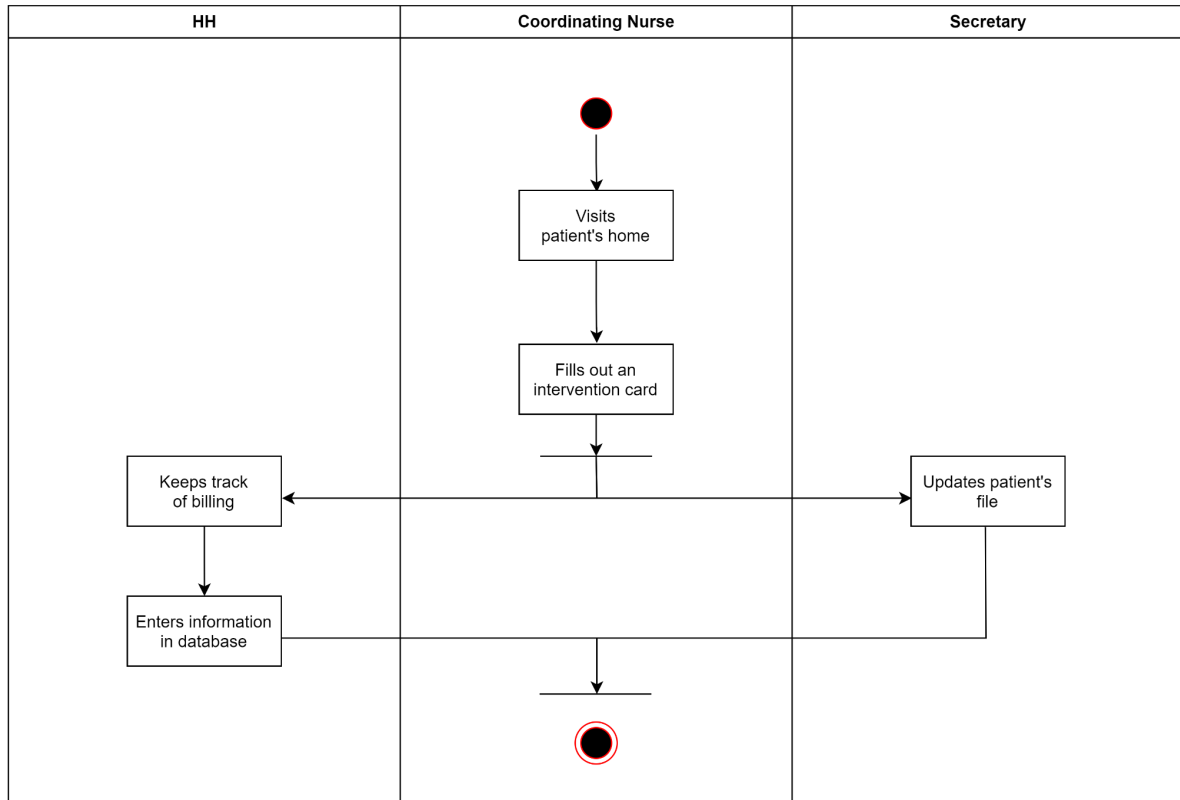
Before entering the HH, the patient must first go through the admission process. This begins with the general practitioner giving a prescription, to which the patient consents, and creating an admission request. Then, the request is forwarded to the hospital, and if approved the coordinating nurse would visit and assess the patient's home. If the nurse sees the home fit, she would send an admission file to the coordinating doctor and if the project is feasible, he would come up with an effective care plan or therapeutic project. The next step is for the GP to validate the plan, and together with the coordinating doctor and care provider to approve the patient's admission.



This tedious process can be significantly shortened through the use of a well-coordinated online platform by each person involved.

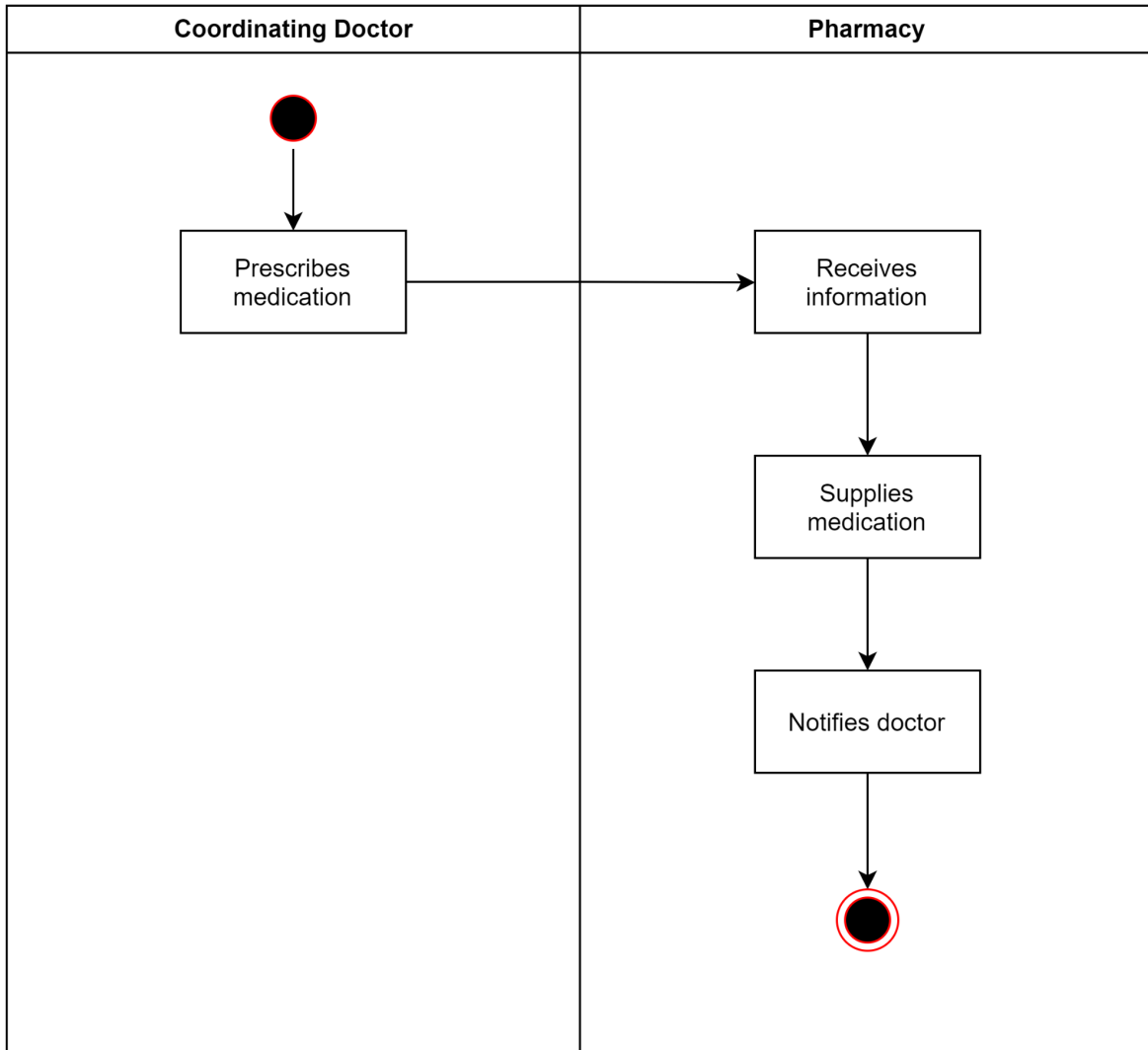
### 3.2. Duration

Now that the patient has been admitted to the HH, the care plan can be put to use. The coordinating nurse would visit the patient and fill out an intervention card. HH uses this to keep track of billing and enters the information in the IS, while the secretary updates the patient's file.



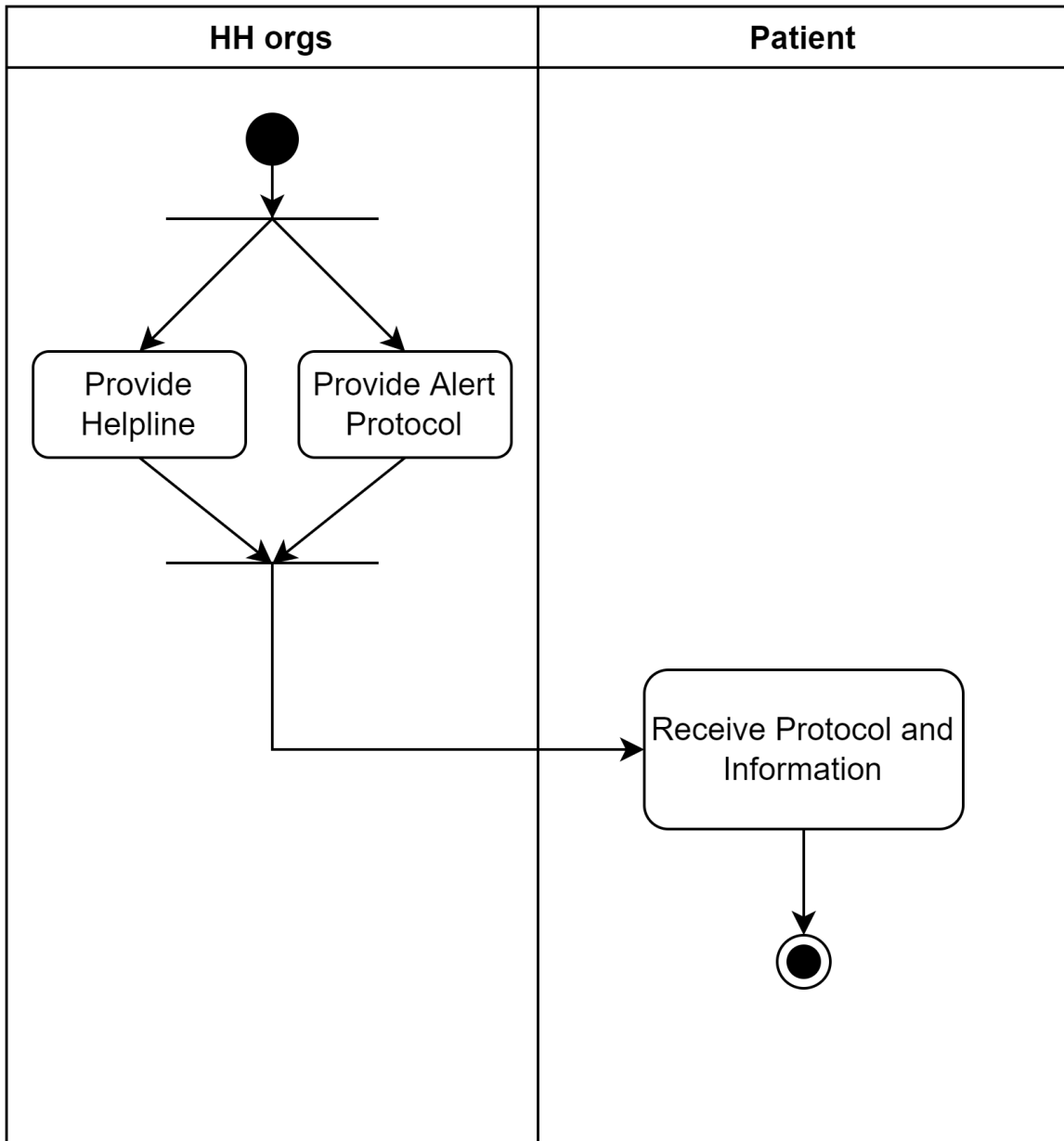
Here it is apparent how inefficient the paper-based system is, as three different people would be working on transmitting the information to whomever might need it. Our proposition is for the nurse to directly fill out the intervention card in the IS system, with the support of Offline mode - she would enter the information, and it will be uploaded when network coverage/internet becomes available on her device after her visit.

Another process identified is the prescription of medication by the coordination doctor, which is transmitted to the pharmacy. There the medication will be supplied, and the doctor would get notified.



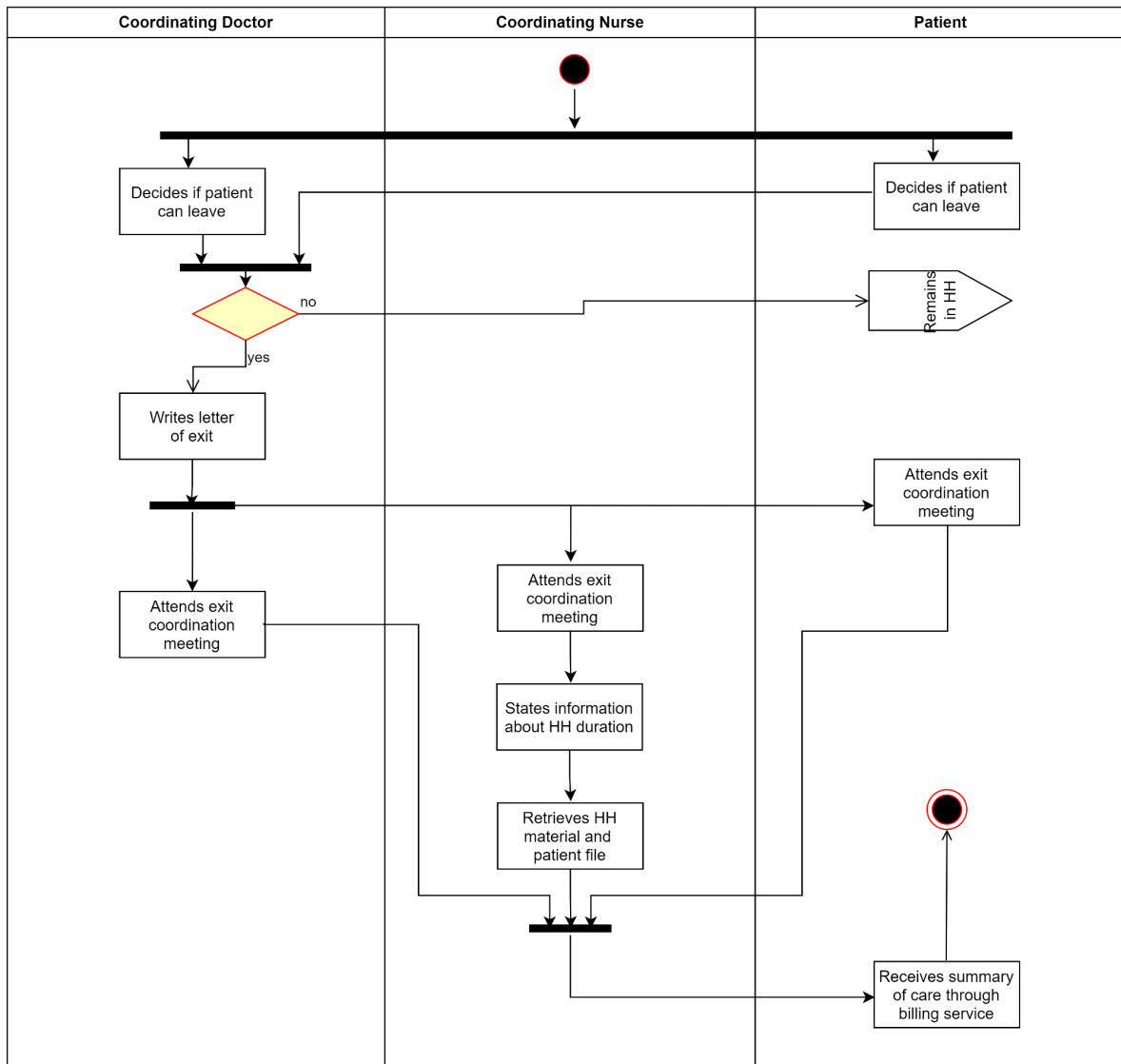
### 3.3. Emergency

In the unfortunate case of an emergency, the HH provides an alert protocol and helpline. This makes it possible to contact the HH organization at any time during the day, every day.



### 3.4. Exit

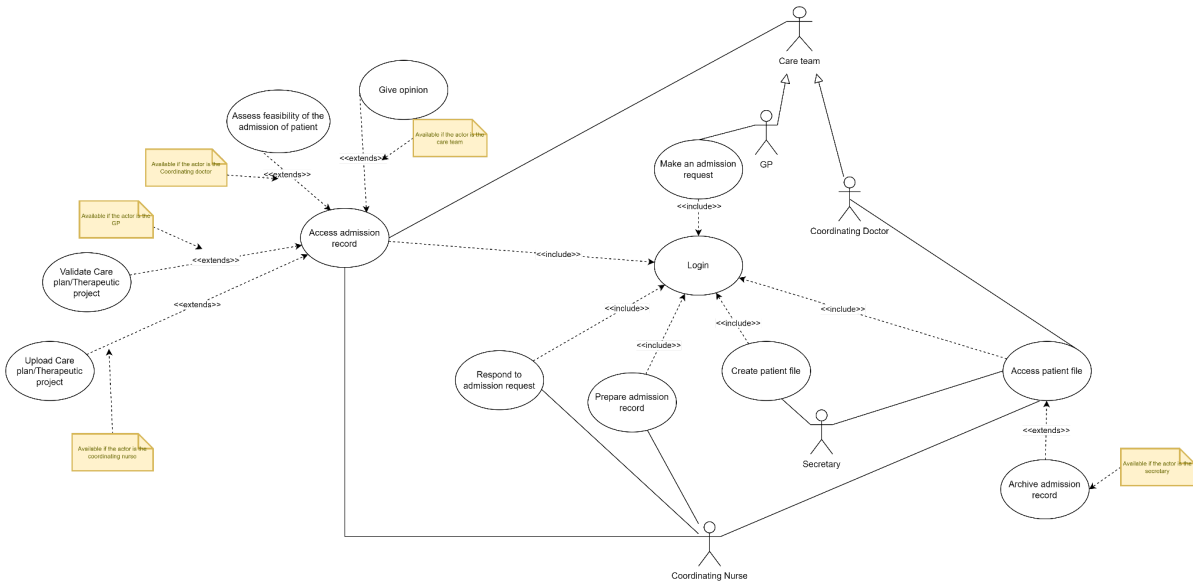
The coordinating doctor is the one to decide if the patient is ready to leave the HH, taking into consideration the patient's opinion. The respective health professionals and the patient get invited to an exit coordination meeting, where the coordinating nurse informs everyone of what has been done during the hospitalization, and what the next steps are. At the end, the patient receives an overall summary of care through the billing service.



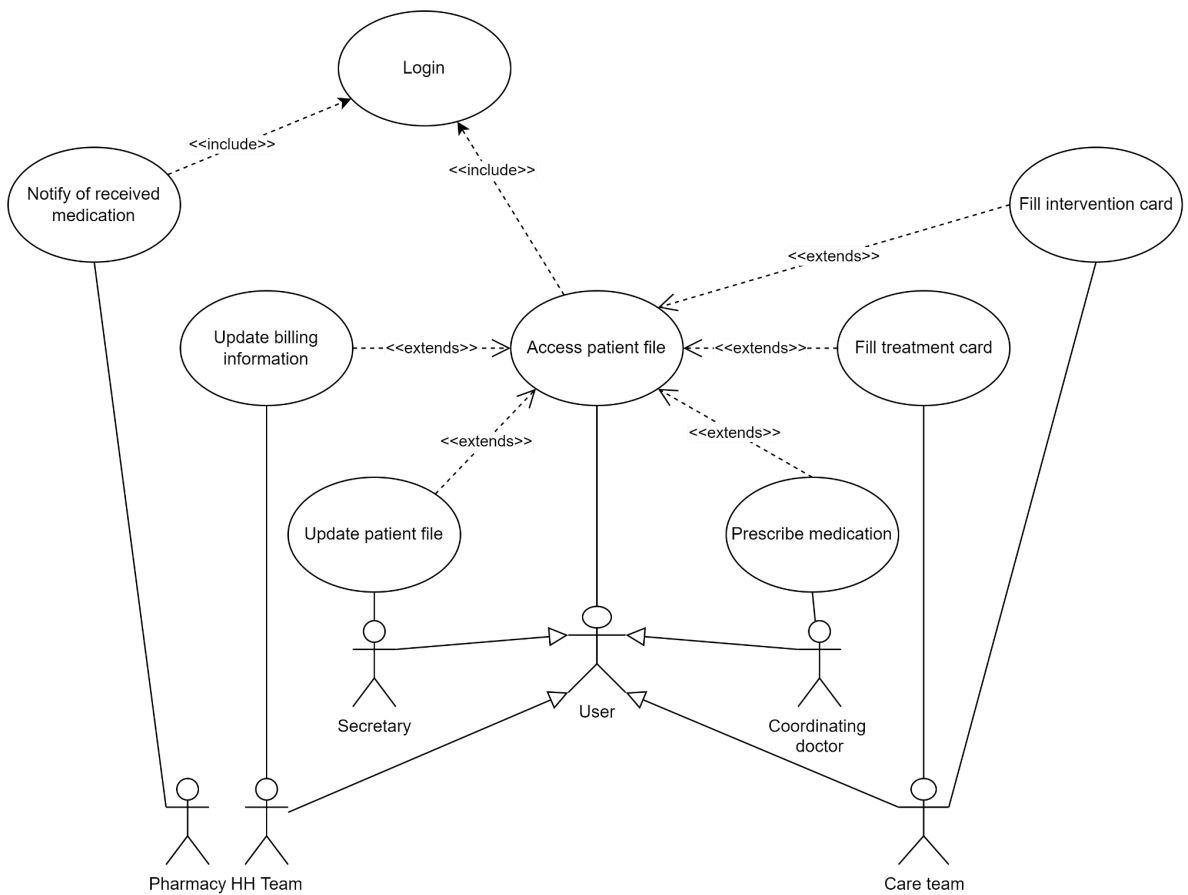
#### 4. Features - Use case diagrams - Scenarios

Through the use of different processes described in the previous part, in combination with the different needs we established, we were able to formulate a list of the necessary IS' features. The functionalities were divided based on who the user performing them is, as different people will have different accesses to the system, and certain functionalities branch off to others to better illustrate the flow.

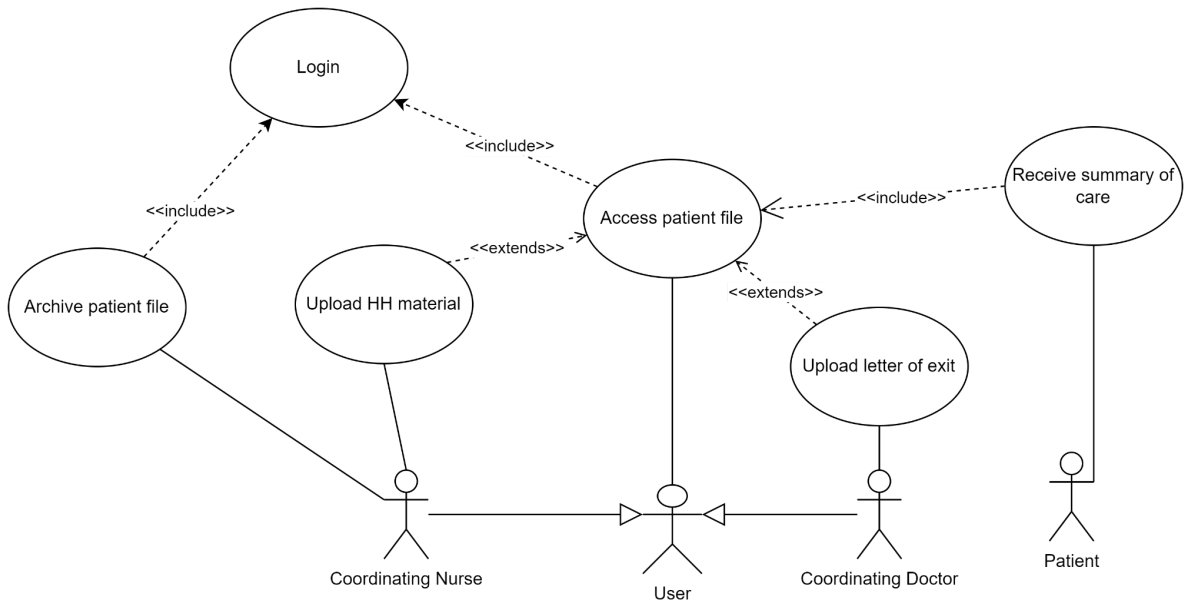




**Use case - Admission**



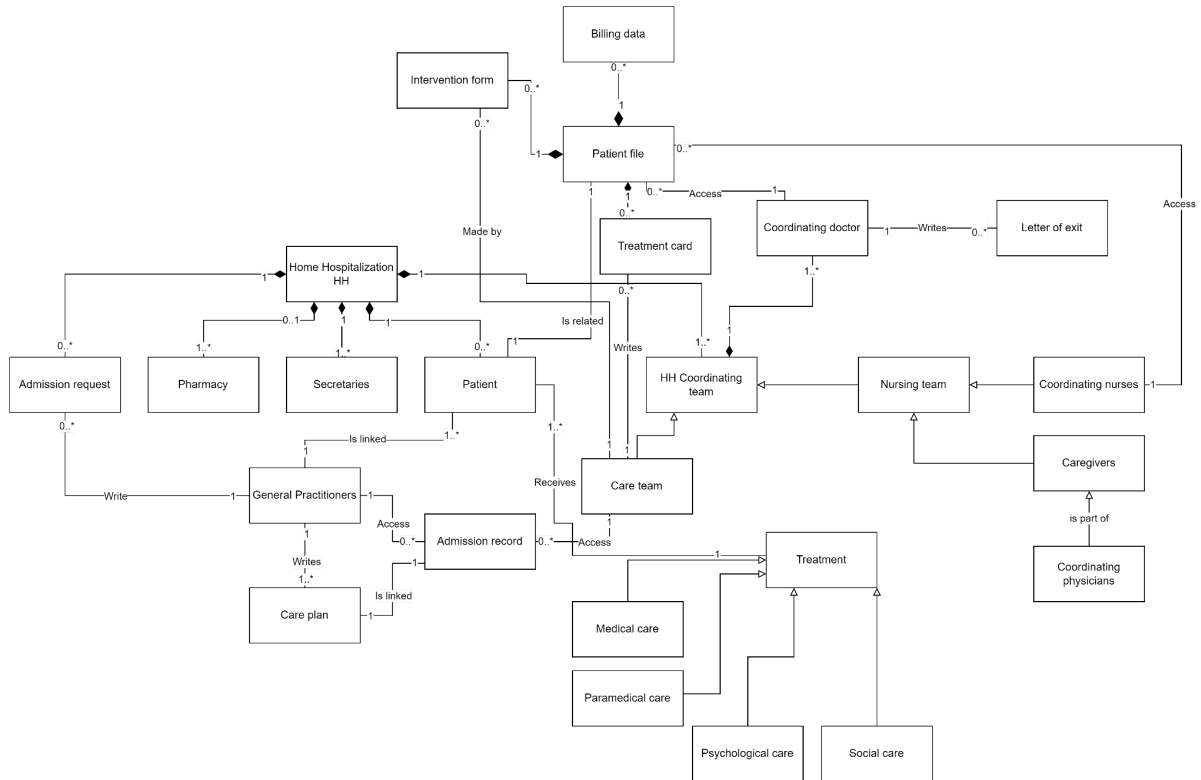
**Use case - Duration**



Use case - Exit

## 5. System entities - Domain model

We have built a domain model to represent the vocabulary and key concepts of the HH, offering a structural point of view. It serves to describe the different entities, their roles and relations that drive the domain of the present issue.



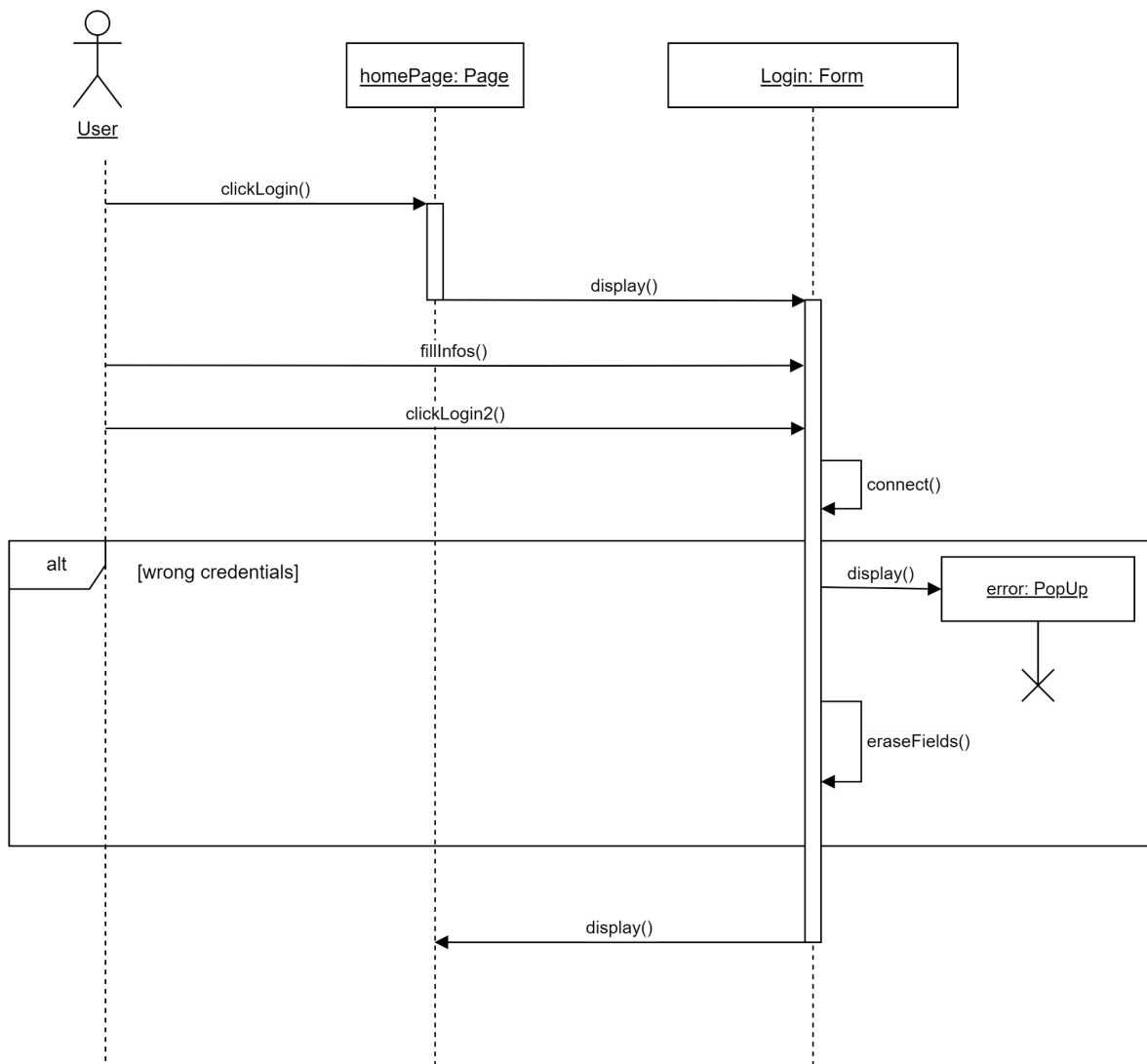
## 6. Interactions - Sequence diagrams

To provide a better grasp on the IS' functionalities, we have created use case scenarios to explain each of them and support the use case diagram. Those briefly describe the use case, which actor performs it, the basic and alternative flows, as well as pre- and post-conditions.

With the help of sequence diagrams we can show the interactions performed among objects specifically in chronological order, during certain periods of time.

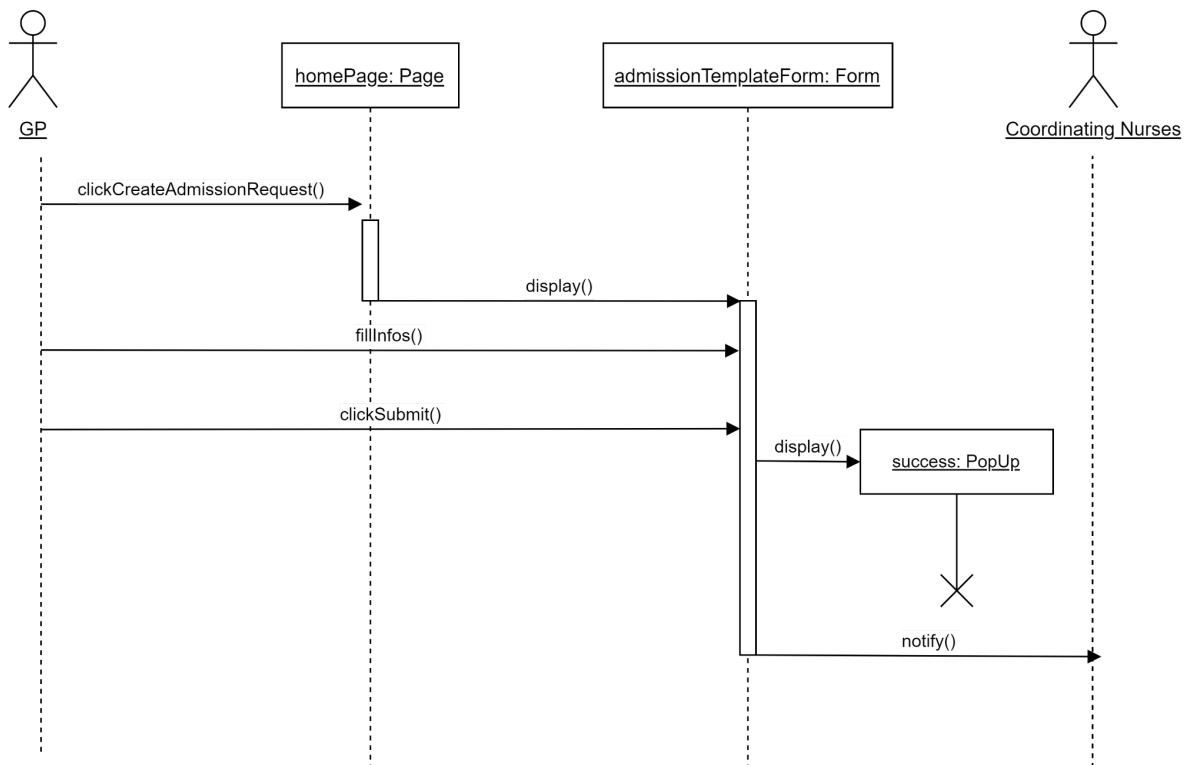
### 6.1. Admission

#### 6.1.1. Login



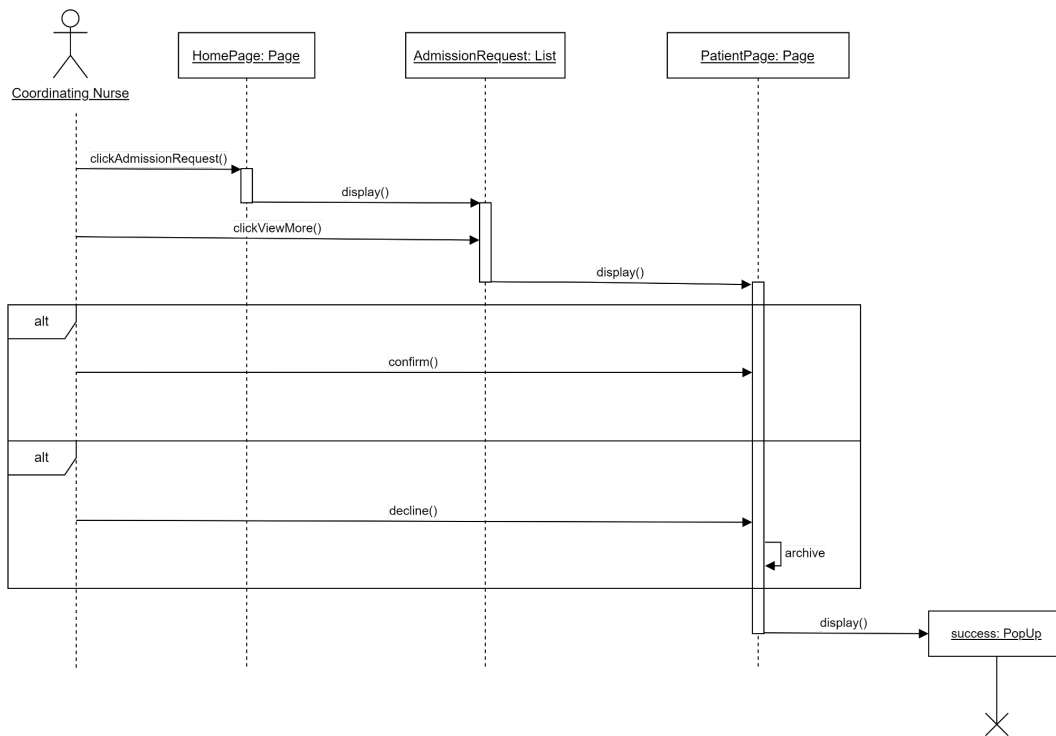
Use case	Login
Brief description	This use case describes how the coordinating nurse can respond to admission requests
Actor(s)	User
Precondition(s)	
Basic flow	<ol style="list-style-type: none"> <li>1. System displays home page</li> <li>2. Actor clicks on "Login" button</li> <li>3. System displays login form</li> <li>4. Actor enters credential informations</li> <li>5. Actor clicks second "Login" button</li> <li>6. System connects the actor to his account</li> </ol>
Alternative flow	<ol style="list-style-type: none"> <li>5.1.1 System displays a pop-up "Wrong credentials"</li> <li>5.1.2 System erases the fields for the actor to try again</li> </ol>
Postconditions	User is logged in

### 6.1.2. Make admission request



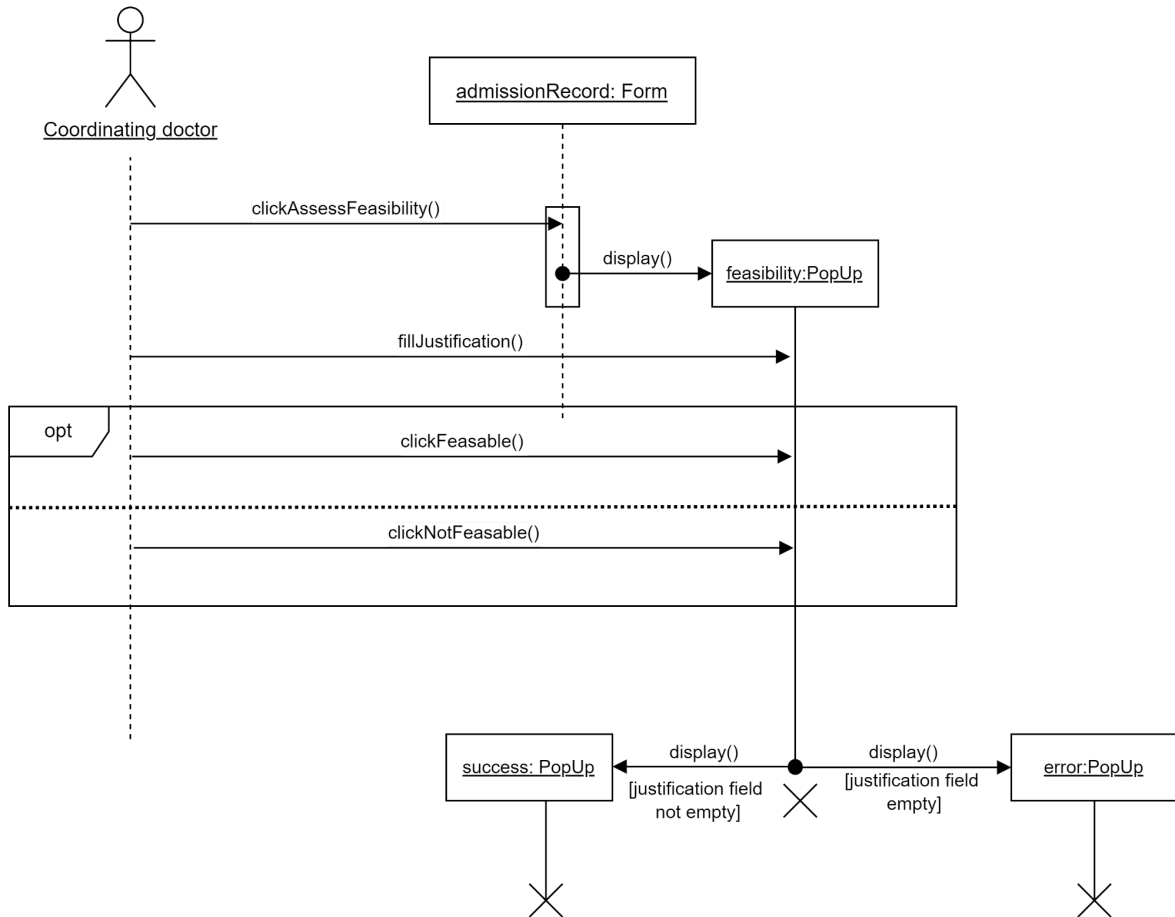
Use case	Make an admission request
Brief description	This use case describes how an admission request is made
Actor(s)	GP
Precondition(s)	User logged in
Basic flow	<ol style="list-style-type: none"> <li>1. GP clicks on "Make admission request" button on home page</li> <li>2. System displays admission request template form</li> <li>3. GP fills up the information about the admission request (Patient informations, reasons, duration, consent justification)</li> <li>4. GP clicks on "Validate" button</li> <li>5. System displays a "Success" POPUP</li> <li>6. System sends notification to nurses team</li> </ol>
Alternative flow	
Postconditions	

### 6.1.3. Respond to admission request



Use case	Respond to admission request
Brief description	This use case describes how the coordinating nurse can respond to admission requests
Actor(s)	Coordinating nurse
Precondition(s)	Admission request created - User logged in
Basic flow	<ol style="list-style-type: none"> <li>1. System displays home page</li> <li>2. Coordinating nurse clicks on “Pending admission requests” button on the home page</li> <li>3. Systems displays a page with the list of all the admissions requests.</li> <li>4. Coordinating nurse presses the “View more” button next to the specific request</li> <li>5. System displays a page with detailed information of the request</li> <li>6. Coordinating nurse presses the “Confirm” button on the bottom of the page</li> <li>7. System displays “Success” popup</li> </ol>
Alternative flow	<p>6.1.1 Coordinating nurse presses the “Decline” button on the bottom of the page</p> <p>6.1.2. System archives the admission request</p>
Postconditions	Admission record template created (only if it’s confirmed)

### 6.1.4. Assess feasibility of the admission of the patient

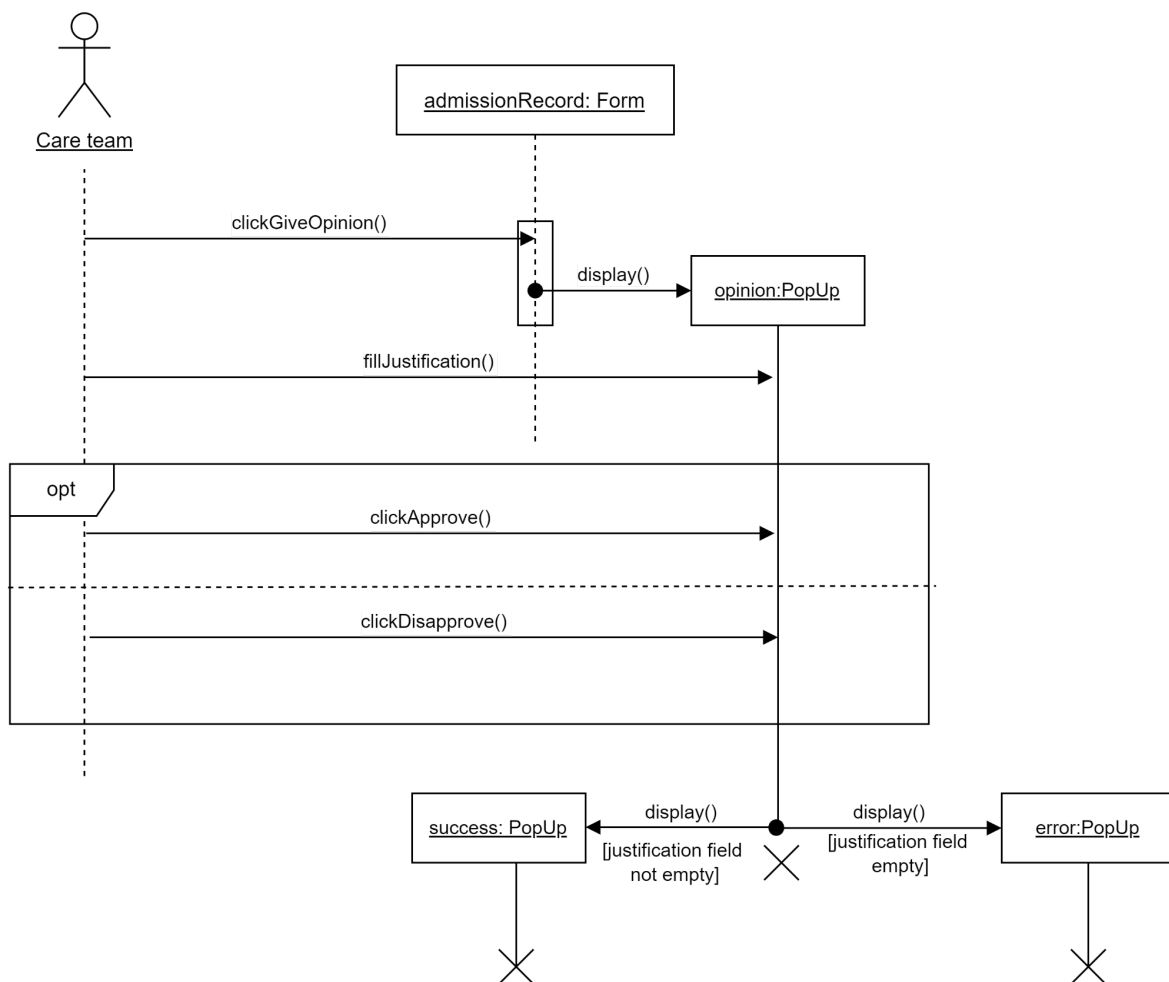


Use case	Assess feasibility of the admission of patient
Brief description	This use case describes how the coordinating doctor can assess the feasibility of a patient's admission
Actor(s)	Coordinating doctor
Precondition(s)	Admission record created, admission record page accessed, user logged in
Basic flow	<ol style="list-style-type: none"> <li>1. Coordinating doctor clicks on "Assess feasibility" button at the end of admission record.</li> <li>2. System displays popup with a justification field and Feasible/Not feasible buttons.</li> <li>3. Coordinating doctor fills up the justification field</li> </ol>



	<p>4. Coordinating doctor clicks on either Feasible or not Feasible button based on their choice</p> <p>5. System displays “Success” popup</p>
Alternative flow	5.1 if justification is empty, system displays “Error” popup
Postconditions	

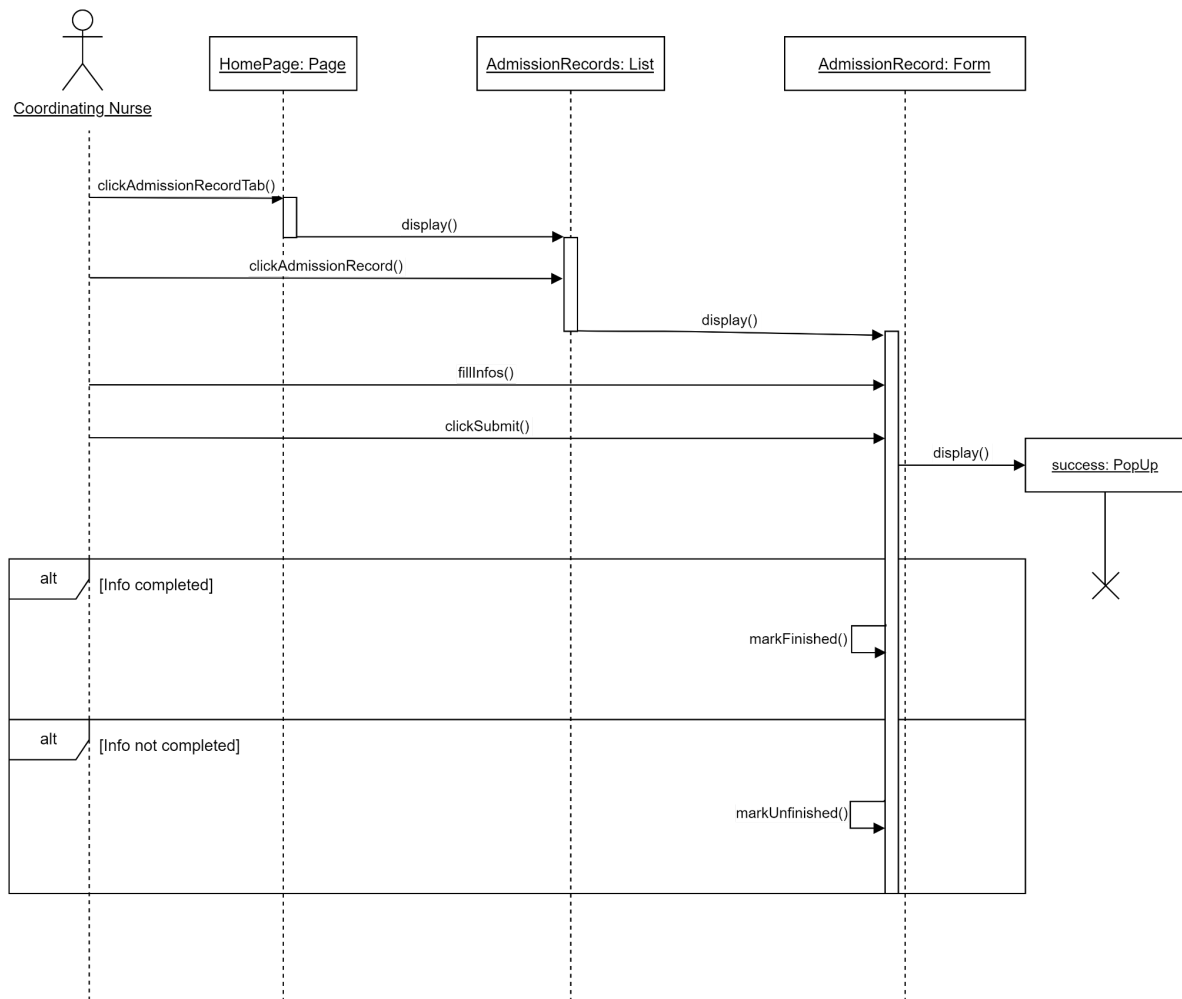
### 6.1.5. Give opinion



Use case	Give opinion
Brief description	This use case describes how the care team provide their opinion during the admission process
Actor(s)	Care team

Precondition(s)	Admission record created, admission record page accessed, user logged in
Basic flow	<ol style="list-style-type: none"> <li>1. User clicks on “Give opinion” button at the end of the admission record.</li> <li>2. System displays popup with a justification field and approve/disapprove buttons at the end of the admission record.</li> <li>3. User fills up the justification field</li> <li>4. User clicks on either approve or disapprove button based on their choice</li> <li>5. System displays “Success” popup</li> </ol>
Alternative flow	5.1 if justification is empty, system displays “Error” popup
Postconditions	

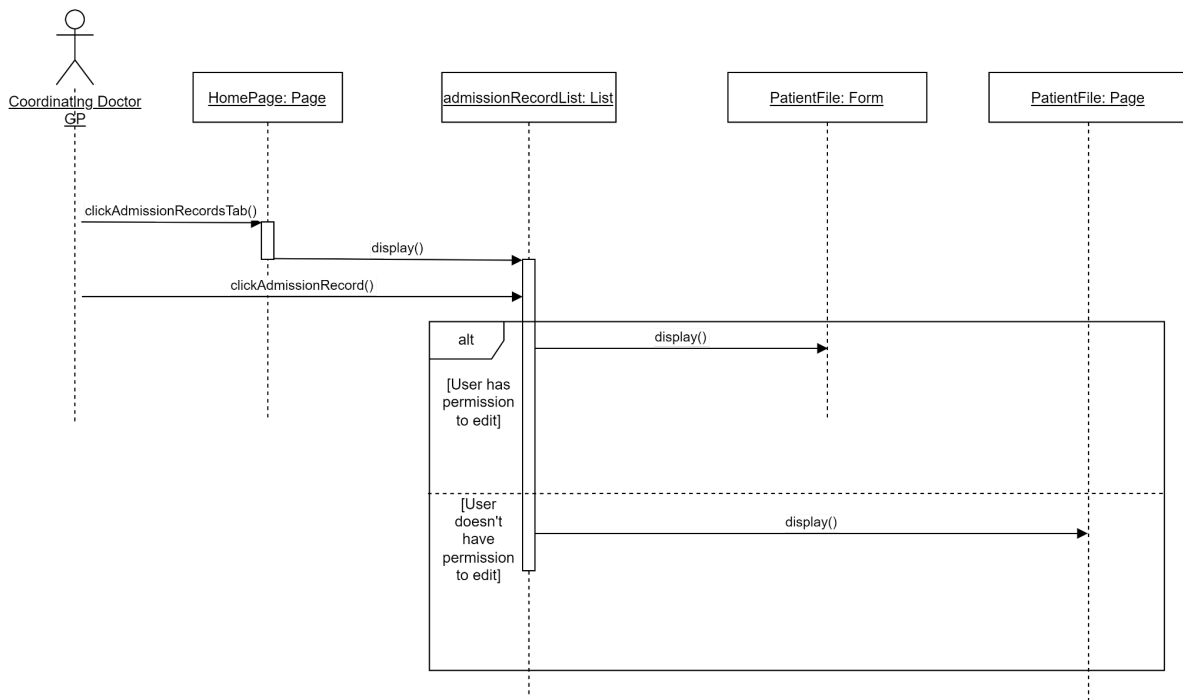
## 6.1.6. Prepare admission record



Use case	Prepare admission record
Brief description	This use case describes how the coordinating nurse can prepare an admission record
Actor(s)	Coordinating nurse
Precondition(s)	Admission record template created, Coordinating nurse logged in
Basic flow	<ol style="list-style-type: none"> <li>1. Coordinating nurse clicks on “Admission record” tab on the homepage</li> <li>2. System displays list of admission records</li> <li>3. Coordinating nurse selects admission record, marked as “unfinished”, from the list</li> <li>4. Systems displays form of admission record</li> </ol>

	<ol style="list-style-type: none"> <li>5. Coordinating nurse fills the empty fields (housing description, patient’s medical status, etc.)</li> <li>6. Coordinating nurse clicks on “Submit” button</li> <li>7. Systems displays “Success” popup</li> <li>8. Systems no longer marks the admission record as unfinished</li> </ol>
Alternative flow	8.1 If there are still missing parts the system keeps the admission record marked as “unfinished”
Postconditions	

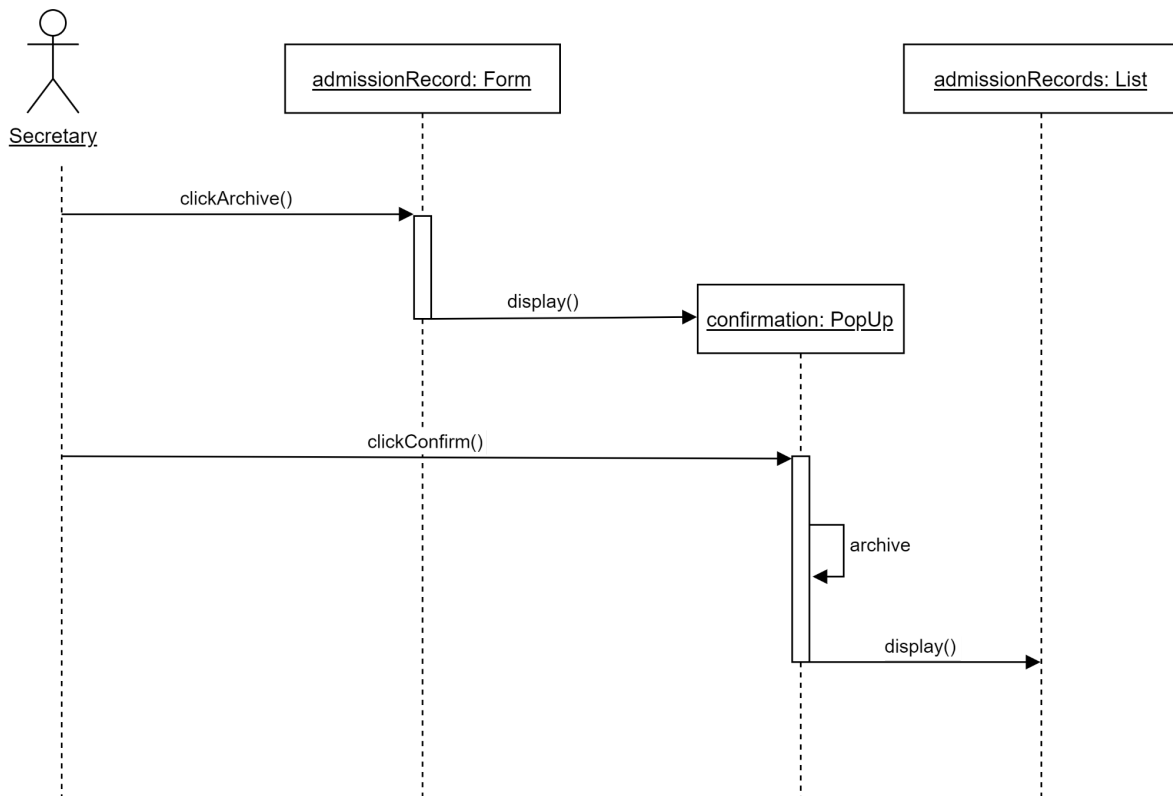
### 6.1.7. Access admission record



Use case	Access admission record
Brief description	This use case describes how an admission record is accessed
Actor(s)	
Precondition(s)	Admission record created, user logged in
Basic flow	<ol style="list-style-type: none"> <li>1. User clicks on “Admission records” tab in home page</li> </ol>

	<ol style="list-style-type: none"> <li>2. System displays list of admission records (according to the user)</li> <li>3. User clicks on the admission records he wants to access</li> <li>4. System displays an editable or not admission records based on the permission of the user</li> </ol>
Alternative flow	
Postconditions	

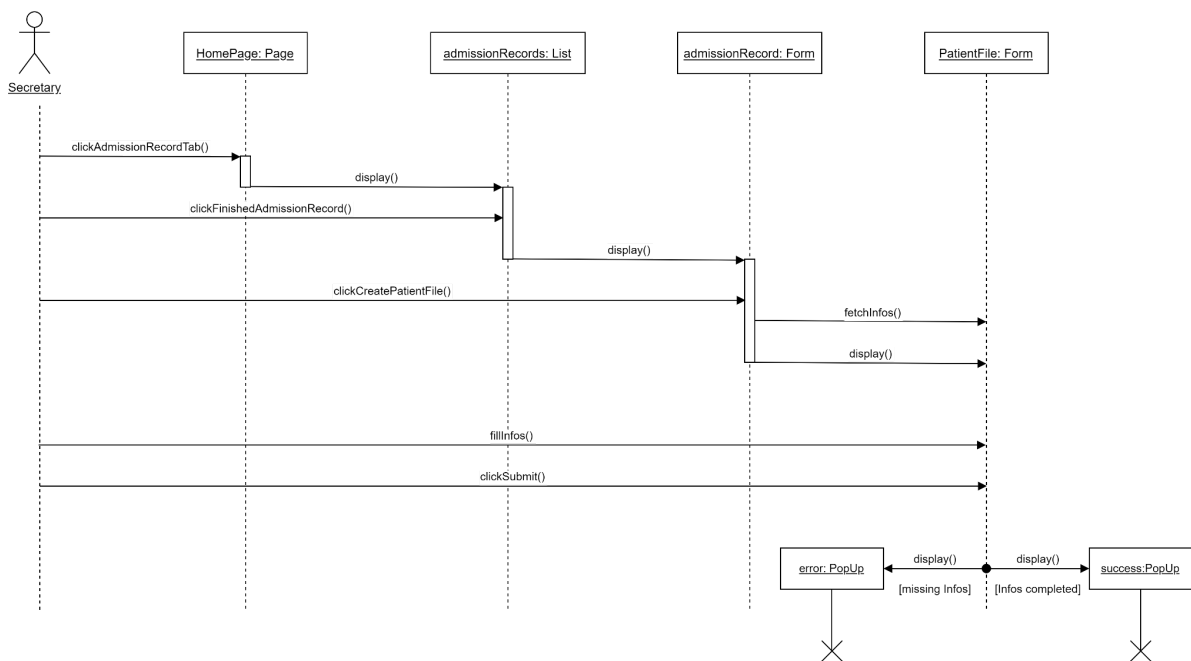
### 6.1.8. Archive admission record



Use case	Archive admission record
Brief description	This use case describes how an admission record can be archived
Actor(s)	Secretary
Precondition(s)	Admission record created, admission record accessed, secretary logged in

Basic flow	<ol style="list-style-type: none"> <li>Secretary clicks on “Archive” button on the admission record page</li> <li>System displays a confirmation popup</li> <li>Secretary clicks on “Confirm” button</li> <li>System archive the admission record</li> <li>System redirect the secretary to the admission record tab.</li> </ol>
Alternative flow	
Postconditions	

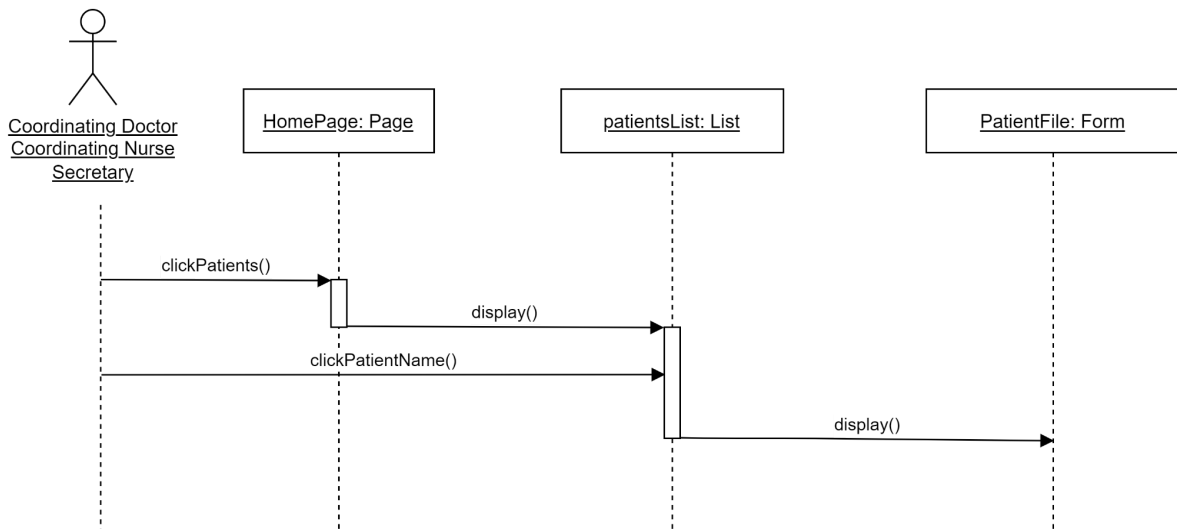
### 6.1.9. Create patient file



Use case	Create patient file
Brief description	This use case describes how the secretary can create a patient file
Actor(s)	Secretary
Precondition(s)	Admission record created, Secretary logged in
Basic flow	<ol style="list-style-type: none"> <li>Secretary clicks on “Admission record” tab on the home page</li> <li>System displays list of admission records</li> <li>Secretary selects admission record marked as “finished”, from the list</li> </ol>

	<ol style="list-style-type: none"> <li>4. System displays admission record form</li> <li>5. Secretary clicks on "Create patient file" button</li> <li>6. System displays form with patient informations retrieved from admission record</li> <li>7. Secretary fills up missing informations</li> <li>8. Secretary clicks on "Submit" button</li> <li>9. System displays a "Success" popup</li> </ol>
Alternative flow	9.1 System displays "Error" popup when some informations are missing
Postconditions	Patient file created in the system

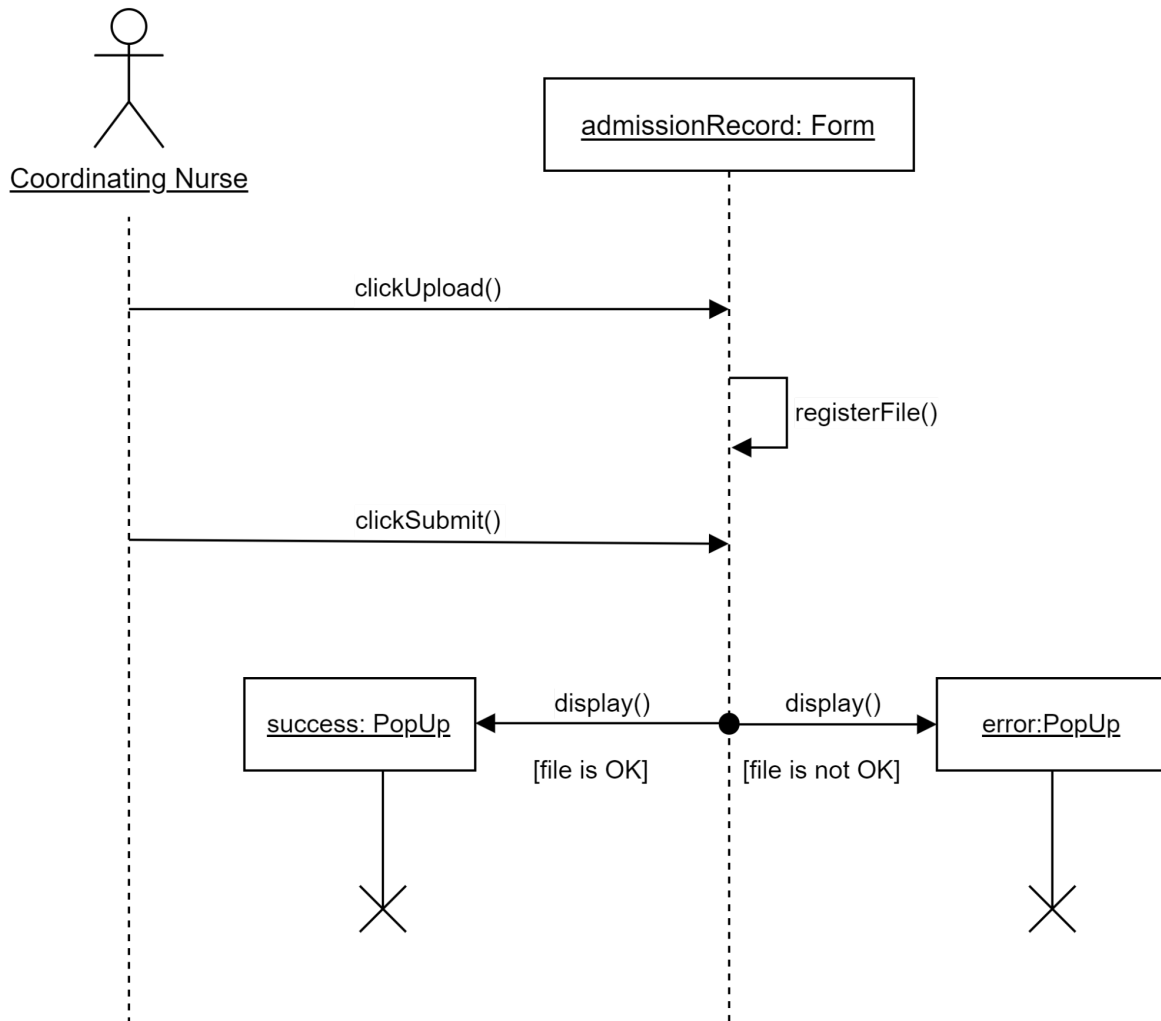
### 6.1.10. Access patient file



Use case	Access patient file
Brief description	This use case describes how you can access a patient file from the system
Actor(s)	Coordinating doctor, coordinating nurse, secretary
Precondition(s)	Patient file created, User logged in
Basic flow	<ol style="list-style-type: none"> <li>1. User clicks on "Patients" tab in home page</li> <li>2. System displays list of patients (according to the user)</li> <li>3. User clicks on the name of the patient he wants to access</li> <li>4. System displays patient file</li> </ol>
Alternative flow	
Postconditions	



### 6.1.11. Upload care plan/Therapeutic plan

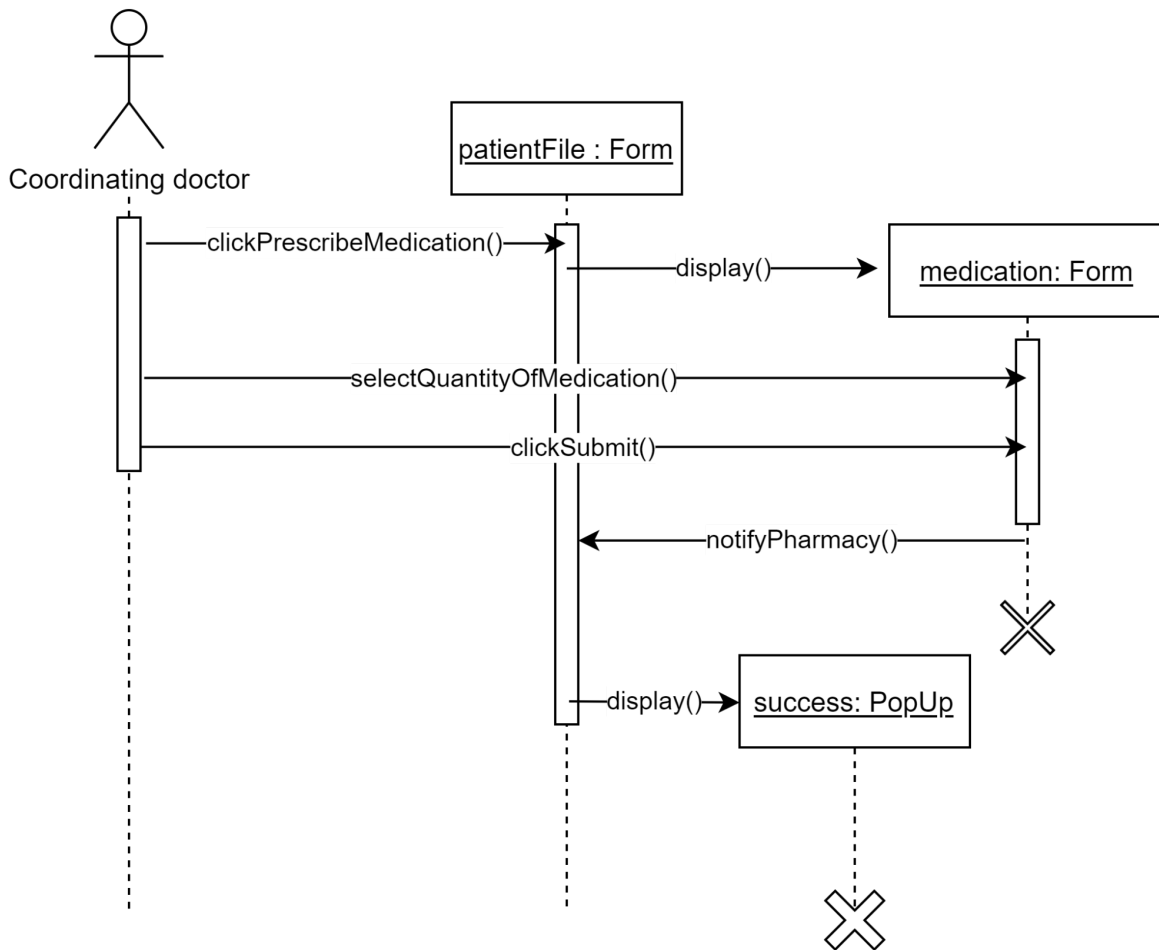


Use case	Upload care plan/therapeutic project
Brief description	This use case describes how the coordinating nurse uploads a patient's care plan/therapeutic project to the HH system
Actor(s)	Coordinating nurse
Precondition(s)	Admission record accessed
Basic flow	<ol style="list-style-type: none"> <li>1. Coordinating nurse clicks on "Upload care plan" button</li> <li>2. System registers the reception of file</li> <li>3. Coordinating nurse clicks on "Submit" button</li> <li>4. System displays a "Success" popup</li> </ol>

Alternative flow	4.1 System displays "Error" popup (due to invalid size, or corrupted file)
Postconditions	

## 6.2. Duration

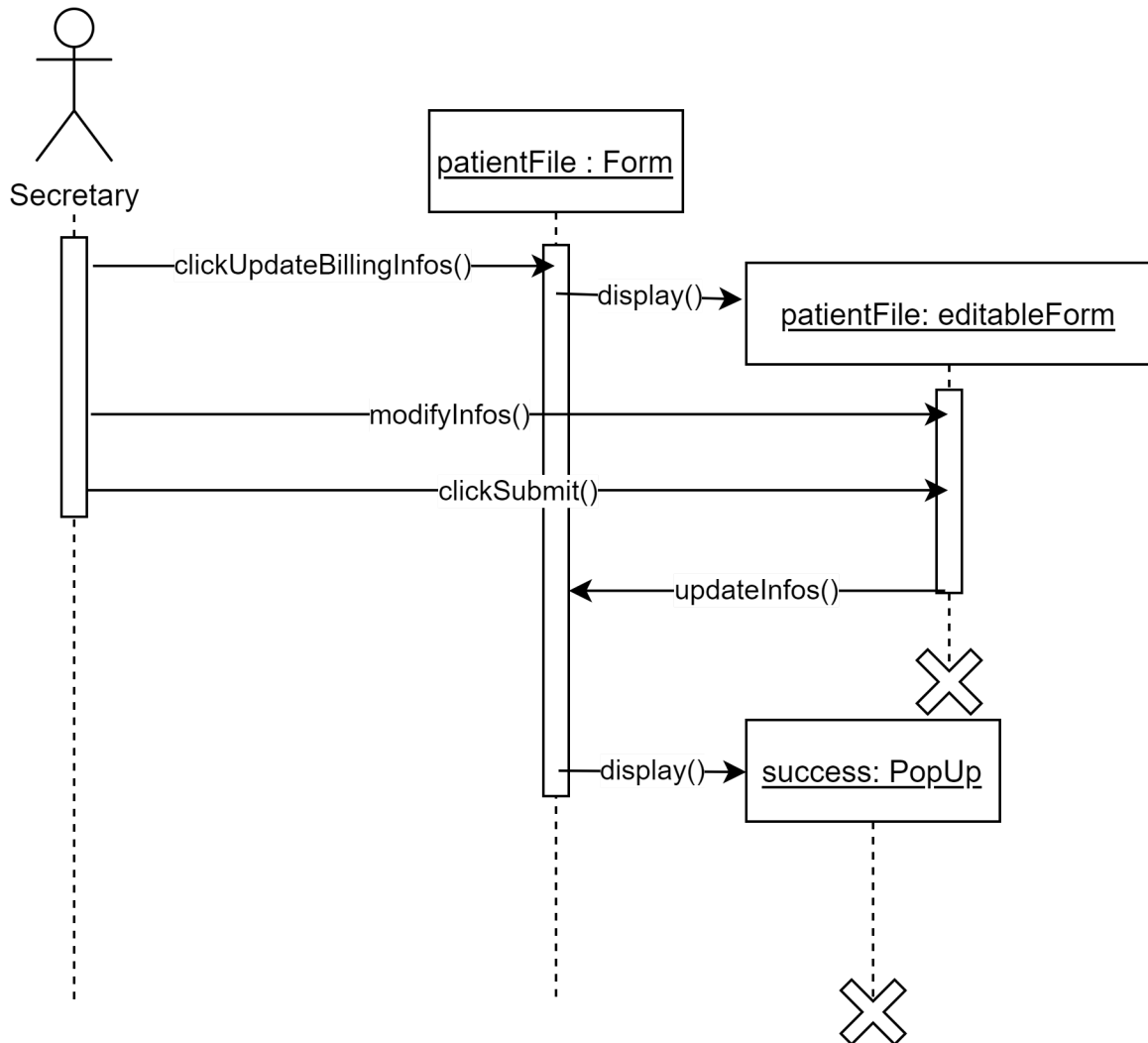
### 6.2.1. Prescribe medication



Use case	Prescribe medication
Brief description	This use case describes how the coordinating doctor can prescribe medication to patients
Actor(s)	Coordinating doctor
Precondition(s)	Patient file accessed

Basic flow	<ol style="list-style-type: none"> <li>1. Coordinating doctor clicks on the “Prescribe medication” button</li> <li>2. System displays a medication form with a list of all the medications</li> <li>3. Coordinating doctor searches for the required medication in the list</li> <li>4. Coordinating doctor selects quantity with an increment/decrement button</li> <li>5. Coordination doctor clicks “Submit” button</li> <li>6. System displays “Success” popup</li> <li>7. System notifies the pharmacy</li> </ol>
Alternative flow	4.1 If the required medication is not available, “Select quantity” button can not be pressed, and is greyed
Postconditions	Medication is prescribed

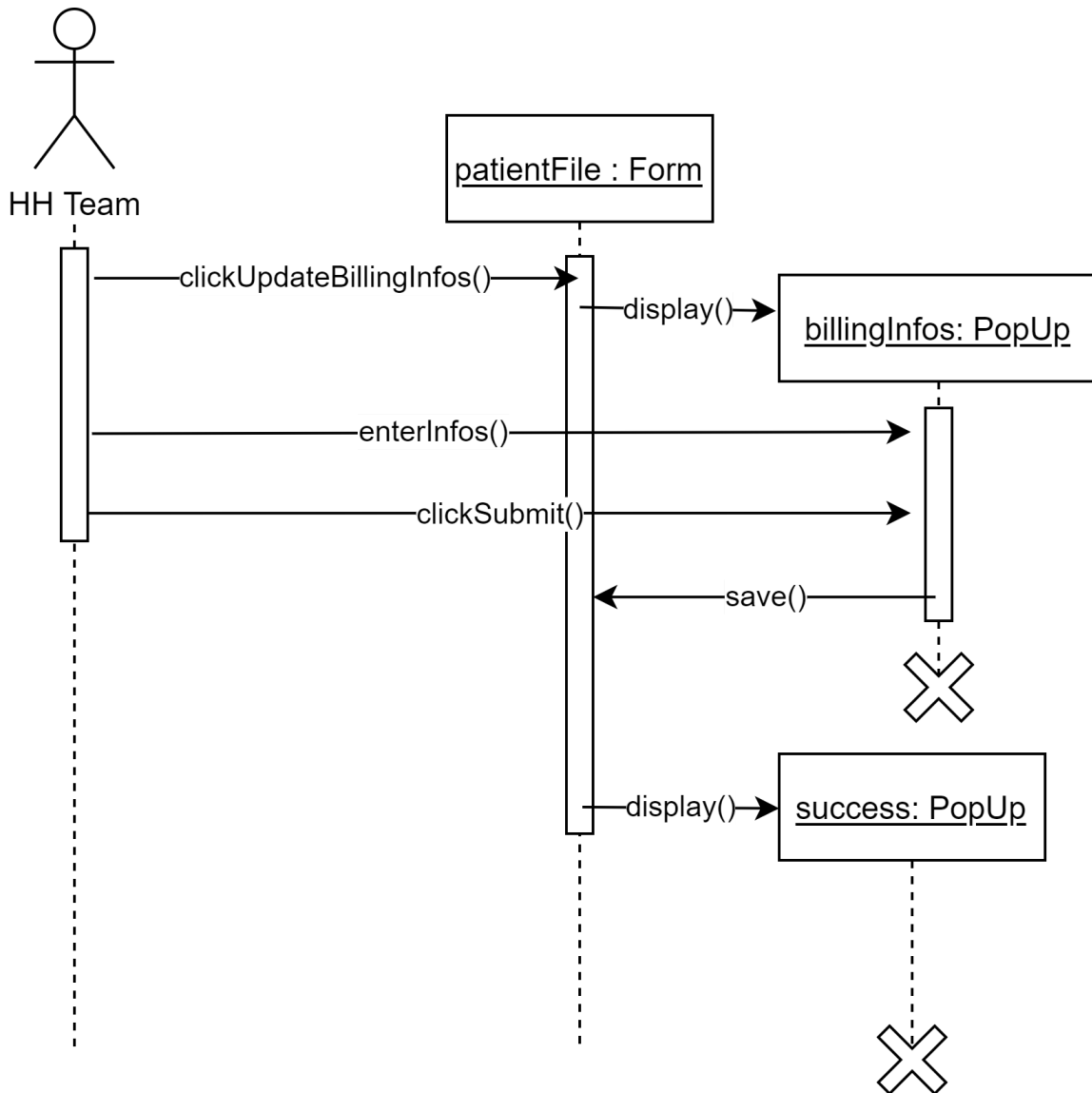
## 6.2.2. Update patient file



Use case	Update patient file
Brief description	This use case describes how the secretary can modify the patient's file
Actor(s)	Secretary
Precondition(s)	Patient file accessed
Basic flow	<ol style="list-style-type: none"> <li>1. Secretary clicks on "Update patient information" button</li> <li>2. System displays a patient form</li> <li>3. Secretary modifies the information</li> <li>4. Secretary clicks on "Submit" button</li> <li>5. System displays "Success" popup</li> </ol>

Alternative flow	-
Postconditions	Patient file is updated

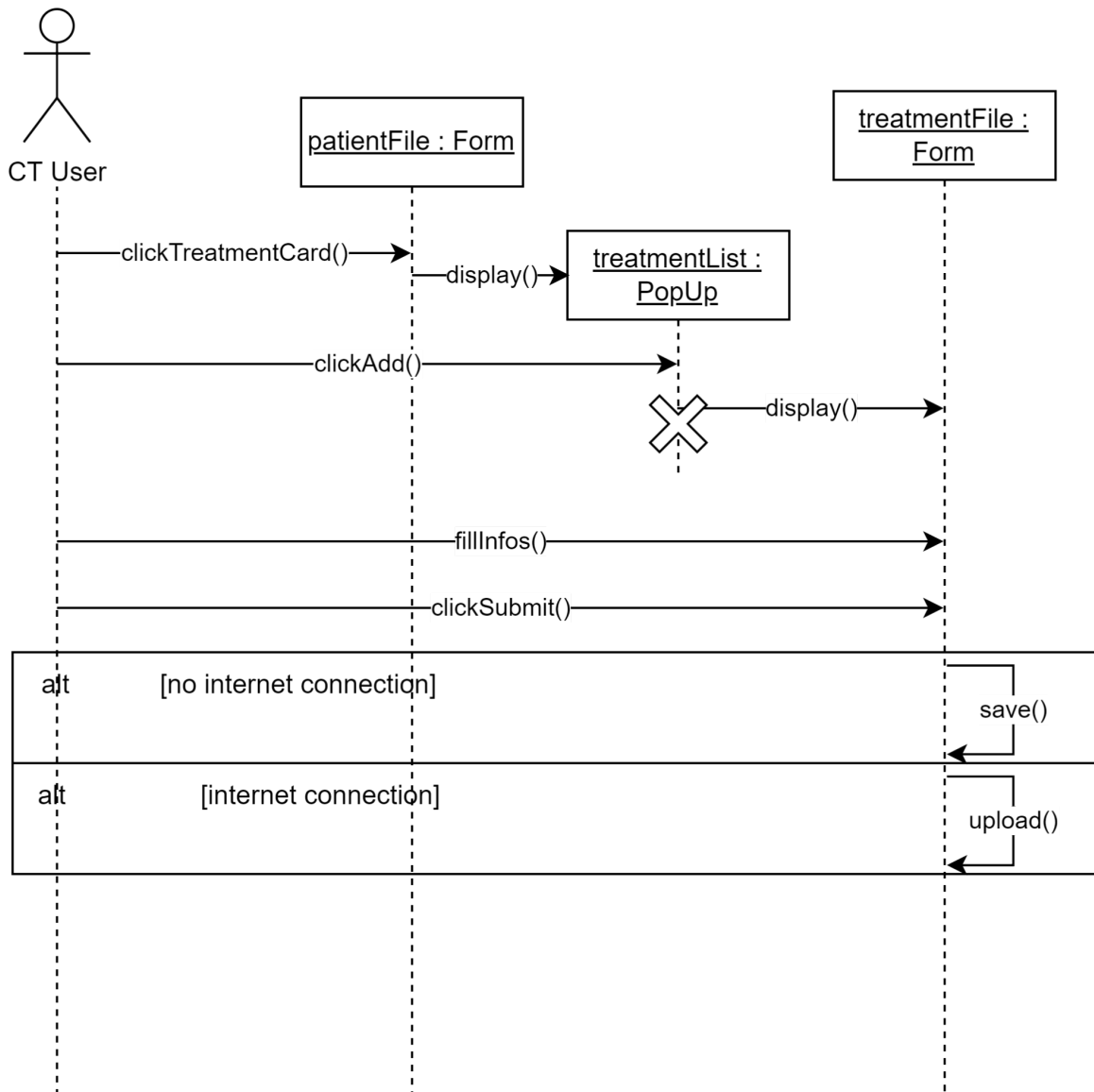
### 6.2.3. Update billing information



Use case	Update billing information
Brief description	This use case describes how the HH team can update the billing information
Actor(s)	HH team

Precondition(s)	Patient file accessed
Basic flow	<ol style="list-style-type: none"> <li>1) HH Team clicks on "Update billing information" button</li> <li>2) System displays a billing information form</li> <li>3) HH team modifies the information</li> <li>4) HH team clicks on "Submit" button</li> <li>5) System displays "Success" popup</li> </ol>
Alternative flow	-
Postconditions	Billing information is updated

### 6.2.4. Fill treatment card

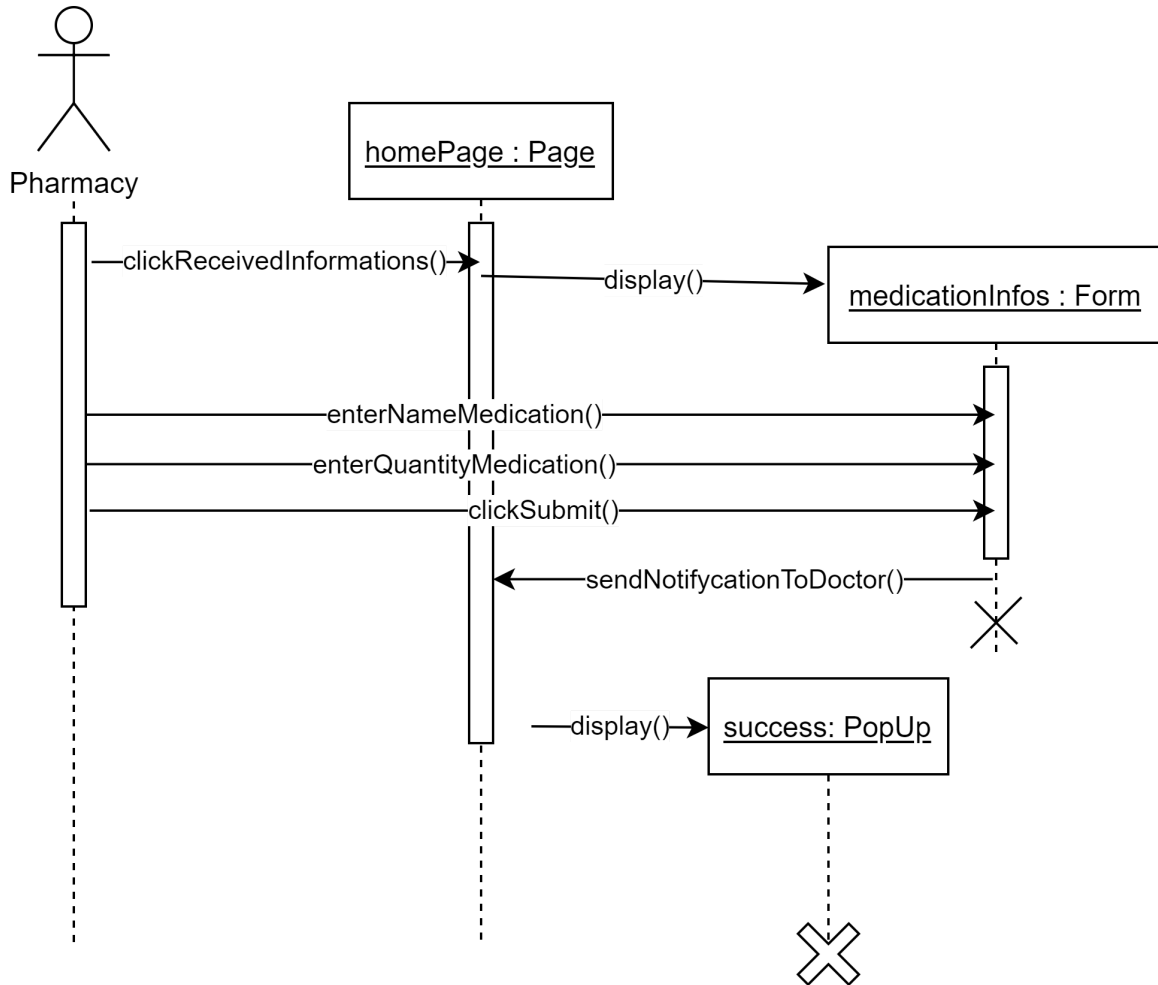


Use case	Fill treatment card
Brief description	This use case describes how the care team fills the information on treatment cards
Actor(s)	Care team
Precondition(s)	Patient file accessed
Basic flow	<ol style="list-style-type: none"> <li>Care team user clicks on "Treatment card" on the patient file</li> <li>System displays a popup with a list of existing treatment card and a "+" button</li> </ol>

	<ol style="list-style-type: none"> <li>3. Care team user clicks on the “+” button at the top right corner of the popup</li> <li>4. System closes the opened popup and displays a treatment card form</li> <li>5. Care team user fills the form with the informations about the treatment</li> <li>6. Care team user clicks on “Submit” button</li> <li>7. System displays “Success” popup</li> <li>8. System upload the treatment card into the system</li> </ol>
Alternative flow	<ol style="list-style-type: none"> <li>8.1 If Care Team user has no internet connection, System put the treatment card in cache</li> <li>8.2 System upload the treatment card once the connexion come back</li> </ol>
Postconditions	



## 6.2.5. Notify of received medication

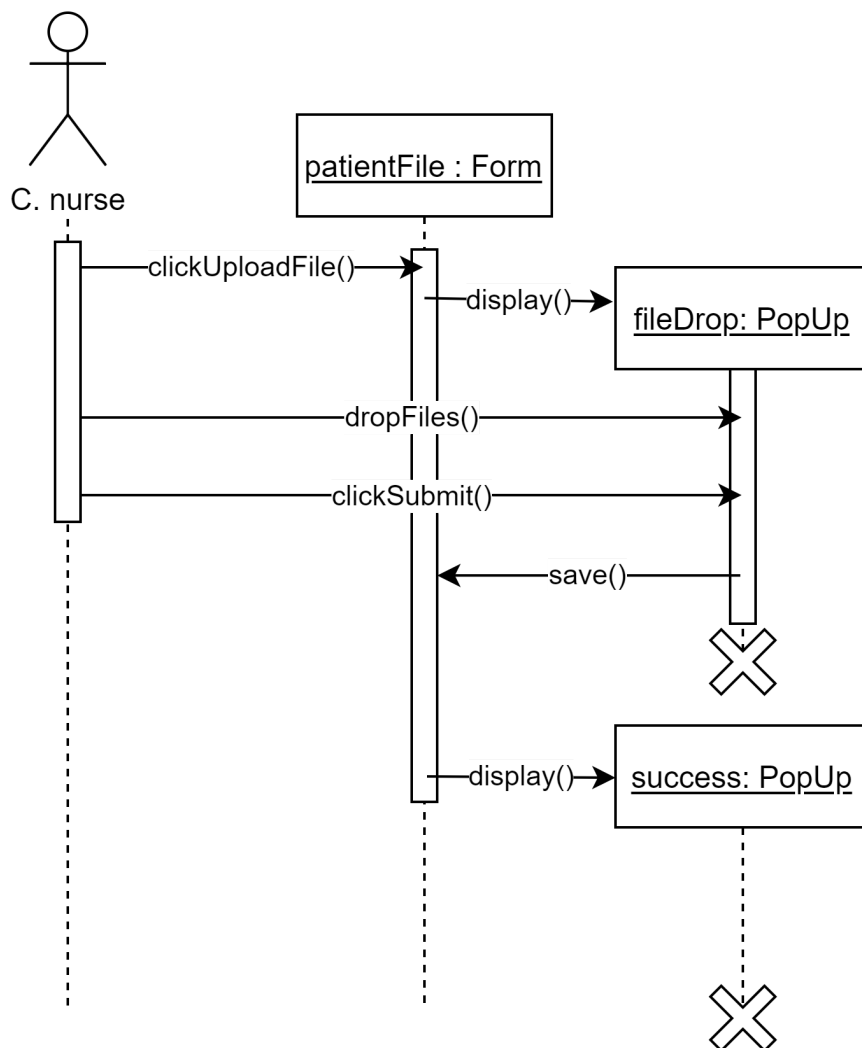


Use case	Notify of received medication
Brief description	This use case describes how the pharmacy can announce the reception of medication
Actor(s)	Pharmacy
Precondition(s)	Pharmacy logged in
Basic flow	<ol style="list-style-type: none"> <li>1. Pharmacy clicks on "Received medication" button on home page</li> <li>2. System displays editable form with fields for medication infos (name and quantity)</li> <li>3. Pharmacy fills the form with the informations about the medication it received</li> <li>4. Pharmacy clicks on "Submit" button</li> <li>5. System displays "Success" popup</li> </ol>

	6. System sends notification of received medication to the doctor
Alternative flow	
Postconditions	

### 6.3. Exit

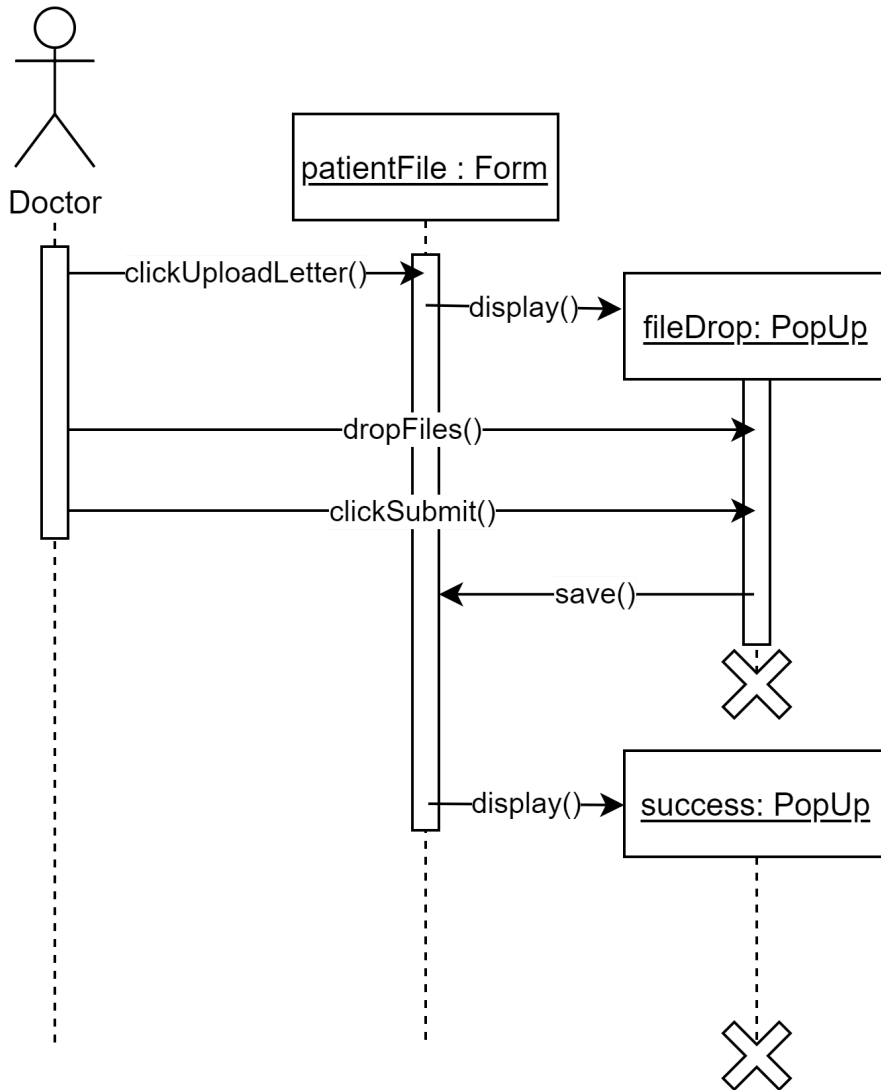
#### 6.3.1. Upload HH materials



Use case	Upload HH materials
Brief description	This use case describes how the coordinating nurse can upload HH materials to the patient file

Actor(s)	Coordinating nurse
Precondition(s)	Patient file accessed
Basic flow	<ol style="list-style-type: none"> <li>1. Coordinating nurse clicks on “Upload HH materials” at the end of the patient file</li> <li>2. System displays a popup with a field to drop files</li> <li>3. Coordinating nurse drops the file into the field</li> <li>4. Coordinating nurse clicks “Submit” button at the end of the popup</li> <li>5. System uploads the file linked to the patient file</li> <li>6. System displays “Success” popup</li> </ol>
Alternative flow	-
Postconditions	

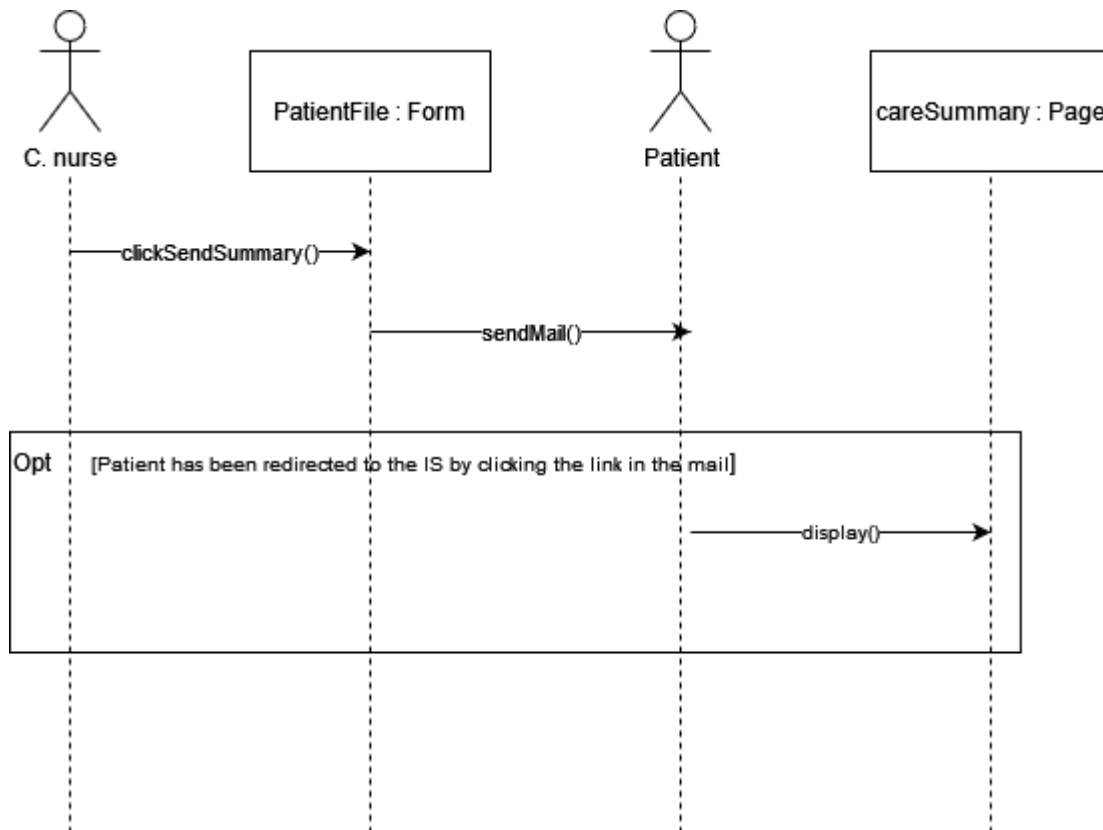
### 6.3.2. Upload letter of exit



Use case	Upload letter of exit
Brief description	This use case describes how the coordinating doctor can upload the letter of exit to the system
Actor(s)	Coordinating doctor
Precondition(s)	Patient file accessed
Basic flow	<ol style="list-style-type: none"> <li>1. Coordinating doctor clicks on "Upload letter of exit" at the end of the patient file</li> <li>2. System displays a popup with a field to drop files</li> </ol>

	<ol style="list-style-type: none"> <li>3. Coordinating doctor drops the file into the field</li> <li>4. Coordinating doctor clicks "Submit" button at the end of the popup</li> <li>5. System uploads the letter of exit linked to the patient file</li> <li>6. System displays "Success" popup</li> </ol>
Alternative flow	-
Postconditions	Letter of exit uploaded

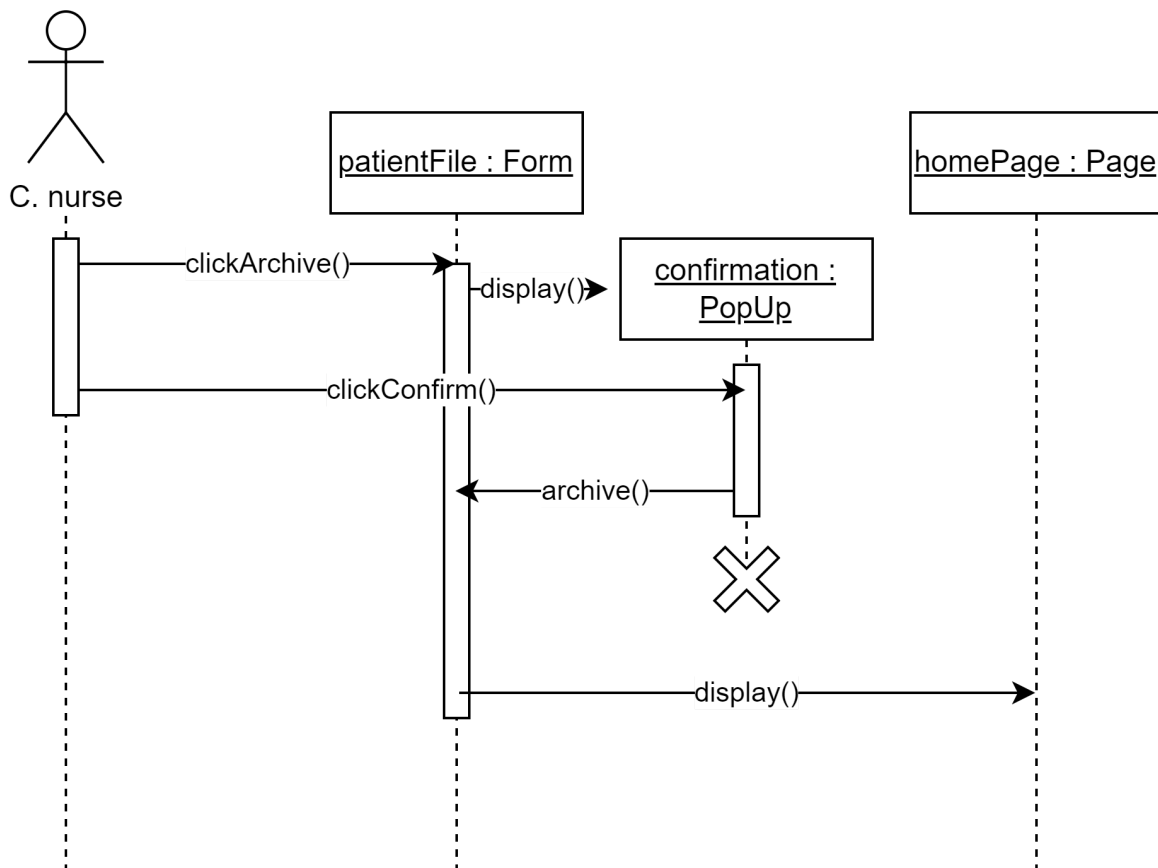
### 6.3.3. Receive summary of care



Use case	Receive summary of care
Brief description	This use case describes how the patient can receive the summary of care
Actor(s)	Patient, Coordinating nurse
Precondition(s)	Patient file archived, patient file accessed

Basic flow	<ol style="list-style-type: none"> <li>1. Coordinating nurse clicks on “Send summary” on the patient file.</li> <li>2. System sends mail to the patient with a link</li> <li>3. When the patient has clicked on the link and is redirected to the system, it displays a page with summary of care and a link to his patient file archived</li> </ol>
Alternative flow	-
Postconditions	

### 6.3.4. Archive patient file

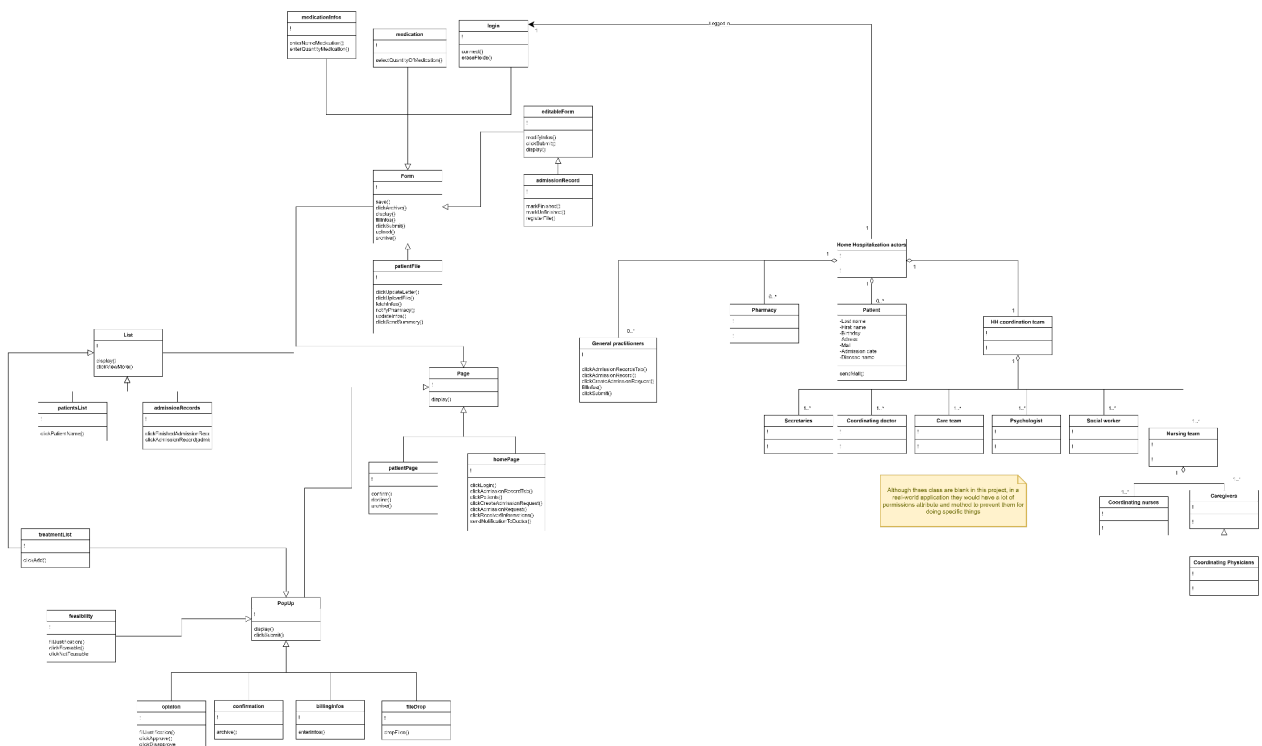


Use case	Archive patient file
Brief description	This use case describes how the coordinating nurse can archive the patient file at the end of the exit phase of HH

Actor(s)	Coordinating nurse
Precondition(s)	Coordinating nurse logged in - The letter of exit has been uploaded
Basic flow	<ol style="list-style-type: none"> <li>1. Coordinating nurse clicks on “Archive” button on the patient file</li> <li>2. System displays a confirmation popup</li> <li>3. Coordinating nurse clicks on “Confirm” button</li> <li>4. System archive the patient file</li> <li>5. System redirects the Coordinating nurse to the home page</li> </ol>
Alternative flow	-
Postconditions	Patient file archived

## 7. Relation between entities - Class diagram

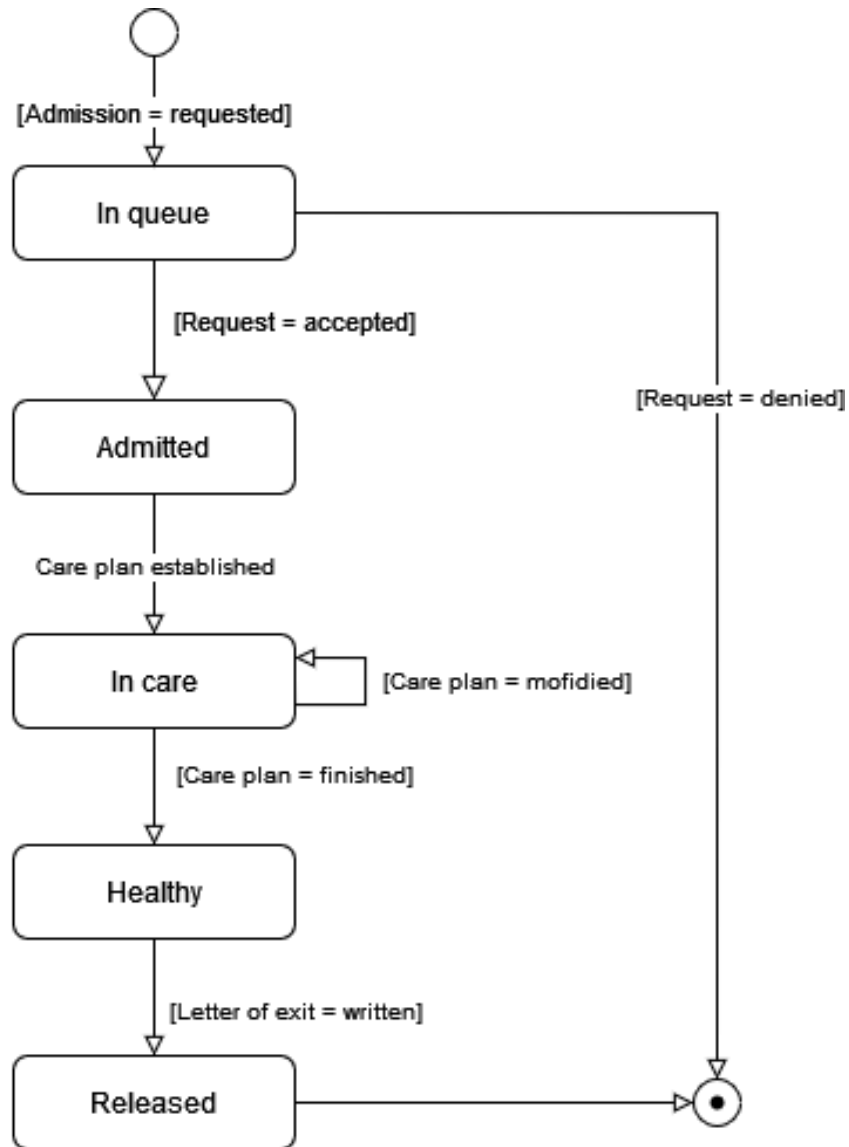
To give an overview of the system, we have created a class diagram. It shows the different classes and relationships among them, however, it does not explain what exactly happens when they do interact.



## 8. Details of states - Statechart diagrams

To clarify the evolution of certain previously described objects, we have modeled state-chart diagrams. Those document all of the states through which an object goes, and the conditions it needs to satisfy.

### 8.1. Patient



## 9. Conclusion

Converting an almost entirely paper-based system to an entirely digital one is no easy task. Especially when we had to think of stakeholders and users outside of the HH who are still relevant to the HH and require access to this system, such as general practitioners. We had to adapt to this and think of a system that can accommodate everyone who needs to have



access, in order to reach the HH organizations' goal of saving time and better preserving records.

We took into account the possible lack of internet connection in some places by proposing an offline mode - the user would enter the information, and it will be uploaded to the system when network coverage becomes available again.

Moreover, since it was important that documents be viewed by different people, we had to adjust the roles of users and give them different permissions. For example, a patient would be able to view their patient file in the system upon logging in, but he would not have permission to modify or archive it.

The proposed system is fully functional and optimized, and ensures good coordination between the professionals of the establishment. The risk of documentation loss is also prevented, thus helping avoid unfortunate emergencies. We think that in the future it would be possible to optimize some features and add new ones, but for this we would need to observe how the newly proposed functionalities are being used.